APPENDIX 2-1—DATA LIMITATIONS

This assessment included the compilation and analysis of many hundreds of individual data sets from a great number of sources; totaling approximately 10 GB of storage in reduced form. While a great number of data sets were compiled, only some were used in the assessments, while others were not used. These determinations were made to illustrate what the authors felt was necessary and reasonable to include in the assessment, while minimizing superfluous data.

The following is a statement of the limitations of some of the spatial data used for analysis in this assessment. It should be noted that this statement may not be entirely complete, however an attempt was made to address all major sources of spatial data such that results from these analyses could be considered holistically. This statement includes the following topics:

- Current Vegetation
- Historic Vegetation
- Invasive Vegetation
- Vegetative Fragmentation
- Disturbance
- Altered Hydrology
- Altered Fire Regime
- Grazing
- Points of Diversion
- Geology
- Ownership
- Fish Distributions
- South West Idaho Eco-Group Data
- Urban Rural Development Class (Urban Sprawl)

Analysis of all spatial products was done utilizing Environmental Research Systems Institute (ESRI) ArcView, ArcMap, and ArcInfo software. It is notable that some coverages were continuous (e.g., vegetation) while others were not spatially continuous (e.g., grazing allotments). The analyses included intersecting and joining spatial layers and cross-tabulating attributes. Areas for polygons were calculated using the XTOOLS extension in ESRI ArcView, and the majority of tabular reports were generated in Microsoft Excel in pivot tables.

1 Current Vegetation Cover

Two data sets describing the current distribution of vegetation categories in the region were available for analysis. The first was a layer produced by ICBEMP, and the second produced by the GAP project. The ICBEMP layer did provide a seamless current vegetation coverage for the region, however after comparative analysis and data exploration, the authors of this project felt the GAP products were more representative, and thus were used in place of ICBEMP when available.

It is essential to consider that, as with any remotely derived product, there is a certain degree of uncertainty within the GAP product. In GAP, spatial and spectral resolutions, temporal constraints, cloud cover, and geometric correction accentuate this uncertainty. Thus, while it is imperative to include basal vegetation for spatial analysis, the GAP data should not be considered an ideal data set from which major decisions should be based. Instead, it should serve as a guideline for development of future projects, which in turn will improve our understanding of vegetative systems. It is important to note that GAP data was used to define the quantity of focal habitats and vegetative species distributions for this assessment.

Very little has been done to serve as a regional accuracy assessment for the GAP derived vegetation layer. In the late 1990's, field crews from the Bureau of Land Management and Pacific Northwest National Laboratories collected 1,168 field vegetation survey points and performed a first-cut accuracy assessment of the classification of GAP II vegetation in the state of Idaho (Table 1). The results demonstrate that GAP II performs respectably, producing accuracies commonly between 40% and 70%. Unfortunately, there is not a sufficient number of data points to reliably estimate the accuracy of all classes. Analysis of the data presented in Table 1 produces the accuracy summary presented in Table 2. It is notable that the Riparian classification produced an accuracy of zero percent; however, there was only one data point for comparison. It is also of note that this data point was grass, which may or may not be associated with a riparian system.

Table 1. Confidence levels for reference and classified habitat types using GAP II. Overall, 58%; khat 0.403. This table is an calculated product derived from related information provided by the BLM and is presumably very similar to original data.

		Classified							
		Shrub	**Conifer**	**Aspen**	**Juniper Pinyon**	**Grass**	**Riparian**	**Other**	**Totals**
Reference	**Shrub**	344	62	7	5	23	3	2	446
	Conifer	37	231	36	0	0	0	0	304
	Aspen	57	50	28	1	2	1	0	139
	Juniper Pinyon	25	4	0	38	0	0	0	67
	Grass	91	3	5	3	32	0	11	145
	Riparian	0	0	0	0	1	0	0	1
	Other	40	4	0	7	14	0	1	66
	Totals	594	354	76	54	72	4	14	1168

Table 2. Producer's accuracies for specified vegetation categories.

Cover Type	Producers Accuracy
Shrub	58%
Conifer	65%
Aspen	37%
Juniper/Pinyon Pine	70%
Grass	44%
Riparian	0%
Other	7%

The overall accuracy (58%) is the sum of all correct classifications divided by the count of all classifications tested. This calculation provides a broad analysis of the quality of the data set, but does not represent the quality of any one class. The Producer's accuracies illustrated in Table 2 are the estimated accuracies by class. While it is notable that there is considerable variance between class accuracies, it is also of note that there is also considerable difference between the numbers of field-validated plots (Table 1), which introduces a bias. As sample sizes increase, the certainty that the variance of the sample actually represents the variance of the data set increases. Congalton (1991) indicate that a minimum of 100 field samples per class is necessary to produce a meaningful result for geographically large data sets.

The final calculation is that of Khat, which is a measure of the probability that the resulting overall accuracy is due only to random variability (applied as a Kappa test of independence). A Khat value of 1 implies that there is no possibility that the calculations were due to chance, while a Khat value of 0 dictates that there is great probability of chance classification. The Khat value of the GAP II classification is 0.403, which is notably low and may reduce confidence in the classification.

For the state of Idaho, GAP II vegetation classifications were used. GAP II is a refinement of the original GAP vegetation classification, with finer spatial scale and assumedly higher accuracies. Where necessary, GAP classifications for other states in the region were used (Wyoming, Utah, and Nevada). Unfortunately, the different state projects did not always collaborate on processing methods and classifications systems, which resulted in products with different spatial scales and different names for the same vegetative categories. The boundaries between states are also commonly are expressed as abrupt changes in vegetative structure. Additionally, state boundaries do not always line up according to how different states performed their analyses. At times this resulted in large gaps of missing data between states. Where this occurred, the ICBEMP classification for current vegetation was utilized to fill these holes.

1.1 Data Documentation

Attribute_Accuracy_Report:
Accuracy is estimated at 67.27% (range 53.89% to 93.39%) for northern Idaho based on a scene by scene fuzzy set analysis. For southern Idaho, accuracy is estimated at 69.3% (range 63.6% to 79.3%) based on total percent correct over 9 regions.

Regarding inappropriate uses, it is far easier to identify appropriate uses than inappropriate ones. However, there is a "fuzzy line" that is eventually crossed when the differences in resolution of the data, size of geographic area being analyzed, and precision of the answer required for the question are no longer compatible. Following are several examples:

- Using the data as a "content" map for small areas (less than thousands of hectares), typically requiring mapping resolution at 1:24,000 scale and using aerial photographs or ground surveys.
- Combining GAP data with other data finer than 1:100,000 scale to produce new hybrid maps or answer queries resulting in precise measurements.
- Generating specific areal measurements from the data finer than the nearest thousand hectares. (Minimum mapping unit size and accuracy affect this precision.)
- Establishing exact boundaries for regulation or acquisition.
- Establishing definite occurrence or nonoccurrence of any feature for an exact geographic area. (For land cover, the

percent accuracy will provide a measure of probability.)

- Determining abundance, health, or condition of any feature.

- Establishing a measure of accuracy of any other data by comparison with GAP data.

- Altering the data in any way and redistributing them as a GAP data product.

- Using the data without acquiring and reviewing the metadata and this report.

2 Historic Vegetation Cover

To estimate the relative degree of vegetative change (resulting from habitat or ecosystem fragmentation, urbanization, natural morphology, etc.), it was necessary to analyze a layer of historical natural vegetation cover. The layer used for this analysis was the Kuchler's Potential Natural Vegetation Polygon layer, maintained at ICBEMP. Unfortunately, there is no way to test the accuracy of a layer describing potential natural vegetation. It is assumed that this coverage is a broad overview of what an idealistic vegetative state might be like without any anthropogenic influence. The scale of these data is much larger than the scale of the GAP data used for the distribution of current vegetation. Unfortunately, the availability of regional, contiguous data sets describing potential natural vegetation is very limited, and Kuchler's classification was the best option found for spatial and temporal analysis of vegetation changes.

2.1 Data Documentation

Originator: U.S. Forest Service
Publication Date: 03/15/1995
Title: Kuchler's Potential Natural Vegetation –Polygon
Abstract: Kuchler's Potential Natural Vegetation–Polygon (1964)
Purpose: Used for analysis in Scientific Assessment of the ICBEMP.

Use Constraints

These data were intended for use at the broad-scale, generally the regional, subbasin (4th field HUC) or possibly the subwatershed (6th field HUC) level. The individual listed as contact person can answer questions concerning appropriate use of data.

Contact Person: Becky Gravenmier
Contact Telephone: (503) 808-2851
Contact Fax: (503) 808-2622
Contact E-mail: bgravenmier@fs.fed.us

3 Invasive Vegetation

This assessment utilizes invasive species from the Idaho State Department of Agriculture and a variety of local agencies in Wyoming. While the Idaho data are statewide and contiguous, there are several limitations. Foremost is that the data were compiled by ISDA but collected by individual county weed control offices, presumably using different mapping techniques. Visual evaluation of this data set demonstrates strong biases in weed distributions as delineated by county boundaries.

The known distributions of invasive species in the State of Idaho is mapped only by dominant invasive by PLSS section. This implies that while a given section may have an abundant population of a particular invasive community, it may also have significant distributions of a second community that is not represented by this data set. Alternatively, presence of a particular invasive species may be over emphasized through the same bias.

Invasive weeds from Wyoming are not by PLSS section, but rather are represented by GPS polygons. While this distribution is more accurate for the weeds that are mapped, it omits weeds that are not inventoried using GPS that are known to exist.

These limitations effective prohibit the use of the data for area calculations or for relative impacts. They are useful to the extent that they demonstrate known occurrences of weeds, but they are by no means representative of the actually distribution of noxious weeds in any areas.

4 Vegetative Fragmentation

Vegetative fragmentation in the scope of this assessment is defined as the relative degree of fragmentation within a vegetative community, regardless of cause. The fragmentation factor utilized in this assessment was derived as part of the ICBEMP assessment.

4.1 Data Documentation

Originator: Interior Columbia Basin Ecosystem Management Project
Title: Similarity/Fragmentation Index for Succession/Disturbance and Vegetation Composition/Structure (ASMNT)
Other Citation Details: /emp/crbdb/crb/h6char/sim.dbf
Online Linkage: http://www.icbemp.gov/spatial/landchar/

Abstract

Similarity index of subwatershed succession/disturbance regime and vegetation composition/structure to historical range of variability pattern. The inverse of this similarity index provides an index of fragmentation. This is a broad-scale index classifying subwatersheds into classes of similarity to the historical landscape regime based on the system developed and described in the landscape assessment. The index is assigned to subwatersheds for the current conditions as a similarity comparison to the historical regime.

Purpose

Used for Supplemental Draft EIS and Integrated Risk Assessment analysis. At the broad-scale, summary of the classes of this variable can be used to identify how much area may be similar to the historical regime or the inverse can be used to estimate departure from the historical regime. In addition, this variable could be summarized at a 4th code HUC level to identify and assess subbasins in a similar manner. These broad-scale data should not be used to target specific subwatershed similarity or departure, since the classification is relative and has a potential error of 20%. Since classes are relative to each other, these data should be used in this context and not as an absolute calculation of conditions. For example, if one subwatershed has a given classification and the adjacent subwatershed has a different classification, the interpretation is that the one subwatershed has much higher probability of its assigned class than the other. Another way to consider this interpretation is that the absolute amount of a given class is unknown at this scale, but these data indicate that one subwatershed has much higher probability than the other of the assigned class.

This index ranks subwatersheds (6th field HUC) from 0 (lowest) to 10 (highest) based on similarity of the succession/disturbance regime, vegetation composition/structure, and landscape pattern to the historical range of variability pattern. Regional and landscape similarities of historical and current vegetation conditions, and succession/disturbance regimes are discussed on page 420 of Hann *et al.* (1997). Multiple input variables and calculations were used to classify this variable into a similarity to the historical regime. Definition and prediction of this variable is described in Hann *et al.* (1997).

Use Constraints

SIM is a single index calculated for each subwatershed based on the current or future broad- and mid-scale integrated departure from a 400-year pre-EuroAmerican settlement estimate of variation. The index calculation included integration of several variables that are listed in the Capture Methods section. Any summary of these subwatershed data to a finer stratification, such as potential vegetation group (PVG), will contain some error since multiple PVGs occur in any one subwatershed. This variable can be used to assess, identify, or correlate the general similarity or departure from the historical regime. This variable should not be used to summarize refined stratifications or small area absolute amounts similarity or departure, because of the inclusions and the generic nature of this classification.

These data were intended for use at the broad-scale, generally to summarize regional conditions, prioritize subbasins (4th field HUC), or identify large groups of subwatersheds (6th field HUC) that would contain a predominance of the conditions for the class. Data should not be used to target conditions for specific subwatersheds, because of accuracy limitations. The individual listed as the Contact Person can answer questions concerning appropriate use of data.

Contact Person: Becky Gravenmier
Contact Telephone: (503) 808-2851
Contact Fax: (503) 808-2622
Contact E-mail: bgravenmier@fs.fed.us

Logical Consistency Report

The attributes in this data set are derived from a rule set linked to the intermediate input variables. Because these intermediate input variables are predicted, any one resulting subwatershed variable class has approximately 15 to 25% chance of error into an adjacent class and 5 to 15% chance of error to non-adjacent classes. When classes are summarized at the Basin or groups of subbasins scale, confidence in the class area summary is approximately plus or minus 10%. When classes are summarized at the subbasin scale, confidence in the class area summary is approximately plus or minus 20%. This can be improved to plus or minus 10% by grouping classes into a coarser (3 class; low, moderate, high) classification, which will improve accuracy. The classes are only applicable and accurate when considered in a relative sense to each other.

This variable should not be used to summarize absolute inferences. Confidence in correct classification of any one subwatershed compared to ground truth is estimated to be 65% (2 out of 3 chances of being right). Confidence in composition of the different classes summarized across the basin is estimated at 90% (9 out of 10 chances of being right), 85% for a group of subbasins, 80% for subwatersheds within a subbasin, and 70% for a smaller group (10 to 20) of subwatersheds.

5 Forest Management Activity

For the scope of this assessment, disturbance is defined as the change of a system from its natural state. This is important to consider for a subbasin assessment. The disturbance layer utilized in subbasin planning was derived from the ICBEMP project, and included many attributes. Of these attributes, the authors selected to only use Forest Management Activity.

Logically it would have been preferable to use GPS or higher resolution field data collections to more accurately represent timber harvest. Large logistical barriers were encountered, however, when attempting to coordinate with several government and private sector agencies as to the extent and type of timber management activities at the subbasin scale within the timeframe of this assessment. Therefore, the ICBEMP layer was utilized as the best available regional estimate of timber management activity through the subbasin.

5.1 Data Documentation

Abstract

Current Disturbance and Activities—The current time period generally reflects the current year (1999) plus or minus 5 years (i.e., 1994–2004). Developed from data and models using administrative unit data from the past 10 years as one input. Reflects the disturbance from 1988 to 1997 (10-year average). Current disturbance and activities include 10 variables of which most are expressed in relative low, moderate, and high classes. The data for these 10 variables for Forest Service and BLM lands came from administrative unit reports and wildfire reports, while data for other lands came from general resource reports and extrapolation of assumptions. Activities are planned treatments , while disturbances include unplanned effects. Planned activities include: livestock grazing measured in relative classes of animal unit months (AUMs) and range allotment restoration and maintenance (RST), which is measured in relative classes of area affected; timber and woodland harvest (HRV) and thinning (THN) measured in relative classes of area treated, while wood product volume (VOL) is measured in an approximate estimate of millions of board feet; and prescribed fire and fuel management (PRS) and prescribed natural fire (PNF), both also measured in relative classes of area treated. Two summary activity variables are provided: forest and woodland management activity (FMA) is a summary of HRV and THN, while fire activity (FAD) is a summary of PRS and PNF. The one unplanned disturbance variable is the amount of wildland fire (wildfire, WLF).

Purpose

The intent of current disturbance and activity data is to provide baseline information useful to understanding current activity and disturbance levels at the broad-scale. Future predictions of this information can be used at the broad-scale to evaluate scenarios or alternatives. The 10 disturbance and activity variables can be used to address an understanding of the relative location and relative amounts of management treatments and disturbance that are occurring currently and how those may change in the future under different scenarios or alternatives.

Use Constraints

All of the disturbance and activity variables are expressed as relative classes, except volume, which is expressed in millions of board feet. The classes are based on relativized indexes generated from actual data on acres of activity or disturbance. Consequently, the classes are only useful in a relative sense, i.e., comparing different areas or summarizing conditions within or across the whole area.

These data were intended for use at the broad-scale, generally to summarize regional levels of activities and disturbance, prioritize or plan subbasin (4th field HUC) outcomes for a given level of activity or disturbance. The individual listed as the Contact Person can answer questions concerning appropriate use of data

Contact Person: Becky Gravenmier
Contact Telephone: (503) 808-2851
Contact Fax: (503) 808-2622
Contact E-mail: bgravenmier@fs.fed.us

Attribute Accuracy Report:

The attributes in this data set are derived from a rule set linked to the input of treatment and disturbance acre or volume data. The reported treatment and disturbance data was only spatially specific to the administrative unit. Consequently, this reported data was spatially redistributed through modeling and assumptions to a finer scale. Because of the general nature of the reported data and the extrapolation approach, any one resulting subbasin variable class has approximately 15 to 25% chance of error into an adjacent class and 5 to 15% chance of error to nonadjacent classes. When classes are summarized at the Basin or groups of subbasins scale, confidence in the class area summary is approximately plus or minus 10%. When classes are summarized at the subbasin scale, confidence in the class area summary is approximately plus or minus 20%. The classes are only applicable and accurate when considered in a relative sense to each other. The estimated timber volume has plus or minus 10% accuracy at the basin or groups of subbasin scale, which declines to plus or minus 20% for just one subbasin.

This variable should not be used to summarize absolute inferences. Confidence in correct classification of any one subbasin compared to ground truth is estimated to be 65% (2 out of 3 chances of being right). Confidence in composition of the different classes summarized across the basin is estimated at 90% (9 out of 10 chances of being right), 85% for a group of subbasins, 80% for subwatersheds within a subbasin, and 70% for a smaller group (10 to 20) of subwatersheds.

6 Altered Hydrology

As part of this subbasin assessment, it is necessary to evaluate the relationships between humans and the effect that they have on hydrologic systems. This is a very large and sweeping concept that may be impacted by factors ranging from construction of dams to urban sprawl, road construction, and timber harvest. ICBEMP performed a multivariate analysis of this type and derived an estimate of the relative impact that anthropogenic activity has effected regions in the Columbia River Basin. In this assessment, we utilized this factor, called the Hydro Human Impact factor, in our analysis.

6.1 Data Documentation

Abstract

Hydrologic Impacts Index. The hydrologic impacts index reflects the cumulative impacts from human associated developments of cropland agriculture, mining, dams, and roads. This is a broad-scale index classifying subwatersheds into classes from very low to very high relative probability of amounts of these impacts. The index is assigned to subwatersheds based on the presence or absence of substantial amounts of cropland, mines, and dams, and from road density classification.

Purpose

Used for Supplemental Draft EIS and Integrated Risk Assessment analysis. Can be used to assess the cumulative impacts from cropland, mines, dams and roads on hydrologic systems. At the broad-scale, summary of the classes of this variable can be used to identify how much area may have relatively high or low amounts of impacts.. In addition, this variable could be summarized at a 4th code HUC level to identify subbasins with levels of impact.. These broad-scale data should not be used to target specific subwatershed hydrologic or soil problems, since the very low to high type of classification is relative and has a potential error of 20%. Since classes are relative to each other, these data should be used in this context and not as an absolute calculation of conditions.

For example, if one subwatershed has a very high rating and the adjacent subwatershed has a low rating, the interpretation is that the one subwatershed has much higher probability of impact than the other. Another way to consider this interpretation is that the absolute amount of impact is unknown at this scale, but these data indicate that one subwatershed has much higher probability than the other.

These data were used for Supplemental Draft EIS and Integrated Risk Assessment analysis. The hydrologic impacts index was derived using 4 variables from the Watershed Characterization theme (ID #797, export name ATRINTRP): Cropland, Mines, Dams, and Road Class. See auxiliary metadata file (HII.PDF) to define the assignment process for the Dominant Impact variable and the Hydrologic Impact Index.

The rule set used to classify this variable into very low (L), low (L), moderate (M), or high (H) hydrologic impact index is based on logical relationships (Jenny 1980, Alexander 1988, Jensen *et al.* 1997, Megahan 1991, Rockwell 1998, Oregon State University 1993, U.S. Department of Agriculture 1993). These relationships assume that as the presence and amount of impacts of cropland, mines, dams, and roads increase the impact to hydrologic systems and soil processes accumulate through time.

The spatial distribution of the high and very high classes is concentrated in the areas of the Basin with cropland and high density roads or cropland. In contrast, the very low and low are concentrated in the areas of wilderness and roadless or rangeland with low road density. The moderate category tends to follow the areas with intermediate conditions.

Use Constraints

These data were intended for use at the broad-scale, generally to summarize regional conditions, prioritize subbasins (4th field HUC), or identify large groups of subwatersheds (6th field HUC) that would contain a predominance of the conditions for the class. Data should not be used to target conditions for specific subwatersheds, because of accuracy limitations. The individual listed as the Contact Person can answer questions concerning appropriate use of data.

Contact Person: Becky Gravenmier
Contact Telephone: (503) 808-2851
Contact Fax: (503) 808-2622
Contact E-mail: bgravenmier@fs.fed.us

Attribute Accuracy Report

The attributes in this data set are derived from a rule set linked to the intermediate input variables. Because these intermediate input variables are predicted, any one resulting subwatershed variable class has approximately 15 to 25% chance of error into an adjacent class and 5 to 15% chance of error to non-adjacent classes. When classes are summarized at the Basin or groups of subbasins scale, confidence in the class area summary is approximately plus or minus 10%. When classes are summarized at the subbasin scale, confidence in the class area summary is approximately plus or minus 20%. This can be improved to plus or minus 10% by grouping classes into a coarser (3 class: low, moderate, high) classification, which will improve accuracy. The classes are only applicable and accurate when considered in a relative sense to each other.

This variable should not be used to summarize absolute inferences. Confidence in correct classification of any one subwatershed compared to ground truth is estimated to be 65% (2 out of 3 chances of being right). Confidence in composition of the different classes summarized across the basin is estimated at 90% (9 out of 10 chances of being right), 85% for a group of subbasins, 80% for subwatersheds within a subbasin, and 70% for a smaller group (10 to 20) of subwatersheds.

7 Altered Fire Regime

Ecosystems-at-risk (EAR) integrates ignition probability, fire weather hazard, and fire regime condition class (FRCC), based on the probability of severe fire effects. FRCC is a very large and complex data set that essentially represents how much damage might be done to any particular area in the event of a fire. Analysis of this type aids in the understanding of ecosystem health and sustainability, and when combined with data indicating how likely an area is to burn, assists in identifying areas in immanent danger of dramatic habitat changes.

7.1 Data Documentation

Entity and Attribute Overview

The fire regime condition class codes, short descriptions, and explanations follow:

Code	FRCC Description
1	Low departure—Fire regimes are within their historical range and the risk of losing key ecosystem components is low.
2	Moderate departure—At least one fire interval has been missed, or exotic species have altered native species composition (e.g., cheatgrass and blister rust). There is a moderate risk of losing key ecosystem components should a fire occur.
3	High departure—Several fire intervals have been missed, or exotic species have substantially altered native species composition (e.g., cheatgrass and blister rust). There is a high risk of losing key ecosystem components should a fire occur.
4	Moderate grass/shrub—Moderate departure in shrubland or grassland systems. At least one fire interval has been missed, or exotic species have substantially altered native species composition (e.g., cheatgrasss and blister rust). There is moderate risk of losing key ecosystem components should a fire occur.
8	Agriculture
9	Rock/barren
10	Urban
11	Water
12	Snow/ice
13	No information

We used three condition classes to qualitatively rank the departure from the historical fire-regimes. To a large extent, fire-regime condition classes were derived from a comparison of the historical fire regime and the current fire severity. To derive condition class, we simply assessed the transition between our projected current fire severity and the historical fire regime of a given site. If the evidence suggested that fire severity had changed by at least one class, then we would conclude that the condition class has a value that exceeds Class 1. In other words, we would infer that the fire effects would be something other than the effects expected if the structure and composition reflected the historical range of conditions. The greater the departure, the greater the probability that key components would be lost if a wildfire occurred.

Assumptions

We made many assumptions prior to developing the modeling rules to derive fire regime condition class:

1. The current fire severity, and consequently the condition class could only increase as a result of fire exclusion.

2 Condition Class 1 occurred if there had been no detectable change in fire severity between the historical fire regime and the current fire severity.

3. Although fire exclusion has likely resulted in an increase of the duff depth, and consequently future fires will probably be more severe, the resolution of our base data did not allow us to make inferences concerning duff depths.

4. Fire exclusion has not measurably changed fire severity of the communities within the MS3, SR1, and SR2 fire regimes. Our inability to detect change within these fire regimes is more of a function of an inappropriate scale - changes within these regimes (as well as MS2) are much better detected at a landscape scale, rather than at a stand scale. The attributes representing stand structure and composition in our database were not refined enough to detect change within these historical fire regimes.

We adjusted the FRC within tshe (western hemlock), abla4 (Subalpine Fir type 4), pial (whitebark pine), and laly (alpine larch) Potential Natural Vegetation (PNV) types to account for the potential effects of blister rust on western white pine and whitebark pine. The adjustment made to FRCC was relative to canopy cover. For example, if canopy cover = 3 (roughly 40–70%), the FRCC was changed from low to moderate. If canopy cover = 4 (roughly >70%), then FRCC was changed from low to high. We also adjusted the FRCC when broadleaf cover types occurred in coniferous forest PNVs. Since fire would likely be beneficial to aspen, the FRCC was changed to low.

Purpose

These data were designed to characterize broad scale patterns of fire regime departures for use in regional and subregional assessments. The departure of the current condition from the historical base line serves as a proxy to the potential of severe fire effects. In applying the condition class concept, we assume that historical fire regimes represent the conditions under which the ecosystem components within fire-adapted ecosystems evolved and have been maintained over time. Thus, if we projected that fire intervals and/or fire severity has changed from the historical conditions, we would expect that fire size, intensity, and burn patterns would also be subsequently altered if a fire occurred. Furthermore, we assumed that if these basic fire characteristics have changed, then it is likely that there would be subsequent effects to those ecosystem components that had adapted to the historical fire regimes. As used here, fire regime condition classes reflect the probability that key ecosystem components may be lost should a fire occur. Furthermore, a key ecosystem component can represent virtually any attribute of an ecosystem (for example, soil productivity, water quality, floral and faunal species, large-diameter trees, snags, etc.).

General Limitations

These data were designed to characterize broad scale patterns of fire-regime departures for use in regional and subregional assessments. Any decisions based on these data should be supported with field verification, especially at scales finer than 1:100,000. Although the resolution of the FRCC theme is 90-meter cell size, the expected accuracy does not warrant their use for analyses of areas smaller than about 10,000 acres (for example, assessments that typically require 1:24,000 data).

FRCC is based upon information associated to stands, i.e., stand level information. Since fire processes operate at a landscape level, it seems logical that FRCC should be derived at a landscape level instead of a stand level. However, we need to run vegetation simulation models to derive historical range of variability, which would allow FRCC to be modeled at landscape levels.

The derivation of FRCC for grassland and shrubland settings is overly simplistic at this time. Currently, there is little empirical data concerning fire regimes in non-forested settings.

Source Data

http://www.fs.fed.us/r1/cohesive_strategy/datafr.htm

8 Grazing

Two spatial coverages characterizing grazing in the subbasin were utilized in this assessment. The first was a grazing allotment coverage acquired from the ICBEMP website, used to determine type of domestic grazing. It was used because it provided contiguous grazing information compiled from various sources. The grazing data from this coverage is limited in that some records may be old our otherwise outdated, spatial accuracies are variable, and current allotment status is not always documented. These issues are not easily surmounted given the number of contributing source agencies and variability in data collection / record management. This layer was used to calculated percentages of areas grazed by animal type by watershed.

The second coverage used to evaluate grazing in the subbasin was an uncharacteristic grazing layer, also downloaded from the ICBEMP website. This layer is an indicator of the effect of grazing on a natural system, as compared to the predicted potential status of the natural system with only native ungulate grazing and browsing. This layer was used to generate the High, Moderate, and Low categories used in Appendix 3-1.

8.1 Data Documentation—Animal Type

Publication Date: 05/15/1995
Abstract: Range Allotments—Idaho
Purpose: Provide information on locations of grazing on federal lands, type of livestock, and seasonal use.

Use Constraints

These data were intended for use at the broad-scale, generally the regional, subbasin (4th field HUC), or possibly the subwatershed (6th field HUC) level. The individual listed as Contact Person can answer questions concerning appropriate use of data.

Contact Person: Becky Gravenmier
Contact Telephone: (503) 808-2851
Contact Fax: (503)808-2622
Contact E-mail: bgravenmier@fs.fed.us

Attribute Accuracy Report

Topology and attributes for this theme were manually checked by comparing plots of the processed data against original materials. Attribute accuracy information for source materials were not collected since acquisition of source data pre-dated FGDC metadata standards.

Completeness Report

Capture Method: Received digital files or manuscripts. Projections usually UTM (zone 10, 11, 12) or State Plane. Scales 1:24,000 to 1:126,720. Tabular data received in database format or hardcopy. Agencies/field units consulted for edits/data as needed.

Not all agencies submitted data. Received data from: Boise NF, Caribou NF, Challis NF, Clearwater NF, Idaho Panhandle NF, Nez Perce NF, Payette NF, Salmon NF, Sawtooth NF, Targhee NF, Wallowa-Whitman NF, BLM-Boise, BLM-Burley, BLM-Coeur d'Alene, BLM-Idaho Falls, BLM-Salmon, BLM-Shoshone, USFWS, Nat'l Park Service. Allotment number links the spatial and tabular data. Pastures (smaller divisions) are included in some places, but the tabular data applies at the allotment level. In merging the coverages, precedence was given to the most accurate coverage. The merged coverage was edited (eliminating slivers, etc.) and then clipped to state and CRBA boundaries to create seven state coverages.

8.2 Data Documentation—Uncharacteristic Grazing

Originator: Interior Columbia Basin Ecosystem Management Project
Title: Current Year Uncharacteristic Livestock Grazing
Other Citation Details: /emp/crbdb/crb/dst/bdbulg.dbf
Online Linkage: http://www.icbemp.gov/spatial/landchar/
Time Period of Content: 5/1/1999
Status: Progress: Complete

Purpose

The objective is to understand the cycles and relationships of current native ungulate regimes as it affects vegetative communities, as compared to the characteristics of natural (historical) ungulate regimes of the Pre-European settlement without the influence of livestock grazing.

Abstract

Uncharacteristic livestock grazing has effects outside of the normal range of effects that occurred in the historical (natural) system. The normal range is considered to be within the 400-year historic range of variability minimum +25% and maximum –25%. The 400-year period includes the variation that is predicted to occur within the recent and current climate without influence of Euro-American settlement influence. The historical regime accounts in general for influences of native species adaptations and soil development for the past 10 to 15 thousand years since the last glacial period. Some native species adaptations have evolved over the last 1 to 3 million years in response to changing paleoecological climates and disturbances.

Current time period generally reflects the current year (1999) plus or minus 5 years (i.e., 1994–2004). Developed from data and models using administrative unit data from the past 10 years as one input. Reflects the disturbance from 1988 to 1997 (10-year average) .

Use Constraints

These data were intended for use at the broad-scale, generally the regional, subbasin (4th field HUC), or possibly the subwatershed (6th field HUC) level. The individual listed as contact person (Becky Gravenmier) can answer questions concerning appropriate use of data.

Attribute Definition

Description = Current Uncharacteristic Livestock Grazing Classification

VH: ≥ 0.900000001 to ≤ 1.0.

Very high probability of uncharacteristic livestock grazing in the subwatershed.

H: > 0.549471265 to 0.0.

High probability of extensive uncharacteristic livestock grazing effects in the subwatershed with considerable cumulative effects from high stocking levels in the early to mid 1900s. This level of uncharacteristic livestock grazing would likely result in negative effects to both upland and riparian systems, unless mitigated with distribution mgt. Spatial distribution highly correlated with the dry shrub PVGs.

M: ≥ 0.049981819 to < 0.549471264.

Moderate probability of extensive uncharacteristic livestock grazing effects in the subwatershed. This level of uncharacteristic livestock grazing could result in negative effects, particularly on riparian systems in steep, complex terrain, unless mitigated with distribution mgt. Spatial distribution highly correlated with the dry shrub, cool shrub, and moist forest.

L: ≥ 0.0000000002 to < 0.049981818.

Low probability of uncharacteristic livestock grazing in the subwatershed. It is unlikely that this level of uncharacteristic livestock grazing would cause extensive effects, but in steep, complex terrain could result in negative impacts on riparian systems. Spatial distribution highly correlated with the dry forest, moist forest, and cool shrub PVGs.

N: < 0.0000000001

Almost no probability of uncharacteristic livestock grazing in the subwatershed. Spatial distribution highly correlated with agricultural, urban lands, and moist forest.

9 Points of Diversion

The PODs summed in tables are actually water rights with surface water irrigation PODs associated with them. It consists of the Snake River Basin Adjudication recommended rights, the claims they are or will be processing, and any other licensed and permitted rights currently recognized. There can be more than one POD associated with a water right and vice versa, so the count is an estimate. Also, because the amount of water that can be diverted at any one time depends on available water and many other factors, no diversion rates or volumes have been given. Models are being developed for this, but these can only be verified and used in areas where there is a substantial effort at gauging the flow.

Points of diversion in across the basin may be in various states of adjudication. Until adjudicated, much of these data are as of date of the claim application in the late 1980s. Many POD locations are only accurate to the quarter-quarter or QQQ section. PODs for the state of Idaho are currently being adjudicated, and inventories are changing rapidly. It is notable that these points were acquired from IDWR in November 2003, and the database may have altered significantly since.

Diversion Rates

Also, because the amount of water that can be diverted at any one time depends on available water and many other factors, no diversion rates or volumes have been given. Models are being developed for this, but these can only be verified and used in areas where there is a substantial effort at gauging the flow. *MIKE Basin Surface Water Budget Modeling*, as well as projects by USBR, IDWR, and DHI, Inc., are examples of quantifying the amount of available water being diverted. PHabSim is an additional software approach that evaluates the effects on aquatic species.

10 Geology

Major geological features are important at the subbasin scale whereas they influence stream and slope stability, topography, stream incision, vegetative structure, and other factors. While much of the areas encompassed in creation of this assessment is mapped at a high resolution for geologic features, these records are scattered amongst several academic and governmental organizations, and many are not in formats easily utilized. Therefore, a major lithology coverage maintained by ICBEMP was used for this assessment. This coverage was intended for large-scale (> 1:1000000) analysis, however for this application it was the best available data source, and since not direct decisions will be made based on high discritization of this layer, its relatively coarse resolution is considered acceptable.

10.1 Data Documentation

Citation Information

Originator: U.S. Geological Survey
Publication Date: 11/03/1995
Title: Major Lithology
Other Citation Details: /emp/crbv/crb/min/lithm
Online Linkage: http://www.icbemp.gov/spatial/min/

Abstract

Classification of Geologic Map Units According to their Major Lithology—The major lithologies classifications were used for the component Scientific Assessment portion of the project. Both the biophysical and economic sections utilize information provided in this data set.

Use Constraints

These data were intended for use at the broad-scale, generally the regional, subbasin (4th field HUC), or possibly the subwatershed (6th field HUC) level. The individual listed as Contact Person can answer questions concerning appropriate use of data.

Contact Information

Contact Person: Bruce Johnson
Contact Organization: U.S. Geological Survey
Contact Telephone: (509) 353-3176
Contact E-mail: bjohnson@galileo.wr.usgs.gov
Native Data Set Environment: Computer Operating System: SUN/ARC/INFO
Filename: /emp/crbv/crb/min/lithm, Native File Size: 27.12 Mb, Export File Size: 50.22 Mb

Data Quality Information:

Topology and attributes for this theme were manually checked by comparing plots of the processed data against original materials. Attribute accuracy information for source materials were not collected since acquisition of source data pre-dated FGDC metadata standards.

State geologic maps digitized by scanning Washington, Idaho, and Montana from paper sources and Wyoming, Utah, Nevada, and California from stable base material made from publication mylars. Maps edgematched at state lines. Montana had an RMS error on transform of 965m, the rest had RMS errors<190m. Map units for each state were classified by expert team. Using the classifications, the maps were dissolved, unioned, slivers eliminated at state lines, then dissolved again. Classifications were then modified considering other geologic knowledge.

11 Ownership

Political components to this subbasin assessment are important whereas they commonly reflect land use practices and, in the case of private vs. public lands, ownership impacts the ability for management agencies to access areas for inventory or remediation purposes. For this reason, ownership was considered in this analysis at a broad scale using regional land ownership categories maintained by ICBEMP.

11.1 Data Documentation

Use Constraints

These data were intended for use at the broad-scale, generally the regional, subbasin (4th field HUC), or possibly the subwatershed (6th field HUC) level. The individual listed as Contact Person can answer questions concerning appropriate use of data.

Contact Information

Contact Person: Becky Gravenmier
Contact Organization: Interior Columbia Basin Ecosystem Management Project
Contact Position: ICBEMP Spatial Team Lead
Contact Telephone: (503) 808-2851
Contact Fax: (503) 808-2622
Contact E-mail: bgravenmier@fs.fed.us

Attribute Domain Values

Enumerated Domain Value: 0

Enumerated Domain Value Definition: NOT ATTRIBUTED

Enumerated Domain Value: 11

Enumerated Domain Value Definition: FOREST SERVICE

Enumerated Domain Value: 20

Enumerated Domain Value Definition: DEPT OF DEFENSE

Enumerated Domain Value: 90

Enumerated Domain Value Definition: TRIBAL LAND

Enumerated Domain Value: 1

Enumerated Domain Value Definition: PRIVATE

Enumerated Domain Value: 80

Enumerated Domain Value Definition: STATE LAND

Enumerated Domain Value: 12

Enumerated Domain Value Definition: AGRICULTURAL RESEARCH SERVICE

12 Fish Distributions

Various assessments may have included analyses on different fish species, including but not limited to Chinook salmon, Snake River steelhead, bull trout, redband trout, and Yellowstone cutthroat trout. All fish distribution information was submitted to a review panel including local and regional experts for comment before publication. Chinook and steelhead information was mapped at fine scale by submitting data requests to local experts in the form of large scale maps and digitizing their returned comments into GIS. Other fish information, such as bull trout, redband trout, and Yellowstone cutthroat trout distributions were collected dominantly as electrofishing surveys by various agencies. Only surveys conducted in the last 5 years were utilized.

Estimation of fish distributions and populations is not a trivial science and has serious ramifications. It is important to note that, in this assessment, the best attempt possible was made to generate an objective and representative snapshot as to the current status of fish populations and distributions. There is obviously some degree of inherent error on both spatial and temporal scales, however it is felt that the analyses included in this assessment are representative of the most current and best estimation of distribution and status. More specific comments are referenced in the assessment text, and the authors are available for comment on their approaches.

Where appropriate, fish densities were calculated at survey locations for bull trout, redband trout, and Yellowstone cutthroat trout. Densities were drawn from the number of fish surveyed (electrofishing) divided by the reach length, and then normalized by subbasin. Because fish density distributions are often strongly skewed toward lower densities, normalization provides a method to statistically separate low from nominal and high densities. For this assessment, low fish densities are ½ standard deviation below the mean, nominal densities are –1/2 to 1/2 standard deviations from the mean, and high densities are greater than ½ standard deviation above the mean of the normalized distribution. Normalization of data ideally forces distributions to mimic a Gaussian distribution, however due to the strong skew of fish densities, the resulting histogram is not normal in appearance. It is, however, more normal than it was before the transform and allows the data to be displayed more effectively.

13 Southwest Idaho Ecogroup Data

In 2001, the Southwest Idaho Ecogroup, made up of the Boise, Payette and Sawtooth National Forests, produced a series of ecoregional assessments for southwestern Idaho. As part of this assessment, they compiled a large amount of spatial data relative to subbasin planning and performed many high-quality analyses. While this was an excellent project, the study areas for their assessment and those for subbasin planning do not overlap, making it difficult to incorporate much of their product into subbasin planning assessments. An attempt was made to use their data as a reference to either substantiate or negate the findings of the authors in this subbasin assessment. However, large-scale implementation of their findings was very difficult to address.

Water quality integrity and geomorphic integrity were two figures that did incorporate the SWIEG data by replacing Inland West Watershed Initiative (IWWI) calls with the SWIEG calls in the 6th field HUCs covered by SWIEG. Fire perimeters and years compiled by SWIEG were also used.

14 Urban Rural Development Class (Urban Sprawl)

An assessment of how urbanization and urban sprawl are affecting natural systems could be an integral part of subbasin planning. In an attempt to constrain the effects of urban areas and their proximity to natural resources, we analyzed the Urban Rural Development Class layer maintained by ICBEMP. This layer provides a very sweeping picture of the geographic and intensity effects of population centers on nearby systems. This layer is based on a variety of older data; it is notable that there is more current information available. However, this layer was the only known source that assessed impacts of this type on a basin scale. It was not used for detailed analysis.

14.1 Data Documentation

Originator: Interior Columbia Basin Ecosystem Management Project
Publication Date: 05/30/1997
Title: Urban / Rural Classes
Other Citation Details: /emp/crbg/crb/demog/rurbclass
Online Linkage: http://www.icbemp.gov/spatial/demog/

Abstract

Urban Rural Development Class. A classification of influence to lands within the ICBEMP from human-created developments. **Purpose**: Used as one of the measures of human influence at the landscape level in the Scientific Assessment of the ICBEMP.

This theme is a general correlate for developments such as housing, roads, industry, utilities, and assorted human-created developments. Classes range from low influence to very high influence for all lands within the Basin.

Use Constraints

These data were intended for use at the broad-scale, generally the regional, subbasin (4th field HUC), or possibly the subwatershed (6th field HUC) level. The individual listed as Contact Person can answer questions concerning appropriate use of data.

Attribute Accuracy Report

This is a data set resulting from modeling or analysis. The accuracy of the attributes are dependent on the accuracy of source materials as well as the statistical accuracy of the modeling process. Attribute accuracy information for source materials were not collected since acquisition of source data pre-dated FGDC metadata standards.

Logical Consistency Report

Not applicable to raster data.

Completeness Report

These data are as complete as the source data maps: Towns DCW-1:1M Point (export name BVBTOWNB) and Road Density Predicted (export name BGBRDDN).

Originator: Intermountain Fire Science Lab - Missoula, MT
Publication Date: 02/29/1996
Title: Road Density (Predicted)
Other Citation Details: /emp/crbg/crb/culture/roaddens
Online Linkage: http://www.icbemp.gov/spatial/culture/

Originator: Census Bureau
Publication Date: 09/18/1995
Title: Towns—100k (Point)
Other Citation Details: /emp/subv/crb/demog/towns
Online Linkage: http://www.icbemp.gov/spatial/demog/

Process Description

Reclass Urban Pop Wildland Interface very high to high and very low to low; take category of towns (Yakima, Tri Cities, Spokane, Missoula, Boise, Caldwell) & assign very high class to all areas w/in 60 miles of center w/predicted road density ≥ moderate.

Attribute Domain Values

Enumerated Domain Value: 2

Enumerated Domain Value Definition: LOW—Influence from Human-Created Developments

Enumerated Domain Value: 3

Enumerated Domain Value Definition: MODERATE—Influence from Human-Created Developments

Enumerated Domain Value: 5

Enumerated Domain Value Definition: VERY HIGH—Influence from Human-Created Developments

Enumerated Domain Value: 4

Enumerated Domain Value Definition: HIGH—Influence from Human-Created Developments

Contact Person: Becky Gravenmier
Contact Organization: Interior Columbia Basin Ecosystem Management Project
Address: USDA Forest Service, Regional Office R6, 333 S.W. First Avenue, 4th Floor, Portland, OR 97204
Contact Telephone: (503) 808-2851
Contact Fax: (503) 808-2622
Contact E-mail: bgravenmier@fs.fed.us

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APPENDIX 2-2—KEY ECOLOGICAL FUNCTIONS OF SPECIES

A Hierarchical Classification of KEFs and KECs

I Classification of the Key Ecological Functions (KEFs) of Wildlife

(Marcot and Vander Heyden 2001)

1. Trophic relationships
   - 1.1. heterotrophic consumer (an organism that is unable to manufacture its own food and must feed on other organisms)
     - 1.1.1. primary consumer (herbivore; an organism that feeds primarily on plant material) (also see below under Herbivory)
       - 1.1.1.1. foliovore (leaf eater)
       - 1.1.1.2. spermivore (seed eater)
       - 1.1.1.3. browser (leaf, stem eater)
       - 1.1.1.4. grazer (grass, forb eater)
       - 1.1.1.5. frugivore (fruit eater)
       - 1.1.1.6. sap feeder
       - 1.1.1.7. root feeders
       - 1.1.1.8. nectivore (nectar feeder)
       - 1.1.1.9. fungivore (fungus feeder)
       - 1.1.1.10. flower/bud/catkin feeder
       - 1.1.1.11. aquatic herbivore
       - 1.1.1.12. feeds in water on decomposing benthic substrate (benthic is the lowermost zone of a water body)
       - 1.1.1.13. bark/cambium/bole feeder
     - 1.1.2 secondary consumer (primary predator or primary carnivore; a carnivore that preys on other vertebrate or invertebrate animals, primarily herbivores)
       - 1.1.2.1 invertebrate eater
         - 1.1.2.1.1 terrestrial invertebrates
         - 1.1.2.1.2 aquatic macroinvertebrates (e.g., not plankton)
         - 1.1.2.1.3 freshwater or marine zooplankton
       - 1.1.2.2 vertebrate eater (consumer or predator of herbivorous or carnivorous vertebrates)
         - 1.1.2.2.1 piscivorous (fish eater)

1.1.2.3 ovivorous (egg eater)

1.1.3 tertiary consumer (secondary predator or secondary carnivore; a carnivore that preys on other carnivores)

1.1.4 carrion feeder (feeds on dead animals)

1.1.5 cannibalistic (eats members of its own species)

1.1.6 coprophagous (feeds on fecal material)

1.1.7 feeds on human garbage/refuse

1.1.7.1 aquatic (e.g., offal and bycatch of fishing boats)

1.1.7.2 terrestrial (e.g., garbage cans, landfills)

1.2 prey relationship

1.2.1 prey for secondary or tertiary consumer (primary or secondary predator)

2. Aids in physical transfer of substances for nutrient cycling (C,N,P, etc.)

3. Organismal relationships

3.1. controls or depresses insect population peaks

3.2. controls terrestrial vertebrate populations (through predation or displacement)

3.3. pollination vector

3.4. transportation of viable seeds, spores, plants, or animals (through ingestion, caching, caught in hair or mud on feet, etc.)

3.4.1. disperses fungi

3.4.2. disperses lichens

3.4.3. disperses bryophytes, including mosses

3.4.4. disperses insects and other invertebrates (phoresis)

3.4.5. disperses seeds/fruits (through ingestion or caching)

3.4.6. disperses vascular plants

3.5. creates feeding, roosting, denning, or nesting opportunities for other organisms

3.5.1. creates feeding opportunities (other than direct prey relations)

3.5.1.1.creates sapwells in trees

3.5.2. creates roosting, denning, or nesting opportunities

3.6. primary creation of structures (possibly used by other organisms)

3.6.1. aerial structures (typically large raptor or squirrel stick or leaf nests in trees or on platforms, or barn swallow/cliff swallow nests)

3.6.2. ground structures (above-ground, nonaquatic nests and ends and other substrates, such as woodrat middens, nesting mounds of swans, for example)

3.6.3. aquatic structures (muskrat lodges, beaver dams)

3.7. user of structures created by other species

3.7.1. aerial structures (typically large raptor or squirrel stick or leaf nests in trees or on platforms, or barn swallow/cliff swallow nests)

3.7.2. ground structures (above-ground, nonaquatic nests and ends and other substrates, such as woodrat middens, nesting mounds of swans, for example)

3.7.3. aquatic structures (muskrat lodges, beaver dams)

3.8. nest parasite

3.8.1. interspecies parasite (commonly lays eggs in nests of other species)

3.8.2. common interspecific host (parasitized by other species)

3.9. primary cavity excavator in snags or live trees (organisms able to excavate their own cavities)

3.10. secondary cavity user (organisms that do not excavate their own cavities and depend on primary cavity excavators or natural cavities)

3.11. primary burrow excavator (fossorial or underground burrows)

3.11.1. creates large burrows (rabbit-sized or larger)

3.11.2. creates small burrows (less than rabbit-sized)

3.12. uses burrows dug by other species (secondary burrow user)

3.13. creates runways (possibly used by other species; runways typically are worn paths in dense vegetation)

3.14. uses runways created by other species

3.15. pirates food from other species

3.16. interspecific hybridization (species known to regularly interbreed)

4. Carrier, transmitter, or reservoir of vertebrate diseases

4.1. diseases that affect humans

4.2. diseases that affect domestic animals

4.3. diseases that affect other wildlife species

5. Soil relationships

5.1. physically affects (improves) soil structure, aeration (typically by digging)

5.2. physically affects (degrades) soil structure, aeration (typically by trampling)

6. Wood structure relationships (either living or dead wood)

6.1. physically fragments down wood

6.2. physically fragments standing wood

7. Water relationships

7.1. impounds water by creating diversions or dams

   7.2. creates ponds or wetlands through wallowing

8. Vegetation structure and composition relationships
   8.1. creates standing dead trees (snags)
   8.2. herbivory on trees or shrubs that may alter vegetation structure and composition (browsers)
   8.3. herbivory on grasses or forbs that may alter vegetation structure and composition (grazers)

II Defining Habitat Elements—Key Environmental Correlates (KECs)

(O'Neil *et al.* 2001)

Site-specific habitat elements are those components of the environment believed to most influence wildlife species distribution, abundance, fitness, and viability (definition adapted from Marcot *et al*. (1997) and Mayer and Laudenslayer (1988). In this context, habitat elements include natural attributes, both biological and physical (e.g., large trees, woody debris, cliffs, and soil characteristics) as well as anthropogenic features and their effects such as roads, buildings, and pollution. Including these fine-scale attributes of an animal's environment when describing the habitat associations for a particular species expands the concept and definition of habitat, a term widely used only to characterize the vegetative community or structural condition occupied by a species. Failing to assess and inventory habitat elements within these communities and conditions may lead to errors of commission; species may be presumed to occur when in actuality they do not. Habitat elements that influence a species negatively may preclude occupancy or breeding despite adequate floristic or structural conditions.

Traditionally defined, the term habitat is that set of environmental conditions, usually depicted as food, water, and cover, used and selected for by a given organism.

Despite this broad definition, many land management agencies use the term habitat to denote merely the vegetation conditions and/or structural or seral stages used by a particular species. However, many other environmental attributes or features influence and affect the population viability of wildlife species. Marcot *et al*. (1997) in their assessment of the terrestrial species of the Columbia River Basin emphasized the importance of examining all features that exert influence on wildlife by expanding the definition of habitat to encompass all environmental correlates, naming the entirety of these attributes key environmental correlates or KECs. All environmental scales, from broad floristic communities to fine-scale within-stand features, were included in their definition of a KEC. The word "key" in key environmental correlate refers to the high degree of influence (either positive or negative) the environmental correlates exert on the realized fitness of a given species. Nonetheless, when this information was determined, only direct relationships between the habitat element and a species were identified. Most of the habitat elements-species associations refer to mostly positive influences between the habitat elements and the species. Negative influence between habitat elements and the species may be viewed as environmental stressors; however, a comprehensive list of negative influences is not presented here.

The list of habitat elements and their definitions was derived from Marcot *et al*.1997 and was refined and edited based on the published literature and expert review. The final list comprises 287 habitat elements, including naturally occurring biological and physical elements as well as elements created or caused by human actions. Definitions are provided to characterize each element and clarify the nature of its influence on wildlife species. The following are habitat elements definitions.

1. Forest, shrubland, and grassland habitat elements

Biotic, naturally occurring attributes of forest and shrubland communities; the information that follows is for mostly positive relationships.

1.1 Forest/woodland vegetative elements or substrates. Biotic components found within a forested context.

1.1.1 Down wood. Includes downed logs, branches, and rootwads.

1.1.1.1 Decay class. A system by which down wood is classified based on its deterioration.

1.1.1.1.1 hard (class 1, 2). Little wood decay evident; bark and branches present; log resting on branches, not fully in contact with ground; includes classes 1 and 2 as described in Thomas 1979.

1.1.1.1.2 moderate (class 3). Moderate decay present; some branches and bark missing or loose; most of log in contact with ground; includes class 3 as described in Thomas 1979.

1.1.1.1.3 soft (class 4, 5). Well decayed logs; bark and branches missing; fully in contact with ground; includes classes 4 and 5 as described in Thomas 1979.

1.1.1.2 Down wood in riparian areas. Includes down wood in the terrestrial portion of riparian zones in forest habitats. Does not refer to instream woody debris.

1.1.1.3 Down wood in upland areas. Includes downed wood in upland areas of forest habitats.

1.1.2 Litter. The upper layer of loose, organic (primarily vegetative) debris on the forest floor. Decomposition may have begun, but components still recognizable.

1.1.3 Duff. The matted layer of organic debris beneath the litter layer. Decomposition more advanced than in litter layer; intergrades with uppermost humus layer of soil.

1.1.4 Shrub layer. Refers to the shrub strata within forest stands.

Biotic components found within a shrubland or grassland context (these are positive influences only).

1.2.1 Herbaceous layer. Zone of understory nonwoody vegetation beneath shrub layer (nonforest context). May include forbs, grasses.

1.2.2 Fruits/seeds/nuts. Plant reproductive bodies that are used by animals.

1.2.3 Moss. Large group of green plants without flowers but with small leafy stems growing in clumps.

1.2.4 Cactus. Any of a large group of drought resistant plants with fleshy, usually jointed stems and leaves replaced by scales or spines.

1.2.5 Flowers. A modified plant branch for the production of seeds and bearing leaves specialized into floral organs.

1.2.6 Shrubs. Plant with persistent woody stems and <16.5 feet tall; usually produces several basal shoots as opposed to a single bole.

1.2.6.1 Shrub size. Refers to shrub height.

1.2.6.1.1 small <2.0 feet

1.2.6.1.2 medium 2.0–6.5 feet

1.2.6.1.3 large 6.5–16.5 feet

1.2.6.2 Percent shrub canopy cover. Percent of ground covered by vertical projection of shrub crown diameter.

1.2.6.3 Shrub canopy layer. Within a shrub community, differences in shrub height and growth form produce multi-layered shrub canopies.

1.2.6.3.1 Subcanopy. The space below the predominant shrub crowns.

1.2.6.3.2 Above canopy. The space above the predominant shrub crowns.

1.2.7 Fungi. Mushrooms, molds, yeasts, rusts, etc.

1.2.8 Forbs. Broad-leaved herbaceous plants. Does not include grasses, sedges, or rushes.

1.2.9 Bulbs/tubers. Any underground part of a plant that functions in nutrient absorption, aeration, storage, reproduction and/or anchorage.

1.2.10 Grasses. Members of the Graminae family.

1.2.11 Cryptogamic crusts. Nonvascular plants that grow on the soil surface. Primarily lichens, mosses, and algae. Often found in arid or semiarid regions. May form soil surface pinnacles.

1.2.12 Trees (located in a shrubland/grassland context). Small groups of trees or isolated individuals.

1.2.12.1 Snags. Standing dead trees.

1.2.12.1.1 Decay class. System by which snags are classified based on their deterioration.

1.2.12.1.1.1 hard. Little wood decay evident; bark, branches, top, present; recently dead; includes class 1 as described in Brown 1985.

1.2.12.1.1.2 moderate. Moderately decayed wood; some branches and bark missing and/or loose; top broken; includes classes 2 and 3 as described in Brown 1985.

1.2.12.1.1.3 soft. Well-decayed wood; bark and branches generally absent; top broken; includes classes 4 and 5 as described in Brown 1985.

1.2.12.2 Snag size. Measured in dbh, as previously defined.

1.2.12.2.1 shrub/seedling <1 inch dbh

1.2.12.2.2 sapling/pole 1–9 inches dbh

1.2.12.2.3 small tree 10–14 inches dbh

1.2.12.2.4 medium tree 15–19 inches dbh

1.2.12.2.5 large tree 20–29 inches dbh

1.2.12.2.6 giant tree >30 inches dbh

1.2.12.3 Tree size. Measured in dbh, as previously defined.

1.2.12.3.1 shrub/seedling <1 inch dbh

1.2.12.3.2 sapling/pole 1–9 inches dbh

1.2.12.3.3 small tree 10–14 inches dbh

1.2.12.3.4 medium tree 15–19 inches dbh

1.2.12.3.5 large tree 20–29 inches dbh

1.2.12.3.6 giant tree >30 inches dbh

1.2.13 Edges. The place where plant communities meet or where successional stages or vegetative conditions within plant communities come together.

2. Ecological habitat elements

Selected interspecies relationships within the biotic community; they include both positive and negative influences.

2.1 Exotic species. Any nonnative plant or animal, including cats, dogs, and cattle.

2.1.1 Plants. This field refers to the relationship between an exotic plant species and animal species.

2.1.2 Animals. This field refers to the relationship between an exotic animal species and the animal species.

2.1.2.1 Predation. The species queried is preyed upon by or preys upon an exotic species.

2.1.2.2 Direct displacement. The species queried is physically displaced by an exotic species, either by competition or actual disturbance.

2.1.2.3 Habitat structure change. The species queried is affected by habitat structural changes caused by an exotic species, for example, cattle grazing.

2.1.2.4 Other. Any other effects of an exotic species on a native species.

2.2 Insect population irruptions. The species directly benefits from insect population irruptions (i.e., benefits from the insects themselves, not the resulting tree mortality or loss of foliage).

2.2.1 Mountain pine beetle. The species directly benefits from mountain pine beetle eruptions.

2.2.2 Spruce budworm. The species directly benefits from spruce budworm irruptions.

2.2.3 Gypsy moth. The species directly benefits from gypsy moth irruptions.

2.3 Beaver/muskrat activity. The results of beaver activity including dams, lodges, and ponds, that are beneficial to other species.

2.4 Burrows. Aquatic or terrestrial cavities produced by burrowing animals that are beneficial to other species.

3. Nonvegetative, Abiotic, Terrestrial Habitat Elements

Nonliving components found within any ecosystem. Primarily positive influences with a few exceptions as indicated.

3.1 Rocks. Solid mineral deposits.

3.1.1 Gravel. Particle size from 0.1–3.0 inches (0.2–7.6 cm) in diameter; gravel bars associated with streams and rivers are a separate category.

3.1.2 Talus. Accumulations of rocks at the base of cliffs or steep slopes; rock/boulder sizes varied and determine what species can inhabit the spaces between them.

3.1.3 Talus-like habitats. Refers to areas that contain many rocks and boulders but are not associated with cliffs or steep slopes.

3.2 Soils. Various soil characteristics.

3.2.1 Soil depth. The distance from the top layer of the soil to the bedrock or hardpan below.

3.2.2 Soil temperature. Any measure of soil temperature or range of temperatures that are key to the queried species.

3.2.3 Soil moisture. The amount of water contained within the soil.

3.2.4 Soil organic matter. The accumulation of decomposing plant and animal materials found within the soil.

3.2.5 Soil texture. Refers to size distribution and amount of mineral particles (sand, silt, and clay) in the soil; examples are sandy clay, sandy loam, silty clay, etc.

3.3 Rock substrates. Various rock formations.

3.3.1 Avalanche chute. An area where periodic snow or rock slides prevent the establishment of forest conditions; typically shrub and herb dominated (sitka alder, *Alnus sinuate*, and/or vine maple, *Acer circinatum*).

3.3.2 Cliffs. A high, steep formation, usually of rock. Coastal cliffs are a separate category under Marine Habitat Elements.

3.3.3 Caves. An underground chamber open to the surface with varied opening diameters and depths; includes cliff-face caves, intact lava tubes, coastal caves, and mine shafts.

3.3.4 Rocky outcrops and ridges. Areas of exposed rock.

3.3.5 Rock crevices. Refers to the joint spaces in cliffs, and fissures and openings between slab rock; crevices among rocks and boulders in talus fields are a separate category (talus).

3.3.6 Barren ground. Bare exposed soil with >40% of area not vegetated; includes mineral licks and bare agricultural fields; natural bare exposed rock is under the rocky outcrop category.

3.3.7 Playa (alkaline, saline). Shallow desert basins that are without natural drainage ways where water accumulates and evaporates seasonally.

3.4 Snow. Selected features of snow.

3.4.1 Snow depth. Any measure of the distance between the top layer of snow and the ground below.

3.4.2 Glaciers, snow field. Areas of permanent snow and ice.

4. Freshwater Riparian and Aquatic Bodies Habitat Elements

Includes selected forms and characteristics of any body of freshwater attributes. Ranges of continuous attributes that are key to the queried species, if known, will be in the comments.

4.1.1 Dissolved oxygen. Amount of oxygen passed into solution.

4.1.2 Water depth. Distance from the surface of the water to the bottom substrate.

4.1.3 Dissolved solids. A measure of dissolved minerals in water

4.1.4 Water pH. A measure of water acidity or alkalinity.

4.1.5 Water temperature. Water temperature range that is key to the queried species; if known, it is in the comments field.

4.1.6 Water velocity. Speed or momentum of water flow.

4.1.7 Water turbidity. Amount of roiled sediment within the water.

4.1.8 Free water. Water derived from any source.

4.1.9 Salinity and alkalinity. The presence of salts.

4.2 Rivers and streams. Various characteristics of streams and rivers.

4.2.1 Oxbows. A pond or wetland created when a river bend is cut off from the main channel of the river.

4.2.2 Order and class. Systems of stream classification.

4.2.2.1 Intermittent. Streams/rivers that contain nontidal flowing water for only part of the year; water may remain in isolated pools.

4.2.2.2 Upper perennial. Streams/rivers with a high gradient, fast water velocity, no tidal influence; some water flowing throughout the year, substrate consists of rock, cobbles, or gravel with occasional patches of sand; little floodplain development.

4.2.2.3 Lower perennial. Streams/rivers with a low gradient, slow water velocity, no tidal influence; some water flowing throughout the year, substrate consists mainly of sand and mud; floodplain is well developed.

4.2.3 Zone. System of water body classification based on the horizontal strata of the water column.

4.2.3.1 Open water. Open water areas not closely associated with the shoreline or bottom.

4.2.3.2 Submerged/benthic. Relating to the bottom of a body of water, includes the substrate and the overlaying body of water within 3.2 feet (1 m) of the substrate.

4.2.3.3 Shoreline. Continually exposed substrate that is subject to splash, waves, and/or periodic flooding. Includes gravel bars, islands, and immediate nearshore areas.

4.2.4 In-stream substrate. The bottom materials in a body of water.

4.2.4.1 Rocks. Rocks >10 inches (256 mm) in diameter.

4.2.4.2 Cobble/gravel. Rocks or pebbles, .1–10 inches (2.5–256 mm) in diameter, substrata may consist of cobbles, gravel, shell, and sand with no substratum type >70% cover.

4.2.4.3 Sand/mud. Fine substrata <.01 inch (1mm) in diameter, little gravel present, may be mixed with organics.

4.2.5 Vegetation. Herbaceous plants.

4.2.5.1 Submergent vegetation. Rooted aquatic plants that do not emerge above the water surface.

4.2.5.2 Emergent vegetation. Rooted aquatic plants that emerge above the water surface.

4.2.5.3 Floating mats. Unrooted plants that form vegetative masses on the surface of the water.

4.2.6 Coarse woody debris in streams and rivers. Any piece of woody material (debris piles, stumps, root wads, fallen trees) that intrudes into or lies within a river or stream.

4.2.7 Pools. Portions of the stream with reduced current velocity, often with water deeper than surrounding areas.

4.2.8 Riffles. Shallow rapids where the water flows swiftly over completely or partially submerged obstructions to produce surface agitation, but where standing waves are absent.

4.2.9 Runs/glides. Areas of swiftly flowing water, without surface agitation or waves, which approximates uniform flow and in which the slope of the water surface is roughly parallel to the overall gradient of the stream reach.

4.2.10 Overhanging vegetation. Herbaceous plants that cascade over stream and river banks and are <3.2 feet (1 m) above the water surface.

4.2.11 Waterfalls. Steep descent of water within a stream or river.

4.2.12 Banks. Rising ground that borders a body of water.

4.2.13 Seeps or springs. A concentrated flow of ground water issuing from openings in the ground.

4.3 Ephemeral pools. Pools that contain water for only brief periods of time usually associated with periods of high precipitation.

4.4 Sand bars. Exposed areas of sand or mud substrate.

4.5 Gravel bars. Exposed areas of gravel substrate.

4.6 Lakes/ponds/reservoirs. Various characteristics of lakes, ponds, and reservoirs.

4.6.1 Zone. System of water body classification based on the horizontal strata of the water column.

4.6.1.1 Open water. Open water areas not closely associated with the shoreline or bottom substrates.

4.6.1.2 Submerged/benthic. Relating to the bottom of a body of water, includes the substrate and the overlaying body of water within one meter of the substrate.

4.6.1.3 Shoreline. Continually exposed substrate that is subject to splash, waves, and/or periodic flooding. Includes gravel bars, islands, and immediate nearshore areas.

4.6.2 In-water substrate. The bottom materials in a body of water.

4.6.2.1 Rock. Rocks >10 inches (256 mm) in diameter.

4.6.2.2 Cobble/gravel. Rocks or pebbles, .1–10 inches (2.5–256 mm) in diameter, substrata may consist of cobbles, gravel, shell, and sand with no substratum type exceeding 70% cover.

4.6.2.3 Sand/mud. Fine substrata <.1 inch (2.5 mm) in diameter, little gravel present, may be mixed with organics.

4.6.3 Vegetation. Herbaceous plants.

4.6.3.1 Submergent vegetation. Rooted aquatic plants that do not emerge above the water surface.

4.6.3.2 Emergent vegetation. Rooted aquatic plants that emerge above the water surface.

4.6.3.3 Floating mats. Unrooted plants that form vegetative masses on the surface of the water.

4.6.4 Size. Refers to whether or not the species is differentially associated with water bodies based on their size.

4.6.4.1 Ponds. Bodies of water <5 acre (2 ha).

4.6.4.2 Lakes. Bodies of water >5 acre (2 ha).

4.7 Wetlands/marshes/wet meadows/bogs and swamps. Various components and characteristics related to any of these systems.

4.7.1 Riverine wetlands. Wetlands found in association with rivers.

4.7.2 Context When checked, indicates that the setting of the wetland, marsh, wet meadow, bog, or swamp is key to the queried species.

4.7.2.1 Forest. Wetlands within a forest.

4.7.2.2 Nonforest. Wetlands that are not surrounded by forest.

4.7.3 Size. When checked, indicates that the queried species is differentially associated with a wetland, marsh, wet meadow, bog, or swamp based on the size of the water body.

4.7.4 Marshes. Frequently or continually inundated wetlands characterized by emergent herbaceous vegetation (grasses, sedges, reeds) adapted to saturated soil conditions.

4.7.5 Wet meadows. Grasslands with waterlogged soil near the surface but without standing water for most of the year.

4.8 Islands. A piece of land made up of either rock and/or unconsolidated material that projects above and is completely surrounded by water.

4.9 Seasonal flooding. Flooding that occurs periodically due to precipitation patterns.

5. Marine Habitat Elements

Selected biotic and abiotic components and characteristics of marine systems - water depth, and relationship to substrate.

5.1.1 Supratidal. The zone that extends landward from the higher high water line up to either the top of a coastal cliff or the landward limit of marine process (i.e., storm surge limit).

5.1.2 Intertidal. The zone between the higher high water line and the lower low water line.

5.1.3 Nearshore subtidal. The zone that extends from the lower low water line seaward to the 65 foot (20 m) isobath, typically within 0.6 miles (1 km) of shore.

5.1.4 Shelf. The area between the 65–650 feet (20–200 m) isobath, typically within 36 miles (60 km) of shore.

5.1.5 Oceanic. The zone that extends seaward from the 650 feet (200 m) isobath.

5.2 Substrates. The bottom materials of a body of water.

- 5.2.1 Bedrock. The solid rock underlying surface materials.
- 5.2.2 Boulders. Large, worn, rocks >10 inches (256 mm) in diameter.
- 5.2.3 Hardpan. Consolidated clays forming a substratum firm enough to support an epibenthos and too firm to support a normal infauna (clams, worms, etc.), but with an unstable surface that sloughs frequently.
- 5.2.4 Cobble. Rocks or pebbles, 2.5–10 inches (64–256 mm) in diameter, may be a mix of cobbles, gravel, shells, and sand, with no type exceeding 70% cover.
- 5.2.5 Mixed-coarse. Substrata consisting of cobbles, gravel, shell, and sand with no substratum type exceeding 70% cover.
- 5.2.6 Gravel. Small rocks or pebbles, 0.2–2.5 inches (4–64 mm) in diameter.
- 5.2.7 Sand. Fine substrata <0.2 inch (4 mm) in diameter, little gravel present, may be mixed with organics.
- 5.2.8 Mixed-fine. Mixture of sand and mud particles <0.2 inch (4 mm) in diameter, little gravel present.
- 5.2.9 Mud. Fine substrata <0.002 inch (0.06 mm) in diameter, little gravel present, usually mixed with organics.
- 5.2.10 Organic. Substrata composed primarily of organic matter such as wood chips, leaf litter, or other detritus.

5.3 Energy. Degree of exposure to oceanic swell, currents, and wind waves.

- 5.3.1 Protected. No sea swells, little or no current, and restricted wind fetch.
- 5.3.2 Semi-protected. Shorelines protected from sea swell, but may receive waves generated by moderate wind fetch, and/or moderate-to-weak tidal currents.
- 5.3.3 Partially exposed. Oceanic swell attenuated by offshore reefs, islands, or headlands, but shoreline substantially exposed to wind waves, and/or strong-to-moderate tidal currents.
- 5.3.4 Exposed. Highly exposed to oceanic swell, wind waves, and/or very strong currents.

5.4 Vegetation. Includes herbaceous plants and plants lacking vascular systems.

- 5.4.1 Mixed macro algae. Includes brown, green, and red algae.
- 5.4.2 Kelp. Subaquatic rooted vegetation found in the nearshore marine environment
- 5.4.3 Eelgrass. Subaquatic rooted vegetation found in an estuarine environment

5.5 Water depth. Refers to the vertical layering of the water column.

- 5.5.1 Surface layer. The uppermost part of the water column.
  - 5.5.1.1 Tide rip. A current of water disturbed by an opposing current, especially in tidal water or by passage over an irregular bottom.
  - 5.5.1.2 Surface microlayer (neuston). The thin uppermost layer of the water surface.

5.5.2 Euphotic. Upper layer of a water body that receives sufficient sunlight for the photosynthesis of plants.

5.5.3 Disphotic. Area below the euphotic zone where photosynthesis ceases.

5.5.4 Demersal/benthic. Submerged lands including vegetated and unvegetated areas.

5.6 Water temperature. Measure of ocean water temperature.

5.7 Salinity. The presence and concentration of salts; salinity range that is key to the species, if it is known, will be in the comments field.

5.8 Forms. Morphological elements within marine areas.

5.8.1 Beach. An accumulation of unconsolidated material (sand, gravel, angular fragments) formed by waves and wave-induced currents in the intertidal and subtidal zones.

5.8.2 A piece of land made up of either rock and/or unconsolidated material that projects above and is completely surrounded by water at higher high water for large (spring) tide. Includes off-shore marine cliffs.

5.8.3 Marine cliffs (mainland). A sloping face steeper than 20½ usually formed by erosion and composed of either bedrock and/or unconsolidated materials.

5.8.4 Delta. An accumulation of sand, silt, and gravel deposited at the mouth of a stream where it discharges into the sea.

5.8.5 Dune. In a marine context; a mound or ridge formed by the transportation and deposition of wind-blown material (sand and occasionally silt).

5.8.6 Lagoon. Shallow depression within the shore zone continuously occupied by salt or brackish water lying roughly parallel to the shoreline and separated from the open sea by a barrier.

5.8.7 Salt marsh. A coastal wetland area that is periodically inundated by tidal brackish or salt water and that supports significant (15% cover) nonwoody vascular vegetation (e.g., grasses, rushes, sedges) for at least part of the year.

5.8.8 Reef. A rock outcrop, detached from the shore, with maximum elevations below the high-water line.

5.8.9 Tidal flat. A level or gently sloping (<5½) constructional surface exposed at low tide, usually consisting primarily of sand or mud with or without detritus, and resulting from tidal processes.

5.9 Water clarity. As influenced by sediment load.

6. (No Data)

Formerly contained topographic information, such as elevation, that has been moved to the life history matrix.

7. Fire as a Habitat Element

Refers to species that benefit from fire. The time frame after which the habitat is suitable for the species, if known, will be found in the comments field.

8. Anthropogenic Related Habitat Elements

This section contains selected examples of human-related habitat elements that may be a key part of the environment for many species. These habitat elements may have either a negative or positive influence on the queried species.

- 8.1 Campgrounds/picnic areas. Sites developed and maintained for camping and picnicking.
- 8.2 Roads. Either paved or unpaved.
- 8.3 Buildings. Permanent structures.
- 8.4 Bridges. Permanent structures typically over water or ravines.
- 8.5 Diseases transmitted by domestic animals. Some domestic animal diseases may be a source of mortality or reduced vigor for wild species.
- 8.6 Animal harvest or persecution. Includes illegal harvest/poaching, incidental take (resulting from fishing net by-catch, or by hay mowing, for example), and targeted removal for pest control.
- 8.7 Fences/corrals. Wood, barbed wire, or electric fences.
- 8.8 Supplemental food. Food deliberately provided for wildlife (e.g., bird feeders, ungulate feeding programs, etc.) as well as spilled or waste grain along railroads and cattle feedlots.
- 8.9 Refuse. Any source of human-derived garbage (includes landfills).
- 8.10 Supplemental boxes, structures and platforms. Includes bird houses, bat boxes, raptor and waterfowl nesting platforms.
- 8.11 Guzzlers and waterholes. Water sources typically built for domestic animal use.
- 8.12 Toxic chemical use. Proper use of regulated chemicals; documented effects only.
  - 8.12.1 Herbicides/fungicides. Chemicals used to kill vegetation and fungi.
  - 8.12.2 Insecticides. Chemicals used to kill insects.
  - 8.12.3 Pesticides. Chemicals used to kill vertebrate species.
  - 8.12.4 Fertilizers. Chemicals used to enhance vegetative growth.
- 8.13 Hedgerows/windbreaks. Woody and/or shrubby vegetation either planted or that develops naturally along fence lines and field borders.
- 8.14 Sewage treatment ponds. Settling ponds associated with sewage treatment plants.
- 8.15 Repellents. Various methods used to repel or deter wildlife species that damage crops or property (excluding pesticides and insecticides).
  - 8.15.1 Chemical (taste, smell, or tactile). Chemical substances that repel wildlife.

8.15.2 Noise or visual disturbance. Nonchemical methods to deter wildlife.

8.16 Culverts. Drain crossings under roads or railroads.

8.17 Irrigation ditches/canals. Ditches built to transport water to agricultural crops or to handle runoff.

8.18 Powerlines/corridors. Utility lines, poles, and rights-of-way associated with transmission, telephone, and gas lines.

8.19 Pollution. Human-caused environmental contamination.

8.19.1 Chemical. Contamination caused by chemicals.

8.19.2 Sewage. Contamination caused by human waste.

8.19.3 Water. Aquatic contamination from any source.

8.20 Piers. Structures built out over water.

8.21 Mooring piles, dolphins, buoys. Floating objects anchored out in the water for nautical purposes.

8.22 Bulkheads, seawalls, revetment. Retaining structures built to protect the shoreline from wave action.

8.23 Jetties, groins, breakwaters. Structures built to influence the current or protect harbors.

8.24 Water diversion structures. Structures built to funnel or direct water, including dams, dikes and levies.

8.25 Log boom. A raft of logs lashed together either to transport the logs or as barriers to boat traffic near marinas or dams.

8.26 Boats/ships. Watercraft, either motorized or nonmotorized.

8.27 Dredge spoil islands. Sediment deposited from dredging operations.

8.28 Hatchery facilities and fish. Fish that are hatched in captivity and later released into the wild. For simplicity this refers to freshwater areas, though marine birds and mammals likely feed on hatchery released fish too. This also includes the facilities and their operation.

III Major Assumptions with the IBIS Data set

The Northwest Habitat Institute (NHI) Interactive Biodiversity Information System (IBIS), supplied the data set used in the assessment of the key ecological functions for the wildlife species in the Salmon subbasin. The data set included information from basinwide wildlife habitat maps. Vegetation maps from all or parts of seven states (Idaho, Montana, Nevada, Oregon, Utah, Washington and Wyoming) in the Columbia River Basin were used by NHI to develop the wildlife habitat maps depicting current conditions. These maps were developed to serve as an initial basis for large-scale mapping or database investigations.

Consequently, the wildlife habitat maps used in this assessment provide only an initial depiction of the amounts of wildlife habitats that may exist within watersheds, but are not of sufficient resolution for depicting the site-specific location of habitats within each watershed. Thus, wildlife habitats that occur in patch sizes less than 250 acres (i.e., linear riparian habitat) are likely underrepresented in the assessment.

Further, there has been no formal validation of the basinwide current wildlife habitat maps. Because maps are only a representation of reality and cannot depict all the detail represented in nature, some generalization is unavoidable. It is also important to not that remotely sensed maps developed from photograph interpretation or satellite imagery also contain errors.

NHI also developed a historic map by combining products from two previous works: Interior Columbia Basin Ecosystem Management Project (ICBEMP 1997) and the Oregon Biodiversity Project (Defenders of Wildlife 1998). These two mapping efforts used very different methods. The ICBEMP historic data were mostly derived from a modeling exercise, and the Oregon Biodiversity Project map was created from using surveyor notes from the 1850 land survey. Thus, the historic map is a theoretical construct with a coarse (1-km^2 pixel size) level of resolution. Wildlife habitats that are small or linear in size or shape (i.e., riparian or herbaceous wetlands) are underrepresented in the historic condition maps. In addition, no validation of the historic map was completed, and because there are no recognized historical data sets presently available, validation is difficult. Hence, the historic map best depicts gross generalizations of gains or loses of specific wildlife habitats.

B Total Functional Richness

Total functional richness is an ecological functional pattern that totals the number of KEF categories in a community. Total functional richness denotes the degree of functional complexity in a community, such that the more functionally diverse communities have a greater measure of total functional richness. The total functional richness in a community also denotes the degree to which the full “functional web” of a community would be provided or conserved (Marcot and Vander Heyden, 2001).

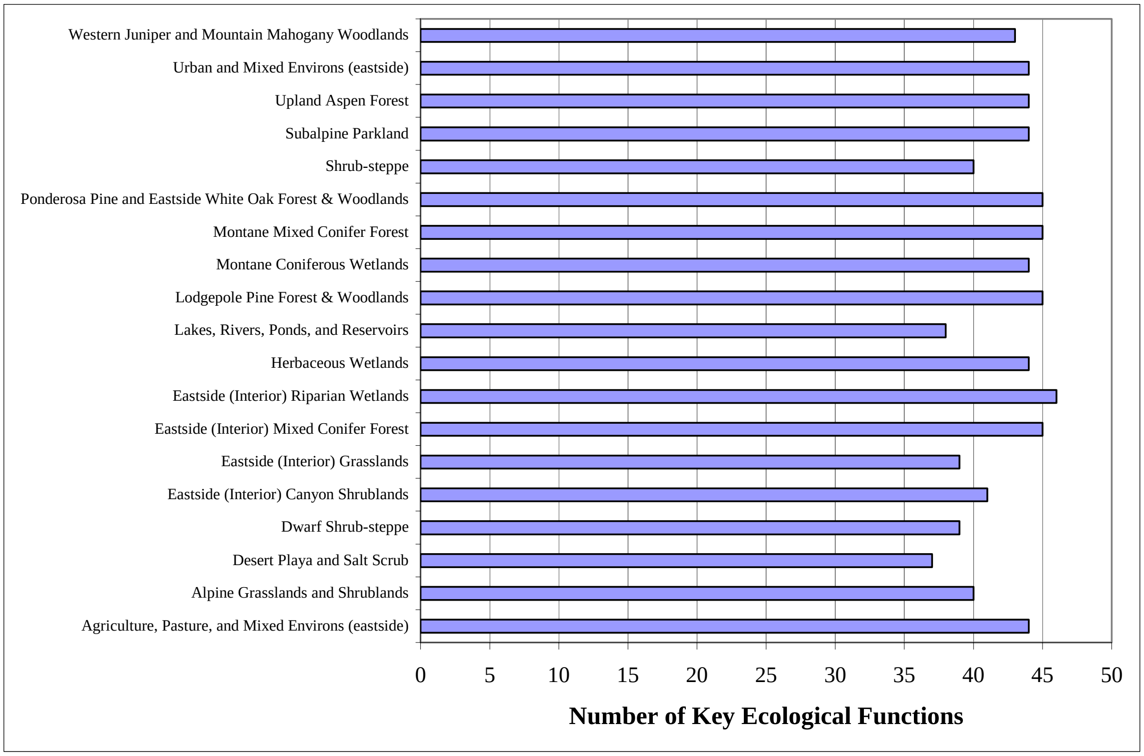

Figure 1. Total functional richness (number of KEFs) by wildlife habitat in the Salmon subbasin (source: IBIS 2003).

C Wildlife Species Associated with Aquatic Environments

Table 1. Wildlife species identified as having associations with aquatic habitats in the Salmon subbasin. This table was generated by searching the IBIS data set for species with category 4 KECs and then summing their respective KEFs and KECs.

Wildlife Species	KEF	KEC	Total Count
American avocet	8	24	32
American badger	8	4	12
American beaver	15	29	44
American bittern	6	9	15
American black duck	8	22	30
American coot	15	23	38
American crow	11	6	17
American dipper	4	27	31
American golden-plover	3	13	16
American marten	9	5	14
American robin	5	1	6
American tree sparrow	7	4	11
American white pelican	6	16	22

Wildlife Species	KEF	KEC	Total Count
American wigeon	12	23	35
Baird's sandpiper	3	24	27
Bald eagle	8	21	29
Band-tailed pigeon	5	3	8
Bank swallow	5	12	17
Barn owl	5	3	8
Barn swallow	4	3	7
Barred owl	8	10	18
Barrow's goldeneye	6	17	23
Belted kingfisher	9	22	31
Big brown bat	6	14	20
Black bear	22	5	27
Black swift	1	3	4
Black tern	12	7	19
Black-bellied plover	3	13	16
Black-billed magpie	9	4	13
Black-capped chickadee	8	4	12
Black-crowned night-heron	10	16	26
Black-necked stilt	8	20	28
Blue grouse	7	7	14
Blue-winged teal	10	18	28
Bobcat	4	3	7
Bobolink	3	3	6
Bonaparte's gull	10	8	18
Bufflehead	8	21	29
Bullfrog	9	19	28
Burrowing owl	7	4	11
California gull	11	16	27
California myotis	4	14	18
California quail	7	3	10
Canada goose	8	18	26
Canvasback	10	35	45
Canyon wren	2	2	4
Caspian tern	9	19	28
Cattle egret	9	4	13
Chukar	7	3	10
Cinnamon teal	11	18	29
Clark's grebe	8	16	24
Cliff swallow	4	7	11
Columbia spotted frog	6	21	27
Common garter snake	7	11	18

Wildlife Species	KEF	KEC	Total Count
Common goldeneye	6	21	27
Common loon	6	12	18
Common merganser	10	21	31
Common nighthawk	1	3	4
Common raven	10	3	13
Common tern	8	8	16
Common yellowthroat	4	8	12
Cooper’s hawk	4	4	8
Coyote	9	3	12
Double-crested cormorant	8	15	23
Dunlin	3	27	30
Eared grebe	7	17	24
Eastern kingbird	6	4	10
Fisher	11	3	14
Forster’s tern	9	19	28
Franklin’s gull	11	9	20
Fringed myotis	4	10	14
Gadwall	12	19	31
Golden eagle	6	2	8
Gray partridge	7	3	10
Gray wolf	9	11	20
Great Basin spadefoot	9	18	27
Great blue heron	11	19	30
Great egret	10	21	31
Great gray owl	4	5	9
Great horned owl	5	4	9
Greater scaup	5	9	14
Greater white-fronted goose	11	18	29
Greater yellowlegs	5	31	36
Green-winged teal	11	20	31
Grizzly bear	14	2	16
Gyrfalcon	2	9	11
Harlequin duck	2	24	26
Heather vole	6	2	8
Herring gull	12	17	29
Hoary bat	4	12	16
Hooded merganser	10	20	30
Horned grebe	7	17	24
Idaho giant salamander	7	17	24
Killdeer	7	29	36
Least sandpiper	3	29	32

Wildlife Species	KEF	KEC	Total Count
Lesser scaup	9	28	37
Lesser yellowlegs	5	32	37
Lincoln's sparrow	7	3	10
Little brown myotis	4	13	17
Long-billed curlew	9	19	28
Long-billed dowitcher	3	18	21
Long-eared myotis	3	14	17
Long-legged myotis	4	14	18
Long-tailed vole	5	3	8
Long-toed salamander	10	30	40
Mallard	13	23	36
Marbled godwit	4	7	11
Marsh wren	3	13	16
Meadow vole	9	5	14
Merlin	2	6	8
Mink	11	12	23
Montane shrew	2	4	6
Montane vole	7	3	10
Moose	6	29	35
Mountain chickadee	8	4	12
Mountain goat	4	3	7
Mountain lion	5	3	8
Mountain quail	7	3	10
Mourning dove	4	8	12
Mule deer	13	7	20
Muskrat	9	23	32
Northern goshawk	5	5	10
Northern harrier	4	6	10
Northern leopard frog	7	21	28
Northern pintail	11	20	31
Northern pocket gopher	8	5	13
Northern river otter	8	45	53
Northern rough-winged swallow	4	12	16
Northern saw-whet owl	3	4	7
Northern shoveler	9	14	23
Northern shrike	3	4	7
Northern waterthrush	2	3	5
Olive-sided flycatcher	3	2	5
Oregon spotted frog	8	14	22
Osprey	4	15	19
Pacific chorus (tree) frog	8	18	26

Wildlife Species	KEF	KEC	Total Count
Pacific-slope flycatcher	6	5	11
Painted turtle	5	21	26
Pallid bat	4	13	17
Pectoral sandpiper	3	22	25
Peregrine falcon	2	6	8
Pied-billed grebe	5	15	20
Preble’s shrew	2	4	6
Pronghorn antelope	8	6	14
Raccoon	14	12	26
Red-breasted merganser	9	7	16
Red-eyed vireo	5	4	9
Redhead	11	31	42
Red-necked grebe	7	16	23
Red-necked phalarope	9	13	22
Red-tailed hawk	6	4	10
Red-winged blackbird	5	8	13
Ring-billed gull	13	16	29
Ring-necked duck	10	36	46
Ring-necked pheasant	9	7	16
Rocky Mountain bighorn sheep	4	3	7
Rocky Mountain elk	13	8	21
Ross’s goose	4	18	22
Rough-legged hawk	3	2	5
Rubber boa	5	4	9
Ruddy duck	7	29	36
Ruffed grouse	9	7	16
Sandhill crane	15	20	35
Savannah sparrow	6	2	8
Semipalmated plover	3	20	23
Semipalmated sandpiper	3	23	26
Sharp-shinned hawk	4	4	8
Sharp-tailed grouse	10	3	13
Short-eared owl	4	5	9
Silver-haired bat	6	9	15
Snow goose	11	18	29
Snowy egret	9	15	24
Solitary sandpiper	4	21	25
Sora	9	13	22
Spotted bat	3	12	15
Spotted sandpiper	8	34	42
Spruce grouse	6	6	12

Wildlife Species	KEF	KEC	Total Count
Stilt sandpiper	3	19	22
Striped skunk	10	9	19
Swainson’s hawk	4	2	6
Tailed frog	5	12	17
Tiger salamander	10	19	29
Townsend’s big-eared bat	6	14	20
Tree swallow	6	6	12
Trumpeter swan	9	23	32
Tundra swan	6	19	25
Turkey vulture	1	3	4
Upland sandpiper	5	5	10
Vagrant shrew	6	3	9
Violet-green swallow	5	8	13
Virginia rail	8	14	22
Water shrew	5	23	28
Water vole	7	11	18
Western grebe	10	16	26
Western harvest mouse	8	8	16
Western jumping mouse	4	2	6
Western pipistrelle	3	11	14
Western sandpiper	3	27	30
Western screech-owl	4	4	8
Western small-footed myotis	4	12	16
Western terrestrial garter snake	9	7	16
Western toad	10	27	37
White-faced ibis	8	10	18
White-tailed deer (eastside)	10	11	21
Wild turkey	10	3	13
Willet	9	20	29
Wilson’s phalarope	9	22	31
Wilson’s snipe	6	19	25
Wolverine	2	6	8
Wood duck	9	21	30
Yellow warbler	5	3	8
Yellow-billed cuckoo	5	10	15
Yellow-breasted chat	4	3	7
Yellow-headed blackbird	3	8	11
Yellow-pine chipmunk	10	4	14
Yuma myotis	4	13	17

D Critical Functional Link Species

Critical functional link species are those species that perform unique KEFs in a community. In other words, for a particular habitat or community, the critical functional link species are species that perform certain ecological functions that no other species perform.

Not all of the roles performed by critical functional link species are critical, however, such that communities would not collapse if some of these species were absent. For example, the brown-headed cowbird is identified as a critical functional link species for many habitats in the Salmon subbasin because it is the only species that acts as a nest parasite (Table 2). Even though there would be impacts to communities if the brown-headed cowbird were to disappear from all the habitats it frequents, it is unlikely that the communities would collapse due to its absence. The disappearance of the brown-headed cowbird would most likely benefit communities because the reproductive success of other bird species would improve.

On the other hand, the rufous hummingbird and black-chinned hummingbird are vertebrate species that act as a pollination vectors for several habitats. If these hummingbirds were to disappear and there were no other pollinators for the plants in the communities they inhabited, then the effect could greatly alter the community habitat structure and function. In this scenario, the hummingbird species might be considered functional keystone species, such that their removal altered the structure and function of a community.

Table 2. List of species that perform critical functional roles in the Salmon subbasin, Idaho (source: IBIS 2003).

Habitat	Key Ecological Function	Critical Functional Link Species
Agriculture, pasture, and mixed environs (eastside)	Creates roosting, denning, or nesting opportunities	Great blue heron
	Interspecies parasite	Brown-headed cowbird
	Impounds water by creating diversions or dams	American beaver
Alpine grasslands and shrublands	Pollination vector	Rufous hummingbird
	User of aerial structures	Great horned owl
	Coprophagous (feeds on fecal material)	American pika
	User of ground structures	Deer mouse
	Creates ponds or wetlands through wallowing	Rocky Mountain elk
	Creates standing dead trees (snags); physically fragments standing wood	Black bear
Desert playa and salt scrub	Cannibalistic (eats members of its own species)	Great Basin spadefoot
	User of aerial structures	Great horned owl
	Interspecies parasite	Brown-headed cowbird
	Pollination vector	American avocet
	User of ground structures	Deer mouse
	User of aquatic structures	Mink
Dwarf shrub-steppe	Pollination vector	Black-chinned hummingbird

Habitat	Key Ecological Function	Critical Functional Link Species
	Interspecies parasite	Brown-headed cowbird
	Creates standing dead trees (snags); physically fragments standing wood; primary cavity excavator	Black bear
	Creates ponds or wetlands through wallowing	Rocky Mountain elk
Eastside (interior) canyon shrublands	Interspecies parasite	Brown-headed cowbird
	Transportation of viable seeds, spores, plants; disperses vascular plants	Golden-mantled ground squirrel
	User of aquatic structures	Mink
	Creates ponds or wetlands through wallowing	Rocky Mountain elk
Eastside (interior) grasslands	Interspecies parasite	Brown-headed cowbird
	User of aquatic structures	Mink
	Creates feeding opportunities	Grizzly bear
	Creates standing dead trees (snags); primary cavity excavator	Black bear
	Creates ponds or wetlands through wallowing	Rocky Mountain elk
Eastside (interior) mixed conifer forest	Interspecies parasite	Brown-headed cowbird
	Creates roosting, denning, or nesting opportunities	Red squirrel
	Primary creation of aquatic structures; impounds water by creating diversions or dams	American beaver
Eastside (interior) riparian wetlands	Creates roosting, denning, or nesting opportunities	Great blue heron
	Carrier, transmitter, or reservoir of diseases that affect domestic animals	Double-crested cormorant
	Primary creation of ground structures	Bushy-tailed woodrat
	Impounds water by creating diversions or dams	American beaver
Herbaceous wetlands	Creates roosting, denning, or nesting opportunities	Great blue heron
	Carrier, transmitter, or reservoir of diseases that affect domestic animals	Double-crested cormorant
	Creates standing dead trees (snags); primary cavity excavator	Black bear
	Impounds water by creating diversions or dams	American beaver
Lakes, rivers, ponds, and reservoirs	Interspecific hybridization	Oregon spotted frog
	User of aerial structures	Black tern
	Creates roosting, denning, or nesting opportunities; creates feeding opportunities	Great blue heron
	Carrier, transmitter, or reservoir of diseases that affect domestic animals	Double-crested cormorant
	Herbivory on grasses or forbs that may alter vegetation structure and composition	Canada goose
	Primary creation of ground structures	Greater scaup

Habitat	Key Ecological Function	Critical Functional Link Species
	Impounds water by creating diversions or dams; creates ponds or wetlands	American beaver
	Herbivory on trees or shrubs that may alter vegetation structure and composition	Moose
Lodgepole pine forest & woodlands	Interspecies parasite	Brown-headed cowbird
	Creates roosting, denning, or nesting opportunities	Red squirrel
	Transportation of viable seeds, spores, plants; disperses vascular plants	Golden-mantled ground squirrel
	Primary creation of aquatic structures; impounds water by creating diversions or dams	American beaver
	User of aquatic structures	Mink
	Coprophagous (feeds on fecal material)	Snowshoe hare
Montane coniferous wetlands	Interspecies parasite	Brown-headed cowbird
	Carrier, transmitter, or reservoir of diseases that affect other wildlife species	Common porcupine
	Primary creation of ground structures	Bushy-tailed woodrat
	User of ground structures	Deer mouse
	Primary creation of aquatic structures; impounds water by creating diversions or dams	American beaver
	Coprophagous (feeds on fecal material)	Snowshoe hare
Montane mixed conifer forest	Interspecies parasite	Brown-headed cowbird
	Creates roosting, denning, or nesting opportunities	Red squirrel
	User of ground structures	Deer mouse
	Primary creation of aquatic structures; impounds water by creating diversions or dams	American beaver
Ponderosa pine and eastside white oak forest & woodlands	Interspecies parasite	Brown-headed cowbird
	Creates roosting, denning, or nesting opportunities	Red squirrel
	Coprophagous (feeds on fecal material)	Snowshoe hare
	Primary creation of aquatic structures; impounds water by creating diversions or dams	American beaver
Shrub-steppe	Pollination vector	Black-chinned hummingbird
	Interspecies parasite	Brown-headed cowbird
	User of aquatic structures	Mink
	Creates ponds or wetlands through wallowing	Rocky Mountain elk
Subalpine parkland	Interspecies parasite	Brown-headed cowbird
	User of aquatic structures	Fisher
	User of ground structures	Deer mouse

Habitat	Key Ecological Function	Critical Functional Link Species
	Primary creation of aquatic structures; impounds water by creating diversions or dams	American beaver
Upland aspen forest	Interspecies parasite	Brown-headed cowbird
	User of aquatic structures	Mink
	User of ground structures	Deer mouse
	Primary creation of ground structures	Bushy-tailed woodrat
	Transportation of viable seeds, spores, plants; disperses vascular plants	Golden-mantled ground squirrel
	Primary creation of aquatic structures; impounds water by creating diversions or dams	American beaver
Urban and mixed environs (eastside)	Interspecies parasite	Brown-headed cowbird
	Creates roosting, denning, or nesting opportunities	Great blue heron
	User of aerial structures	Great horned owl
	Coprophagous (feeds on fecal material)	Nuttall's mountain cottontail
	Primary creation of ground structures	Bushy-tailed woodrat
	User of aquatic structures	Mink
	Primary creation of aquatic structures; impounds water by creating diversions or dams	American beaver
Western juniper and mountain mahogany woodlands	Cannibalistic	Great Basin spadefoot
	Interspecies parasite	Brown-headed cowbird
	Coprophagous (feeds on fecal material)	Nuttall's mountain cottontail
	Transportation of viable seeds, spores, plants; disperses vascular plants	Golden-mantled ground squirrel
	User of aquatic structures	Mink
	Primary creation of aquatic structures; impounds water by creating diversions or dams	American beaver

E Functional Specialists

Species with the fewest KEFs are functional specialists and may be more vulnerable to extirpation from changes in environmental conditions supporting their ecological functions. There may be several species that perform the same function in a particular habitat, but the functional specialists are species that perform only one or two key ecological functions.

The functional specialist species in the Salmon subbasin are listed in Table 3. There is a total of 60 species.

Table 3. Functional specialist species and their associated KEF count and KEC code in the Salmon subbasin, Idaho (IBIS 2003). KEC codes are provided in section A.

Functional Specialist Common Name	KEF Count	Habitat Code[a]	Key Environmental Correlates
American bittern	2	A, I	4.1.2, 4.6.3, 4.7.1, 4.9
American black duck	2	C, F, H, I, J, O	1.2.1, 1.2.10, 1.2.13, 1.2.6, 2.1.2, 2.3, 4.1.9, 4.2.2, 4.2.3, 4.6.1, 4.6.3, 4.7.1, 4.8, 4.9, 7, 8.12.2, 8.5
American dipper	2	H, I, J, P	2.3, 3.3.5, 4.1.2, 4.1.6, 4.2.10, 4.2.11, 4.2.12, 4.2.2, 4.2.3, 4.2.4, 4.2.6, 4.2.7, 4.2.8, 4.2.9, 4.6.1, 8.19.3, 8.4
American golden-plover	2	J	2.1.1, 2.1.2, 3.2.3, 3.3.6, 4.2.3, 4.2.4, 4.6.1, 4.6.2, 4.9
Baird's sandpiper	2	A, B, C, I, J	2.1.1, 3.2.3, 3.3.6, 3.3.7, 4.1.6, 4.2.13, 4.2.2, 4.2.3, 4.2.4, 4.6.1, 4.6.2, 4.7.2, 4.8, 4.9, 8.14
Black swift	1	B, G, H, I, J, K, L, M, N, P	1.1.5, 3.3.3, 3.3.5, 4.2.11
Black-bellied plover	2	C, J	2.1.1, 2.1.2, 3.2.3, 3.3.6, 3.3.7, 4.2.3, 4.2.4, 4.6.1, 4.6.2, 4.9, 8.14, 8.21, 8.23, 8.25
Boreal owl	2	G, K, M, Q	1.1.14, 1.1.16, 8.1
Brown creeper	2	A, G, H, K, L, M, N, Q, R	1.1.14, 1.2.12
Canyon wren	2	B, D, E, F, G, H, K, M, N, O, P, S	3.1.2, 3.3.2, 3.3.4, 3.3.5
Common nighthawk	1	A, C, D, E, F, G, H, I, J, K, L, M, N, O, Q, R, S	2.1.1, 3.1.1, 3.1.3, 3.3.4, 3.3.6, 3.3.7, 7, 8.12.2, 8.2, 8.3
Common poorwill	1	A, C, D, E, F, G, J, K, N, O, S	1.2.6, 3.1.1, 3.3.4, 3.3.6, 7, 8.2
Dunlin	2	C, I, J	2.1.1, 2.1.2, 3.2.3, 3.3.6, 3.3.7, 4.1.2, 4.1.6, 4.2.2, 4.2.3, 4.2.4, 4.6.1, 4.6.2, 4.6.3, 4.7.1, 4.8, 4.9, 8.14, 8.18, 8.19.3, 8.2, 8.21, 8.23, 8.25, 8.6
Ferruginous hawk	2	A, C, D, E, F, O, S	1.2.10, 1.2.12, 1.2.6, 3.3.2, 3.3.4, 7, 8.18
Greater yellowlegs	2	A, C, D, F, H, I, J, O	2.1.1, 3.2.3, 3.3.6, 4.1.6, 4.2.1, 4.2.13, 4.2.2, 4.2.3, 4.2.4, 4.2.5, 4.6.1, 4.6.2, 4.6.3, 4.7.1, 4.7.2, 4.8, 8.14, 8.19.3
Gyrfalcon	2	A, F, I, J	6.1, 4.7.1, 4.7.2, 4.9
Harlequin duck	1	H, J	1.1.1, 1.1.16, 1.1.4, 4.1.6, 4.2.12, 4.2.2, 4.2.3, 4.2.4, 4.2.6, 4.2.7, 4.2.8, 4.2.9, 4.6.1, 8.19.1, 8.23, 8.26, 8.6

Functional Specialist Common Name	KEF Count	Habitat Code[a]	Key Environmental Correlates
Least sandpiper	2	A, C, I, J	2.1.1, 3.2.3, 3.3.6, 3.3.7, 4.1.6, 4.2.1, 4.2.13, 4.2.2, 4.2.3, 4.2.4, 4.6.1, 4.6.2, 4.6.3, 4.7.2, 4.8, 4.9, 8.14, 8.23, 8.25
Lesser yellowlegs	2	A, C, D, F, H, I, J, O	2.1.1, 3.2.3, 3.3.6, 4.1.4, 4.1.6, 4.2.1, 4.2.13, 4.2.2, 4.2.3, 4.2.4, 4.2.5, 4.6.1, 4.6.2, 4.6.3, 4.7.1, 4.7.2, 4.8, 8.14, 8.19.3
Loggerhead shrike	2	A, C, D, E, F, I, O, S	1.1.16, 1.2.12, 1.2.6, 7, 8.13, 8.18, 8.2, 8.7
Long-billed dowitcher	2	A, C, I, J	2.1.1, 3.2.3, 3.2.4, 3.2.5, 3.3.6, 3.3.7, 4.2.2, 4.2.3, 4.2.4, 4.6.1, 4.6.2, 4.8, 8.14, 8.19.3, 8.23, 8.25, 8.6
Long-eared myotis	2	A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, R, S	1.1.1, 1.1.14, 1.1.16, 1.2.12, 1.2.13, 2.1.2, 2.3, 3.1.2, 3.1.3, 3.3.2, 3.3.3, 3.3.4, 3.3.5, 4.2.1, 4.2.13, 4.2.3, 4.2.7, 4.2.9, 4.6.1, 4.7.1, 8.1, 8.11, 8.12.2, 8.12.3, 8.13, 8.17, 8.19.1, 8.3, 8.4
Lynx	2	B, G, K, L, M, P	1.1.1, 1.1.14, 1.1.4, 3.4.1, 8.2, 8.6
Marsh wren	2	I	2.1.1, 4.2.2, 4.2.5, 4.6.3, 4.7.1, 8.17
Masked shrew	2	G, H, K, L, M, N, P	1.1.1, 1.1.2, 1.1.3, 2.4
Merlin	1	B, D, E, F, G, H, I, J, K, L, M, N, O, P, S	1.1.14, 1.1.16, 1.2.12, 2.1.2, 4.7.1, 4.7.2, 8.12.2, 8.13, 8.3
Montane shrew	2	B, G, H, K, L, M, P, Q	1.1.1, 1.1.10, 1.1.13, 1.1.2, 1.1.4, 1.1.7, 1.2.6, 1.2.7, 2.4, 4.7.2
Northern harrier	2	A, B, C, D, E, F, H, I, O, P, R	1.2.1, 1.2.10, 1.2.6, 3.4.1, 4.7.1, 4.7.2, 4.7.3, 7, 8.12.2, 8.6
Northern pygmy-owl	2	A, G, H, I, K, L, M, N, P, R, S	1.1.14
Northern saw-whet owl	2	A, G, H, K, L, M, N, Q, R, S	1.1.14, 3.4.1, 4.7.2, 8.1
Northern shrike	2	A, C, D, E, F, I, O, S	1.2.12, 1.2.13, 1.2.6, 3.4.1, 4.7.2, 7, 8.13, 8.18, 8.7
Northern waterthrush	2	H	1.1.13, 1.1.14, 1.1.4, 4.2.12
Olive-sided flycatcher	2	G, H, K, L, M, N, P	1.1.14, 1.1.16, 7
Osprey	2	A, B, G, H, J, K, M, N, O, P, R	1.1.14, 1.1.16, 1.2.12, 1.2.13, 2.1.2, 2.3, 4.1.7, 4.2.1, 4.2.2, 4.2.3, 4.2.7, 4.6.1, 4.9, 8.1, 8.18, 8.21, 8.28
Pectoral sandpiper	2	A, I, J	2.1.1, 3.2.3, 3.3.6, 4.1.6, 4.2.13, 4.2.2, 4.2.3, 4.2.4, 4.6.1, 4.6.2, 4.7.2, 4.8, 4.9, 8.14
Peregrine falcon	2	C, D, E, F, G, H, I, J, K, L, M, N, O, Q, S	1.1.14, 1.1.16, 1.2.12, 1.2.13, 2.1.2, 3.3.2, 3.3.4, 3.3.5, 4.7.1, 4.9, 8.1, 8.3, 8.4

Functional Specialist Common Name	KEF Count	Habitat Code[a]	Key Environmental Correlates
Pied-billed grebe	2	H, I, J	4.1.2, 4.2.1, 4.2.3, 4.6.1, 4.6.3, 8.28
Preble's shrew	2	A, D, F, G, H, I, O, Q	4.7.2
Ringneck snake	1	A, N, O, R	1.1.1, 1.1.2, 2.1.1, 2.1.2, 2.4, 3.1.2, 3.1.3, 3.3.4, 3.3.5, 7
Rock wren	2	B, C, D, E, F, G, N, O, P, S	3.1.1, 3.1.2, 3.1.3, 3.3.1, 3.3.2, 3.3.4, 3.3.5
Ross's goose	2	I, J	4.1.2, 4.2.3, 4.6.1, 4.6.3, 4.6.4, 4.7.3
Rough-legged hawk	1	A, B, C, D, E, F, H, I, N, O, R, S	1.1.14, 1.2.10, 1.2.12, 3.4.1, 8.13, 8.18, 8.7
Sanderling	2	C, J	2.1.1
Semipalmated plover	2	C, J	2.1.1, 2.1.2, 3.2.3, 3.3.6, 3.3.7, 4.2.3, 4.2.4, 4.6.1, 4.6.2, 4.6.3, 4.8, 4.9, 8.14
Semipalmated sandpiper	2	J	2.1.1, 4.2.1, 4.2.2, 4.2.3, 4.2.5, 4.6.1, 4.6.2, 4.6.3, 4.8, 4.9, 8.14, 8.2, 8.23, 8.25
Short-eared owl	2	A, C, D, F, I, O	1.2.1, 1.2.10, 1.2.6, 1.2.8, 2.1.1, 2.1.2, 3.4.1, 4.7.2, 4.9, 7, 8.13, 8.6, 8.7
Snowy owl	2	A, F, I, R	1.2.1, 1.2.10
Solitary sandpiper	2	A, C, D, F, H, I, J, O	1.1.1, 1.1.16, 2.1.1, 2.3, 3.2.3, 3.3.6, 4.1.4, 4.1.6, 4.2.1, 4.2.2, 4.2.3, 4.2.4, 4.6.1, 4.6.2, 4.7.1, 8.14, 8.17, 8.19.3, 8.25
Spotted bat	2	A, C, D, E, F, H, I, J, N, O	1.2.13, 3.3.2, 3.3.4, 3.3.5, 4.2.1, 4.2.3, 4.2.6, 4.2.9, 4.6.1, 8.3
Stilt sandpiper	2	J	2.1.1, 4.2.1, 4.2.3, 4.2.4, 4.6.1, 4.6.2, 4.6.3, 4.8, 4.9, 8.14
Swainson's hawk	2	A, B, C, D, F, H, I, O, S	1.1.14, 1.1.16, 1.2.1, 1.2.10, 1.2.12, 2.1.1, 4.9, 7, 8.12.3, 8.12.4, 8.13, 8.18
Turkey vulture	1	A, B, C, D, E, F, G, H, I, K, L, M, N, O, P, Q, R, S	1.1.1, 1.1.14, 1.2.12, 3.1.2, 3.1.3, 3.3.2, 3.3.3, 3.3.4, 3.3.5, 8.2, 8.6, 8.9
Vaux's swift	2	A, G, H, I, J, K, L, M, N, P, Q, R	1.1.14, 1.2.6, 2.2.2, 8.3
Western pipistrelle	2	A, C, D, E, F, G, H, J, N, O, R, S	1.1.16, 1.2.13, 3.1.2, 3.1.3, 3.3.2, 3.3.4, 3.3.5, 4.1.8, 4.2.13, 4.2.7, 4.2.9, 4.6.1, 8.11, 8.12.2, 8.12.3
Western sandpiper	2	A, C, I, J	2.1.1, 2.1.2, 3.2.3, 3.3.6, 3.3.7, 4.1.2, 4.1.6, 4.2.2, 4.2.3, 4.2.4, 4.6.1, 4.6.2, 4.6.3, 4.7.1, 4.8, 4.9, 8.14, 8.18, 8.19.3, 8.21, 8.23, 8.25
Western screech-owl	2	A, G, H, I, K, L, N, Q, R, S	1.1.14, 4.7.2, 8.1, 8.13
Western wood-pewee	2	A, G, H, M, N, P, Q, R	1.1.14, 1.1.16, 7, 8.1, 8.18

Functional Specialist Common Name	KEF Count	Habitat Code[a]	Key Environmental Correlates
White-throated swift	2	A, C, D, E, F, G, H, I, J, M, N, O, R, S	3.3.2, 3.3.5, 8.3, 8.4
Winter wren	2	B, G, H, L, M, P	1.1.1, 1.1.12, 1.1.14, 1.1.2, 1.1.4, 1.1.5
Wolverine	2	B, L, M, P	3.1.2, 3.1.3, 3.3.1, 3.3.3, 3.3.4, 3.3.5, 3.4.2, 4.1.8, 4.7.2, 8.2, 8.6

[a] Habitat Codes: A = agriculture, pasture, and mixed environments (eastside); B = alpine grasslands and shrublands; C = desert playa and salt scrub; D = dwarf shrub-steppe; E = eastside (interior) canyon shrublands; F = eastside (interior) grasslands; G = eastside interior mixed conifer forest; H = eastside (interior) riparian wetlands; I = herbaceous wetlands; J = lakes, rivers, ponds, and reservoirs; K = lodgepole pine forest and woodlands; M = montane coniferous wetlands; N = montane mixed conifer forest; O = ponderosa pine and eastside white oak forest and woodlands; P = shrub-steppe; Q = upland aspen forest; R = urban and mixed environments (eastside); S = western juniper and mountain mahogany woodlands

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APPENDIX 2-3—AERIAL STEELHEAD REDD COUNTS, 1987–1998

Steelhead redd count trends for recent years in selected study streams in Idaho.

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
South Fork Salmon River												
Johnson Creek	12	23	NC	23	64	27	66	28	29	10	18	10
South Fork-Poverty				62	76	31	75	30	44	32	2	7
South Fork Darling Cabin				25	39	17	49	25	34	31	14	3
South Fork-Oxbow				37	31	26	34	11	14	2	13	8
South Fork-Krassel					38	8	23	5	15	17	2	2
Middle Fork Salmon River												
Bear Valley Creek		27	11	62	32	26	28	17	13	10	3	5
Marsh Creek				23	1	10	7	1	1	1	0	0
Sulphur Creek		17	7	14	6	5	18	2	2	3	3	6
Loon Creek				38	17	8	NC	3	4	5	NC	NC
Camas Creek	27			55	26	3	NC	12	10	6	NC	1
Big Creek				44	25	NC	NC	3	4	5	NC	6
South Fork Camas				6	1	4	3	0	1	0	0	3
Salmon River												
Valley Creek				8	6	26	9	4	5	2	1	0
Alturas				6	NC	3	NC	NC	NC	NC	NC	NC
Upper Salmon												
-Pole to Busterback				6	0	0	0	NC	NC	NC	NC	NC
-Busterback to Alturas Lake Creek				1	0	0	12	NC	NC	NC	NC	NC
-Alturas Lake to Hell Roaring Bridge				16	2	17	3	NC	NC	NC	NC	NC
-Hell Roaring Bridge to weir				33	13	12	21	NC	NC	NC	NC	NC
-Weir to Redfish Lake				101	24	26	79	30	18	NC	3	NC
East Fork Salmon River												
-Germania to weir				9	3	0	NC	NC	NC	NC	NC	NC
-Weir to Herd Creek				NC	15	10	NC	NC	NC	NC	NC	NC
Chamberlain Creek				6	1	0	1	0	1	0	0	1
West Fork Chamberlain Creek				5	0	3	5	0	0	0	0	0
South Fork Clearwater River												
Crooked River												
-Mouth to Weir			NC	NC	1	2	NC	0	NC	0	0	0
-Weir to Meanders			NC	NC	9	8	0	0	0	0	0	0
-Meanders			NC	NC	25	5	1	1	2	0	0	0
-Meanders to Canyon			NC	NC	6	1	0	0	0	0	0	0
-Canyon to Bridge				128	4	3	1	0	2	0	0	0
-Bridge to Orogrande				91	5	1	2	2	0	0	0	0
Lochsa River												
White Sands Creek			NC	10	7	20	NC	12	3	2	7	3
Storm Creek				11	0	3	NC	3	8	1	0	1
Crooked Fork				33	7	10	NC	8	11	1	6	2
Fish Creek				9	0	3	NC	5	5	NC	NC	NC
Selway River												
-Magruder to Little Clearwater	0								NC	1	NC	NC
Bear Creek				15	2	4	NC	6	8	2	2	2

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APPENDIX 2-4—SALMON RIVER SAWTOOTH SPRING CHINOOK HATCHERY AND GENETIC MANAGEMENT PLAN

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	**Salmon River Basin, Spring Chinook Salmon** Sawtooth Fish Hatchery East Fork Salmon River Satellite
Species or Hatchery Stock:	Spring Chinook Salmon *Oncorhynchus tshawytscha.*
Agency/Operator:	Idaho Department of Fish and Game
Watershed and Region:	Salmon River, Idaho.
Date Submitted:	September 30, 2002
Date Last Updated:	September 30, 2002

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Hatchery: Sawtooth Fish Hatchery
East Fork Salmon River Satellite

Program: Spring chinook salmon

1.2) Species and population (or stock) under propagation, and ESA status.

Spring chinook salmon *Oncorhynchus tshawytscha*.

The hatchery population is not ESA-listed if it originates from known hatchery-origin adults. The natural and supplementation populations are ESA-listed.

1.3) Responsible organization and individuals

Lead Contact
Name (and title): Sharon W. Kiefer, Anadromous Fish Manager.
Agency or Tribe: Idaho Department of Fish and Game.
Address: 600 S. Walnut, P.O. Box 25, Boise, ID 83707.
Telephone: (208) 334-3791.
Fax: (208) 334-2114.
Email: skiefer@idfg.state.id.us

On-site Operations Lead
Name (and title): Brent Snider, Fish Hatchery Manager II, Sawtooth Fish Hatchery.
Agency or Tribe: Idaho Department of Fish and Game.
Address: HC 64 Box 9905 Stanley, ID 83278.
Telephone: (208) 774-3684.
Fax: (208) 774-3413.
Email: bsinder@idfg.state.id.us

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

U.S. Fish and Wildlife Service – Lower Snake River Compensation Plan Office: Administers the Lower Snake River Compensation Plan as authorized by the Water Resources Development Act of 1976.

Idaho Power Company – Funding source for Pahsimeroi Fish Hatchery. The Sawtooth Fish Hatchery may incubate eggs and provide for some early rearing of Pahsimeroi Fish Hatchery spring chinook salmon.

1.4) Funding source, staffing level, and annual hatchery program operational costs.

Sawtooth Fish Hatchery and East Fork Salmon River Satellite
U.S. Fish and Wildlife Service – Lower Snake River Compensation Plan funded.
Staffing level: 5 FTE.
Annual budget: $850,000.

1.5) Location(s) of hatchery and associated facilities.

Sawtooth Fish Hatchery – The Sawtooth Fish Hatchery is located on the upper Salmon River approximately 8.0 kilometers south of Stanley, Idaho. The river kilometer code for the facility is 503.303.617. The hydrologic unit code for the facility is 17060201.

East Fork Salmon River Satellite – The East Fork Salmon River Satellite is located on the East Fork Salmon River approximately 29 kilometers upstream of the confluence of the East Fork with the main stem Salmon River. The river kilometer code for the facility is 522.303.552.029. The hydrologic unit code for the facility is 17060201.

1.6) Type of program.

Lower Snake River Compensation Plan - The Salmon River spring chinook salmon program was envisioned as an Isolated Harvest Program but has operated as an Integrated Recovery Program since its inception. Hatchery x hatchery broodstock spawn crosses are performed using no natural (unmarked) parents. Resulting progeny may be ESA-listed or not depending on brood year and parental origin. In addition, hatchery x natural crosses are performed (resulting in ESA-listed progeny) to support an ongoing supplementation research.

1.7) Purpose (Goal) of program.

Mitigation - The goal of the Lower Snake River Compensation Plan is to return approximately 19,445 adult spring chinook salmon to the project area above Lower Granite Dam to mitigate for survival reductions resulting from the construction and operation of the four lower Snake River dams. Initial facility plans identified production targets of 1.3 million smolts released in the Salmon River at the Sawtooth Fish Hatchery, 700,000 smolts released in the East Fork Salmon River, and 300,000 smolts released in Valley Creek, a tributary to the Salmon River. Adult return targets were 11,310 adults back to the Sawtooth Fish Hatchery, 6,090 adults back to the East Fork Salmon River, and 2,045 adults back to Valley Creek (all based on a smolt-to-adult return rate of 0.87%).

The Valley Creek component of the program has never been implemented. The East Fork Salmon River component was terminated in 1998.

1.8) Justification for the program.

The Lower Snake River Compensation Program has been in operation since 1983 to provide mitigation for lost salmon and steelhead production caused by the construction and operation of the four lower Snake River dams. The Sawtooth Fish Hatchery was constructed in 1985 to contribute to this end.

Actions taken to minimize adverse effects on listed fish include:

1. Continuing fish health practices to minimize the incidence of infectious disease agents. Follow IHOT, AFS, and PNFHPC guidelines.

2. Marking hatchery-produced spring chinook salmon for broodstock management. Smolts released for supplementation research will be marked differentially from other fish.

3. Not releasing spring chinook salmon for supplementation research in the Salmon River in excess of estimated carrying capacity.

4. Continuing to reduce effect of the release of large numbers of hatchery chinook salmon at a single site by spreading the release over a number of days.

5. Attempting to program time of release to mimic natural fish for Salmon River smolt releases.

6. Evaluating natural rearing techniques for Salmon River spring chinook salmon at the Sawtooth Fish Hatchery.

7. Continuing to use broodstock for general production and supplementation research that exhibit life history characteristics similar to locally evolved stocks.

8. Continuing to segregate female spring chinook salmon broodstock for BKD via ELISA. We will incubate each female's progeny separately and also segregate progeny for rearing. We will continue development of culling and rearing segregation guidelines and practices, relative to BKD.

9. Monitoring hatchery effluent to ensure compliance with National Pollutant Discharge Elimination System permit.

10. Continuing Hatchery Evaluation Studies (HES) to provide comprehensive monitoring and evaluation for LSRCP chinook.

1.9) List of program “Performance Standards”.

3.1 Legal Mandates.
3.2 Harvest.
3.3 Conservation of natural spawning populations.
3.4 Life History Characteristics.
3.5 Genetic Characteristics.

3.6 Research Activities.
3.7 Operation of Artificial Production Facilities.

1.10) List of program "Performance Indicators", designated by "benefits" and "risks."

Note: Performance Standards and Indicators used to develop Sections 1.10.1 and 1.10.2 were taken from the final January 17, 2001 version of Performance Standards and Indicators for the Use of Artificial Production for Anadromous and Resident Fish Populations in the Pacific Northwest. Numbers referenced below correspond to numbers used in the above document.

3.1.2 Standard: Program contributes to mitigation requirements.

Indicator 1: Number of fish returning to mitigation requirements estimated.

3.1.3 Standard: Program addresses ESA responsibilities.

Indicator 1: ESA Section 7 Consultation completed.

3.2.2 Standard: Release groups sufficiently marked in a manner consistent with information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries.

Indicator 1: Marking rate by type in each release group documented.

3.3.1 Standard: Artificial propagation program contributes to an increasing number of spawners returning to natural spawning areas.

Indicator 1: Annual number of spawners on spawning grounds estimated in specific locations.
Indicator 2: Spawner-recruit ratios estimated is specific locations.
Indicator 3: Number of redds in natural production index areas documented in specific locations.

3.3.2 Standard: Releases are sufficiently marked to allow statistically significant evaluation of program contribution.

Indicator 1: Marking rates and type of mark documented.
Indicator 2: Number of marks identified in juvenile and adult groups documented.

1.10.2) "Performance Indicators" addressing risks.

3.4.1 Standard: Fish collected for broodstock are taken throughout the return in proportions approximating the timing and age structure of the population.

Indicator 1: Temporal distribution of broodstock collection managed.

Indicator 2: Age composition of broodstock collection managed.

3.4.2 Standard: Broodstock collection does not significantly reduce potential juvenile production in natural areas.

Indicator 1: Number of natural-origin spawners removed for broodstock determined annually and documented.
Indicator 2: Natural origin spawners released to migrate to natural spawning areas documented.
Indicator 3: Number of adults, eggs or juveniles placed in natural rearing areas managed.

3.4.3 Standard: Life history characteristics of the natural population do not change as a result of this program.

Indicator 1: Life history characteristics of natural and hatchery-produced populations are measured (e.g., juvenile dispersal timing, juvenile size at outmigration, juvenile sex ratio at outmigration, adult return timing, adult age and sex ratio, spawn timing, hatch and swim-up timing, rearing densities, growth, diet, physical characteristics, fecundity, egg size).

3.4.4 Standard: Annual release numbers do not exceed estimated basin-wide and local habitat capacity.

Indicator 1: Annual release numbers, life-stage, size at release, length of acclimation documented.
Indicator 2: Location of releases documented.
Indicator 3: Timing of hatchery releases documented.

3.5.1 Standard: Patterns of genetic variation within and among natural populations do not change significantly as a result of artificial production.

Indicator 1: Genetic profiles of naturally-produced and hatchery-produced adults developed.

3.5.2 Standard: Collection of broodstock does not adversely impact the genetic diversity of the naturally spawning population.

Indicator 1: Total number of natural spawners reaching collection facilities documented.
Indicator 2: Total number of natural spawners estimated passing collection facilities documented.
Indicator 3: Timing of collection compared to overall run timing.

3.5.3 Standard: Artificially produced adults in natural production areas do not exceed appropriate proportion.

Indicator 1: Ratio of natural to hatchery-produced adults monitored.
Indicator 2: Observed and estimated total numbers of natural and hatchery-produced adults passing counting stations.

3.5.4 Standard: Juveniles are released on-station, or after sufficient acclimation to maximize homing ability to intended return locations.

Indicator 1: Location of juvenile releases documented.
Indicator 2: Length of acclimation period documented.
Indicator 3: Release type (e.g., volitional or forced) documented.
Indicator 4: Adult straying documented.

3.5.5 Standard: Juveniles are released at fully smolted stage of development.

Indicator 1: Level of smoltification at release documented.
Indicator 1: Release type (e.g., forced or volitional) documented.

3.5.6 Standard: The number of adults returning to the hatchery that exceeds broodstock needs is declining.

Indicator 1: The number of adults in excess of broodstock needs documented in relation to mitigation goals of the program.

3.6.1 Standard: The artificial production program uses standard scientific procedures to evaluate various aspects of artificial production.

Indicator 1: Scientifically based experimental design with measurable objectives and hypotheses.

3.6.2. Standard: The artificial production program is monitored and evaluated on an appropriate schedule and scale to address progress toward achieving the experimental objectives.

Indicator 1: Monitoring and evaluation framework including detailed time line.
Indicator 2: Annual and final reports.

3.7.1 Standard: Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols.

Indicator 1: Annual reports indicating level of compliance with applicable standards and criteria.

3.7.2 Standard: Effluent from artificial production facility will not detrimentally affect natural populations.

Indicator 1: Discharge water quality compared to applicable water quality standards.

3.7.3 Standard: Water withdrawals and in stream water diversion structures for artificial production facility operation will not prevent access to natural spawning areas, affect spawning, or impact juveniles.

Indicator 1: Water withdrawals documented – no impacts to listed species.
Indicator 2: NMFS screening criteria adhered to.

3.7.4 Standard: Releases do not introduce pathogens not already existing in the local populations and do not significantly increase the levels of existing pathogens.

Indicator 1: Certification of juvenile fish health documented prior to release.

3.7.5 Standard: Any distribution of carcasses or other products for nutrient enhancement is accomplished in compliance with appropriate disease control regulations and guidelines.

Indicator 1: Number and location(s) of carcasses distributed to habitat documented.

3.7.6 Standard: Adult broodstock collection operation does not significantly alter spatial and temporal distribution of natural population.

Indicator 1: Spatial and temporal spawning distribution of natural population above and below trapping facilities monitored.

3.7.7 Standard: Weir/trap operations do not result in significant stress, injury, or mortality in natural populations.

Indicator 1: Mortality rates in trap documented.
Indicator 2: Prespawning mortality rates of trapped fish in hatchery or after release documented.

3.7.8 Standard: Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of natural fish.

Indicator 1: *Size and time of release of juvenile fish documented and compared to size and timing of natural fish.*

1.11) Expected size of program.

1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).

Sawtooth Fish Hatchery – Approximately 450 spring chinook females are needed to meet current program management objectives for the upper Salmon River. The ratio of males to females needed is approximately 50:50 necessitating the need to trap and pond approximately 450 males. Mitigation and supplementation management objectives are addressed at the Sawtooth Fish Hatchery.

East Fork Salmon River Satellite – Adult, spring chinook salmon collections were discontinued at the East Fork Salmon River satellite facility in 1998. Approximately 170 females were needed to meet the original management objectives for this facility.

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location.

Note: the following abbreviations are used in the table:

Prod. = Lower Snake River Compensation Program harvest mitigation.
Supp. = Idaho Supplementation Studies Program.
Sawtooth = Sawtooth Fish Hatchery.
EFSR = East Fork Salmon River Satellite.

Proposed, annual fish release numbers for the Sawtooth Fish Hatchery and the East Fork Salmon River Satellite are presented below. While proposed exist, the program is being managed to address the higher priority of providing sufficient broodstock for natural production and hatchery production. Lack of sufficient broodstock coupled with ESA-listing has substantially modified releases. For some time now, broodstock criteria have driven fish release levels, not production targets.

Life Stage	Facility	Release Location	Annual Release Level and purpose
Yearling	Sawtooth	upper Salmon River	1,300,000 (prod.)
Yearling	Sawtooth	Valley Creek/ West Fork Yankee Fork Salmon River	300,000 (prod.)
Yearling	EFSR	East Fork Salmon River	700,000 (prod.)

Note: The proposed, annual fish release numbers reported in the above table include the following, original juvenile release targets for the Idaho Supplementation Studies Program:

Life Stage	Facility	Release Location	Annual Release Level and purpose
Yearling	Sawtooth	upper Salmon River	500,000 (supp.)
Yearling	Sawtooth	West Fork Yankee Fork Salmon River	61,000 (supp.)
Yearling	EFSR	East Fork Salmon River	173,000 (supp.)

1.12) Current program performance, including estimated smolt-to-adult survival rates,

adult production levels, and escapement levels. Indicate the source of these data.

The most recent Idaho Department of Fish and Game performance data for the Sawtooth Fish Hatchery is presented below. **Adult return information after 1995 does not include unmarked fish because hatchery and natural-origin fish could be determined due to the initiation of the IDFG mass marking program in 1991 and 1992.**. As such, numbers presented in the following table may be lower than numbers presented in subsequent tables in this HGMP. In addition, any loss of adults due to harvest or straying has not been accounted for in the following tables. As such, SAR information presented below are minimum estimates.

Information for juvenile spring chinook salmon released into the upper Salmon River at the Sawtooth Fish Hatchery is presented in the following table.

			Return Age From BY				
Brood Year	Number Released	Year Released	1-ocean	2-ocean	3-ocean	Total	SAR (%)
1986	100,600 1,604,900	1987 1988	428	1,410	326	2,164	0.127
1987	990,995 1,101,600	1988 1989	41	199	109	349	0.017
1988	717,400 1,500,200	1989 1990	41	263	481	785	0.035
1989	650,600	1991	15	77	26	118	0.018
1990	1,263,864	1992	29	64	6	99	0.007
1991	774,583	1993	6	15	25	46	0.006
1992	213,830	1994	16	74	26	116	0.054
1993	128,532 205,781	1994 1995	0	79	10	69	0.022
1994	25,006	1996	0	3	4	7	0.028
1995	4,650	1997	0	12	37	49	1.010
1996	43,161	1998	60	135	32	227	0.526
1997	217,336	1999	279	1,219	327	1,825	0.840
1998	123,425	2000	176	531	-	-	-
1999	57,134	2001	65	-	-	-	-

Information for juvenile spring chinook salmon released into the East Fork Salmon River is presented in the following table.

			Return Age From BY				
Brood Year	Number Released	Year Released	1-ocean	2-ocean	3-ocean	Total	SAR (%)
1984	108,700	1986	1	23	51	75	0.069
1985	195,100	1987	6	55	27	88	0.045
1986	249,200	1988	22	106	32	160	0.064
1987	305,300	1989	12	23	23	58	0.019

1988	514,600	1990	7	27	65	99	0.019
1989	98,300	1991	15	18	13	46	0.046
1990	79,300	1992	6	2	0	8	0.010
1991	35,172	1993	0	0	0	0	0.000
1992	12,368	1994	0	7	0	7	0.056
1993	48,845	1995	3	7	n/a	10	0.020

The IDFG developed and implemented standardized procedures for counting chinook salmon redds in the early 1990s. Single peak count surveys are made over each trend area each year in Salmon and Clearwater basin streams. The surveys are timed to coincide with the period of maximum spawning activity on a particular stream. Recent redd count data for Idaho streams are presented in Attachment 2. of this HGMP.

1.13) Date program started (years in operation), or is expected to start.

Sawtooth Fish Hatchery – In operation since 1985.

East Fork Salmon River Satellite - In operation since 1984.

1.14) Expected duration of program.

This program is expected to continue indefinitely to provide mitigation under the Lower Snake River Compensation Plan.

1.15) Watersheds targeted by program.

Listed by hydrologic unit code –

Salmon River (Pahsimeroi River to headwaters):	17060201
East Fork Salmon River:	17060201
Yankee Fork Salmon River:	17060201
Valley Creek:	17060201

1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

Lower Snake River Compensation Plan hatcheries were constructed to mitigate for fish losses caused by construction and operation of the four lower Snake River federal hydroelectric dams. The Idaho Department of Fish and Game’s objective is to ensure that harvestable components of hatchery-produced spring chinook salmon are available to provide fishing opportunity, consistent with meeting spawning escapement and preserving the genetic integrity of natural populations (IDFG 1992). The Idaho Department of Fish and Game has not considered alternative actions for obtaining program goals.

SECTION 2. PROGRAM EFFECTS ON NMFS ESA-LISTED SALMONID POPULATIONS. (USFWS ESA-Listed Salmonid Species and Non-Salmonid Species are addressed in Addendum A)

2.1) List all ESA permits or authorizations in hand for the hatchery program.

Section 7 Consultation with U.S. Fish and Wildlife Service (April 2, 1999) resulting in NMFS Biological Opinion for the Lower Snake River Compensation Program.

Section 10 Permit Number 920 for East Fork Salmon River trapping and spawning activities (expired, reapplied for 1/10/00).

Section 10 Permit Number 919 for Sawtooth Fish Hatchery trapping and spawning activities (expired, reapplied for 1/10/00).

2.2) Provide descriptions, status, and projected take actions and levels for NMFS ESA-listed natural populations in the target area.

2.2.1) <u>Description of NMFS ESA-listed salmonid population(s) affected by the program.</u>

The following excerpts on the present status of Salmon River spring chinook salmon were taken from the Draft Subbasin Summary for the Salmon Subbasin of the Mountain Snake Province (NPPC 2001).

Idaho's stream-type chinook salmon are truly unique. Smolts leaving their natal rearing areas migrate 700 to 950 miles downstream every spring to reach the Pacific Ocean. Mature adults migrate the same distance upstream, after entering freshwater, to reach their place of birth and spawn. The life history characteristics of spring and summer chinook are well documented by IDFG et al. 1990; Healey 1991; NMFS: 57 FR 14653 and 58FR68543). Kiefer's (1987) An Annotated Bibliography on Recent Information Concerning Chinook Salmon in Idaho, prepared for the Idaho Chapter of the American Fisheries Society, provides a reference of information available through the mid-1980s on life history, limiting factors, mitigation efforts, harvest, agency planning, and legal issues. Snake River spring and summer chinook salmon, of which spawning populations in the Salmon Subbasin are a part, were listed as Threatened under the Endangered Species Act in 1992 (57 FR 14653); critical habitat was designated in 1993 (58 FR 68543). Recent and ongoing research has provided managers with more specific knowledge of the Salmon Subbasin stocks. Intensive monitoring of summer parr and juvenile emigrants from nursery streams has provided insights into freshwater rearing and migration behavior (Walters et al. 2001; Achord et al. 2000; Hansen and Lockhart 2001; Nelson and Vogel 2001). Recovered tags and marks on returning adults at hatchery weirs and on spawning grounds have indirectly provided stock specific measures of recruitment and fidelity (Walters et al. 2001; Berggren and Basham 2000). Since 1992, most hatchery-produced chinook have been marked to distinguish them from naturally produced fish.

Age-length frequencies and age composition of individual stocks are currently being refined for specific stocks (Kiefer et al. 2001). Distribution and abundance of spawning is being monitored with intensity in specific watersheds (Walters et al. 2001; Nelson and Vogel 2001).

Ongoing since the mid-1980s, annual standard surveys continue to provide trends in abundance and distribution of summer parr (Hall-Griswold and Petrosky 1997). Resultant data show an erratic trend toward lower abundance of juvenile chinook salmon in their preferred habitat (Rosgen C-typoe channels), both in hatchery-influenced streams and in areas serving as wild fish sanctuaries.

Analysis of recent stock-recruitment data (Kiefer et al. 2001) indicates that much of the freshwater spawning/rearing habitat of Snake River spring/summer chinook salmon is still productive. The average production for brood years 1990-1998 was 243 smolts/female. Stock-recruitment data show modestly density-dependent survival for the escapement levels observed in recent years and have been used to estimate smolt-to-adult survival necessary to maintain or rebuild the chinook salmon populations. A survival rate of 4.0% would result in an escapement at Lower Granite Dam of approximately 40,000 wild adult spring/summer chinook salmon.

In the mid-1990s, the Salmon Subbasin produced an estimated 39% of the spring and 45% of the summer chinook salmon that returned as adults to the mouth of the Columbia River. Natural escapements approached 100,000 spring and summer chinook salmon from 1955 to 1960; with total escapements declining to an average of about 49,300 (annual average of 29,300 spring chinook salmon and 20,000 summer chinook salmon) during the 1960s. Smolt production within the Salmon Subbasin is estimated to have ranged from about 1.5 million to 3.4 million fish between 1964 and 1970.

Populations of stream-type (spring and summer) chinook salmon in the subbasin have declined drastically and steadily since about 1960. This holds true despite substantial capacities of watersheds within the subbasin to produce natural smolts and significant hatchery augmentation of many populations. For example, counts of spring/summer chinook salmon redds in IDFG standard survey areas within the subbasin declined markedly from 1957 to 1999. The total number of spring and summer chinook salmon redds counted in these areas surveys ranged from 11,704 in 1957 to 166 in 1995. Stream-type chinook salmon redds counted in all of the subbasin's monitored spawning areas have averaged only 1,044 since 1980, compared to an average 6,524 before 1970. Land management activities have affected habitat quality for the species in many areas of the subbasin, but spawner abundance declines have been common to populations in both high-quality and degraded spawning and rearing habitats (IDFG 1998).

Kucera and Blenden (1999) have reported that all five "index populations" (spawning aggregations) of stream-type chinook in the Salmon Subbasin, fish that spawn in specific areas of the Middle Fork and South Fork Salmon watersheds, exhibited highly significant ($p<0.01$) declines in abundance during the period 1957-95. The NMFS (2000) estimated that the population growth rates (lambda) for these populations during the 1990s were all substantially less than needed for the fish to replace themselves: Poverty Flats (lambda = 0.757), Johnson Creek (0.815), Bear Valley/Elk Creek (0.812), Marsh Creek (0.675), and Sulphur Creek (0.681). Many wild populations of stream-type chinook in the subbasin are now at a remnant status and it is likely that there will be complete losses of some spawning populations. Annual redd counts for the index populations have dropped to zero three times in Sulphur Creek and twice in Marsh Creek, and zero counts have been observed in spawning areas elsewhere within the Salmon Subbasin. All of these chinook populations are in significant decline, are at low levels of abundance, and at high risk of localized extinction (Oosterhout and Mundy 2001).

- Identify the NMFS ESA-listed population(s) that will be <u>directly</u> affected by the program

Snake River Spring/Summer-run chinook salmon ESU (T – 4/92).

- Identify the NMFS ESA-listed population(s) that may be <u>incidentally</u> affected by the program.

Snake River Spring/Summer-run chinook salmon ESU (T – 4/92)

Snake River sockeye salmon ESU (E – 11/91)

Snake River Basin steelhead ESU (T – 8/97)

Bull trout (T – 6/98)

2.2.2) <u>Status of NMFS ESA-listed salmonid population(s) affected by the program.</u>

- **Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds.**

Critical and viable population thresholds have not been identified. The NMFS has identified interim abundance and productivity targets for Columbia Basin salmon and steelhead listed under the ESA. Snake River spring chinook salmon abundance targets for local spawning aggregates area:

1) Mainstem Salmon River tributaries (Lemhi to Yankee Fork):	2,000
2) Upper East Fork Salmon River tributaries:	700
3) Upper Salmon River Basin:	5,100

The following excerpts were taken from the Status Review for Spring and Summer Snake River Chinook Salmon (Matthews and Waples 1991) produced by NMFS as part of the federal process to determine ESA listing status.

During this century, man's activities have resulted in a severe and continued decline of the once robust runs of Snake River spring and summer chinook salmon. Nearly 95% of the total reduction in estimated abundance occurred prior to the mid-1900s. Over the last 30-40 years, the remaining population was further reduced nearly tenfold to about 0.5% of the estimated historical abundance. Over the last 26 years, redd counts in all index areas combined (excluding the Clearwater River) have also shown a steady decline. This is in spite of the fact that all in-river fisheries have been severely limited since the mid-1970s (Chapman et al. 1991). The 1990 redd count represented only 14.3% of the 1964 count.

To obtain insight into the likely persistence times of the ESU given present conditions, we applied the stochastic extinction model of Dennis et al. (1991) to a 33-year record of redds counted in index areas. The 33-year period is the longest possible, as redd counting in the Snake River began in 1957. We examined both sets of redd counts described previously: a 33-year series excluding the Grande Ronde River and a 26-year series that began with the first count of redds in the Grand Ronde River in 1964. We feel it is prudent to include the Grande Ronde River in at least part of the analysis because it has contributed between 10 and 20% of the total number of redds in the Snake River since 1964. Five-year running sums of redd counts (hereafter referred to as the "index value") were used to approximate the number of redds in single generations. These index values were the input data for the Dennis model; output was the probability that the index value would fall below a threshold value in a given time. An "endangered" threshold was defined as the index value at which the probability of reaching extinction (index value < 1) within the next 100 years is 5%; a "threatened" threshold was defined as the index value at which the probability of reaching the "endangered" threshold within the next 10 years is 50%.

For the 33-year time series (excluding the Grande Ronde River), the current index value of 8,456 redds is well below the threatened index value of 15,474 redds and only slightly above the endangered index value of 7,065 redds. According to the model, the probability of extinction in 100 years is 0.032, and the probability of reaching the endangered threshold in 10 years is 0.943. For the 26-year time series (including the Grande Ronde River), the current index value of 10,258 redds is somewhat above the threatened index value of 7,730 redds. According to the model, the probability of extinction in 100 years is < 0.001, and the probability of reaching the endangered threshold in 10 years is 0.270. The different results are primarily attributable to the fact that the initial index value was higher and the current index value lower in the former analysis. As previously discussed, the use of redd counts means that results of the model provide a conservative perspective of the rate of decline in abundance of adult salmon; hence, the model predictions are also conservative.

The results from the Dennis model should be regarded as rough approximations, given that the model's simplicity undoubtedly fails to consider all of the factors that can affect population viability. In particular, the model does not consider compensatory or depensatory effects that may be important at small population sizes. Nevertheless, considered together, results of the two analyses suggest that the ESU is at risk of extinction.

Other factors besides total abundance are also relevant to a threshold determination. Although the most recent data suggest that several thousand wild spring and summer chinook salmon currently return to the Snake River each year, these fish are thinly spread over a large and complex river system. In many local areas, the number of spawners in some recent years has been low. For example, in the small index area of upper Valley Creek, redd counts averaged 215 (range 83 to 350) from 1960 through 1970 (White and Cochnauer 1989). However, from 1980 through 1990, redd counts averaged only 10 (range 1 to 31). Similarly, in the large index area of the entire Middle Fork of the Salmon River, redd counts averaged 1,603 (range 1,026 to 2,180) from 1960 through 1970 but only 283 (range 38 to 972) from 1980 through 1990. If significant population subdivision occurs within the Snake River Basin (as evidence discussed above suggests may be the case), the size of some local populations may have declined to levels at which risks associated with inbreeding or other random factors become important considerations. As numbers decline, fish returning to spawn may also have difficulty finding mates if they are widely distributed in space and time of spawning.

Short-term projections for spring and summer chinook salmon in the Snake River are not optimistic. The recent series of drought years undoubtedly impacted the number of outmigrating juveniles that will produce returning adults in the next few years. The very low number of jacks returning over Lower Granite Dam in 1990 provides additional reason for concern for the ESU.

Collectively, these data indicate that spring and summer chinook salmon in the Snake River are in jeopardy: Present abundance is a small fraction of historical abundance, the Dennis model provides evidence that the ESU is at risk, threats to individual subpopulations may be greater still, and the short-term projections indicate a continuation of the downward trend in abundance. We do not feel the evidence suggests that the ESU is in imminent danger of extinction throughout a significant portion of its range; however, we do feel it is likely to become endangered in the near future if corrective measures are not taken.

- Provide the most recent 12-year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.

The following information was taken from Kiefer et al. (2001). For brood years 1990–1998, estimated wild/natural (W/N) smolt production ranged from 161,157 to 1,560,298. During this period, smolts/female production averaged 243 smolts/female, and ranged from 92-406 smolts/female.

Brood Year	**1990**		**1991**		**1992**	
Run	Spring	Summer	Spring	Summer	Spring	Summer
Dam Counts	17,315	5,093	6,623	3,809	21,391	3,014
% Females	48	44	44	52	49	43
# of Females	8,368	2,246	2,906	1,961	10,482	1,294

# of Females in Hatcheries	3,395	421	1,330	252	2,747	462
Adjustment for Migration Mortality	4,244	526	1,663	350	3,434	578
# of Females in Harvest	796	10	1	0	897	43
Female Escapement	3,328	1,710	1,292	1,611	6,151	673
Combined Female Escapement	5,038		2,853		6,824	
Combined W/N Smolts	527,000		627,037		627,942	
# of Smolts/Female	105		220		92	

Brood Year	**1993**		**1994**		**1995**	
Run	Spring	Summer	Spring	Summer	Spring	Summer
Dam Counts	21,035	7,889	3,120	795	1,105	694
% Females	55	55	55	60	41	52
# of Females	11,535	4,340	1,706	478	452	361
# of Females in Hatcheries	4,861	528	686	164	153	100
Adjustment for Migration Mortality	6,076	660	858	205	191	125
# of Females in Harvest	658	0	83	5	0	1
Female Escapement	4,801	3,680	765	268	261	235
Combined Female Escapement	8,481		1,033		496	
Combined W/N Smolts	1,558,786		419,826		161,157	
# of Smolts/Female	184		406		325	

Brood Year	**1996**		**1997**		**1998**	
Run	Spring	Summer	Spring	Summer	Spring	Summer
Dam Counts	4,215	2,608	33,855	10,709	9,854	4,355
% Females	38	40	55	44	54	54
# of Females	2,023	1,032	18,620	4,766	5,333	2,346
# of Females in Hatcheries	1.036	148	5,503	894	2,229	365
Adjustment for Migration Mortality	1,295	185	6,879	1,118	2,786	456
# of Females in Harvest	20	0	3,183	322	643	67
Female Escapement	708	847	8,558	3,326	1,904	1,823
Combined Female Escapement	1,555		11,884		3,727	
Combined W/N Smolts	599,159		1,560,298		1,344,382	
# of Smolts/Female	385		131		361	

- Provide the most recent 12-year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

Lower Granite Dam counts for wild/natural spring and summer chinook salmon are presented in the previous section for the period of 1990 through 1998. Spring chinook salmon adult return numbers (natural-origin and hatchery-origin) for the Sawtooth Fish Hatchery and East Fork Salmon River are presented in the following table. Beginning in 1995, hatchery-origin and natural-origin adults were identifiable based on marks.

Return Year	Sawtooth Fish Hatchery Total Returns (Hatchery-Produced/Natural)	Total Ponded (H/N)	Total Released (H/N)	Total Male Returns (H/N)	Total Female Returns (H/N)
1995	37 (19/18)	17 (17/0)	20 (2/18)	33 (17/16)	4 (2/2)

1996	156 (51/105)	62 (32/30)	94 (19/75)	118 (34/84)	38 (17/21)
1997	254 (99/155)	142 (92/50)	112 (7/105)	153 (49/104)	101 (50/51)
1998	153 (26/127)	61 (17/44)	92 (9/83)	76 (11/65)	77 (15/62)
1999	196 (75/121)	67 (26/41)	129 (49/80)	161 (66/95)	35 (9/26)
2000	986 (451/535)	461 (408/53)	525 (43/482)	734 (329/405)	252 (122/130)
2001	2,103 (1,427/676)	872 (815/57)	1,231 (612/619)	1,227 (833/394)	876 (594/282)
2002	1,786 (923/863)	446 (377/69)	1,340 (546/794)	884 (368/516)	902 (555/347)

Return Year	East Fork Salmon River Total Returns (Hatchery-Produced/Natural)	Total Ponded (H/N)	Total Released (H/N)	Total Male Returns (H/N)	Total Female Returns (H/N)
1995	0 (0/0)	0	0	0	0
1996	10 (1/9)	0	10 (1/9)	8 (1/7)	2 (0/2)
1997	7 (1/6)	0	7 (1/6)	5 (0/5)	2 (1/1)
1998	Trap Not Operated				
1999	Trap Not Operated				
2000	Trap Not Operated				
2001	Trap Not Operated				
2002	Trap Not Operated				

- Provide the most recent 12-year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

Numbers of hatchery- and natural-origin spring chinook salmon released for natural spawning are presented in the above table for IDFG Sawtooth Fish Hatchery and East Fork Salmon River Satellite facilities. Current guidelines pursuant to the Idaho Supplementation Studies project design state that up to 50% of the adults released upstream of the Sawtooth Fish Hatchery weir may be of hatchery origin; specifically of supplementation cross origin (hatchery x natural).

2.2.3) <u>Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of NMFS listed fish in the target area, and provide estimated annual levels of take.</u>

See below.

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

ESA-listed, spring chinook salmon are trapped during broodstock collections periods at the Sawtooth Fish Hatchery and the East Fork Salmon River Satellite. However, the chinook salmon trap on the East Fork Salmon River has not been operated since 1998.

The Sawtooth Fish Hatchery develops broodstocks to meet LSRCP mitigation objectives in addition to objectives associated with an ongoing supplementation experiment.

Annually, natural-origin, hatchery-origin, and supplementation adults may be trapped at this facility. Based on federal permit and consultation language and on agreements with supplementation studies cooperators, annual weir management plans are developed. Depending on run size and composition, supplementation and natural-origin adults may be retained in the hatchery to produce future supplementation broodstocks. Generally, a minimum of 50% of the natural-origin adults that return annually are released upstream for natural spawning.

- **Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish**.

The final table presented above in Section 2.2.2 reviews the number of natural-origin adult spring chinook salmon retained ("ponded") in the hatchery and incorporated in annual spawning designs.

- **Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).**

All adult spring chinook salmon (hatchery- and natural-origin) are trapped and handled at the Sawtooth Fish Hatchery weir. The numbers of natural-origin adults varies annually (see final tables in Section 2.2.2 above). Beginning in 2003, the IDFG anticipates that all natural-origin adults will be passed upstream for spawning as the development of supplementation broodstocks is expected to conclude. Following capture, natural-origin fish may be marked and tissue sampled before release.

Prior to adult return year 2003, a portion of natural adults were retained for broodstock purposes (see final tables in Section 2.2.2 above). Take associated with this program is presented in Table 1 (attached).

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

It is unlikely that take levels for natural-origin spring chinook salmon will exceed projected take levels presented in Table 1 (attached). The Idaho Supplementation Studies project is beginning to phase out of developing new supplementation broodstocks. As such, beginning in 2003, we anticipate that all natural-origin chinook salmon will be released upstream for natural spawning. However, in the unlikely event that stated levels of take are exceeded, the IDFG will consult with NMFS Sustainable Fisheries Division or Protected Resource Division staff and agree to an action plan. We assume that any contingency plan will include a provision to discontinue hatchery-origin, steelhead trapping activities.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER

MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.

This program conforms with the plans and policies of the Lower Snake River Compensation Program administered by the U.S. Fish and Wildlife Service to mitigate for the loss of chinook salmon production caused by the construction and operation of the four dams on the lower Snake River.

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.

Cooperative Agreement between the U.S. Fish and Wildlife Service and the Idaho Department of Fish and Game, USFWS Agreement No.: 141102J010 (for Lower Snake River Compensation Plan monitoring and evaluation studies).

Cooperative Agreement between the U.S. Fish and Wildlife Service and the Idaho Department of Fish and Game, USFWS Agreement No.: 141102J009 (for Lower Snake River Compensation Plan hatchery operations).

Current Interim Management Agreement for Upriver Spring Chinook, Summer Chinook and Sockeye pursuant to United States of America v. State of Oregon, U.S. District Court, District of Oregon.

3.3) Relationship to harvest objectives.

The Lower Snake River Compensation Plan defined replacement of adults “in place” and “in kind” for appropriate state management purposes. The Idaho Department of Fish and Game, the U.S. Fish and Wildlife Service, and other tribal and agency fish managers work cooperatively to develop annual production and mark plans. Juvenile production and adult escapement targets were established at the outset of the LSRCP program.

As part of its harvest management and monitoring program, the IDFG conducts annual creel and angler surveys to assess the contribution program fish make toward meeting program harvest objectives.

3.3.1) Describe fisheries benefiting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

Since the inception of the LSRCP program, chinook salmon sport fishing seasons have not occurred in the upper Salmon River. Hatchery-origin adults produced at the Sawtooth Fish Hatchery are subjected to potential harvest during their upstream migration through river sections where sport fishing seasons have occurred.

3.4) Relationship to habitat protection and recovery strategies.

Hatchery production for harvest mitigation is influenced but not linked to habitat protection strategies in the Salmon Subbasin and other areas. The NMFS has not developed a recovery plan specific to Snake River chinook salmon, but the Salmon River spring chinook program is operated consistent with existing Biological Opinions.

3.5) Ecological interactions. [Please review Addendum A before completing this section. If it is necessary to complete Addendum A, then limit this section to NMFS jurisdictional species. Otherwise complete this section as is.]

We considered hatchery water withdrawal in the upper Salmon River to have no effect upon listed salmon. Water is only temporarily diverted from the Salmon River and East Fork Salmon river. The recent six-year average use of water at the Sawtooth Fish Hatchery was 33.8 cfs, including well and river water. The range of water usage for this period was 11 to 53 cfs. The most recent six-year average use of water at the East Fork Salmon River Satellite was 10 cfs and the range was 8 to 15 cfs. We have not observed dewatered redds in the Salmon River or East Fork Salmon River as a result of hatchery water diversion. Chinook salmon and steelhead juveniles occur in the vicinity of both facilities. As such, we assume that rearing habitat is available. Stream flows during juvenile release periods are sufficient for all life history stages of listed species in the short stretches of river between where water is extracted and returned.

The Sawtooth Fish Hatchery water intake structure could potentially have an effect on listed salmon and steelhead. We noted chinook salmon fry mortalities on the Sawtooth Fish Hatchery headbox screens in 1992 and subsequently installed new screens with narrower spaces to prevent fry impingement. The IDFG also made modifications to the headbox such as adding a spryer pipe to wash fry to the collection trough, which transports fry from the trash screen back to the river.

Hatchery water discharge is not expected to have an effect on rearing listed salmon and steelhead. Hatchery discharge is consistently within NPDES standards.

Potential adverse effects to listed salmon could occur from the release of hatchery-produced spring chinook smolts through the following interactions: predation, competition, behavior modification, and disease transmission. Hatchery-produced smolts are spatially separated from listed species during early rearing so effects are likely to occur only in the migration corridor after release.

The IDFG does not believe that the release of spring chinook juveniles in the upper Salmon River will affect listed sockeye salmon in the free-flowing migration corridor. Adults and juveniles of these two runs of salmon are temporally and spatially separated with juvenile sockeye having a later outmigration timing (May-June) that spring chinook salmon (March-April). There is no information available that indicates that competition occurs between these two species.

Although it is possible that both hatchery-produced spring chinook salmon and natural fall chinook salmon could occur in the Snake River at the same time, the IDFG believes that hatchery-produced smolts released in March and April will be out of the Snake River production area when fall chinook salmon emerge in late April and early May (IFRO 1992). Because of their larger size, spring chinook salmon smolts migrating through the Salmon and Snake rivers will probably be using different habitat than emerging fall chinook salmon fry (Everest 1969). Fall chinook salmon adults would be temporally and spatially separated from the spring chinook salmon adults returning to the upper Salmon River.

Based on general migration information, it appears that the potential for adverse effects from hatchery-produced spring chinook salmon would be greatest with juvenile, listed spring and summer chinook salmon. As mentioned earlier, hatchery-produced juveniles are spatially separated from listed spring chinook salmon during early rearing. Perry and Bjornn (1992) documented that natural, chinook salmon fry movement in the upper Salmon river began in early March, peaked in late April, and early May, and then decreased into the early summer as the fish grew to parr size. Average mean length of spring chinook salmon fry ranged from 32.9 – 34.9 mm through late April in the upper Salmon River. Mean fry size increased to 39.8 mm by mid-June (Perry and Bjornn 1992). Assuming that hatchery-produced chinook salmon smolts could feed on prey up to 1/3 of their body length, natural fry would be in a size range to be potential prey. However, emigration from release sites generally occurs within a few days and the IDFG does not believe that hatchery-produced smolts would convert from a hatchery diet to a natural diet in such a short time (USFWS 1992, 1993). Additionally, the IDFG is unaware of any literature that suggests that juvenile chinook salmon are piscivorous.

The literature suggests that the effects of behavioral or competitive interactions between hatchery-produced and natural chinook salmon juveniles would be difficult to evaluate or quantify (Cannamela 1992b; USFWS 1992, 1993). There is limited information describing adverse behavioral effects of summer releases of hatchery-produced chinook salmon fingerlings (age 0) on natural chinook salmon fingerlings. Hillman and Mullan (1989) reported that larger hatchery-produced fingerlings apparently “pulled” smaller chinook salmon from their stream margin stations as the hatchery fish drifted downstream. The hatchery-produced fish were approximately twice as large as the natural juveniles. In this study, spring releases of steelhead smolts had no observable effect on natural chinook fry or smolts. However, effects of emigrating yearling, hatchery-produced chinook salmon on natural chinook salmon fry or yearlings is unknown. There may be potential for the larger hatchery-produced fish, presumably migrating in large schools, to “pull” natural chinook salmon juveniles with them as they migrate. It this occurs, effects of large, single-site releases on natural survival may be adverse. We do not know if this occurs, or the magnitude of the potential effect. In the upper Salmon River, IDFG biologists observed chinook salmon fry in typical areas during steelhead sampling in April – June, 1992 even though 1.27 million spring chinook salmon smolts had been released in mid-March (IDFG 1993c).

The IDFG believes that competition for food, space, and habitat between hatchery-produced chinook salmon smolts and natural fry and smolts should be minimal due to: 1) spatial segregation, 2) foraging efficiency of hatchery-produced fish, 3) rapid emigration in free flowing river sections, and 4) differences in migration timing. If competition occurs, it would be localized at sites of large group releases (Petrosky 1984).

Chinook salmon habitat preference criteria studies have illustrated that spatial habitat segregation occurs (Hampton 1988). Larger juveniles (hatchery-produced) select deeper water and faster velocities than smaller juveniles (natural fish). This mechanism should help minimize competition between emigrating hatchery-produced chinook salmon and natural fry in free-flowing river sections.

The time taken for hatchery-produced juvenile chinook salmon to adjust to the natural environment reduces the effect of hatchery-produced fish on natural fish. Foraging and habitat selection deficiencies of hatchery-produced fish have been noted (Ware 1971; Bachman 1984; Marnell 1986). Various behavior studies have noted the inefficiency of hatchery-produced when fish placed in the natural environment (including food selection). Because of this, and the time it takes for hatchery-produced fish to adapt to their new environment, the IDFG believes competition between hatchery-produced and natural origin chinook salmon is minimal; particularly soon after release.

The IDFG does not believe that the combined release of hatchery mitigation and supplementation chinook salmon in the upper Salmon River exceeds the carrying capacity of the free-flowing migration corridor. Food, space, and habitat should not be limiting factors in the Salmon River and free-flowing Snake River.

The spring smolt outmigration of naturally produced chinook salmon is generally more protracted than the hatchery-produced smolt outmigration. Data illustrating arrival timing at Lower Granite Dam support this observation (Kiefer 1993). This factor may lessen the potential for competition in the river.

Spring chinook salmon reared at the Sawtooth Fish Hatchery have a history of chronic bacterial kidney disease (BKD) incidence. Current control measures at the Sawtooth Fish Hatchery include: 1) adult antibiotic injections, 2) egg disinfection, 3) egg culling based on BKD ELISA value, 4) egg segregation incubation, 5) juvenile segregation rearing, and 6) juvenile antibiotic feedings.

Bacterial kidney disease and other diseases can be horizontally transmitted from hatchery fish to natural, listed species. However, in a review of the literature, Steward and Bjornn (1990) stated that there was little evidence to suggest that horizontal transmission of disease from hatchery-produced smolts to natural fish is widespread in the production area or free-flowing migration corridor. However, little additional research has occurred in this area. Hauck and Munson (IDFG, unpublished) stated that hatcheries with open water supplies (river water) may derive pathogen problems from natural populations.

The hatchery often promotes environmental conditions favorable for the spread of specific pathogens. When liberated, infected hatchery-produced fish have the potential to perpetuate and carry pathogens into the wild population.

The IDFG monitors the health status of hatchery-produced spring chinook salmon from the time they are ponded at the Sawtooth Fish Hatchery until their release as pre-smolts or smolts. Sampling protocols follow those established by the PNFHPC and AFS Fish Health Section.

All pathogens require a critical level of challenge dose to establish an infection in their host. Factors of dilution, low water temperature, and low population density in the upper Salmon River minimize the potential for disease transmission to naturally produced chinook salmon. However, none of these factors preclude the risk of transmission (Pilcher and Fryer 1980; LaPatra et al. 1990; Lee and Evelyn 1989). Even with consistent monitoring, it is difficult to attribute a particular occurrence of disease to actions of the LSRCP hatchery spring chinook program in the upper Salmon River.

There are potential adverse effects to listed adult spring chinook salmon and to their progeny from the release of hatchery-produced adult spring chinook salmon upstream of the Sawtooth Fish Hatchery weir for natural spawning. None of these potential impacts will result in direct mortality of natural adults. Potential effects include: changes in fitness, growth, survival, and disease resistance of natural populations. In addition, natural populations may be impacted through decreased productivity and decreased long-term adaptability (Kapuscinski and Jacobson 1987; Bowles and Leitzinger 1991). Negative impacts to natural populations are more likely when hatchery populations are not derived from locally adapted, endemic broodstocks. However, some increase in natural production can be expected when hatchery-origin fish are sufficiently similar to wild fish and natural rearing habitats are not at capacity (Reisenbichler 1983). The IDFG believes this to be the case in the upper Salmon River; recognizing that releasing adult spring chinook salmon from the Sawtooth Fish Hatchery to spawn naturally can increase natural production, but not necessarily productivity.

It is important to note that the IDFG has developed criteria to manage the release of hatchery-origin adults upstream of the Sawtooth Fish Hatchery weir for natural spawning. These criteria conform to NMFS and USFWS Section 10 and 7 permit language in addition to meeting the management objectives of the IDFG salmon supplementation study.

The potential exists for returning hatchery adults to stray and pose additional risk to natural populations. However, existing IDFG data indicate that this is not currently a problem for Sawtooth-origin adults.

SECTION 4. WATER SOURCE

4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to

the water source.

Sawtooth Fish Hatchery – The Sawtooth Fish Hatchery receives water from the Salmon River and from four wells. River water enters an intake structure located approximately 0.8 km upstream of the hatchery facility. River water intake screens comply with NMFS criteria. River waters flows from the collection site to a control box located in the hatchery building where it is screened to remove fine debris. River water can be distributed to indoor vats, outside raceways, or adult holding raceways. The hatchery water right for river water use is approximately 60 cfs. Incubation and early rearing water needs are met by two primary wells. A third well provides tempering water to control the build up of ice on the river water intake during winter months. The fourth well provides domestic water for the facility. The hatchery water right for well water is approximately 9 cfs. River water temperatures range from 0.0ºC in the winter to 20.0ºC in the summer. Well water temperatures range from 3.9ºC in the winter to 11.1ºC in the summer.

East Fork Salmon River Satellite – The East Fork Salmon River Satellite receives water from the East Fork Salmon River. Approximately 15 cfs is delivered to the facility through a gravity line. Water is delivered to adult holding raceways. A well provides domestic water and pathogen-free water for spawning (egg water-hardening process). No fish rearing occurs at this site. The intake screens are in compliance with NMFS screen criteria by design of the Corp of Engineers.

4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

Intake screens at all facilities are in compliance with NMFS screen criteria by design of the Corp of Engineers.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Sawtooth Fish Hatchery – Adult collection at the Sawtooth Fish Hatchery is facilitated by a permanent weir that spans the Salmon River. Weir panels are installed to prevent the upstream migration of adult chinook salmon. Fish are allowed to volitionally migrate into the adult trap where they are manually sorted into adult holding raceways. The hatchery has three 167 ft long x 16 ft wide x 5 ft deep holding raceways and an enclosed spawning building. Each raceway has the capacity to hold approximately 1,300 adults.

East Fork Salmon River Satellite - The East Fork Salmon River Satellite was constructed with a velocity barrier fitted with radial gates to prevent upstream passage beyond the trap. Adult chinook salmon move into a fish ladder and then into two adult holding raceways that measure 68 ft long by 10 ft wide by 4.5 ft deep. Each adult pond has the capacity to hold approximately 500 adults.

5.2) Fish transportation equipment (description of pen, tank truck, or container used).

A variety of transportation vehicles and equipment are available at the various facilities. Generally, adult transportation at both facilities is unnecessary as hatchery-produced adults are trapped and spawned on site.

5.3) Broodstock holding and spawning facilities.

See Section 5.1 above for a review of broodstock holding and spawning facilities.

5.4) Incubation facilities.

Sawtooth Fish Hatchery – Incubation facilities at the Sawtooth Fish Hatchery consist of a well water supplied system of 100 stacks of incubator frames containing 800 incubation trays. The maximum incubation capacity at the Sawtooth Fish Hatchery is 7 million steelhead eggs.

East Fork Salmon River Satellite – No incubation occurs at this facility. Eggs are transferred to the Sawtooth Fish Hatchery for incubation.

5.5) Rearing facilities.

Sawtooth Fish Hatchery – Inside rearing consists of ten semi-square tanks with an individual volume of 17 cubic feet and a capacity of 15,000 swim up fry each, 6 inside rearing tanks with an individual volume of 50 cubic feet and a capacity for 30,000 fry each, and 13 inside rearing vats with an individual volume of 391 cubic feet and a capacity for 100,000 fry each. Outside rearing consists of 12 fry raceways each with 750 cubic ft of rearing space and 28 production raceways each with 2,700 cubic ft of rearing space. Each production raceway has a capacity to raise 100,000 chinook to smolt stage for a total capacity of 2.8 million fish.

East Fork Salmon River Satellite – No rearing occurs at this facility. All rearing occurs at the Sawtooth Fish Hatchery.

5.6) Acclimation/release facilities.

For the Salmon River spring chinook program, acclimation occurs at the Sawtooth Fish Hatchery in outside production raceways supplied with river water.

5.7) Describe operational difficulties or disasters that led to significant fish mortality.

Brood year 1992 spring chinook salmon experienced an epizootic of apparent mycotic nature. As a result of this infection, survival to release as smolts averaged 50.4%. Brood year 1992 juveniles were released earlier than usual as a result of this infection. Typically, eyed-egg to smolt survival averages 95.0% or better.

5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

Sawtooth Fish Hatchery - The Sawtooth Fish Hatchery is staffed around the clock and equipped with an alarm system. The hatchery well water supply system is backed up by generator power. The inside vat room can be switched to gravity flow with river water in the event of a generator failure. Protocols are in place to guide emergency situations during periods of time when the hatchery well water supply is interrupted. Protocols are also in place to guide the disinfection of equipment and gear to minimize risks associated with the transfer of potential disease agents.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.

The Salmon River spring chinook broodstock was developed primarily from endemic sources. Prior to the construction of the Sawtooth Fish Hatchery in 1985, chinook salmon smolts were periodically released in the vicinity of the present hatchery (first records from 1966). While locally returning adults were used as much as possible, juveniles were released from adults sourced at Rapid River Fish Hatchery, Hayden Creek Fish Hatchery (Lemhi River tributary), and Marion Forks Fish Hatchery (Oregon) in 1967 (Bowles and Leitzinger 1991).

6.2) Supporting information.

6.2.1) History.

See Section 6.1 above.

6.2.2) Annual size.

Information on the number of adults used to develop broodstocks prior to the construction of the present-day Sawtooth Fish Hatchery is not available. See Section 6.2.3 below. Approximately 450 female and 450 male chinook salmon are needed annually to meet state and federal production objectives for the Sawtooth Fish Hatchery.

6.2.3) Past and proposed level of natural fish in broodstock.

Spring chinook salmon adult return numbers (natural-origin and hatchery-origin) for the Sawtooth Fish Hatchery and East Fork Salmon River are presented in the following table. Beginning in 1995, hatchery-origin and natural-origin adults were identifiable based on marks.

Return Year	Sawtooth Fish Hatchery Total Returns (Hatchery-Produced/Natural)	Total Ponded (H/N)	Total Released (H/N)	Total Male Returns (H/N)	Total Female Returns (H/N)
1995	37 (19/18)	17 (17/0)	20 (2/18)	33 (17/16)	4 (2/2)
1996	156 (51/105)	62 (32/30)	94 (19/75)	118 (34/84)	38 (17/21)
1997	254 (99/155)	142 (92/50)	112 (7/105)	153 (49/104)	101 (50/51)
1998	153 (26/127)	61 (17/44)	92 (9/83)	76 (11/65)	77 (15/62)
1999	196 (75/121)	67 (26/41)	129 (49/80)	161 (66/95)	35 (9/26)
2000	986 (451/535)	461 (408/53)	525 (43/482)	734 (329/405)	252 (122/130)
2001	2,103 (1,427/676)	872 (815/57)	1,231 (612/619)	1,227 (833/394)	876 (594/282)
2002	1,786 (923/863)	446 (377/69)	1,340 (546/794)	884 (368/516)	902 (555/347)

Return Year	East Fork Salmon River Total Returns (Hatchery-Produced/Natural)	Total Ponded (H/N)	Total Released (H/N)	Total Male Returns (H/N)	Total Female Returns (H/N)
1995	0 (0/0)	0	0	0	0
1996	10 (1/9)	0	10 (1/9)	8 (1/7)	2 (0/2)
1997	7 (1/6)	0	7 (1/6)	5 (0/5)	2 (1/1)
1998	Trap Not Operated				
1999	Trap Not Operated				
2000	Trap Not Operated				
2001	Trap Not Operated				
2002	Trap Not Operated				

6.2.4) Genetic or ecological differences.

The following excerpt was taken from:

Myers, et al. 1998. Status Review of Chinook Salmon from Washington, Idaho, Oregon, and California. NOAA Technical Memorandum NMFS-NWFSC-35.

One of the earliest studies of chinook salmon genetics in the Columbia River was by Kristiansson and McIntyre (1976), who reported allelic frequencies for 4 polymorphic loci in samples from 10 hatcheries, 5 of which were located along the coast and 5 in the lower Columbia River Basin. Significant frequency differences for SOD* were detected between spring- and fall-run samples collected at the Little White Salmon Hatchery on the Columbia River, but not for spring- and fall-run samples from the Trask River Hatchery along the northern coast of Oregon. Significant allele-frequency differences were also found between Columbia River samples as a group and Oregon coastal samples for PGM* and MDH*.

Utter et al. (1989) compared allelic frequencies at 12 polymorphic loci in samples of fall-run chinook salmon from the Priest Rapids Hatchery in the mid-Columbia River and from Ice Harbor Dam on the Snake River. These samples were taken over four years at each locality. Significant allele-frequency differences between populations were detected for 5 loci.

Schreck et al. (1986) examined allele-frequency variability at 18 polymorphic loci to infer genetic relationships among 56 Columbia River Basin chinook salmon populations. A hierarchical cluster analysis of genetic correlations between populations identified two major groups. The first contained spring-run chinook salmon east of the Cascade Mountains and summer-run fish in the Salmon River. Within this group they found three subclusters: 1) wild and hatchery spring-run chinook salmon east of the Cascade Mountains, 2) spring-run chinook salmon in Idaho, and 3) widely scattered groups of spring-run chinook salmon in the White Salmon River Hatchery, the Marion Forks Hatchery, and the Tucannon River. A second major group consisted of spring-run chinook salmon west of the Cascade Crest, summer-run fish in the upper Columbia River, and all fall-run fish. Three subclusters also appeared in this group: 1) spring- and fall-run fish in the Willamette River, 2) spring- and fall-run chinook salmon below Bonneville Dam, and 3) summer- and fall-run chinook salmon in the upper Columbia River. Schreck et al. (1986) also surveyed morphological variability among areas, and these results were reviewed in the Life History section of this status review.

Waples et al. (1991a) examined 21 polymorphic loci in samples from 44 populations of chinook salmon in the Columbia River Basin. A UPGMA tree of Nei's (1978) genetic distances between samples showed three major clusters of Columbia River Basin chinook salmon: 1) Snake River spring- and summer-run chinook salmon, and mid- and upper Columbia River spring-run chinook salmon, 2) Willamette River spring-run chinook salmon, 3) mid- and upper Columbia River fall- and summer-run chinook salmon, Snake River fall-run chinook salmon, and lower Columbia River fall- and spring-run chinook salmon. These results indicate that the timing of chinook salmon returns to natal rivers was not necessarily consistent with genetic subdivisions. For example, summer-run chinook salmon in the Snake River were genetically distinct from summer-run chinook salmon in the mid and upper Columbia River, but still had similar adult run timings. Spring-run populations in the Snake, Willamette and lower, mid, and upper Columbia Rivers were also genetically distinct from each other but had similar run timings. Conversely, some populations with similar run timings, such as lower Columbia River "tule" fall-run fish and upper Columbia River "bright" fall-run fish, were genetically distinct from one another. Juvenile outmigration also differed among some groups with similar adult run timing. For example, summer-run juveniles in the upper Columbia River exhibit ocean-type life-history characteristics, but summer-run chinook salmon in the Snake River migrate exhibit stream-type life-history characteristics.

In a status review of Snake River fall chinook salmon, Waples et al. (1991b) examined genetic relationships among fall-run chinook salmon in the Columbia and Snake Rivers (Group 3 of Waples et al. 1991a) in more detail. A UPGMA cluster analysis of Nei's unbiased genetic distance, based on 21 polymorphic loci, indicated that "bright" fall-run chinook salmon in the upper Columbia River were genetically distinct from those in the Snake River. Populations in the two groups were characterized by allele-frequency differences of about 10-20% at several loci, and these differences remained relatively constant from year to year in the late 1970s and early 1980s. However, allele-frequency shifts from 1985 to 1990 for samples of fall-run chinook salmon at Lyons Ferry Hatchery in the Snake River suggested that mixing with upper Columbia River fish had occurred. This is consistent with reports that stray hatchery fish from the upper Columbia River were inadvertently used as brood stock at the Lyons Ferry Hatchery. Samples of "bright" fall-run chinook salmon from the Deschutes River and the Marion Drain irrigation channel in the Yakima River Basin also appeared in the same cluster with samples of fall-run chinook salmon from the Snake River.

In a study of genetic effects of hatchery supplementation on naturally spawning populations in the upper Snake River Basin, Waples et al. (1993) examined allele-frequency variability at 35 polymorphic loci in 14 wild (no hatchery supplementation), naturally spawning (some hatchery supplementation), and hatchery populations of spring- and summer-run chinook salmon. Most populations were sampled over two years. An analysis of these data indicated that 96.6% of the genetic diversity existed as genetic differences among individuals within populations. Most of the remaining 3.4% was due to differences between localities, and only a negligible amount was due to allele-frequency differences between spring- and summer-run chinook salmon. Results reveal a close genetic affinity in the upper Snake River between natural spawners that suggests either gene flow between populations or a recent common ancestry. Comparisons between hatchery and natural populations in the same river indicated that the degree of genetic similarity between them reflected the source of the brood stock in the hatchery. As expected, the genetic similarity between wild and hatchery fish, for which local wild fish were used as brood stock, was high.

In a study of upper Columbia River chinook salmon, Utter et al. (1995) examined allele-frequency variability at 36 loci in samples of 16 populations. A UPGMA tree of Nei's (1972) genetic distances between samples indicated that spring-run populations were distinct from summer- and fall-run populations. The average genetic distance between samples from the two groups was about eight times the average of genetic distances between samples within each group. Allele-frequency variability among spring-run populations was considerably greater than that among summer- and fall-run populations in the upper Columbia River. The lack of strong allele-frequency differentiation between summer- and fall-run samples indicated minimal reproductive isolation between these two groups of fish. Hatchery populations of spring-run chinook salmon were genetically distinct from wild spring-run populations, but hatchery populations of fall-run chinook salmon were not genetically distinct from wild fall-run populations.

Some studies have indicated that Snake River spring- and summer-run chinook salmon have reduced levels of genetic variability. Utter et al. (1989) estimated gene diversities with 25 polymorphic loci for 65 population units and found that gene diversities in the Snake River were lower than those in the Columbia River. Winans (1989) estimated levels of gene diversity with 33 loci for spring-, summer-, and fall-run chinook salmon at 28 localities in the Columbia River Basin. Fall-run chinook salmon tended to have significantly greater levels of gene diversity (N=12, mean H=0.081) than both spring- (N=17, H=0.065) and summer-run (N=3, mean H=0.053) chinook salmon. Spring-run fish in the Snake River had the lowest gene diversities (N=4, mean H=0.044). However, Waples et al. (1991a) found that, with a larger sample of 65 loci, gene diversities in Snake River spring-run and summer-run chinook salmon were not as low as that suggested by earlier studies.

Recent, but unpublished, data are available for chinook salmon and will be discussed in the next section. However the results of the foregoing studies of Columbia and Snake River chinook salmon permit the following generalizations:

1) Populations of chinook salmon in the Columbia and Snake Rivers are genetically discrete from populations along the coasts of Washington and Oregon.

2) Strong genetic differences exist between populations of spring-run and fall-run fish in the upper Columbia and Snake Rivers. In the lower Columbia River, however, spring-run fish are genetically more closely allied with nearby fall-run fish in the lower Columbia River than with spring-run fish in the Snake and upper Columbia Rivers.

3) Summer-run fish are genetically related to spring-run fish in some areas (e.g., Snake River), but to fall-run fish in other areas (e.g., upper Columbia River).

4) Populations of fall-run fish are subdivided into several genetically discrete geographical groups in the Columbia and Snake Rivers (these populations will be discussed in detail in the next section).

5) Hatchery populations of chinook salmon tend to be genetically similar to the respective source populations used to found or augment the hatchery populations.

6.2.5) Reasons for choosing.

The upper Salmon River endemic spring chinook salmon stock was used to found this program. Reasons for choosing include: availability, local adaptability, and less risk posed to upper Salmon River stocks.

6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

The selection of natural-origin adults for broodstock purposes conforms with federal ESA permit and biological opinion language. Annually, escapement targets are prioritized. If run size is not severely constrained, targets are prioritized to ensure a minimum number of natural-origin adults escape to spawn. Similarly, the release of hatchery-origin adults in natural production areas is managed.

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Adult chinook salmon are collected for this program. Three groups of chinook salmon adults are collected at the Sawtooth Fish Hatchery weir: natural, supplementation, and hatchery reserve. Hatchery x hatchery progeny may be ESA-listed or not and may be adipose fin-clipped or marked in some other way to differentiate them from supplementation research progeny. Supplementation research progeny (hatchery x natural) are differentially marked from hatchery reserve progeny and generally do not receive an adipose fin clip. Supplementation broodstocks have been developed at the Sawtooth Fish Hatchery since 1991 as part of the cooperative Idaho Supplementation Studies project.

7.2) Collection or sampling design.

Natural escapement criteria drives the selection process. Typically, this ensures that a minimum number of adults escape to spawn naturally and that natural production takes priority over hatchery broodstock retention. The component of the adult return released above the weir to spawn may include up to 50% of the supplementation broodstock. Hatchery returns can comprise no more than 50% of the broodstock retained for supplementation. Surplus supplementation adult returns will be passed *over* the weir to supplement natural production up to natural equivalents; fish surplus to this need will be used for the general hatchery production broodstock within smolt production capacities.

The East Fork Salmon River adult chinook salmon trap has not been operated since 1998. No collection of adults for spawning has occurred since 1993. Between 1994 and 1998, the trap was operated to count fish only. All fish were passed above the weir.

7.3) Identity.

All harvest mitigation hatchery produced fish are marked with an adipose fin clip. Supplementation broodstocks have been developed at the Sawtooth Fish Hatchery and East Fork Salmon River since 1991 as part of the cooperative Idaho Supplementation Studies project. Juvenile fish produced for this program were visibly marked with a ventral or adipose fin clip from 1991 through 1996. Beginning with brood year 1997, supplementation juveniles were released unclipped but were 100% CWT-marked. Additionally, supplementation broodstock may be ventral fin clipped. The intent for supplementation fish is that they not be intercepted in selective fisheries. With the advent of down river selective fisheries, adipose fin clipping is no longer appropriate for supplementation juveniles.

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults):

Approximately 450 female and 450 male chinook salmon are needed annually to meet state and federal production objectives for the Sawtooth Fish Hatchery.

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

Information for 1995 through 2002 is presented below. Beginning in 1995, adult chinook salmon of hatchery origin were identifiable based on marks.

Sawtooth Fish Hatchery broodstock collection history.

Return Year	Sawtooth Fish Hatchery Total Returns (Hatchery-Produced/Natural)	Total Spawned (H/N)	Total Males Spawned (H/N)	Total Females Spawned (H/N)
1995	37 (19/18)	10 (10/0)	8 (8/0)	2 (2/0)
1996	156 (51/105)	50 (20/30)	40 (16/24)	10 (4/6)
1997	254 (99/155)	118 (79/39)	64 (35/29)	54 (44/10)
1998	153 (26/127)	54 (21/33)	27 (11/16)	27 (10/17)
1999	196 (75/121)	43 (17/26)	31 (14/17)	12 (3/9)
2000	986 (451/535)	254 (202/52)	165 (127/38)	89 (75/14)
2001	2,103 (1,427/676)	764 (707/57)	382 (352/30)	382 (355/27)
2002	1,786 (923/863)	358 (297/61)	161 (125/36)	197 (172/25)

No spawning has occurred at the East Fork Salmon River satellite since 1993.

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.

Sawtooth Fish Hatchery – Generally, chinook salmon are not collected in surplus to need at the Sawtooth Fish Hatchery. However, the disposition of surplus, hatchery-origin chinook salmon could include outplanting fish (as appropriate) to identified areas, the sacrifice of fish, and distribution of carcasses to the public, tribe, or human assistance organizations.

7.6) Fish transportation and holding methods.

Adult chinook salmon migrate into the adult holding facility at the Sawtooth Fish Hatchery. No fish transportation is needed. As adults enter the trap, they are anesthetized with MS222, identified, measured, and injected with Erythromycin (20 mg/kg) to control the level of bacteria responsible for causing bacterial kidney disease. Adults are then distributed to concrete holding raceways where they may remain for up to two months before spawning occurs. Adults are generally treated with formalin to retard the growth of fungus.

7.7) Describe fish health maintenance and sanitation procedures applied.

Adult chinook salmon held for spawning are typically spawned within two months of arrival. Fish health monitoring at spawning includes sampling for viral, bacterial and parasitic disease agents. Ovarian fluid is sampled from females and used in viral assays. Kidney samples are taken from a representative number of females spawned and used in bacterial assays. Head wedges are taken from a representative number of fish spawned and used to assay for presence/absence of the parasite responsible for whirling disease.

Eggs are rinsed with pathogen free well water after fertilization, and disinfected with a 100 ppm buffered iodophor solution for one hour before being placed in incubation trays. Necropsies are performed on pre-spawn mortalities as dictated by the Idaho Department of Fish and Game Fish Health Laboratory.

7.8) Disposition of carcasses.

Carcasses may be returned to the Salmon River or taken to landfill or rendering facilities.

7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

Broodstock selection criteria has been established to comply with ESA Section 10 permit and 7 consultation language in addition to meeting IDFG and cooperator mitigation and supplementation objectives.

SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1) Selection method.

Three groups of chinook salmon adults are collected at the Sawtooth Fish Hatchery weir: natural (unmarked), supplementation (CWT-marked) and hatchery reserve (adipose fin-clipped). Supplementation broodstocks have been developed at the Sawtooth Fish Hatchery since 1991 as part of the cooperative Idaho Supplementation Studies project. Juvenile fish produced for this program were visibly marked with a ventral or adipose fin clip from 1991 through 1996. Beginning with brood year 1997, all supplementation juveniles were released unclipped but were 100% CWT-marked. All smolts released in the East Fork Salmon River have been for supplementation research. Hatchery reserve juveniles released in the upper Salmon River at the Sawtooth Fish Hatchery are 100% adipose fin-clipped. No hatchery-reserve juveniles have been released in the East Fork Salmon River.

Spawning protocols will typically follow existing hatchery practices. Sexes will be spawned 1:l as they ripen, and follow a spawning plan (developed by the IDFG) to develop supplementation and hatchery reserve broodstocks. Spawn timing will be dependent on ripeness, which is assumed to correspond with run timing. If adult escapement is low (e.g., < 100 females), factorial or modified diallele crosses may be utilized to minimize genetic drift and maintain genetic diversity, (Kapuscinski et al.

1991).

8.2) Males.

Generally, males are used only once for spawning. In cases where skewed sex ratios exist (fewer males than females) or in situations where males mature late, males may be used twice. In addition, if factorial or modified diallele spawning designs are followed, males will be used more than once.

8.3) Fertilization.

Spawning ratios of 1 male to 1 female will be used unless the broodstock population contains less than 100 females. If the spawning population contains less than 100 females, then eggs from each female may be split into multiple sub-families and fertilized by multiple males. Following fertilization, one cup of well water is added to each bucket (sub-family of eggs) and set aside for 30 seconds to one minute.

8.4) Cryopreserved gametes.

Milt is not cryopreserved as part of this program and no cryopreserved gametes are used in this program. However, the Nez Perce Tribe has collected milt from natural males at the Sawtooth Fish Hatchery.

8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

Prior to spawning, adults may receive an antibiotic treatment to control the presence of the bacterium responsible for causing bacterial kidney disease. In addition, adults may receive formalin treatments to control the spread of fungus and fungus-related pre-spawn mortality. At spawning, ELISA optical density values for female spawners are used to establish criteria for egg culling and isolation incubation needs.

SECTION 9. INCUBATION AND REARING -

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

9.1) Incubation:

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.

The original Lower Snake River Compensation Program production target of 19,445 adults back to the project area upstream of Lower Granite Dam was based on a smolt-to-adult survival rate of 0.87%. To date, program SARs have not met these planning guidelines. This is not due to lower than expected "in-hatchery" performance.

Sawtooth Fish Hatchery spring chinook salmon egg information.

Spawn Year	Green Eggs Taken	Eyed-eggs	Survival to Eyed Stage (%)
1986	2,035,535	1,870,306	92.8
1987	2,721,399	2,533,640	93.1
1988	3,120,688	2,846,235	91.2
1989	733,365	668,373	91.1
1990	1,431,360	1,346,350	94.1
1991	861,830	742,530	86.2
1992	468,300	423,600	90.5
1993	369,340	341,252	92.4
1994	29,933	25,632	85.6
1995	7,377	4,914	66.6
1996	51,743	44,600	86.2
1997	260,840	228,997	87.8
1998	139,469	127,064	91.1
1999	63,642	59,111	92.9
2000	417,709	386,671	93.0
2001	1,804,892	1,600,957	89.0
2002	1,037,558	920,651	88.7

East Fork Salmon River spring chinook salmon egg information. No spring chinook salmon spawning has occurred at this facility since 1993.

Spawn Year	Green Eggs Taken	Eyed-eggs	Survival to Eyed Stage (%)
1985	245,175	219,097	89.4
1986	300,438	272,781	90.8
1987	419,555	346,134	82.5
1988	790,512	728,000	92.1
1989	121,854	102,195	83.9
1990	98,560	90,010	91.3
1991	38,640	34,890	90.3
1992	30,500	28,200	92.5
1993	50,939	43,399	85.2

9.1.2) Cause for, and disposition of surplus egg takes.

Surplus eggs have not been generated in this program.

9.1.3) Loading densities applied during incubation.

Sawtooth Fish Hatchery – Incubation flows are set at 5 to 6 gpm per eight tray incubation stack. Typically, eggs from one female are incubated per tray (approximately 5,000 eggs).

9.1.4) Incubation conditions.

Sawtooth Fish Hatchery – Pathogen free well water is used for all incubation at the Sawtooth Fish Hatchery. Incubation stacks utilize catch basins to prevent silt and fine sand from circulating through incubation trays. Following 48 hours of incubation, eggs are treated three times per week with formalin (1,667 ppm) to control the spread of fungus. Formalin treatments are discontinued at eye-up. Once eggs reach the eyed stage of development (approximately 360 FTU), they are shocked to identify dead and unfertilized eggs. Dead and undeveloped eggs are then removed with the assistance of an automatic egg picking machine. During this process, the number of eyed and dead eggs is generated. Eggs generally reach the eyed stage of development when they have accumulated approximately 560 FTUs.

9.1.5) Ponding.

Sawtooth Fish Hatchery – Eggs are typically held in incubation trays until they reach the swim-up stage of development at approximately 1,650 FTUs. Ponding and rearing plans are generally developed to accommodate segregation groups (based on female ELISA optical density values) and whether juveniles are destined for supplementation or production (mitigation) releases.

Fry are ponded directly into inside rearing vats. Vats are baffled to provide compartmentalized rearing space and to assist with cleaning. In addition, vats are covered to provide some degree of privacy from human activity and building lights. Density and flow indices are maintained to not exceed 0.3 and 1.5, respectively (Piper et al. 1982). Fish are reared to approximately 7.6 mm in vats before being transferred to outside rearing raceways.

9.1.6) Fish health maintenance and monitoring.

Following fertilization, eggs are typically water-hardened in a 100 ppm Iodophor solution for a minimum of 30 minutes. During incubation, eggs routinely receive scheduled formalin treatments to control the growth of fungus. Treatments are typically administered three times per week at a concentration of 1667 ppm active ingredient. Dead eggs are removed following shocking. Additional egg picks are performed as needed to remove additional eggs not identified immediately after shocking.

9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

No adverse genetic or ecological effects to listed fish are anticipated. Eggs destined for supplementation and production releases are maintained in separate incubation trays. To offset potential risk from overcrowding and disease transmission, only eggs from one female are placed in individual incubation trays.

9.2) Rearing:

9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available.

Sawtooth Fish Hatchery spring chinook survival information by hatchery life stage.

Brood Year	Eyed-Eggs	Number of Fry Ponded to Vats (% survival from eye)	Number of Fingerlings Transferred From Vats to Raceways (% survival from eye)	Number of Smolts Released	Percent Survival From Eyed-Egg to Release
1988	2,846,235	2,818,312 (99.0)	n/a	2,541,500	89.3
1989	668,373	n/a	660,560 (98.8)	652,600	97.6
1990	1,346,350	1,308,098 (97.2)	n/a	1,273,400	94.6
1991	794,800	n/a	n/a	774,583	97.5
1992	423,600	422,093 (99.6)	441,835 (97.2)	213,830	50.5
1993	341,641	338,500 (99.1)	336,424 (98.5)	334,313	97.9
1994	26,232	25,888 (98.7)	25,659 (97.8)	25,006	95.3
1995	4,997	4,890 (97.9)	4,812 (96.3)	4,756	95.2
1996	45,128	44,875 (99.4)	43,650 (96.7)	43,161	95.6
1997	234,000	232,213 (99.2)	225,468 (96.4)	223,240	95.4
1998	129,593	127,064 (98.0)	124,730 (96.2)	123,425	95.2
1999	59,373	59,111 (99.6)	58,114 (97.9)	57,134	96.2
2000	420,733	402,777 (95.7)	398,833 (94.8)	385,761	91.7
2001	1,231,111	1,213,215 (98.5)	1,196,468 (97.2)	n/a	n/a

9.2.2) Density and loading criteria (goals and actual levels).

Sawtooth Fish Hatchery - Density (DI) and flow (FI) indices are maintained to not exceed 0.30 and 1.5, respectively (Piper et al. 1982).

9.2.3) Fish rearing conditions

Sawtooth Fish Hatchery – Swim-up fry are transferred incubation trays to vats at approximately 1,650 FTUs. Vats contain temporary PVC baffles positioned every 4 ft. Starting flows are typically set at approximately 20 gpm per vat. As fish grow, flows are increased up to a maximum of approximately 110 gpm per vat. Vat water is generally supplied from the hatcheries pathogen-free wells. Water temperature during early rearing ranges from 4.4°C to 7.8°C.

Spring chinook salmon are generally transferred to outside rearing raceways when they reach approximately 7.6 mm in length. Initially, fish are placed in the upper sections of two large raceways. Initial raceway flow is set at approximately 660 gpm per raceway. As fish grow, they are split to additional raceways and raceway sections and flows are increased. Flows are increased accordingly. River water supplies the outside rearing raceways at the Sawtooth Fish Hatchery. Water temperatures during outside rearing range from 1.1°C to 16.0°C.

9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.

Juvenile chinook salmon are reared for approximately 18 months before being released as full-term smolts. During this rearing period, chinook salmon are sample-counted monthly. Fish length, weight, and condition factor vary from year-to-year but typically average the following:

1) at ponding (English units) = 1.4 inches, 1,200 fish/pound, condition factor = 3.00.

2) at transfer from indoor vats to outside rearing raceways = 3.0 inches, 130 fish/pound, condition factor = 3.25.

3) at release = 5.5 inches, 15 fish/pound, condition factor = 3.50.

9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

See Section 9.2.4 above.

9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

Juvenile chinook salmon are fed a semi-moist diet provided from different manufacturers (state contract dependent). Conversion rate from first ponding to release averages 1.3 pounds of weight gain for each pound of food fed. Percent body weight fed per day averages the following:

Fish/pound	% body weight fed/day	Term in culture
Swim-up to 800 fpp	3.5	Nov. – Jan.
800 – 500	3.3	Jan. – Feb.
500 – 400	2.5	Feb. – March
400 – 350	2.5	March – April
350 – 300	2.3	April
300 – 250	2.2	May – June
250 – 150	2.4	June
150 – 110	2.4	June – July
110 – 90	2.5	July – August
90 – 50	2.2	August – Sept.
50 – 17	2.0	Sept – Oct.
17 to release	maintenance	Oct. – release

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.

Sawtooth Fish Hatchery – Routine fish health inspections are conducted by staff from the IDFG Eagle Fish Health Laboratory on a monthly basis. More frequent inspections occur if needed. Therapeutics may be used to treat specific disease agents (e.g., Oxytetracycline). Foot baths with disinfectant are used at the entrance of the hatchery early rearing building. Disinfection protocols are in place for equipment, trucks and nets. All raceways are thoroughly chlorinated after fish have been transferred for release.

9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.

No smolt development indices are developed in this program.

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.

The Hatchery Evaluation Studies component of the LSRCP program is evaluating the efficacy of semi-natural rearing treatments on post-release juvenile chinook salmon out-migration survival ("NATURES" experimentation). This research is ongoing. A progress report is expected in federal fiscal year 2003.

9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

At spawning, ELISA optical density values for female spawners are used to establish criteria for egg culling and isolation incubation needs. Fish may receive prophylactic antibiotic treatments to control the spread of infectious disease agents. Fish are maintained at conservative density and flow indices (< 0.3 and < 1.5, respectively). Fish are fed by hand and observed several times daily. Proper disinfection protocols are in place. Rearing vats and raceways are swept on a regular basis.

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.

10.1) Proposed fish release levels.

Sawtooth Fish Hatchery proposed fish release levels for brood year 2001. All fish released directly to the upper Salmon River immediately downstream of the Sawtooth Fish Hatchery adult trapping facility.

Age Class	Maximum Number	Size (fpp)	Release Date	Location	Rearing Hatchery
Eggs					
Unfed Fry					
Fry					
Fingerling					
Yearling	160,000			upper Salmon River (ISS)[1]	Sawtooth
	1,100,000			upper Salmon River (production)[2]	Sawtooth

[1] Releases associated with the Idaho Supplementation Studies program.
[2] General production (mitigation) releases.

10.2) Specific location(s) of proposed release(s).

Stream, river, or watercourse:
Release point: Upper Salmon River at Sawtooth Fish Hatchery 17060201 HUC.
Major watershed: Salmon River.
Basin or Region: Salmon River Basin.

10.3) Actual numbers and sizes of fish released by age class through the program.

Release information presented in the following table reflects releases that occurred in the upper Salmon River immediately downstream of the Sawtooth Fish Hatchery.

Brood Year	Release Year	Life Stage Released	Release Location	Avg. Size (fish/pound)	Number Released
1983	1985	Yearling	upper Salmon River	22.5	420,060
1984	1986	Yearling	upper Salmon River	26.3	347,484
1985	1986	Fingerling	upper Salmon River		103,661
1985	1987	Yearling	upper Salmon River	22.9	1,081,400
1986	1987	Fingerling	upper Salmon River		100,600
1986	1988	Yearling	upper Salmon River	22.1	1,604,900
1987	1988	Fingerling	upper Salmon River		990,995
1987	1989	Yearling	Yankee Fork Salmon River		198,200
1987	1989	Yearling	upper Salmon River	21.1	1,101,600
1988	1989	Fry	upper Salmon River		269,000
1988	1989	Fry	Yankee Fork Salmon River		125,000
1988	1989	Fingerling	upper Salmon River		448,400
1988	1989	Fingerling	Yankee Fork Salmon River		50,000
1988	1990	Yearling	upper Salmon River	25.4	1,500,200
1988	1990	Yearling	Yankee Fork Salmon River		200,800
1989	1991	Yearling	upper Salmon River	26.3	650,600
1990	1992	Yearling	upper Salmon River	30.5	1,263,864
1991	1993	Yearling	upper Salmon River	26.4	774,583
1992	1994	Yearling	upper Salmon River	24.1	213,830
1993	1994	Fingerling	upper Salmon River		103,507
1993	1994	Fingerling	West Fork Yankee Fork S.R.		25,025
1993	1995	Yearling	upper Salmon River	23.9	205,781
1994	1996	Yearling	upper Salmon River	19.9	25,006
1995	1997	Yearling	upper Salmon River	11.9	4,650
1996	1998	Yearling	upper Salmon River	13.9	43,161
1997	1999	Yearling	upper Salmon River	22.3	217,336
1998	2000	Yearling	upper Salmon River	16.4	123,425
1999	2001	Yearling	upper Salmon River	11.5	57,134
2000	2002	Yearling	upper Salmon River		385,761
		Avg. by release year =		21.6 for yearlings	701,997

Release information presented in the following table reflects releases that occurred in East Fork Salmon River.

Release Year	Rearing Hatchery	Life Stage Released	Avg. Size (fish/pound)	Number Released
1985	Sawtooth	Yearling	n/a	n/a
1986	Sawtooth	Yearling	28.0	108,700
1987	Sawtooth	Yearling	25.0	195,100

1988	Sawtooth	Yearling	19.5	249,200
1989	Sawtooth	Yearling	19.7	305,300
1990	Sawtooth	Yearling	22.3	514,600
1991	Sawtooth	Yearling	30.7	98,300
1992	Sawtooth	Yearling	24.6	79,300
1993	Sawtooth	Yearling	10.3	35,172
1994	Sawtooth	Yearling	21.9	12,368
1995	Sawtooth	Yearling	23.0	48,845
		Avg. =	21.8	164,688

10.4) Actual dates of release and description of release protocols.

Release Year	Rearing Hatchery	Life Stage	Date Released
1996	Sawtooth	Yearling	3/26/94
1997	Sawtooth	Yearling	4/17/97
1998	Sawtooth	Yearling	4/21/98
1999	Sawtooth	Yearling	4/16/99
2000	Sawtooth	Yearling	4/12, 4/19/00
2001	Sawtooth	Yearling	4/18/01
2002	Sawtooth	Yearling	4/9, 4/19, 4/23/02

Spring chinook yearlings are generally released during the month of April. Releases are planned to coincide with rising water flows in the Salmon River. Fish are generally released in the evening. Raceway screens and dam boards are removed allowing fish to volitionally emigrate into the tailrace and through a 36% pipe to the Salmon River. Fish that do not volitionally emigrate are forced out.

Fall fingerling (pre-smolt) releases generally occur in the month of October. Spring fry releases generally occur in the month of May.

10.5) Fish transportation procedures, if applicable.

No fish transportation is necessary as all fish are released to the upper Salmon River directly from rearing raceways.

10.6) Acclimation procedures (*methods applied and length of time*).

All spring chinook salmon juveniles released from the Sawtooth Fish Hatchery are reared on river water.

10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

Fish intended for potential harvest interception are generally marked with an adipose fin clip. To evaluate emigration success and timing to main stem dams and to evaluate specific survival studies, PIT tags are inserted in production release groups annually. Coded wire tags may be used as a mark for various evaluation.

Fish that are released as part of the Idaho Supplementation Studies project are generally not adipose fin-clipped. Generally, either a ventral fin clip or CWT and no fin clip are used to differentially identify supplementation fish. (see Attachment 1. for a review of the Idaho Supplementation Studies project).

The following table presents the IDFG draft, brood year 2001 chinook salmon mark and tag management plan.

Rearing Hatchery	AD clip only	CWT/AD tag and clip research/ NATURES	CWT/AD/PIT tags and clip	AD/PIT tag and clip	CWT/ NO CLIP	CWT/NO CLIP/PIT
Sawtooth reserve (production)	1,079,000	240,000		500		
Sawtooth (ISS)					154,500	500

10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

Reserve fish are identified at time of release as surplus to programmed Idaho Supplementation studies levels but are not surplus to the overall LSRCP production target levels.

10.9) Fish health certification procedures applied pre-release.

Between 45 and 30 d prior to release, a 20 fish preliberation sample is taken from each rearing lot to assess the prevalence of viral replicating agents and to detect the pathogens responsible for bacterial kidney disease and whirling disease. In addition, an organosomatic index is developed for each release lot. Diagnostic services are provided by the IDFG Eagle Fish Health Laboratory.

10.10) Emergency release procedures in response to flooding or water system failure.

Emergency procedures are in place to guide activities in the event of potential catastrophic event. Plans include a trouble shooting and repair process followed by the implementation of an emergency action plan if the problem can not be resolved. Emergency actions include switching between well water and river water during incubation and early rearing phases, fish consolidations, and early releases to the Salmon River.

10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

Actions taken to minimize adverse effects on listed fish include:

1. Continuing fish health practices to minimize the incidence of infectious disease agents. Follow IHOT, AFS, and PNFHPC guidelines.

2. Marking hatchery-produced spring chinook salmon for broodstock management. Smolts released for supplementation research will be marked differentially from other fish.

3. Not releasing spring chinook salmon for supplementation research in the Salmon River in excess of estimated carrying capacity.

4. Continuing to reduce effect of the release of large numbers of hatchery chinook salmon at a single site by spreading the release over a number of days.

5. Attempting to program time of release to mimic natural fish for Salmon River smolt releases.

6. Evaluating natural rearing techniques for Salmon River spring chinook salmon at the Sawtooth Fish Hatchery.

7. Continuing to use broodstock for general production and supplementation research that exhibit life history characteristics similar to locally evolved stocks.

8. Continuing to segregate female spring chinook salmon broodstock for BKD via ELISA. We will incubate each female's progeny separately and also segregate progeny for rearing. We will continue development of culling and rearing segregation guidelines and practices, relative to BKD.

9. Monitoring hatchery effluent to ensure compliance with National Pollutant Discharge Elimination System permit.

10. Continuing Hatchery Evaluation Studies (HES) to provide comprehensive monitoring and evaluation for LSRCP chinook.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1) Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

11.1.1) Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

Document LSRCP fish rearing and release practices.

Performance Standards and Indicators: 3.2.2, 3.3.2, 3.4.1, 3.4.2, 3.4.3, 3.4.4, 3.5.2, 3.5.4, 3.5.5, 3.6.1, 3.6.2, 3.7.1, 3.7.2, 3.7.3, 3.7.4, 3.7.5, 3.7.6

Document, report, and archive all pertinent information needed to successfully manage spring chinook salmon spawning, rearing, and release practices. (e.g., number and composition of fish spawned, spawning protocols, spawning success, incubation and rearing techniques, juvenile mark and tag plans, juvenile release locations, number of juveniles released, size at release, migratory timing and success of juveniles, and fish health management).

Document the contribution LSRCP-reared spring chinook salmon make toward meeting mitigation and management objectives. Document juvenile out-migration and adult returns.

Performance Standards and Indicators: 3.1.2, 3.1.3, 3.2.2, 3.3.1, 3.3.2, 3.4.3, 3.4.4, 3.5.1, 3.5.2, 3.5.3, 3.5.4, 3.5.5, 3.5.6, 3.6.1, 3.6.2, 3.7.7, 3.7.8

Estimate the number of wild/natural and hatchery-produced spring chinook salmon escaping to project waters above Lower Granite Dam using dam counts, harvest information, spawner surveys, and trap information (e.g., presence/absence of identifying marks and tags, number, species, size, age, length). Conduct creel surveys and angler phone or mail surveys to collect harvest information. Assess juvenile outmigration success at traps and dams using direct counts, marks, and tags. Reconstruct runs by brood year. Summarize annual mark and tag information (e.g., juvenile out-migration survival, juvenile and adult run timing, adult return timing and survival). Develop estimates of smolt-to-adult survival for wild/natural and hatchery-produced spring chinook salmon. Use identifying marks and tags and age structure analysis to determine the composition of adult spring chinook salmon.

Identify factors that are potentially limiting program success and recommend operational modifications, based on the outcome applied studies, to improve overall performance and success.

Performance Standards and Indicators: 3.6.1, 3.6.2

Evaluate potential relationships between rearing and release history and juvenile and adult survival information. Develop hypotheses and experimental designs to investigate practices that may be limiting program success. Implement study recommendations and monitor and evaluate outcomes.

11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

Yes, funding, staffing and support logistics are dedicated to the existing monitoring and evaluation program through the LSRCP program. Additional monitoring and evaluation activities (that contribute effort and information to addressing similar or common objectives) are associated with BPA Fish and Wildlife programs referenced in Section 12, below.

11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

Risk aversion measures for research activities associated with the evaluation of the Lower Snake River Compensation Program are specified in ESA Section 7 Consultation documents, ESA Section 10 Incidental Take Permits (IDFG permit Nos. 919, 920, 1124). A brief summary of the nature of actions taken is provided below.

Adult handling activities are conducted to minimize impacts to ESA-listed, non-target species. Adult and juvenile weirs and screw traps are engineered properly and installed in locations that minimize adverse impacts to both target and non-target species. All trapping facilities are constantly monitored to minimize a variety of risks (e.g., high water periods, high emigration or escapement periods, security).

Adult spawner and redd surveys are conducted to minimize potential risks to all life stages of ESA-listed species. The IDFG conducts formal redd count training annually. During surveys, care is taken to not disturb ESA-listed species and to not walk in the vicinity of completed redds.

Snorkel surveys conducted primarily to assess juvenile abundance and density are conducted in index sections only to minimize disturbance to ESA-listed species. Displacement of fish is kept to a minimum.

Marking and tagging activities are designed to protect ESA-listed species and allow mitigation harvest objectives to be pursued/met. All hatchery-produced, mitigation steelhead are visibly marked to differentiate them from their wild/natural counterpart.

SECTION 12. RESEARCH

12.1) Objective or purpose.

An extensive monitoring and evaluation program is conducted in the basin to document hatchery practices and evaluate the success of the hatchery programs at meeting program mitigation objectives, Idaho Department of Fish and Game management objectives, and to monitor and evaluate the success of supplementation programs. The hatchery monitoring and evaluation program identifies hatchery rearing and release strategies that will allow the program to meet its mitigation requirements and improve the survival of hatchery fish while avoiding negative impacts to natural (including listed) populations.

To properly evaluate this compensation effort, adult returns to facilities, spawning areas, and fisheries that result from hatchery releases are documented. The program requires the cooperative efforts of the Idaho Department of Fish and Game's hatchery evaluation study, harvest monitoring project, and the coded-wire tag laboratory programs. The Hatchery evaluation study evaluates and provides oversight of certain hatchery operational practices, (e.g., broodstock selection, size and number of fish reared, disease history, and time of release). Hatchery practices will be assessed in relation to their effects on adult returns. Recommendations for improvement of hatchery operations will be made.

The harvest monitoring project provides comprehensive harvest information, which is key to evaluating the success of the program in meeting adult return goals. Numbers of hatchery and wild/natural fish observed in the fishery and in overall returns to the project area in Idaho are estimated. Data on the timing and distribution of the marked hatchery and wild stocks in the fishery are also collected and analyzed to develop harvest management plans. Harvest data provided by the harvest monitoring project are coupled with hatchery return data to provide an estimate of returns from program releases. Coded-wire tags continue to be used extensively to evaluate fisheries contribution of representative groups of program production releases. However, most of these fish serve experimental purposes as well, i.e., for evaluation of hatchery-controlled variables such as size, time, and location of release, rearing densities, etc.

Continuous coordination between the hatchery evaluation study and Idaho Department of Fish and Game's BPA-funded supplementation research project is required because these programs overlap in several areas for different species including: juvenile outplanting, broodstock collection, and spawning (mating) strategies.

12.2) Cooperating and funding agencies.

U.S. Fish and Wildlife Service – Lower Snake River Compensation Plan Office.

12.3) Principle investigator or project supervisor and staff.

Steve Yundt – Fisheries Research Manager, Idaho Department of Fish and Game.

12.4) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

N/A

12.5) Techniques: include capture methods, drugs, samples collected, tags applied.

Research techniques associated with the operation of the broodstock and rearing hatcheries identified in this HGMP involve: hatchery staff; LSRCP hatchery evaluation, harvest monitoring, and coded-wire tag laboratory staff; Idaho supplementation studies staff, and IDFG regional fisheries management staff.

Hatchery staff routinely investigate hatchery variables (e.g., diet used, ration fed, vat or raceway environmental conditions, release timing, size at release, acclimation, etc.) to improve program success. Hatchery-oriented research generally involves the cooperation of LSRCP hatchery evaluation staff. In most cases, PIT and coded-wire tags are used to measure the effect of specific treatments. The IDFG works cooperatively with the Shoshone-Bannock Tribes and the U.S. Fish and Wildlife Service to develop annual mark plans for A-run steelhead juveniles produced at the various hatcheries. Cooperation with LSRCP harvest monitoring and coded-wire tag laboratory staff is required to thoroughly track the distribution of tags in adult salmon. Generally, most hatchery-oriented research occurs prior to the release of spring smolt groups.

Harvest monitoring staff (LSRCP monitoring and evaluations) work cooperatively with IDFG regional fisheries management staff to monitor activities associated with steelhead sport fisheries. Estimates of harvest, pressure, and catch per unit effort are developed in years when sport fisheries occur. The contribution LSRCP-produced fish make to the fishery is also assessed.

Idaho supplementation studies and IDFG regional fisheries management staff work cooperatively to assemble annual juvenile chinook salmon out-migration and adult return data sets. Weir traps and screw traps are used to capture emigrating juvenile chinook salmon. Generally, all target species captured are anesthetized and handled. A portion of captured juveniles may be fin clipped or PIT tagged (See Attachment 1. for Idaho supplementation studies detail). Adult information is assembled from a variety of information sources including: dam and weir counts, fishery information, coded-wire tag information, redd surveys, and spawning surveys.

Idaho Department of Fish and Game and cooperator staff may sample adult steelhead to collect tissue samples for subsequent genetic analysis. Additionally, otoliths, scales, or fins may be collected for age analysis.

12.6) Dates or time period in which research activity occurs.

Fish culture practices are monitored throughout the year by hatchery and hatchery evaluation research staff.

Adult escapement is monitored at downstream dams and above Lower Granite Dam during the majority of the year. Harvest information is collected during periods when sport and tribal fisheries occur. The PSMFC Regional Mark Information System is queried on a year-round basis to retrieve adult coded-wire tag information.

Smolt out-migration through the hydro system corridor is typically monitored from March through December. Juvenile steelhead population abundance and density are monitored during late spring and summer months. The PSMFC PIT Tag Information System is queried on a year-round basis to retrieve juvenile PIT tag information.

Fish health monitoring occurs year round.

12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.

Research activities that involve the handling of eggs or fish apply the same protocols reviewed in Section 9 above. Hatchery staff generally assist with all cooperative activities involving the handling of eggs or fish.

12.8) Expected type and effects of take and potential for injury or mortality.

See Table 1. Generally, take for research activities is defined as: "observe/harass", "capture/handle/release" and "capture, handle, mark, tissue sample, release."

12.9) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1).

See Table 1.

12.10) Alternative methods to achieve project objectives.

Alternative methods to achieve research objectives have not been developed.

12.11) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

N/A.

12.12) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.

See Section 11.2 above.

SECTION 13. ATTACHMENTS AND CITATIONS

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Attachment 1.

The following excerpts were taken from:

Bowles, E., and E. Leitzinger. 1991. Salmon Supplementation Studies in Idaho Rivers. Experimental Design. Prepared for U.S. Department of Energy. Bonneville Power Administration. Environment, Fish and Wildlife. Project No. 89-098, Contract No. 89-BI-01466. Portland, OR.

Note: as this information first appeared in the original 1991 experimental design document for this program, some information may be outdated. This research design also pre-dated ESA-listing. The text has not been modified.

Study Streams

Study streams were classified into two categories based on the existing status and history of the chinook population. Target streams without existing natural populations are classified as supplementation-restoration streams; streams with existing natural populations are classified as supplementation-augmentation. Our design utilizes 11 treatment and 10 control streams classified as having existing natural populations. This classification pertains to all of our study streams in the upper Salmon River drainage and six streams (Red River and Crooked Fork, Lolo, Clear, Bear, and Brushy Fork creeks) in the Clearwater River drainage. We will utilize nine treatment streams to evaluate supplementation-restoration in areas without existing natural populations. These streams are all located in the Clearwater River drainage, except Slate Creek located in the lower Salmon River drainage.

General Criteria

Several basic assumptions or approaches were used to guide development of production plans for each treatment stream.

- For upriver chinook stocks, supplementation cannot be considered an alternative to reducing downriver mortalities. Success is dependent on concurrent improvement in flows, passage and harvest constraints.
- Supplementation can increase natural production (i.e. numbers) but not natural productivity (i.e. survival), except possibly in situations where natural populations are suffering severe inbreeding depression. Reductions in natural productivity can be minimized through proper supplementation strategies so that enhanced production more than compensates for reduced natural productivity.
- Supplementation can potentially benefit only those populations limited by density-independent or depensatory smolt-to-adult mortality. Existing natural smolt production must be limited by adult escapement and not spawning or rearing habitat.
- For supplementation-augmentation programs to be successful, the hatchery component must provide a net survival benefit (adult-to-adult) for the target stock as compared to the natural component.
- Supplementation programs should be kept separate and isolated from traditional

harvest augmentation programs. We hypothesize that some of the past failures of supplementation have been because we have tried to supplement with the wrong product. Conventional hatchery programs are driven by the logical goal to maximize in-hatchery survival and adult returns. This approach may not necessarily be conducive to producing a product that is able to return and produce viable offspring in the natural environment.

- Supplementation strategies (e.g.. broodstock, rearing and release techniques) should be selected to maximize compatibility and introgression with the natural stock and minimize reduction in natural productivity. Harvest augmentation strategies should be selected to maximize adult returns for harvest and minimize interaction/introgression with natural populations.
- Success of hatchery supplementation programs are dependent upon our ability to circumvent some early life history mortality without compromising natural selective processes or incurring hatchery selective mortality. Supplementation programs should be designed to minimize mortality events operating randomly (non-selective) and duplicate mortality events operating selectively on chinook in the natural environment. This, in essence, is the only role of a supplementation hatchery, to reduce random mortality effects in order to produce a net gain in productivity.
- Although our experimental design does not pursue the above assumption vigorously, we encourage implementation of hatchery practices in an adaptive framework to investigate this assumption. Some of this will be initiated in our small-scale studies, or through the LSRCP Hatchery Evaluation Study. Careful design, monitoring and evaluation with treatment and control groups will be necessary to avoid confounding our study results.
- In areas with existing (target) natural populations, we recommend supplementation should not exceed a 50:50 balance between hatchery and natural fish spawning or rearing in the target streams. Under this criteria, supplementation programs are driven by natural fish escapement or rearing abundance, not necessarily hatchery fish availability. Adherence to this criteria results in a slow, patient supplementation approach when existing stocks are at only 10% to 20% carrying capacity, which is typical in Idaho. This concept is nothing new and is promulgated in the IDFG Anadromous Five Year Plan and Oregon's Wild Fish Management Policy (Oregon Administrative Rule 635-07-525 through 529).
- In areas with existing natural populations, we recommend supplementation broodstocks incorporate a relatively high proportion (~40%) of natural fish selected systematically from the target stock. This approach will minimize domestication effects and naturalize hatchery fish as quickly as possible.
- By following the criteria of using natural broodstock and mimicking natural selective pressures to some degree, we anticipate supplementation programs will experience lower in-hatchery survival than is typical of conventional hatchery programs. We believe the very causes of higher in-hatchery mortality will also provide for substantially higher release-to-adult survival and long term fitness. Our modeling indicates that enhanced survival during this post-release stage is critical to the success of supplementation, much more so than the pre-release.
- In areas without existing (target) natural populations, we recommend supplementation-restoration programs be designed to provide 25% to 50% of the

natural summer rearing capacity within one or two generations, depending on hatchery fish availability.

- In all instances, once interim management goals for natural production have been met (e.g. 70% summer carrying capacity), surplus natural and supplementation adults would be available for harvest or other broodstock needs. This criteria does not preclude flexibility for limited harvest prior to reaching management goals.

Supplementation Protocols

We have partitioned specific production plans into eight broad components: existing program, supplementation broodstock management, spawning, incubation, rearing, release, adult returns, and risk assessment. Where feasible, all phases will follow genetic guidelines currently being developed for the Basin (Currens et al. 1991; Emlen et al. 1991; Kapuscinski et al. 1991). The following provides a generalization for each component of the production plans.

Existing Programs

To minimize risk, the majority of our study (70%) is proposed for areas with existing hatchery programs that include supplementation objectives. Five of eight total treatment streams in the Salmon drainage and six of twelve in the Clear-water drainages have existing hatchery programs. An additional three treatment streams have hatchery programs planned independent to our supplementation research.

Existing programs in areas with viable natural populations typically include a weir to trap adults for broodstock and a hatchery facility nearby or in an adjacent sub-basin. Broodstock is collected systematically from adult returns comprised of an unknown proportion of hatchery and natural fish. Typically, one out of every three (33%) females and males is passed over the weir to spawn naturally and the remaining two out of three (67%) are brought into the hatchery for broodstock. Fish are spawned non-selectively throughout the run at a 1:l sex ratio. Progeny are incubated in stacked, horizontal trays (Heath) and reared in concrete raceways or pods. Rearing Density Index typically averages less than 0.3 lbs/ft/in and Flow Indexes typically range from 1 to 2 lbs/in x gal/min (T. Rogers, IDFG, personal communication).

Most fish are reared to smolt and released unmarked during mid April. Releases are typically on-site or trucked to a single release site without an acclimation period. Some programs outplant progeny into on-site rearing and acclimation ponds in June and implement a forced release of presmolts from the ponds in October. The supplementation aspect of these programs is represented by the passage of an unknown component of hatchery adult returns over the weir to spawn naturally. In general, monitoring and evaluation of this supplementation is limited to trend redd counts and in some cases, trend parr density estimates. No evaluation of adult returns is possible because fish cannot be differentiated between hatchery and natural origin.

Existing programs in areas without currently viable natural populations typically include outplanting Parr, presmolts and smolts developed from non-local hatchery broodstocks. In areas where hatchery returns to the target stream have been. used for brood stock, progeny are usually "topped off" with other fish to meet hatchery production and site-specific release goals.

Supplementation Broodstocks

Broodstocks used for target streams with existing natural populations will typically utilize weirs to collect natural and hatchery adults returning to the target stream. Using the target stock as a donor source for supplementation corresponds to the first priority choice specified for genetic conservation by Kapuscinski et al. (1991).

We are currently unable to differentiate hatchery and natural returns in areas with existing hatchery programs. Beginning with BY 1991 all hatchery fish released in study areas will be marked to differentiate supplementation fish, general hatchery production fish and natural fish. During this first (transitional) generation, supplementation broodstocks will be similar to general hatchery production broodstocks, comprised of an unknown component of hatchery and natural origin fish selected systematically from 33% to 50% of the returns. As soon as returns are comprised of known-origin fish (approximately 1996), broodstock selection will be modified.

Natural escapement criteria will drive the selection process. Typically this will entail releasing a minimum of two out of every three (67%) natural female, adult male and jack returns above the weir to spawn naturally. No more than 33% of the natural run will be brought into the hatchery for broodstock. This natural component will comprise a minimum of 50% of the supplementation broodstock. Thus hatchery returns can comprise no more than 50% of the supplementation broodstock. Surplus supplementation adult returns will be passed *over* the weir to supplement natural production up to natural equivalents; fish surplus to this need will be used for the general hatchery production broodstock.

Broodstocks used to supplement areas without existing natural production will be selected from existing hatchery broodstocks based on similarity to historical stocks, availability of fish, and expected or proven performance in the wild. Although this donor source represents the last alternative for broodstock selection as identified by Kapuscinski et al. (1991), it meets the criteria for first priority based on potential risk of collecting broodstock from severely depleted natural populations nearby. These broodstocks will typically be used for only one to two generations.

Spawning

Spawning protocols will typically follow existing hatchery practices. Sexes will be spawned 1:l as they ripen, without selection for size, age, appearance and hatchery-natural origin. The only selection will be to segregate known disease carriers (BKD) from supplementation broodstock. Spawn timing will be dependent on ripeness, which is assumed to correspond with run timing. For stocks with low effective population sizes (N,), factorial crosses or diallele crosses will be utilized to increase allelic diversity and N, (Kapuscinski et al. 1991). Once differentiation of hatchery and natural returns is possible (1996), mating composition (e.g. HxH, NxH, NxN) will be documented to track relative survival to emergence, and for use as a covariate in our long-term productivity studies.

Incubation

Incubation protocols will typically follow existing hatchery practices. Where feasible, individual matings will be kept separate in incubation trays and isolated from disease vectors. Incubation water is typically a mixture of well and river water resulting in more thermal units and earlier emergence than occurs in nature.

Rearing

Rearing protocols will typically follow existing hatchery practices. Emergent fry are loaded into early rearing vats from mid December through February for feed training and reared to approximately 100 fish/pound (mid June) before release as parr or transfer into advanced rearing ponds or raceways. Rearing containers will be typically concrete or plastic with single-pass flow systems derived from well or river water. Baffles will be used in some hatcheries to facilitate cleaning and provide variable water velocity environments. Rearing density will range from 0.5 to 1.5 lbs/ft3 and may be modified based on results of the rearing density study currently underway at Sawtooth and Dworshak hatcheries. Feeding is done manually at regular intervals throughout the ponds and raceways with moist commercial products.

Marking

All supplementation and general production fish released in study areas will be marked with a pelvic fin or maxillary clip until alternative marks are proven. Marks will be administered during early rearing, just prior to the transfer of fish from vats into advanced rearing raceways and ponds. Fish size will be approximately 75 mm and 100 fish/pound. Randomly selected fish will be PIT tagged at this time for parr and presmolt releases, and late summer for fish released as smelts.

Releases

Supplementation smelts will be released off site at multiple release points distributed throughout the treatment stream. Smelts will be trucked to release points and released directly into the stream without acclimation ponding, although natural slackwater areas such as side channels and beaver ponds will be utilized if available. Water temperature acclimation will be administered in the trucks if necessary (i.e. >5ºC differential).

Where possible (e.g. Lemhi River), size and time of release will be programmed to mimic natural fish. This will require releasing smelts mid April at approximately 90-100 mm (48-66 fish/pound). Efforts will be made to coincide releases with environmental cues (e.g. lowering barometric pressure, freshets; Kiefer and Forster 1991). At present, most existing facilities do not have the ability to mimic the time and size of natural smolt emigration. Size and time of release is typically 20 smelts/pound released in March, whereas natural smelts emigrate from the upper Salmon River at approximately 66 fish/pound during mid April (Kiefer and Forster 1991). Chillers would be required on most of our hatcheries to meet these criteria. Our research is not proposing these modifications during the first generation of rearing.

Fall presmolts released for supplementation will be released directly from on-site rearing ponds or trucked to multiple release points throughout the study area. Fish will typically be released mid September to October to correspond with peak natural fall emigration (Kiefer and Forster 1990). Fish size will be slightly larger (100 mm vs. 80 mm) than the natural fish as a result of thermal constraints during incubation and early rearing.

Supplementation parr will be released off site at multiple release points distributed throughout the treatment stream. These unacclimated releases will be by helicopter or trucks. Fish will be released mid June, just prior to transfer from vats to advanced rearing containers. Fish size (>75 mm) will be substantially larger than expected for natural fish (40-50 mm) so fry and parr releases will only occur in streams without existing natural populations (except Lemhi River). One of our small scale studies will investigate the effects of hatchery parr size on natural fry and parr.

Adult Returns

Until interim management goals for escapement (e.g. 70% carrying capacity) are met, enough natural and supplementation fish (marked differently from harvest fish) need to be escaped through terminal fisheries to allow adequate rebuilding and evaluation. This will require non-lethal gear restrictions and catch and release of natural and supplementation fish in terminal areas, if fisheries targeting hatchery stocks are deemed prudent. Studies in British Columbia indicate that hooking mortality of chinook in terminal area catch and release fisheries will be approximately 5%, which is similar for steelhead (T. Gjernes, B.C. Dept. of Fish. and Oceans, personal communication). If lethal gear is used, weak-stock harvest guotas will be regulated to maintain minimal exploitation (e.g. no more than 10%) on natural and supplementation fish. In all instances, terminal fisheries on study stocks will require precise and accurate creel survey data.

Weir management for returning adults will include passing an established proportion of natural fish (e.g. 67%, 75% or 80%), which will in turn determine the number of supplementation fish to pass. Non-supplementation hatchery returns will not be passed over the weir.

Risk Assessment

Our risk assessment of supplementation is based primarily on genetic concerns and follows guidelines currently being developed in the Basin (Busack 1990;Currens et al.1991; Emlen et al.1991; Kapuscinski et al. 1991). All upriver stocks of chinook salmon are currently experiencing severe genetic risks to long-term stock viability (Riggs 1990; Mathews and Waples 1991; Nehlsen et al. 1991). We believe the major contributors to this genetic "bottlenecking" are system modifications (e.g. harvest, flows, and passage) which exert tremendous mortality and artificial selection pressures. These system constraints have forced many upriver stocks into a genetically vulnerable status warranting probable protection under the Endangered Species Act.

In addition to the overriding genetic risks imposed by system modifications, there are also genetic risks to natural stocks associated with the operation of mitigation hatcheries (Busack 1990; Kapuscinski 1991; RASP 1991). Busack (1990) identified four main types of genetic risk associated with hatchery activities: extinction, loss of within population variability, loss of population identity, and inadvertent selection. Kapuscinski et al. (1991) provides a discussion of these risks, possible causative hatchery practices, and the associated genetic process.

Most of our experimental treatments will be implemented in areas with existing hatchery programs that have at least partial supplementation objectives. In general the genetic risk of our experimental design is quite low relative to these existing hatchery programs.

Broodstock management and non-selective spawning protocols should minimize risks to population variability and identity. In areas with existing natural populations, supplementation programs will typically utilize local broodstocks comprised of hatchery and natural fish. During the first generation (5 years) the relative composition will be unknown because of unmarked hatchery fish. By the second generation, all hatchery returns will be marked and a natural component criteria (e.g. >40% natural fish) will determine broodstock collection. In all cases, natural escapement criteria (e.g.67%, 75% or 80% of natural run) will drive the programs.

Mating procedures will be non-selective for age, size or appearance, with pairings at 1:l sex ratios or factorial crosses. Progeny will typically be isolated from general hatchery production fish and marked prior to release. Releases will be timed to coincide with known environmental cues or peak natural emigration activity. In all instances, general hatchery production returns will not be passed over weirs to spawn naturally.

The greatest source of genetic risk associated with our supplementation programs is inadvertent selection resulting from hatchery rearing environments. Most of our experimental design will utilize existing hatcheries with ongoing production programs. These hatcheries were designed and are operated to maximize in-hatchery survival within the constraints of fish marking and production targets. These facilities were not designed to simulate selective pressures associated with natural rearing. In spite of the dramatic egg-to-release survival advantage experienced in the hatchery (up to 8-fold) it may be possible that those fish best suited for survival in the natural environment are the very fish lost in the hatchery environment (Reisenbichler and McIntyre 1977; Chilcote et al. 1986). In addition to this direct selection, there are indirect selection risks associated with hatchery environments not providing the necessary "training" required to maximize post-release survival. These risks are best alleviated by designing hatchery facilities and programs to simulate natural selective pressures and minimize mortality from random natural mortality events.

As discussed previously, we are not proposing dramatic modifications to hatchery facilities and programs during this first generation. Movement in this direction will be a result of LSRCP evaluations and recommendations. Although static and standardized hatchery facilities and practices would be best for statistically powerful inferences from our supplementation treatments, we do not recommend nor anticipate this scenario. We do recommend that changes in hatcheries follow adaptive management procedures and are fully monitored and evaluated with controls to avoid confounding our results.

The major risks associated with supplementation of extirpated populations is straying and introgression/interaction with adjacent natural populations. Introgression from straying can result in genetic drift, loss of identity and outplanting depression. To reduce this risk, selection of donor broodstocks followed criteria proposed by Kapuscinski et al. (1991) and Currens et al. (1991). Regrettably, suitable neighboring or out-of-basin natural stocks are typically unavailable or too vulnerable to extinction themselves to provide brood. As a result, hatchery broodstocks were selected based on the outplanting history of the target stream, location, availability of brood, and demonstrated performance.

Recent studies indicate high homing integrity to release sites for hatchery chinook (Fulton and Pearson 1981; Quinn and Fresh 1984; Sankovich 1990). Straying or wandering is apparently more probable in downriver areas than terminal areas, and is often accentuated if environmental factors (e.g. temperature, flows) inhibit passage (Phinney 1990). In general, our restoration treatment areas are located in areas without adjacent natural populations. We recommend that all general hatchery production fish released in natural production areas be imprinted on morpholine to minimize straying. Although inconclusive, chinook and other fish have been shown to imprint on dilute concentrations of morpholine, resulting in enhanced homing integrity to release site drip stations.

Genetic risks to other naturally reproducing fish populations (e.g. steelhead, cutthroat, rainbow) are minimal. All areas to be supplemented historically have maintained viable chinook populations which co-evolved with these populations. The main risks are associated with potential overestimation of carrying capacity resulting in a swamping of available habitats; elevated exposure to pathogens carried by hatchery fish; and, supplementation fish exhibiting characteristics (e.g. size, behavior, run timing, residualism, etc.) not evolved in the local habitat. These risks will be minimized by maintaining releases at less than 50% of estimated carrying capacity, only releasing fish certified to be free of detectable pathogens, and selecting donor stocks for supplementation that exhibit life history characteristics similar to locally evolved stocks.

Once again, we are weak in areas of hatchery induced behavioral and size differences. We will program size and time of release of supplementation fish to match the natural component as best possible, given the constraints of our facilities. In situations where the hatchery product represents an obvious risk, we will not incorporate it into our long term studies until the risk is assessed. For example, our inability to mimic natural incubation and early rearing growth conditions results in hatchery fry being larger than natural chinook fry at any given time. We will assess the competitive interaction associated with this size disparity prior to incorporating a large-scale fry or parr release into areas with existing natural chinook populations.

Potential Harvest Opportunities

Although it is not the role of ISS to recommend additional management strategies, nor would we presume that prerogative, we do feel it is important to address harvest augmentation opportunities. The justifiably high demand for recreational, ceremonial and subsistence fisheries may have a direct impact on the acceptance and long-term integrity of ISS. The 1.5s Design does not preclude potential harvest opportunities. Implementation of harvest augmentation programs using strategies designed to minimize risks to natural populations can provide for needed fisheries. These interim measures will also buy time and support for the slow, patient rebuilding process required to supplement natural populations. The IDFG Anadromous Fisheries Management Plan provides a detailed discussion of harvest opportunities and programs.

Attachment 2. Idaho Department of Fish and Game redd count data for Salmon and Clearwater index streams.

Stream	Basin	Year	Stream Length	Number of Redds Counted	Redds per kilometer	New Length	New Redds	New Redds/km	Comments
American River	Clearwater	2001	34.6	390	11.27	34.60	390	11.272	
American River	Clearwater	2000	34.6	130	3.76	34.60	130	3.757	
American River	Clearwater	1999	34.6	1	0.03	34.60	1	0.029	
American River	Clearwater	1998	34.6	112	3.24	34.60	112	3.237	
American River	Clearwater	1997	34.6	311	8.99	34.60	311	8.988	
American River	Clearwater	1996	34.6	9	0.26	34.60	9	0.260	
American River	Clearwater	1995	34.6	0	0.00	34.60	0	0.000	
American River	Clearwater	1994	34.6	9	0.26	34.60	9	0.260	
American River	Clearwater	1993	34.6	209	6.04	34.60	209	6.040 [c]	
American River	Clearwater	1992	33.3	5	0.15	33.30	5	0.150	
Big Flat Creek	Clearwater	2001	4.8	14	2.92	4.80	14	2.917	
Big Flat Creek	Clearwater	2000	4.8	0	0.00	4.80	0	0.000	
Big Flat Creek	Clearwater	1999	NC[d]	NC					
Big Flat Creek	Clearwater	1998	NC[d]	NC					
Big Flat Creek	Clearwater	1997	4.8	7	1.46	4.80	7	1.458	
Big Flat Creek	Clearwater	1996	1.5	0	0.00	4.8	0	0.000	New length adjusted for comparisons
Big Flat Creek	Clearwater	1995	5.6	0	0.00	4.8	0	0.000	3.6 miles walked but no redds found
Big Flat Creek	Clearwater	1994	NC	NC					
Big Flat Creek	Clearwater	1993	6	3	0.50	6	3	0.500	
Big Flat Creek	Clearwater	1992	8	8	1.00	8	8	1.000	
Brushy Fork and Spruce Creek	Clearwater	2001	16.1	143	8.88	12.1	127	10.496	
Brushy Fork and Spruce Creek	Clearwater	2000	16.1	16	0.99	12.1	16	1.322	
Brushy Fork and Spruce Creek	Clearwater	1999	16.1	3	0.19	12.1	3	0.248	
Brushy Fork and Spruce Creek	Clearwater	1998	16.1	19	1.18	12.1	19	1.570	
Brushy Fork and Spruce Creek	Clearwater	1997	20.7	75	3.62	12.1	74	6.116	The entire section from the mouth to spruce was surveyed. 12 redds were observed from the mouth to the lower meadow. While the lower meadow is above Pestle Rock, we were unable to determine where the redds were. Since we see very few redds below Pestle Rock, we decided to put all 12 redds above Pestle Rock and truncate the distance to 12.1 km
Brushy Fork and Spruce Creek	Clearwater	1996	21.5	5	0.23	12.1	5	0.413	
Brushy Fork and Spruce Creek	Clearwater	1995	14	5	0.36	8.5	5	0.588	
Brushy Fork and Spruce Creek	Clearwater	1994	21.5	0[h]	0.00	12.1	0	0.000 [h]	
Brushy Fork and Spruce Creek	Clearwater	1993	18.1	25	1.38	12.1	25	2.066	The entire section from the mouth to spruce was surveyed but no redds were observed from the mouth to pestle rock so we truncated the distance to 12.1 km
Brushy Fork and Spruce Creek	Clearwater	1992	14	7	0.50	12.1	7	0.579	Redd number not verified
Clear Creek	Clearwater	2001	20.2	166s	8.2	18.2	127	6.978	
Clear Creek	Clearwater	2000	20.2	30	1.50	18.2	19	1.044	
Clear Creek	Clearwater	1999	16.1	0	0.00	18.2	0	0.000	
Clear Creek	Clearwater	1998	18.5	2	0.11	18.2	1	0.055	

Clear Creek	Clearwater	1997	18.5	17	0.92	18.2	12	0.659	
Clear Creek	Clearwater	1996	16.1	3	0.19	18.2	3	0.165	
Clear Creek	Clearwater	1995	16.1	0	0.00	18.2	0	0.000	
Clear Creek	Clearwater	1994	16.1	1	0.06	18.2	1	0.055	
Clear Creek	Clearwater	1993	16.1	7	0.43	18.2	7	0.385	
Clear Creek	Clearwater	1992	16.1	1	0.06	18.2	1	0.055	
Clear Creek	Clearwater	1991	16.1	4	0.25	16.1	4	0.248	
Colt Killed Creek	Clearwater	2001	50.2	113	2.25	31.6	92	2.911	Ground count from mouth to Heather Cr.
Colt Killed Creek	Clearwater	2000	50.2	2	0.04	26.1	2	0.077	Aerial survey from mouth to big flat
Colt Killed Creek	Clearwater	1999	50.2	0	0.00	26.1	0	0.000 [m]	Aerial survey from mouth to big flat
Colt Killed Creek	Clearwater	1998	50.2	2	0.04	26.1	0	0.000 [m]	Aerial survey from mouth to big flat
Colt Killed Creek	Clearwater	1997	35.7	22	0.62	30.9	22	0.712 [n]	Ground count from mouth to 3 mi above big flat
Colt Killed Creek	Clearwater	1996	6.8	0	0.00	26.1	1	0.038	Aerial survey from mouth to big flat
Colt Killed Creek	Clearwater	1995	2.6	0	0.00	26.1	1	0.038	Aerial survey from mouth to big flat
Colt Killed Creek	Clearwater	1994	NC[d]	NC		26.1	1	0.038	Aerial survey from mouth to big flat
Colt Killed Creek	Clearwater	1993	7	2	0.29	36	6	0.167	4 redds in aerial survey from mouth to big flat; 2 redds from ground count big flat to pack box creek
Colt Killed Creek	Clearwater	1992	11.5	3	0.26	11.5	3	0.261	No raw data - not verified
Crooked Fork Creek	Clearwater	2001	18	229	12.72	16.5	229	13.879	
Crooked Fork Creek	Clearwater	2000	18	100	5.56	16.5	100	6.061 [p]	
Crooked Fork Creek	Clearwater	1999	18	8	0.44	16.5	8	0.485	
Crooked Fork Creek	Clearwater	1998	18	17	0.94	16.5	17	1.030	
Crooked Fork Creek	Clearwater	1997	19	118	6.21	16.5	114	6.909 [o]	Subtracted 4 redds above shotgun cr.
Crooked Fork Creek	Clearwater	1996	21.5	76	3.53	16.5	75	4.545 [e]	Subtracted one redd above shotgun creek.
Crooked Fork Creek	Clearwater	1995	19	4	0.21	16.5	4	0.242	2 miles between Devoto and MP167, and one half mile from Shotgun Creek down not surveyed but included in total distance.
Crooked Fork Creek	Clearwater	1994	21.5	0	0.00	16.5	0	0.000 [f]	
Crooked Fork Creek	Clearwater	1993	28	10	0.36	16.5	10	0.606 [g]	
Crooked Fork Creek	Clearwater	1992	29.5	11	0.37	16.5	11	0.667 [b]	
Crooked River	Clearwater	2001	20.9	136	6.51	20.9	136	6.507	
Crooked River	Clearwater	2000	20.9	93	4.45	20.9	93	4.450	
Crooked River	Clearwater	1999	20.9	1	0.05	20.9	1	0.048	
Crooked River	Clearwater	1998	20.9	30	1.44	20.9	30	1.435	
Crooked River	Clearwater	1997	20.9	62	2.97	20.9	62	2.967	
Crooked River	Clearwater	1996	21.9	6	0.27	21.9	6	0.274 [b]	
Crooked River	Clearwater	1995	21.9	0	0.00	21.9	0	0.000	
Crooked River	Clearwater	1994	21.9	4	0.18	21.9	4	0.183	
Crooked River	Clearwater	1993	21.9	54	2.47	21.9	54	2.466	
Crooked River	Clearwater	1992	21.9	54	2.47	21.9	54	2.466	
Crooked River	Clearwater	1991	21.9	4	0.18	21.9	4	0.183	
Eldorado Creek	Clearwater	2001	3.5	4	1.14	3.5	4	1.143	
Eldorado Creek	Clearwater	2000	3.5	1	0.29	3.5	0	0.000	Based on index count
Eldorado Creek	Clearwater	1999	3.5	0	0.00	3.5	0	0.000	
Eldorado Creek	Clearwater	1998	3.5	0	0.00	3.5	0	0.000	
Eldorado Creek	Clearwater	1997	3.5	0	0.00	3.5	0	0.000	
Eldorado Creek	Clearwater	1996	3.5	0	0.00	3.5	0	0.000	
Eldorado Creek	Clearwater	1995	3.5	0	0.00	3.5	0	0.000	
Eldorado Creek	Clearwater	1994	3.5	0	0.00	3.5	0	0.000	
Eldorado Creek	Clearwater	1993	3.5	2	0.57	3.5	2	0.571	

Eldorado Creek	Clearwater	1992	3.5	0	0.00	3.5	0	0.000	
Lolo and Yoosa Creek	Clearwater	2001	16.7	398	23.83	21.1	428	20.284	Based on index count
Lolo and Yoosa Creek	Clearwater	2000	16.7	98	5.87	21.1	100	4.739	Based on index count
Lolo and Yoosa Creek	Clearwater	1999	16.7	9	0.54	21.1	9	0.427	Based on index count
Lolo and Yoosa Creek	Clearwater	1998	16.7	26	1.56	21.1	31	1.469	Based on index count
Lolo and Yoosa Creek	Clearwater	1997	16.7	139	8.32	21.1	110	5.213	Based on index count
Lolo and Yoosa Creek	Clearwater	1996	16.7	21	1.26	21.1	21	0.995	Based on index count
Lolo and Yoosa Creek	Clearwater	1995	16.7	6	0.36	21.1	6	0.284	Based on index count
Lolo and Yoosa Creek	Clearwater	1994	16.7	7	0.42	21.1	7	0.332	Based on index count
Lolo and Yoosa Creek	Clearwater	1993	16.7	23	1.38	21.1	24	1.137	Based on index count
Lolo and Yoosa Creek	Clearwater	1992	16.7	19	1.14	21.1	19	0.900	Based on index count
Newsome Creek	Clearwater	2001	15.1	221	14.64	15.1	221	14.636	
Newsome Creek	Clearwater	2000	15.1	51	3.38	15.1	5	0.331	Based on index count
Newsome Creek	Clearwater	1999	15.1	0	0.00	15.1	0	0.000	
Newsome Creek	Clearwater	1998	15.1	32	2.12	15.1	32	2.119	
Newsome Creek	Clearwater	1997	15.1	67	4.44	15.1	67	4.437	
Newsome Creek	Clearwater	1996	15.1	4	0.26	15.1	4	0.265	
Newsome Creek	Clearwater	1995	15.1	0	0.00	15.1	0	0.000	
Newsome Creek	Clearwater	1994	15.1	0	0.00	15.1	0	0.000	
Newsome Creek	Clearwater	1993	15.1	55	3.64	15.1	55	3.642 [a]	
Newsome Creek	Clearwater	1992	15.1	2	0.13	15.1	2	0.132	
Papoose Creek	Clearwater	2001	6	194	32.33	6	194	32.333	
Papoose Creek	Clearwater	2000	6	41	6.83	6	41	6.833	
Papoose Creek	Clearwater	1999	6	4	0.67	6	4	0.667	
Papoose Creek	Clearwater	1998	6.8	13	1.91	6.8	13	1.912	
Papoose Creek	Clearwater	1997	6.8	62	9.12	6.8	62	9.118	
Papoose Creek	Clearwater	1996	3	7	2.33	3	7	2.333	
Papoose Creek	Clearwater	1995	3	1	0.33	3	1	0.333	
Papoose Creek	Clearwater	1994	3	0	0.00	3	0	0.000	
Papoose Creek	Clearwater	1993	3	15	5.00	3	15	5.000	
Papoose Creek	Clearwater	1992	3	10	3.33	3	10	3.333	
Pete King Creek	Clearwater	2001	8	17	2.1	8	17	2.125	
Pete King Creek	Clearwater	2000	8	2	0.25	8	2	0.250	
Pete King Creek	Clearwater	1999	8	0	0.00	8	0	0.000	
Pete King Creek	Clearwater	1998	8	0	0.00	8	0	0.000	
Pete King Creek	Clearwater	1997	8	1	0.13	8	1	0.125	
Pete King Creek	Clearwater	1996	8	0	0.00	8	0	0.000	
Pete King Creek	Clearwater	1995	8	0	0.00	8	0	0.000	
Pete King Creek	Clearwater	1994	8	0	0.00	8	0	0.000	
Pete King Creek	Clearwater	1993	8	0	0.00	8	0	0.000	
Pete King Creek	Clearwater	1992	8	0	0.00	8	0	0.000	
Pete King Creek	Clearwater	1991	8	0	0.00	8	0	0.000	
Red River	Clearwater	2001	44.2	348	7.87	44.2	348	7.873	
Red River	Clearwater	2000	39.6	235	5.93	39.6	235	5.934	
Red River	Clearwater	1999	39.6	14	0.35	39.6	14	0.354	
Red River	Clearwater	1998	44.2	93	2.10	44.2	93	2.104	
Red River	Clearwater	1997	44.2	344	7.78	44.2	344	7.783	
Red River	Clearwater	1996	34.1	41	1.20	34.1	41	1.202	
Red River	Clearwater	1995	43	17	0.40	43	17	0.395	
Red River	Clearwater	1994	43	23	0.53	43	23	0.535	

Red River	Clearwater	1993	38.5	69	1.79	38.5	69	1.792
Red River	Clearwater	1992	43	44	1.02	43	44	1.023
Red River	Clearwater	1991	23.6	6	0.25	23.6	6	0.254
Squaw Creek	Clearwater	2001	6	64	10.67	6	64	10.667
Squaw Creek	Clearwater	2000	6	4	0.67	6	4	0.667
Squaw Creek	Clearwater	1999	6	4	0.67	6	4	0.667
Squaw Creek	Clearwater	1998	6	11	1.83	6	11	1.833
Squaw Creek	Clearwater	1997	6	17	2.83	6	17	2.833
Squaw Creek	Clearwater	1996	6	1	0.17	6	1	0.167
Squaw Creek	Clearwater	1995	6	0	0.00	6	0	0.000
Squaw Creek	Clearwater	1994	6	0	0.00	6	0	0.000
Squaw Creek	Clearwater	1993	6	0	0.00	6	0	0.000
Squaw Creek	Clearwater	1992	6	1	0.17	6	1	0.167
White Cap Creek	Clearwater	2001	19.8	19	0.96	19.8	19	0.960
White Cap Creek	Clearwater	2000	19.8	8	0.40	19.8	8	0.404
White Cap Creek	Clearwater	1999	12.9	0	0.00	12.9	0	0.000
White Cap Creek	Clearwater	1998	19.8	4	0.20	19.8	4	0.202
White Cap Creek	Clearwater	1997	19.8	0	0.00	19.8	0	0.000
White Cap Creek	Clearwater	1996	19.8	3	0.15	19.8	3	0.152
White Cap Creek	Clearwater	1995	19.8	0	0.00	19.8	0	0.000
White Cap Creek	Clearwater	1994	19.8	2	0.10	19.8	2	0.101
White Cap Creek	Clearwater	1993	19.8	6	0.30	19.8	6	0.303
White Cap Creek	Clearwater	1992	19.8	2	0.10	19.8	2	0.101
Bear Valley Creek	Salmon	2001	35.7	153	4.29	35.7	153	4.286
Bear Valley Creek	Salmon	2000	35.7	59	1.65	35.7	59	1.653
Bear Valley Creek	Salmon	1999	35.7	26	0.73	35.7	26	0.728
Bear Valley Creek	Salmon	1998	35.7	64	1.79	35.7	64	1.793
Bear Valley Creek	Salmon	1997	35.7	30	0.84	35.7	30	0.840
Bear Valley Creek	Salmon	1996	35.7	12	0.34	35.7	12	0.336
Bear Valley Creek	Salmon	1995	35.7	3	0.08	35.7	3	0.084
Bear Valley Creek	Salmon	1994	35.7	4	0.11	35.7	4	0.112
Bear Valley Creek	Salmon	1993	35.7	138	3.87	35.7	138	3.866
Bear Valley Creek	Salmon	1992	35.7	26	0.73	35.7	26	0.728
East Fork Salmon River	Salmon	2001	27	25	0.93	27	25	0.926
East Fork Salmon River	Salmon	2000	27	2	0.07	27	2	0.074
East Fork Salmon River	Salmon	1999	27	8	0.30	27	8	0.296
East Fork Salmon River	Salmon	1998	27	21	0.78	27	21	0.778
East Fork Salmon River	Salmon	1997	27	0	0.00	27	0	0.000
East Fork Salmon River	Salmon	1996	27	2	0.07	27	2	0.074
East Fork Salmon River	Salmon	1995	27	0	0.00	27	0	0.000
East Fork Salmon River	Salmon	1994	27	5	0.19	27	5	0.185
East Fork Salmon River	Salmon	1993	27	19	0.70	27	19	0.704
East Fork Salmon River	Salmon	1992	27	1	0.04	27	1	0.037
Herd Creek	Salmon	2001	17.1	22	1.29	17.1	22	1.287
Herd Creek	Salmon	2000	17.1	3	0.18	17.1	3	0.175
Herd Creek	Salmon	1999	17.1	3	0.18	17.1	3	0.175
Herd Creek	Salmon	1998	17.1	10	0.58	17.1	10	0.585
Herd Creek	Salmon	1997	17.1	14	0.82	17.1	14	0.819
Herd Creek	Salmon	1996	17.1	0	0.00	17.1	0	0.000
Herd Creek	Salmon	1995	17.1	0	0.00	17.1	0	0.000

Herd Creek	Salmon	1994	17.1	4	0.23	17.1	4	0.234	
Herd Creek	Salmon	1993	17.1	43	2.51	17.1	43	2.515	
Herd Creek	Salmon	1992	14.1	3	0.21	14.1	3	0.213	
Johnson Creek[i]	Salmon	2001	40	387	9.68	25.32	387	15.284[q]	From est redds/km
Johnson Creek[i]	Salmon	2000	40	29	0.73	25.32	33	1.303[r]	From est redds/km
Johnson Creek[i]	Salmon	**1999**	40[i]	**24**	0.60	25.32	24	0.948	From est redds/km
Johnson Creek[i]	Salmon	1998	38[iii]	**96**	2.53	25.32	96	3.791(ii)	From est redds/km
Johnson Creek[i]	Salmon	**1997**	**31**	**97**	3.13	25.32	114.86	4.536	From est redds/km
Johnson Creek[i]	Salmon	1996	31	22	0.71	25.32	25.78	1.018	From est redds/km
Johnson Creek[i]	Salmon	1995	31	5	0.16	25.32	5.86	0.231	From est redds/km
Johnson Creek[i]	Salmon	1994	31	26	0.84	25.32	30.47	1.203	From est redds/km
Johnson Creek[i]	Salmon	1993	20.8	170	8.17	25.32	199.24	7.869j	From est redds/km
Johnson Creek[i]	Salmon	1992	20.8	60	2.88	25.32	70.32	2.777	From est redds/km
Johnson Creek[i]	Salmon	1991	20.8	69	3.32	20.8	69	3.32	New redds not verified
Lake Creek	Salmon	2001	20.76	337	16.23	20.76	337	16.233	From est redds/km
Lake Creek	Salmon	2000	20.76	179	8.62	20.76	179	8.622	From est redds/km
Lake Creek	Salmon	1999	20.76	24	1.16	20.76	24	1.156	From est redds/km
Lake Creek	Salmon	1998	20.76	50	2.41	20.76	50	2.408	From est redds/km
Lake Creek	Salmon	1997	20.8	55	2.64	20.76	55	2.649	From est redds/km
Lake Creek	Salmon	1996	13.6	31	2.28	20.76	36.14	1.741	From est redds/km
Lake Creek	Salmon	1995	13.6	12	0.88	20.76	13.99	0.674	From est redds/km
Lake Creek	Salmon	1994	13.6	12	0.88	20.76	13.99	0.674	From est redds/km
Lake Creek	Salmon	1993	13.6	44	3.24	20.76	51.3	2.471	From est redds/km
Lake Creek	Salmon	1992	13.6	43	3.16	20.76	50.13	2.415	From est redds/km
Lake Creek	Salmon	1991	13.6	34	2.50	13.6	34	2.50	New redds not verified
Lemhi River	Salmon	2001	51.7	339	6.56	51.7	339	6.557	
Lemhi River	Salmon	2000	51.7	93	1.80	51.7	93	1.799	
Lemhi River	Salmon	1999	51.7	48	0.93	51.7	48	0.928	
Lemhi River	Salmon	1998	51.7	41	0.79	51.7	41	0.793	
Lemhi River	Salmon	1997	51.7	50	0.97	51.7	50	0.967	
Lemhi River	Salmon	1996	51.7	29	0.56	51.7	29	0.561	
Lemhi River	Salmon	1995	51.7	9	0.17	51.7	9	0.174	
Lemhi River	Salmon	1994	51.7	20	0.39	51.7	20	0.387	
Lemhi River	Salmon	1993	51.7	37	0.72	51.7	37	0.716	
Lemhi River	Salmon	1992	51.7	15	0.29	51.7	15	0.290[m]	
Marsh Creek[k]	Salmon	2001	11	110	10.00	11	110	10.000	
Marsh Creek[k]	Salmon	2000	11	30	2.73	11	30	2.727	
Marsh Creek[k]	Salmon	1999	11	0	0.00	11	0	0.000	
Marsh Creek[k]	Salmon	1998	11	41	3.73	11	41	3.727	
Marsh Creek[k]	Salmon	1997	11	38	3.45	11	38	3.455	
Marsh Creek[k]	Salmon	1996	11	6	0.55	11	6	0.545	
Marsh Creek[k]	Salmon	1995	11	0	0.00	11	0	0.000	
Marsh Creek[k]	Salmon	1994	11	9	0.82	11	9	0.818	
Marsh Creek[k]	Salmon	1993	11	45	4.09	11	45	4.091[b]	
Marsh Creek[k]	Salmon	1992	9.8	66	6.73	9.8	66	6.735[l]	
North Fork Salmon River	Salmon	2001	36.8	102	2.77	36.8	102	2.772	
North Fork Salmon River	Salmon	2000	15.2	11	0.72	15.2	11	0.724	
North Fork Salmon River	Salmon	1999	36.8	2	0.05	36.8	2	0.054	
North Fork Salmon River	Salmon	1998	36.8	3	0.08	36.8	3	0.082	
North Fork Salmon River	Salmon	1997	36.8	10	0.27	36.8	10	0.272	

North Fork Salmon River	Salmon	1996	36.8	5	0.14	36.8	5	0.136	
North Fork Salmon River	Salmon	1995	36.8	1	0.03	36.8	1	0.027	
North Fork Salmon River	Salmon	1994	36.8	3	0.08	36.8	3	0.082	
North Fork Salmon River	Salmon	1993	36.8	17	0.46	36.8	17	0.462	
North Fork Salmon River	Salmon	1992	36.8	12	0.33	36.8	12	0.326	
North Fork Salmon River	Salmon	1991	36.8	8	0.22	36.8	8	0.217	
Pahsimeroi River	Salmon	2001	24.5	146	5.96	24.5	146	5.959	Redds upstream of PBS1 and P8A removed
Pahsimeroi River	Salmon	2000	24.5	46	1.88	17.8	46	2.584	Redds upstream of PBS1 and P8A removed
Pahsimeroi River	Salmon	1999	24.5	61	2.49	17.8	61	3.427	Redds upstream of PBS1 and P8A removed
Pahsimeroi River	Salmon	1998	31.1	31	1.00	17.8	28	1.573	Redds upstream of PBS1 and P8A removed
Pahsimeroi River	Salmon	1997	15.7	23	1.46	16	23	1.438	Hatchery weir to PBS1. Did not count above Patterson Cr. on the main Pahsimeroi R.
Pahsimeroi River	Salmon	1996	14.5	13	0.90	16.5	13	0.788	Did not do PBS1 to mouth
Pahsimeroi River	Salmon	1995	15.5	11	0.71	16.5	11	0.667	Did not do PBS1 to mouth
Pahsimeroi River	Salmon	1994	16.5	19	1.15	17.8	19	1.067 [f]	Aerial count on 9/7, only ground count was from dowton lane to p11
Pahsimeroi River	Salmon	1993	23	63	2.74	16.5	63	3.818	Did not do PBS1 to mouth
Pahsimeroi River	Salmon	1992	26.5	32	1.21	26.5	32	1.208	It is likely that areas where fish do not spawn were surveyed but we were unable to find any data sheets that listed areas walked or redd distribution
Secesh River	Salmon	2001	32.1	381	11.87	11.9	239	20.084	Based on index count
Secesh River	Salmon	2000	32.1	148	4.61	11.9	104	8.739	Based on index count
Secesh River	Salmon	1999	32.1	42	1.31	11.9	34	2.857	Based on index count
Secesh River	Salmon	1998	32.1	69	2.15	11.9	50	4.202	Based on index count
Secesh River	Salmon	1997	32.1	90	2.80	11.9	74	6.218	Based on index count
Secesh River	Salmon	1996	10.3	42	4.08	11.9	41	3.445	Based on index count
Secesh River	Salmon	1995	10.3	18	1.75	11.9	18	1.513	Based on index count
Secesh River	Salmon	1994	10.3	21	2.04	11.9	21	1.765	Based on index count
Secesh River	Salmon	1993	10.3	91	8.83	11.9	91	7.647	Based on index count
Secesh River	Salmon	1992	10.3	66	6.41	11.9	66	5.546	Based on index count
Secesh River	Salmon	1991	10.3	62	6.02	10.3	62	6.02	New redds not verified
Slate Creek	Salmon	2001	34.61	26	0.75	5.53	18	3.255	Based on index count
Slate Creek	Salmon	2000	34.61	5	0.14	5.53	4	0.723	Based on index count
Slate Creek	Salmon	1999	34.61	2	0.06	5.53	2	0.362	Based on index count
Slate Creek	Salmon	1998	28.6	8	0.28	5.53	6	1.085	Based on index count
Slate Creek	Salmon	1997	15	8	0.53	5.53	5	0.904	Based on index count
Slate Creek	Salmon	1996	5.5	0	0.00	5.53	0	0.000	Based on index count
Slate Creek	Salmon	1995	5.5	3	0.55	5.53	3	0.542	Based on index count
Slate Creek	Salmon	1994	5.5	1	0.18	5.53	2	0.362	Based on index count
Slate Creek	Salmon	1993	5.5	1	0.18	5.53	1	0.181	Based on index count
Slate Creek	Salmon	1992	5.5	4	0.73	5.53	4	0.723	Based on index count
Slate Creek	Salmon	1991	5.5	6	1.09	5.5	6	1.09	New redds not verified
South Fork Salmon River	Salmon	2001	24.5	493	20.12	20.2	430	21.287	Removed tributaries from survey
South Fork Salmon River	Salmon	2000	24.5	315	12.86	20.2	290	14.356	Removed tributaries from survey
South Fork Salmon River	Salmon	1999	22.6	281	12.43	20.2	259	12.822	Removed tributaries from survey
South Fork Salmon River	Salmon	1998	20.2	149	7.38	20.2	149	7.376	
South Fork Salmon River	Salmon	1997	20.2	264	13.07	20.2	264	13.069	
South Fork Salmon River	Salmon	1996	20.2	78	3.86	20.2	78	3.861	
South Fork Salmon River	Salmon	1995	20.2	61	3.02	20.2	61	3.020	
South Fork Salmon River	Salmon	1994	20.2	76	3.76	20.2	76	3.762	

South Fork Salmon River	Salmon	1993	20.2	694	34.36	20.2	694	34.356	
South Fork Salmon River	Salmon	1992	20.2	454	22.48	20.2	454	22.475	
Upper Salmon River	Salmon	2001	59	257	4.36	59	257	4.356	Aerial survey
Upper Salmon River	Salmon	2000	59	146	2.47	59	146	2.475	Aerial survey
Upper Salmon River	Salmon	1999	59	14	0.24	59	14	0.237	Aerial survey
Upper Salmon River	Salmon	1998	59	25	0.42	59	25	0.424	Aerial survey
Upper Salmon River	Salmon	1997	59	8	0.14	59	8	0.136	Aerial survey
Upper Salmon River	Salmon	1996	59	14	0.24	59	14	0.237	Aerial survey
Upper Salmon River	Salmon	1995	59	0	0.00	59	0	0.000	Aerial survey
Upper Salmon River	Salmon	1994	59	22	0.37	59	22	0.373	Aerial survey
Upper Salmon River	Salmon	1993	59	127	2.15	59	127	2.153	Aerial survey
Upper Salmon River	Salmon	1992	59	27	0.46	59	27	0.458	Aerial survey
Valley Creek	Salmon	2001	32.2	59	1.83	32.2	59	1.832	
Valley Creek	Salmon	2000	33.2	23	0.69	33.2	23	0.693	
Valley Creek	Salmon	1999	33.2	18	0.54	33.2	18	0.542	
Valley Creek	Salmon	1998	33.2	33	0.99	33.2	33	0.994	
Valley Creek	Salmon	1997	33.2	5	0.15	33.2	5	0.151	
Valley Creek	Salmon	1996	48.7	1	0.02	48.7	1	0.021	
Valley Creek	Salmon	1995	48.7	0	0.00	48.7	0	0.000	
Valley Creek	Salmon	1994	43.7	4	0.09	43.7	4	0.092	
Valley Creek	Salmon	1993	52.3	73	1.40	52.3	73	1.396	
Valley Creek	Salmon	1992	33.2	7	0.21	33.2	7	0.211	
West Fork Yankee Fork Salmon River	Salmon	2001	11.6	36	3.10	11.6	36	3.103	
West Fork Yankee Fork Salmon River	Salmon	2000	11.6	4	0.34	11.6	4	0.345	
West Fork Yankee Fork Salmon River	Salmon	1999	11.6	0	0.00	11.6	0	0.000	
West Fork Yankee Fork Salmon River	Salmon	1998	11.6	12	1.03	11.6	12	1.034	
West Fork Yankee Fork Salmon River	Salmon	1997	11.6	6	0.52	11.6	6	0.517	
West Fork Yankee Fork Salmon River	Salmon	1996	11.6	7	0.60	11.6	7	0.603	
West Fork Yankee Fork Salmon River	Salmon	1995	11.6	0	0.00	11.6	0	0.000	
West Fork Yankee Fork Salmon River	Salmon	1994	11.6	9	0.78	11.6	9	0.776	
West Fork Yankee Fork Salmon River	Salmon	1993	11.6	14	1.21	11.6	14	1.207	
West Fork Yankee Fork Salmon River	Salmon	1992	11.6	6	0.52	11.6	6	0.517	

Notes:
[a] 125 adult pairs were outplanted from Rapid River Hatchery.
[b] Two additional redds occurred below the juvenile trap.
[c] 150 adult pairs were outplanted from Rapid River Hatchery.
[d] NC = No count (stream was not surveyed).
[e] Six additional redds occurred below the juvenile trap.
[f] Distance reported is for the IDFG trend area; number of redds is from Nemeth et al. (1996).
[g] Three additional redds occurred below the juvenile trap.
[h] A single adult chinook salmon was seen in Brushy Fork Creek during snorkeling activities.
[i] Moose Creek to Burnt Log Creek section (6.2 km) not surveyed 1991-1993; from 1994-present, Burnt Log Creek, from the mouth to 2.0 km above Buck Creek (4.0 km total), was included in the count.
[j] This number is conservative as one section of stream, Moose Creek to Burnt Log trail crossing, was not counted, but was known to have redds.
[k] Includes Knapp Creek.
[l] Section from Knapp Cr. to Dry Cr. was not surveyed in 1992.
[m] Aerial count.

[n] Seven of the redds counted were located in Colt Creek, a tributary of Colt Killed Creek.
[o] Nine additional redds were located between the mouth of Crooked Fk Cr and the juvenile screw trap.
[p] Nine additional redds located below the screw trap
[q] Nez Perce Tribe removed 149 adults for culture
[r] Nez Perce Tribe removed 73 adults for culture
[s] An estimated 408 adults escaped above weir in addition to the 90 known adults.

SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by_____________________________ Date:_____________

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: ______ ESU/Population: ______ Activity: ______				
Location of hatchery activity: ______ Dates of activity: ______ Hatchery program operator: ______				
Type of Take	**Annual Take of Listed Fish By Life Stage (*Number of Fish*)**			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)				
Capture, handle, tag/mark/tissue sample, and release d)			Entire run	
Removal (e.g. broodstock) e)			Section 7.2	
Intentional lethal take f)				
Unintentional lethal take g)			Pre-spawn mortality varies and may be as high as 8%.	
Other Take (specify) h) Carcass sampling				50

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

Instructions:

1. *An entry for a fish to be taken should be in the take category that describes the greatest impact.*
2. *Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).*
3. *If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.*

APPENDIX 2-5—DRAFT LEMHI RIVER SPRING/SUMMER CHINOOK IN THE SALMON SUBBASIN

HATCHERY AND GENETIC MANAGEMENT PLAN

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

DRAFT

Hatchery Program	Lemhi River
Species or Hatchery Stock	Spring/summer Chinook
Agency/Operator	IDF&G
Watershed and Region	Salmon River, Columbia River
Date Submitted	March 3, 2003
Date Last Updated	September 9, 2003

1

Section 1: General Program Description

1.1 Name of hatchery or program.

1 Lemhi River

1.2 Species and population (or stock) under propagation, and ESA status.

1 Spring/summer Chinook

9 ESA Status: Threatened

1.3 Responsible organization and individuals.

Name (and title): Paul Kline
Principal Fisheries Research Biologist

3 **Agency or Tribe:** IDF&G

Address: 1800 Trout Road, Eagle, ID 83616

Telephone: 208-939-4114
Fax: 208-939-2415
Email: pkline@idfg.state.id.us

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and exten involvement in the program.

	Co-operators	Role
4	Shosone Bannock Tribe	periodically assists with the transfer and planting of pr generated eyed-eggs to in-stream incubation boxes.
	NOAA Fisheries	shares captive broodstock development responsibility culture and rearing)
	University of Idaho	Genetics support
	nya	nya

1.4 Funding source, staffing level, and annual hatchery program operational costs.

	Funding Sources
	Bonneville Power Administration
	nya
	nya
5	nya
	nya
	nya
	nya

	Operational Information	Number
6	Full time equivalent staff	2.2
	Annual operating cost (dollars)	475,000

Comments:

The information above applies to the following three programs:

Lemhi River Spring_Summer Chinook

West Fork Yankee Fork Salmon River Spring/Summer Chinook

East Fork Salmon River Spring/Summer Chinook

Reviewer Comments:

nc
nc

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 8/9/03

1.5 Location(s) of hatchery and associated facilities.

Broodstock source	Lemhi River
Broodstock collection location (stream, RKm, subbasin)	Lemhi River, 522.303.416, Salmon River
Adult holding location	

	(stream, RKm, subbasin)	Eagle Hatchery (HUC 17050114)
	Spawning location (stream, RKm, subbasin)	Lemhi River, 522.303.416, Salmon River
2	**Incubation location (facility name, stream, RKm, subbasin)**	Eagle Hatchery (HUC 17050114)
	Rearing location (facility name, stream, RKm, subbasin)	Eagle Hatchery (HUC 17050114), NOAA Fisheries Manchester Station

Comments:

Broodstock source: Lemhi River, West Fork Yankee Fork Salmon River, and East Fork Salmon River spring chinook salmon. collected and reared at IDFG freshwater and NOAA Fisheries seawater hatcheries to maturation. Mature adults released to n for volitional spawning. Some in-hatchery spawning occurs to document reproductive potential.

Broodstock collection location (Stream, RKM, subbasin): 522.303.416 Lemhi River, 522.303.591.011 West Fork Yankee Fork 522.303.552.029 East Fork Salmon River.

Adult holding location (Stream, RKM, subbasin): IDFG Eagle Fish Hatchery, no RKM, NOAA Fisheries Manchester Marine Ex Station, no RKM.

Spawning location (Stream, RKM, subbasin): Spawning primarily occurs in natal streams (captive adults released to spawn n kilometer information is provided above. Some in-hatchery spawning occurs at the IDFG Eagle Fish Hatchery, no RKM.

Incubation location (Facility name, stream, RKM, subbasin): IDFG Eagle Fish Hatchery, no RKM.

Rearing location (Facility name, stream, RKM, subbasin): IDFG Eagle Fish Hatchery, no RKM, NOAA Fisheries Manchester M Experiment Station, no RKM.

Data source:

Source: Project annual reports to Bonneville Power Administration. Project annual reports to NOAA Fisheries for ESA Section Per Paul Kline IDFG 9/8/03.

1.6 Type of program.

8 Integrated

Comments:

Data source:

Per Paul Kline IDFG 9/8/03

1.7 Purpose (Goal) of program.

9 The purpose of this hatchery program is to contribute to conservation/recovery and research and education.

10 the purpose of the program is mitigation for hydro impacts .

Comments:

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.

1.8 Justification for the program.

138
- It is unknown if hatchery fish are accessible to fisheries.

Comments:

nc
nc
nc

Data source:

Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03
nds
nds
nds

1.9 List of program "Performance Standards".

11 The program adheres to the following fish culture guideline(s) and standard(s):
IHOT
PNFHPC
state
federal
other

Comments:

Other = Chinook Salmon Captive Propagation Technical Oversight Committee. A team of technical experts representing the agencies and tribes involved with the program in addition to invited experts. The CSCPTOC meets periodically to review pro activities, address critical uncertainties, and to adaptively manage future activities.

Data source:

Per Paul Kline IDFG 9/8/03

1.10 List of program "Performance Indicators", designated by "benefits" and "risks".

139

Indicators of Harvest Benefits

Indicator	Performance Standard	Indicator is Monitore
Spawner to spawner survival of hatchery fish	dna	dna
Contribution of hatchery fish to target fisheries	dna	dna
Angler success (hatchery fish per angler day) in target recreational fisheries	dna	dna
Contribution of hatchery fish to cultural needs	dna	dna
Selective harvest success (expected benefits of mass marking)	dna	dna

141

Indicators of Conservation Benefits

Indicator	Performance Standard	Indicator is Monitore
Genetic and life history diversity (over time)	3.4.1, 3.4.3, 3.5.1, 3.5.3, 3.2.2	3.4.1, 3.4.3, 3.5.1, 3.5.3,
Spawner to spawner reproductive success of hatchery fish	3.3.1, 3.4.3, 3.4.4, 3.5.3, 3.5.4, 3.6.1	Y
Reproductive success of the receiving (supplemented) naturally spawning population	3.2.2, 3.3.1, 3.4.3, 3.4.4, 3.5.3	Y
Contribution to the abundance of the naturally spawning population	3.2.2, 3.3.1, 3.4.3, 3.4.4, 3.5.3	Y
Time and location of spawning	3.2.2, 3.3.1, 3.4.3, 3.4.4, 3.5.3	Y
Contribution to ecosystem function (e.g. through nutrient enhancement, food web effects, etc.)	3.7.5	Y

Indicators of Harvest Risks

	Indicator	Performance Standard	Indicator is Monitore
	Harvest impacts on co-mingled stocks	dna	dna
140	**Bias in run size estimation of natural stocks due to masking effect**	dna	dna
	Lack of harvest access (under harvest due e.g. to co-mingling with weaker stocks)	dna	dna

Indicators of Conservation Risks

	Indicator	Performance Standard	Indicator is Monitore
	Unintended contribution of hatchery fish to natural spawning (through straying)	3.3.1, 3.3.2, 3.4.4, 3.5.3	Y
	Loss of genetic and life history diversity	3.3.2, 3.4.1, 3.4.3, 3.5.2	Y
142	**Loss of reproductive success**	3.3.2, 3.4.3	Y
	Ecological interactions through competition with natural stocks (by life stage)	3.3.2, 3.4.3	Y
	Ecological interactions through predation on natural stocks (by life stage)	3.3.2, 3.4.3, 3.7.8	Y
	Adverse effects of hatchery operations and facilities on fish migration Disease transfers	3.7.3, 3.7.6, 3.7.7	Y

The following plans and methods are proposed to collect data for each Performance Indicator: Note: Performance Standards described in this section or our response were taken from the final January 17, 2001 version of Performance Standards and I the Use of Artificial Production for Anadromous and Resident Fish Populations in the Pacific Northwest. Numbers referenced correspond to numbers used in the above document.

Performance Standards and Indicators addressing "benefits."

3.2.2 Standard: Release groups sufficiently marked in a manner consistent with information needs and protocols to enable de impacts to natural- and hatchery-origin fish in fisheries.

Indicator 1: Marking rate by type in each release group documented.

3.3.1 Standard: Artificial propagation program contributes to an increasing number of spawners returning to natural spawning

Indicator 1: Annual number of spawners on spawning grounds estimated in specific locations.

Indicator 2: Spawner-recruit ratios are estimated in specific locations.

Indicator 3: Number of redds in natural production index areas documented.

3.3.2 Standard: Releases are sufficiently marked to allow statistically significant evaluation of program contribution.

Indicator 1: Marking rates and type of mark documented.

Indicator 2: Number of marks identified in adult groups documented.

Performance Standards and Indicators addressing ?risks.?

3.4.1 Standard: Fish collected for broodstock are taken throughout the return in proportions approximating the timing and age the population.

Indicator 1: Temporal distribution of broodstock collection managed.

Indicator 2: Age composition of broodstock collection managed.

3.4.2 Standard: Broodstock collection does not significantly reduce potential juvenile production in natural areas.

Indicator 1: Eyed-eggs are collected from a sub-set of wild redds to source broodstocks.

Indicator 2: Hatchery-produced spawners are released to migrate to natural spawning areas.

Indicator 3: Number of adults, eggs or juveniles placed in natural rearing areas is managed.

3.4.3 Standard: Life history characteristics of the natural population do not change as a result of this program.

Indicator 1: Life history characteristics of natural and hatchery-produced populations

are measured (e.g., juvenile dispersal timing, juvenile size at out-migration, adult return timing, adult age and sex ratio, natura spawn timing, hatch and swim-up timing, hatchery rearing densities, growth, diet, physical characteristics, fecundity, egg size

3.4.4 Standard: Annual release numbers do not exceed estimated basin-wide and local habitat capacity.

Indicator 1: Annual release numbers, life-stage, size at release, documented.

Indicator 2: Location of releases documented.

Indicator 3: Timing of hatchery releases documented.

3.5.1 Standard: Patterns of genetic variation within and among natural populations do not change significantly as a result of a production.

Indicator 1: Genetic profiles of naturally-produced and hatchery-produced adults developed.

3.5.2 Standard: Collection of broodstock does not adversely impact the genetic diversity of the naturally spawning population

Indicator 1: Eyed-eggs are collected from a sub-set of wild redds to source broodstocks.

Indicator 2: Timing of collection compared to overall run timing considered.

3.5.3 Standard: Artificially produced adults in natural production areas do not exceed appropriate proportion.

Indicator 1: Ratio of natural to hatchery-produced adults monitored.

3.6.1 Standard: The artificial production program uses standard scientific procedures to evaluate various aspects of artificial p

Indicator 1: Scientifically based experimental design with measurable objectives and hypotheses.

3.6.2. Standard: The artificial production program is monitored and evaluated on an appropriate schedule and scale to addres toward achieving the experimental objectives.

Indicator 1: Monitoring and evaluation framework including detailed time line.

Indicator 2: Annual and final reports.

3.7.1 Standard: Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility o standards and protocols.

Indicator 1: Annual reports indicating level of compliance with applicable standards and criteria.

3.7.2 Standard: Effluent from artificial production facility will not detrimentally affect natural populations.

144

Indicator 1: Discharge water quality compared to applicable water quality standards.

3.7.3 Standard: Water withdrawals and in stream water diversion structures for artificial production facility operation will not p to natural spawning areas, affect spawning, or impact juveniles.

Indicator 1: Water withdrawals documented ? no impacts to listed species.

Indicator 2: Number of adult fish aggregating and/or spawning immediately below water intake point monitored.

Indicator 3: NMFS screening criteria adhered to.

3.7.4 Standard: Releases do not introduce pathogens not already existing in the local populations and do not significantly inc levels of existing pathogens.

Indicator 1: Certification of juvenile fish health documented prior to release.

Indicator 2: Samples of natural populations for disease occurrence conducted.

Indicator 3: Juvenile densities during artificial rearing managed conservatively.

3.7.6 Standard: Adult broodstock collection operation does not significantly alter spatial and temporal distribution of natural p

Indicator 1: Spatial and temporal spawning distribution of natural population above and below trapping facilities monitored.

3.7.7 Standard: Weir/trap operations do not result in significant stress, injury, or mortality in natural populations.

Indicator 1: Mortality rates in trap documented.

Indicator 2: Pre-spawning mortality rates of trapped fish in hatchery or after release documented.

3.7.8 Standard: Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of nat

Indicator 1: Juveniles are not released. Production occurs from captive-reared adults released to spawn naturally.

Monitoring and Evaluation of Performance Standards and Indicators:

Standard 3.2.2 and associated Indicators. All adult chinook salmon released back to the habitat are PIT tagged, elastomer ta Petersen disk tagged. Genetic tissue samples from progeny that result from natural spawning events are taken to facilitate in assignment test analyses. Hatchery groups are PIT tagged and elastomer tagged.

Standard 3.3.1 and associated Indicators. The primary objective of this program is to reintroduce hatchery-produced adults fo spawning. Adults are sourced from eyed-eggs collected from redds constructed by wild adult chinook salmon.

Standard 3.3.2 and associated Indicators. Adults released for natural spawning are 100% marked with PIT tags, elastomer ta Petersen disk tags. Intensive post-release behavioral monitoring occurs to document spawning-related behavior and spawnin

Standard 3.4.1, 3.4.2, 3.5.3, and associated indicators. Chinook salmon rearing groups are sourced as eyed-eggs from redds by wild adults. Approximately 50 eyed-eggs are removed, using hydraulic sampling gear, from six redds each. Redds are sel represent the range of spawn timing. Care is taken to not negatively impact eggs remaining in redds sampled by program pe

Standard 3.4.3 and associated indicators. Life history characteristics of natural and hatchery-produced adult chinook salmon (e.g., adult spawning success). In-hatchery variables are monitored continuously (e.g., growth, survival, rearing conditions, m at maturity, spawning success, gamete quality, egg size, fecundity, egg survival to the eyed stage of development, etc.).

Standard 3.4.4, 3.5.3 and associated indicators. Annual adult release numbers, size at release, and release location are disc at the CSCPTOC level. Release levels do not exceed habitat spawning and rearing capacities.

Standard 3.5.1, 3.5.2 and associated indicators. The university of Idaho provides genetic support for this program. Genetic p and hatchery-produced chinook salmon have been, and continue to be produced. The hatchery population is constantly mon determine such variables as genetic effective population size, loss of genetic variability, and loss of heterozygosity.

Standard 3.6.1, 3.6.2 and associated indicators. Program goals, objectives, and tasks focus on the preservation / conservatic this effort. Hatchery practices (e.g., spawning, and rearing protocols) are based on current and emerging ?best practices? an constant review at the CSCPTOC level. An experimental design has been established to guide the reintroduction of adults ba habitat. A comprehensive monitoring and evaluation program is in place to track post-release adult spawning success.

Standard 3.7.1, 3.7.2, 3.7.3, 3.7.6, 3.7.7 and associated indicators. The artificial production component of the program adher state and federal policies in place to prevent the spread of infectious pathogens, to insure that facility discharge water quality appropriate standards, and that intake and outflow screens meet appropriate standards.

Adult and juvenile weirs are monitored to not adversely affect target or other fish species. Anadromous chinook salmon adult distribution below weirs is carefully monitored. Every precaution is taken to insure that trapping does not negatively impact ar adults.

Standard 3.7.4 and associated indicators. IDFG and NOAA fish health facilities process samples for diagnostic and inspectio from captive broodstock chinook salmon. Routine fish necropsies include investigations for viral pathogens (infectious pancre virus and infectious hematopoietic necrosis virus), and various bacterial pathogens (e.g., bacterial kidney disease Renibacter salmoninarium, bacterial gill disease Flavobacterium branchiophilum, coldwater disease Flavobacterium psychrophilum, and aeromonad septicemia Aeromonas spp.). In addition to the above, captive fish are screened for the causative agent of whirlir Myxobolus cerebralis, furunculus Aeromonas salmonicida and the North American strain of viral hemorrhagic septicemia viru

Approved chemical therapeutants are used prophylactically and for the treatment of infectious diseases. Prior to effecting tre use of chemical therapeutants is discussed with an IDFG fish health professional. Fish necropsies are performed on all progr that satisfy minimum size criteria for the various diagnostic or inspection procedures performed.

All appropriate state permits are secured prior to transporting eggs or fish across state boundaries. Prior to release, pre-libera health sampling occurs for pre-smolt and smolt release groups.

Standard 3.7.8 and associated standards. Predation by artificially produced fish on naturally produced fish is not expected to juvenile releases occur. Juveniles produced by this program hatch from redds constructed in the habitat.

143 The program contributes to information gain in the following way(s): Hatchery program contributes to research to improve pe cost effectiveness
New information affects change to the hatchery program through a structured adaptive decision making process
Hatchery program participates in basin wide-coordinated research efforts
Hatchery program actively contributes to public education
Funding for monitoring of performance indicators is adequate

Comments:

Standards are referenced to NPPC Artificial Production Review (Jan 17, 2001).

Standards are referenced to NPPC Artificial Production Review (Jan 17, 2001).

null

Data source:

Per Paul Kline IDFG 9/8/03.
Per Paul Kline IDFG 9/8/03.
Per Paul Kline IDFG 9/8/03

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

1.11.1 Proposed annual broodstock collection level (maximum number of adult fish).

198 nya

Data source:

1.11.2 Proposed annual fish release levels (maximum number) by life stage and location.

Age Class	Maximum Number	Size (ffp)	Release Date	Location: Stream	Release Point (RKm)	Major Watershed	Ecopr

1

Eggs	50,000	2700	November	Lemhi River	522.303.416.049	Salmon River	Mounta Snake
Unfed Fry	nya	nya	nya	nya	nya	nya	nya
Fry	nya	nya	nya	nya	nya	nya	nya
Fingerling	nya	nya	nya	nya	nya	nya	nya
Yearling	nya	nya	nya	nya	nya	nya	nya

Comments:

Adult Release: Release

Max. Number Size Date Stream Release Point Watershed

200 3-10 August Lemhi River 522.303.416.049 Salmon R.

lbs/fish

Data source:

Per Paul Kline IDFG 9/8/2003 Note for above table: To develop an understanding of the reproductive potential of captive-rea chinook salmon, the Chinook Salmon Captive Propagation Technical Oversight Committee (CSCPTOC) recommended that place at the Eagle Fish Hatchery to investigate several reproduction variables (e.g., maturation timing, gamete quality, egg s stage of development. Information developed in this manner is used to compliment behavioral observations and reproductiv collected in the field following the release of maturing adult chinook salmon. Eggs produced from hatchery spawning events used to supplement captive rearing groups or returned to hatch boxes in target streams. Milt has been cryopreserved in the program since 1997.

1.12 Current program performance, including estimated smolt-to-adult survival rates, adult pı levels, and escapement levels. Indicate the source of these data.

33

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	NA	M	M	NA	NA
1990	M	M	M	NA	NA
1991	M	M	M	NA	NA
1992	M	M	M	NA	NA
1993	M	M	M	NA	NA
1994	M	M	M	NA	NA
1995	M	M	M	NA	NA
1996	M	M	M	NA	NA
1997	M	M	M	NA	NA
1998	M	M	M	NA	NA
1999	M	M	M	NA	NA
2000	M	M	M	NA	NA
2001	M	M	M	NA	NA

Comments:

This is a captive rearing program with a goal of collecting 250 eggs per stock per year. This programs releases maturing adı salmon for natural spawning.

Data source:

Paul Kline, 10.22.03.

Status and Goals of Stocks and Habitats

	NoRs		HoRs		Combined (HoRs + NoRs)	
Brood Year	**Smolt to Adult Survival(%)**	**Recruits per Spawner**	**Smolt to Adult Survival(%)**	**Recruits per Spawner**	**Smolt to Adult Survival(%)**	**Recruits per Spawner**
Goal	nya	nya	nya	nya	nya	nya
1988	nya	nya	nya	nya	nya	nya
1989	nya	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya	nya

34

Comments:

Data source:

1.13 Date program started (years in operation), or is expected to start.

7 The first year of operation for this hatchery was 1997 .

Comments:

Fish were first collected in brood year 1994.

Data source:

Per Paul Kline IDFG 9/8/03

1.14 Expected duration of program.

148 The final year of the program is undetermined.

149 The program is expected to end when goals can be met by other means not requiring artificial production.

Comments:

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

1.15 Watersheds targeted by program.

1 Salmon River, Columbia River

1.16 Indicate alternative actions considered for attaining program goals, and reasons why thos are not being proposed.

The hatchery program is a part of a strategy to meet conservation and/or harvest goals for the target stock. The tables below the short- and long-term goals are for the stock in terms of stock status (biological significance and viability), habitat and harv in the table indicate High, Medium, or Low levels for the respective attributes. Changes in these levels from current status inc outcomes for the hatchery program and other strategies (including habitat protection and restoration).

18

	Biological Significance	Viability	Habitat
Current Status	H	L	L
Short-term Goal	H	L	L
Long-term Goal	H	M	M

This table shows current status and goals for harvest opportunity. **H** implies harvest opportunity every year, **M** opportunity mo some years, and **N** no opportunity.

19
20
21
22
23

		Location of Fishery				
Fishery type		**Marine**	**L. Columbia**	**Zone 6**	**U. Columbia**	**Subba**
Commercial	**Current Status**	N	N	N	N	N
	Short-term Goal	N	N	N	N	N
	Long-term Goal	N	N	N	N	N
Ceremonial	**Current Status**	N	N	N	N	N
	Short-term Goal	N	N	N	N	N
	Long-term Goal	N	N	N	N	N
Subsistence	**Current Status**	N	N	N	N	N
	Short-term Goal	N	N	N	N	N
	Long-term Goal	N	N	N	N	N
Recreational	**Current Status**	N	N	N	N	N
	Short-term Goal	N	N	N	N	L
	Long-term Goal	N	N	N	N	M
Catch and Release	**Current Status**	N	N	N	N	N
	Short-term Goal	N	N	N	N	L
	Long-term Goal	N	N	N	N	M

Comments:

All references to unproductive habitat should be specific to hydro habitat as natal spawning and rearing habitat is not limiting
Edits per Paul Kline (IDFG), 10.22.03.
Edits per Paul Kline (IDFG), 10.22.03.
Edits per Paul Kline (IDFG), 10.22.03.
Edits per Paul Kline (IDFG), 10.22.03.
Edits per Paul Kline (IDFG), 10.22.03.

Data source:

Per Paul Kline (IDFG), 7.22.03.
Paul Kline
Paul Kline
Paul Kline
Paul Kline

Section 2: Program Effects on ESA-Listed Salmonid Populations

2.1 List all ESA permits or authorizations in hand for the hatchery program.

150 The program has the following permits or authorizations: Section 7 or Section 10 permit
.

Comments:

NOAA Fisheries Section 10 permit No. 1010

Data source:

Per Paul Kline IDFG 9/8/03

2.2.1 Descriptions, status and projected take actions and levels for ESA-listed natural populatic target area.

145 The program may incidentally affect Snake River basin steelhead, Snake River spring/summer chinook, and Columbia Intern trout.

15 nya

32 Listed stocks may be directly affected by nya.

The following ESA listed natural salmonid populations occur in the subbasin where the program fish are released:

ESA listed stock	Viability	Habitat
Summer Chinook (Johnson Creek)	L	L
Summer Chinook (McCall Hatchery)	H	L
Summer Chinook (Pahsimeroi)	L	L
Spring Chinook (Upper Salmon/Sawtooth)	U	L
Spring Chinook - Natural	H	L
Summer Chinook - Natural	H	L
Steelhead B-Natural	L	L
Redfish Lake Sockeye	L	L
Spring/Summer Chinook (W. Fork Yankee Fork- Salmon River)-Integrated	L	L
Spring/Summer Chinook (East Fork Salmon River)- Integrated	L	L
Lemhi River Spring_Summer Chinook	L	L

H, M and L refer to high, medium and low ratings, low implying critical and high healthy.

Comments:

null
nc
nc
All references to unproductive habitat should be specific to hydro habitat as natal spawning and rearing habitat is not limiting

Data source:

Per Paul Kline IDFG 9/8/03
nds
nds
nc

2.2.2 Status of ESA-listed salmonid population(s) affected by the program.

nya

Most recent available spawning escapement estimates are shown in the table below:

Summer Chinook (Johnson Creek)

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Summer Chinook (McCall Hatchery)

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Summer Chinook (Pahsimeroi)

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs

Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Spring Chinook (Upper Salmon/Sawtooth)

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	18	19
1996	nya	nya	nya	105	51
1997	nya	nya	nya	155	99
1998	nya	nya	nya	127	26
1999	nya	nya	nya	121	75
2000	nya	nya	nya	535	451
2001	nya	nya	nya	676	1,427

Spring Chinook - Natural

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya

1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Summer Chinook - Natural

Return Year	**Total Catch (all ages)**	**Natural Escapement**		**Hatchery Spawning**	
		NoRs	**HoRs**	**NoRs**	**HoRs**
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Steelhead B-Natural

Return Year	**Total Catch (all ages)**	**Natural Escapement**		**Hatchery Spawning**	
		NoRs	**HoRs**	**NoRs**	**HoRs**
Goal	unk	unk	unk	unk	unk
1990	unk	unk	unk	unk	unk
1991	unk	unk	unk	unk	unk
1992	unk	unk	unk	unk	unk
1993	unk	unk	unk	unk	unk
1994	unk	unk	unk	unk	unk

1995	unk	unk	unk	unk	unk
1996	unk	unk	unk	unk	unk
1997	unk	unk	unk	unk	unk
1998	unk	unk	unk	unk	unk
1999	unk	unk	unk	unk	unk
2000	unk	unk	unk	unk	unk
2001	unk	unk	unk	unk	unk

Redfish Lake Sockeye

Return Year	**Total Catch (all ages)**	**Natural Escapement**		**Hatchery Spawning**	
		NoRs	**HoRs**	**NoRs**	**HoRs**
Goal	nya	2000	nya	nya	600
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Spring/Summer Chinook (W. Fork Yankee Fork- Salmon River)- Integrated

Return Year	**Total Catch (all ages)**	**Natural Escapement**		**Hatchery Spawning**	
		NoRs	**HoRs**	**NoRs**	**HoRs**
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya

1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Spring/Summer Chinook (East Fork Salmon River)- Integrated

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Lemhi River Spring_Summer Chinook

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	NA	M	M	NA	NA
1990	M	M	M	NA	NA
1991	M	M	M	NA	NA
1992	M	M	M	NA	NA
1993	M	M	M	NA	NA
1994	M	M	M	NA	NA
1995	M	M	M	NA	NA
1996	M	M	M	NA	NA
1997	M	M	M	NA	NA
1998	M	M	M	NA	NA
1999	M	M	M	NA	NA
2000	M	M	M	NA	NA

2001	M	M	M	NA	NA

Comments:

nc
nc
This is a captive rearing program with a goal of collecting 250 eggs per stock per year. This programs releases maturing ad salmon for natural spawning.

Data source:

nds
nds
Per Paul Kline IDFG 9/8/03

2.2.3 Describe hatchery activities, including associated monitoring and evaluation and researcl programs, that may lead to the take of listed fish in the target area, and provide estimate levels of take.

Steelhead B (East Fork) - Integrated

152

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

153

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (Johnson Creek)

152

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya

Dates of activity	nya
Hatchery Program Operator	nya

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
153 **Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (McCall Hatchery)

ESU/Population	nya
Activity	nya
152 **Location of hatchery activity**	nya
Dates of activity	nya
Hatchery Program Operator	nya

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
153 **Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook (Rapid River) - Hatchery

152	**ESU/Population**	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

	Annual Take of Listed Fish by life Stage (number of fish)				
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (Pahsimeroi)

152	**ESU/Population**	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

	Annual Take of Listed Fish by life Stage (number of fish)				
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
153	**Capture, handle, and release (c)**	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya

Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook (Upper Salmon/Sawtooth)

ESU/Population nya

Activity nya

152 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program Operator nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook - Natural

ESU/Population nya

Activity nya

152 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program Operator nya

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya

153					
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook - Natural

152		
	ESU/Population	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

153		Annual Take of Listed Fish by life Stage (number of fish)			
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Run (Pahsimeroi)- Hatchery

152		
	ESU/Population	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**

153

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead B (Dworshak)-Hatchery

152

ESU/Population nya

Activity nya

Location of hatchery activity nya

Dates of activity nya

Hatchery Program Operator nya

Annual Take of Listed Fish by life Stage (number of fish)

153

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead B-Natural

152

ESU/Population nya

Activity nya

Location of hatchery activity nya

Dates of activity nya

Hatchery Program Operator nya

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
153 Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Natural

ESU/Population nya

Activity nya

152 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program Operator nya

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
153 Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Redfish Lake Sockeye

152

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

153

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Spring/Summer Chinook (W. Fork Yankee Fork- Salmon River)- Integrated

152

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

153

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya

Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Spring/Summer Chinook (East Fork Salmon River)- Integrated

ESU/Population	nya
Activity	nya
152 **Location of hatchery activity**	nya
Dates of activity	nya
Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
153 **Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Lemhi River Spring_Summer Chinook

ESU/Population	Lemhi River Spring/Summer Chinook, Salmon River
Activity	Broodstock Collection
152 **Location of hatchery activity**	Lemhi River, 522.303.416.049
Dates of activity	nya
Hatchery Program Operator	IDF&G

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya

153

Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	250	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Run (Sawtooth)- Hatchery

ESU/Population nya

Activity nya

152 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program Operator nya

153

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Comments:

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

Section 3: Relationship of Program to Other Management Objectives

3.1 Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hooc*

***Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the *NP* *Production Review* Report and Recommendations - NPPC document 99-15). Explain any | deviations from the plan or policies.**

Endangered Species Act: The Snake River spring/summer chinook salmon ESU was

listed as threatened under the Endangered Species Act on April 22, 1992 (correction printed on June 3, 1992). The ESU inc natural populations of spring/summer chinook salmon in the mainstem Snake River and any of the following subbasins: Tuc Grande Ronde River, Imnaha River, and Salmon River. The ESA requires that recovery plans be generated to guide efforts recovering and delisting of species.

Salmon Subbasin Summary: The depressed status of Snake River spring/summer chinook salmon is clearly described in S of the Northwest Power Planning Councils Salmon Subbasin Summary. Section 4.5.1 identifies the Captive Rearing Project River Chinook Salmon as one of two artificial production programs in place in the Salmon Subbasin addressing recovery gc the use of conservation hatchery practices. Program goals and objectives are also consistent with existing plans, policies ar presented in Section 5.1. of the Subbasin Summary as developed by Bonneville Power Administration (Section 5.1.1.a.), th Marine Fisheries Service (Section 5.1.1.b.), the Nez Perce Tribe (Section 5.1.2.a.), the Shoshone-Bannock Tribes (Section the Idaho Department of Fish and Game (Section 5.1.3.a.).

Existing federal goals, objectives and strategies identified in the Subbasin Summary (Section 5.2.) overlap significantly with objectives of the Captive Rearing Project for Salmon River Chinook Salmon. The "overarching" hatchery goal of the Basinw Recovery Strategy (Federal Caucus) is to reduce genetic, ecological, and management effects of artificial production on na populations. By selecting the captive rearing approach to hatchery intervention, this program is designed to minimize negati effects on natural populations. Specific Federal Caucus recommendations that overlap with Objective 1. of this program inc safety net programs on an interim basis to avoid extinction while other recovery actions take place; preserving the genetic l most at-risk populations; limiting the adverse effects of hatchery practices on ESA-listed populations; and using genetically broodstock to stabilize and/or bolster weak populations (Section 5.2.1.).

Bonneville Power Administration (Section 5.2.1.a.) presented basinwide objectives for implementing actions under the FCR Opinion and suggested that hatcheries can play a critical role in recovery of anadromous fish by "increasing the number of l appropriate naturally spawning adults; improving fish health and fitness; and improving hatchery facilities, operation, and m
155 and reducing potential harm to listed fish." Specific strategies developed by BPA include: reducing the potentially harmful ef hatcheries; using safety net programs on an interim basis to avoid extinction; and using hatcheries in a variety of ways to ai Objective 1. and 2. of the Captive Rearing Project for Salmon River Chinook Salmon overlap significantly with the goals, ob strategies developed by BPA. Chinook captive rearing program objectives and tasks specifically address the development c prudent broodstocks and the use of cryopreservation to archive key genetic resources and to keep unique identities availab future options. Objective 1., Task D. specifically address the production of adult chinook salmon for reintroduction to the hal practices reflect the regions best protocols and undergo constant review and modification through the CSCPTOC process.

The goal of NOAA Fisheries in the Salmon Subbasin (Section 5.2.1.b.) is to achieve the recovery of Snake River spring/sur chinook, sockeye and steelhead resources. Ultimately, NOAA Fisheries goal is the achievement of self-sustaining, harvesta salmon populations that no longer require the protection of the Endangered Species Act. Chinook captive rearing program g objectives are consistent with this language.

2000 Columbia River Basin Fish and Wildlife Program- The Captive Rearing Project for Salmon River Chinook Salmon con general vision of the Fish and Wildlife Program (Section III.A.1.) and its "overarching" objective to protect, mitigate and enha and wildlife of the Columbia River and its tributaries (Section III.C.1.). Specifically, the Primary Artificial Production Strategy and Wildlife Program (Section 4.) addresses the need to complement habitat improvements by supplementing native fish pc hatchery-produced fish with similar genetics and behavior to their wild counterpart. In addition, Section 4. includes language need to minimize the negative impacts of hatcheries in the recovery process. Chinook captive rearing program goals and ol aligned with this philosophy. Program methods receive constant review at CSCPTOC level and constantly strive to provide practices that meet Fish and Wildlife Program standards.

2000 FCRPS Biological Opinion- The Federal Columbia River Power System Biological Opinion includes Artificial Propagat (Section 9.6.4.) that address reforms to "reduce or eliminate adverse genetic, ecological, and management effects of artifici on natural production while retaining and enhancing the potential of hatcheries to contribute to basinwide objectives for con recovery." The Biological Opinion recognizes that artificial production measures have "proven effective in many cases at all term extinction risks." Many of the Actions to Reform Existing Hatcheries and Artificial Production Programs (Section 9.6.4.2 carried-out in the Captive Rearing Project for Salmon River Chinook Salmon. Specifically, Objective 1. and 2. of the chinook rearing program address reform measures dealing with: the management of genetic risk, the production of fish from locally stocks, the use of mating protocols designed to avoid genetic divergence from the biologically appropriate population, matc with habitat carrying capacity, and marking hatchery-produced fish to distinguish natural from hatchery fish. The Biological reviews the need for the development of NOAA Fisheries-approved Hatchery and Genetic Management Plans (HGMP). At writing, a draft is in its final stages of development.

Specific Actions in the Biological Opinion that demonstrate logical connections with the chinook captive rearing program are Section 9.6.4.3. Actions 170, 173, 174, 175, 177, 182, and 184 are all addressed by objectives identified in the Captive Rea Salmon River Chinook Salmon. Actions 170 and 173 call for the design and funding of capital modifications to implement re identified in HGMPs. Action 174 identifies the need for "additional sampling efforts and specific experiments to determine re distribution and timing of hatchery and natural spawners". This need is addressed in research conducted by the Captive Re for Salmon River Chinook Salmon under Objective 2. Actions 175 and 177 call for the development and funding of safety ne of at-risk salmon and steelhead. Target populations specifically addressed by the IDFG Captive Rearing Project for Salmon Salmon are specifically referenced in the Biological Opinion. Recommendations made in Action 182 are to fund studies "to reproductive success of hatchery fish relative to wild fish", and concerns over the genetic implications are expressed. The C Project for Salmon River Chinook Salmon is actively involved with research designed to address this question. Objective 2. rearing project includes research directed at determining the reproductive success of pre-spawn adults released for natural of captive-reared adults retained in the hatchery. In addition, the IDFG and NOAA Fisheries have initiated maturation physic to address questions related to reproductive timing and success. Action 184 states the need to provide funding for a "hatch monitoring, and evaluation program consisting of studies to determine whether hatchery reforms reduce the risk of extinctio River basin salmonids and whether conservation hatcheries contribute to recovery". The Captive Rearing Project for Salmo Chinook Salmon is making a clear attempt to provide the needed monitoring and evaluation of conservation hatchery techn behavioral patterns and spawning success in pre-spawn adults produced by the program.

Offices of the Governors. 2000. Recommendations of the governors of Idaho, Montana, Oregon and Washington for the pro restoration of fish in the Columbia River Basin. The Governors of the states of Idaho, Montana, Oregon and Washington ur recovery planners to recognize the multi-purpose aspect of hatcheries, which includes fish production for harvest, suppleme rebuild naturally spawning populations, and captive brood stock experiments for conservation and restoration. The Governo recommended, "all hatcheries in the Columbia River Basin be reviewed within three years to determine the facilities specifi potential future uses in support of fish recovery and harvest." They further recommended that the supplementation plan rec tribal, state and federal roles in implementation of the plan. Lastly, the Governors supported the concept of wild fish refuges these refuges as controls for evaluating conservation hatchery efforts.

Other Plans and Guidelines- Goals and objectives of the Captive Rearing Project for Salmon River Chinook Salmon are co several guidelines contained in the Review of Artificial Production of Anadromous and Resident Fish in the Columbia River (Scientific Review Team). Objective 1. and 2. of the chinook captive rearing program are actively following elements of Gui 5., 8., 10., 11., 12., 13., 14., and 15. of the Artificial Production Review. These guidelines address: the hatchery rearing env natural population parameters, habitat carrying capacity, genetic and breeding protocols, germ plasm repositories, and pop history knowledge. Performance standards and indicators presented in The final Artificial Production Review document pre of performance standards addressing both benefits and risks to populations. Many of these standards are addressed by sp captive rearing program objectives. These relationships will be identified in the final HGMP for chinook captive rearing prog activities.

Relationships described above are substantive in nature and address core guidelines, goals, objectives and strategies iden various planning documents. Techniques and products developed in the Captive Rearing Project for Salmon River Chinook critical components of the overall conceptual framework being developed in the region.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

3.2 List all existing cooperative agreements, memoranda of understanding, memoranda of ag or other management plans or court orders under which program operates.

	Document Title	T
	The Federal Endangered Species Act of 1973 - Section 10 Permit No. 1010	CC
156	The 2001-2006 Idaho Department of Fish and Game Fisheries Management Plan	MI
	Draft, NOAA Fisheries Salmon Recovery Plans (1995 and 1997)	ny
	Interim Productivity and Abundance Targets (NPPC document)	ny

Comments:

Data source:

Per Paul Kline IDFG 9/8/03

3.3 Relationship to harvest objectives.

157 There are no harvest objectives in the immediate future for this stock.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

3.4 Relationship to habitat protection and recovery strategies.

158 NOAA Fisheries has not developed a recovery plan specific to Snake River salmon, but this program is operated consistent Biological Opinions and subbasin planning efforts.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

3.5 Ecological interactions.

The following species co-occur to a significant degree with the program fish in either freshwater or early marine life stages.

159
- Steelhead
- Sockeye
- Chinook
- Bull Trout

Comments:

Data source:

Per Paul Kline IDFG 9/8/03

Section 4. Water Source

4.1 Provide a quantitative and narrative description of the water source (spring, well, surfac quality profile and natural limitations to production attributable to the water source.

The following statements describe the adult holding water source:

12
- The water source is pumped.
- The water source is pathogen-free.
- The water source is specific-pathogen free.
- The water source is fish free.
- The water source is accessible to anadromous fish.
- Water is available from multiple sources.
- The water used results in natural water temperature profiles that provide optimum maturation and gamete developn
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu temperature.
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu

ammonia, carbon dioxide, chlorine, pH, copper, dissolved oxygen, hydrogen sulfide, dissolved nitrogen, iron, and zi
- The water supply is protected by flow and/or pond level alarms at the holding pond(s).
- The water supply is protected by back-up power generation.
- Naturally produced fish do not have access to intake screens.
- Hatchery intake screening complies with Integrated Hatchery Operations Team (IHOT) and National Marine Fisheri facility guidelines.

The following statements describe the incubation water source:

- The water source is pumped.
- The water source is pathogen-free.
- The water source is specific-pathogen free.
- The water source is fish free.
- Water is available from multiple sources.
- 13 Water is from the natal stream for the cultured stock.
- The water used provides natural water temperature profiles that results in hatching/emergence timing similar to tha naturally produced stock.
- Incubation water can be heated or chilled to approximate natural water temperature profiles.
- The water supply is protected by flow alarms at the head box.
- The water supply is protected by flow and/or pond level alarms at the holding pond(s).
- The water supply is protected by back-up power generation
- Naturally produced fish do not have access to intake screens.

The following statements describe the rearing water source:

- The water source is pumped.
- The water source is pathogen-free.
- The water source is specific-pathogen free.
- The water source is fish free.
- The water source is accessible to anadromous fish.
- Water is available from multiple sources.
- The water used provides natural water temperature profiles that results in hatching/emergence timing similar to tha naturally produced stock.
- Rearing water has a chemical profile significantly different from natural stream conditions to provide adequate impri hatchery fish and minimize the attraction of naturally produced fish into the hatchery.
- 14 The hatchery operates to allow all migrating species of all ages to by-pass or pass through hatchery related structu
- Adequate flows are maintained to provide unimpeded passage of adults and juveniles in the by-pass reach created water withdrawals.
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu temperature.
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu ammonia, carbon dioxide, chlorine, pH, copper, dissolved oxygen, hydrogen sulfide, dissolved nitrogen, iron, and zi
- The water supply is protected by flow and/or pond level alarms at the holding pond(s)
- The water supply is protected by back-up power generation.
- Naturally produced fish do not have access to intake screens.
- Hatchery intake screening complies with Integrated Hatchery Operations Team (IHOT) and National Marine Fisheri facility guidelines.

Comments:

q. Does not apply, since the water source is from wells.

These answers apply to Eagle Hatchery, not NOAA Manchester or Burley Creek
r. Does not apply since water source is from wells.

These answers apply to Eagle Hatchery, not NOAA Manchester or Burley Creek
i. Answer is no for fingerling and smolt releases, but the answer to "i." is yes for adult releases. Hatchery reared fingerlings a larger than naturally reared fingerlings and smolts.

t. Does not apply since water source is from wells.

These answers apply to Eagle Hatchery, not NOAA Manchester or Burley Creek

Data source:

Updates per Paul Kline IDFG 10/22/03.
Updates per Paul Kline IDFG 10/22/03.
Updates per Paul Kline IDFG 10/22/03.

4.2 Indicate risk aversion measures that will be applied to minimize the likelihood for the ta listed natural fish as a result of hatchery water withdrawal, screening, or effluent discha

15 The facility operates within the limitations established in its National Pollution Discharge Elimination System (NPDES) perm production from this facility falls below the minimum production requirement for an NPDES permit, but the facility operates i with state or federal regulations for discharge and The facility does not have a discharge permit.

Comments:

These answers apply to Eagle Hatchery, not NOAA Manchester or Burley Creek

Eagle Hatchery follows guidelines set up in the NPDES permit, but is not required to monitor effluent based on the pounds (produced annually.

Data source:

Per Paul Kline IDFG 9/8/03

Section 5. Facilities

5.1 Broodstock collection facilities (or methods).

16 Brookstock for this program is collected:

- by methods described below. ** NO STATEMENT PROVIDED FOR THIS CHOICE **

188

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available F (gpm)
24	Fiberglass	230	10	10	2.3	60
2	Fiberglass	1,250	20	20	4	250
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya

Comments:

Captive populations for this project are sourced from the progeny of naturally spawning adults. Beginning with the first collecti continuing through 1998, parr were collected from the three source streams. Beginning in 1999, captive populations were sou eggs from natural redds using hydraulic equipment. Broodstock is collected by hydraulic redd pumping. Spawning takes place with the exception of operations to meet specific program objectives dealing with reproductive success.

Limited spawning for this program takes place at the IDFG Eagle Fish Hatchery.

Data source:

Per Paul Kline IDFG 10/22/03.
Aquafarms 2000 Inc. specifications manual Eagle Hatchery historical flow data Per Paul Kline IDFG 9/8/03

5.2 Fish transportation equipment (description of pen, tank, truck, or container used).

99 IHOT guidelines for transportation are followed.

187

Equipment Type	Capacity (gallons)	Supplemental Oxygen (y/n)	Temperature Control (y/n)	Normal Transit Time (minutes)	Chemical (s) Used	Do (p
Transport Tank	250	Y	nya	4-17 hours	None	nya
Transport Tank	2700	Y	nya	4-17 hours	None	nya

nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya

Comments:

Both 250 and 2700 gallon tanks are equipped with Fresh-flow aeration pumps.

Data source:

Per Paul Kline IDFG 9/8/03
From chinook BPA Hatchery Reports and 1010 Chinook NOAA Fisheries Reports. Per Paul Kline IDFG 9/8/03

5.3 Broodstock holding and spawning facilities.

Spawning for this program takes place:

16

** NO STATEMENT PROVIDED FOR THIS CHOICE **** NO STATEMENT PROVIDED FOR THIS CHOICE **

34 Integrated Hatchery Operations Team (IHOT) adult holding guidelines followed for adult holding , density , water quality , alar
predator control measures to provide the necessary security for the broodstock.

188

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available F (gpm)
24	Fiberglass	230	10	10	2.3	60
2	Fiberglass	1,250	20	20	4	250
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya

Comments:

Captive populations for this project are sourced from the progeny of naturally spawning adults. Beginning with the first collecti
continuing through 1998, parr were collected from the three source streams. Beginning in 1999, captive populations were sou
eggs from natural redds using hydraulic equipment. Broodstock is collected by hydraulic redd pumping. Spawning takes place
with the exception of operations to meet specific program objectives dealing with reproductive success.

Limited spawning for this program takes place at the IDFG Eagle Fish Hatchery.

Data source:

Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03
Aquafarms 2000 Inc. specifications manual Eagle Hatchery historical flow data Per Paul Kline IDFG 9/8/03

5.4 Incubation facilities.

189

Incubator Type	Units (number)	Flow (gpm)	Volume (cu.ft.)	Loading-Eyeing (eggs/unit)	Loading-Hatcl (eggs/unit
Upweller/downweller	256	.288	.62 gal	800	800
nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya

Comments:

Data source:

From Chinook BPA Hatchery Reports and 1010 Chinook NOAA Fisheries Reports. Per Paul Kline IDFG 9/8/03

5.5 Rearing facilities.

	Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Maximum Flow Index	Maxir Den: Ind
190	10	Fiberglass	4.3	2.17	2.17	.917	.8	1.34	.25
	66	Fiberglass	10.6	3.25	3.25	1.0	2	.8833	.1667
	8	Fiberglass	50	6.5	6.5	1.2	9.3	.5376	.1
	24	Fiberglass	228.9	10	10	2.3	42.8	.1903	.0357

Comments:

Data source:

Aquafarms 2000 Inc. specifications manual. Eagle Hatchery historical flow data. Per Paul Kline IDFG 9/8/03

5.6 Acclimation/release facilities.

	Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Maximum Flow Index	Maxir Den: Ind
190	10	Fiberglass	4.3	2.17	2.17	.917	.8	1.34	.25
	66	Fiberglass	10.6	3.25	3.25	1.0	2	.8833	.1667
	8	Fiberglass	50	6.5	6.5	1.2	9.3	.5376	.1
	24	Fiberglass	228.9	10	10	2.3	42.8	.1903	.0357

Comments:

Data source:

Aquafarms 2000 Inc. specifications manual. Eagle Hatchery historical flow data. Per Paul Kline IDFG 9/8/03

5.7 Describe operational difficulties or disasters that led to significant fish mortality.

160 No significant operational disasters have occured in this program.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

5.8 Indicate available back-up systems, and risk aversion measures that will be applied, tha the likelihood for the take of listed natural fish that may result from equipment failure, v flooding, disease transmission, or other events that could lead to injury or mortality.

70 Fish are reared in multiple facilities or with redundant systems to reduce the risk of catastrophic loss.

78 The facility is sited so as to minimize the risk of catastrophic fish loss from flooding.

79 Staff is notified of emergency situations at the facility.

80 The facility is continuously staffed to assure the security of fish stocks on-site.

Comments:

The hatchery has never been flooded.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

Section 6. Broodstock Origin and Identity

6.1 Source.

17 The broodstock chosen represents natural populations native or adapted to the watersheds in which hatchery fish will be re

Comments:

Data source:

Per Paul Kline IDFG 9/8/03

6.2.1 History.

183

Broodstock Source	Origin	Year(s) Used Begin	Year(s) Used End
Howling Creek Natural	nya	1980	1985
Silver Creek Hatchery	nya	1988	1990
Howling Creek Hatchery	nya	1986	1987
Howling Creek Hatchery	nya	1991	2001
nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya

Comments:

Data source:

Per Paul Kline IDFG 9/8/03

6.2.2 Annual size.

22 The program collects sufficient numbers of donors from the natural stock to minimize founder effects.

23

25

27 The program does NOT collect sufficient broodstock to maintain an effective population size of 1000 fish per generation.

28 More than 10% of the broodstock is derived from wild fish each year.

Comments:

Eggs are collected from approximately 50% of the redds.

The natural spawning population has an effective population size lower than 1000. While this is a desirable goal, the chinoc rearing program operates at a considerably lower effective population size level due to the extremely depressed nature of tl population. our primary tactic in managing genetic risk is to avoid cohort failure by supplementing fish from the captive prog fish are appropriately sourced form multiple wild families, genetic impacts from supplementation are expected to be minima 100% of the broodstock is derived from wild fish each year.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

6.2.3 Past and proposed level of natural fish in the broodstock.

33

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	NA	M	M	NA	NA
1990	M	M	M	NA	NA
1991	M	M	M	NA	NA
1992	M	M	M	NA	NA
1993	M	M	M	NA	NA
1994	M	M	M	NA	NA
1995	M	M	M	NA	NA
1996	M	M	M	NA	NA
1997	M	M	M	NA	NA
1998	M	M	M	NA	NA
1999	M	M	M	NA	NA
2000	M	M	M	NA	NA
2001	M	M	M	NA	NA

Comments:

This is a captive rearing program with a goal of collecting 250 eggs per stock per year. This programs releases maturing ad salmon for natural spawning.

Data source:

Paul Kline, 10.22.03.

6.2.4 Genetic or ecological differences.

19 The broodstock chosen displays morphological and life history traits similar to the natural population.

Comments:

Data source:

Per Paul Kline IDFG 9/8/03

6.2.5 Reasons for choosing.

18 dna

20

21 dna

Comments:

Selectio of stocks used in this program based on past hatchery intervention history, present wild/natural status, lack of curre intervention, and low to moderate viability.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.

6.3 Indicate risk aversion measures that will be applied to minimize the likelihood for advers or ecological effects to listed natural fish that may occur as a result of broodstock selecti practices.

The following procedures are in place that maintain broodstock collection within programmed levels:

161

nya

Comments:

The collection of eyed-eggs to source rearing groups is follows the experimental design of the program and is constantly re the CSPTOC process. Multiple redds (families) are sampled.

Data source:

Per Paul Kline IDFG 10/22/03.

Section 7. Broodstock Collection

7.1 Life-history stage to be collected (adults, eggs, or juveniles).

		Adults				
	Year	**Females**	**Males**	**Jacks**	**Eggs**	**Juveniles**
	Planned	nya	nya	nya	600	nya
	1990	nya	nya	nya	nya	nya
	1991	nya	nya	nya	nya	nya
	1992	nya	nya	nya	nya	nya
	1993	nya	nya	nya	nya	nya
191	**1994**	nya	nya	nya	nya	615
	1995	nya	nya	nya	nya	163
	1996	nya	nya	nya	nya	296
	1997	nya	nya	nya	nya	357
	1998	nya	nya	nya	304	605
	1999	nya	nya	nya	798	nya
	2000	nya	nya	nya	807	nya

2001	nya	nya	nya	583	nya

Comments:

2002 - 636 Eggs

Data source:

From Chinook BPA Hatchery Reports and 101 Chinook NOAA Fisheries Reports. Numbers combined from four stocks of chir
Note:these numbers represenbt eyed-eggs and juveniles collected for a captive rearing program. Per Paul Kline IDFG 9/8/03

7.2 Collection or sampling design

16

22 The program collects sufficient numbers of donors from the natural stock to minimize founder effects.

23

24 Representative samples of the population are NOT collected with respect to size, age, sex ratio, run and spawn timing, and important to long-term fitness.

25

27 The program does NOT collect sufficient broodstock to maintain an effective population size of 1000 fish per generation.

28 More than 10% of the broodstock is derived from wild fish each year.

Comments:

Eggs are collected from approximately 50% of the redds.

This program uses only eggs collected from the natural stock. Eggs are not collected from the hatchery component of the n spawning population.

A small sample (approximately 50 eggs out of 4000) are brought into the hatchery from multiple redds.

The natural spawning population has an effective population size lower than 1000. While this is a desirable goal, the chinoc rearing program operates at a considerably lower effective population size level due to the extremely depressed nature of tl population. our primary tactic in managing genetic risk is to avoid cohort failure by supplementing fish from the captive prog fish are appropriately sourced form multiple wild families, genetic impacts from supplementation are expected to be minima 100% of the broodstock is derived from wild fish each year.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

7.3 Identity.

100 Marking techniques are used to distinguish among hatchery population segments.

101 100% of the hatchery fish released are marked so that they can be distinguished from the natural population.

102 Marked fish can be identified using non-lethal means.

106 Wild fish make up >30% (greater than thirty percent) % of the broodstock for this program.

Comments:

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

7.4 Proposed number to be collected:

198 **7.4.1 Program goal (assuming 1:1 sex ratio for adults):**
nya

7.4.2 Broodstock collection levels for the last twelve years (e.g. 1990-2001), or for most recent years availab

	Adults				
Year	**Females**	**Males**	**Jacks**	**Eggs**	**Juvenile**
Planned	nya	nya	nya	600	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	615
1995	nya	nya	nya	nya	163
1996	nya	nya	nya	nya	296
1997	nya	nya	nya	nya	357
1998	nya	nya	nya	304	605
1999	nya	nya	nya	798	nya
2000	nya	nya	nya	807	nya
2001	nya	nya	nya	583	nya

191

Comments:

2002 - 636 Eggs

Data source:

From Chinook BPA Hatchery Reports and 101 Chinook NOAA Fisheries Reports. Numbers combined from four stocks of chir
Note:these numbers represenbt eyed-eggs and juveniles collected for a captive rearing program. Per Paul Kline IDFG 9/8/03

7.5 Disposition of hatchery-origin fish collected in surplus of broodstock needs.

The following procedures are in place that maintain broodstock collection within programmed levels:

161

nya

Comments:

The collection of eyed-eggs to source rearing groups is follows the experimental design of the program and is constantly re
the CSPTOC process. Multiple redds (families) are sampled.

Data source:

Per Paul Kline IDFG 10/22/03.

7.6 Fish transportation and holding methods.

Equipment Type	Capacity (gallons)	Supplemental Oxygen (y/n)	Temperature Control (y/n)	Normal Transit Time (minutes)	Chemical (s) Used	Dc (p

	Transport Tank	250	Y	nya	4-17 hours	None	nya
	Transport Tank	2700	Y	nya	4-17 hours	None	nya
187	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya

	Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available F (gpm)
188	24	Fiberglass	230	10	10	2.3	60
	2	Fiberglass	1,250	20	20	4	250
	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya

33 Broodstock is collected and held in a manner that results in less than 10% prespawning mortality.

99 IHOT guidelines for transport are followed for this program.

Comments:

Both 250 and 2700 gallon tanks are equipped with Fresh-flow aeration pumps.

The calculation should include capture and holding up to spawning.

Data source:

From chinook BPA Hatchery Reports and 1010 Chinook NOAA Fisheries Reports. Per Paul Kline IDFG 9/8/03
Aquafarms 2000 Inc. specifications manual Eagle Hatchery historical flow data Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

7.7 Describe fish health maintenance and sanitation procedures applied.

98 "Fish transfers into the subbasin are inspected and accompanied by notifications as described in IHOT and PNFHPC guide

32 Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection committee (PNFHPC), state or triba are followed for broodstock fish health inspection , transfer of eggs or adults and broodstock holding and disposal of carcas

Comments:

Guidelines are in place for adult transfers.

Data source:

Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03

7.8 Disposition of carcasses.

32 Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection committee (PNFHPC), state or triba are followed for broodstock fish health inspection , transfer of eggs or adults and broodstock holding and disposal of carcas

103 Hatchery adults are distributed by staff within the subbasin to provide hatchery adults are distributed (by staff) within the sul provide natural production.

The following procedures are in polace that maintain broodstock collection within programmed levels:

161

nya

Comments:

The collection of eyed-eggs to source rearing groups is follows the experimental design of the program and is constantly re
the CSPTOC process. Multiple redds (families) are sampled.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.

7.9 Indicate risk aversion measures that will be applied to minimize the likelihood for advers or ecological effects to listed natural fish resulting from the broodstock collection progra

29 The program has guidelines for acceptable contribution of hatchery fish to natural spawning.

30 These guidelines are met for all affected natural stocks.

32 Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection committee (PNFHPC), state or triba are followed for broodstock fish health inspection , transfer of eggs or adults and broodstock holding and disposal of carcas

Comments:

Annual project reports submitted to BPA and NOZZ Fisheries to meet contract and permit obligations.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

Section 8. Mating

8.1 Selection method.

35

39 Fish are allowed to select their own mates and go through all normal spawning behavior.

Comments:

Captive-reared adults produced in this program are primarily released to the habitat to naturally spawn. However, to develo understanding of the reproductive potential of captive-reared adult chinook salmon (e.g., maturation timing, gamete quality, eyed stage of development), some in-hatchery spawning occurs. Information developed in this manner is used to complime observations and reproductive success data collected in the field following the release of maturing adult chinook salmon.

Hatchery spawning follows accepted, standard practices. In addition, input on the development of spawning designs is prov University of Idaho and discussed at the CSCPTOC level. Dissimilarity spawning matrices may be developed by the Univer using results from genetic analyses. Eggs produced at spawning are divided into sub-lots (by female) and fertilized with milt program males. Up to four sub-families may be produced from each female (factorial design). Unique males are used an ap number of times to balance their contribution to the spawning design. Milt is pre-harvested from contributing males and exa motility prior to use. Eggs are incubated by sub-family to yield lineage-specific rearing groups. Overall egg quality is judged egg size, clarity of ovarian fluid, and presence/absence of polarized or overripe eggs. Fecundities are developed by applyin weights to the total egg weight for each female. Egg survival to the eyed stage off development is determined by subtractin unfertilized eggs from the total estimated number of eggs for each female.
Spawning of captively reared fish takes place in the wild.

Some hatchery spawning occurs to document specific spawning variables and reproductive potential.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.

8.2 Males.

38 Precocious males are used as a set percentage or in proportion to their contribution to the adult run.

37 Back-up males are not used in the spawning protocol.

Comments:

Spawning of captively reared fish takes place in the wild.

Spawning of captively reared fish takes place in the wild. Some hatchery spawning occurs to document specific spawning v reproductive potential.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.

8.3 Fertilization.

36 Gametes are NOT pooled prior to fertilization.

39 Fish are allowed to select their own mates and go through all normal spawning behavior.

11 IHOT PNFHPC state federal other guidelines are followed for culture practices for this program.

40 Disinfection procedures that prevent pathogen transmission between stocks of fish are implemented during spawning.

Comments:

Spawning of captively reared fish takes place in the wild.

Spawning of captively reared fish takes place in the wild.

Some hatchery spawning occurs to document specific spawning variables and reproductive potential.

Other = Chinook Salmon Captive Propagation Technical Oversight Committee. A team of technical experts representing the agencies and tribes involved with the program in addition to invited experts. The CSCPTOC meets periodically to review pro activities, address critical uncertainties, and to adaptively manage future activities.

Spawning of captively reared fish takes place in the wild.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

8.4 Cryopreserved gametes.

162 Cryopreserved gametes are used.

Comments:

Milt has been cryopreserved in the captive rearing program since 1997 and follows accepted protocols. Cryopreserved milt selectively incorporated (based on spawning matrices developed cooperatively with the University of Idaho) in spawning ev

Data source:

Per Paul Kline IDFG 9/8/03

8.5 Indicate risk aversion measures that will be applied to minimize the likelihood for advers or ecological effects to listed natural fish resulting from the mating scheme.

35 dna

36 Gametes are NOT pooled prior to fertilization.

37 Back-up males are not used in the spawning protocol.

38 Precocious males are used as a set percentage or in proportion to their contribution to the adult run.

39 Fish are allowed to select their own mates and go through all normal spawning behavior.

Comments:

Captive-reared adults produced in this program are primarily released to the habitat to naturally spawn. However, to develo understanding of the reproductive potential of captive-reared adult chinook salmon (e.g., maturation timing, gamete quality, eyed stage of development), some in-hatchery spawning occurs. Information developed in this manner is used to complime observations and reproductive success data collected in the field following the release of maturing adult chinook salmon.

Hatchery spawning follows accepted, standard practices. In addition, input on the development of spawning designs is prov University of Idaho and discussed at the CSCPTOC level. Dissimilarity spawning matrices may be developed by the Univer using results from genetic analyses. Eggs produced at spawning are divided into sub-lots (by female) and fertilized with milt program males. Up to four sub-families may be produced from each female (factorial design). Unique males are used an ap number of times to balance their contribution to the spawning design. Milt is pre-harvested from contributing males and exa motility prior to use. Eggs are incubated by sub-family to yield lineage-specific rearing groups. Overall egg quality is judged egg size, clarity of ovarian fluid, and presence/absence of polarized or overripe eggs. Fecundities are developed by applyin weights to the total egg weight for each female. Egg survival to the eyed stage off development is determined by subtractin unfertilized eggs from the total estimated number of eggs for each female.
Spawning of captively reared fish takes place in the wild.

Spawning of captively reared fish takes place in the wild. Some hatchery spawning occurs to document specific spawning v reproductive potential.
Spawning of captively reared fish takes place in the wild.

Spawning of captively reared fish takes place in the wild.

Some hatchery spawning occurs to document specific spawning variables and reproductive potential.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.

Section 9. Incubation and Rearing.

9.1.1 Number of eggs taken and survival rates to eye-up and/or ponding.

	Year	Egg Take	Green-Eyed Survival (%)	Eyed-Ponding Survival (%)	Egg Survival Performance Std.	Fry-fingerling Survival (%)	Rearing Survival Performance Std.	Finger Smo Surviva
	1990	nya	nya	nya	nya	nya	nya	nya
	1991	nya	nya	nya	nya	nya	nya	nya
	1992	nya	nya	nya	nya	nya	nya	nya
	1993	nya	nya	nya	nya	nya	nya	nya
192	**1994**	nya	nya	nya	nya	nya	nya	78.49
	1995	nya	nya	nya	nya	nya	nya	92.47
	1996	nya	nya	nya	nya	nya	nya	84.91
	1997	nya	nya	nya	nya	nya	nya	94.03
	1998	44,414	72.47	84.87	nya	97.45	nya	96.91
	1999	4,631	78.73	94.11	nya	95.34	nya	96.93
	2000	1,323	95.69	96.50	nya	95.1	nya	96.7
	2001	21,500	37.9	96.91	nya	95.93	nya	U

Comments:

2002:

Egg Take-72,203

Green-Eyed Survival(%) - 66.45

Eyed-Ponding Survival(%) - 94.50

Fry-Fingerling Survival (%) - U

Fingerling-Smolt Survival (%) - U

Data source:

Project annual reports to Bonneville Power Administration. Project annual reports to NOAA Fisheries for ESA Section 10 acti
First two columns represent hatchery production (All eyed-eggs returned to natal streams). The remaning columns represent
eyed-eggs and parr collected from the field and reared in captivity. Per Paul Kline IDFG 9/8/03

9.1.2 Cause for, and disposition of surplus egg takes.

163 Extra eggs are not intentionally produced in this program.

45

48 Families are incubated individually.

59 No culling of juveniles occur.

60

61

44 0 (eggs are never culled)

Comments:

Eggs are not routinely culled.

Juveniles are not culled.
Rearing groups for this program are sourced as eyed-eggs from redds built by wild chinook salmon. An approximately equa
eyed-eggs (~50) are removed from up six redds. As such, family size is equalized at collection.

Data source:

Per Paul Kline IDFG 11/18/03.
Per Paul Kline IDFG 9/8/03

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

9.1.3 Loading densities applied during incubation.

51 Integrated Hatchery Operations Team (IHOT) species-specific incubation recommendations were followed for water quality temperature and incubator capacities.

47 Families within spawning groups are NOT mixed randomly at ponding, thus unintentional rearing differences may affect fam differently.

42 Eggs are incubated under conditions that result in equal survival of all segments of the population to ponding.

Comments:

Chinook captive rearing program uses isolation buckets to incubate small numbers of family-specific eggs. No substrate is ı Each family is ponded and reared separately until PIT tagging to allow identification of family groups.

Eggs in the hatchery are incubated under these conditions. Those from the captively reared fish spawning in the wild are nc

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

9.1.4 Incubation conditions.

49 Incubation takes place in home stream water.

50 The program uses water sources that result in hatching/emergence timing similar to that of the naturally produced populatic

51 Integrated Hatchery Operations Team (IHOT) species-specific incubation recommendations were followed for water quality temperature and incubator capacities.

53 Eggs are monitored when needed to determine fertilization efficiency and embryonic development.

42 Eggs are incubated under conditions that result in equal survival of all segments of the population to ponding.

47 Families within spawning groups are NOT mixed randomly at ponding, thus unintentional rearing differences may affect fam differently.

48 Families are incubated individually.

43 Incubation conditions are manipulated as to synchronize ponding of fry.

Comments:

Captive adults are released to spawn naturally. Production from these adults hatch and rear on home stream water. For eg from wild redds and brought into the hatchery to source rearing groups, incubation occurs through the eyed stage of develo wild and in the hatchery from eye through hatch.

Chinook captive rearing program uses isolation buckets to incubate small numbers of family-specific eggs. No substrate is ı Fertilization efficiency in the hatchery is not monitored until the eyed stage. Fertilization efficiency of the captively reared fis the wild is also monitored.

Using hydraulic sampling methods, a subsample of redds (produced by captive-reared adults released to spawn naturally) a verify that eggs were successfully desposited and fertilized.
nc
Each family is ponded and reared separately until PIT tagging to allow identification of family groups.

Eggs and alevin in the hatchery are incubated under these conditions. Those from the captively reared fish spawning in the

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

9.1.5 Ponding.

The procedures used for determining when fry are ponded include:

55

- Fry are ponded based on visual inspection of the amount of yolk remaining

46 Eggs are NOT incubated in a manner that allows volitional ponding of fry.

Comments:

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

9.1.6 Fish health maintenance and monitoring.

52 Disinfection procedures are implemented during incubation that prevent pathogen transmission between stocks of fish on s

53 Eggs are monitored when needed to determine fertilization efficiency and embryonic development.

54 Following eye-up stage, eggs are inventoried, and dead or undeveloped eggs removed and disposed of as described in the control guidelines.

56 Dead or culled eggs are discarded in a manner that prevents transmission to receiving watershed.

Comments:

Section 10 permit and CSCPTOC guidelines.

Fertilization efficiency in the hatchery is not monitored until the eyed stage. Fertilization efficiency of the captively reared fis the wild is also monitored.

Using hydraulic sampling methods, a subsample of redds (produced by captive-reared adults released to spawn naturally) a verify that eggs were successfully desposited and fertilized.

Eggs are disinfected and discarded in a landfill.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

9.1.7 Indicate risk aversion measures that will be applied to minimize the likelihood for advers and ecological effects to listed fish during incubation.

47 Families within spawning groups are NOT mixed randomly at ponding, thus unintentional rearing differences may affect fam differently.

49 Incubation takes place in home stream water.

50 The program uses water sources that result in hatching/emergence timing similar to that of the naturally produced populatic

51 Integrated Hatchery Operations Team (IHOT) species-specific incubation recommendations were followed for water quality

temperature and incubator capacities.

52 Disinfection procedures are implemented during incubation that prevent pathogen transmission between stocks of fish on s

56 Dead or culled eggs are discarded in a manner that prevents transmission to receiving watershed.

61 Families are NOT culled to minimize family size variation.

Comments:

Each family is ponded and reared separately until PIT tagging to allow identification of family groups.

Captive adults are released to spawn naturally. Production from these adults hatch and rear on home stream water. For eg from wild redds and brought into the hatchery to source rearing groups, incubation occurs through the eyed stage of develo wild and in the hatchery from eye through hatch.

Chinook captive rearing program uses isolation buckets to incubate small numbers of family-specific eggs. No substrate is Section 10 permit and CSCPTOC guidelines.

Eggs are disinfected and discarded in a landfill.

Rearing groups for this program are sourced as eyed-eggs from redds built by wild chinook salmon. An approximately equa eyed-eggs (~50) are removed from up six redds. As such, family size is equalized at collection.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

9.2.1 Provide survival rate data (*average program performance*) by hatchery life stage (fry to f fingerling to smolt) for the most recent twelve years (1990-2001), or for years dependab are available.

	Year	Egg Take	Green-Eyed Survival (%)	Eyed-Ponding Survival (%)	Egg Survival Performance Std.	Fry-fingerling Survival (%)	Rearing Survival Performance Std.	Finger Smo Surviva
	1990	nya	nya	nya	nya	nya	nya	nya
	1991	nya	nya	nya	nya	nya	nya	nya
	1992	nya	nya	nya	nya	nya	nya	nya
	1993	nya	nya	nya	nya	nya	nya	nya
192	**1994**	nya	nya	nya	nya	nya	nya	78.49
	1995	nya	nya	nya	nya	nya	nya	92.47
	1996	nya	nya	nya	nya	nya	nya	84.91
	1997	nya	nya	nya	nya	nya	nya	94.03
	1998	44,414	72.47	84.87	nya	97.45	nya	96.91
	1999	4,631	78.73	94.11	nya	95.34	nya	96.93
	2000	1,323	95.69	96.50	nya	95.1	nya	96.7
	2001	21,500	37.9	96.91	nya	95.93	nya	U

Comments:

2002:

Egg Take-72,203

Green-Eyed Survival(%) - 66.45

Eyed-Ponding Survival(%) - 94.50

Fry-Fingerling Survival (%) - U

Fingerling-Smolt Survival (%) - U

Data source:

Project annual reports to Bonneville Power Administration. Project annual reports to NOAA Fisheries for ESA Section 10 acti
First two columns represent hatchery production (All eyed-eggs returned to natal streams). The remaning columns represent
eyed-eggs and parr collected from the field and reared in captivity. Per Paul Kline IDFG 9/8/03

9.2.2 Density and loading criteria (goals and actual levels).

71 The juvenile rearing density and loading guidelines used at the facility are based on: other criteria .

72 IHOT standards are followed for: water quality , alarm systems , predator control measures to provide the necessary securi
cultured stock , loading and density.

Comments:

Loading and density is based on Chinook Salmon Captive Propagation Technical Oversight Committee (CSCPTOC) guidel

Program uses more conservative loading and density criteria than IHOT.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

9.2.3 Fish rearing conditions.

66 The program uses a diet and growth regime that mimics natural seasonal growth patterns.

67 Settleable solids, unused feed and feces are removed periodically to ensure proper cleanliness of rearing containers.

72 IHOT standards are followed for: water quality , alarm systems , predator control measures to provide the necessary securi
cultured stock , loading and density.

71 The juvenile rearing density and loading guidelines used at the facility are based on other criteria .

Comments:

The program uses diets specifically designed for captive broodstock efforts. One manufacturer (Bio-Oregon) develops a sp
is designed to provide a more natural protein source than traditional diets (krill v. fish meal). Feeding schedules are develop
precocity in full-term captive broodstocks while providing for optimal growth.

Fish rear through the smolt stage of development at the IDFG Eagle Fish Hatchery. Water temperature and diet ration are u
modulate growth to minimize precocial development at age-two. At smoltification, fish are transferred to the NOAA Fisheries
Marine Experiment Station where they rear through maturation. Diet ration and water protocols are balanced to produce fisl
program objectives.

Program uses more conservative loading and density criteria than IHOT.

Loading and density is based on Chinook Salmon Captive Propagation Technical Oversight Committee (CSCPTOC) guidel

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

9.2.4 Indicate biweekly or monthly fish growth information (average program performance), ir length, weight, and condition factor data collected during rearing, if available.

	Rearing Period	Length (mm)	Weight (fpp)	Condition Factor	Growth Rate	Hepatosomatic Index	Boc Moist Cont
	January	54.687	1.140	NA	1	NA	NA
	February	55.139	1.173	NA	7	NA	NA
	March	62.737	1.834	NA	10	NA	NA
	April	72.451	3.019	NA	9	NA	NA
	May	81.565	4.550	NA	10	NA	NA
194	June	91.773	6.844	NA	12	NA	NA
	July	103.6	10.414	NA	10	NA	NA
	August	113.9	14.458	NA	13	NA	NA
	September	126.82	20.974	NA	9	NA	NA
	October	135.01	26.044	NA	10	NA	NA
	November	144.922	37.412	NA	6	NA	NA
	December	150.673	43.710	NA	9	NA	NA

Comments:

Data source:

Project annual reports to Bonnefillt Power Administration. Project annual reports to NOAA Fisheries for ESA Section 10 activ sample count data from Eagle Hatchery. Condition factor can not be determined since all length measurements represent "F Per Paul Kline IDFG 9/8/03.

9.2.5 Indicate monthly fish growth rate and energy reserve data (*average program performanc* available.

64
- Feeding rates are followed so that fish size is within 10% of program goal each year.
- Feed is stored under proper conditions as described by IHOT guidelines.

65 The correct amount and type of food is provided to achieve the desired growth rate , body composition and condition factorsf and life stages being reared.

	Rearing Period	Length (mm)	Weight (fpp)	Condition Factor	Growth Rate	Hepatosomatic Index	Boc Moist Cont
	January	54.687	1.140	NA	1	NA	NA
	February	55.139	1.173	NA	7	NA	NA
	March	62.737	1.834	NA	10	NA	NA
	April	72.451	3.019	NA	9	NA	NA
194	May	81.565	4.550	NA	10	NA	NA
	June	91.773	6.844	NA	12	NA	NA
	July	103.6	10.414	NA	10	NA	NA
	August	113.9	14.458	NA	13	NA	NA
	September	126.82	20.974	NA	9	NA	NA
	October	135.01	26.044	NA	10	NA	NA
	November	144.922	37.412	NA	6	NA	NA
	December	150.673	43.710	NA	9	NA	NA

66 The program uses a diet and growth regime that mimics natural seasonal growth patterns.

Comments:

The program uses diets specifically designed for captive broodstock efforts. One manufacturer (Bio-Oregon) develops a spec
designed to provide a more natural protein source than traditional diets (krill v. fish meal). Feeding schedules are developed
precocity in full-term captive broodstocks while providing for optimal growth.

Fish rear through the smolt stage of development at the IDFG Eagle Fish Hatchery. Water temperature and diet ration are us
modulate growth to minimize precocial development at age-two. At smoltification, fish are transferred to the NOAA Fisheries
Marine Experiment Station where they rear through maturation. Diet ration and water protocols are balanced to produce fish
program objectives.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Project annual reports to Bonnefillt Power Administration. Project annual reports to NOAA Fisheries for ESA Section 10 activ
sample count data from Eagle Hatchery. Condition factor can not be determined since all length measurements represent "F
Per Paul Kline IDFG 9/8/03.
Per Paul Kline IDFG 9/8/03

9.2.6 Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*averag performance*).

64
- Feeding rates are followed so that fish size is within 10% of program goal each year.
- Feed is stored under proper conditions as described by IHOT guidelines.

65 The correct amount and type of food is provided to achieve the desired growth rate , body composition and condition factorsf
and life stages being reared.

195

Rearing Period	Food Type	Application Schedule (#feedings/day)	Feeding Rate Range (% B.W./day)	Lbs. Fed Per gpm of Inflow	Food Conversi During Perioc
Swim-up to	Starter	8	2.8	0.005	1.0
1.0 to 1.3 g/f	1.0	4	2.16	0.0076	1.1
1.3 to 2.2 g/f	1.3	4	2.08	0.0073	1.2
2.2 to 4.0 g/f	1.5	4	1.92	0.0101	1.2
4.0 to 7.5 g/f	2.0	4	1.76	0.0078	1.2
7.5-12.0 g/f	2.5	4	1.68	0.0137	1.3

Comments:

Rearing Food Application Feeding Lbs.fedper Food

Period Type Schedule Rate Range gpm of inflow Conversion

12-25 g/f 3.0 4 1.56 0.0206 1.3

25-70 g/f 4.0 4 1.36 0.012 1.3

70-500 g/f 5.0 4 0.88 0.0233 1.4

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
BioOregon feed recommendations followed for feed size and percent Body Weight per day. Food conversion and pounds fec
based on historical hatchery data. Per Paul Kline IDFG 9/8/03.

9.2.7 Fish health monitoring, disease treatment, and sanitation procedures.

62 IHOT fish health guidelines are followed to prevent transmission between lots of fish on site or transmission or amplification the watershed.

63 Whenever possible, vaccines are used to minimize the use of antimicrobial compounds.

71 The juvenile rearing density and loading guidelines used at the facility are based on other criteria .

Comments:

Loading and density is based on Chinook Salmon Captive Propagation Technical Oversight Committee (CSCPTOC) guidel

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

9.2.8 Smolt development indices (e.g. gill ATPase activity), if applicable.

87 The migratory state of the release population is determined by dna.

Comments:

Smolts are not relased by this program. Production occurs from captive-reared adults released to spawn naturally. This not questions 88 through 96 as well.

Data source:

Per Paul Kline IDFG 9/8/03

9.2.9 Indicate the use of "natural" rearing methods as applied in the program.

68 The program attempts to better mimic the natural rearing environment by reducing rearing density below agency or other gu rearing under natural water temperature and actively simulating photoperiod .

69 Fish produced are qualitatively similar to natural fish in morphology , behavior , physiological status , health and other chara

66 The program uses a diet and growth regime that mimics natural, seasonal growth patterns.

84 Fish are released at sizes similar to natural fish of the same life stage and species.

88

Comments:

Fish are reared with 70% of the ponds covered with shade cloth, but this is not meant to simulate natural cover.

69g. Every effort is made to not accelerate growth and to produce fish that are similar to natural fish in every respect.

The program uses diets specifically designed for captive broodstock efforts. One manufacturer (Bio-Oregon) develops a sp is designed to provide a more natural protein source than traditional diets (krill v. fish meal). Feeding schedules are develop precocity in full-term captive broodstocks while providing for optimal growth.

Fish rear through the smolt stage of development at the IDFG Eagle Fish Hatchery. Water temperature and diet ration are u modulate growth to minimize precocial development at age-two. At smoltification, fish are transferred to the NOAA Fisheries Marine Experiment Station where they rear through maturation. Diet ration and water protocols are balanced to produce fisl program objectives.
Adults released are generally smaller than naturally produced fish.

Eyed-egg, pre-smolt, smolt, and pre-spawn adults are released.
This is an adult supplementation program. The question applies to juveniles.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

9.2.10 Indicate risk aversion measures that will be applied to minimize the likelihood for advers and ecological effects to listed fish under propagation.

60 dna

72 IHOT standards are followed for: water quality , alarm systems , predator control measures to provide the necessary securi cultured stock , loading and density.

80 The facility is continuously staffed to assure the security of fish stocks on-site.

84 Fish are released at sizes similar to natural fish of the same life stage and species.

88

98 "Fish transfers into the subbasin are inspected and accompanied by notifications as described in IHOT and PNFHPC guide

76 Fish inventory data accurately reflect rearing vessel population abundance with 10%.

86

96 Fish are NOT released in the same subbasin as the rearing facility.

Comments:

Juveniles are not culled.
Program uses more conservative loading and density criteria than IHOT.

Adults released are generally smaller than naturally produced fish.

Eyed-egg, pre-smolt, smolt, and pre-spawn adults are released.
This is an adult supplementation program. The question applies to juveniles.

Guidelines are in place for adult transfers.
Sample counts are conducted monthly. In addition, fish are completely inventoried at ponding and when split to larger conta mortality is documented and subtrated from the running inventory.

This is an adult supplementation program. Out-migration does not apply.

Data source:

Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

Section 10. Release

10.1 Proposed fish release levels.

	Age Class	Maximum Number	Size (ffp)	Release Date	Stream	Location: Release Point (RKm)	Location: Major Watershed	Location: Ecopro
1	**Eggs**	50,000	2700	November	Lemhi River	522.303.416.049	Salmon River	Mountai Snake
	Unfed Fry	nya	nya	nya	nya	nya	nya	nya
	Fry	nya	nya	nya	nya	nya	nya	nya
	Fingerling	nya	nya	nya	nya	nya	nya	nya
	Yearling	nya	nya	nya	nya	nya	nya	nya

Comments:

Adult Release: Release

Max. Number Size Date Stream Release Point Watershed

200 3-10 August Lemhi River 522.303.416.049 Salmon R.

lbs/fish

Data source:

Per Paul Kline IDFG 9/8/2003 Note for above table: To develop an understanding of the reproductive potential of captive-rea chinook salmon, the Chinook Salmon Captive Propagation Technical Oversight Committee (CSCPTOC) recommended that s place at the Eagle Fish Hatchery to investigate several reproduction variables (e.g., maturation timing, gamete quality, egg su stage of development. Information developed in this manner is used to compliment behavioral observations and reproductive collected in the field following the release of maturing adult chinook salmon. Eggs produced from hatchery spawning events h used to supplement captive rearing groups or returned to hatch boxes in target streams. Milt has been cryopreserved in the c program since 1997.

10.2 Specific location(s) of proposed release(s).

	Age Class	Maximum Number	Size (ffp)	Release Date	Stream	Location: Release Point (RKm)	Location: Major Watershed	Location: Ecopro
1	**Eggs**	50,000	2700	November	Lemhi River	522.303.416.049	Salmon River	Mountai Snake
	Unfed Fry	nya	nya	nya	nya	nya	nya	nya
	Fry	nya	nya	nya	nya	nya	nya	nya
	Fingerling	nya	nya	nya	nya	nya	nya	nya
	Yearling	nya	nya	nya	nya	nya	nya	nya

96 Fish are NOT released in the same subbasin as the rearing facility.

Comments:

Adult Release: Release

Max. Number Size Date Stream Release Point Watershed

200 3-10 August Lemhi River 522.303.416.049 Salmon R.

lbs/fish

Data source:

Per Paul Kline IDFG 9/8/2003 Note for above table: To develop an understanding of the reproductive potential of captive-rea chinook salmon, the Chinook Salmon Captive Propagation Technical Oversight Committee (CSCPTOC) recommended that s place at the Eagle Fish Hatchery to investigate several reproduction variables (e.g., maturation timing, gamete quality, egg su stage of development. Information developed in this manner is used to compliment behavioral observations and reproductive collected in the field following the release of maturing adult chinook salmon. Eggs produced from hatchery spawning events h used to supplement captive rearing groups or returned to hatch boxes in target streams. Milt has been cryopreserved in the c program since 1997.
Per Paul Kline IDFG 9/8/03

10.3 Actual numbers and sizes of fish released by age class through the program.

>

		Eggs/Unfed Fry Release			Fry Release			Fingerling Release			Yearling	
	Release Year	**Number**	**Date (MM/DD)**	**Avg Size (fpp)**	**Number**	**Date (MM/DD)**	**Avg size (fpp)**	**Number**	**Date (MM/DD)**	**Avg Size (fpp)**	**Number**	**D (MM**
	1991	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya
	1992	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya
	1993	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya
	1994	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya
196	**1995**	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya
	1996	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya
	1997	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya
	1998	30,054	11/98	nya	nya	nya	nya	nya	nya	nya	nya	nya
	1999	3,335	10/99	nya	nya	nya	nya	nya	nya	nya	nya	nya
	2000	1,266	11/00	nya	nya	nya	nya	nya	nya	nya	nya	nya
	2001	8,154	11/01	nya	nya	nya	nya	nya	nya	nya	nya	nya
	2002	47,977	10/00	nya	nya	nya	nya	nya	nya	nya	219	4/02
	Avg	18,156	Nov.	nya	nya	nya	nya	nya	nya	nya	219	April

Comments:

Adult Release (all streams combined).

Year Number Date(MM/DD) Avg Size (fpp)

1997 9 8/97 1.0

1998 112 8/98 n/a

1999 69 8/99 n/a

2000 72 7/00 n/a

2001 89 8/01 n/a

2002 347 8/02 .35

Average 116 August .35

Average from Initial year release through 2002. Includes all chinook releases into the WFYF, EFSR and Lemhi River.

(Yearling=Smolt)

Data source:

Per Paul Kline IDFG 10/22/03.

10.4 Actual dates of release and description of release protocols.

84 Fish are released at sizes similar to natural fish of the same life stage and species.

85

86

88

89

90

91

92 The carrying capacity of the subbasin has been taken into consideration in sizing this program.

87 The migratory state of the release population is determined by dna.

Comments:

This is an adult supplementation program. Out-migration does not apply.
No harvest of wild/natural chinook salmon occurs. Progeny produced from captive adults released to nautrally spawn are n clipped and appear as wild/natural fish.
Adults released are generally smaller than naturally produced fish.

Eyed-egg, pre-smolt, smolt, and pre-spawn adults are released.
This is an adult supplementation program. The question applies to juveniles.

This is an adult supplementation program. The question applies to juveniles.

This is an adult supplementation program. The question applies to juveniles.

This is an adult supplementation program. The question applies to juveniles.

This is an adult supplementation program. The question applies to juveniles.

Smolts are not relased by this program. Production occurs from captive-reared adults released to spawn naturally. This not questions 88 through 96 as well.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

10.5 Fish transportation procedures, if applicable.

96 Fish are NOT released in the same subbasin as the rearing facility.

Equipment Type	Capacity (gallons)	Supplemental Oxygen (y/n)	Temperature Control (y/n)	Normal Transit Time (minutes)	Chemical (s) Used	Dc (I

	Transport Tank	250	Y	nya	4-17 hours	None	nya
	Transport Tank	2700	Y	nya	4-17 hours	None	nya
187	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya

Comments:

Both 250 and 2700 gallon tanks are equipped with Fresh-flow aeration pumps.

Data source:

Per Paul Kline IDFG 9/8/03
From chinook BPA Hatchery Reports and 1010 Chinook NOAA Fisheries Reports. Per Paul Kline IDFG 9/8/03

10.6 Acclimation procedures (*methods applied and length of time*).

166 Maturaing, adult chinook salmon are released to natal streams for natural sparning. Adequate water temperature acclimatic to release. Adults are typically released in late July and early August. Adults typically spawn in September.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

10.7 Marks applied, and proportions of the total hatchery population marked, to identify hatcl adults.

100 Marking techniques are used to distinguish among hatchery population segments.

101 100% of the hatchery fish released are marked so that they can be distinguished from the natural population.

102 Marked fish can be identified using non-lethal means.

Comments:

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

10.8 Disposition plans for fish identified at the time of release as surplus to programmed or a levels

167 Surplus adults are not produced in this program.

163 Extra eggs are not intentionally produced in this program.

Comments:

null
null

Data source:

Per Paul Kline IDFG 9/8/03

Per Paul Kline IDFG 9/8/03

10.9 Fish health certification procedures applied pre-release.

97 All fish are examined for the presence of “reportable pathogens” as defined in the PNFHPC disease control guidelines, with prior to release.

98 Fish transfers into the subbasin are inspected and accompanied by notifications as described in IHOT and PNFHPC guideli

Comments:

Guidelines are in place for adult transfers.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.

10.10 Emergency release procedures in response to flooding or water system failure.

168 Backup and system redundancy is in place for degassing, pumping, and power generation. Oxygen is available on-site for e supply to all rearing tanks. Eight water level alarms are in use and linked through an emergency service operator. Additiona provided by limiting public access and by the presence of four on-site residences occupied by IDFG hatchery personnel.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

10.11 Indicate risk aversion measures that will be applied to minimize the likelihood for advers and ecological effects to listed fish resulting from fish releases.

84 Fish are released at sizes similar to natural fish of the same life stage and species.

86 Volitional release during natural out-migration timing is practiced.

88

89

91

104 The percent of the naturally spawning population in the subbasin that consists of adults from the program is 0-5% (less tha

105 The percent of hatchery fish spawning in the wild is estimated by:

- Annual stream surveys (e.g. carcasses)

95 Fish are released at times of the year and sizes to allow adoption of multiple life history strategies.

94 Fish are released within the historic range for that stock.

93 The carrying capacity of the subbasin was taken into account when determining the number of fish to be released.

Comments:

Adults released are generally smaller than naturally produced fish.

Eyed-egg, pre-smolt, smolt, and pre-spawn adults are released.
This is an adult supplementation program. Out-migration does not apply.
This is an adult supplementation program. The question applies to juveniles.

This is an adult supplementation program. The question applies to juveniles.

This is an adult supplementation program. The question applies to juveniles.

null

The number of hatchery fish is known from the adult release records.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
nds
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

Section 11. Monitoring and Evaluation of Performance Indicators

11.1.1 Describe plans and methods proposed to collect data necessary to respond to each "Perf Indicator" identified for the program.

Note: Performance Standards and Indicators described in this section or our response were taken from the final January 17 of Performance Standards and Indicators for the Use of Artificial Production for Anadromous and Resident Fish Populations Northwest. Numbers referenced below correspond to numbers used in the above document.

Performance Standards and Indicators addressing "benefits."

3.2.2 Standard: Release groups sufficiently marked in a manner consistent with information needs and protocols to enable of impacts to natural- and hatchery-origin fish in fisheries.

Indicator 1: Marking rate by type in each release group documented.

3.3.1 Standard: Artificial propagation program contributes to an increasing number of spawners returning to natural spawnii

Indicator 1: Annual number of spawners on spawning grounds estimated in specific locations.

Indicator 2: Spawner-recruit ratios are estimated in specific locations.

Indicator 3: Number of redds in natural production index areas documented.

3.3.2 Standard: Releases are sufficiently marked to allow statistically significant evaluation of program contribution.

Indicator 1: Marking rates and type of mark documented.

Indicator 2: Number of marks identified in adult groups documented.

Performance Standards and Indicators addressing ?risks.?

3.4.1 Standard: Fish collected for broodstock are taken throughout the return in proportions approximating the timing and a the population.

Indicator 1: Temporal distribution of broodstock collection managed.

Indicator 2: Age composition of broodstock collection managed.

3.4.2 Standard: Broodstock collection does not significantly reduce potential juvenile production in natural areas.

Indicator 1: Eyed-eggs are collected from a sub-set of wild redds to source broodstocks.

Indicator 2: Hatchery-produced spawners are released to migrate to natural spawning areas.

Indicator 3: Number of adults, eggs or juveniles placed in natural rearing areas is managed.

3.4.3 Standard: Life history characteristics of the natural population do not change as a result of this program.

Indicator 1: Life history characteristics of natural and hatchery-produced populations

are measured (e.g., juvenile dispersal timing, juvenile size at out-migration, adult return timing, adult age and sex ratio, natu hatchery spawn timing, hatch and swim-up timing, hatchery rearing densities, growth, diet, physical characteristics, fecundi etc).

3.4.4 Standard: Annual release numbers do not exceed estimated basin-wide and local habitat capacity.

Indicator 1: Annual release numbers, life-stage, size at release, documented.

Indicator 2: Location of releases documented.

Indicator 3: Timing of hatchery releases documented.

3.5.1 Standard: Patterns of genetic variation within and among natural populations do not change significantly as a result of production.

Indicator 1: Genetic profiles of naturally-produced and hatchery-produced adults developed.

3.5.2 Standard: Collection of broodstock does not adversely impact the genetic diversity of the naturally spawning populatic

Indicator 1: Eyed-eggs are collected from a sub-set of wild redds to source broodstocks.

Indicator 2: Timing of collection compared to overall run timing considered.

3.5.3 Standard: Artificially produced adults in natural production areas do not exceed appropriate proportion.

Indicator 1: Ratio of natural to hatchery-produced adults monitored.

3.6.1 Standard: The artificial production program uses standard scientific procedures to evaluate various aspects of artificia

Indicator 1: Scientifically based experimental design with measurable objectives and hypotheses.

3.6.2. Standard: The artificial production program is monitored and evaluated on an appropriate schedule and scale to addr toward achieving the experimental objectives.

Indicator 1: Monitoring and evaluation framework including detailed time line.

Indicator 2: Annual and final reports.

3.7.1 Standard: Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility standards and protocols.

Indicator 1: Annual reports indicating level of compliance with applicable standards and criteria.

144 3.7.2 Standard: Effluent from artificial production facility will not detrimentally affect natural populations.

Indicator 1: Discharge water quality compared to applicable water quality standards.

3.7.3 Standard: Water withdrawals and in stream water diversion structures for artificial production facility operation will not access to natural spawning areas, affect spawning, or impact juveniles.

Indicator 1: Water withdrawals documented ? no impacts to listed species.

Indicator 2: Number of adult fish aggregating and/or spawning immediately below water intake point monitored.

Indicator 3: NMFS screening criteria adhered to.

3.7.4 Standard: Releases do not introduce pathogens not already existing in the local populations and do not significantly ir levels of existing pathogens.

Indicator 1: Certification of juvenile fish health documented prior to release.

Indicator 2: Samples of natural populations for disease occurrence conducted.

Indicator 3: Juvenile densities during artificial rearing managed conservatively.

3.7.6 Standard: Adult broodstock collection operation does not significantly alter spatial and temporal distribution of natural

Indicator 1: Spatial and temporal spawning distribution of natural population above and below trapping facilities monitored.

3.7.7 Standard: Weir/trap operations do not result in significant stress, injury, or mortality in natural populations.

Indicator 1: Mortality rates in trap documented.

Indicator 2: Pre-spawning mortality rates of trapped fish in hatchery or after release documented.

3.7.8 Standard: Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of na

Indicator 1: Juveniles are not released. Production occurs from captive-reared adults released to spawn naturally.

Monitoring and Evaluation of Performance Standards and Indicators:

Standard 3.2.2 and associated Indicators. All adult chinook salmon released back to the habitat are PIT tagged, elastomer Petersen disk tagged. Genetic tissue samples from progeny that result from natural spawning events are taken to facilitate assignment test analyses. Hatchery groups are PIT tagged and elastomer tagged.

Standard 3.3.1 and associated Indicators. The primary objective of this program is to reintroduce hatchery-produced adults spawning. Adults are sourced from eyed-eggs collected from redds constructed by wild adult chinook salmon.

Standard 3.3.2 and associated Indicators. Adults released for natural spawning are 100% marked with PIT tags, elastomer Petersen disk tags. Intensive post-release behavioral monitoring occurs to document spawning-related behavior and spawn

Standard 3.4.1, 3.4.2, 3.5.3, and associated indicators. Chinook salmon rearing groups are sourced as eyed-eggs from red by wild adults. Approximately 50 eyed-eggs are removed, using hydraulic sampling gear, from six redds each. Redds are se represent the range of spawn timing. Care is taken to not negatively impact eggs remaining in redds sampled by program p

Standard 3.4.3 and associated indicators. Life history characteristics of natural and hatchery-produced adult chinook salmo monitored (e.g., adult spawning success). In-hatchery variables are monitored continuously (e.g., growth, survival, rearing c maturation, age at maturity, spawning success, gamete quality, egg size, fecundity, egg survival to the eyed stage of develo

Standard 3.4.4, 3.5.3 and associated indicators. Annual adult release numbers, size at release, and release location are dis annually at the CSCPTOC level. Release levels do not exceed habitat spawning and rearing capacities.

Standard 3.5.1, 3.5.2 and associated indicators. The university of Idaho provides genetic support for this program. Genetic and hatchery-produced chinook salmon have been, and continue to be produced. The hatchery population is constantly mo determine such variables as genetic effective population size, loss of genetic variability, and loss of heterozygosity.

Standard 3.6.1, 3.6.2 and associated indicators. Program goals, objectives, and tasks focus on the preservation / conserva this effort. Hatchery practices (e.g., spawning, and rearing protocols) are based on current and emerging ?best practices? a constant review at the CSCPTOC level. An experimental design has been established to guide the reintroduction of adults habitat. A comprehensive monitoring and evaluation program is in place to track post-release adult spawning success.

Standard 3.7.1, 3.7.2, 3.7.3, 3.7.6, 3.7.7 and associated indicators. The artificial production component of the program adhe state and federal policies in place to prevent the spread of infectious pathogens, to insure that facility discharge water quali appropriate standards, and that intake and outflow screens meet appropriate standards.

Adult and juvenile weirs are monitored to not adversely affect target or other fish species. Anadromous chinook salmon adu and distribution below weirs is carefully monitored. Every precaution is taken to insure that trapping does not negatively imp anadromous adults.

Standard 3.7.4 and associated indicators. IDFG and NOAA fish health facilities process samples for diagnostic and inspect from captive broodstock chinook salmon. Routine fish necropsies include investigations for viral pathogens (infectious panc virus and infectious hematopoietic necrosis virus), and various bacterial pathogens (e.g., bacterial kidney disease Renibact salmoninarium, bacterial gill disease Flavobacterium branchiophilum, coldwater disease Flavobacterium psychrophilum, an aeromonad septicemia Aeromonas spp.). In addition to the above, captive fish are screened for the causative agent of whir Myxobolus cerebralis, furunculus Aeromonas salmonicida and the North American strain of viral hemorrhagic septicemia vi

Approved chemical therapeutants are used prophylactically and for the treatment of infectious diseases. Prior to effecting tr use of chemical therapeutants is discussed with an IDFG fish health professional. Fish necropsies are performed on all pro mortalities that satisfy minimum size criteria for the various diagnostic or inspection procedures performed.

All appropriate state permits are secured prior to transporting eggs or fish across state boundaries. Prior to release, pre-libe health sampling occurs for pre-smolt and smolt release groups.

Standard 3.7.8 and associated standards. Predation by artificially produced fish on naturally produced fish is not expected t juvenile releases occur. Juveniles produced by this program hatch from redds constructed in the habitat.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

11.1.2 Indicate whether funding, staffing, and other support logistics are available or committe implementation of the monitoring and evaluation program.

146 nya

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

11.2 Indicate risk aversion measures that will be applied to minimize the likelihood for advers and ecological effects to listed fish resulting from monitoring and evaluation activities.

Risk aversion measures for monitoring and evaluation activities associated with the Chinook Captive Rearing Program are ESA Section 10 Research and Enhancement Permits (IDFG permit No.1010). A brief summary of the nature of actions take below.

147 Adult handling and release activities are conducted to minimize impacts to ESA-listed, species. Adult weirs are engineered installed in locations that minimize adverse impacts to both target and non-target species. All trapping facilities are constant minimize a variety of risks (e.g., high water periods, high emigration or escapement periods, security).

Post-release, adult spawning behavior observations are conducted to minimize potential risks to all life stages of ESA-listec IDFG conducts formal redd count training annually. During surveys, care is taken to not disturb ESA-listed species and to n impact completed redds. A detailed protocol is in place to conduct spawning behavior observations.

Snorkel surveys conducted primarily to assess juvenile abundance and density are conducted in to minimize disturbance to species. Displacement of fish is kept to a minimum.

Marking and tagging activities are designed to protect ESA-listed species and follow accepted, regional protocols.

Fish husbandry activities follow the region?s best protocols and undergo constant review through the CSCPTOC process.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

Section 12. Research

12.1 Objective or purpose.

The Chinook Captive Rearing Program incorporates a comprehensive research monitoring and evaluation component prim address the reproductive behavior and success of adults released to volitionally spawn. Program research objectives and ta

Objective 1. Produce captive-reared adult chinook salmon with morphological, physiological, and behavioral characteristics naturally produced fish.

Task A. Maintain facilities to produce captive-reared adult chinook salmon and attain objectives.

Task B. Modify facilities (hatchery building well field) to meet water demands, and life support system safety requirements t program rearing needs to atain objectives. Construct and connect new hatchery well. Construct new single family residence

Task C. Demolish failing raceway walls and construct new concrete slab foundation. Reinstall water lines and tanks and en security fencing. Complete additional grounds repair as needed.

Task D. Collect fish/eggs from three stocks to initiate rearing groups. Rear captive chinook salmon through maturation. Con reared adults to wild/natural conspecifics.

169

Task E. Monitor and adaptively manage culture protocols as they relate to fish survival, fish growth, and fish maturation.

Task F. PIT tag and visual implant tag all fish to facilitate poulation isolation and tracking during captive culture. Vaccinate ju chinook for Vibrio and Bacterial Kidney Disease.

Task G. Cryopreserve milt from male captive chinook salmon as needed to preserve future options.

Objective 2. Evaluate spawning behavior and success of out planted (captive-reared) adults.

Task A. Tag adults with externally visible tags prior to out planting and radio-tag a resonable number of fish for field tracking

Task B. Out plant maturing captive-reared chinook salmon to appropriate stream study sections.

Task C. Monitor and document movement, distribution, behavior, and spawning success of out planted fish. Associate prod (juveniles and adults) with potential parents.

Task D. Identify and document location of radio-tagged fish daily.

Task E. Map redd locations and note observed spawning pairings.

Task F. Hydraulically sample completed redds and perform snorkel surveys to verify and estimate production.

Task G. Evaluate gamete quality and survival to the eyed-egg stage of development.

Comments:

null

Data source:

Per Paul KLine IDFG 9/8/03

12.2 Cooperating and funding agencies.

Shoshone-Bannock Tribes ? Funded by the Bonneville Power Administration through the Northwest Power Planning Counc Wildlife Program. The Shoshone-Bannock Tribes provide assistance with adult chinook salmon monitoring, juvenile chinook monitoring, and the planting of eyed-eggs produced from hatchery spawning events.

170 University of Idaho - Funded by the Bonneville Power Administration through the Northwest Power Planning Council?s Fish Program. The U of I provides genetics support for the program.

NOAA Fisheries - Funded by the Bonneville Power Administration through the Northwest Power Planning Council?s Fish ar Program. NOAA Fisheries shares fish culture responsibility for the program.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

12.3 Principle investigator or project supervisor and staff.

Steve Yundt - Idaho Department of Fish and Game Fisheries Research Manager.

Paul Kline - Idaho Department of Fish and Game Principal Fisheries Research Biologist.

171 David Venditti - Idaho Department of Fish and Game Senior Fisheries Research Biologist.

Danny Baker- Idaho Department of Fish and Game Hatchery Manager II.

Comments:

null

Data source:

Per Paul Kline IDFG 10/22/03.

12.4 Status of stock, particularly the group affected by project, if different than the stock(s) c in Section 2.

Snake River sockeye salmon

Snake River spring/summer chinook salmon

172 Snake Basin summer steelhead

Bull trout

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

12.5 Techniques: include capture methods, drugs, samples collected, tags applied.

Chinook salmon for inclusion in the captive rearing program are generally collected as eyed-eggs using the hydraulic samp described by McNeil (1964). This system consists of two main components. The first is a gas-powered pump attached to a diameter aluminum probe, via flexible tubing. Holes drilled near the top of the probe allow air to infuse into the water stream venturi action. The second component is the collection net frame, which consists of a ?D? shaped aluminum frame with exp mesh along its curved portion and netting around the bottom and sides of its straight portion. When the pump is on, water is through the probe, which is worked into the substrate within the net frame. The air/water stream then lifts eggs out of the su they are swept downstream into the net. The expanded plastic screen confines eggs lifted out near the periphery and chann the net. In order to minimize disturbance to the redd, sampling is begun slightly below estimated nest pocket locations and upstream. This prevents the fine materials lifted out of the substrate from settling back into the redd and possibly smotherin Care is also taken to keep people behind or to the side of the net frame to minimize redd trampling. To facilitate eyed-egg c locations of redds are recorded and their corresponding construction and completion dates are estimated. Recording therm located near completed redds to track the number of Celsius temperature units (CTUs) received by the developing embryos sampled when the eggs have received approximately 300-400 CTUs and reached the eyed stage.

Juvenile chinook salmon may also be collected using rotary screw traps (E.G. Solutions, Corvallis, OR) or beach seines. Ro traps are passive capture devices generally positioned in the thalweg of the stream. Stream flow turns a baffled cylinder tha captured fish to a live well for temporary holding. IDFG and cooperator personnel from the Shoshone-Bannock Tribes atten Captured juveniles may be temporarily held in streamside live boxes until transfer to the Sawtooth or Eagle fish hatchery fo Beach seines may also be used to collect juvenile chinook salmon over a broad range of stream distances. Juveniles are lo snorkeling, and a beach seine is positioned downstream of the target assemblage of fish. Fish collected with this method ar
173 temporarily in streamside live boxes until transfer to the IDFG Sawtooth or Eagle fish hatchery.

Eyed-eggs may also be collected from redds spawned by captive-reared chinook salmon to determine fertilization and surv or hatching. These redds are sampled using the procedures described above, with one modification. In order to sample as possible in a short time, sampling begins near the center of anticipated egg pocket locations. Although this probably results additional fine loading, we feel this is acceptable due to the experimental, as opposed to production, nature of the redds. A 10-20 eggs from each redd is preserved and provided to University of Idaho geneticists to determine the number of individu contributed to the spawning population. These eggs are also checked for fertilization to estimate the proportion of eggs that fertilization.

Fish released back to their natal streams are unloaded from the transport truck into 100 L coolers equipped with locking lids release locations. Prior to releasing transported fish, transport and receiving water temperatures are tempered to within a 2 each other.

Several tagging methods are employed in this project, including Passive Integrated Transponder (PIT), elastomer, Petersor and radio transmitters. Captive reared juvenile chinook are PIT tagged when they reach appropriate size. Those collected a smolts are PIT tagged upon capture. PIT tags are injected into the peritoneal cavity using standard PIT tagging methodolog protocols (Prentice et al. 1990). PIT tags are used to track individual fish through the captive rearing project along with gene to construct spawning matrices. Latex elastomer tags are used as a secondary marking system to indicate rearing location stream. Fish are marked with elastomer tags by using a hypodermic needle to inject a thin stripe of pigment into the clear ti to the eye. Disc tags having unique color/numeric combinations may be attached to the dorsal surface of released fish, allov identification of individual fish. Floy tags may also be inserted near the dorsal fin to serve a function similar to disc tags. Rac used to facilitate tracking of adult chinook salmon released in various drainages for volitional spawning. Techniques develo et al. (1985) are utilized to implant radio tags in the stomach, via the esophagus. Radio tags have a life span sufficient to er transmitter operation beyond the time of post-spawning mortality. Radio tagging permits individual fish to be easily identifiec and may allow us to evaluate the spawning behavior of captive-reared individuals over larger stream sections, while interac conspecifics.

Anesthetics and chemical therapeutants are used in the collection and/or rearing of chinook salmon. Anesthetics are used t from physical injury during collection, handling and tagging procedures. Tricaine methane sulfonate (MS-222) buffered with bicarbonate is a Federal Drug Administration (FDA) approved anesthetic utilized during all fish activities requiring anestheti project personnel involved in the utilization of MS-222 stringently follow established protocols.

Chemical therapeutants are utilized during the culture of chinook salmon up to the time of in-hatchery spawning or release i environment. Chemical therapeutants may be used prophylactically or for treatment of acute fish health problems. The mos used antibiotic is Erythromycin, which is used to control bacterial kidney disease (BKD). Erythromycin may be injected intra incorporated into fish diets. Other drugs or treatments which may be utilized include: 1) formalin for the control of fungus on incubation and on adults during final maturation holding, 2) chloramine T for the control of myxobacteria 3) oxytetracycline f of motile aeromonads and myxobacteria, and 4) Ivermectin intubation for the treatment of Salmincola californensis parasite juvenile chinook salmon are vaccinated against Vibrio spp. and BKD prior to transfer to saltwater.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

12.6 Dates or time periods in which research activity occurs.

Eyed-egg collections - August through September

Adult maturation assessment - April through July

Adult marking and tagging - June through July

174 Adult out-planting - July through August

Adult behavioral monitoring - August through October

Redd construction success assessment - October through November

Juvenile tissue sampling (genetic testing) - July-Aug., March-April, Sept-Oct

Comments:

null

Data source:

Per Paul Kline 9/8/03

12.7 Care and maintenance of live fish or eggs, holding duration, transport methods.

The IDFG Eagle Fish Hatchery and the NOAA Manchester Marine Experiment Station are the primary sites for the chinook captive rearing program. Fish culture protocols follow accepted, standard practices and are reviewed on a regular basis at (meetings.

To manage for catastrophic loss in the program, and to provide a location for saltwater rearing, fish culture responsibilities a NOAA Fisheries at their Manchester Marine Experiment Station in Washington State. Initial rearing occurs at the Eagle Fisl smoltification, up to 100% of each rearing group is transferred to the NOAA Fisheries site. As adults mature, fish are transfe the Eagle Fish Hatchery and ultimately released to natal streams for natural spawning.

The containers used to transport fish will vary based on the task. In all cases, containers of the proper size and configuratio for the task at hand. Fish will be maintained in water of the proper quality (temperature, oxygen and chemical composition) possible during handling and transfer phases of transportation. Containers will vary from five gallon plastic buckets and 100 coolers for short term holding, to sophisticated truck-mounted tanks for long distance/duration transfers. Eyed-eggs may be from NOAA Fisheries facilities to IDFG facilities and/or between IDFG facilities. Eyed-eggs are packed at a conservative de perforated shipping tubes (27-cm long by 6-cm diameter at approximately 2,000 eggs per tube), capped, and labeled to ide number of eyed-eggs. Tubes are wrapped with hatchery water-saturated cheesecloth and packed in small, insulated cooler added to ensure proper temperature maintenance and coolers are sealed with packing tape. Eggs are monitored hourly du transportation.

Fish are transported to and from rearing locations, release locations, and adult trapping facilities in truck mounted, insulatec (typically 1,136 L capacity) with alarm, back-up oxygen systems, and "fresh flow" mechanical water movement units on boa and containers used is dependent upon the size and number of fish and the distance to be hauled. For longer duration trips NOAA Fisheries Washington facilities to Idaho), truck-mounted tanks are available to the program with 1,136 L (300 gal), 3, gal), and 9,463 L (2,500 gal) capacities. Transport guidelines are in place to not exceed 119 g/L (1.0 lb/gal). All trucks are e provide appropriate conditions to facilitate safe transport of fish to the specified destination. All vehicles are equipped with t and cellular phones to provide routine or emergency communications. Fish are monitored regularly during transportation.

Project leaders ensure that fish transport is conducted to provide the best possible conditions for safe transfer of fish betwe destinations. Pathology and fish culture experts provide guidance on all fish transportation events.

Disease histories of brood groups are reviewed and evaluated before, during and post transportation by program pathologis

175

Prior to transport, fish are fasted for 48 hours to reduce metabolic demand and stress. Transport guidelines are in place to r g/L (1.0 lb/gal). Tanks on transport trucks are disinfected and filled with clean well water prior to transportation. All vehicles to provide the appropriate conditions (temperature, oxygen, capacity) to ensure the safe transport of fish to and from specifi Water temperature in transport tanks is maintained at levels necessitating minimal tempering between source and destinati temperatures. In addition, all vehicles are equipped with two-way radios or cellular phones to provide routine or emergency communication capability. Prior to releasing transported fish at hatchery or remote release locations, transport and receivin temperatures are tempered to within 2.0°C of each other.

Sampling regimes are used throughout the program to monitor fish health and to evaluate attainment of program objectives weight measurements are collected from juvenile fish during routine hatchery procedures (e.g., tagging and sample count a fish mature and become more sensitive to handling, the frequency of handling events is reduced to maturation sorts.

Determinations of sex and maturation state in captive-reared chinook salmon are conducted using non-lethal genetic sex de ultrasound, and physical sorting. Genetic sex determinations are conducted by the NOAA Fisheries Northwest Fisheries Sc (Seattle, WA). To facilitate this process, fin tissue is removed from anesthetized chinook salmon at the Eagle Fish Hatchery Manchester Marine Experiment Station. Tissue samples are transferred to the NOAA Fisheries for analysis. Ultrasound ma determine maturation status prior to the time when fish are exhibiting external maturation signs. Physical maturation sorts a during August and September. Fish are examined for detection of changes in body coloration, the development of other sec characteristics, and gonad development. Fish determined to be maturing are isolated, by stock, from non-maturing fish.

Tissue samples are collected from mortalities during necropsies on program fish to monitor for disease. Genetic samples ar collected from mortalities in an effort to develop mitochondrial DNA, and nuclear DNA markers for chinook salmon populatio program.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

12.8 Expected type and effects of take and potential for injury or mortality.

Risk aversion measures for monitoring and evaluation activities associated with the Chinook Salmon Captive Rearing Progr described in ESA Section 10 Research and Enhancement Permits (IDFG permit No.1010). A brief summary of the nature o is provided below.

Juvenile trapping/handling ? Collecting eyed-eggs from the field is designed to have minimum impact on listed fish. Redds a approached from downstream, and care is taken to avoid trampling the redd. Information from field observations and therm used to ensure eggs are collected during their most tolerant stage. Eggs are immediately transferred to small coolers satura chilled river water for transfer to the hatchery. The hydraulic sampling system used to collect eggs appears to have little effe developing embryos. Generally, less than 2% of the collected eggs do not hatch (IDFG unpublished data). When juveniles a screw-traps, equal care is taken to minimize harm. Trap boxes are checked at least twice each day to reduce the time fish s traps and to ensure traps are functioning properly. Appropriate conditions (temperature, dissolved oxygen, and flow rate) ar in temporary holding structures prior to their transfer to the hatchery.

Juvenile to Adult in-hatchery ? Upon arrival at the hatchery, eggs are immediately disinfected in a 100 ppm iodine solution f This minimizes disease transmission from contaminated rivers. Collection of eyed-eggs also reduces the possibility of disea in culture. Fish collected as eggs have lower incidence of BKD than those collected as parr or fry. In addition, the egg stage susceptible to Myxobolus cerebralis, the organism that causes whirling disease. Juvenile collection at this stage results in h minimizes the risk of contaminating culture facilities, and increases survival of captive individuals. While in culture, disturba minimized by limiting the number of times fish are handled and through tank configuration. Fish are handled up to twice a w approximate four-week period for maturation sorting and only infrequently throughout the remainder of the year during tank sample counts. In addition, tanks are shade covered to minimize disturbance by normal hatchery operations and to provide bright sunlight.

176 Captive-reared chinook salmon generally appear to be in extremely good condition, but cultured fish differ from wild conspe and fin quality. Both characteristics appear to be influenced by rearing environment. Saltwater reared fish have higher fin qu slightly larger than those reared in fresh water. In accordance with these differences, the majority of fish are reared at the N Manchester Marine Experiment Station (from smoltification through maturation). The remaining fish are reared at the IDFG Hatchery in fresh water. Maintaining rearing activities at both facilities ensures research efforts will continue if either facility catastrophic stock loss.

Adult releases - Captive-reared individuals determined to be maturing are released into their natal streams to assess their s behavior. Frequent observations are made of these fish and of wild chinook salmon in the area for comparative purposes. M disturbance to the fish while attempting to observe normal activity is crucial. Field workers approach fish slowly and obscure presence as much as possible. In no cases are fish handled or unnecessarily disturbed.

Adult blocking weirs are monitored regularly to insure that adverse impacts to listed species are minimized.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

12.9 Level of take of listed fish: number of range or fish handled, injured, or killed by sex, age, not already indicated in Section 2 and the attached "take table" (Table 1).

Steelhead B (East Fork) - Integrated

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

181

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle,				

	tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
182	**Intentional lethal take (f)**	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (Johnson Creek)

	ESU/Population	nya
	Activity	nya
181	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

		Annual Take of Listed Fish by life Stage (number of fish)			
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (McCall Hatchery)

	ESU/Population	nya
	Activity	nya
181	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

		Annual Take of Listed Fish by life Stage (number of fish)			
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or				

	harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook (Rapid River) - Hatchery

	ESU/Population	nya
	Activity	nya
181	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

		Annual Take of Listed Fish by life Stage (number of fish)			
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (Pahsimeroi)

	ESU/Population	nya
	Activity	nya
181	**Location of hatchery activity**	nya
	Dates of activity	nya

Hatchery Program Operator nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook (Upper Salmon/Sawtooth)

ESU/Population nya

Activity nya

181 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program Operator nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook - Natural

	ESU/Population	nya
	Activity	nya
181	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

		Annual Take of Listed Fish by life Stage (number of fish)			
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook - Natural

	ESU/Population	nya
	Activity	nya
181	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

		Annual Take of Listed Fish by life Stage (number of fish)			
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
182	**Capture, handle, and release (c)**	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional	nya	nya	nya	nya

lethal take (f)				
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Run (Pahsimeroi)- Hatchery

181	**ESU/Population**	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
182	**Observe or harrass (a)**	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Steelhead B (Dworshak)-Hatchery

181	**ESU/Population**	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
182	**Intentional lethal take (f)**	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Steelhead B-Natural

	ESU/Population	nya
	Activity	nya
181	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Natural

	ESU/Population	nya
	Activity	nya
181	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass

182

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Redfish Lake Sockeye

181

ESU/Population nya

Activity nya

Location of hatchery activity nya

Dates of activity nya

Hatchery Program Operator nya

182

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Spring/Summer Chinook (W. Fork Yankee Fork- Salmon River)- Integrated

181

ESU/Population nya

Activity nya

Location of hatchery activity nya

Dates of activity	nya
Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring/Summer Chinook (East Fork Salmon River)- Integrated

	ESU/Population	nya
	Activity	nya
181	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Lemhi River Spring_Summer Chinook

ESU/Population Lemhi River Spring/summer Chinook

Activity Research

181 **Location of hatchery activity** Lemhi River, Salmon River, 522.303.416.049

Dates of activity nya

Hatchery Program Operator IDF&G

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	1000	100	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
182 Capture, handle, tag/mark/tissue sample, and release (d)	nya	100	nya	60
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	2	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Run (Sawtooth)- Hatchery

ESU/Population nya

Activity nya

181 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program Operator nya

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
182 Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya

Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Comments:

Data source:

Per Paul Kline IDFG 9/8/03

12.10 Alternative methods to achieve project objects.

177 None identified

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

12.11 List species similar or related to the threatened species; provide number and causes of r related to this research project.

178 Mortality associated with this project is reported in IDFG Section 10 permit reports to NOAA Fisheries. No impacts to simila been documented.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

12.12 Indicate risk aversion measures that will be applied to minimize the likelihood for advers ecological effects, injury or mortality to listed fish as a result of the proposed research a

The operation of hatchery facilities (weirs, water removal, and effluent discharge), production levels, disease transmission, resources, predation, and negative genetic impact are examples of ecological interactions that could affect listed species in area.

Hatchery facilities - Project hatchery facilities do not withdraw from or discharge water into natural habitat areas occupied b species.

179 Weirs installed to confine captive adults following release for natural spawning are maintained daily and managed to not ad listed species.

Production levels ? Production levels from this program and not expected to adversely affect listed species. Eggs produced constructed by captive-reared adults hatch within a natural time frame and produce juvenile chinook salmon that recruit to t community with wild conspecifics. Natural escapement levels are such that the additional contribution of spawners from this not expected to adversely affect listed species.

Disease Transmission ? IDFG and NOAA Fisheries programs follow stringent disease prevention protocols and produce he quality fish. Pre-liberation fish health monitoring occurs to insure that healthy fish are released to receiving waters. Fish hea in place for common bacterial and viral pathogens and require fish to not exceed CSCPTOC-accepted pathogen prevalenc they can be released.

Competition ? Competition between hatchery-produced and naturally-produced chinook salmon is expected to be minimal. competition between wild and hatchery-produced adults occurs during courting and spawning activities. Eggs produced fro constructed by captive-reared adults hatch within a natural time frame and produce juvenile chinook salmon that recruit to t community with wild conspecifics.

Predation ? Predation is not expected to occur as juvenile chinook salmon produced by captive adults hatch and recruit to t community along with wild conspecifics.

Genetic Impacts - Some genetic change associated with the management of Snake River chinook salmon in the hatchery i unavoidable. However, every opportunity is taken to minimize this change. Eggs collected to source rearing groups for this removed from several redds representing the full range of spawn timing. Numbers of eggs removed from redds is equalize Fish that hatch from eggs are reared by family (e.g., redd) until they are uniquely marked (e.g., PIT tagged). In-hatchery sp follow protocols developed by University of Idaho and NOAA Fisheries geneticists and are designed to minimize inbreeding genetic diversity.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

Section 13. Attachments and Citations

13.1 Attachments and Citations

197 nya

Comments:

null

Data source:

Section 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

14.1 Certification Language and Signature of Responsible Party

“I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973.”

Name, Title, and Signature of Applicant:

Certified by_____________________________ Date:_____________

APPENDIX 2-6—DRAFT SPRING/SUMMER CHINOOK (EAST FORK SALMON RIVER)–INTEGRATED IN THE SALMON SUBBASIN

HATCHERY AND GENETIC MANAGEMENT PLAN

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

DRAFT

	Hatchery Program	East Fork Salmon River
	Species or Hatchery Stock	Spring/Summer Chinook
	Agency/Operator	IDF&G
1	**Watershed and Region**	Salmon River, Columbia River
	Date Submitted	March 3, 2003
	Date Last Updated	August 9, 2003

Section 1: General Program Description

1.1 Name of hatchery or program.

1 East Fork Salmon River

1.2 Species and population (or stock) under propagation, and ESA status.

1 Spring/Summer Chinook

9 ESA Status: Threatened

1.3 Responsible organization and individuals.

Name (and title): Paul Kline
Principal Fisheries Research Biologist

3 **Agency or Tribe:** IDF&G

Address: 1800 Trout Road, Eagle, ID 83616

Telephone: 208-939-4114
Fax: 208-939-2415
Email: pkline@idfg.state.id.us

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and exten involvement in the program.

4

Co-operators	Role
Shosone Bannock Tribe	periodically assists with the transfer and planting of pr generated eyed-eggs to in-stream incubation boxes.
NOAA Fisheries	shares captive broodstock development responsibility culture and rearing).
University of Idaho	Genetics support
nya	nya

1.4 Funding source, staffing level, and annual hatchery program operational costs.

5

Funding Sources
Bonneville Power Administration
nya
nya
nya
nya
nya
nya

6

Operational Information	Number
Full time equivalent staff	2.2
Annual operating cost (dollars)	475,000

Comments:

These numbers reflect the following three programs:

Lemhi River Spring_Summer Chinook

Spring Summer Chinook(East Fork Salmon River) Integrated

Spring Summer Chinook (West Fork Yankee Fork Salmon River) Integrated

Reviewer Comments:

nc
nc

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

1.5 Location(s) of hatchery and associated facilities.

Broodstock source	East Fork Salmon River
Broodstock collection location (stream, RKm, subbasin)	East Fork Salmon River, 522.303.552.029, Salmon River
Adult holding location	

(stream, RKm, subbasin)	Eagle Hatchery (HUC 17050114)
Spawning location (stream, RKm, subbasin)	East Fork Salmon River, 522.303.552.029 , Salmon River
Incubation location (facility name, stream, RKm, subbasin)	Eagle Hatchery (HUC 17050114)
Rearing location (facility name, stream, RKm, subbasin)	Eagle Hatchery (HUC 17050114), NOAA Fisheries Manchester Station

2

Comments:

The East Fork Salmon River Satellite is located on the East Fork Salmon River approximately 29 kilometers upstream of the c the East Fork with the main stem Salmon River. The river kilometer code for the facility is 522.303.552.029. The hydrologic ur facility is 17060201.

Broodstock source: Lemhi River, West Fork Yankee Fork Salmon River, and East Fork Salmon River spring chinook salmon. collected and reared at IDFG freshwater and NOAA Fisheries seawater hatcheries to maturation. Mature adults released to n for volitional spawning. Some in-hatchery spawning occurs to document reproductive potential.

Broodstock collection location (Stream, RKM, subbasin): 522.303.416 Lemhi River, 522.303.591.011 West Fork Yankee Fork 522.303.552.029 East Fork Salmon River.

Adult holding location (Stream, RKM, subbasin): IDFG Eagle Fish Hatchery, no RKM, NOAA Fisheries Manchester Marine Ex Station, no RKM.

Spawning location (Stream, RKM, subbasin): Spawning primarily occurs in natal streams (captive adults released to spawn n kilometer information is provided above. Some in-hatchery spawning occurs at the IDFG Eagle Fish Hatchery, no RKM.

Incubation location (Facility name, stream, RKM, subbasin): IDFG Eagle Fish Hatchery, no RKM.

Rearing location (Facility name, stream, RKM, subbasin): IDFG Eagle Fish Hatchery, no RKM, NOAA Fisheries Manchester M Experiment Station, no RKM.

Data source:

Per Paul Kline IDFG 9/8/03 Source: Project annual reports to Bonneville Power Administration. Project annual reports to NOA ESA Section 10 activities.

1.6 Type of program.

8 Integrated

Comments:

Lower Snake River Compensation Plan - The Salmon River spring chinook salmon program was envisioned as an Isolated Program but has operated as an Integrated Recovery Program since its inception. Hatchery x hatchery broodstock spawn c performed using no natural (unmarked) parents. Resulting progeny may be ESA-listed or not depending on brood year and origin. In addition, hatchery x natural crosses are performed (resulting in ESA-listed progeny) to support an ongoing supplei research.

Data source:

Per Paul Kline IDFG 9/8/03

1.7 Purpose (Goal) of program.

9 The purpose of this hatchery program is to contribute to conservation/recovery and research and education.

10 the purpose of the program is mitigation for hydro impacts .

Comments:

Mitigation - The goal of the Lower Snake River Compensation Plan is to return approximately 19,445 adult spring chinook s project area above Lower Granite Dam to mitigate for survival reductions resulting from the construction and operation of th Snake River dams. Initial facility plans identified production targets of 1.3 million smolts released in the Salmon River at the

Hatchery, 700,000 smolts released in the East Fork Salmon River, and 300,000 smolts released in Valley Creek, a tributary River. Adult return targets were 11,310 adults back to the Sawtooth Fish Hatchery, 6,090 adults back to the East Fork Salm 2,045 adults back to Valley Creek (all based on a smolt-to-adult return rate of 0.87%).

The Valley Creek component of the program has never been implemented. The East Fork Salmon River component was te 1998.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.

1.8 Justification for the program.

138 • It is unknown if hatchery fish are accessible to fisheries.

Comments:

Mitigation - The goal of the Lower Snake River Compensation Plan is to return approximately 19,445 adult spring chinook s project area above Lower Granite Dam to mitigate for survival reductions resulting from the construction and operation of th Snake River dams. Initial facility plans identified production targets of 1.3 million smolts released in the Salmon River at the Hatchery, 700,000 smolts released in the East Fork Salmon River, and 300,000 smolts released in Valley Creek, a tributary River. Adult return targets were 11,310 adults back to the Sawtooth Fish Hatchery, 6,090 adults back to the East Fork Salm 2,045 adults back to Valley Creek (all based on a smolt-to-adult return rate of 0.87%).

The Valley Creek component of the program has never been implemented. The East Fork Salmon River component was te 1998.

nc
nc
nc

Data source:

Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03
nds
nds
nds

1.9 List of program "Performance Standards".

The program adheres to the following fish culture guideline(s) and standard(s):
IHOT
11 PNFHPC
state
federal
other

Comments:

Other = Chinook Salmon Captive Propagation Technical Oversight Committee. A team of technical experts representing the agencies and tribes involved with the program in addition to invited experts. The CSCPTOC meets periodically to review pro activities, address critical uncertainties, and to adaptively manage future activities

Data source:

Per Paul Kline IDFG 9/8/03

1.10 List of program "Performance Indicators", designated by "benefits" and "risks".

Indicators of Harvest Benefits

	Indicator	Performance Standard	Indicator is Monitore
139	Spawner to spawner survival of hatchery fish	NA	NA
	Contribution of hatchery fish to target fisheries	NA	NA
	Angler success (hatchery fish per angler day) in target	NA	NA

recreational fisheries		
Contribution of hatchery fish to cultural needs	NA	NA
Selective harvest success (expected benefits of mass marking)	NA	NA

Indicators of Conservation Benefits

Indicator	Performance Standard	Indicator is Monitore
Genetic and life history diversity (over time)	3.4.1, 3.4.2, 3.4.3, 3.4.4, 3.5.1, 3.5.2, 3.5.3, 3.2.2	3.4.1, 3.4.2, 3.4.3, 3.4.4, 3.5.2, 3.5.3, 3.2.2
Spawner to spawner reproductive success of hatchery fish	3.3.1, 3.6.1, 3.6.2	Y
141 Reproductive success of the receiving (supplemented) naturally spawning population	3.3.1, 3.3.2, 3.6.1, 3.6.2	Y
Contribution to the abundance of the naturally spawning population	3.3.1, 3.3.2, 3.6.1, 3.6.2	Y
Time and location of spawning	3.3.1, 3.3.2, 3.6.1, 3.6.2	Y
Contribution to ecosystem function (e.g. through nutrient enhancement, food web effects, etc.)	NA	NA

Indicators of Harvest Risks

Indicator	Performance Standard	Indicator is Monitore
Harvest impacts on co-mingled stocks	NA	NA
140 **Bias in run size estimation of natural stocks due to masking effect**	NA	NA
Lack of harvest access (under harvest due e.g. to co-mingling with weaker stocks)	NA	NA

Indicators of Conservation Risks

Indicator	Performance Standard	Indicator is Monitore
Unintended contribution of hatchery fish to natural spawning (through straying)	3.4.4, 3.5.3	Y
Loss of genetic and life history diversity	3.4.1, 3.4.2, 3.4.3, 3.4.4, 3.5.1, 3.5.2, 3.5.3	Y
142 **Loss of reproductive success**	3.3.1, 3.3.2, 3.4.1, 3.4.3, 3.4.4, 3.5.3, 3.6.2	Y
Ecological interactions through competition with natural stocks (by life stage)	3.7.6, 3.7.4, 3.7.8	Y
Ecological interactions through predation on natural stocks (by life stage)	3.7.8	Y
Adverse effects of hatchery operations and facilities on fish migration Disease transfers	3.7.1, 3.7.2, 3.7.3, 3.7.4, 3.7.7	Y

The following plans and methods are proposed to collect data for each Performance Indicator: Performance Standards and I addressing ?benefits.?

3.2.2 Standard: Release groups sufficiently marked in a manner consistent with information needs and protocols to enable de impacts to natural- and hatchery-origin fish in fisheries.

Indicator 1: Marking rate by type in each release group documented.

3.3.1 Standard: Artificial propagation program contributes to an increasing number of spawners returning to natural spawning

Indicator 1: Annual number of spawners on spawning grounds estimated in specific locations.

Indicator 2: Spawner-recruit ratios are estimated in specific locations.

Indicator 3: Number of redds in natural production index areas documented.

3.3.2 Standard: Releases are sufficiently marked to allow statistically significant evaluation of program contribution.

Indicator 1: Marking rates and type of mark documented.

Indicator 2: Number of marks identified in adult groups documented.

Performance Standards and Indicators addressing ?risks.?

3.4.1 Standard: Fish collected for broodstock are taken throughout the return in proportions approximating the timing and age the population.

Indicator 1: Temporal distribution of broodstock collection managed.

Indicator 2: Age composition of broodstock collection managed.

3.4.2 Standard: Broodstock collection does not significantly reduce potential juvenile production in natural areas.

Indicator 1: Eyed-eggs are collected from a sub-set of wild redds to source broodstocks.

Indicator 2: Hatchery-produced spawners are released to migrate to natural spawning areas.

Indicator 3: Number of adults, eggs or juveniles placed in natural rearing areas is managed.

3.4.3 Standard: Life history characteristics of the natural population do not change as a result of this program.

Indicator 1: Life history characteristics of natural and hatchery-produced populations

are measured (e.g., juvenile dispersal timing, juvenile size at out-migration, adult return timing, adult age and sex ratio, natura spawn timing, hatch and swim-up timing, hatchery rearing densities, growth, diet, physical characteristics, fecundity, egg size

3.4.4 Standard: Annual release numbers do not exceed estimated basin-wide and local habitat capacity.

Indicator 1: Annual release numbers, life-stage, size at release, documented.

Indicator 2: Location of releases documented.

Indicator 3: Timing of hatchery releases documented.

3.5.1 Standard: Patterns of genetic variation within and among natural populations do not change significantly as a result of a production.

Indicator 1: Genetic profiles of naturally-produced and hatchery-produced adults developed.

3.5.2 Standard: Collection of broodstock does not adversely impact the genetic diversity of the naturally spawning population

Indicator 1: Eyed-eggs are collected from a sub-set of wild redds to source broodstocks.

Indicator 2: Timing of collection compared to overall run timing considered.

3.5.3 Standard: Artificially produced adults in natural production areas do not exceed appropriate proportion.

Indicator 1: Ratio of natural to hatchery-produced adults monitored.

3.6.1 Standard: The artificial production program uses standard scientific procedures to evaluate various aspects of artificial p

Indicator 1: Scientifically based experimental design with measurable objectives and hypotheses.

3.6.2. Standard: The artificial production program is monitored and evaluated on an appropriate schedule and scale to addres toward achieving the experimental objectives.

144

Indicator 1: Monitoring and evaluation framework including detailed time line.

Indicator 2: Annual and final reports.

3.7.1 Standard: Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility c standards and protocols.

Indicator 1: Annual reports indicating level of compliance with applicable standards and criteria.

3.7.2 Standard: Effluent from artificial production facility will not detrimentally affect natural populations.

Indicator 1: Discharge water quality compared to applicable water quality standards.

3.7.3 Standard: Water withdrawals and in stream water diversion structures for artificial production facility operation will not p to natural spawning areas, affect spawning, or impact juveniles.

Indicator 1: Water withdrawals documented ? no impacts to listed species.

Indicator 2: Number of adult fish aggregating and/or spawning immediately below water intake point monitored.

Indicator 3: NMFS screening criteria adhered to.

3.7.4 Standard: Releases do not introduce pathogens not already existing in the local populations and do not significantly inc levels of existing pathogens.

Indicator 1: Certification of juvenile fish health documented prior to release.

Indicator 2: Samples of natural populations for disease occurrence conducted.

Indicator 3: Juvenile densities during artificial rearing managed conservatively.

3.7.6 Standard: Adult broodstock collection operation does not significantly alter spatial and temporal distribution of natural p

Indicator 1: Spatial and temporal spawning distribution of natural population above and below trapping facilities monitored.

3.7.7 Standard: Weir/trap operations do not result in significant stress, injury, or mortality in natural populations.

Indicator 1: Mortality rates in trap documented.

Indicator 2: Pre-spawning mortality rates of trapped fish in hatchery or after release documented.

3.7.8 Standard: Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of nat

Indicator 1: Juveniles are not released. Production occurs from captive-reared adults released to spawn naturally.

Monitoring and Evaluation of Performance Standards and Indicators:

Standard 3.2.2 and associated Indicators. All adult chinook salmon released back to the habitat are PIT tagged, elastomer ta Petersen disk tagged. Genetic tissue samples from progeny that result from natural spawning events are taken to facilitate in assignment test analyses. Hatchery groups are PIT tagged and elastomer tagged.

Standard 3.3.1 and associated Indicators. The primary objective of this program is to reintroduce hatchery-produced adults fo spawning. Adults are sourced from eyed-eggs collected from redds constructed by wild adult chinook salmon.

Standard 3.3.2 and associated Indicators. Adults released for natural spawning are 100% marked with PIT tags, elastomer ta Petersen disk tags. Intensive post-release behavioral monitoring occurs to document spawning-related behavior and spawnir

Standard 3.4.1, 3.4.2, 3.5.3, and associated indicators. Chinook salmon rearing groups are sourced as eyed-eggs from redds by wild adults. Approximately 50 eyed-eggs are removed, using hydraulic sampling gear, from six redds each. Redds are sel represent the range of spawn timing. Care is taken to not negatively impact eggs remaining in redds sampled by program pe

Standard 3.4.3 and associated indicators. Life history characteristics of natural and hatchery-produced adult chinook salmon (e.g., adult spawning success). In-hatchery variables are monitored continuously (e.g., growth, survival, rearing conditions, m at maturity, spawning success, gamete quality, egg size, fecundity, egg survival to the eyed stage of development, etc.).

Standard 3.4.4, 3.5.3 and associated indicators. Annual adult release numbers, size at release, and release location are disc at the CSCPTOC level. Release levels do not exceed habitat spawning and rearing capacities.

Standard 3.5.1, 3.5.2 and associated indicators. The university of Idaho provides genetic support for this program. Genetic p and hatchery-produced chinook salmon have been, and continue to be produced. The hatchery population is constantly mon determine such variables as genetic effective population size, loss of genetic variability, and loss of heterozygosity.

Standard 3.6.1, 3.6.2 and associated indicators. Program goals, objectives, and tasks focus on the preservation / conservatio this effort. Hatchery practices (e.g., spawning, and rearing protocols) are based on current and emerging ?best practices? an constant review at the CSCPTOC level. An experimental design has been established to guide the reintroduction of adults ba habitat. A comprehensive monitoring and evaluation program is in place to track post-release adult spawning success.

Standard 3.7.1, 3.7.2, 3.7.3, 3.7.6, 3.7.7 and associated indicators. The artificial production component of the program adher state and federal policies in place to prevent the spread of infectious pathogens, to insure that facility discharge water quality appropriate standards, and that intake and outflow screens meet appropriate standards.

Adult and juvenile weirs are monitored to not adversely affect target or other fish species. Anadromous chinook salmon adult distribution below weirs is carefully monitored. Every precaution is taken to insure that trapping does not negatively impact ar adults.

Standard 3.7.4 and associated indicators. IDFG and NOAA fish health facilities process samples for diagnostic and inspectio from captive broodstock chinook salmon. Routine fish necropsies include investigations for viral pathogens (infectious pancre virus and infectious hematopoietic necrosis virus), and various bacterial pathogens (e.g., bacterial kidney disease Renibacter salmoninarium, bacterial gill disease Flavobacterium branchiophilum, coldwater disease Flavobacterium psychrophilum, and aeromonad septicemia Aeromonas spp.). In addition to the above, captive fish are screened for the causative agent of whirlin Myxobolus cerebralis, furunculus Aeromonas salmonicida and the North American strain of viral hemorrhagic septicemia viru

Approved chemical therapeutants are used prophylactically and for the treatment of infectious diseases. Prior to effecting trea use of chemical therapeutants is discussed with an IDFG fish health professional. Fish necropsies are performed on all progr that satisfy minimum size criteria for the various diagnostic or inspection procedures performed.

All appropriate state permits are secured prior to transporting eggs or fish across state boundaries. Prior to release, pre-libera health sampling occurs for pre-smolt and smolt release groups.

Standard 3.7.8 and associated standards. Predation by artificially produced fish on naturally produced fish is not expected to juvenile releases occur. Juveniles produced by this program hatch from redds constructed in the habitat.

The program contributes to information gain in the following way(s): Hatchery program contributes to research to improve pe cost effectiveness
143 New information affects change to the hatchery program through a structured adaptive decision making process
Hatchery program participates in basin wide-coordinated research efforts
Hatchery program actively contributes to public education
Funding for monitoring of performance indicators is adequate

Comments:

Note: Performance Standards and Indicators used to develop Sections 1.10.1 and 1.10.2 were taken from the final January 1 version of Performance Standards and Indicators for the Use of Artificial Production for Anadromous and Resident Fish Popu Pacific Northwest. Numbers referenced below correspond to numbers used in the above document.

3.1.2 Standard: Program contributes to mitigation requirements.

Indicator 1: Number of fish returning to mitigation requirements estimated.

3.1.3 Standard: Program addresses ESA responsibilities.

Indicator 1: ESA Section 7 Consultation completed.

3.2.2 Standard: Release groups sufficiently marked in a manner consistent with information needs and protocols to enable de impacts to natural- and hatchery-origin fish in fisheries.

Indicator 1: Marking rate by type in each release group documented.

3.3.1 Standard: Artificial propagation program contributes to an increasing number of spawners returning to natural spawning

Indicator 1: Annual number of spawners on spawning grounds estimated in specific locations.

Indicator 2: Spawner-recruit ratios estimated is specific locations.

Indicator 3: Number of redds in natural production index areas documented in specific locations.

3.3.2 Standard: Releases are sufficiently marked to allow statistically significant evaluation of program contribution.

Indicator 1: Marking rates and type of mark documented.

Indicator 2: Number of marks identified in juvenile and adult groups documented.

1.10.2) ?Performance Indicators? addressing risks.

3.4.1 Standard: Fish collected for broodstock are taken throughout the return in proportions approximating the timing and age the population.

Indicator 1: Temporal distribution of broodstock collection managed.

Indicator 2: Age composition of broodstock collection managed.

3.4.2 Standard: Broodstock collection does not significantly reduce potential juvenile production in natural areas.

Indicator 1: Number of natural-origin spawners removed for broodstock determined annually and documented.

Indicator 2: Natural origin spawners released to migrate to natural spawning areas documented.

Indicator 3: Number of adults, eggs or juveniles placed in natural rearing areas managed.

3.4.3 Standard: Life history characteristics of the natural population do not change as a result of this program.

Indicator 1: Life history characteristics of natural and hatchery-produced populations are measured (e.g., juvenile dispersal ti size at outmigration, juvenile sex ratio at outmigration, adult return timing, adult age and sex ratio, spawn timing, hatch and s rearing densities, growth, diet, physical characteristics, fecundity, egg size).

3.4.4 Standard: Annual release numbers do not exceed estimated basin-wide and local habitat capacity.

Indicator 1: Annual release numbers, life-stage, size at release, length of acclimation documented.

Indicator 2: Location of releases documented.

Indicator 3: Timing of hatchery releases documented.

3.5.1 Standard: Patterns of genetic variation within and among natural populations do not change significantly as a result of a production.

Indicator 1: Genetic profiles of naturally-produced and hatchery-produced adults developed.

3.5.2 Standard: Collection of broodstock does not adversely impact the genetic diversity of the naturally spawning population

Indicator 1: Total number of natural spawners reaching collection facilities documented.

Indicator 2: Total number of natural spawners estimated passing collection facilities documented.

Indicator 3: Timing of collection compared to overall run timing.

3.5.3 Standard: Artificially produced adults in natural production areas do not exceed appropriate proportion.

Indicator 1: Ratio of natural to hatchery-produced adults monitored.

Indicator 2: Observed and estimated total numbers of natural and hatchery-produced adults passing counting stations.

3.5.4 Standard: Juveniles are released on-station, or after sufficient acclimation to maximize homing ability to intended return

Indicator 1: Location of juvenile releases documented.

Indicator 2: Length of acclimation period documented.

Indicator 3: Release type (e.g., volitional or forced) documented.

Indicator 4: Adult straying documented.

3.5.5 Standard: Juveniles are released at fully smolted stage of development.

Indicator 1: Level of smoltification at release documented.

Indicator 1: Release type (e.g., forced or volitional) documented.

3.5.6 Standard: The number of adults returning to the hatchery that exceeds broodstock needs is declining.

Indicator 1: The number of adults in excess of broodstock needs documented in relation to mitigation goals of the program.

3.6.1 Standard: The artificial production program uses standard scientific procedures to evaluate various aspects of artificial p

Indicator 1: Scientifically based experimental design with measurable objectives and hypotheses.

3.6.2. Standard: The artificial production program is monitored and evaluated on an appropriate schedule and scale to addres toward achieving the experimental objectives.

Indicator 1: Monitoring and evaluation framework including detailed time line.

Indicator 2: Annual and final reports.

3.7.1 Standard: Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility o standards and protocols.

Indicator 1: Annual reports indicating level of compliance with applicable standards and criteria.

3.7.2 Standard: Effluent from artificial production facility will not detrimentally affect natural populations

Indicator 1: Discharge water quality compared to applicable water quality standards.

3.7.3 Standard: Water withdrawals and in stream water diversion structures for artificial production facility operation will not p to natural spawning areas, affect spawning, or impact juveniles.

Indicator 1: Water withdrawals documented ? no impacts to listed species.

Indicator 2: NMFS screening criteria adhered to.

3.7.4 Standard: Releases do not introduce pathogens not already existing in the local populations and do not significantly inc levels of existing pathogens.

Indicator 1: Certification of juvenile fish health documented prior to release.

3.7.5 Standard: Any distribution of carcasses or other products for nutrient enhancement is accomplished in compliance with disease control regulations and guidelines.

Indicator 1: Number and location(s) of carcasses distributed to habitat documented.

3.7.6 Standard: Adult broodstock collection operation does not significantly alter spatial and temporal distribution of natural p

Indicator 1: Spatial and temporal spawning distribution of natural population above and below trapping facilities monitored.

3.7.7 Standard: Weir/trap operations do not result in significant stress, injury, or mortality in natural populations.

Indicator 1: Mortality rates in trap documented.

Indicator 2: Prespawning mortality rates of trapped fish in hatchery or after release documented.

3.7.8 Standard: Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of nat

Indicator 1: Size and time of release of juvenile fish documented and compared to size and timing of natural fish.
Standards are referenced to NPPC Artificial Production Review (Jan 17, 2001).

Standards are referenced to NPPC Artificial Production Review (Jan 17, 2001).

null

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

1.11.1 Proposed annual broodstock collection level (maximum number of adult fish).

198 Approximately 250 eyed eggs are collected annually from target streams to initiate rearing groups.

Data source:

Per Paul Kline (IDFG), 10.22.03.

1.11.2 Proposed annual fish release levels (maximum number) by life stage and location.

				Location			
Age Class	Maximum Number	Size (ffp)	Release Date	Stream	Release Point (RKm)	Major Watershed	Ecopr
Eggs	50,000	2700	November	East Fork Salmon River	522.303.552.029	Salmon River	Mounta Snake
1 Unfed Fry	nya	nya	nya	nya	nya	nya	nya
Fry	nya	nya	nya	nya	nya	nya	nya
Fingerling	nya	nya	nya	nya	nya	nya	nya
Yearling	700,000	nya	nya	East Fork Salmon River	nya	Salmon River	Mounta Snake

Comments:

Age Class Max No. Size Release Date Stream Release Point Major Watershed Ecoprovince

Adult 150 0.12 Aug. East Fork 522.303.225.029 Salmon Mountain

Salmon River Snake

Proposed, annual fish release numbers for the Sawtooth Fish Hatchery and the East Fork Salmon River Satellite are presen While proposed exist, the program is being managed to address the higher priority of providing sufficient broodstock for natu and hatchery production. Lack of sufficient broodstock coupled with ESA-listing has substantially modified releases. For som broodstock criteria have driven fish release levels, not production targets.

Yearling numbers include original juvenile release target for the Idaho Supplementation Studies Program for the East Fork S as 173,000(supp.)

To develop an understanding of the reproductive potential of captive-reared adult chinook salmon, the Chinook Salmon Cap Propagation Technical Oversight Committee (CSCPTOC) recommended that spawning take place at the Eagle Fish Hatche investigate several reproduction variables (e.g., maturation timing, gamete quality, egg survival to eyed stage of developmer developed in this manner is used to compliment behavioral observations and reproductive success data collected in the fielc release of maturing adult chinook salmon.

Eggs produced from hatchery spawning events have been used to supplement captive rearing groups or returned to hatch b streams.

Milt has been cryopreserved in the captive rearing program since 1997.

Data source:

Per Paul Kline IDFG 9/8/03

1.12 Current program performance, including estimated smolt-to-adult survival rates, adult pı levels, and escapement levels. Indicate the source of these data.

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
33 1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya

1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Comments:

This is a captive rearing program with a goal of collecting 250 eggs per stock per year. The program releases maturing adul salmon for natural spawning.

Data source:

Paul Kline, reviewed 10.22.03.

Status and Goals of Stocks and Habitats

	NoRs		HoRs		Combined (HoRs + NoRs)	
Brood Year	**Smolt to Adult Survival(%)**	**Recruits per Spawner**	**Smolt to Adult Survival(%)**	**Recruits per Spawner**	**Smolt to Adult Survival(%)**	**Recruits per Spawner**
Goal	nya	nya	nya	nya	nya	nya
1988	nya	nya	0.019	nya	nya	nya
1989	nya	nya	0.046	nya	nya	nya
1990	nya	nya	0.010	nya	nya	nya
1991	nya	nya	0.000	nya	nya	nya
1992	nya	nya	0.056	nya	nya	nya
1993	nya	nya	0.020	nya	nya	nya
1994	nya	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya	nya

34

Comments:

There is no information available yet for estimating the recruits per spawner from this adult supplementation program. The su within the hatchery program is to achieve 80% survival from hatch to mature adult.

The IDFG developed and implemented standardized procedures for counting chinook salmon redds in the early 1990s. Singl surveys are made over each trend area each year in Salmon and Clearwater basin streams. The surveys are timed to coincic period of maximum spawning activity on a particular stream. Recent redd count data for Idaho streams are presented in Attac this HGMP.

Data source:

Paul Kline

1.13 Date program started (years in operation), or is expected to start.

7 The first year of operation for this hatchery was 1997 .

Comments:

Fish were first collected in brood year 1994.

Data source:

Per Paul Kline IDFG 9/8/03

1.14 Expected duration of program.

148 The final year of the program is undetermined.

149 The program is expected to end when goals can be met by other means not requiring artificial production.

Comments:

This program is expected to continue indefinitly to provide mitigation under the Lower Snake River Compensation Plan.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

1.15 Watersheds targeted by program.

1 Salmon River, Columbia River

1.16 Indicate alternative actions considered for attaining program goals, and reasons why thos are not being proposed.

The hatchery program is a part of a strategy to meet conservation and/or harvest goals for the target stock. The tables below the short- and long-term goals are for the stock in terms of stock status (biological significance and viability), habitat and harv in the table indicate High, Medium, or Low levels for the respective attributes. Changes in these levels from current status inc outcomes for the hatchery program and other strategies (including habitat protection and restoration).

18

	Biological Significance	Viability	Habitat
Current Status	H	L	L
Short-term Goal	H	L	L
Long-term Goal	H	M	M

This table shows current status and goals for harvest opportunity. **H** implies harvest opportunity every year, **M** opportunity mc some years, and **N** no opportunity.

19
20
21
22
23

		Location of Fishery				
Fishery type		**Marine**	**L. Columbia**	**Zone 6**	**U. Columbia**	**Subba**
	Current Status	N	N	N	N	N
Commercial	**Short-term Goal**	N	N	N	N	N
	Long-term Goal	N	N	N	N	N
	Current Status	N	N	N	N	N
Ceremonial	**Short-term Goal**	N	N	N	N	L
	Long-term Goal	N	N	N	N	L
	Current Status	N	N	N	N	N
Subsistence	**Short-term Goal**	N	N	N	N	N
	Long-term Goal	N	N	N	N	N
	Current Status	N	N	N	N	N
Recreational	**Short-term Goal**	N	N	N	N	L
	Long-term Goal	N	N	N	N	M
	Current Status	N	N	N	N	N

Catch and Release	**Short-term Goal**	N	N	N	N	L
	Long-term Goal	N	N	N	N	M

Comments:

All references to unproductive habitat should be specific to hydro habitat as natal spawning and rearing habitat is not limiting
Above edits per Paul Kline (IDFG), 10.22.03.

Lower Snake River Compensation Plan hatcheries were constructed to mitigate for fish losses caused by construction and o
four lower Snake River federal hydroelectric dams. The Idaho Department of Fish and Game's objective is to ensure that har
components of hatchery-produced spring chinook salmon are available to provide fishing opportunity, consistent with meetin
escapement and preserving the genetic integrity of natural populations (IDFG 1992). The Idaho Department of Fish and Gam
considered alternative actions for obtaining program goals.

Edits per Paul Kline (IDFG), 10.22.03.
Edits per Paul Kline (IDFG), 10.22.03.
Edits per Paul Kline (IDFG), 10.22.03.

Data source:

Paul Kline (IDFG), 7.22.03.
Paul Kline, HGMP
Paul Kline
Paul Kline
Paul Kline

Section 2: Program Effects on ESA-Listed Salmonid Populations

2.1 List all ESA permits or authorizations in hand for the hatchery program.

150 The program has the following permits or authorizations: Section 7 or Section 10 permit
.

Comments:

Section 7 Consultation with U.S. Fish and Wildlife Service (April 2, 1999) resulting in NMFS Biological Opinion for the Lowe
Compensation Program.

Section 10 Permit Number 920 for East Fork Salmon River trapping and spawning activities (expired, reapplied for 1/10/00)

Data source:

Per Paul Kline IDFG 9/8/03

2.2.1 Descriptions, status and projected take actions and levels for ESA-listed natural populatic target area.

The following excerpts on the present status of Salmon River spring chinook salmon were taken from the Draft Subbasin Su
Salmon Subbasin of the Mountain Snake Province (NPPC 2001).

Idaho??s stream-type chinook salmon are truly unique. Smolts leaving their natal rearing areas migrate 700 to 950 miles do
spring to reach the Pacific Ocean. Mature adults migrate the same distance upstream, after entering freshwater, to reach the
and spawn. The life history characteristics of spring and summer chinook are well documented by IDFG et al. 1990; Healey
57 FR 14653 and 58FR68543). Kiefer??s (1987) An Annotated Bibliography on Recent Information Concerning Chinook Sal
prepared for the Idaho Chapter of the American Fisheries Society, provides a difference of information available through the
onlife history, limiting factors, mitigation efforts, harvest, agency planning, and legal issues. Snake River spring and summer
salmon, of which spawning populations in the Salmon Subbasin are a part, were listed as Threatened under the Endangered
1992 (57 FR 14653); critical habitat was designated in 1993 (58 FR 68543). Recent and ongoing research has provided man
more specific knowledge of the Salmon Subbasin stocks. Intensive monitoring of summer parr and juvenile emigrants from n
has provided insights into freshwater rearing and migration behavior (Walters et al. 2001; Achord et al. 2000; Hansen and Lo
Nelson and Vogel 2001). Recovered tags and marks on returning adults at hatchery weirs and on spawning grounds have in
provided stock specific measures of recruitment and fidelity (Walters et al. 2001; Berggren and Basham 2000). Since 1992, r

produced chinook have been marked to distinguish them from naturally produced fish.

Age-length frequencies and age composition of individual stocks are currently being refined for specific stocks (Kiefer et al. 2 Distribution and abundance of spawning is being monitored with intensity in specific watersheds (Walters et al. 2001; Nelson 2001).

Ongoing since the mid-1980s, annual standard surveys continue to provide trends in abundance and distribution of summer Griswold and Petrosky 1997). Resultant data show an erratic trend toward lower abundance of juvenile chinook salmon in th habitat (Rosgen C-typoe channels), both in hatchery-influenced streams and in areas serving as wild fish sanctuaries.

Analysis of recent stock-recruitment data (Kiefer et al. 2001) indicates that much of the freshwater spawning/rearing habitat c spring/summer chinook salmon is still productive. The average production for brood years 1990-1998 was 243 smolts/female recruitment data show modestly density-dependent survival for the escapement levels observed in recent years and have be estimate smolt-to-adult survival necessary to maintain or rebuild the chinook salmon populations. A survival rate of 4.0% wou escapement at Lower Granite Dam of approximately 40,000 wild adult spring/summer chinook salmon.

In the mid-1990s, the Salmon Subbasin produced an estimated 39% of the spring and 45% of the summer chinook salmon t adults to the mouth of the Columbia River. Natural escapements approached 100,000 spring and summer chinook salmon fr 1960; with total escapements declining to an average of about 49,300 (annual average of 29,300 spring chinook salmon and summer chinook salmon) during the 1960s. Smolt production within the Salmon Subbasin is estimated to have ranged from a million to 3.4 million fish between 1964 and 1970.

Populations of stream-type (spring and summer) chinook salmon in the subbasin have declined drastically and steadily since This holds true despite substantial capacities of watersheds within the subbasin to produce natural smolts and significant hat augmentation of many populations. For example, counts of spring/summer chinook salmon redds in IDFG standard survey a subbasin declined markedly from 1957 to 1999. The total number of spring and summer chinook salmon redds counted in th surveys ranged from 11,704 in 1957 to 166 in 1995. Stream-type chinook salmon redds counted in all of the subbasin??s mc
145 spawning areas have averaged only 1,044 since 1980, compared to an average 6,524 before 1970. Land management activ affected habitat quality for the species in many areas of the subbasin, but spawner abundance declines have been common in both high-quality and degraded spawning and rearing habitats (IDFG 1998).

Kucera and Blenden (1999) have reported that all five ?index populations? (spawning aggregations) of stream-type chinook i Subbasin, fish that spawn in specific areas of the Middle Fork and South Fork Salmon watersheds, exhibited highly significar declines in abundance during the period 1957-95. The NMFS (2000) estimated that the population growth rates (lambda) for populations during the 1990s were all substantially less than needed for the fish to replace themselves: Poverty Flats (lambd Johnson Creek (0.815), Bear Valley/Elk Creek (0.812), Marsh Creek (0.675), and Sulphur Creek (0.681). Many wild populatio type chinook in the subbasin are now at a remnant status and it is likely that there will be complete losses of some spawning Annual redd counts for the index populations have dropped to zero three times in Sulphur Creek and twice in Marsh Creek, a counts have been observed in spawning areas elsewhere within the Salmon Subbasin. All of these chinook populations are i decline, are at low levels of abundance, and at high risk of localized extinction (Oosterhout and Mundy 2001).

- Identify the NMFS ESA-listed population(s) that will be directly affected by the program

Snake River Spring/Summer-run chinook salmon ESU (T ? 4/92).

- Identify the NMFS ESA-listed population(s) that may be incidentally affected by the program.

Snake River Spring/Summer-run chinook salmon ESU (T ? 4/92)

Snake River sockeye salmon ESU (E ? 11/91)

Snake River Basin steelhead ESU (T ? 8/97)

Bull trout (T ? 6/98)

15 nya

32 Listed stocks may be directly affected by nya.

The following ESA listed natural salmonid populations occur in the subbasin where the program fish are released:

ESA listed stock	Viability	Habitat
Summer Chinook (Johnson Creek)	L	L
Summer Chinook (McCall Hatchery)	H	L
Summer Chinook (Pahsimeroi)	L	L
Spring Chinook (Upper Salmon/Sawtooth)	U	L
Spring Chinook - Natural	H	L
Summer Chinook - Natural	H	L

Steelhead B-Natural	L	L
Redfish Lake Sockeye	L	L
Spring/Summer Chinook (W. Fork Yankee Fork- Salmon River)-Integrated	L	L
Spring/Summer Chinook (East Fork Salmon River)- Integrated	L	L
Lemhi River Spring_Summer Chinook	L	L

H, M and L refer to high, medium and low ratings, low implying critical and high healthy.

Comments:

null
nc
nc
All references to unproductive habitat should be specific to hydro habitat as natal spawning and rearing habitat is not limiting

Data source:

Per Paul Kline IDFG 9/8/03
nds
nds
nc

2.2.2 Status of ESA-listed salmonid population(s) affected by the program.

nya

Most recent available spawning escapement estimates are shown in the table below:

Summer Chinook (Johnson Creek)

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Summer Chinook (McCall Hatchery)

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Summer Chinook (Pahsimeroi)

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Spring Chinook (Upper Salmon/Sawtooth)

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs

Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	18	19
1996	nya	nya	nya	105	51
1997	nya	nya	nya	155	99
1998	nya	nya	nya	127	26
1999	nya	nya	nya	121	75
2000	nya	nya	nya	535	451
2001	nya	nya	nya	676	1,427

Spring Chinook - Natural

Return Year	**Total Catch (all ages)**	**Natural Escapement**		**Hatchery Spawning**	
		NoRs	**HoRs**	**NoRs**	**HoRs**
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Summer Chinook - Natural

Return Year	**Total Catch (all ages)**	**Natural Escapement**		**Hatchery Spawning**	
		NoRs	**HoRs**	**NoRs**	**HoRs**
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya

1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Steelhead B-Natural

Return Year	**Total Catch (all ages)**	**Natural Escapement**		**Hatchery Spawning**	
		NoRs	**HoRs**	**NoRs**	**HoRs**
Goal	unk	unk	unk	unk	unk
1990	unk	unk	unk	unk	unk
1991	unk	unk	unk	unk	unk
1992	unk	unk	unk	unk	unk
1993	unk	unk	unk	unk	unk
1994	unk	unk	unk	unk	unk
1995	unk	unk	unk	unk	unk
1996	unk	unk	unk	unk	unk
1997	unk	unk	unk	unk	unk
1998	unk	unk	unk	unk	unk
1999	unk	unk	unk	unk	unk
2000	unk	unk	unk	unk	unk
2001	unk	unk	unk	unk	unk

Redfish Lake Sockeye

Return Year	**Total Catch (all ages)**	**Natural Escapement**		**Hatchery Spawning**	
		NoRs	**HoRs**	**NoRs**	**HoRs**
Goal	nya	2000	nya	nya	600
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya

1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Spring/Summer Chinook (W. Fork Yankee Fork- Salmon River)- Integrated

Return Year	**Total Catch (all ages)**	**Natural Escapement**		**Hatchery Spawning**	
		NoRs	**HoRs**	**NoRs**	**HoRs**
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Spring/Summer Chinook (East Fork Salmon River)- Integrated

Return Year	**Total Catch (all ages)**	**Natural Escapement**		**Hatchery Spawning**	
		NoRs	**HoRs**	**NoRs**	**HoRs**
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya

1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Lemhi River Spring_Summer Chinook

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	NA	M	M	NA	NA
1990	M	M	M	NA	NA
1991	M	M	M	NA	NA
1992	M	M	M	NA	NA
1993	M	M	M	NA	NA
1994	M	M	M	NA	NA
1995	M	M	M	NA	NA
1996	M	M	M	NA	NA
1997	M	M	M	NA	NA
1998	M	M	M	NA	NA
1999	M	M	M	NA	NA
2000	M	M	M	NA	NA
2001	M	M	M	NA	NA

Comments:

nc
nc
This is a captive rearing program with a goal of collecting 250 eggs per stock per year. The program releases maturing adul salmon for natural spawning.

Data source:

nds
nds
Per Paul Kline IDFG 9/8/03

2.2.3 Describe hatchery activities, including associated monitoring and evaluation and researcl programs, that may lead to the take of listed fish in the target area, and provide estimate levels of take.

Steelhead B (East Fork) - Integrated

ESU/Population nya

Activity nya

152 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program

Operator nya

Type of Take	Annual Take of Listed Fish by life Stage (number of fish) Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
153 Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (Johnson Creek)

ESU/Population nya

Activity nya

152 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program Operator nya

Type of Take	Annual Take of Listed Fish by life Stage (number of fish) Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
153 Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (McCall Hatchery)

152	ESU/Population	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

	Annual Take of Listed Fish by life Stage (number of fish)				
	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook (Rapid River) - Hatchery

152	ESU/Population	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

	Annual Take of Listed Fish by life Stage (number of fish)				
	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
153	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional	nya	nya	nya	nya

lethal take (f)				
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (Pahsimeroi)

152

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

153

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook (Upper Salmon/Sawtooth)

152

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
153	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook - Natural

	ESU/Population	nya
	Activity	nya
152	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook - Natural

	ESU/Population	nya
	Activity	nya
152	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass

153

Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Run (Pahsimeroi)- Hatchery

152

ESU/Population nya

Activity nya

Location of hatchery activity nya

Dates of activity nya

Hatchery Program Operator nya

153

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead B (Dworshak)-Hatchery

152

ESU/Population nya

Activity nya

Location of hatchery activity nya

Dates of activity	nya
Hatchery Program Operator	nya

Type of Take	**Annual Take of Listed Fish by life Stage (number of fish)**			
	Egg/Fry	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
153 **Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead B-Natural

ESU/Population	nya
Activity	nya
152 **Location of hatchery activity**	nya
Dates of activity	nya
Hatchery Program Operator	nya

Type of Take	**Annual Take of Listed Fish by life Stage (number of fish)**			
	Egg/Fry	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
153 **Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Natural

152	**ESU/Population**	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
153	**Observe or harrass (a)**	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Redfish Lake Sockeye

152	**ESU/Population**	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
153	**Observe or harrass (a)**	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Spring/Summer Chinook (W. Fork Yankee Fork- Salmon River)- Integrated

ESU/Population nya

Activity nya

152 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program Operator nya

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
153 **Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Spring/Summer Chinook (East Fork Salmon River)- Integrated

ESU/Population East Fork Salmon River Spring/Summer Chinook

Activity Broodstock Collection

152 **Location of hatchery activity** East Fork Salmon River, 522.303.552.029

Dates of activity nya

Hatchery Program Operator IDF&G

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya

	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	250	nya	nya	nya
153	**Intentional lethal take (f)**	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Lemhi River Spring_Summer Chinook

	ESU/Population	nya
	Activity	nya
152	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Run (Sawtooth)- Hatchery

	ESU/Population	nya
	Activity	nya
152	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass

	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Comments:

Data source:

Per Paul Kline IDFG 9/8/03

Per Paul Kline IDFG 9/8/03

Section 3: Relationship of Program to Other Management Objectives

3.1 Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hooc Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the *NP Production Review* Report and Recommendations - NPPC document 99-15). Explain any deviations from the plan or policies.

155 nya

Comments:

null

Data source:

HGMP Per Paul Kline IDFG 9/8/03

3.2 List all existing cooperative agreements, memoranda of understanding, memoranda of agi or other management plans or court orders under which program operates.

	Document Title	T
	The Federal Endangered Species Act of 1973 - Section 10 Permit No. 1010	ny
156	The 2001-2006 Idaho Deparment of Fish and Game Fisheries Management Plan	MF
	Draft, NOAA Fisheries Salmon Recovery Plans (1995 and 1997)	ny
	Interim Productivity and Abundance Targets (NPPC document)	ny

Comments:

Cooperative Agreement between the U.S. Fish and Wildlife Service and the Idaho Department of Fish and Game, USFWS Ag

141102J010 (for Lower Snake River Compensation Plan monitoring and evaluation studies).

Cooperative Agreement between the U.S. Fish and Wildlife Service and the Idaho Department of Fish and Game, USFWS Ag
141102J009 (for Lower Snake River Compensation Plan hatchery operations).

Current Interim Management Agreement for Upriver Spring Chinook, Summer Chinook and Sockeye pursuant to United State
v. State of Oregon, U.S. District Court, District of Oregon

Data source:

HGMP Per Paul Kline IDFG 9/8/03

3.3 Relationship to harvest objectives.

There are no harvest objectives in the immediate future for this stock.

The Lower Snake River Compensation Plan defined replacement of adults ?in place? and ?in kind? for appropriate state ma
purposes. The Idaho Department of Fish and Game, the U.S. Fish and Wildlife Service, and other tribal and agency fish ma
cooperatively to develop annual production and mark plans. Juvenile production and adult escapement targets were establi
outset of the LSRCP program.

157 As part of its harvest management and monitoring program, the IDFG conducts annual creel and angler surveys to assess t
program fish make toward meeting program harvest objectives.

3.3.1) Describe fisheries benefiting from the program, and indicate harvest levels and rates for program-origin fish for the la
(1988-99), if available.

Since the inception of the LSRCP program, chinook salmon sport fishing seasons have not occurred in the upper Salmon R
origin adults produced at the Sawtooth Fish Hatchery are subjected to potential harvest during their upstream migration thro
sections where sport fishing seasons have occurred.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

3.4 Relationship to habitat protection and recovery strategies.

158 NOAA Fisheries has not developed a recovery plan specific to Snake River salmon, but this program is operated consistent
Biological Opinions and subbasin planning efforts.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

3.5 Ecological interactions.

The following species co-occur to a significant degree with the program fish in either freshwater or early marine life stages.

159

- Steelhead
- Sockeye
- Chinook
- Bull Trout

Comments:

We considered hatchery water withdrawal in the upper Salmon River to have no effect upon listed salmon. Water is only ter
diverted from the Salmon River and East Fork Salmon river. The recent six-year average use of water at the Sawtooth Fish
33.8 cfs, including well and river water. The range of water usage for this period was 11 to 53 cfs. The most recent six-year
of water at the East Fork Salmon River Satellite was 10 cfs and the range was 8 to 15 cfs. We have not observed dewatere
Salmon River or East Fork Salmon River as a result of hatchery water diversion. Chinook salmon and steelhead juveniles o

vicinity of both facilities. As such, we assume that rearing habitat is available. Stream flows during juvenile release periods a for all life history stages of listed species in the short stretches of river between where water is extracted and returned.

The Sawtooth Fish Hatchery water intake structure could potentially have an effect on listed salmon and steelhead. We not salmon fry mortalities on the Sawtooth Fish Hatchery headbox screens in 1992 and subsequently installed new screens wit spaces to prevent fry impingement. The IDFG also made modifications to the headbox such as adding a spryer pipe to was collection trough, which transports fry from the trash screen back to the river.

Hatchery water discharge is not expected to have an effect on rearing listed salmon and steelhead. Hatchery discharge is c within NPDES standards.

Potential adverse effects to listed salmon could occur from the release of hatchery-produced spring chinook smolts through interactions: predation, competition, behavior modification, and disease transmission. Hatchery-produced smolts are spatial from listed species during early rearing so effects are likely to occur only in the migration corridor after release.

The IDFG does not believe that the release of spring chinook juveniles in the upper Salmon River will affect listed sockeye s free-flowing migration corridor. Adults and juveniles of these two runs of salmon are temporally and spatially separated with sockeye having a later outmigration timing (May-June) that spring chinook salmon (March-April). There is no information av indicates that competition occurs between these two species.

Although it is possible that both hatchery-produced spring chinook salmon and natural fall chinook salmon could occur in th at the same time, the IDFG believes that hatchery-produced smolts released in March and April will be out of the Snake Riv area when fall chinook salmon emerge in late April and early May (IFRO 1992). Because of their larger size, spring chinook migrating through the Salmon and Snake rivers will probably be using different habitat than emerging fall chinook salmon fr 1969). Fall chinook salmon adults would be temporally and spatially separated from the spring chinook salmon adults returr upper Salmon River.

Based on general migration information, it appears that the potential for adverse effects from hatchery-produced spring chir would be greatest with juvenile, listed spring and summer chinook salmon. As mentioned earlier, hatchery-produced juvenil separated from listed spring chinook salmon during early rearing. Perry and Bjornn (1992) documented that natural, chinool movement in the upper Salmon river began in early March, peaked in late April, and early May, and then decreased into the as the fish grew to parr size. Average mean length of spring chinook salmon fry ranged from 32.9 ? 34.9 mm through late A upper Salmon River. Mean fry size increased to 39.8 mm by mid-June (Perry and Bjornn 1992). Assuming that hatchery-pro chinook salmon smolts could feed on prey up to 1/3 of their body length, natural fry would be in a size range to be potential However, emigration from release sites generally occurs within a few days and the IDFG does not believe that hatchery-pro would convert from a hatchery diet to a natural diet in such a short time (USFWS 1992, 1993). Additionally, the IDFG is una literature that suggests that juvenile chinook salmon are piscivorous.

The literature suggests that the effects of behavioral or competitive interactions between hatchery-produced and natural chi juveniles would be difficult to evaluate or quantify (Cannamela 1992b; USFWS 1992, 1993). There is limited information des adverse behavioral effects of summer releases of hatchery-produced chinook salmon fingerlings (age 0) on natural chinook fingerlings. Hillman and Mullan (1989) reported that larger hatchery-produced fingerlings apparently ?pulled? smaller chino their stream margin stations as the hatchery fish drifted downstream. The hatchery-produced fish were approximately twice the natural juveniles. In this study, spring releases of steelhead smolts had no observable effect on natural chinook fry or sr However, effects of emigrating yearling, hatchery-produced chinook salmon on natural chinook salmon fry or yearlings is ur may be potential for the larger hatchery-produced fish, presumably migrating in large schools, to ?pull? natural chinook salr with them as they migrate. It this occurs, effects of large, single-site releases on natural survival may be adverse. We do no occurs, or the magnitude of the potential effect. In the upper Salmon River, IDFG biologists observed chinook salmon fry in during steelhead sampling in April ? June, 1992 even though 1.27 million spring chinook salmon smolts had been released (IDFG 1993c).

The IDFG believes that competition for food, space, and habitat between hatchery-produced chinook salmon smolts and na smolts should be minimal due to: 1) spatial segregation, 2) foraging efficiency of hatchery-produced fish, 3) rapid emigratior river sections, and 4) differences in migration timing. If competition occurs, it would be localized at sites of large group relea 1984).

Chinook salmon habitat preference criteria studies have illustrated that spatial habitat segregation occurs (Hampton 1988). juveniles (hatchery-produced) select deeper water and faster velocities than smaller juveniles (natural fish). This mechanisr minimize competition between emigrating hatchery-produced chinook salmon and natural fry in free-flowing river sections.

The time taken for hatchery-produced juvenile chinook salmon to adjust to the natural environment reduces the effect of ha produced fish on natural fish. Foraging and habitat selection deficiencies of hatchery-produced fish have been noted (Ware Bachman 1984; Marnell 1986). Various behavior studies have noted the inefficiency of hatchery-produced when fish placed environment (including food selection). Because of this, and the time it takes for hatchery-produced fish to adapt to their ne the IDFG believes competition between hatchery-produced and natural origin chinook salmon is minimal; particularly soon a

The IDFG does not believe that the combined release of hatchery mitigation and supplementation chinook salmon in the up River exceeds the carrying capacity of the free-flowing migration corridor. Food, space, and habitat should not be limiting fa Salmon River and free-flowing Snake River.

The spring smolt outmigration of naturally produced chinook salmon is generally more protracted than the hatchery-produce outmigration. Data illustrating arrival timing at Lower Granite Dam support this observation (Kiefer 1993). This factor may le potential for competition in the river.

Spring chinook salmon reared at the Sawtooth Fish Hatchery have a history of chronic bacterial kidney disease (BKD) incid control measures at the Sawtooth Fish Hatchery include: 1) adult antibiotic injections, 2) egg disinfection, 3) egg culling bas ELISA value, 4) egg segregation incubation, 5) juvenile segregation rearing, and 6) juvenile antibiotic feedings.

Bacterial kidney disease and other diseases can be horizontally transmitted from hatchery fish to natural, listed species. Ho review of the literature, Steward and Bjornn (1990) stated that there was little evidence to suggest that horizontal transmissi from hatchery-produced smolts to natural fish is widespread in the production area or free-flowing migration corridor. Howe additional research has occurred in this area. Hauck and Munson (IDFG, unpublished) stated that hatcheries with open wat (river water) may derive pathogen problems from natural populations. The hatchery often promotes environmental conditior the spread of specific pathogens. When liberated, infected hatchery-produced fish have the potential to perpetuate and carı into the wild population.

The IDFG monitors the health status of hatchery-produced spring chinook salmon from the time they are ponded at the Sav Hatchery until their release as pre-smolts or smolts. Sampling protocols follow those established by the PNFHPC and AFS Section.

All pathogens require a critical level of challenge dose to establish an infection in their host. Factors of dilution, low water te and low population density in the upper Salmon River minimize the potential for disease transmission to naturally-produced salmon. However, none of these factors preclude the risk of transmission (Pilcher and Fryer 1980; LaPatra et al. 1990; Lee 1989). Even with consistent monitoring, it is difficult to attribute a particular occurrence of disease to actions of the LSRCP h chinook program in the upper Salmon River.

There are potential adverse effects to listed adult spring chinook salmon and to their progeny from the release of hatchery-p spring chinook salmon upstream of the Sawtooth Fish Hatchery weir for natural spawning. None of these potential impacts direct mortality of natural adults. Potential effects include: changes in fitness, growth, survival, and disease resistance of na populations. In addition, natural populations may be impacted through decreased productivity and decreased long-term ada (Kapuscinski and Jacobson 1987; Bowles and Leitzinger 1991). Negative impacts to natural populations are more likely wh populations are not derived from locally adapted, endemic broodstocks. However, some increase in natural production can when hatchery-origin fish are sufficiently similar to wild fish and natural rearing habitats are not at capacity (Reisenbichler 1 IDFG believes this to be the case in the upper Salmon River; recognizing that releasing adult spring chinook salmon from th Fish Hatchery to spawn naturally can increase natural production, but not necessarily productivity.

It is important to note that the IDFG has developed criteria to manage the release of hatchery-origin adults upstream of the Hatchery weir for natural spawning. These criteria conform with NMFS and USFWS Section 10 and 7 permit language in ac meeting the management objectives of the IDFG salmon supplementation study.

The potential exists for returning hatchery adults to stray and pose additional risk to natural populations. However, existing indicate that this is not currently a problem for Sawtooth-origin adults.

Data source:

HGMP Per Paul Kline IDFG 9/8/03

Section 4. Water Source

4.1 Provide a quantitative and narrative description of the water source (spring, well, surfac quality profile and natural limitations to production attributable to the water source.

The following statements describe the adult holding water source:

- The water source is pumped.
- The water source is pathogen-free.
- The water source is specific-pathogen free.
- The water source is fish free.
- The water source is accessible to anadromous fish.
- Water is available from multiple sources.
- 12 The water used results in natural water temperature profiles that provide optimum maturation and gamete developn
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu temperature.
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu ammonia, carbon dioxide, chlorine, pH, copper, dissolved oxygen, hydrogen sulfide, dissolved nitrogen, iron, and zi
- The water supply is protected by flow and/or pond level alarms at the holding pond(s).
- The water supply is protected by back-up power generation.
- Naturally produced fish do not have access to intake screens.
- Hatchery intake screening complies with Integrated Hatchery Operations Team (IHOT) and National Marine Fisheri facility guidelines.

The following statements describe the incubation water source:

- The water source is pumped.
- The water source is pathogen-free.
- The water source is specific-pathogen free.
- The water source is fish free.
- Water is available from multiple sources.
- Water is from the natal stream for the cultured stock.
- 13 The water used provides natural water temperature profiles that results in hatching/emergence timing similar to that naturally produced stock.
- Incubation water can be heated or chilled to approximate natural water temperature profiles.
- The water supply is protected by flow alarms at the head box.
- The water supply is protected by flow and/or pond level alarms at the holding pond(s).
- The water supply is protected by back-up power generation
- Naturally produced fish do not have access to intake screens.

The following statements describe the rearing water source:

- The water source is pumped.
- The water source is pathogen-free.
- The water source is specific-pathogen free.
- The water source is fish free.
- The water source is accessible to anadromous fish.
- Water is available from multiple sources.
- The water used provides natural water temperature profiles that results in hatching/emergence timing similar to that naturally produced stock.
- Rearing water has a chemical profile significantly different from natural stream conditions to provide adequate impri
14 hatchery fish and minimize the attraction of naturally produced fish into the hatchery.
- The hatchery operates to allow all migrating species of all ages to by-pass or pass through hatchery related structu
- Adequate flows are maintained to provide unimpeded passage of adults and juveniles in the by-pass reach created water withdrawals.
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu temperature.
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu ammonia, carbon dioxide, chlorine, pH, copper, dissolved oxygen, hydrogen sulfide, dissolved nitrogen, iron, and zi
- The water supply is protected by flow and/or pond level alarms at the holding pond(s)
- The water supply is protected by back-up power generation.
- Naturally produced fish do not have access to intake screens.
- Hatchery intake screening complies with Integrated Hatchery Operations Team (IHOT) and National Marine Fisheri facility guidelines.

Comments:

q. Does not apply, since the water source is from wells.

These answers apply to Eagle Hatchery, not NOAA Manchester or Burley Creek

The East Fork Salmon River Satellite receives water from the East Fork Salmon River. Approximately 15 cfs is delivered to through a gravity line. Water is delivered to adult holding raceways. A well provides domestic water and pathogen-free wate (egg water-hardening process). No fish rearing occurs at this site. The intake screens are in compliance with NMFS screen design of the Corp of Engineers.
r. Does not apply since water source is from wells.

These answers apply to Eagle Hatchery, not NOAA Manchester or Burley Creek.
i. Answer is no for fingerling and smolt releases, but the answer to "i." is yes for adult releases. Hatchery reared fingerlings a larger than naturally reared fingerlings and smolts.

t. Does not apply since water source is from wells.

These answers apply to Eagle Hatchery, not NOAA Manchester or Burley Creek

Data source:

Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 10/22/03.

4.2 Indicate risk aversion measures that will be applied to minimize the likelihood for the ta listed natural fish as a result of hatchery water withdrawal, screening, or effluent discha

The facility operates within the limitations established in its National Pollution Discharge Elimination System (NPDES) perm
15 production from this facility falls below the minimum production requirement for an NPDES permit, but the facility operates i with state or federal regulations for discharge and The facility does not have a discharge permit.

Comments:

These answers apply to Eagle Hatchery, not NOAA Manchester or Burley Creek

Eagle Hatchery follows guidelines set-up in the NPDES permit, but is not required to monitor effluent based on the pounds (produced annually.

Data source:

Per Paul Kline IDFG 9/8/03

Section 5. Facilities

5.1 Broodstock collection facilities (or methods).

Brookstock for this program is collected:

16

- by methods described below. ** NO STATEMENT PROVIDED FOR THIS CHOICE **

188

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available F (gpm)
24	Fiberglass	230	10	10	2.3	60
2	Fiberglass	1250	20	20	4	250
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya

Comments:

Per Paul Kline (IDFG): Limited spawning for this program takes place at the IDFG Eagle Fish Hatchery.

Broodstock is collected by hydraulic redd pumping. Spawning takes place in the wild with the exception of operations to meet program objectives dealing with reproductive success.

The East Fork Salmon River Satellite was constructed with a velocity barrier fitted with radial gates to prevent upstream pass the trap. Adult chinook salmon move into a fish ladder and then into two adult holding raceways that measure 68 ft long by 1C ft deep. Each adult pond has the capacity to hold approximately 500 adults.

Captive populations for this project are sourced from the progeny of naturally spawning adults. Beginning with the first collecti continuing through 1998, parr were collected from the three source streams. Beginning in 1999, captive populations were sou eggs from natural redds using hydraulic equipment.

Spawning takes place primarily in natal streams (hatchery-produced adults released to spawn).

Data source:

Per Paul Kline IDFG 10/22/03
Per Paul Kline IDFG 9/8/03 Aquafarms 2000 Inc. specifications manual Eagle Hatchery historical flow data

5.2 Fish transportation equipment (description of pen, tank, truck, or container used).

99 IHOT guidelines for transportation are followed.

187

Equipment Type	Capacity (gallons)	Supplemental Oxygen (y/n)	Temperature Control (y/n)	Normal Transit Time (minutes)	Chemical (s) Used	Dc (p
3/4 Ton PU w/Tank	250	Y	nya	9 hrs	None	NA
10 Wheel Tanker	2700	Y	nya	12 hrs	None	NA
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya

nya	nya	nya	nya	nya	nya	nya

Comments:

Both 250 and 2700 gallon tanks are equipped with Fresh-flow aeration pumps.

A variety of transportation vehicles and equipment are available at the various facilities. Generally, adult transportation at botl unnecessary as hatchery-produced adults are trapped and spawned on site.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03 From Chinook BPA Hatchery Reports and 1010 Chinook NOAA Fisheries Reports.

5.3 Broodstock holding and spawning facilities.

Spawning for this program takes place:

16

** NO STATEMENT PROVIDED FOR THIS CHOICE **** NO STATEMENT PROVIDED FOR THIS CHOICE **

34 Integrated Hatchery Operations Team (IHOT) adult holding guidelines followed for adult holding , density , water quality , alar predator control measures to provide the necessary security for the broodstock.

188

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available F (gpm)
24	Fiberglass	230	10	10	2.3	60
2	Fiberglass	1250	20	20	4	250
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya

Comments:

Per Paul Kline (IDFG): Limited spawning for this program takes place at the IDFG Eagle Fish Hatchery.

Broodstock is collected by hydraulic redd pumping. Spawning takes place in the wild with the exception of operations to meet program objectives dealing with reproductive success.

The East Fork Salmon River Satellite was constructed with a velocity barrier fitted with radial gates to prevent upstream pass the trap. Adult chinook salmon move into a fish ladder and then into two adult holding raceways that measure 68 ft long by 1C ft deep. Each adult pond has the capacity to hold approximately 500 adults.

Captive populations for this project are sourced from the progeny of naturally spawning adults. Beginning with the first collecti continuing through 1998, parr were collected from the three source streams. Beginning in 1999, captive populations were sou eggs from natural redds using hydraulic equipment.

Spawning takes place primarily in natal streams (hatchery-produced adults released to spawn).

Data source:

Per Paul Kline IDFG 10/22/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03 Aquafarms 2000 Inc. specifications manual Eagle Hatchery historical flow data

5.4 Incubation facilities.

189

Incubator Type	Units (number)	Flow (gpm)	Volume (cu.ft.)	Loading-Eyeing (eggs/unit)	Loading-Hatcl (eggs/unit
Upweller/Downweller	256	0.288	0.62 gal	800	800
nya	nya	nya	nya	nya	nya

nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya

Comments:

Data source:

From Chinook BPA Hatchery Reports and 1010 Chinook NOAA Fisheries Reports Per Paul Kline IDFG 9/8/03

5.5 Rearing facilities.

	Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Maximum Flow Index	Maxir Dens Ind
190	10	Fiberglass	4.3	2.17	2.17	0.917	0.8	1.34	0.25
	66	Fiberglass	10.6	3.25	3.25	1.0	2	0.8833	0.1667
	8	Fiberglass	50	6.5	6.5	1.2	9.3	0.5376	0.1
	24	Fiberglass	228.9	10	10	2.3	42.8	0.1903	0.0357

Comments:

Data source:

Aquafarms 2000 Inc. specifications manual Eagle Hatchery historical flow data. Per Paul Kline IDFG 9/8/03

5.6 Acclimation/release facilities.

	Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Maximum Flow Index	Maxir Dens Ind
190	10	Fiberglass	4.3	2.17	2.17	0.917	0.8	1.34	0.25
	66	Fiberglass	10.6	3.25	3.25	1.0	2	0.8833	0.1667
	8	Fiberglass	50	6.5	6.5	1.2	9.3	0.5376	0.1
	24	Fiberglass	228.9	10	10	2.3	42.8	0.1903	0.0357

Comments:

Data source:

Aquafarms 2000 Inc. specifications manual Eagle Hatchery historical flow data. Per Paul Kline IDFG 9/8/03

5.7 Describe operational difficulties or disasters that led to significant fish mortality.

160 No significant operational disasters have occurred in this program.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

5.8 Indicate available back-up systems, and risk aversion measures that will be applied, tha the likelihood for the take of listed natural fish that may result from equipment failure, v flooding, disease transmission, or other events that could lead to injury or mortality.

70 Fish are reared in multiple facilities or with redundant systems to reduce the risk of catastrophic loss.

78 The facility is sited so as to minimize the risk of catastrophic fish loss from flooding.

79 Staff is notified of emergency situations at the facility.

80 The facility is continuously staffed to assure the security of fish stocks on-site.

Comments:

The hatchery has never been flooded.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

Section 6. Broodstock Origin and Identity

6.1 Source.

17 The broodstock chosen represents natural populations native or adapted to the watersheds in which hatchery fish will be re

Comments:

The Salmon River spring chinook broodstock was developed primarily from endemic sources. Prior to the construction of th Fish Hatchery in 1985, chinook salmon smolts were periodically released in the vicinity of the present hatchery (first records While locally returning adults were used as much as possible, juveniles were released from adults sourced at Rapid River F Hayden Creek Fish Hatchery (Lemhi River tributary), and Marion Forks Fish Hatchery (Oregon) in 1967 (Bowles and Leitzir

Data source:

Per Paul Kline IDFG 9/8/03

6.2.1 History.

183

Broodstock Source	Origin	Year(s) Used Begin	Year(s) Used End
Lemhi River	N	1994	1999
West Fork Yankee Fork Salmon River	N	1994	2002
East Fork Salmon River	N	1994	2002
nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya

nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya

Comments:

Stock Brood Year

BY94 BY95 BY96 BY97 BY98 BY99 BY00 BY01 BY02

Lemhi NP 200 163 178 147 191

Lemhi NE 264

Lemhi SN

WFYF NP 214 113 210 229

WFYF NE 304 272 308

WFYF SN 300

EFSR NP 201 5 185

EFSR NE 143 503 311 328

EFSR SN 304 91

NP and NE refer to rearing groups sourced as natural parr and eyed-eggs, respectively.

SN refers to safety net rearing groups sourced from in-hatchery spawning. Lemhi,

WFYF, and EFSR refer to the Lemhi, West Fork Yankee Fork Salmon, and the East Fork

Salmon rivers.

Data source:

Per Paul Kline IDFG 9/8/03

6.2.2 Annual size.

22 The program collects sufficient numbers of donors from the natural stock to minimize founder effects.

23

25

27 The program does NOT collect sufficient broodstock to maintain an effective population size of 1000 fish per generation.

28 More than 10% of the broodstock is derived from wild fish each year.

Comments:

Eggs are collected from approximately 50% of the redds.

The natural spawning population has an effective population size lower than 1000. While this is a desirable goal, the chinoc rearing program operates at a considerably lower effective population size level due to the extremely depressed nature of tl population. Our primary tactic in managing genetic risk is to avoid cohort failure by supplementing fish from the captive prog fish are appropriately sourced from multiple wild families, genetic impacts from supplementation are expected to be minima 100% of the broodstock is derived from wild fish each year.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

6.2.3 Past and proposed level of natural fish in the broodstock.

33

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Comments:

This is a captive rearing program with a goal of collecting 250 eggs per stock per year. The program releases maturing adul salmon for natural spawning.

Data source:

Paul Kline, reviewed 10.22.03.

6.2.4 Genetic or ecological differences.

19 The broodstock chosen displays morphological and life history traits similar to the natural population.

Comments:

The following excerpt was taken from:

Myers, et al. 1998. Status Review of Chinook Salmon from Washington, Idaho, Oregon, and California. NOAA Technical M NMFS-NWFSC-35.

One of the earliest studies of chinook salmon genetics in the Columbia River was by Kristiansson and McIntyre (1976), whc allelic frequencies for 4 polymorphic loci in samples from 10 hatcheries, 5 of which were located along the coast and 5 in th Columbia River Basin. Significant frequency differences for SOD* were detected between spring- and fall-run samples colle Little White Salmon Hatchery on the Columbia River, but not for spring- and fall-run samples from the Trask River Hatchery northern coast of Oregon. Significant allele-frequency differences were also found between Columbia River samples as a g Oregon coastal samples for PGM* and MDH*.

Utter et al. (1989) compared allelic frequencies at 12 polymorphic loci in samples of fall-run chinook salmon from the Priest Hatchery in the mid-Columbia River and from Ice Harbor Dam on the Snake River. These samples were taken over four ye locality. Significant allele-frequency differences between populations were detected for 5 loci.

Schreck et al. (1986) examined allele-frequency variability at 18 polymorphic loci to infer genetic relationships among 56 Co Basin chinook salmon populations. A hierarchical cluster analysis of genetic correlations between populations identified two The first contained spring-run chinook salmon east of the Cascade Mountains and summer-run fish in the Salmon River. W they found three subclusters: 1) wild and hatchery spring-run chinook salmon east of the Cascade Mountains, 2) spring-run salmon in Idaho, and 3) widely scattered groups of spring-run chinook salmon in the White Salmon River Hatchery, the Mar Hatchery, and the Tucannon River. A second major group consisted of spring-run chinook salmon west of the Cascade Cre run fish in the upper Columbia River, and all fall-run fish. Three subclusters also appeared in this group: 1) spring- and fall-r Willamette River, 2) spring- and fall-run chinook salmon below Bonneville Dam, and 3) summer- and fall-run chinook salmo Columbia River. Schreck et al. (1986) also surveyed morphological variability among areas, and these results were reviewe History section of this status review.

Waples et al. (1991a) examined 21 polymorphic loci in samples from 44 populations of chinook salmon in the Columbia Riv UPGMA tree of Nei??s (1978) genetic distances between samples showed three major clusters of Columbia River Basin ch 1) Snake River spring- and summer-run chinook salmon, and mid- and upper Columbia River spring-run chinook salmon, 2 River spring-run chinook salmon, 3) mid- and upper Columbia River fall- and summer-run chinook salmon, Snake River fall- salmon, and lower Columbia River fall- and spring-run chinook salmon. These results indicate that the timing of chinook sal natal rivers was not necessarily consistent with genetic subdivisions. For example, summer-run chinook salmon in the Snak genetically distinct from summer-run chinook salmon in the mid and upper Columbia River, but still had similar adult run tim run populations in the Snake, Willamette and lower, mid, and upper Columbia Rivers were also genetically distinct from eac had similar run timings. Conversely, some populations with similar run timings, such as lower Columbia River "tule" fall-run Columbia River ?bright? fall-run fish, were genetically distinct from one another. Juvenile outmigration also differed among with similar adult run timing. For example, summer-run juveniles in the upper Columbia River exhibit ocean-type life-history characteristics, but summer-run chinook salmon in the Snake River migrate exhibit stream-type life-history characteristics.

In a status review of Snake River fall chinook salmon, Waples et al. (1991b) examined genetic relationships among fall-run salmon in the Columbia and Snake Rivers (Group 3 of Waples et al. 1991a) in more detail. A UPGMA cluster analysis of Ne genetic distance, based on 21 polymorphic loci, indicated that "bright" fall-run chinook salmon in the upper Columbia River genetically distinct from those in the Snake River. Populations in the two groups were characterized by allele-frequency diff about 10-20% at several loci, and these differences remained relatively constant from year to year in the late 1970s and ea However, allele-frequency shifts from 1985 to 1990 for samples of fall-run chinook salmon at Lyons Ferry Hatchery in the S suggested that mixing with upper Columbia River fish had occurred. This is consistent with reports that stray hatchery fish f Columbia River were inadvertently used as brood stock at the Lyons Ferry Hatchery. Samples of "bright" fall-run chinook sa Deschutes River and the Marion Drain irrigation channel in the Yakima River Basin also appeared in the same cluster with s run chinook salmon from the Snake River.

In a study of genetic effects of hatchery supplementation on naturally spawning populations in the upper Snake River Basin (1993) examined allele-frequency variability at 35 polymorphic loci in 14 wild (no hatchery supplementation), naturally spaw hatchery supplementation), and hatchery populations of spring- and summer-run chinook salmon. Most populations were sa two years. An analysis of these data indicated that 96.6% of the genetic diversity existed as genetic differences among indi populations. Most of the remaining 3.4% was due to differences between localities, and only a negligible amount was due to frequency differences between spring- and summer-run chinook salmon. Results reveal a close genetic affinity in the upper between natural spawners that suggests either gene flow between populations or a recent common ancestry. Comparisons hatchery and natural populations in the same river indicated that the degree of genetic similarity between them reflected the brood stock in the hatchery. As expected, the genetic similarity between wild and hatchery fish, for which local wild fish wer brood stock, was high.

In a study of upper Columbia River chinook salmon, Utter et al. (1995) examined allele-frequency variability at 36 loci in sar populations. A UPGMA tree of Neis (1972) genetic distances between samples indicated that spring-run populations were c summer- and fall-run populations. The average genetic distance between samples from the two groups was about eight tim of genetic distances between samples within each group. Allele-frequency variability among spring-run populations was cor greater than that among summer- and fall-run populations in the upper Columbia River. The lack of strong allele-frequency between summer- and fall-run samples indicated minimal reproductive isolation between these two groups of fish. Hatchery spring-run chinook salmon were genetically distinct from wild spring-run populations, but hatchery populations of fall-run ch were not genetically distinct from wild fall-run populations.

Some studies have indicated that Snake River spring- and summer-run chinook salmon have reduced levels of genetic vari al. (1989) estimated gene diversities with 25 polymorphic loci for 65 population units and found that gene diversities in the S were lower than those in the Columbia River. Winans (1989) estimated levels of gene diversity with 33 loci for spring-, sumi run chinook salmon at 28 localities in the Columbia River Basin. Fall-run chinook salmon tended to have significantly greate gene diversity (N=12, mean H=0.081) than both spring- (N=17, H=0.065) and summer-run (N=3, mean H=0.053) chinook s run fish in the Snake River had the lowest gene diversities (N=4, mean H=0.044). However, Waples et al. (1991a) found tha sample of 65 loci, gene diversities in Snake River spring-run and summer-run chinook salmon were not as low as that sugg earlier studies.

Recent, but unpublished, data are available for chinook salmon and will be discussed in the next section. However the resu foregoing studies of Columbia and Snake River chinook salmon permit the following generalizations:

1) Populations of chinook salmon in the Columbia and Snake Rivers are genetically discrete from populations along the coa Washington and Oregon.

2) Strong genetic differences exist between populations of spring-run and fall-run fish in the upper Columbia and Snake Riv

lower Columbia River, however, spring-run fish are genetically more closely allied with nearby fall-run fish in the lower Colu than with spring-run fish in the Snake and upper Columbia Rivers.

3) Summer-run fish are genetically related to spring-run fish in some areas (e.g., Snake River), but to fall-run fish in other a upper Columbia River).

4) Populations of fall-run fish are subdivided into several genetically discrete geographical groups in the Columbia and Sna (these populations will be discussed in detail in the next section).

5) Hatchery populations of chinook salmon tend to be genetically similar to the respective source populations used to found the hatchery populations.

Data source:

HGMP Per Paul Kline IDFG 9/8/03

6.2.5 Reasons for choosing.

18 dna

20

21 dna

Comments:

The upper Salmon River endemic spring chinook salmon stock was used to found this program. Reasons for choosing inclu availability, local adaptability, and less risk posed to upper Salmon River stocks.

Selection of stocks used in this program based on past hatchery intervention history, present wild/natural status, lack of cur intervention, and low to moderate viability.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.

6.3 Indicate risk aversion measures that will be applied to minimize the likelihood for advers or ecological effects to listed natural fish that may occur as a result of broodstock selecti practices.

The following procedures are in place that maintain broodstock collection within programmed levels:

161

- The collection plan for natural origin adults is in place that prevents collection of surplus fish

Comments:

The collection of eyed-eggs to source rearing groups is follows the experimental design of the program and is constantly re the CSCPTOC process. Multiple redds (families) are sampled.

Data source:

Per Paul Kline IDFG 10/22/03.

Section 7. Broodstock Collection

7.1 Life-history stage to be collected (adults, eggs, or juveniles).

	Adults				
Year	**Females**	**Males**	**Jacks**	**Eggs**	**Juvenile**
Planned	nya	nya	nya	600	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya

191

1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	615
1995	nya	nya	nya	nya	163
1996	nya	nya	nya	nya	296
1997	nya	nya	nya	nya	357
1998	nya	nya	nya	304	605
1999	nya	nya	nya	798	nya
2000	nya	nya	nya	807	nya
2001	nya	nya	nya	583	nya

Comments:

2002 Eggs- 636

Adult chinook salmon are collected for this program. Three groups of chinook salmon adults are collected at the Sawtooth Fis weir: natural, supplementation, and hatchery reserve. Hatchery x hatchery progeny may be ESA-listed or not and may be adi clipped or marked in some other way to differentiate them from supplementation research progeny. Supplementation researcl (hatchery x natural) are differentially marked from hatchery reserve progeny and generally do not receive an adipose fin clip. Supplementation broodstocks have been developed at the Sawtooth Fish Hatchery since 1991 as part of the cooperative Idal Supplementation Studies project.

Data source:

From Chinook BPA Hatchery Reports and 1010 Chinook NOAA Fisheries Reports. Numbers combined from four stocks of ch These numbers represent eyed-eggs and juveniles collected for a captive rearing program. Per Paul Kline IDFG 9/8/03

7.2 Collection or sampling design

16

22 The program collects sufficient numbers of donors from the natural stock to minimize founder effects.

23

24 Representative samples of the population are NOT collected with respect to size, age, sex ratio, run and spawn timing, and important to long-term fitness.

25

27 The program does NOT collect sufficient broodstock to maintain an effective population size of 1000 fish per generation.

28 More than 10% of the broodstock is derived from wild fish each year.

Comments:

Eggs are collected from approximately 50% of the redds.

This program uses only eggs collected from the natural stock. Eggs are not collected from the hatchery component of the n spawning population.

The East Fork Salmon River adult chinook salmon trap has not been operated since 1998. No collection of adults for spawr occurred since 1993. Between 1994 and 1998, the trap was operated to count fish only. All fish were passed above the wei A small sample (approximately 50 eggs out of 4000) are brought into the hatchery from multiple redds.

The natural spawning population has an effective population size lower than 1000. While this is a desirable goal, the chinoc rearing program operates at a considerably lower effective population size level due to the extremely depressed nature of tl population. Our primary tactic in managing genetic risk is to avoid cohort failure by supplementing fish from the captive prog fish are appropriately sourced from multiple wild families, genetic impacts from supplementation are expected to be minima 100% of the broodstock is derived from wild fish each year.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

7.3 Identity.

100 Marking techniques are used to distinguish among hatchery population segments.

101 100% of the hatchery fish released are marked so that they can be distinguished from the natural population.

102 Marked fish can be identified using non-lethal means.

106 Wild fish make up >30% (greater than thirty percent) % of the broodstock for this program.

Comments:

All harvest mitigation hatchery produced fish are marked with an adipose fin clip. Supplementation broodstocks have been the Sawtooth Fish Hatchery and East Fork Salmon River since 1991 as part of the cooperative Idaho Supplementation Stud Juvenile fish produced for this program were visibly marked with a ventral or adipose fin clip from 1991 through 1996. Begir brood year 1997, supplementation juveniles were released unclipped but were 100% CWT-marked. Additionally, suppleme broodstock may be ventral fin clipped. The intent for supplementation fish is that they not be intercepted in selective fisherie advent of down river selective fisheries, adipose fin clipping is no longer appropriate for supplementation juveniles.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

7.4 Proposed number to be collected:

198 **7.4.1 Program goal (assuming 1:1 sex ratio for adults):**
Approximately 250 eyed eggs are collected annually from target streams to initiate rearing groups.

7.4.2 Broodstock collection levels for the last twelve years (e.g. 1990-2001), or for most recent years availab

191

	Adults				
Year	**Females**	**Males**	**Jacks**	**Eggs**	**Juveniles**
Planned	nya	nya	nya	600	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	615
1995	nya	nya	nya	nya	163
1996	nya	nya	nya	nya	296
1997	nya	nya	nya	nya	357
1998	nya	nya	nya	304	605
1999	nya	nya	nya	798	nya
2000	nya	nya	nya	807	nya
2001	nya	nya	nya	583	nya

Comments:

2002 Eggs- 636

Adult chinook salmon are collected for this program. Three groups of chinook salmon adults are collected at the Sawtooth Fis weir: natural, supplementation, and hatchery reserve. Hatchery x hatchery progeny may be ESA-listed or not and may be adi clipped or marked in some other way to differentiate them from supplementation research progeny. Supplementation researcl (hatchery x natural) are differentially marked from hatchery reserve progeny and generally do not receive an adipose fin clip. Supplementation broodstocks have been developed at the Sawtooth Fish Hatchery since 1991 as part of the cooperative Idal Supplementation Studies project.

Data source:

From Chinook BPA Hatchery Reports and 1010 Chinook NOAA Fisheries Reports. Numbers combined from four stocks of ch These numbers represent eyed-eggs and juveniles collected for a captive rearing program. Per Paul Kline IDFG 9/8/03

7.5 Disposition of hatchery-origin fish collected in surplus of broodstock needs.

The following procedures are in place that maintain broodstock collection within programmed levels:

161

- The collection plan for natural origin adults is in place that prevents collection of surplus fish.

Comments:

The collection of eyed-eggs to source rearing groups is follows the experimental design of the program and is constantly re the CSCPTOC process. Multiple redds (families) are sampled.

Data source:

Per Paul Kline IDFG 10/22/03.

7.6 Fish transportation and holding methods.

187

Equipment Type	Capacity (gallons)	Supplemental Oxygen (y/n)	Temperature Control (y/n)	Normal Transit Time (minutes)	Chemical (s) Used	Do (p
3/4 Ton PU w/Tank	250	Y	nya	9 hrs	None	NA
10 Wheel Tanker	2700	Y	nya	12 hrs	None	NA
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya

188

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available F (gpm)
24	Fiberglass	230	10	10	2.3	60
2	Fiberglass	1250	20	20	4	250
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya

33 Broodstock is collected and held in a manner that results in less than 10% prespawning mortality.

99 IHOT guidelines for transport are followed for this program.

Comments:

Both 250 and 2700 gallon tanks are equipped with Fresh-flow aeration pumps.

A variety of transportation vehicles and equipment are available at the various facilities. Generally, adult transportation at bot unnecessary as hatchery-produced adults are trapped and spawned on site.

Data source:

Per Paul Kline IDFG 9/8/03 From Chinook BPA Hatchery Reports and 1010 Chinook NOAA Fisheries Reports.
Per Paul Kline IDFG 9/8/03 Aquafarms 2000 Inc. specifications manual Eagle Hatchery historical flow data
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

7.7 Describe fish health maintenance and sanitation procedures applied.

98 "Fish transfers into the subbasin are inspected and accompanied by notifications as described in IHOT and PNFHPC guide

32 Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection committee (PNFHPC), state or triba are followed for broodstock fish health inspection , transfer of eggs or adults and broodstock holding and disposal of carcas

Comments:

Guidelines are in place for adult transfers.

Data source:

Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03

7.8 Disposition of carcasses.

32 Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection committee (PNFHPC), state or triba are followed for broodstock fish health inspection , transfer of eggs or adults and broodstock holding and disposal of carcas

103 Hatchery adults are distributed by staff within the subbasin to provide hatchery adults are distributed (by staff) within the sul provide natural production.

161 The following procedures are in polace that maintain broodstock collection within programmed levels:

- The collection plan for natural origin adults is in place that prevents collection of surplus fish

Comments:

The collection of eyed-eggs to source rearing groups is follows the experimental design of the program and is constantly re the CSCPTOC process. Multiple redds (families) are sampled.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.

7.9 Indicate risk aversion measures that will be applied to minimize the likelihood for advers or ecological effects to listed natural fish resulting from the broodstock collection progra

29 The program has guidelines for acceptable contribution of hatchery fish to natural spawning.

30 These guidelines are met for all affected natural stocks.

32 Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection committee (PNFHPC), state or triba are followed for broodstock fish health inspection , transfer of eggs or adults and broodstock holding and disposal of carcas

Comments:

Annual project reports submitted to BPA and NOAA Fisheries to meet contract and permit obligations.

Data source:

Per Paul Kline IDFG 9/8/03

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

Section 8. Mating

8.1 Selection method.

35 Males and females available on a given day are mated randomly.

39 Fish are allowed to select their own mates and go through all normal spawning behavior.

Comments:

Captive-reared adults produced in this program are primarily released to the habitat to naturally spawn. However, to develo understanding of the reproductive potential of captive-reared adult chinook salmon (e.g., maturation timing, gamete quality, eyed stage of development), some in-hatchery spawning occurs. Information developed in this manner is used to complime observations and reproductive success data collected in the field following the release of maturing adult chinook salmon.

Hatchery spawning follows accepted, standard practices. In addition, input on the development of spawning designs is prov University of Idaho and discussed at the CSCPTOC level. Dissimilarity spawning matrices may be developed by the Univer using results from genetic analyses. Eggs produced at spawning are divided into sub-lots (by female) and fertilized with milt program males. Up to four sub-families may be produced from each female (factorial design). Unique males are used an ap number of times to balance their contribution to the spawning design. Milt is pre-harvested from contributing males and exa motility prior to use. Eggs are incubated by sub-family to yield lineage-specific rearing groups. Overall egg quality is judged egg size, clarity of ovarian fluid, and presence/absence of polarized or overripe eggs. Fecundities are developed by applyin weights to the total egg weight for each female. Egg survival to the eyed stage off development is determined by subtractin unfertilized eggs from the total estimated number of eggs for each female.
Spawning of captively reared fish takes place in the wild. Some hatchery spawning occurs to document specific spawning v reproductive potential.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.

8.2 Males.

38

37 Back-up males are not used in the spawning protocol.

Comments:

Spawning of captively reared fish takes place in the wild.

Generally, males are used only once for spawning. In cases where skewed sex ratios exist (fewer males than females) or ir where males mature late, males may be used twice. In addition, if factorial or modified diallele spawning designs are followe be used more than once
Spawning of captively reared fish takes place in the wild. Some hatchery spawning occurs to document specific spawning v reproductive potential.

Data source:

HGMP Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.

8.3 Fertilization.

36 Gametes are NOT pooled prior to fertilization.

39 Fish are allowed to select their own mates and go through all normal spawning behavior.

11 IHOT PNFHPC state federal other guidelines are followed for culture practices for this program.

40 Disinfection procedures that prevent pathogen transmission between stocks of fish are implemented during spawning.

Comments:

Spawning of captively reared fish takes place in the wild.

Spawning ratios of 1 male to 1 female will be used unless the broodstock population contains less than 100 females. If the s population contains less than 100 females, then eggs from each female may be split into multiple sub-families and fertilized males. Following fertilization, one cup of well water is added to each bucket (sub-family of eggs) and set aside for 30 secon minute.
Spawning of captively reared fish takes place in the wild. Some hatchery spawning occurs to document specific spawning v reproductive potential.
Other = Chinook Salmon Captive Propagation Technical Oversight Committee. A team of technical experts representing the agencies and tribes involved with the program in addition to invited experts. The CSCPTOC meets periodically to review pr activities, address critical uncertainties, and to adaptively manage future activities
Some hatchery spawning occurs to document specific spawning variables and reproductive potential.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.

8.4 Cryopreserved gametes.

162 Cryopreserved gametes are used.

Comments:

Milt is not cryopreserved as part of this program and no cryopreserved gametes are used in this program. However, the Ne: has collected milt from natural males at the Sawtooth Fish Hatchery.

Data source:

HGMP Per Paul Kline IDFG 9/8/03

8.5 Indicate risk aversion measures that will be applied to minimize the likelihood for advers or ecological effects to listed natural fish resulting from the mating scheme.

35 Males and females available on a given day are mated randomly.

36 Gametes are NOT pooled prior to fertilization.

37 Back-up males are not used in the spawning protocol.

38 dna

39 Fish are allowed to select their own mates and go through all normal spawning behavior.

Comments:

Captive-reared adults produced in this program are primarily released to the habitat to naturally spawn. However, to develo understanding of the reproductive potential of captive-reared adult chinook salmon (e.g., maturation timing, gamete quality, eyed stage of development), some in-hatchery spawning occurs. Information developed in this manner is used to complime observations and reproductive success data collected in the field following the release of maturing adult chinook salmon.

Hatchery spawning follows accepted, standard practices. In addition, input on the development of spawning designs is prov University of Idaho and discussed at the CSCPTOC level. Dissimilarity spawning matrices may be developed by the Univer using results from genetic analyses. Eggs produced at spawning are divided into sub-lots (by female) and fertilized with milt program males. Up to four sub-families may be produced from each female (factorial design). Unique males are used an ap number of times to balance their contribution to the spawning design. Milt is pre-harvested from contributing males and exa motility prior to use. Eggs are incubated by sub-family to yield lineage-specific rearing groups. Overall egg quality is judged egg size, clarity of ovarian fluid, and presence/absence of polarized or overripe eggs. Fecundities are developed by applyin weights to the total egg weight for each female. Egg survival to the eyed stage off development is determined by subtracting unfertilized eggs from the total estimated number of eggs for each female.
Spawning of captively reared fish takes place in the wild.

Spawning ratios of 1 male to 1 female will be used unless the broodstock population contains less than 100 females. If the s population contains less than 100 females, then eggs from each female may be split into multiple sub-families and fertilized males. Following fertilization, one cup of well water is added to each bucket (sub-family of eggs) and set aside for 30 secon minute.
Spawning of captively reared fish takes place in the wild. Some hatchery spawning occurs to document specific spawning v reproductive potential.
Spawning of captively reared fish takes place in the wild.

Generally, males are used only once for spawning. In cases where skewed sex ratios exist (fewer males than females) or ir where males mature late, males may be used twice. In addition, if factorial or modified diallele spawning designs are followe be used more than once
Spawning of captively reared fish takes place in the wild. Some hatchery spawning occurs to document specific spawning v reproductive potential.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.
HGMP Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.

Section 9. Incubation and Rearing.

9.1.1 Number of eggs taken and survival rates to eye-up and/or ponding.

	Year	Egg Take	Green-Eyed Survival (%)	Eyed-Ponding Survival (%)	Egg Survival Performance Std.	Fry-fingerling Survival (%)	Rearing Survival Performance Std.	Finger Smo Surviva
	1990	NA	NA	NA	NA	NA	NA	NA
	1991	NA	NA	NA	NA	NA	NA	NA
	1992	NA	NA	NA	NA	NA	NA	NA
	1993	NA	NA	NA	NA	NA	NA	NA
192	1994	NA	NA	NA	NA	NA	NA	78.49
	1995	NA	NA	NA	NA	NA	NA	92.47
	1996	NA	NA	NA	NA	NA	NA	84.91
	1997	NA	NA	NA	NA	NA	NA	94.03
	1998	44,414	72.47	84.87	NA	97.45	NA	96.91
	1999	4,631	78.73	94.11	NA	95.34	NA	96.93
	2000	1,323	95.69	96.50	NA	95.1	NA	96.7
	2001	21,500	37.9	96.91	NA	95.93	NA	Unknown

Comments:

Egg Green-Eyed Eyed-ponding Egg surv. fry-fingerling rearing surv. fing.-smolt

Year Take Survival(%) Survival (%) perf std. survival perf. std. surv. (%)

2002 72,203 66.45 94.50 NA Unknown NA unknown

Note: First two columns represent hatchery production (All eyed-eggs returned to natal streams). The remaining columns rep of eyed-eggs and parr collected from the field and reared in captivity.

Data source:

Project annual reports to Bonneville Power Administration. Project annual reports to NOAA Fisheries for ESA Section 10 acti Kline IDFG 9/8/03

9.1.2 Cause for, and disposition of surplus egg takes.

163 Extra eggs are not intentionally produced in this program.

45

48 Families are incubated individually.

59 No culling of juveniles occur.

60

61

44 0 (eggs are never culled)

Comments:

Eggs are not culled.

Juvenile chinook salmon are not culled.
Rearing groups for this program are sourced as eyed-eggs from redds built by wild chinook salmon. An approximately equa
eyed-eggs(~50) are removed from up six redds. As such, family size is equalized at collection.

Data source:

Per Paul Kline IDFG, 11/18/03.
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

9.1.3 Loading densities applied during incubation.

51 Integrated Hatchery Operations Team (IHOT) species-specific incubation recommendations were followed for water quality temperature and incubator capacities.

47 Families within spawning groups are NOT mixed randomly at ponding, thus unintentional rearing differences may affect fam differently.

42 Eggs are incubated under conditions that result in equal survival of all segments of the population to ponding.

Comments:

The chinook captive rearing program uses isolation buckets to incubate small numbers of family-specific eggs. No substrate
Eggs are sourced from wild redds, they are ponded by "redd" until they are large enough to PIT tag. Different families are g
following PIT tagging.
Eggs in the hatchery are incubated under these conditions. Those from the captively reared fish spawning in the wild are nc

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

9.1.4 Incubation conditions.

49 Incubation takes place in home stream water.

50 The program uses water sources that result in hatching/emergence timing similar to that of the naturally produced populatic

51 Integrated Hatchery Operations Team (IHOT) species-specific incubation recommendations were followed for water quality temperature and incubator capacities.

53 Eggs are monitored when needed to determine fertilization efficiency and embryonic development.

42 Eggs are incubated under conditions that result in equal survival of all segments of the population to ponding.

47 Families within spawning groups are NOT mixed randomly at ponding, thus unintentional rearing differences may affect fam differently.

48 Families are incubated individually.

43 Incubation conditions are manipulated as to synchronize ponding of fry.

Comments:

Captive adults are released to spawn naturally. Production from these adults hatch and rear on home stream water. For eg
from wild redds and brought into the hatchery to source rearing groups, incubation occurs through the eyed stage of develo
wild and in the hatchery from eye through hatch.

The chinook captive rearing program uses isolation buckets to incubate small numbers of family-specific eggs. No substrat
Fertilization efficiency in the hatchery is not monitored until the eyed stage. Fertilization efficiency of the captively reared fis
the wild is also monitored.

Using hydraulic sampling methods, a subsample of redds (produced by captive-reared adults released to spawn naturally) a
verify that eggs were successfully deposited and fertilized.

nc
Eggs are sourced from wild redds, they are ponded by "redd" until they are large enough to PIT tag. Different families are g
following PIT tagging.

Eggs and alevin in the hatchery are incubated under these conditions. Those from the captively reared fish spawning in the

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

9.1.5 Ponding.

The procedures used for determining when fry are ponded include:

55

- Fry are ponded based on visual inspection of the amount of yolk remaining

46 Eggs are NOT incubated in a manner that allows volitional ponding of fry.

Comments:

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

9.1.6 Fish health maintenance and monitoring.

52 Disinfection procedures are implemented during incubation that prevent pathogen transmission between stocks of fish on s

53 Eggs are monitored when needed to determine fertilization efficiency and embryonic development.

54 Following eye-up stage, eggs are inventoried, and dead or undeveloped eggs removed and disposed of as described in the
control guidelines.

56 Dead or culled eggs are discarded in a manner that prevents transmission to receiving watershed.

Comments:

Section 10 permit and CSCPTOC guidelines.

Fertilization efficiency in the hatchery is not monitored until the eyed stage. Fertilization efficiency of the captively reared fis the wild is also monitored.

Using hydraulic sampling methods, a subsample of redds (produced by captive-reared adults released to spawn naturally) a
verify that eggs were successfully deposited and fertilized.

Eggs are disinfected and discarded in a landfill.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

9.1.7 Indicate risk aversion measures that will be applied to minimize the likelihood for advers and ecological effects to listed fish during incubation.

47 Families within spawning groups are NOT mixed randomly at ponding, thus unintentional rearing differences may affect fam differently.

49 Incubation takes place in home stream water.

50 The program uses water sources that result in hatching/emergence timing similar to that of the naturally produced populatic

51 Integrated Hatchery Operations Team (IHOT) species-specific incubation recommendations were followed for water quality temperature and incubator capacities.

52 Disinfection procedures are implemented during incubation that prevent pathogen transmission between stocks of fish on s

56 Dead or culled eggs are discarded in a manner that prevents transmission to receiving watershed.

61 Families are NOT culled to minimize family size variation.

Comments:

Eggs are sourced from wild redds, they are ponded by "redd" until they are large enough to PIT tag. Different families are g following PIT tagging.
Captive adults are released to spawn naturally. Production from these adults hatch and rear on home stream water. For eg from wild redds and brought into the hatchery to source rearing groups, incubation occurs through the eyed stage of develo wild and in the hatchery from eye through hatch.

The chinook captive rearing program uses isolation buckets to incubate small numbers of family-specific eggs. No substrate Section 10 permit and CSCPTOC guidelines.

Eggs are disinfected and discarded in a landfill.

Rearing groups for this program are sourced as eyed-eggs from redds built by wild chinook salmon. An approximately equa eyed-eggs(~50) are removed from up six redds. As such, family size is equalized at collection.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

9.2.1 Provide survival rate data (*average program performance*) by hatchery life stage (fry to f fingerling to smolt) for the most recent twelve years (1990-2001), or for years dependab are available.

	Year	Egg Take	Green-Eyed Survival (%)	Eyed-Ponding Survival (%)	Egg Survival Performance Std.	Fry-fingerling Survival (%)	Rearing Survival Performance Std.	Finger Smo Surviva
	1990	NA	NA	NA	NA	NA	NA	NA
	1991	NA	NA	NA	NA	NA	NA	NA
	1992	NA	NA	NA	NA	NA	NA	NA
	1993	NA	NA	NA	NA	NA	NA	NA
192	1994	NA	NA	NA	NA	NA	NA	78.49
	1995	NA	NA	NA	NA	NA	NA	92.47
	1996	NA	NA	NA	NA	NA	NA	84.91
	1997	NA	NA	NA	NA	NA	NA	94.03
	1998	44,414	72.47	84.87	NA	97.45	NA	96.91
	1999	4,631	78.73	94.11	NA	95.34	NA	96.93
	2000	1,323	95.69	96.50	NA	95.1	NA	96.7
	2001	21,500	37.9	96.91	NA	95.93	NA	Unknown

Comments:

Egg Green-Eyed Eyed-ponding Egg surv. fry-fingerling rearing surv. fing.-smolt

Year Take Survival(%) Survival (%) perf std. survival perf. std. surv. (%)

2002 72,203 66.45 94.50 NA Unknown NA unknown

Note: First two columns represent hatchery production (All eyed-eggs returned to natal streams). The remaining columns rep of eyed-eggs and parr collected from the field and reared in captivity.

Data source:

Project annual reports to Bonneville Power Administration. Project annual reports to NOAA Fisheries for ESA Section 10 acti Kline IDFG 9/8/03

9.2.2 Density and loading criteria (goals and actual levels).

71 The juvenile rearing density and loading guidelines used at the facility are based on: other criteria .

72 IHOT standards are followed for: water quality , alarm systems , predator control measures to provide the necessary securi cultured stock , loading and density.

Comments:

Loading and density is based on Chinook Salmon Captive Propagation Technical Oversight Committee (CSCPTOC) guidel

Program uses more conservative loading and density criteria than IHOT.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

9.2.3 Fish rearing conditions.

66 The program uses a diet and growth regime that mimics natural seasonal growth patterns.

67 Settleable solids, unused feed and feces are removed periodically to ensure proper cleanliness of rearing containers.

72 IHOT standards are followed for: water quality , alarm systems , predator control measures to provide the necessary securi cultured stock , loading and density.

71 The juvenile rearing density and loading guidelines used at the facility are based on other criteria .

Comments:

The diet ration is altered based on the time of year and the age of the fish.

Program uses more conservative loading and density criteria than IHOT.

Loading and density is based on Chinook Salmon Captive Propagation Technical Oversight Committee (CSCPTOC) guidel

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

9.2.4 Indicate biweekly or monthly fish growth information (average program performance), ir length, weight, and condition factor data collected during rearing, if available.

194

Rearing Period	Length (mm)	Weight (fpp)	Condition Factor	Growth Rate	Hepatosomatic Index	Boc Moist Conte
January	54.687	1.140	NA	1	NA	NA
February	55.139	1.173	NA	7	NA	NA
March	62.737	1.834	NA	10	NA	NA
April	72.451	3.019	NA	9	NA	NA
May	81.565	4.550	NA	10	NA	NA
June	91.773	6.844	NA	12	NA	NA
July	103.6	10.414	NA	10	NA	NA
August	113.9	14.458	NA	13	NA	NA
September	126.82	20.974	NA	9	NA	NA
October	135.01	26.044	NA	10	NA	NA
November	144.922	37.412	NA	6	NA	NA
December	150.673	43.710	NA	9	NA	NA

Comments:

Rearing Length Weight Condition Growth Hepatosomatic Body Moisture

Period (mm) (fpp) Factor Rate Index Content

January 159.910 55.448 NA 5 NA NA

February 165.099 63.000 NA 6 NA NA

March 171.309 73.020 NA 7 NA NA

April 178.371 85.820 NA 8 NA NA

May 186.583 102.740 NA 7 NA NA

June 195.571 124.000 NA 8 NA NA

Data source:

Per Paul Kline IDFG 9/8/03 Project annual reports to Bonneville Power Administration. Project annual reports to NOAA Fishe Section 10 activities. Historical sample count data from Eagle Hatchery. Condition factor can not be determined since all leng measurements represent "Fork Length".

9.2.5 Indicate monthly fish growth rate and energy reserve data (*average program performanc* available.

64
- Feeding rates are followed so that fish size is within 10% of program goal each year.
- Feed is stored under proper conditions as described by IHOT guidelines.

65 The correct amount and type of food is provided to achieve the desired growth rate , body composition and condition factorsf and life stages being reared.

194

Rearing Period	Length (mm)	Weight (fpp)	Condition Factor	Growth Rate	Hepatosomatic Index	Boc Moist Cont
January	54.687	1.140	NA	1	NA	NA
February	55.139	1.173	NA	7	NA	NA
March	62.737	1.834	NA	10	NA	NA
April	72.451	3.019	NA	9	NA	NA
May	81.565	4.550	NA	10	NA	NA
June	91.773	6.844	NA	12	NA	NA
July	103.6	10.414	NA	10	NA	NA
August	113.9	14.458	NA	13	NA	NA
September	126.82	20.974	NA	9	NA	NA
October	135.01	26.044	NA	10	NA	NA
November	144.922	37.412	NA	6	NA	NA
December	150.673	43.710	NA	9	NA	NA

66 The program uses a diet and growth regime that mimics natural seasonal growth patterns.

Comments:

Juvenile chinook salmon are fed a semi-moist diet provided from different manufacturers (state contract dependent). Convers first ponding to release averages 1.3 pounds of weight gain for each pound of food fed.
Rearing Length Weight Condition Growth Hepatosomatic Body Moisture

Period (mm) (fpp) Factor Rate Index Content

January 159.910 55.448 NA 5 NA NA

February 165.099 63.000 NA 6 NA NA

March 171.309 73.020 NA 7 NA NA

April 178.371 85.820 NA 8 NA NA

May 186.583 102.740 NA 7 NA NA

June 195.571 124.000 NA 8 NA NA
The diet ration is altered based on the time of year and the age of the fish.

Data source:

Per Paul Kline IDFG 9/8/03
HGMP Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03 Project annual reports to Bonneville Power Administration. Project annual reports to NOAA Fishe
Section 10 activities. Historical sample count data from Eagle Hatchery. Condition factor can not be determined since all leng
measurements represent "Fork Length".
Per Paul Kline IDFG 9/8/03

9.2.6 Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*averag performance*).

64
- Feeding rates are followed so that fish size is within 10% of program goal each year.
- Feed is stored under proper conditions as described by IHOT guidelines.

65 The correct amount and type of food is provided to achieve the desired growth rate , body composition and condition factorsf and life stages being reared.

	Rearing Period	Food Type	Application Schedule (#feedings/day)	Feeding Rate Range (% B.W./day)	Lbs. Fed Per gpm of Inflow	Food Conversi During Perioc
	Swim-upto	Starter	8	2.8	0.005	1.0
195	1.0-1.3 g/f	1.0	4	2.16	0.0076	1.1
	1.3-2.2 g/f	1.3	4	2.08	0.0073	1.2
	2.2-4.0 g/f	1.5	4	1.92	0.0101	1.2
	4.0-7.5 g/f	2.0	4	1.76	0.0078	1.2
	7.5-12.0 g/f	2.5	4	1.68	0.137	1.3

Comments:

Juvenile chinook salmon are fed a semi-moist diet provided from different manufacturers (state contract dependent). Convers
first ponding to release averages 1.3 pounds of weight gain for each pound of food fed.
Rearing Food Application Feeding Rate Lbs. fed per Food Conversion

Period Type Schedule Range gpm of inflow during period

12 - 25 g/f 3.0 4 1.56 .0206 1.3

25 - 70 g/f 4.0 4 1.36 .012 1.3

70 - 500 g/f 5.0 4 .88 .0233 1.4

Data source:

Per Paul Kline IDFG 9/8/03
HGMP Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

9.2.7 Fish health monitoring, disease treatment, and sanitation procedures.

62 IHOT fish health guidelines are followed to prevent transmission between lots of fish on site or transmission or amplification the watershed.

63 Whenever possible, vaccines are used to minimize the use of antimicrobial compounds.

71 The juvenile rearing density and loading guidelines used at the facility are based on other criteria .

Comments:

Loading and density is based on Chinook Salmon Captive Propagation Technical Oversight Committee (CSCPTOC) guidel

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

9.2.8 Smolt development indices (e.g. gill ATPase activity), if applicable.

87 The migratory state of the release population is determined by dna.

Comments:

Smolts are not released by this program. Production occurs from captive-reared adults released to spawn naturally. This nc questions 88 through 96 as well.

Data source:

Per Paul Kline IDFG 9/8/03

9.2.9 Indicate the use of "natural" rearing methods as applied in the program.

68 The program attempts to better mimic the natural rearing environment by reducing rearing density below agency or other gu rearing under natural water temperature and actively simulating photoperiod .

69 Fish produced are qualitatively similar to natural fish in morphology , behavior , physiological status , health and other chara

66 The program uses a diet and growth regime that mimics natural, seasonal growth patterns.

84 Fish are released at sizes similar to natural fish of the same life stage and species.

88

Comments:

Fish are reared with 70% of the ponds covered with shade cloth, but this is not meant to simulate natural cover.

The Hatchery Evaluation Studies component of the LSRCP program is evaluating the efficacy of semi-natural rearing treatr release juvenile chinook salmon out-migration survival (?NATURES? experimentation). This research is ongoing. A progres expected in federal fiscal year 2003.

Other: Every effort is made to not accelerate growth and to produce fish that are similar to natural fish in every respect. The diet ration is altered based on the time of year and the age of the fish.

Adults released are generally smaller than naturally produced fish. Eyed-egg, pre-smolt, and pre-spawn adults are releasec

This is an adult supplementation program. This question applies to juveniles.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.

9.2.10 Indicate risk aversion measures that will be applied to minimize the likelihood for advers and ecological effects to listed fish under propagation.

60 dna

72 IHOT standards are followed for: water quality , alarm systems , predator control measures to provide the necessary securi cultured stock , loading and density.

80 The facility is continuously staffed to assure the security of fish stocks on-site.

84 Fish are released at sizes similar to natural fish of the same life stage and species.

88

98 "Fish transfers into the subbasin are inspected and accompanied by notifications as described in IHOT and PNFHPC guide

76 Fish inventory data accurately reflect rearing vessel population abundance with 10%.

86

96 Fish are NOT released in the same subbasin as the rearing facility.

Comments:

Juvenile chinook salmon are not culled.
Program uses more conservative loading and density criteria than IHOT.

Adults released are generally smaller than naturally produced fish. Eyed-egg, pre-smolt, and pre-spawn adults are releasec

This is an adult supplementation program. This question applies to juveniles.
Guidelines are in place for adult transfers.

Sample counts are conducted monthly. In addition, fish are completely inventoried at ponding and when split to larger conta mortality is documented and subtracted from the running inventory.

This is an adult supplementation program. Out-migration does not apply.

Data source:

Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

Section 10. Release

10.1 Proposed fish release levels.

	Age Class	Maximum Number	Size (ffp)	Release Date	Location: Stream	Location: Release Point (RKm)	Location: Major Watershed	Location: Ecopro
	Eggs	50,000	2700	November	East Fork Salmon River	522.303.552.029	Salmon River	Mountai Snake
1	**Unfed Fry**	nya	nya	nya	nya	nya	nya	nya
	Fry	nya	nya	nya	nya	nya	nya	nya
	Fingerling	nya	nya	nya	nya	nya	nya	nya
	Yearling	700,000	nya	nya	East Fork Salmon River	nya	Salmon River	Mountai Snake

Comments:

Age Class Max No. Size Release Date Stream Release Point Major Watershed Ecoprovince

Adult 150 0.12 Aug. East Fork 522.303.225.029 Salmon Mountain

Salmon River Snake

Proposed, annual fish release numbers for the Sawtooth Fish Hatchery and the East Fork Salmon River Satellite are present While proposed exist, the program is being managed to address the higher priority of providing sufficient broodstock for natu and hatchery production. Lack of sufficient broodstock coupled with ESA-listing has substantially modified releases. For som broodstock criteria have driven fish release levels, not production targets.

Yearling numbers include original juvenile release target for the Idaho Supplementation Studies Program for the East Fork S 173,000(supp.)

To develop an understanding of the reproductive potential of captive-reared adult chinook salmon, the Chinook Salmon Capt Propagation Technical Oversight Committee (CSCPTOC) recommended that spawning take place at the Eagle Fish Hatcher several reproduction variables (e.g., maturation timing, gamete quality, egg survival to eyed stage of development. Informatic this manner is used to compliment behavioral observations and reproductive success data collected in the field following the maturing adult chinook salmon.

Eggs produced from hatchery spawning events have been used to supplement captive rearing groups or returned to hatch b streams.

Milt has been cryopreserved in the captive rearing program since 1997.

Data source:

Per Paul Kline IDFG 9/8/03

10.2 Specific location(s) of proposed release(s).

	Age Class	Maximum Number	Size (ffp)	Release Date	Location: Stream	Location: Release Point (RKm)	Location: Major Watershed	Location: Ecopro
	Eggs	50,000	2700	November	East Fork Salmon River	522.303.552.029	Salmon River	Mountai Snake
1	**Unfed Fry**	nya	nya	nya	nya	nya	nya	nya
	Fry	nya	nya	nya	nya	nya	nya	nya
	Fingerling	nya	nya	nya	nya	nya	nya	nya
	Yearling	700,000	nya	nya	East Fork Salmon River	nya	Salmon River	Mountai Snake

96 Fish are NOT released in the same subbasin as the rearing facility.

Comments:

Age Class Max No. Size Release Date Stream Release Point Major Watershed Ecoprovince

Adult 150 0.12 Aug. East Fork 522.303.225.029 Salmon Mountain

Salmon River Snake

Proposed, annual fish release numbers for the Sawtooth Fish Hatchery and the East Fork Salmon River Satellite are present While proposed exist, the program is being managed to address the higher priority of providing sufficient broodstock for natu and hatchery production. Lack of sufficient broodstock coupled with ESA-listing has substantially modified releases. For som broodstock criteria have driven fish release levels, not production targets.

Yearling numbers include original juvenile release target for the Idaho Supplementation Studies Program for the East Fork S 173,000(supp.)

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Eggs produced from hatchery spawning events have been used to supplement captive rearing groups or returned to hatch b streams.

Milt has been cryopreserved in the captive rearing program since 1997.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

10.3 Actual numbers and sizes of fish released by age class through the program.

>

		Eggs/Unfed Fry Release			Fry Release			Fingerling Release			Yearling	
	Release Year	**Number**	**Date (MM/DD)**	**Avg Size (fpp)**	**Number**	**Date (MM/DD)**	**Avg size (fpp)**	**Number**	**Date (MM/DD)**	**Avg Size (fpp)**	**Number**	**D (MM**
	1991	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya
	1992	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya
	1993	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya
	1994	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya
196	**1995**	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya
	1996	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya
	1997	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya
	1998	30054	11/98	nya	nya	nya	nya	nya	nya	nya	nya	nya
	1999	3335	10/99	nya	nya	nya	nya	nya	nya	nya	nya	nya
	2000	1266	11/00	nya	nya	nya	nya	nya	nya	nya	nya	nya
	2001	8154	11/01	nya	nya	nya	nya	nya	nya	nya	nya	nya
	2002	47977	10/02	nya	nya	nya	nya	nya	nya	nya	219	4/02
	Avg	18156	Nov	nya	nya	nya	nya	nya	nya	nya	219	April

Comments:

Adult release history (all streams combined):

Release year Adult Release Date Avg size(fpp)

1997 9 8/97 1.0

1998 112 8/98 n/a

1999 69 8/99 n/a

2000 72 7/00 n/a

2001 89 8/1 n/a

2002 347 8/02 .35

Average 116 August .35

Data source:

Per Paul Kline IDFG 9/8/03

10.4 Actual dates of release and description of release protocols.

84 Fish are released at sizes similar to natural fish of the same life stage and species.

85

86

88

89

90

91

92 The carrying capacity of the subbasin has been taken into consideration in sizing this program.

87 The migratory state of the release population is determined by dna.

Comments:

This is an adult supplementation program. Out-migration does not apply.

No harvest of wild/natural chinook salmon occurs. Progeny produced from captive adults released to naturally spawn are n
clipped and appear as wild/natural fish.
Adults released are generally smaller than naturally produced fish. Eyed-egg, pre-smolt, and pre-spawn adults are releasec

This is an adult supplementation program. This question applies to juveniles.
This is an adult supplementation program. The question applies to juveniles.

This is an adult supplementation program. The question applies to juveniles.

This is an adult supplementation program. The question applies to juveniles.

Smolts are not released by this program. Production occurs from captive-reared adults released to spawn naturally. This nc
questions 88 through 96 as well.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

Per Paul Kline IDFG 9/8/03

10.5 Fish transportation procedures, if applicable.

96 Fish are NOT released in the same subbasin as the rearing facility.

187

Equipment Type	Capacity (gallons)	Supplemental Oxygen (y/n)	Temperature Control (y/n)	Normal Transit Time (minutes)	Chemical (s) Used	Do (ı
3/4 Ton PU w/Tank	250	Y	nya	9 hrs	None	NA
10 Wheel Tanker	2700	Y	nya	12 hrs	None	NA
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya

Comments:

Both 250 and 2700 gallon tanks are equipped with Fresh-flow aeration pumps.

A variety of transportation vehicles and equipment are available at the various facilities. Generally, adult transportation at bot unnecessary as hatchery-produced adults are trapped and spawned on site.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03 From Chinook BPA Hatchery Reports and 1010 Chinook NOAA Fisheries Reports.

10.6 Acclimation procedures (*methods applied and length of time*).

166 Maturaing, adult chinook salmon are released into natal stream for natural spawning. Adequate water temperature acclimat prior to release. Adults are typically released in late July and early August. Adults typically spawn in September.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

10.7 Marks applied, and proportions of the total hatchery population marked, to identify hatcl adults.

100 Marking techniques are used to distinguish among hatchery population segments.

101 100% of the hatchery fish released are marked so that they can be distinguished from the natural population.

102 Marked fish can be identified using non-lethal means.

Comments:

All harvest mitigation hatchery produced fish are marked with an adipose fin clip. Supplementation broodstocks have been the Sawtooth Fish Hatchery and East Fork Salmon River since 1991 as part of the cooperative Idaho Supplementation Stud Juvenile fish produced for this program were visibly marked with a ventral or adipose fin clip from 1991 through 1996. Begir brood year 1997, supplementation juveniles were released unclipped but were 100% CWT-marked. Additionally, suppleme broodstock may be ventral fin clipped. The intent for supplementation fish is that they not be intercepted in selective fisherie advent of down river selective fisheries, adipose fin clipping is no longer appropriate for supplementation juveniles.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

10.8 Disposition plans for fish identified at the time of release as surplus to programmed or a levels

167 Surplus adults are not produced in this program.

163 Extra eggs are not intentionally produced in this program.

Comments:

null
null

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

10.9 Fish health certification procedures applied pre-release.

97 All fish are examined for the presence of “reportable pathogens” as defined in the PNFHPC disease control guidelines, with prior to release.

98 Fish transfers into the subbasin are inspected and accompanied by notifications as described in IHOT and PNFHPC guideli

Comments:

The pathogen history of the fish is known since they are captively reared. The program would not sacrifice 60 adults simply certification guidelines.

Guidelines are in place for adult transfers.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.

10.10 Emergency release procedures in response to flooding or water system failure.

168 Backup and system redundancy is in place for degassing, pumping and power generation. Oxygen is available on-site for e supply to all rearing tanks. Eight water level alarms are in use and linked through an emergency service operator. Additiona provided by limiting public access and by the presence of four on-site residences occupied by IDFG hatchery personnel.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

10.11 Indicate risk aversion measures that will be applied to minimize the likelihood for advers and ecological effects to listed fish resulting from fish releases.

84 Fish are released at sizes similar to natural fish of the same life stage and species.

86 Volitional release during natural out-migration timing is practiced.

88

89

91

104 The percent of the naturally spawning population in the subbasin that consists of adults from the program is 0-5% (less tha

105 The percent of hatchery fish spawning in the wild is estimated by:

- Annual stream surveys (e.g. carcasses)

95 Fish are released at times of the year and sizes to allow adoption of multiple life history strategies.

94 Fish are released within the historic range for that stock.

93 The carrying capacity of the subbasin was taken into account when determining the number of fish to be released.

Comments:

Adults released are generally smaller than naturally produced fish. Eyed-egg, pre-smolt, and pre-spawn adults are releasec

This is an adult supplementation program. Out-migration does not apply.

This is an adult supplementation program. This question applies to juveniles.
This is an adult supplementation program. The question applies to juveniles.

This is an adult supplementation program. The question applies to juveniles.

null
Actions taken to minimize adverse effects on listed fish include:

1. Continuing fish health practices to minimize the incidence of infectious disease agents. Follow IHOT, AFS, and PNFHPC

2. Marking hatchery-produced spring chinook salmon for broodstock management. Smolts released for supplementation re: marked differentially from other fish.

3. Not releasing spring chinook salmon for supplementation research in the Salmon River in excess of estimated carrying c

4. Continuing to reduce effect of the release of large numbers of hatchery chinook salmon at a single site by spreading the number of days.

5. Attempting to program time of release to mimic natural fish for Salmon River smolt releases.

6. Evaluating natural rearing techniques for Salmon River spring chinook salmon at the Sawtooth Fish Hatchery.

7. Continuing to use broodstock for general production and supplementation research that exhibit life history characteristics locally evolved stocks.

8. Continuing to segregate female spring chinook salmon broodstock for BKD via ELISA. We will incubate each female??s separately and also segregate progeny for rearing. We will continue development of culling and rearing segregation guideli practices, relative to BKD.

9. Monitoring hatchery effluent to ensure compliance with National Pollutant Discharge Elimination System permit.

10. Continuing Hatchery Evaluation Studies (HES) to provide comprehensive monitoring and evaluation for LSRCP chinool
The number of hatchery fish is known from the adult release records.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 10/22/03.
nds
Per Paul Kline IDFG 9/8/03
HGMP Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

Section 11. Monitoring and Evaluation of Performance Indicators

11.1.1 Describe plans and methods proposed to collect data necessary to respond to each "Perf Indicator" identified for the program.

Performance Standards and Indicators addressing ?benefits.?

3.2.2 Standard: Release groups sufficiently marked in a manner consistent with information needs and protocols to enable of impacts to natural- and hatchery-origin fish in fisheries.

Indicator 1: Marking rate by type in each release group documented.

3.3.1 Standard: Artificial propagation program contributes to an increasing number of spawners returning to natural spawni

Indicator 1: Annual number of spawners on spawning grounds estimated in specific locations.

Indicator 2: Spawner-recruit ratios are estimated in specific locations.

Indicator 3: Number of redds in natural production index areas documented.

3.3.2 Standard: Releases are sufficiently marked to allow statistically significant evaluation of program contribution.

Indicator 1: Marking rates and type of mark documented.

Indicator 2: Number of marks identified in adult groups documented.

Performance Standards and Indicators addressing ?risks.?

3.4.1 Standard: Fish collected for broodstock are taken throughout the return in proportions approximating the timing and a the population.

Indicator 1: Temporal distribution of broodstock collection managed.

Indicator 2: Age composition of broodstock collection managed.

3.4.2 Standard: Broodstock collection does not significantly reduce potential juvenile production in natural areas.

Indicator 1: Eyed-eggs are collected from a sub-set of wild redds to source broodstocks.

Indicator 2: Hatchery-produced spawners are released to migrate to natural spawning areas.

Indicator 3: Number of adults, eggs or juveniles placed in natural rearing areas is managed.

3.4.3 Standard: Life history characteristics of the natural population do not change as a result of this program.

Indicator 1: Life history characteristics of natural and hatchery-produced populations

are measured (e.g., juvenile dispersal timing, juvenile size at out-migration, adult return timing, adult age and sex ratio, natu hatchery spawn timing, hatch and swim-up timing, hatchery rearing densities, growth, diet, physical characteristics, fecundi etc).

3.4.4 Standard: Annual release numbers do not exceed estimated basin-wide and local habitat capacity.

Indicator 1: Annual release numbers, life-stage, size at release, documented.

Indicator 2: Location of releases documented.

Indicator 3: Timing of hatchery releases documented.

3.5.1 Standard: Patterns of genetic variation within and among natural populations do not change significantly as a result of production.

Indicator 1: Genetic profiles of naturally-produced and hatchery-produced adults developed.

3.5.2 Standard: Collection of broodstock does not adversely impact the genetic diversity of the naturally spawning populatio

Indicator 1: Eyed-eggs are collected from a sub-set of wild redds to source broodstocks.

Indicator 2: Timing of collection compared to overall run timing considered.

144

3.5.3 Standard: Artificially produced adults in natural production areas do not exceed appropriate proportion.

Indicator 1: Ratio of natural to hatchery-produced adults monitored.

3.6.1 Standard: The artificial production program uses standard scientific procedures to evaluate various aspects of artificia

Indicator 1: Scientifically based experimental design with measurable objectives and hypotheses.

3.6.2. Standard: The artificial production program is monitored and evaluated on an appropriate schedule and scale to addr toward achieving the experimental objectives.

Indicator 1: Monitoring and evaluation framework including detailed time line.

Indicator 2: Annual and final reports.

3.7.1 Standard: Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility standards and protocols.

Indicator 1: Annual reports indicating level of compliance with applicable standards and criteria.

3.7.2 Standard: Effluent from artificial production facility will not detrimentally affect natural populations.

Indicator 1: Discharge water quality compared to applicable water quality standards.

3.7.3 Standard: Water withdrawals and in stream water diversion structures for artificial production facility operation will not access to natural spawning areas, affect spawning, or impact juveniles.

Indicator 1: Water withdrawals documented ? no impacts to listed species.

Indicator 2: Number of adult fish aggregating and/or spawning immediately below water intake point monitored.

Indicator 3: NMFS screening criteria adhered to.

3.7.4 Standard: Releases do not introduce pathogens not already existing in the local populations and do not significantly ir levels of existing pathogens.

Indicator 1: Certification of juvenile fish health documented prior to release.

Indicator 2: Samples of natural populations for disease occurrence conducted.

Indicator 3: Juvenile densities during artificial rearing managed conservatively.

3.7.6 Standard: Adult broodstock collection operation does not significantly alter spatial and temporal distribution of natural

Indicator 1: Spatial and temporal spawning distribution of natural population above and below trapping facilities monitored.

3.7.7 Standard: Weir/trap operations do not result in significant stress, injury, or mortality in natural populations.

Indicator 1: Mortality rates in trap documented.

Indicator 2: Pre-spawning mortality rates of trapped fish in hatchery or after release documented.

3.7.8 Standard: Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of na

Indicator 1: Juveniles are not released. Production occurs from captive-reared adults released to spawn naturally.

Monitoring and Evaluation of Performance Standards and Indicators:

Standard 3.2.2 and associated Indicators. All adult chinook salmon released back to the habitat are PIT tagged, elastomer Petersen disk tagged. Genetic tissue samples from progeny that result from natural spawning events are taken to facilitate assignment test analyses. Hatchery groups are PIT tagged and elastomer tagged.

Standard 3.3.1 and associated Indicators. The primary objective of this program is to reintroduce hatchery-produced adults spawning. Adults are sourced from eyed-eggs collected from redds constructed by wild adult chinook salmon.

Standard 3.3.2 and associated Indicators. Adults released for natural spawning are 100% marked with PIT tags, elastomer Petersen disk tags. Intensive post-release behavioral monitoring occurs to document spawning-related behavior and spawr

Standard 3.4.1, 3.4.2, 3.5.3, and associated indicators. Chinook salmon rearing groups are sourced as eyed-eggs from red by wild adults. Approximately 50 eyed-eggs are removed, using hydraulic sampling gear, from six redds each. Redds are s represent the range of spawn timing. Care is taken to not negatively impact eggs remaining in redds sampled by program p

Standard 3.4.3 and associated indicators. Life history characteristics of natural and hatchery-produced adult chinook salmo monitored (e.g., adult spawning success). In-hatchery variables are monitored continuously (e.g., growth, survival, rearing c maturation, age at maturity, spawning success, gamete quality, egg size, fecundity, egg survival to the eyed stage of devel

Standard 3.4.4, 3.5.3 and associated indicators. Annual adult release numbers, size at release, and release location are dis annually at the CSCPTOC level. Release levels do not exceed habitat spawning and rearing capacities.

Standard 3.5.1, 3.5.2 and associated indicators. The university of Idaho provides genetic support for this program. Genetic and hatchery-produced chinook salmon have been, and continue to be produced. The hatchery population is constantly mo determine such variables as genetic effective population size, loss of genetic variability, and loss of heterozygosity.

Standard 3.6.1, 3.6.2 and associated indicators. Program goals, objectives, and tasks focus on the preservation / conserva this effort. Hatchery practices (e.g., spawning, and rearing protocols) are based on current and emerging ?best practices? a constant review at the CSCPTOC level. An experimental design has been established to guide the reintroduction of adults habitat. A comprehensive monitoring and evaluation program is in place to track post-release adult spawning success.

Standard 3.7.1, 3.7.2, 3.7.3, 3.7.6, 3.7.7 and associated indicators. The artificial production component of the program adhe state and federal policies in place to prevent the spread of infectious pathogens, to insure that facility discharge water quali appropriate standards, and that intake and outflow screens meet appropriate standards.

Adult and juvenile weirs are monitored to not adversely affect target or other fish species. Anadromous chinook salmon adu and distribution below weirs is carefully monitored. Every precaution is taken to insure that trapping does not negatively imp anadromous adults.

Standard 3.7.4 and associated indicators. IDFG and NOAA fish health facilities process samples for diagnostic and inspect from captive broodstock chinook salmon. Routine fish necropsies include investigations for viral pathogens (infectious panc virus and infectious hematopoietic necrosis virus), and various bacterial pathogens (e.g., bacterial kidney disease Renibact salmoninarium, bacterial gill disease Flavobacterium branchiophilum, coldwater disease Flavobacterium psychrophilum, an aeromonad septicemia Aeromonas spp.). In addition to the above, captive fish are screened for the causative agent of whir Myxobolus cerebralis, furunculus Aeromonas salmonicida and the North American strain of viral hemorrhagic septicemia vi

Approved chemical therapeutants are used prophylactically and for the treatment of infectious diseases. Prior to effecting tr use of chemical therapeutants is discussed with an IDFG fish health professional. Fish necropsies are performed on all pro mortalities that satisfy minimum size criteria for the various diagnostic or inspection procedures performed.

All appropriate state permits are secured prior to transporting eggs or fish across state boundaries. Prior to release, pre-libe health sampling occurs for pre-smolt and smolt release groups.

Standard 3.7.8 and associated standards. Predation by artificially produced fish on naturally produced fish is not expected t juvenile releases occur. Juveniles produced by this program hatch from redds constructed in the habitat.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

11.1.2 Indicate whether funding, staffing, and other support logistics are available or committe implementation of the monitoring and evaluation program.

146 nya

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

11.2 Indicate risk aversion measures that will be applied to minimize the likelihood for advers and ecological effects to listed fish resulting from monitoring and evaluation activities.

147 nya

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

Section 12. Research

12.1 Objective or purpose.

The Chinook Captive Rearing Program incorporates a comprehensive research monitoring and evaluation component prim address the reproductive behavior and success of adults released to volitionally spawn. Program research objectives and ta

Objective 1. Produce captive-reared adult chinook salmon with morphological, physiological, and behavioral characteristics naturally produced fish.

Task A. Maintain facilities to produce captive-reared adult chinook salmon and attain objectives.

Task B. Modify facilities (hatchery building well field) to meet water demands, and life support system safety requirements t program rearing needs to atain objectives. Construct and connect new hatchery well. Construct new single family residence

Task C. Demolish failing raceway walls and construct new concrete slab foundation. Reinstall water lines and tanks and en security fencing. Complete additional grounds repair as needed.

169

Task D. Collect fish/eggs from three stocks to initiate rearing groups. Rear captive chinook salmon through maturation. Cor reared adults to wild/natural conspecifics.

Task E. Monitor and adaptively manage culture protocols as they relate to fish survival, fish growth, and fish maturation.

Task F. PIT tag and visual implant tag all fish to facilitate poulation isolation and tracking during captive culture. Vaccinate j chinook for Vibrio and Bacterial Kidney Disease.

Task G. Cryopreserve milt from male captive chinook salmon as needed to preserve future options.

Objective 2. Evaluate spawning behavior and success of out planted (captive-reared) adults.

Task A. Tag adults with externally visible tags prior to out planting and radio-tag a resonable number of fish for field trackin

Task B. Out plant maturing captive-reared chinook salmon to appropriate stream study sections.

Task C. Monitor and document movement, distribution, behavior, and spawning success of out planted fish. Associate prod (juveniles and adults) with potential parents.

Task D. Identify and document location of radio-tagged fish daily.

Task E. Map redd locations and note observed spawning pairings.

Task F. Hydraulically sample completed redds and perform snorkel surveys to verify and estimate production.

Task G. Evaluate gamete quality and survival to the eyed-egg stage of development.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

12.2 Cooperating and funding agencies.

Shoshone-Bannock Tribes ? Funded by the Bonneville Power Administration through the Northwest Power Planning Counc Wildlife Program. The Shoshone-Bannock Tribes provide assistance with adult chinook salmon monitoring, juvenile chinool monitoring, and the planting of eyed-eggs produced from hatchery spawning events.

170 University of Idaho - Funded by the Bonneville Power Administration through the Northwest Power Planning Council?s Fish Program. The U of I provides genetics support for the program.

NOAA Fisheries - Funded by the Bonneville Power Administration through the Northwest Power Planning Council?s Fish ar Program. NOAA Fisheries shares fish culture responsibility for the program.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

12.3 Principle investigator or project supervisor and staff.

Steve Yundt- Idaho Department of Fish and Game Fisheries Research Manager.

Paul Kline- Idaho Department of Fish and Game Principal Fisheries Research Biologist.

171 David Venditti- Idaho Department of Fish and Game Senior Fisheries Research Biologist.

Danny Baker- Idaho Department of Fish and Game Hatchery Manager II.

Comments:

null

Data source:

Per Paul Kline IDFG 10/22/03.

12.4 Status of stock, particularly the group affected by project, if different than the stock(s) c in Section 2.

Snake River sockeye salmon

Snake River spring/summer chinook salmon

172 Snake River summer steelhead

Bull trout

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

12.5 Techniques: include capture methods, drugs, samples collected, tags applied.

Chinook salmon for inclusion in the captive rearing program are generally collected as eyed-eggs using the hydraulic samp described by McNeil (1964). This system consists of two main components. The first is a gas-powered pump attached to a diameter aluminum probe, via flexible tubing. Holes drilled near the top of the probe allow air to infuse into the water stream venturi action. The second component is the collection net frame, which consists of a ?D? shaped aluminum frame with exp mesh along its curved portion and netting around the bottom and sides of its straight portion. When the pump is on, water is through the probe, which is worked into the substrate within the net frame. The air/water stream then lifts eggs out of the su they are swept downstream into the net. The expanded plastic screen confines eggs lifted out near the periphery and chann the net. In order to minimize disturbance to the redd, sampling is begun slightly below estimated nest pocket locations and upstream. This prevents the fine materials lifted out of the substrate from settling back into the redd and possibly smotherin Care is also taken to keep people behind or to the side of the net frame to minimize redd trampling. To facilitate eyed-egg c locations of redds are recorded and their corresponding construction and completion dates are estimated. Recording therm located near completed redds to track the number of Celsius temperature units (CTUs) received by the developing embryos sampled when the eggs have received approximately 300-400 CTUs and reached the eyed stage.

Juvenile chinook salmon may also be collected using rotary screw traps (E.G. Solutions, Corvallis, OR) or beach seines. Ro traps are passive capture devices generally positioned in the thalweg of the stream. Stream flow turns a baffled cylinder tha captured fish to a live well for temporary holding. IDFG and cooperator personnel from the Shoshone-Bannock Tribes atten Captured juveniles may be temporarily held in streamside live boxes until transfer to the Sawtooth or Eagle fish hatchery fo Beach seines may also be used to collect juvenile chinook salmon over a broad range of stream distances. Juveniles are lo
173 snorkeling, and a beach seine is positioned downstream of the target assemblage of fish. Fish collected with this method ar temporarily in streamside live boxes until transfer to the IDFG Sawtooth or Eagle fish hatchery.

Eyed-eggs may also be collected from redds spawned by captive-reared chinook salmon to determine fertilization and surv or hatching. These redds are sampled using the procedures described above, with one modification. In order to sample as possible in a short time, sampling begins near the center of anticipated egg pocket locations. Although this probably results additional fine loading, we feel this is acceptable due to the experimental, as opposed to production, nature of the redds. A 10-20 eggs from each redd is preserved and provided to University of Idaho geneticists to determine the number of individu contributed to the spawning population. These eggs are also checked for fertilization to estimate the proportion of eggs that fertilization.

Fish released back to their natal streams are unloaded from the transport truck into 100 L coolers equipped with locking lids release locations. Prior to releasing transported fish, transport and receiving water temperatures are tempered to within a 2 each other.

Several tagging methods are employed in this project, including Passive Integrated Transponder (PIT), elastomer, Peterson and radio transmitters. Captive reared juvenile chinook are PIT tagged when they reach appropriate size. Those collected a smolts are PIT tagged upon capture. PIT tags are injected into the peritoneal cavity using standard PIT tagging methodolog protocols (Prentice et al. 1990). PIT tags are used to track individual fish through the captive rearing project along with gene to construct spawning matrices. Latex elastomer tags are used as a secondary marking system to indicate rearing location stream. Fish are marked with elastomer tags by using a hypodermic needle to inject a thin stripe of pigment into the clear tis to the eye. Disc tags having unique color/numeric combinations may be attached to the dorsal surface of released fish, allov identification of individual fish. Floy tags may also be inserted near the dorsal fin to serve a function similar to disc tags. Rad used to facilitate tracking of adult chinook salmon released in various drainages for volitional spawning. Techniques develop et al. (1985) are utilized to implant radio tags in the stomach, via the esophagus. Radio tags have a life span sufficient to en transmitter operation beyond the time of post-spawning mortality. Radio tagging permits individual fish to be easily identified and may allow us to evaluate the spawning behavior of captive-reared individuals over larger stream sections, while interac conspecifics.

Anesthetics and chemical therapeutants are used in the collection and/or rearing of chinook salmon. Anesthetics are used t from physical injury during collection, handling and tagging procedures. Tricaine methane sulfonate (MS-222) buffered with bicarbonate is a Federal Drug Administration (FDA) approved anesthetic utilized during all fish activities requiring anestheti: project personnel involved in the utilization of MS-222 stringently follow established protocols.

Chemical therapeutants are utilized during the culture of chinook salmon up to the time of in-hatchery spawning or release i environment. Chemical therapeutants may be used prophylactically or for treatment of acute fish health problems. The mos used antibiotic is Erythromycin, which is used to control bacterial kidney disease (BKD). Erythromycin may be injected intra incorporated into fish diets. Other drugs or treatments which may be utilized include: 1) formalin for the control of fungus on incubation and on adults during final maturation holding, 2) chloramine T for the control of myxobacteria 3) oxytetracycline f of motile aeromonads and myxobacteria, and 4) Ivermectin intubation for the treatment of Salmincola californensis parasite juvenile chinook salmon are vaccinated against Vibrio spp. and BKD prior to transfer to saltwater.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

12.6 Dates or time periods in which research activity occurs.

Research activity: Time Period

Eyed-egg collections August through September

Adult maturation assessment April through July

Adult marking and tagging June through July

174

Adult out-planting July through August

Adult behavioral monitoring August through October

Redd construction success assessment October through November

Juvenile tissue sampling (genetic testing) July-Aug, March-April, Sept-Oct

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

12.7 Care and maintenance of live fish or eggs, holding duration, transport methods.

The IDFG Eagle Fish Hatchery and the NOAA Manchester Marine Experiment Station are the primary sites for the chinook captive rearing program. Fish culture protocols follow accepted, standard practices and are reviewed on a regular basis at (meetings.

To manage for catastrophic loss in the program, and to provide a location for saltwater rearing, fish culture responsibilities a NOAA Fisheries at their Manchester Marine Experiment Station in Washington State. Initial rearing occurs at the Eagle Fish smoltification, up to 100% of each rearing group is transferred to the NOAA Fisheries site. As adults mature, fish are transfe the Eagle Fish Hatchery and ultimately released to natal streams for natural spawning.

The containers used to transport fish will vary based on the task. In all cases, containers of the proper size and configuratio for the task at hand. Fish will be maintained in water of the proper quality (temperature, oxygen and chemical composition) possible during handling and transfer phases of transportation. Containers will vary from five gallon plastic buckets and 100 coolers for short term holding, to sophisticated truck-mounted tanks for long distance/duration transfers. Eyed-eggs may be from NOAA Fisheries facilities to IDFG facilities and/or between IDFG facilities. Eyed-eggs are packed at a conservative de perforated shipping tubes (27-cm long by 6-cm diameter at approximately 2,000 eggs per tube), capped, and labeled to ide number of eyed-eggs. Tubes are wrapped with hatchery water-saturated cheesecloth and packed in small, insulated cooler added to ensure proper temperature maintenance and coolers are sealed with packing tape. Eggs are monitored hourly du transportation.

Fish are transported to and from rearing locations, release locations, and adult trapping facilities in truck mounted, insulatec (typically 1,136 L capacity) with alarm, back-up oxygen systems, and "fresh flow" mechanical water movement units on boa and containers used is dependent upon the size and number of fish and the distance to be hauled. For longer duration trips NOAA Fisheries Washington facilities to Idaho), truck-mounted tanks are available to the program with 1,136 L (300 gal), 3, gal), and 9,463 L (2,500 gal) capacities. Transport guidelines are in place to not exceed 119 g/L (1.0 lb/gal). All trucks are e provide appropriate conditions to facilitate safe transport of fish to the specified destination. All vehicles are equipped with t and cellular phones to provide routine or emergency communications. Fish are monitored regularly during transportation.

Project leaders ensure that fish transport is conducted to provide the best possible conditions for safe transfer of fish betwe destinations. Pathology and fish culture experts provide guidance on all fish transportation events.

175

Disease histories of brood groups are reviewed and evaluated before, during and post transportation by program pathologis

Prior to transport, fish are fasted for 48 hours to reduce metabolic demand and stress. Transport guidelines are in place to r g/L (1.0 lb/gal). Tanks on transport trucks are disinfected and filled with clean well water prior to transportation. All vehicles to provide the appropriate conditions (temperature, oxygen, capacity) to ensure the safe transport of fish to and from specifi Water temperature in transport tanks is maintained at levels necessitating minimal tempering between source and destinati temperatures. In addition, all vehicles are equipped with two-way radios or cellular phones to provide routine or emergency communication capability. Prior to releasing transported fish at hatchery or remote release locations, transport and receivin temperatures are tempered to within 2.0°C of each other.

Sampling regimes are used throughout the program to monitor fish health and to evaluate attainment of program objectives weight measurements are collected from juvenile fish during routine hatchery procedures (e.g., tagging and sample count a fish mature and become more sensitive to handling, the frequency of handling events is reduced to maturation sorts.

Determinations of sex and maturation state in captive-reared chinook salmon are conducted using non-lethal genetic sex de ultrasound, and physical sorting. Genetic sex determinations are conducted by the NOAA Fisheries Northwest Fisheries Sc (Seattle, WA). To facilitate this process, fin tissue is removed from anesthetized chinook salmon at the Eagle Fish Hatchery Manchester Marine Experiment Station. Tissue samples are transferred to the NOAA Fisheries for analysis. Ultrasound ma determine maturation status prior to the time when fish are exhibiting external maturation signs. Physical maturation sorts a during August and September. Fish are examined for detection of changes in body coloration, the development of other sec characteristics, and gonad development. Fish determined to be maturing are isolated, by stock, from non-maturing fish.

Tissue samples are collected from mortalities during necropsies on program fish to monitor for disease. Genetic samples ar collected from mortalities in an effort to develop mitochondrial DNA, and nuclear DNA markers for chinook salmon populatio program.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

12.8 Expected type and effects of take and potential for injury or mortality.

Risk aversion measures for monitoring and evaluation activities associated with the Chinook Salmon Captive Rearing Progr described in ESA Section 10 Research and Enhancement Permits (IDFG permit No.1010). A brief summary of the nature o is provided below.

Juvenile trapping/handling- Collecting eyed-eggs from the field is designed to have minimum impact on listed fish. Redds ar from downstream, and care is taken to avoid trampling the redd. Information from field observations and thermographs is us eggs are collected during their most tolerant stage. Eggs are immediately transferred to small coolers saturated with chilled transfer to the hatchery. The hydraulic sampling system used to collect eggs appears to have little effect on the developing Generally, less than 2% of the collected eggs do not hatch (IDFG unpublished data). When juveniles are collected in screw care is taken to minimize harm. Trap boxes are checked at least twice each day to reduce the time fish spend in the traps a traps are functioning properly. Appropriate conditions (temperature, dissolved oxygen, and flow rate) are maintained in tem structures prior to their transfer to the hatchery.

Juvenile to Adult in-hatchery- Upon arrival at the hatchery, eggs are immediately disinfected in a 100 ppm iodine solution fo This minimizes disease transmission from contaminated rivers. Collection of eyed-eggs also reduces the possibility of disea in culture. Fish collected as eggs have lower incidence of BKD than those collected as parr or fry. In addition, the egg stage susceptible to Myxobolus cerebralis, the organism that causes whirling disease. Juvenile collection at this stage results in h minimizes the risk of contaminating culture facilities, and increases survival of captive individuals. While in culture, disturba minimized by limiting the number of times fish are handled and through tank configuration. Fish are handled up to twice a w approximate four-week period for maturation sorting and only infrequently throughout the remainder of the year during tank sample counts. In addition, tanks are shade covered to minimize disturbance by normal hatchery operations and to provide bright sunlight.

176

Captive-reared chinook salmon generally appear to be in extremely good condition, but cultured fish differ from wild conspe and fin quality. Both characteristics appear to be influenced by rearing environment. Saltwater reared fish have higher fin qu slightly larger than those reared in fresh water. In accordance with these differences, the majority of fish are reared at the N Manchester Marine Experiment Station (from smoltification through maturation). The remaining fish are reared at the IDFG Hatchery in fresh water. Maintaining rearing activities at both facilities ensures research efforts will continue if either facility catastrophic stock loss.

Adult releases - Captive-reared individuals determined to be maturing are released into their natal streams to assess their s behavior. Frequent observations are made of these fish and of wild chinook salmon in the area for comparative purposes. M disturbance to the fish while attempting to observe normal activity is crucial. Field workers approach fish slowly and obscure presence as much as possible. In no cases are fish handled or unnecessarily disturbed.

Adult blocking weirs are monitored regularly to insure that adverse impacts to listed species are minimized.

Comments:

null

Data source:

HGMP Per Paul Kline IDFG 9/8/2003

12.9 Level of take of listed fish: number of range or fish handled, injured, or killed by sex, age, not already indicated in Section 2 and the attached "take table" (Table 1).

Steelhead B (East Fork) - Integrated

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

182

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya

Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (Johnson Creek)

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

182

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (McCall Hatchery)

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
182	**Intentional lethal take (f)**	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook (Rapid River) - Hatchery

	ESU/Population	nya
	Activity	nya
181	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (Pahsimeroi)

	ESU/Population	nya
	Activity	nya
181	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook (Upper Salmon/Sawtooth)

	ESU/Population	nya
	Activity	nya
181	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook - Natural

	ESU/Population	nya
181	**Activity**	nya
	Location of hatchery activity	nya

Dates of activity nya

Hatchery Program Operator nya

182

Type of Take	Annual Take of Listed Fish by life Stage (number of fish)			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook - Natural

181

ESU/Population nya

Activity nya

Location of hatchery activity nya

Dates of activity nya

Hatchery Program Operator nya

182

Type of Take	Annual Take of Listed Fish by life Stage (number of fish)			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

181	*Steelhead A-Run (Pahsimeroi)- Hatchery*	
	ESU/Population	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

	Annual Take of Listed Fish by life Stage (number of fish)				
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
182	**Observe or harrass (a)**	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

181	*Steelhead B (Dworshak)-Hatchery*	
	ESU/Population	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

	Annual Take of Listed Fish by life Stage (number of fish)				
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
182	**Observe or harrass (a)**	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead B-Natural

181

ESU/Population nya

Activity nya

Location of hatchery activity nya

Dates of activity nya

Hatchery Program Operator nya

182

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Natural

181

ESU/Population nya

Activity nya

Location of hatchery activity nya

Dates of activity nya

Hatchery Program Operator nya

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya

182					
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Redfish Lake Sockeye

181		
	ESU/Population	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

182		**Annual Take of Listed Fish by life Stage (number of fish)**			
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring/Summer Chinook (W. Fork Yankee Fork- Salmon River)- Integrated

181		
	ESU/Population	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

		Annual Take of Listed Fish by life Stage (number of fish)			
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**

	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring/Summer Chinook (East Fork Salmon River)- Integrated

181	**ESU/Population**	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	500	40	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	0	0	nya
182	Capture, handle, tag/mark/tissue sample, and release (d)	nya	150	0	nya
	Removal (e.g., brookstock (e)	nya	20	0	nya
	Intentional lethal take (f)	nya	0	0	nya
	Unintentional lethal take (f)	nya	0	0	nya
	Other take (specify) (h)	nya	nya	nya	nya

Lemhi River Spring_Summer Chinook

181	**ESU/Population**	nya
	Activity	nya
	Location of hatchery activity	nya

Dates of activity nya

Hatchery Program Operator nya

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
182 **Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Run (Sawtooth)- Hatchery

ESU/Population nya

Activity nya

181 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program Operator nya

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
182 **Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Comments:

Data source:

Per Paul Kline IDFG 9/8/03

12.10 Alternative methods to achieve project objects.

177 Alternative methods to achieve research objectives have not been developed.

Comments:

null

Data source:

HMGP Per Paul Kline IDFG 9/8/03

12.11 List species similar or related to the threatened species; provide number and causes of r related to this research project.

178 Mortality associated with this project is reported in IDFG Section 10 permit reports to NOAA Fisheries. No impacts to simila been documented.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

12.12 Indicate risk aversion measures that will be applied to minimize the likelihood for advers ecological effects, injury or mortality to listed fish as a result of the proposed research a

The operation of hatchery facilities (weirs, water removal, and effluent discharge), production levels, disease transmission, resources, predation, and negative genetic impact are examples of ecological interactions that could affect listed species in area.

Hatchery facilities - Project hatchery facilities do not withdraw from or discharge water into natural habitat areas occupied b species.

Weirs installed to confine captive adults following release for natural spawning are maintained daily and managed to not ad listed species.

179

Production levels ? Production levels from this program and not expected to adversely affect listed species. Eggs produced constructed by captive-reared adults hatch within a natural time frame and produce juvenile chinook salmon that recruit to t community with wild conspecifics. Natural escapement levels are such that the additional contribution of spawners from this not expected to adversely affect listed species.

Disease Transmission ? IDFG and NOAA Fisheries programs follow stringent disease prevention protocols and produce he quality fish. Pre-liberation fish health monitoring occurs to insure that healthy fish are released to receiving waters. Fish hea in place for common bacterial and viral pathogens and require fish to not exceed CSCPTOC-accepted pathogen prevalenc they can be released.

Competition ? Competition between hatchery-produced and naturally-produced chinook salmon is expected to be minimal. competition between wild and hatchery-produced adults occurs during courting and spawning activities. Eggs produced fro constructed by captive-reared adults hatch within a natural time frame and produce juvenile chinook salmon that recruit to t community with wild conspecifics.

Predation ? Predation is not expected to occur as juvenile chinook salmon produced by captive adults hatch and recruit to t community along with wild conspecifics.

Genetic Impacts - Some genetic change associated with the management of Snake River chinook salmon in the hatchery is unavoidable. However, every opportunity is taken to minimize this change. Eggs collected to source rearing groups for this removed from several redds representing the full range of spawn timing. Numbers of eggs removed from redds is equalizec Fish that hatch from eggs are reared by family (e.g., redd) until they are uniquely marked (e.g., PIT tagged). In-hatchery spa follow protocols developed by University of Idaho and NOAA Fisheries geneticists and are designed to minimize inbreeding genetic diversity.

Comments:

null

Data source:

HGMP Per Paul Kline IDFG 9/8/03

Section 13. Attachments and Citations

13.1 Attachments and Citations

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Comments:

null

Data source:

Section 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

14.1 Certification Language and Signature of Responsible Party

“I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973.”

Name, Title, and Signature of Applicant:

Certified by_____________________________ Date:_____________

APPENDIX 2-7—DRAFT SPRING/SUMMER CHINOOK (W. FORK YANKEE FORK SALMON RIVER)–INTEGRATED IN THE SALMON SUBBASIN

HATCHERY AND GENETIC MANAGEMENT PLAN

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

DRAFT

1

Hatchery Program	West Fork Salmon River
Species or Hatchery Stock	Spring/Summer Chinook
Agency/Operator	IDF&G
Watershed and Region	Salmon River, Columbia River
Date Submitted	March 3, 2003
Date Last Updated	September 12, 2003

Section 1: General Program Description

1.1 Name of hatchery or program.

1 West Fork Salmon River

1.2 Species and population (or stock) under propagation, and ESA status.

1 Spring/Summer Chinook

9 ESA Status: Threatened

1.3 Responsible organization and individuals.

Name (and title): Paul Kline
Principal Fisheries Research Biologist

3 **Agency or Tribe:** IDF&G

Address: 1800 Trout Road, Eagle, ID 83616

Telephone: 208-939-4114

Fax: 208-939-2415

Email: pkline@idfg.state.id.us

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and exten involvement in the program.

	Co-operators	Role
4	Shosone Bannock Tribe	Periodically assists with the transfer and planting of pr generated eyed-eggs to in-stream incubation boxes.
	NOAA Fisheries	Shares captive broodstock development responsibility culture and rearing)
	University of Idaho	Genetics support
	nya	nya

1.4 Funding source, staffing level, and annual hatchery program operational costs.

Funding Sources

Bonneville Power Administration

nya

nya

5 nya

nya

nya

nya

	Operational Information	Number
6	Full time equivalent staff	2.2
	Annual operating cost (dollars)	475,000

Comments:

The above data includes the following three programs:

Lemhi River Spring/Summer Chinook

Spring/Summer Chinook (East Fork Salmon River)-Integrated

Spring/Summer Chinook (West Fork Yankee Fork Salmon River)-Integrated

Reviewer Comments:

nc
nc

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

1.5 Location(s) of hatchery and associated facilities.

Broodstock source W. Fork Yankee Fork Salmon River

Broodstock collection location (stream, RKm, subbasin) W. Fork Yankee Fork Salmon River, 522.303.591,011, Salmon River

Adult holding location

(stream, RKm, subbasin)	Eagle Hatchery (HUC 17050114)
Spawning location (stream, RKm, subbasin)	W. Fork Yankee Fork Salmon River, 522.303.591,011, Salmon River
Incubation location (facility name, stream, RKm, subbasin)	Eagle Hatchery (HUC 17050114)
Rearing location (facility name, stream, RKm, subbasin)	Eagle Hatchery (HUC 17050114), NOAA Fisheries Manchester Station

2

Comments:

Broodstock source: Lemhi River, West Fork Yankee Fork Salmon River, and East Fork Salmon River spring chinook salmon. collected and reared at IDFG freshwater and NOAA Fisheries seawater hatcheries to maturation. Mature adults released to n for volitional spawning. Some in-hatchery spawning occurs to document reproductive potential.

Broodstock collection location (Stream, RKM, subbasin): 522.303.416 Lemhi River, 522.303.591.011 West Fork Yankee Fork 522.303.552.029 East Fork Salmon River.

Adult holding location (Stream, RKM, subbasin): IDFG Eagle Fish Hatchery, no RKM, NOAA Fisheries Manchester Marine Ex Station, no RKM.

Spawning location (Stream, RKM, subbasin): Spawning primarily occurs in natal streams (captive adults released to spawn n kilometer information is provided above. Some in-hatchery spawning occurs at the IDFG Eagle Fish Hatchery, no RKM.

Incubation location (Facility name, stream, RKM, subbasin): IDFG Eagle Fish Hatchery, no RKM.

Rearing location (Facility name, stream, RKM, subbasin): IDFG Eagle Fish Hatchery, no RKM, NOAA Fisheries Manchester M Experiment Station, no RKM.

Data source:

Per Paul Kline IDFG 9/8/03 Source: Project annual reports to Bonneville Power Administration. Project annual reports to NOA ESA Section 10 activities.

1.6 Type of program.

8 Integrated

Comments:

Data source:

Per Paul Kline IDFG 9/8/03

1.7 Purpose (Goal) of program.

9 The purpose of this hatchery program is to contribute to conservation/recovery and research and education.

10 the purpose of the program is mitigation for hydro impacts .

Comments:

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.

1.8 Justification for the program.

138
- It is unknown if hatchery fish are accessible to fisheries.

Comments:

nc
nc
nc

Data source:

Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03
nds
nds
nds

1.9 List of program "Performance Standards".

11 The program adheres to the following fish culture guideline(s) and standard(s):
IHOT
PNFHPC
state
federal
other

Comments:

Other = Chinook Salmon Captive Propagation Technical Oversight Committee. A team of technical experts representing the agencies and tribes involved with the program in addition to invited experts. The CSCPTOC meets periodically to review pro activities, address critical uncertainties, and to adaptively manage future activities

Data source:

Per Paul Kline IDFG 9/8/03

1.10 List of program "Performance Indicators", designated by "benefits" and "risks".

139

Indicators of Harvest Benefits

Indicator	Performance Standard	Indicator is Monitore
Spawner to spawner survival of hatchery fish	NA	NA
Contribution of hatchery fish to target fisheries	NA	NA
Angler success (hatchery fish per angler day) in target recreational fisheries	NA	NA
Contribution of hatchery fish to cultural needs	NA	NA
Selective harvest success (expected benefits of mass marking)	NA	NA

141

Indicators of Conservation Benefits

Indicator	Performance Standard	Indicator is Monitore
Genetic and life history diversity (over time)	3.4.1,3.4.2, 3.4.3, 3.4.4, 3.5.1, 3.5.2, 3.5.3, 3.2.2	3.4.1,3.4.2, 3.4.3, 3.4.4, 3 3.5.2, 3.5.3, 3.2.2
Spawner to spawner reproductive success of hatchery fish	3.3.1, 3.3.2, 3.6.1, 3.6.2	Y
Reproductive success of the receiving (supplemented) naturally spawning population	3.3.1, 3.3.2, 3.6.1, 3.6.2	Y
Contribution to the abundance of the naturally spawning population	3.3.1, 3.3.2, 3.6.1, 3.6.2	Y
Time and location of spawning	3.3.1, 3.3.2, 3.6.1, 3.6.2	Y
Contribution to ecosystem function (e.g. through nutrient enhancement, food web effects, etc.)	NA	NA

Indicators of Harvest Risks

Indicator	Performance Standard	Indicator is Monitore
Harvest impacts on co-mingled stocks	NA	NA
140 **Bias in run size estimation of natural stocks due to masking effect**	NA	NA
Lack of harvest access (under harvest due e.g. to co-mingling with weaker stocks)	NA	NA

Indicators of Conservation Risks

Indicator	Performance Standard	Indicator is Monitore
Unintended contribution of hatchery fish to natural spawning (through straying)	3.4.4, 3.5.3	Y
Loss of genetic and life history diversity	3.4.1, 3.4.2, 3.4.3, 3.4.4, 3.5.1, 3.5.2, 3.5.3	Y
142 **Loss of reproductive success**	3.3.1, 3.3.2, 3.4.1, 3.4.2, 3.4.3, 3.4.4, 3.5.3, 3.6.2	Y
Ecological interactions through competition with natural stocks (by life stage)	3.7.6, 3.7.4, 3.7.8	Y
Ecological interactions through predation on natural stocks (by life stage)	3.7.8	Y
Adverse effects of hatchery operations and facilities on fish migration Disease transfers	3.7.1, 3.7.2, 3.7.3, 3.7.4, 3.7.7	Y

The following plans and methods are proposed to collect data for each Performance Indicator: Performance Standards and I addressing benefits.

3.2.2 Standard: Release groups sufficiently marked in a manner consistent with information needs and protocols to enable de impacts to natural- and hatchery-origin fish in fisheries.

Indicator 1: Marking rate by type in each release group documented.

3.3.1 Standard: Artificial propagation program contributes to an increasing number of spawners returning to natural spawning

Indicator 1: Annual number of spawners on spawning grounds estimated in specific locations.

Indicator 2: Spawner-recruit ratios are estimated in specific locations.

Indicator 3: Number of redds in natural production index areas documented.

3.3.2 Standard: Releases are sufficiently marked to allow statistically significant evaluation of program contribution.

Indicator 1: Marking rates and type of mark documented.

Indicator 2: Number of marks identified in adult groups documented.

Performance Standards and Indicators addressing risks.

3.4.1 Standard: Fish collected for broodstock are taken throughout the return in proportions approximating the timing and age the population.

Indicator 1: Temporal distribution of broodstock collection managed.

Indicator 2: Age composition of broodstock collection managed.

3.4.2 Standard: Broodstock collection does not significantly reduce potential juvenile production in natural areas.

Indicator 1: Eyed-eggs are collected from a sub-set of wild redds to source broodstocks.

Indicator 2: Hatchery-produced spawners are released to migrate to natural spawning areas.

Indicator 3: Number of adults, eggs or juveniles placed in natural rearing areas is managed.

3.4.3 Standard: Life history characteristics of the natural population do not change as a result of this program.

Indicator 1: Life history characteristics of natural and hatchery-produced populations

are measured (e.g., juvenile dispersal timing, juvenile size at out-migration, adult return timing, adult age and sex ratio, natur spawn timing, hatch and swim-up timing, hatchery rearing densities, growth, diet, physical characteristics, fecundity, egg size

3.4.4 Standard: Annual release numbers do not exceed estimated basin-wide and local habitat capacity.

Indicator 1: Annual release numbers, life-stage, size at release, documented.

Indicator 2: Location of releases documented.

Indicator 3: Timing of hatchery releases documented.

3.5.1 Standard: Patterns of genetic variation within and among natural populations do not change significantly as a result of a production.

Indicator 1: Genetic profiles of naturally-produced and hatchery-produced adults developed.

3.5.2 Standard: Collection of broodstock does not adversely impact the genetic diversity of the naturally spawning population

Indicator 1: Eyed-eggs are collected from a sub-set of wild redds to source broodstocks.

Indicator 2: Timing of collection compared to overall run timing considered.

3.5.3 Standard: Artificially produced adults in natural production areas do not exceed appropriate proportion.

Indicator 1: Ratio of natural to hatchery-produced adults monitored.

3.6.1 Standard: The artificial production program uses standard scientific procedures to evaluate various aspects of artificial

Indicator 1: Scientifically based experimental design with measurable objectives and hypotheses.

3.6.2. Standard: The artificial production program is monitored and evaluated on an appropriate schedule and scale to addre toward achieving the experimental objectives.

Indicator 1: Monitoring and evaluation framework including detailed time line.

Indicator 2: Annual and final reports.

3.7.1 Standard: Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility standards and protocols.

Indicator 1: Annual reports indicating level of compliance with applicable standards and criteria.

3.7.2 Standard: Effluent from artificial production facility will not detrimentally affect natural populations.

Indicator 1: Discharge water quality compared to applicable water quality standards.

3.7.3 Standard: Water withdrawals and in stream water diversion structures for artificial production facility operation will not p
to natural spawning areas, affect spawning, or impact juveniles.

Indicator 1: Water withdrawals documented ? no impacts to listed species.

Indicator 2: Number of adult fish aggregating and/or spawning immediately below water intake point monitored.

Indicator 3: NMFS screening criteria adhered to.

3.7.4 Standard: Releases do not introduce pathogens not already existing in the local populations and do not significantly inc
levels of existing pathogens.

Indicator 1: Certification of juvenile fish health documented prior to release.

Indicator 2: Samples of natural populations for disease occurrence conducted.

Indicator 3: Juvenile densities during artificial rearing managed conservatively.

3.7.6 Standard: Adult broodstock collection operation does not significantly alter spatial and temporal distribution of natural p

Indicator 1: Spatial and temporal spawning distribution of natural population above and below trapping facilities monitored.

3.7.7 Standard: Weir/trap operations do not result in significant stress, injury, or mortality in natural populations.

Indicator 1: Mortality rates in trap documented.

144

Indicator 2: Pre-spawning mortality rates of trapped fish in hatchery or after release documented.

3.7.8 Standard: Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of nat

Indicator 1: Juveniles are not released. Production occurs from captive-reared adults released to spawn naturally.

Monitoring and Evaluation of Performance Standards and Indicators:

Standard 3.2.2 and associated Indicators. All adult chinook salmon released back to the habitat are PIT tagged, elastomer ta
Petersen disk tagged. Genetic tissue samples from progeny that result from natural spawning events are taken to facilitate in
assignment test analyses. Hatchery groups are PIT tagged and elastomer tagged.

Standard 3.3.1 and associated Indicators. The primary objective of this program is to reintroduce hatchery-produced adults fo
spawning. Adults are sourced from eyed-eggs collected from redds constructed by wild adult chinook salmon.

Standard 3.3.2 and associated Indicators. Adults released for natural spawning are 100% marked with PIT tags, elastomer ta
Petersen disk tags. Intensive post-release behavioral monitoring occurs to document spawning-related behavior and spawnir

Standard 3.4.1, 3.4.2, 3.5.3, and associated indicators. Chinook salmon rearing groups are sourced as eyed-eggs from redds
by wild adults. Approximately 50 eyed-eggs are removed, using hydraulic sampling gear, from six redds each. Redds are sel
represent the range of spawn timing. Care is taken to not negatively impact eggs remaining in redds sampled by program per

Standard 3.4.3 and associated indicators. Life history characteristics of natural and hatchery-produced adult chinook salmon (e.g., adult spawning success). In-hatchery variables are monitored continuously (e.g., growth, survival, rearing conditions, m at maturity, spawning success, gamete quality, egg size, fecundity, egg survival to the eyed stage of development, etc.).

Standard 3.4.4, 3.5.3 and associated indicators. Annual adult release numbers, size at release, and release location are disc at the CSCPTOC level. Release levels do not exceed habitat spawning and rearing capacities.

Standard 3.5.1, 3.5.2 and associated indicators. The university of Idaho provides genetic support for this program. Genetic pı and hatchery-produced chinook salmon have been, and continue to be produced. The hatchery population is constantly mon determine such variables as genetic effective population size, loss of genetic variability, and loss of heterozygosity.

Standard 3.6.1, 3.6.2 and associated indicators. Program goals, objectives, and tasks focus on the preservation / conservatic this effort. Hatchery practices (e.g., spawning, and rearing protocols) are based on current and emerging ?best practices? an constant review at the CSCPTOC level. An experimental design has been established to guide the reintroduction of adults ba habitat. A comprehensive monitoring and evaluation program is in place to track post-release adult spawning success.

Standard 3.7.1, 3.7.2, 3.7.3, 3.7.6, 3.7.7 and associated indicators. The artificial production component of the program adher state and federal policies in place to prevent the spread of infectious pathogens, to insure that facility discharge water quality appropriate standards, and that intake and outflow screens meet appropriate standards.

Adult and juvenile weirs are monitored to not adversely affect target or other fish species. Anadromous chinook salmon adult distribution below weirs is carefully monitored. Every precaution is taken to insure that trapping does not negatively impact ar adults.

Standard 3.7.4 and associated indicators. IDFG and NOAA fish health facilities process samples for diagnostic and inspectio from captive broodstock chinook salmon. Routine fish necropsies include investigations for viral pathogens (infectious pancre virus and infectious hematopoietic necrosis virus), and various bacterial pathogens (e.g., bacterial kidney disease Renibacter salmoninarium, bacterial gill disease Flavobacterium branchiophilum, coldwater disease Flavobacterium psychrophilum, and aeromonad septicemia Aeromonas spp.). In addition to the above, captive fish are screened for the causative agent of whirlin Myxobolus cerebralis, furunculus Aeromonas salmonicida and the North American strain of viral hemorrhagic septicemia viru

Approved chemical therapeutants are used prophylactically and for the treatment of infectious diseases. Prior to effecting trea use of chemical therapeutants is discussed with an IDFG fish health professional. Fish necropsies are performed on all progr that satisfy minimum size criteria for the various diagnostic or inspection procedures performed.

All appropriate state permits are secured prior to transporting eggs or fish across state boundaries. Prior to release, pre-libera health sampling occurs for pre-smolt and smolt release groups.

Standard 3.7.8 and associated standards. Predation by artificially produced fish on naturally produced fish is not expected to juvenile releases occur. Juveniles produced by this program hatch from redds constructed in the habitat.

The program contributes to information gain in the following way(s): Hatchery program contributes to research to improve pe cost effectiveness
143 New information affects change to the hatchery program through a structured adaptive decision making process
Hatchery program participates in basin wide-coordinated research efforts
Hatchery program actively contributes to public education
Funding for monitoring of performance indicators is adequate

Comments:

Standards are referenced to NPPC Artificial Production Review (Jan 17, 2001)

Standards are referenced to NPPC Artificial Production Review (Jan 17, 2001)

null

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

1.11.1 Proposed annual broodstock collection level (maximum number of adult fish).

198 Approximately 250 eyed-eggs are collected annually from target streams to initiate rearing groups.

Data source:

Per Paul Kline (IDFG), 10.22.03.

1.11.2 Proposed annual fish release levels (maximum number) by life stage and location.

					Location			
	Age Class	**Maximum Number**	**Size (ffp)**	**Release Date**	**Stream**	**Release Point (RKm)**	**Major Watershed**	**Ecopr**
1	**Eggs**	50,000	2700	November	W. Fork Yankee Fork, Salmon River	522.303.591.011	Salmon River	Mounta Snake
	Unfed Fry	nya	nya	nya	nya	nya	nya	nya
	Fry	nya	nya	nya	nya	nya	nya	nya
	Fingerling	nya	nya	nya	nya	nya	nya	nya
	Yearling	nya	nya	nya	nya	nya	nya	nya

Comments:

Adult Release: Release

Max. Number Size Date Stream Release Point Watershed

200 3-10 August W.F. Yankee Fork 522.303.591.011 Salmon R.

lbs/fish

Note for above table: To develop an understanding of the reproductive potential of captive-reared adult chinook salmon, the Salmon Captive Propagation Technical Oversight Committee (CSCPTOC) recommended that spawning take place at the Ea Hatchery to investigate several reproduction variables (e.g., maturation timing, gamete quality, egg survival to eyed stage of Information developed in this manner is used to compliment behavioral observations and reproductive success data collecte following the release of maturing adult chinook salmon.

Eggs produced from hatchery spawning events have been used to supplement captive rearing groups or returned to hatch b streams.

Milt has been cryopreserved in the captive rearing program since 1997.

Data source:

Per Paul Kline IDFG 9/8/03

1.12 Current program performance, including estimated smolt-to-adult survival rates, adult pı levels, and escapement levels. Indicate the source of these data.

33

Return Year	Total Catch (all ages)	Natural Escapement NoRs	Natural Escapement HoRs	Hatchery Spawning NoRs	Hatchery Spawning HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Comments:

This is a captive rearing program with a goal of collecting 250 eggs per stock per year. The program releases mature adult c for natural spawning.

Data source:

Per Paul Kline (IDFG), 10.22.03.

Status and Goals of Stocks and Habitats

34

Brood Year	NoRs Smolt to Adult Survival(%)	NoRs Recruits per Spawner	HoRs Smolt to Adult Survival(%)	HoRs Recruits per Spawner	Combined (HoRs + NoRs) Smolt to Adult Survival(%)	Combined (HoRs + NoRs) Recruits per Spawner
Goal	nya	nya	nya	nya	nya	nya
1988	nya	nya	nya	nya	nya	nya
1989	nya	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya	nya

Comments:

Data source:

1.13 Date program started (years in operation), or is expected to start.

7 The first year of operation for this hatchery was 1997 .

Comments:

Fish were first collected in brood year 1994.

Data source:

Per Paul Kline IDFG 9/8/03

1.14 Expected duration of program.

148 The final year of the program is undetermined.

149 The program is expected to end when goals can be met by other means not requiring artificial production.

Comments:

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

1.15 Watersheds targeted by program.

1 Salmon River, Columbia River

1.16 Indicate alternative actions considered for attaining program goals, and reasons why thos are not being proposed.

The hatchery program is a part of a strategy to meet conservation and/or harvest goals for the target stock. The tables below the short- and long-term goals are for the stock in terms of stock status (biological significance and viability), habitat and harv in the table indicate High, Medium, or Low levels for the respective attributes. Changes in these levels from current status inc outcomes for the hatchery program and other strategies (including habitat protection and restoration).

18

	Biological Significance	Viability	Habitat
Current Status	H	L	L
Short-term Goal	H	L	L
Long-term Goal	H	M	M

This table shows current status and goals for harvest opportunity. **H** implies harvest opportunity every year, **M** opportunity mo some years, and **N** no opportunity.

19
20
21
22
23

		Location of Fishery				
Fishery type		**Marine**	**L. Columbia**	**Zone 6**	**U. Columbia**	**Subba**
	Current Status	N	N	N	N	N
Commercial	**Short-term Goal**	N	N	N	N	N
	Long-term Goal	N	N	N	N	N
	Current Status	N	N	N	N	N
Ceremonial	**Short-term Goal**	N	N	N	N	N
	Long-term Goal	N	N	N	N	N
	Current Status	N	N	N	N	N
Subsistence	**Short-term Goal**	N	N	N	N	N
	Long-term Goal	N	N	N	N	N
	Current Status	N	N	N	N	N
Recreational	**Short-term Goal**	N	N	N	N	L
	Long-term Goal	N	N	N	N	M

Catch and Release	Current Status	N	N	N	N	N
	Short-term Goal	N	N	N	N	L
	Long-term Goal	N	N	N	N	M

Comments:

All references to unproductive habitat should be specific to hydro habitat as natal spawning and rearing habitat is not limiting.
Not Applicable per Paul Kline (IDFG), 10.22.03.
Not Applicable per Paul Kline (IDFG), 10.22.03.
Not Applicable per Paul Kline (IDFG), 10.22.03.
N= Not Applicable, per Paul Kline (IDFG), 10.22.03.
N= Not Applicable per Paul Kline (IDFG), 10.22.03.

Data source:

Paul Kline (IDFG), 7.22.03.
Paul Kline
Paul Kline
Paul Kline
Paul Kline

Section 2: Program Effects on ESA-Listed Salmonid Populations

2.1 List all ESA permits or authorizations in hand for the hatchery program.

150 The program has the following permits or authorizations: Section 7 or Section 10 permit
.

Comments:

NOAA Fisheries Section 10 Permit No. 1010.

Data source:

Per Paul Kline IDFG 9/8/03

2.2.1 Descriptions, status and projected take actions and levels for ESA-listed natural populatic target area.

145 The program may incidentally affect Snake River basin steelhead, Snake River spring/summer chinook, and Columbia Intern trout.

15 nya

32 Listed stocks may be directly affected by nya.

The following ESA listed natural salmonid populations occur in the subbasin where the program fish are released:

ESA listed stock	Viability	Habitat
Summer Chinook (Johnson Creek)	L	L
Summer Chinook (McCall Hatchery)	H	L
Summer Chinook (Pahsimeroi)	L	L
Spring Chinook (Upper Salmon/Sawtooth)	U	L
Spring Chinook - Natural	H	L
Summer Chinook - Natural	H	L
Steelhead B-Natural	L	L
Redfish Lake Sockeye	L	L
Spring/Summer Chinook (W. Fork Yankee Fork- Salmon River)- Integrated	L	L

Spring/Summer Chinook (East Fork Salmon River)- Integrated	L	L
Lemhi River Spring_Summer Chinook	L	L

H, M and L refer to high, medium and low ratings, low implying critical and high healthy.

Comments:

null
nc
nc
All references to unproductive habitat should be specific to hydro habitat as natal spawning and rearing habitat is not limiting

Data source:

Per Paul Kline IDFG 9/8/03
nds
nds
nc

2.2.2 Status of ESA-listed salmonid population(s) affected by the program.

nya

Most recent available spawning escapement estimates are shown in the table below:

Summer Chinook (Johnson Creek)

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Summer Chinook (McCall Hatchery)

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs

Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Summer Chinook (Pahsimeroi)

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Spring Chinook (Upper Salmon/Sawtooth)

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya

1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	18	19
1996	nya	nya	nya	105	51
1997	nya	nya	nya	155	99
1998	nya	nya	nya	127	26
1999	nya	nya	nya	121	75
2000	nya	nya	nya	535	451
2001	nya	nya	nya	676	1,427

Spring Chinook - Natural

Return Year	**Total Catch (all ages)**	**Natural Escapement**		**Hatchery Spawning**	
		NoRs	**HoRs**	**NoRs**	**HoRs**
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Summer Chinook - Natural

Return Year	**Total Catch (all ages)**	**Natural Escapement**		**Hatchery Spawning**	
		NoRs	**HoRs**	**NoRs**	**HoRs**
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya

1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Steelhead B-Natural

Return Year	**Total Catch (all ages)**	**Natural Escapement**		**Hatchery Spawning**	
		NoRs	**HoRs**	**NoRs**	**HoRs**
Goal	unk	unk	unk	unk	unk
1990	unk	unk	unk	unk	unk
1991	unk	unk	unk	unk	unk
1992	unk	unk	unk	unk	unk
1993	unk	unk	unk	unk	unk
1994	unk	unk	unk	unk	unk
1995	unk	unk	unk	unk	unk
1996	unk	unk	unk	unk	unk
1997	unk	unk	unk	unk	unk
1998	unk	unk	unk	unk	unk
1999	unk	unk	unk	unk	unk
2000	unk	unk	unk	unk	unk
2001	unk	unk	unk	unk	unk

Redfish Lake Sockeye

Return Year	**Total Catch (all ages)**	**Natural Escapement**		**Hatchery Spawning**	
		NoRs	**HoRs**	**NoRs**	**HoRs**
Goal	nya	2000	nya	nya	600
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya

1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Spring/Summer Chinook (W. Fork Yankee Fork- Salmon River)- Integrated

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Spring/Summer Chinook (East Fork Salmon River)- Integrated

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya

2001	nya	nya	nya	nya	nya

Lemhi River Spring_Summer Chinook

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	NA	M	M	NA	NA
1990	M	M	M	NA	NA
1991	M	M	M	NA	NA
1992	M	M	M	NA	NA
1993	M	M	M	NA	NA
1994	M	M	M	NA	NA
1995	M	M	M	NA	NA
1996	M	M	M	NA	NA
1997	M	M	M	NA	NA
1998	M	M	M	NA	NA
1999	M	M	M	NA	NA
2000	M	M	M	NA	NA
2001	M	M	M	NA	NA

Comments:

nc
nc
This is a captive rearing program with a goal of collecting 250 eggs per stock per year. The program releases mature adult c salmon for natural spawning.

Data source:

nds
nds
Per Paul Kline IDFG 9/8/03

2.2.3 Describe hatchery activities, including associated monitoring and evaluation and researcl programs, that may lead to the take of listed fish in the target area, and provide estimate levels of take.

Steelhead B (East Fork) - Integrated

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

152

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass

153	**Observe or harrass (a)**	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

152

Summer Chinook (Johnson Creek)

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

153

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

152

Summer Chinook (McCall Hatchery)

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya

Dates of activity nya

Hatchery Program Operator nya

		Annual Take of Listed Fish by life Stage (number of fish)			
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook (Rapid River) - Hatchery

ESU/Population nya

Activity nya

152 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program Operator nya

		Annual Take of Listed Fish by life Stage (number of fish)			
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (Pahsimeroi)

152

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

153

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook (Upper Salmon/Sawtooth)

152

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

153

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook - Natural

152

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

153

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook - Natural

152

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya

153					
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

152

Steelhead A-Run (Pahsimeroi)- Hatchery

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

153

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

152

Steelhead B (Dworshak)-Hatchery

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Steelhead B-Natural

ESU/Population nya

Activity nya

152 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program Operator nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Natural

ESU/Population nya

152 **Activity** nya

Location of hatchery activity nya

Dates of activity nya

Hatchery Program Operator nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Redfish Lake Sockeye

ESU/Population nya

Activity nya

152 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program Operator nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring/Summer Chinook (W. Fork Yankee Fork- Salmon River)- Integrated

ESU/Population West Fork Yankee Fork, Salmon River Spring/summer Chinook

Activity Broodstock Collection

152 **Location of hatchery activity** West Fork Yankee Fork, Salmon River, 522.303.591.011

Dates of activity nya

Hatchery Program Operator IDF&G

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	250	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring/Summer Chinook (East Fork Salmon River)- Integrated

ESU/Population nya

Activity nya

152 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program Operator nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
153	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Lemhi River Spring_Summer Chinook

ESU/Population nya

Activity nya

152 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program Operator nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Run (Sawtooth)- Hatchery

ESU/Population nya

Activity nya

152 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program Operator nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya

Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

153

Comments:

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

Section 3: Relationship of Program to Other Management Objectives

3.1 Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hooc Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the *NP Production Review* Report and Recommendations - NPPC document 99-15). Explain any deviations from the plan or policies.

Endangered Species Act: The Snake River spring/summer chinook salmon ESU was

listed as threatened under the Endangered Species Act on April 22, 1992 (correction printed on June 3, 1992). The ESU in natural populations of spring/summer chinook salmon in the mainstem Snake River and any of the following subbasins: Tuc Grande Ronde River, Imnaha River, and Salmon River. The ESA requires that recovery plans be generated to guide efforts recovering and delisting of species.

Salmon Subbasin Summary: The depressed status of Snake River spring/summer chinook salmon is clearly described in S of the Northwest Power Planning Councils Salmon Subbasin Summary. Section 4.5.1 identifies the Captive Rearing Project River Chinook Salmon as one of two artificial production programs in place in the Salmon Subbasin addressing recovery go the use of conservation hatchery practices. Program goals and objectives are also consistent with existing plans, policies a presented in Section 5.1. of the Subbasin Summary as developed by Bonneville Power Administration (Section 5.1.1.a.), th Marine Fisheries Service (Section 5.1.1.b.), the Nez Perce Tribe (Section 5.1.2.a.), the Shoshone-Bannock Tribes (Section the Idaho Department of Fish and Game (Section 5.1.3.a.).

Existing federal goals, objectives and strategies identified in the Subbasin Summary (Section 5.2.) overlap significantly with objectives of the Captive Rearing Project for Salmon River Chinook Salmon. The ?overarching? hatchery goal of the Basinv Recovery Strategy (Federal Caucus) is to reduce genetic, ecological, and management effects of artificial production on na populations. By selecting the captive rearing approach to hatchery intervention, this program is designed to minimize negati effects on natural populations. Specific Federal Caucus recommendations that overlap with Objective 1. of this program inc safety net programs on an interim basis to avoid extinction while other recovery actions take place; preserving the genetic l most at-risk populations; limiting the adverse effects of hatchery practices on ESA-listed populations; and using genetically broodstock to stabilize and/or bolster weak populations (Section 5.2.1.).

Bonneville Power Administration (Section 5.2.1.a.) presented basinwide objectives for implementing actions under the FCR Opinion and suggested that hatcheries can play a critical role in recovery of anadromous fish by ?increasing the number of appropriate naturally spawning adults; improving fish health and fitness; and improving hatchery facilities, operation, and m and reducing potential harm to listed fish.? Specific strategies developed by BPA include: reducing the potentially harmful e hatcheries; using safety net programs on an interim basis to avoid extinction; and using hatcheries in a variety of ways to ai

Objective 1. and 2. of the Captive Rearing Project for Salmon River Chinook Salmon overlap significantly with the goals, ob strategies developed by BPA. Chinook captive rearing program objectives and tasks specifically address the development c prudent broodstocks and the use of cryopreservation to archive key genetic resources and to keep unique identities availab future options. Objective 1., Task D. specifically address the production of adult chinook salmon for reintroduction to the hal practices reflect the regions best protocols and undergo constant review and modification through the CSCPTOC process.

The goal of NOAA Fisheries in the Salmon Subbasin (Section 5.2.1.b.) is to achieve the recovery of Snake River spring/sur chinook, sockeye and steelhead resources. Ultimately, NOAA Fisheries goal is the achievement of self-sustaining, harvesta salmon populations that no longer require the protection of the Endangered Species Act. Chinook captive rearing program g objectives are consistent with this language.

2000 Columbia River Basin Fish and Wildlife Program ? The Captive Rearing Project for Salmon River Chinook Salmon coı general vision of the Fish and Wildlife Program (Section III.A.1.) and its ?overarching" objective to protect, mitigate and enh and wildlife of the Columbia River and its tributaries (Section III.C.1.). Specifically, the Primary Artificial Production Strategy and Wildlife Program (Section 4.) addresses the need to complement habitat improvements by supplementing native fish pc hatchery-produced fish with similar genetics and behavior to their wild counterpart. In addition, Section 4. includes language need to minimize the negative impacts of hatcheries in the recovery process. Chinook captive rearing program goals and ol aligned with this philosophy. Program methods receive constant review at CSCPTOC level and constantly strive to provide practices that meet Fish and Wildlife Program standards.

2000 FCRPS Biological Opinion ? The Federal Columbia River Power System Biological Opinion includes Artificial Propaga (Section 9.6.4.) that address reforms to ?reduce or eliminate adverse genetic, ecological, and management effects of artific on natural production while retaining and enhancing the potential of hatcheries to contribute to basinwide objectives for con recovery.? The Biological Opinion recognizes that artificial production measures have ?proven effective in many cases at a term extinction risks.? Many of the Actions to Reform Existing Hatcheries and Artificial Production Programs (Section 9.6.4. carried-out in the Captive Rearing Project for Salmon River Chinook Salmon. Specifically, Objective 1. and 2. of the chinook rearing program address reform measures dealing with: the management of genetic risk, the production of fish from locally stocks, the use of mating protocols designed to avoid genetic divergence from the biologically appropriate population, matcl with habitat carrying capacity, and marking hatchery-produced fish to distinguish natural from hatchery fish. The Biological (reviews the need for the development of NOAA Fisheries-approved Hatchery and Genetic Management Plans (HGMP). At
155 writing, a draft is in its final stages of development.

Specific Actions in the Biological Opinion that demonstrate logical connections with the chinook captive rearing program are Section 9.6.4.3. Actions 170, 173, 174, 175, 177, 182, and 184 are all addressed by objectives identified in the Captive Rea Salmon River Chinook Salmon. Actions 170 and 173 call for the design and funding of capital modifications to implement re identified in HGMPs. Action 174 identifies the need for "additional sampling efforts and specific experiments to determine re distribution and timing of hatchery and natural spawners". This need is addressed in research conducted by the Captive Re for Salmon River Chinook Salmon under Objective 2. Actions 175 and 177 call for the development and funding of safety ne of at-risk salmon and steelhead. Target populations specifically addressed by the IDFG Captive Rearing Project for Salmon Salmon are specifically referenced in the Biological Opinion. Recommendations made in Action 182 are to fund studies "to reproductive success of hatchery fish relative to wild fish", and concerns over the genetic implications are expressed. The C Project for Salmon River Chinook Salmon is actively involved with research designed to address this question. Objective 2. rearing project includes research directed at determining the reproductive success of pre-spawn adults released for natural of captive-reared adults retained in the hatchery. In addition, the IDFG and NOAA Fisheries have initiated maturation physic to address questions related to reproductive timing and success. Action 184 states the need to provide funding for a "hatch monitoring, and evaluation program consisting of studies to determine whether hatchery reforms reduce the risk of extinctio River basin salmonids and whether conservation hatcheries contribute to recovery". The Captive Rearing Project for Salmo Chinook Salmon is making a clear attempt to provide the needed monitoring and evaluation of conservation hatchery techn behavioral patterns and spawning success in pre-spawn adults produced by the program.

Offices of the Governors. 2000. Recommendations of the governors of Idaho, Montana, Oregon and Washington for the prc restoration of fish in the Columbia River Basin. The Governors of the states of Idaho, Montana, Oregon and Washington urg recovery planners to recognize the multi-purpose aspect of hatcheries, which includes fish production for harvest, suppleme rebuild naturally spawning populations, and captive brood stock experiments for conservation and restoration. The Governo recommended, ?all hatcheries in the Columbia River Basin be reviewed within three years to determine the facilities specifi potential future uses in support of fish recovery and harvest.? They further recommended that the supplementation plan rec tribal, state and federal roles in implementation of the plan. Lastly, the Governors supported the concept of wild fish refuges these refuges as controls for evaluating conservation hatchery efforts.

Other Plans and Guidelines ? Goals and objectives of the Captive Rearing Project for Salmon River Chinook Salmon are cc several guidelines contained in the Review of Artificial Production of Anadromous and Resident Fish in the Columbia River

(Scientific Review Team). Objective 1. and 2. of the chinook captive rearing program are actively following elements of Guic 5., 8., 10., 11., 12., 13., 14., and 15. of the Artificial Production Review. These guidelines address: the hatchery rearing env natural population parameters, habitat carrying capacity, genetic and breeding protocols, germ plasm repositories, and pop history knowledge. Performance standards and indicators presented in The final Artificial Production Review document pres of performance standards addressing both benefits and risks to populations. Many of these standards are addressed by sp captive rearing program objectives. These relationships will be identified in the final HGMP for chinook captive rearing prog activities.

Relationships described above are substantive in nature and address core guidelines, goals, objectives and strategies iden various planning documents. Techniques and products developed in the Captive Rearing Project for Salmon River Chinook critical components of the overall conceptual framework being developed in the region.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

3.2 List all existing cooperative agreements, memoranda of understanding, memoranda of ag or other management plans or court orders under which program operates.

	Document Title	T
	The Federal Endangered Species Act of 1973-Section 10 Permit No. 1010	ny
156	The 2001-2006 Idaho Deparment of Fish and Game Fisheries Management Plan	MI
	Draft, NOAA Fisheries Salmon Recovery Plans (1995 and 1997)	ny
	Interim Productivity and Abundance Targets (NPPC Document)	ny

Comments:

Data source:

Per Paul Kline IDFG 9/8/03

3.3 Relationship to harvest objectives.

157 There are no harvest objectives in the immediate future for this stock.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

3.4 Relationship to habitat protection and recovery strategies.

158 NOAA Fisheries has not developed a recovery plan specific to Snake River salmon, but this program is operated consistent Biological Opinions and subbasin planning efforts.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

3.5 Ecological interactions.

The following species co-occur to a significant degree with the program fish in either freshwater or early marine life stages.

- 159 Steelhead
- Sockeye
- Chinook
- Bull Trout

Comments:

Data source:

Per Paul Kline IDFG 9/8/03

Section 4. Water Source

4.1 Provide a quantitative and narrative description of the water source (spring, well, surfac quality profile and natural limitations to production attributable to the water source.

The following statements describe the adult holding water source:

- The water source is pumped.
- The water source is pathogen-free.
- The water source is specific-pathogen free.
- The water source is fish free.
- The water source is accessible to anadromous fish.
- Water is available from multiple sources.
- 12 The water used results in natural water temperature profiles that provide optimum maturation and gamete developr
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu temperature.
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu ammonia, carbon dioxide, chlorine, pH, copper, dissolved oxygen, hydrogen sulfide, dissolved nitrogen, iron, and zi
- The water supply is protected by flow and/or pond level alarms at the holding pond(s).
- The water supply is protected by back-up power generation.
- Naturally produced fish do not have access to intake screens.
- Hatchery intake screening complies with Integrated Hatchery Operations Team (IHOT) and National Marine Fisheri facility guidelines.

The following statements describe the incubation water source:

- The water source is gravity flow.
- The water source is pumped.
- The water source is pathogen-free.
- The water source is specific-pathogen free.
- The water source is fish free.
- 13 Water is from the natal stream for the cultured stock.
- The water used provides natural water temperature profiles that results in hatching/emergence timing similar to tha naturally produced stock.
- Incubation water can be heated or chilled to approximate natural water temperature profiles.
- The water supply is protected by flow alarms at the head box.
- The water supply is protected by flow and/or pond level alarms at the holding pond(s).
- The water supply is protected by back-up power generation
- Naturally produced fish do not have access to intake screens.

The following statements describe the rearing water source:

- The water source is pumped.
- The water source is pathogen-free.
- The water source is specific-pathogen free.
- 14 The water source is fish free.
- The water source is accessible to anadromous fish.
- Water is available from multiple sources.
- The water used provides natural water temperature profiles that results in hatching/emergence timing similar to tha naturally produced stock.
- Rearing water has a chemical profile significantly different from natural stream conditions to provide adequate impri hatchery fish and minimize the attraction of naturally produced fish into the hatchery.

- The hatchery operates to allow all migrating species of all ages to by-pass or pass through hatchery related structu
- Adequate flows are maintained to provide unimpeded passage of adults and juveniles in the by-pass reach created water withdrawals.
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu temperature.
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu ammonia, carbon dioxide, chlorine, pH, copper, dissolved oxygen, hydrogen sulfide, dissolved nitrogen, iron, and zi
- The water supply is protected by flow and/or pond level alarms at the holding pond(s)
- The water supply is protected by back-up power generation.
- Naturally produced fish do not have access to intake screens.
- Hatchery intake screening complies with Integrated Hatchery Operations Team (IHOT) and National Marine Fisheri facility guidelines.

Comments:

q. Does not apply, since the water source is from wells.

These answers apply to Eagle Hatchery, not NOAA Manchester or Burley Creek.
r. Does not apply since water source is from wells.

These answers apply to Eagle Hatchery, not NOAA Manchester or Burley Creek.
i. Answer is no for fingerling and smolt releases, but the answer to "i." is yes for adult releases. Hatchery reared fingerlings larger than naturally reared fingerlings and smolts.

t. Does not apply since water source is from wells.

These answers apply to Eagle Hatchery, not NOAA Manchester or Burley Creek.

Data source:

Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 10/22/03.

4.2 Indicate risk aversion measures that will be applied to minimize the likelihood for the ta listed natural fish as a result of hatchery water withdrawal, screening, or effluent discha

15 The production from this facility falls below the minimum production requirement for an NPDES permit, but the facility opera compliance with state or federal regulations for discharge and The facility does not have a discharge permit.

Comments:

These answers apply to Eagle Hatchery, not NOAA Manchester or Burley Creek

Eagle Fish Hatchery follows guidelines set-up in the NPDES permit, but is not required to monitor effluent based on pounds produced annually.

Data source:

Per Paul Kline IDFG 9/8/03

Section 5. Facilities

5.1 Broodstock collection facilities (or methods).

16 Brookstock for this program is collected:

- by methods described below.

188

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available F (gpm)
24	Fiberglass	230	10	10	2.3	60
2	Fiberglass	1250	20	20	4	250
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya

Comments:

Captive populations for this project are sourced from the progeny of naturally spawning adults. Beginning with the first collecti continuing through 1998, parr were collected from the three source streams. Beginning in 1999, captive populations were sou eggs from natural redds using hydraulic equipment. Spawning takes place primarily in natal streams (hatchery-produced adul spawn).

Limited spawning for this program takes place at the IDFG Eagle Fish Hatchery.

Data source:

Per Paul Kline IDFG 10/22/03.
Aquafarms 2000 Inc. specifications manual Eagle Hatchery historical flow data. Per Paul Kline IDFG 9/8/03

5.2 Fish transportation equipment (description of pen, tank, truck, or container used).

99 IHOT guidelines for transportation are followed.

	Equipment Type	Capacity (gallons)	Supplemental Oxygen (y/n)	Temperature Control (y/n)	Normal Transit Time (minutes)	Chemical (s) Used	Dc (p
	3/4 Ton PU w/Tank	250	Y	nya	9 hrs	None	NA
187	10 wheel Tanker	2700	Y	nya	12 hrs	None	NA
	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya

Comments:

Both 250 and 2700 gallon tanks are equipped with Fresh-flow aeration pumps.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03 From Chinook BPA Hatchery Reports and 1010 Chinook NOAA Fisheries Reports

5.3 Broodstock holding and spawning facilities.

Spawning for this program takes place:

16

** NO STATEMENT PROVIDED FOR THIS CHOICE **

34 Integrated Hatchery Operations Team (IHOT) adult holding guidelines followed for adult holding , density , water quality , alar predator control measures to provide the necessary security for the broodstock.

	Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available F (gpm)
	24	Fiberglass	230	10	10	2.3	60
188	2	Fiberglass	1250	20	20	4	250
	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya

Comments:

Captive populations for this project are sourced from the progeny of naturally spawning adults. Beginning with the first collecti continuing through 1998, parr were collected from the three source streams. Beginning in 1999, captive populations were sou eggs from natural redds using hydraulic equipment. Spawning takes place primarily in natal streams (hatchery-produced adul spawn).

Limited spawning for this program takes place at the IDFG Eagle Fish Hatchery.

Data source:

Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03
Aquafarms 2000 Inc. specifications manual Eagle Hatchery historical flow data. Per Paul Kline IDFG 9/8/03

5.4 Incubation facilities.

189

Incubator Type	Units (number)	Flow (gpm)	Volume (cu.ft.)	Loading-Eyeing (eggs/unit)	Loading-Hatcl (eggs/unit
Upweller/downweller	256	0.288	0.62 gal	800	800
nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya

Comments:

Data source:

From Chinook BPA Hatchery Reports and 1010 Chinook NOAA Fisheries Reports Per Paul Kline IDFG 9/8/03

5.5 Rearing facilities.

190

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Maximum Flow Index	Maxir Dens Ind
10	Fiberglass	4.3	2.17	2.17	0.917	0.8	1.34	0.25
66	Fiberglass	10.6	3.25	3.25	1.0	2	0.8833	0.1667
8	Fiberglass	50	6.5	6.5	1.2	9.3	0.5376	0.1
24	Fiberglass	228.9	10	10	2.3	42.8	0.1903	0.0357

Comments:

Data source:

Aquafarms 2002 Inc. specifications manual. Eagle Hatchery historical flow data. Per Paul Kline IDFG 9/8/03

5.6 Acclimation/release facilities.

190

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Maximum Flow Index	Maxir Dens Ind
10	Fiberglass	4.3	2.17	2.17	0.917	0.8	1.34	0.25
66	Fiberglass	10.6	3.25	3.25	1.0	2	0.8833	0.1667
8	Fiberglass	50	6.5	6.5	1.2	9.3	0.5376	0.1
24	Fiberglass	228.9	10	10	2.3	42.8	0.1903	0.0357

Comments:

Data source:

Aquafarms 2002 Inc. specifications manual. Eagle Hatchery historical flow data. Per Paul Kline IDFG 9/8/03

5.7 Describe operational difficulties or disasters that led to significant fish mortality.

160 No significant operational disasters have occurred in this program.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

5.8 Indicate available back-up systems, and risk aversion measures that will be applied, tha the likelihood for the take of listed natural fish that may result from equipment failure, v flooding, disease transmission, or other events that could lead to injury or mortality.

70 Fish are reared in multiple facilities or with redundant systems to reduce the risk of catastrophic loss.

78 The facility is sited so as to minimize the risk of catastrophic fish loss from flooding.

79 Staff is notified of emergency situations at the facility.

80 The facility is continuously staffed to assure the security of fish stocks on-site.

Comments:

The hatchery has never been flooded.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

Section 6. Broodstock Origin and Identity

6.1 Source.

17 The broodstock chosen represents natural populations native or adapted to the watersheds in which hatchery fish will be re

Comments:

Data source:

Per Paul Kline IDFG 9/8/03

6.2.1 History.

183

Broodstock Source	Origin	Year(s) Used	
		Begin	End
West Fork Yankee Fork Salmon River	N	1994	2002
Lemhi River	N	1994	1999
East Fork Salmon River	N	1994	2002
nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya

nya		nya	nya	nya

Comments:

Data source:

Per Paul Kline IDFG 9/8/03

6.2.2 Annual size.

22 The program collects sufficient numbers of donors from the natural stock to minimize founder effects.

23

25

27 The program does NOT collect sufficient broodstock to maintain an effective population size of 1000 fish per generation.

28 More than 10% of the broodstock is derived from wild fish each year.

Comments:

Eggs are collected from approximately 50% of the redds.

The natural spawning population has an effective population size lower than 1000. While this is a desirable goal, the chinoc rearing program operates at a considerably lower effective population size level due to the extremely depressed nature of tl populatin. Our primary tactic in managing genetic risk is to avoid cohort failure by supplementing fish from the captive progr fish are appropriately sourced from multiple wild families, genetic impacts from supplementation are expected to be minima 100% of the broodstock is derived from wild fish each year.

Data source:

Per Paul Kline IDFG 9/8/03.
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

6.2.3 Past and proposed level of natural fish in the broodstock.

33

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Comments:

This is a captive rearing program with a goal of collecting 250 eggs per stock per year. The program releases mature adult (salmon for natural spawning.

Data source:

Per Paul Kline (IDFG), 10.22.03.

6.2.4 Genetic or ecological differences.

19 The broodstock chosen displays morphological and life history traits similar to the natural population.

Comments:

Data source:

Per Paul Kline IDFG 9/8/03

6.2.5 Reasons for choosing.

18 dna

20

21 dna

Comments:

Selection of stocks used in this program based on past hatchery intervention history, present wild/natural status, lack of cur intervention , and low to moderate viability.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.

6.3 Indicate risk aversion measures that will be applied to minimize the likelihood for advers or ecological effects to listed natural fish that may occur as a result of broodstock selecti practices.

The following procedures are in place that maintain broodstock collection within programmed levels:

161

nya

Comments:

The collection of eyed-eggs to source rearing groups is follows the experimental design of the program and is constantly re the CSCPTOC process. Multiple redds (families are sampled).

Data source:

Per Paul Kline IDFG 10/22/03.

Section 7. Broodstock Collection

7.1 Life-history stage to be collected (adults, eggs, or juveniles).

	Adults				
Year	**Females**	**Males**	**Jacks**	**Eggs**	**Juveniles**
Planned	nya	nya	nya	600	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya

	1993	nya	nya	nya	nya	nya
	1994	nya	nya	nya	nya	615
	1995	nya	nya	nya	nya	163
	1996	nya	nya	nya	nya	296
191	1997	nya	nya	nya	nya	357
	1998	nya	nya	nya	304	605
	1999	nya	nya	nya	798	nya
	2000	nya	nya	nya	807	nya
	2001	nya	nya	nya	583	nya

Comments:

2002 Eggs - 636

Numbers combined from three stocks of chinook. Note: these numbers represent eyed-eggs and juveniles collected or a capt program.

Data source:

From Chinook BPA Hatchery Reports and 1010 Chinook NOAA Fisheries Reports. Numbers combined from three stocks of c Paul Kline IDFG 9/8/03

7.2 Collection or sampling design

16

22 The program collects sufficient numbers of donors from the natural stock to minimize founder effects.

23

24 Representative samples of the population are NOT collected with respect to size, age, sex ratio, run and spawn timing, and important to long-term fitness.

25

27 The program does NOT collect sufficient broodstock to maintain an effective population size of 1000 fish per generation.

28 More than 10% of the broodstock is derived from wild fish each year.

Comments:

Eggs are collected from approximately 50% of the redds.

This program uses only eggs collected from the natural stock. Eggs are not collected from the hatchery component of the n spawning population.

A small sample (approximately 50 eggs out of 4000) are brought into the hatchery from multiple redds.
The natural spawning population has an effective population size lower than 1000. While this is a desirable goal, the chinoc rearing program operates at a considerably lower effective population size level due to the extremely depressed nature of tl populatin. Our primary tactic in managing genetic risk is to avoid cohort failure by supplementing fish from the captive progr fish are appropriately sourced from multiple wild families, genetic impacts from supplementation are expected to be minima 100% of the broodstock is derived from wild fish each year.

Data source:

Per Paul Kline IDFG 9/8/03.
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

7.3 Identity.

100 Marking techniques are used to distinguish among hatchery population segments.

101 100% of the hatchery fish released are marked so that they can be distinguished from the natural population.

102 Marked fish can be identified using non-lethal means.

106 Wild fish make up >30% (greater than thirty percent) % of the broodstock for this program.

Comments:

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

7.4 Proposed number to be collected:

198 **7.4.1 Program goal (assuming 1:1 sex ratio for adults):**
Approximately 250 eyed-eggs are collected annually from target streams to initiate rearing groups.

7.4.2 Broodstock collection levels for the last twelve years (e.g. 1990-2001), or for most recent years availab

			Adults			
	Year	**Females**	**Males**	**Jacks**	**Eggs**	**Juveniles**
	Planned	nya	nya	nya	600	nya
	1990	nya	nya	nya	nya	nya
	1991	nya	nya	nya	nya	nya
	1992	nya	nya	nya	nya	nya
191	**1993**	nya	nya	nya	nya	nya
	1994	nya	nya	nya	nya	615
	1995	nya	nya	nya	nya	163
	1996	nya	nya	nya	nya	296
	1997	nya	nya	nya	nya	357
	1998	nya	nya	nya	304	605
	1999	nya	nya	nya	798	nya
	2000	nya	nya	nya	807	nya
	2001	nya	nya	nya	583	nya

Comments:

2002 Eggs - 636

Numbers combined from three stocks of chinook. Note: these numbers represent eyed-eggs and juveniles collected or a capt program.

Data source:

From Chinook BPA Hatchery Reports and 1010 Chinook NOAA Fisheries Reports. Numbers combined from three stocks of c Paul Kline IDFG 9/8/03

7.5 Disposition of hatchery-origin fish collected in surplus of broodstock needs.

The following procedures are in place that maintain broodstock collection within programmed levels:

161 nya

Comments:

The collection of eyed-eggs to source rearing groups is follows the experimental design of the program and is constantly re the CSCPTOC process. Multiple redds (families are sampled).

Data source:

Per Paul Kline IDFG 10/22/03.

7.6 Fish transportation and holding methods.

187

Equipment Type	Capacity (gallons)	Supplemental Oxygen (y/n)	Temperature Control (y/n)	Normal Transit Time (minutes)	Chemical (s) Used	Dc (p
3/4 Ton PU w/Tank	250	Y	nya	9 hrs	None	NA
10 wheel Tanker	2700	Y	nya	12 hrs	None	NA
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya

188

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available F (gpm)
24	Fiberglass	230	10	10	2.3	60
2	Fiberglass	1250	20	20	4	250
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya

33 Broodstock is collected and held in a manner that results in less than 10% prespawning mortality.

99 IHOT guidelines for transport are followed for this program.

Comments:

Both 250 and 2700 gallon tanks are equipped with Fresh-flow aeration pumps.

Data source:

Per Paul Kline IDFG 9/8/03 From Chinook BPA Hatchery Reports and 1010 Chinook NOAA Fisheries Reports
Aquafarms 2000 Inc. specifications manual Eagle Hatchery historical flow data. Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

7.7 Describe fish health maintenance and sanitation procedures applied.

98 "Fish transfers into the subbasin are inspected and accompanied by notifications as described in IHOT and PNFHPC guide

32 Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection committee (PNFHPC), state or triba are followed for broodstock fish health inspection , transfer of eggs or adults and broodstock holding and disposal of carcas

Comments:

Guidelines are in place for adult transfers.

Data source:

Per Paul Kline IDFG 10/22/03.

Per Paul Kline IDFG 9/8/03.

7.8 Disposition of carcasses.

32 Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection committee (PNFHPC), state or triba are followed for broodstock fish health inspection , transfer of eggs or adults and broodstock holding and disposal of carcas

103 Hatchery adults are distributed by staff within the subbasin to provide hatchery adults are distributed (by staff) within the sul provide natural production.

161 The following procedures are in polace that maintain broodstock collection within programmed levels:

nya

Comments:

The collection of eyed-eggs to source rearing groups is follows the experimental design of the program and is constantly re the CSCPTOC process. Multiple redds (families are sampled).

Data source:

Per Paul Kline IDFG 9/8/03.
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.

7.9 Indicate risk aversion measures that will be applied to minimize the likelihood for advers or ecological effects to listed natural fish resulting from the broodstock collection progra

29 The program has guidelines for acceptable contribution of hatchery fish to natural spawning.

30 These guidelines are met for all affected natural stocks.

32 Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection committee (PNFHPC), state or triba are followed for broodstock fish health inspection , transfer of eggs or adults and broodstock holding and disposal of carcas

Comments:

Annual project reports submitted to BPA and NOAA Fisheries to meet contract and permit obligations.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03.

Section 8. Mating

8.1 Selection method.

35 Males and females available on a given day are mated randomly.

39 Fish are allowed to select their own mates and go through all normal spawning behavior.

Comments:

Captive-reared adults produced in this program are primarily released to the habitat to naturally spawn. However, to develo understanding of the reproductive potential of captive-reared adult chinook salmon (e.g., maturation timing, gamete quality, eyed stage of development), some in-hatchery spawning occurs. Information developed in this manner is used to complime observations and reproductive success data collected in the field following the release of maturing adult chinook salmon.

Hatchery spawning follows accepted, standard practices. In addition, input on the development of spawning designs is prov University of Idaho and discussed at the CSCPTOC level. Dissimilarity spawning matrices may be developed by the Univer using results from genetic analyses. Eggs produced at spawning are divided into sub-lots (by female) and fertilized with milt program males. Up to four sub-families may be produced from each female (factorial design). Unique males are used an ap number of times to balance their contribution to the spawning design. Milt is pre-harvested from contributing males and exa motility prior to use. Eggs are incubated by sub-family to yield lineage-specific rearing groups. Overall egg quality is judged

egg size, clarity of ovarian fluid, and presence/absence of polarized or overripe eggs. Fecundities are developed by applyin weights to the total egg weight for each female. Egg survival to the eyed stage off development is determined by subtractin unfertilized eggs from the total estimated number of eggs for each female.
Spawning of captively reared fish takes place in the wild. Some hatchery spawning occurs to document specific spawning v reproductive potential.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.

8.2 Males.

38 Precocious males are used as a set percentage or in proportion to their contribution to the adult run.

37 Back-up males are not used in the spawning protocol.

Comments:

Spawning of captively reared fish takes place in the wild. Some hatchery spawning occurs to document specific spawning v reproductive potential.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.

8.3 Fertilization.

36 Gametes are NOT pooled prior to fertilization.

39 Fish are allowed to select their own mates and go through all normal spawning behavior.

11 IHOT PNFHPC state federal other guidelines are followed for culture practices for this program.

40 Disinfection procedures that prevent pathogen transmission between stocks of fish are implemented during spawning.

Comments:

Spawning of captively reared fish takes place in the wild.
Spawning of captively reared fish takes place in the wild. Some hatchery spawning occurs to document specific spawning v reproductive potential.
Other = Chinook Salmon Captive Propagation Technical Oversight Committee. A team of technical experts representing the agencies and tribes involved with the program in addition to invited experts. The CSCPTOC meets periodically to review pr activities, address critical uncertainties, and to adaptively manage future activities

Spawning of captively reared fish takes place in the wild. Some hatchery spawning occurs to document specific spawning v reproductive potential.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.

8.4 Cryopreserved gametes.

162 Cryopreserved gametes are used.

Comments:

Milt has been cryopreserved in the captive rearing program since 1997 and follows accepted protocols. Cryopreserved milt selectively incorporated (based on spawning matrices developed cooperatively with the University of Idaho) in spawning ev

Data source:

Per Paul Kline IDFG 9/8/03

8.5 Indicate risk aversion measures that will be applied to minimize the likelihood for advers or ecological effects to listed natural fish resulting from the mating scheme.

35 Males and females available on a given day are mated randomly.

36 Gametes are NOT pooled prior to fertilization.

37 Back-up males are not used in the spawning protocol.

38 Precocious males are used as a set percentage or in proportion to their contribution to the adult run.

39 Fish are allowed to select their own mates and go through all normal spawning behavior.

Comments:

Captive-reared adults produced in this program are primarily released to the habitat to naturally spawn. However, to develo understanding of the reproductive potential of captive-reared adult chinook salmon (e.g., maturation timing, gamete quality, eyed stage of development), some in-hatchery spawning occurs. Information developed in this manner is used to complime observations and reproductive success data collected in the field following the release of maturing adult chinook salmon.

Hatchery spawning follows accepted, standard practices. In addition, input on the development of spawning designs is prov University of Idaho and discussed at the CSCPTOC level. Dissimilarity spawning matrices may be developed by the Univer using results from genetic analyses. Eggs produced at spawning are divided into sub-lots (by female) and fertilized with milt program males. Up to four sub-families may be produced from each female (factorial design). Unique males are used an ap number of times to balance their contribution to the spawning design. Milt is pre-harvested from contributing males and exa motility prior to use. Eggs are incubated by sub-family to yield lineage-specific rearing groups. Overall egg quality is judged egg size, clarity of ovarian fluid, and presence/absence of polarized or overripe eggs. Fecundities are developed by applyin weights to the total egg weight for each female. Egg survival to the eyed stage off development is determined by subtractin unfertilized eggs from the total estimated number of eggs for each female.
Spawning of captively reared fish takes place in the wild.
Spawning of captively reared fish takes place in the wild. Some hatchery spawning occurs to document specific spawning v reproductive potential.

Spawning of captively reared fish takes place in the wild. Some hatchery spawning occurs to document specific spawning v reproductive potential.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.

Section 9. Incubation and Rearing.

9.1.1 Number of eggs taken and survival rates to eye-up and/or ponding.

Year	Egg Take	Green-Eyed Survival (%)	Eyed-Ponding Survival (%)	Egg Survival Performance Std.	Fry-fingerling Survival (%)	Rearing Survival Performance Std.	Finger Smo Surviva
1990	NA	NA	NA	NA	NA	NA	NA
1991	NA	NA	NA	NA	NA	NA	NA
1992	NA	NA	NA	NA	NA	NA	NA
1993	NA	NA	NA	NA	NA	NA	NA

1994	NA	NA	NA	NA	NA	NA	78.49
1995	NA	NA	NA	NA	NA	NA	92.47
1996	NA	NA	NA	NA	NA	NA	84.91
1997	NA	NA	NA	NA	NA	NA	94.03
1998	44414	72.47	84.87	NA	97.45	NA	96.91
1999	4631	78.73	94.11	NA	95.34	NA	96.93
2000	1323	95.69	96.50	NA	95.1	NA	96.7
2001	21500	37.9	96.91	NA	95.93	NA	Unknown

192

Comments:

Egg Green-eyed Eyed-Ponding Egg survival fry-fing. rearing surv. fing.-smolt

Year Take Survival(%) Surival(%) perf. std. survival(%) perf. std. surv.(%)

2002 72203 66.45 94.50 NA Unknown NA Unknown

Note: First two columns represent hatchery production (All eyed-eggs returned to natal streams). The remaining columns rep of eyed-eggs and parr collected from the field and reared in captivity.

Data source:

Project annual reports to Bonneville Power Administration. Project annual reports to NOAA Fisheries for ESA Section 10 acti Kline IDFG 9/8/03

9.1.2 Cause for, and disposition of surplus egg takes.

163 Extra eggs are not intentionally produced in this program.

45

48 Families are incubated individually.

59 No culling of juveniles occur.

60

61

44 0 (eggs are never culled)

Comments:

Eggs are not culled.

Juvenile chinook salmon are not culled.
Rearing groups for this program are sourced as eyed-eggs from redds built by wild chinook salmon. An approximately equa eyed-eggs (~50) are removed from up six redds. As such, family size is equalized at collection.

Data source:

Per Paul Kline IDFG 11/18/03.
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

9.1.3 Loading densities applied during incubation.

51 Integrated Hatchery Operations Team (IHOT) species-specific incubation recommendations were followed for water quality temperature and incubator capacities.

47 Families within spawning groups are NOT mixed randomly at ponding, thus unintentional rearing differences may affect fam differently.

42 Eggs are incubated under conditions that result in equal survival of all segments of the population to ponding.

Comments:

The chinook captive rearing program uses isolation buckets to incubate small numbers of family-specific eggs. No substrate
Eggs are sourced from wild redds, they are ponded by ?redd? until they are large enough to PIT tag. Different families are g
following PIT tagging.
Eggs in the hatchery are incubated under these conditions. Those from the captively reared fish spawning in the wild are nc

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

9.1.4 Incubation conditions.

49 Incubation takes place in home stream water.

50 The program uses water sources that result in hatching/emergence timing similar to that of the naturally produced populatic

51 Integrated Hatchery Operations Team (IHOT) species-specific incubation recommendations were followed for water quality temperature and incubator capacities.

53 Eggs are monitored when needed to determine fertilization efficiency and embryonic development.

42 Eggs are incubated under conditions that result in equal survival of all segments of the population to ponding.

47 Families within spawning groups are NOT mixed randomly at ponding, thus unintentional rearing differences may affect fam differently.

48 Families are incubated individually.

43 Incubation conditions are manipulated as to synchronize ponding of fry.

Comments:

Captive adults are released to spawn naturally. Production from these adults hatch and rear on home stream water. For egg
from wild redds and brought into the hatchery to source rearing groups, incubation occurs through the eyed stage of develo
wild and in the hatchery from eye through hatch.

The chinook captive rearing program uses isolation buckets to incubate small numbers of family-specific eggs. No substrate
Fertilization efficiency in the hatchery is not monitored until the eyed stage. Fertilization efficiency of the captively reared fis
the wild is also monitored.

Using hydraulic sampling methods, a subsample of redds (produced by captive-reared adults released to spawn naturally) a
verify that eggs were successfully desposited and fertilized.
nc
Eggs are sourced from wild redds, they are ponded by ?redd? until they are large enough to PIT tag. Different families are g
following PIT tagging.

Eggs and alevin in the hatchery are incubated under these conditions. Those from the captively reared fish spawning in the

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

9.1.5 Ponding.

The procedures used for determining when fry are ponded include:

55

- Fry are ponded based on visual inspection of the amount of yolk remaining

46 Eggs are NOT incubated in a manner that allows volitional ponding of fry.

Comments:

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

9.1.6 Fish health maintenance and monitoring.

52 Disinfection procedures are implemented during incubation that prevent pathogen transmission between stocks of fish on s

53 Eggs are monitored when needed to determine fertilization efficiency and embryonic development.

54 Following eye-up stage, eggs are inventoried, and dead or undeveloped eggs removed and disposed of as described in the control guidelines.

56 Dead or culled eggs are discarded in a manner that prevents transmission to receiving watershed.

Comments:

Section 10 permit and CSCPTOC guidelines.

Fertilization efficiency in the hatchery is not monitored until the eyed stage. Fertilization efficiency of the captively reared fis the wild is also monitored.

Using hydraulic sampling methods, a subsample of redds (produced by captive-reared adults released to spawn naturally) a verify that eggs were successfully desposited and fertilized.

Eggs are disinfected and discarded in a landfill.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

9.1.7 Indicate risk aversion measures that will be applied to minimize the likelihood for advers and ecological effects to listed fish during incubation.

47 Families within spawning groups are NOT mixed randomly at ponding, thus unintentional rearing differences may affect fam differently.

49 Incubation takes place in home stream water.

50 The program uses water sources that result in hatching/emergence timing similar to that of the naturally produced populatic

51 Integrated Hatchery Operations Team (IHOT) species-specific incubation recommendations were followed for water quality temperature and incubator capacities.

52 Disinfection procedures are implemented during incubation that prevent pathogen transmission between stocks of fish on s

56 Dead or culled eggs are discarded in a manner that prevents transmission to receiving watershed.

61 Families are NOT culled to minimize family size variation.

Comments:

Eggs are sourced from wild redds, they are ponded by ?redd? until they are large enough to PIT tag. Different families are g following PIT tagging.
Captive adults are released to spawn naturally. Production from these adults hatch and rear on home stream water. For egg from wild redds and brought into the hatchery to source rearing groups, incubation occurs through the eyed stage of develo wild and in the hatchery from eye through hatch.

The chinook captive rearing program uses isolation buckets to incubate small numbers of family-specific eggs. No substrate Section 10 permit and CSCPTOC guidelines.

Eggs are disinfected and discarded in a landfill.

Rearing groups for this program are sourced as eyed-eggs from redds built by wild chinook salmon. An approximately equa
eyed-eggs (~50) are removed from up six redds. As such, family size is equalized at collection.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

9.2.1 Provide survival rate data (*average program performance*) by hatchery life stage (fry to f fingerling to smolt) for the most recent twelve years (1990-2001), or for years dependab are available.

	Year	Egg Take	Green-Eyed Survival (%)	Eyed-Ponding Survival (%)	Egg Survival Performance Std.	Fry-fingerling Survival (%)	Rearing Survival Performance Std.	Finger Smc Surviva
	1990	NA	NA	NA	NA	NA	NA	NA
	1991	NA	NA	NA	NA	NA	NA	NA
	1992	NA	NA	NA	NA	NA	NA	NA
	1993	NA	NA	NA	NA	NA	NA	NA
192	**1994**	NA	NA	NA	NA	NA	NA	78.49
	1995	NA	NA	NA	NA	NA	NA	92.47
	1996	NA	NA	NA	NA	NA	NA	84.91
	1997	NA	NA	NA	NA	NA	NA	94.03
	1998	44414	72.47	84.87	NA	97.45	NA	96.91
	1999	4631	78.73	94.11	NA	95.34	NA	96.93
	2000	1323	95.69	96.50	NA	95.1	NA	96.7
	2001	21500	37.9	96.91	NA	95.93	NA	Unknown

Comments:

Egg Green-eyed Eyed-Ponding Egg survival fry-fing. rearing surv. fing.-smolt

Year Take Survival(%) Surival(%) perf. std. survival(%) perf. std. surv.(%)

2002 72203 66.45 94.50 NA Unknown NA Unknown

Note: First two columns represent hatchery production (All eyed-eggs returned to natal streams). The remaining columns rep
of eyed-eggs and parr collected from the field and reared in captivity.

Data source:

Project annual reports to Bonneville Power Administration. Project annual reports to NOAA Fisheries for ESA Section 10 acti
Kline IDFG 9/8/03

9.2.2 Density and loading criteria (goals and actual levels).

71 The juvenile rearing density and loading guidelines used at the facility are based on: other criteria .

72 IHOT standards are followed for: water quality , alarm systems , predator control measures to provide the necessary securi
cultured stock , loading and density.

Comments:

Loading and density is based on Chinook Salmon Captive Propagation Technical Oversight Committee (CSCPTOC) guidel

Program uses more conservative loading and density criteria than IHOT.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

9.2.3 Fish rearing conditions.

66 The program uses a diet and growth regime that mimics natural seasonal growth patterns.

67 Settleable solids, unused feed and feces are removed periodically to ensure proper cleanliness of rearing containers.

72 IHOT standards are followed for: water quality , alarm systems , predator control measures to provide the necessary securi cultured stock , loading and density.

71 The juvenile rearing density and loading guidelines used at the facility are based on other criteria .

Comments:

The program uses diets specifically designed for captive broodstock efforts. One manufacturer (Bio-Oregon) develops a sp is designed to provide a more natural protein source than traditional diets (krill v. fish meal). Feeding schedules are develop precocity in full-term captive broodstocks while providing for optimal growth.

Fish rear through the smolt stage of development at the IDFG Eagle Fish Hatchery. Water temperature and diet ration are u modulate growth to minimize precocial development at age-two. At smoltification, fish are transferred to the NOAA Fisherie Marine Experiment Station where they rear through maturation. Diet ration and water protocols are balanced to produce fisl program objectives.

Program uses more conservative loading and density criteria than IHOT.

Loading and density is based on Chinook Salmon Captive Propagation Technical Oversight Committee (CSCPTOC) guidel

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

9.2.4 Indicate biweekly or monthly fish growth information (average program performance), ir length, weight, and condition factor data collected during rearing, if available.

	Rearing Period	Length (mm)	Weight (fpp)	Condition Factor	Growth Rate	Hepatosomatic Index	Boc Moist Conte
	January	54.687	1.140	NA	1	NA	NA
	February	55.139	1.173	NA	7	NA	NA
	March	62.737	1.834	NA	10	NA	NA
	April	72.451	3.019	NA	9	NA	NA
194	May	81.565	4.550	NA	10	NA	NA
	June	91.773	6.844	NA	12	NA	NA
	July	103.6	10.414	NA	10	NA	NA
	August	113.9	14.458	NA	13	NA	NA
	September	126.82	20.974	NA	9	NA	NA
	October	135.01	26.044	NA	10	NA	NA
	November	144.922	37.412	NA	6	NA	NA

December	150.673	43.710	NA	9	NA	NA

Comments:

Rearing Length Weight Condition Growth Hepatosomatic Body Moisture

Period (mm) (fpp) Factor Rate Index Context

January 159.910 55.448 NA 5 NA NA

February 165.099 63.000 NA 6 NA NA

March 171.309 73.020 NA 7 NA NA

April 178.371 85.820 NA 8 NA NA

May 186.583 102.740 NA 7 NA NA

June 195.571 124.000 NA 8 NA NA

Data source:

Project annual reports to Bonneville Power Administration. Project annual reports to NOAA Fisheries for ESA Section 10 acti Historical sample count data from Eagle Hatchery. Condition factor can not be determined since all length measurements rep Length?. Per Paul Kline IDFG 9/8/03

9.2.5 Indicate monthly fish growth rate and energy reserve data (*average program performanc* available.

64
- Feeding rates are followed so that fish size is within 10% of program goal each year.
- Feed is stored under proper conditions as described by IHOT guidelines.

65 The correct amount and type of food is provided to achieve the desired growth rate , body composition and condition factorsf and life stages being reared.

194

Rearing Period	Length (mm)	Weight (fpp)	Condition Factor	Growth Rate	Hepatosomatic Index	Boc Moist Conte
January	54.687	1.140	NA	1	NA	NA
February	55.139	1.173	NA	7	NA	NA
March	62.737	1.834	NA	10	NA	NA
April	72.451	3.019	NA	9	NA	NA
May	81.565	4.550	NA	10	NA	NA
June	91.773	6.844	NA	12	NA	NA
July	103.6	10.414	NA	10	NA	NA
August	113.9	14.458	NA	13	NA	NA
September	126.82	20.974	NA	9	NA	NA
October	135.01	26.044	NA	10	NA	NA
November	144.922	37.412	NA	6	NA	NA
December	150.673	43.710	NA	9	NA	NA

66 The program uses a diet and growth regime that mimics natural seasonal growth patterns.

Comments:

Rearing Length Weight Condition Growth Hepatosomatic Body Moisture

Period (mm) (fpp) Factor Rate Index Context

January 159.910 55.448 NA 5 NA NA

February 165.099 63.000 NA 6 NA NA

March 171.309 73.020 NA 7 NA NA

April 178.371 85.820 NA 8 NA NA

May 186.583 102.740 NA 7 NA NA

June 195.571 124.000 NA 8 NA NA
The program uses diets specifically designed for captive broodstock efforts. One manufacturer (Bio-Oregon) develops a spec designed to provide a more natural protein source than traditional diets (krill v. fish meal). Feeding schedules are developed precocity in full-term captive broodstocks while providing for optimal growth.

Fish rear through the smolt stage of development at the IDFG Eagle Fish Hatchery. Water temperature and diet ration are us modulate growth to minimize precocial development at age-two. At smoltification, fish are transferred to the NOAA Fisheries Marine Experiment Station where they rear through maturation. Diet ration and water protocols are balanced to produce fish program objectives.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Project annual reports to Bonneville Power Administration. Project annual reports to NOAA Fisheries for ESA Section 10 acti
Historical sample count data from Eagle Hatchery. Condition factor can not be determined since all length measurements rep
Length?. Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

9.2.6 Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*averag performance*).

64
- Feeding rates are followed so that fish size is within 10% of program goal each year.
- Feed is stored under proper conditions as described by IHOT guidelines.

65 The correct amount and type of food is provided to achieve the desired growth rate , body composition and condition factorsf and life stages being reared.

	Rearing Period	Food Type	Application Schedule (#feedings/day)	Feeding Rate Range (% B.W./day)	Lbs. Fed Per gpm of Inflow	Food Conversi During Perioc
	Swim-up to	Starter	8	2.8	0.005	1.0
195	1.0-1.3 g/f	1.0	4	2.76	0.0076	1.1
	1.3-2.2 g/f	1.3	4	2.08	0.0073	1.2
	33-4.0 g/f	1.5	4	1.92	0.0101	1.2
	4.0-7.5 g/f	2.0	4	1.76	0.0078	1.2
	7.5-12 g/f	2.5	4	1.68	0.0137	1.3

Comments:

Rearing Food Application Feeding Rate Lbs. fed per Food Conversion

Period Type Schedule Range gpm of inflow During Period

12 - 25 g/f 3.0 4 1.56 .0206 1.3

25 - 70 g/f 4.0 4 1.36 .012 1.3

70 - 500 g/f 5.0 4 .88 .0233 1.4

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
BioOregon feed recommendations followed for feed size and percent Body Weight per day. Food cenversion and pounds fec

based on historical hatchery data.

9.2.7 Fish health monitoring, disease treatment, and sanitation procedures.

62 IHOT fish health guidelines are followed to prevent transmission between lots of fish on site or transmission or amplification the watershed.

63 Whenever possible, vaccines are used to minimize the use of antimicrobial compounds.

71 The juvenile rearing density and loading guidelines used at the facility are based on other criteria .

Comments:

Loading and density is based on Chinook Salmon Captive Propagation Technical Oversight Committee (CSCPTOC) guidel

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

9.2.8 Smolt development indices (e.g. gill ATPase activity), if applicable.

87 The migratory state of the release population is determined by dna.

Comments:

Smolts are not released by this program. Production occurs from captive-reared adults released to spawn naturally. This nc questions 88 through 96 as well.

Data source:

Per Paul Kline IDFG 9/8/03

9.2.9 Indicate the use of "natural" rearing methods as applied in the program.

68 The program attempts to better mimic the natural rearing environment by reducing rearing density below agency or other gu rearing under natural water temperature and actively simulating photoperiod .

69 Fish produced are qualitatively similar to natural fish in morphology , behavior , physiological status , health and other chara

66 The program uses a diet and growth regime that mimics natural, seasonal growth patterns.

84 Fish are released at sizes similar to natural fish of the same life stage and species.

88

Comments:

Fish are reared with 70% of the ponds covered with shade cloth, but this is not meant to simulate natural cover.
Every effort is made to not accelerate growth and to produce fish that are similar to natural fish in every respect.
The program uses diets specifically designed for captive broodstock efforts. One manufacturer (Bio-Oregon) develops a sp is designed to provide a more natural protein source than traditional diets (krill v. fish meal). Feeding schedules are develop precocity in full-term captive broodstocks while providing for optimal growth.

Fish rear through the smolt stage of development at the IDFG Eagle Fish Hatchery. Water temperature and diet ration are u modulate growth to minimize precocial development at age-two. At smoltification, fish are transferred to the NOAA Fisheries Marine Experiment Station where they rear through maturation. Diet ration and water protocols are balanced to produce fisl program objectives.
Adults released are generally smaller than naturally produced fish.

This is an adult supplementation program. The question applies to juveniles.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.

9.2.10 Indicate risk aversion measures that will be applied to minimize the likelihood for advers and ecological effects to listed fish under propagation.

60 dna

72 IHOT standards are followed for: water quality , alarm systems , predator control measures to provide the necessary securi cultured stock , loading and density.

80 The facility is continuously staffed to assure the security of fish stocks on-site.

84 Fish are released at sizes similar to natural fish of the same life stage and species.

88

98 "Fish transfers into the subbasin are inspected and accompanied by notifications as described in IHOT and PNFHPC guide

76 Fish inventory data accurately reflect rearing vessel population abundance with 10%.

86 Volitional release is practiced during natural out-migration timing.

96 Fish are NOT released in the same subbasin as the rearing facility.

Comments:

Juvenile chinook salmon are not culled.
Program uses more conservative loading and density criteria than IHOT.

Adults released are generally smaller than naturally produced fish.

This is an adult supplementation program. The question applies to juveniles.

Guidelines are in place for adult transfers.
Sample counts are conducted monthly. In addition, fish are completely inventoried at ponding and when split to larger conta mortality is documented and subtracted from the running inventory.
This is an adult supplementation program. Out-migration does not apply.

Data source:

Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03

Section 10. Release

10.1 Proposed fish release levels.

					Location			
	Age Class	Maximum Number	Size (ffp)	Release Date	Stream	Release Point (RKm)	Major Watershed	Ecopr
1	**Eggs**	50,000	2700	November	W. Fork Yankee Fork, Salmon River	522.303.591.011	Salmon River	Mountai Snake

Unfed Fry	nya	nya	nya	nya	nya	nya	nya
Fry	nya	nya	nya	nya	nya	nya	nya
Fingerling	nya	nya	nya	nya	nya	nya	nya
Yearling	nya	nya	nya	nya	nya	nya	nya

Comments:

Adult Release: Release

Max. Number Size Date Stream Release Point Watershed

200 3-10 August W.F. Yankee Fork 522.303.591.011 Salmon R.

lbs/fish

Note for above table: To develop an understanding of the reproductive potential of captive-reared adult chinook salmon, the (Salmon Captive Propagation Technical Oversight Committee (CSCPTOC) recommended that spawning take place at the Ea Hatchery to investigate several reproduction variables (e.g., maturation timing, gamete quality, egg survival to eyed stage of (Information developed in this manner is used to compliment behavioral observations and reproductive success data collectec following the release of maturing adult chinook salmon.

Eggs produced from hatchery spawning events have been used to supplement captive rearing groups or returned to hatch bc streams.

Milt has been cryopreserved in the captive rearing program since 1997.

Data source:

Per Paul Kline IDFG 9/8/03

10.2 Specific location(s) of proposed release(s).

	Age Class	Maximum Number	Size (ffp)	Release Date	Stream	Location Release Point (RKm)	Major Watershed	Ecopro
1	**Eggs**	50,000	2700	November	W. Fork Yankee Fork, Salmon River	522.303.591.011	Salmon River	Mountai Snake
	Unfed Fry	nya	nya	nya	nya	nya	nya	nya
	Fry	nya	nya	nya	nya	nya	nya	nya
	Fingerling	nya	nya	nya	nya	nya	nya	nya
	Yearling	nya	nya	nya	nya	nya	nya	nya

96 Fish are NOT released in the same subbasin as the rearing facility.

Comments:

Adult Release: Release

Max. Number Size Date Stream Release Point Watershed

200 3-10 August W.F. Yankee Fork 522.303.591.011 Salmon R.

lbs/fish

Note for above table: To develop an understanding of the reproductive potential of captive-reared adult chinook salmon, the (Salmon Captive Propagation Technical Oversight Committee (CSCPTOC) recommended that spawning take place at the Ea Hatchery to investigate several reproduction variables (e.g., maturation timing, gamete quality, egg survival to eyed stage of (Information developed in this manner is used to compliment behavioral observations and reproductive success data collectec following the release of maturing adult chinook salmon.

Eggs produced from hatchery spawning events have been used to supplement captive rearing groups or returned to hatch bc streams.

Milt has been cryopreserved in the captive rearing program since 1997.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

10.3 Actual numbers and sizes of fish released by age class through the program.

>

		Eggs/Unfed Fry Release			Fry Release			Fingerling Release			Yearling	
	Release Year	**Number**	**Date (MM/DD)**	**Avg Size (fpp)**	**Number**	**Date (MM/DD)**	**Avg size (fpp)**	**Number**	**Date (MM/DD)**	**Avg Size (fpp)**	**Number**	**D (MM**
	1991	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya
	1992	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya
	1993	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya
	1994	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya
196	**1995**	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya
	1996	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya
	1997	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya
	1998	30054	11/98	nya	nya	nya	nya	nya	nya	nya	nya	nya
	1999	3335	10/99	nya	nya	nya	nya	nya	nya	nya	nya	nya
	2000	1266	11/00	nya	nya	nya	nya	nya	nya	nya	nya	nya
	2001	8154	11/01	nya	nya	nya	nya	nya	nya	nya	nya	nya
	2002	47977	10/00	nya	nya	nya	nya	nya	nya	nya	219	4/02
	Avg	18156	November	nya	nya	nya	nya	nya	nya	nya	219	April

Comments:

Release Adult Release Release Avg size

Year Number Date (fpp)

1997 9 8/97 1.0

1998 112 8/98 n/a

1999 69 8/99 n/a

2000 72 7/00 n/a

2001 89 8/01 n/a

2002 347 8/02 .35

Average 116 August .35

Data source:

Per Paul Kline IDFG 9/8/03

10.4 Actual dates of release and description of release protocols.

84 Fish are released at sizes similar to natural fish of the same life stage and species.

85

86 Volitional release during natural out-migration timing is practiced.

88

89

90

91

92 The carrying capacity of the subbasin has been taken into consideration in sizing this program.

87 The migratory state of the release population is determined by dna.

Comments:

This is an adult supplementation program. Out-migration does not apply.

No harvest of wild/natural chinook salmon occurs. Progeny produced from captive adults released to naturally spawn are no
clipped and appear as wild/natural fish.
Adults released are generally smaller than naturally produced fish.

This is an adult supplementation program. The question applies to juveniles.

This is an adult supplementation program. The question applies to juveniles.

This is an adult supplementation program. The question applies to juveniles.

This is an adult supplementation program. The question applies to juveniles.

Smolts are not released by this program. Production occurs from captive-reared adults released to spawn naturally. This no
questions 88 through 96 as well.

Data source:

Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

10.5 Fish transportation procedures, if applicable.

96 Fish are NOT released in the same subbasin as the rearing facility.

	Equipment Type	Capacity (gallons)	Supplemental Oxygen (y/n)	Temperature Control (y/n)	Normal Transit Time (minutes)	Chemical (s) Used	Dc (
	3/4 Ton PU w/Tank	250	Y	nya	9 hrs	None	NA
187	10 wheel Tanker	2700	Y	nya	12 hrs	None	NA
	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya

Comments:

Both 250 and 2700 gallon tanks are equipped with Fresh-flow aeration pumps.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03 From Chinook BPA Hatchery Reports and 1010 Chinook NOAA Fisheries Reports

10.6 Acclimation procedures (*methods applied and length of time*).

166 Maturing, adult chinook salmon are released to natal streams for natural spawning. Adequate water temperature acclimatio to release. Adults are typically released in late July and early August. Adults typically spawn in September.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

10.7 Marks applied, and proportions of the total hatchery population marked, to identify hatcl adults.

100 Marking techniques are used to distinguish among hatchery population segments.

101 100% of the hatchery fish released are marked so that they can be distinguished from the natural population.

102 Marked fish can be identified using non-lethal means.

Comments:

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

10.8 Disposition plans for fish identified at the time of release as surplus to programmed or a levels

167 Surplus adults are not produced in this program.

163 Extra eggs are not intentionally produced in this program.

Comments:

null
null

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

10.9 Fish health certification procedures applied pre-release.

97 All fish are examined for the presence of “reportable pathogens” as defined in the PNFHPC disease control guidelines, with prior to release.

98 Fish transfers into the subbasin are inspected and accompanied by notifications as described in IHOT and PNFHPC guideli

Comments:

The pathogen history of the fish is known since they are captively reared. The program would not sacrifice 60 adults simply certification guidelines.

Guidelines are in place for adult transfers.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.

10.10 Emergency release procedures in response to flooding or water system failure.

168 Backup and system redundancy is in place for degassing, pumping, and power generation. Oxygen is available on-site for e supply to all rearing tanks. Eight water level alarms are in use and linked through an emergency service operator. Additiona provided by limiting public access and by the presence of four on-site residences occupied by IDFG hatchery personnel.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

10.11 Indicate risk aversion measures that will be applied to minimize the likelihood for advers and ecological effects to listed fish resulting from fish releases.

84 Fish are released at sizes similar to natural fish of the same life stage and species.

86 Volitional release during natural out-migration timing is practiced.

88

89

91

104 The percent of the naturally spawning population in the subbasin that consists of adults from the program is 0-5% (less tha

105 The percent of hatchery fish spawning in the wild is estimated by:

- Annual stream surveys (e.g. carcasses)

95 Fish are released at times of the year and sizes to allow adoption of multiple life history strategies.

94 Fish are released within the historic range for that stock.

93 The carrying capacity of the subbasin was taken into account when determining the number of fish to be released.

Comments:

Adults released are generally smaller than naturally produced fish.

This is an adult supplementation program. Out-migration does not apply.

This is an adult supplementation program. The question applies to juveniles.

This is an adult supplementation program. The question applies to juveniles.

This is an adult supplementation program. The question applies to juveniles.

null

The number of hatchery fish is known from the adult release records.

Data source:

Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 10/22/03.
Per Paul Kline IDFG 9/8/03
nds
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03
Per Paul Kline IDFG 9/8/03

Section 11. Monitoring and Evaluation of Performance Indicators

11.1.1 Describe plans and methods proposed to collect data necessary to respond to each "Perf Indicator" identified for the program.

Performance Standards and Indicators addressing benefits.

3.2.2 Standard: Release groups sufficiently marked in a manner consistent with information needs and protocols to enable of impacts to natural- and hatchery-origin fish in fisheries.

Indicator 1: Marking rate by type in each release group documented.

3.3.1 Standard: Artificial propagation program contributes to an increasing number of spawners returning to natural spawnii

Indicator 1: Annual number of spawners on spawning grounds estimated in specific locations.

Indicator 2: Spawner-recruit ratios are estimated in specific locations.

Indicator 3: Number of redds in natural production index areas documented.

3.3.2 Standard: Releases are sufficiently marked to allow statistically significant evaluation of program contribution.

Indicator 1: Marking rates and type of mark documented.

Indicator 2: Number of marks identified in adult groups documented.

Performance Standards and Indicators addressing risks.

3.4.1 Standard: Fish collected for broodstock are taken throughout the return in proportions approximating the timing and a the population.

Indicator 1: Temporal distribution of broodstock collection managed.

Indicator 2: Age composition of broodstock collection managed.

3.4.2 Standard: Broodstock collection does not significantly reduce potential juvenile production in natural areas.

Indicator 1: Eyed-eggs are collected from a sub-set of wild redds to source broodstocks.

Indicator 2: Hatchery-produced spawners are released to migrate to natural spawning areas.

Indicator 3: Number of adults, eggs or juveniles placed in natural rearing areas is managed.

3.4.3 Standard: Life history characteristics of the natural population do not change as a result of this program.

Indicator 1: Life history characteristics of natural and hatchery-produced populations are measured (e.g., juvenile dispersal timing, juvenile size at out-migration, adult return timing, adult age and sex ratio, natu hatchery spawn timing, hatch and swim-up timing, hatchery rearing densities, growth, diet, physical characteristics, fecundi etc).

3.4.4 Standard: Annual release numbers do not exceed estimated basin-wide and local habitat capacity.

Indicator 1: Annual release numbers, life-stage, size at release, documented.

Indicator 2: Location of releases documented.

Indicator 3: Timing of hatchery releases documented.

3.5.1 Standard: Patterns of genetic variation within and among natural populations do not change significantly as a result of production.

Indicator 1: Genetic profiles of naturally-produced and hatchery-produced adults developed.

3.5.2 Standard: Collection of broodstock does not adversely impact the genetic diversity of the naturally spawning populatic

Indicator 1: Eyed-eggs are collected from a sub-set of wild redds to source broodstocks.

Indicator 2: Timing of collection compared to overall run timing considered.

3.5.3 Standard: Artificially produced adults in natural production areas do not exceed appropriate proportion.

Indicator 1: Ratio of natural to hatchery-produced adults monitored.

144

3.6.1 Standard: The artificial production program uses standard scientific procedures to evaluate various aspects of artificia

Indicator 1: Scientifically based experimental design with measurable objectives and hypotheses.

3.6.2. Standard: The artificial production program is monitored and evaluated on an appropriate schedule and scale to addr toward achieving the experimental objectives.

Indicator 1: Monitoring and evaluation framework including detailed time line.

Indicator 2: Annual and final reports.

3.7.1 Standard: Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility standards and protocols.

Indicator 1: Annual reports indicating level of compliance with applicable standards and criteria.

3.7.2 Standard: Effluent from artificial production facility will not detrimentally affect natural populations.

Indicator 1: Discharge water quality compared to applicable water quality standards.

3.7.3 Standard: Water withdrawals and in stream water diversion structures for artificial production facility operation will not access to natural spawning areas, affect spawning, or impact juveniles.

Indicator 1: Water withdrawals documented ? no impacts to listed species.

Indicator 2: Number of adult fish aggregating and/or spawning immediately below water intake point monitored.

Indicator 3: NMFS screening criteria adhered to.

3.7.4 Standard: Releases do not introduce pathogens not already existing in the local populations and do not significantly ir levels of existing pathogens.

Indicator 1: Certification of juvenile fish health documented prior to release.

Indicator 2: Samples of natural populations for disease occurrence conducted.

Indicator 3: Juvenile densities during artificial rearing managed conservatively.

3.7.6 Standard: Adult broodstock collection operation does not significantly alter spatial and temporal distribution of natural

Indicator 1: Spatial and temporal spawning distribution of natural population above and below trapping facilities monitored.

3.7.7 Standard: Weir/trap operations do not result in significant stress, injury, or mortality in natural populations.

Indicator 1: Mortality rates in trap documented.

Indicator 2: Pre-spawning mortality rates of trapped fish in hatchery or after release documented.

3.7.8 Standard: Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of na

Indicator 1: Juveniles are not released. Production occurs from captive-reared adults released to spawn naturally.

Monitoring and Evaluation of Performance Standards and Indicators:

Standard 3.2.2 and associated Indicators. All adult chinook salmon released back to the habitat are PIT tagged, elastomer Petersen disk tagged. Genetic tissue samples from progeny that result from natural spawning events are taken to facilitate assignment test analyses. Hatchery groups are PIT tagged and elastomer tagged.

Standard 3.3.1 and associated Indicators. The primary objective of this program is to reintroduce hatchery-produced adults spawning. Adults are sourced from eyed-eggs collected from redds constructed by wild adult chinook salmon.

Standard 3.3.2 and associated Indicators. Adults released for natural spawning are 100% marked with PIT tags, elastomer Petersen disk tags. Intensive post-release behavioral monitoring occurs to document spawning-related behavior and spawr

Standard 3.4.1, 3.4.2, 3.5.3, and associated indicators. Chinook salmon rearing groups are sourced as eyed-eggs from red by wild adults. Approximately 50 eyed-eggs are removed, using hydraulic sampling gear, from six redds each. Redds are se represent the range of spawn timing. Care is taken to not negatively impact eggs remaining in redds sampled by program p

Standard 3.4.3 and associated indicators. Life history characteristics of natural and hatchery-produced adult chinook salmo monitored (e.g., adult spawning success). In-hatchery variables are monitored continuously (e.g., growth, survival, rearing c maturation, age at maturity, spawning success, gamete quality, egg size, fecundity, egg survival to the eyed stage of develo

Standard 3.4.4, 3.5.3 and associated indicators. Annual adult release numbers, size at release, and release location are dis annually at the CSCPTOC level. Release levels do not exceed habitat spawning and rearing capacities.

Standard 3.5.1, 3.5.2 and associated indicators. The university of Idaho provides genetic support for this program. Genetic and hatchery-produced chinook salmon have been, and continue to be produced. The hatchery population is constantly mo

determine such variables as genetic effective population size, loss of genetic variability, and loss of heterozygosity.

Standard 3.6.1, 3.6.2 and associated indicators. Program goals, objectives, and tasks focus on the preservation / conserva this effort. Hatchery practices (e.g., spawning, and rearing protocols) are based on current and emerging ?best practices? a constant review at the CSCPTOC level. An experimental design has been established to guide the reintroduction of adults l habitat. A comprehensive monitoring and evaluation program is in place to track post-release adult spawning success.

Standard 3.7.1, 3.7.2, 3.7.3, 3.7.6, 3.7.7 and associated indicators. The artificial production component of the program adhe state and federal policies in place to prevent the spread of infectious pathogens, to insure that facility discharge water quali appropriate standards, and that intake and outflow screens meet appropriate standards.

Adult and juvenile weirs are monitored to not adversely affect target or other fish species. Anadromous chinook salmon adu and distribution below weirs is carefully monitored. Every precaution is taken to insure that trapping does not negatively imp anadromous adults.

Standard 3.7.4 and associated indicators. IDFG and NOAA fish health facilities process samples for diagnostic and inspect from captive broodstock chinook salmon. Routine fish necropsies include investigations for viral pathogens (infectious panc virus and infectious hematopoietic necrosis virus), and various bacterial pathogens (e.g., bacterial kidney disease Renibact salmoninarium, bacterial gill disease Flavobacterium branchiophilum, coldwater disease Flavobacterium psychrophilum, an aeromonad septicemia Aeromonas spp.). In addition to the above, captive fish are screened for the causative agent of whir Myxobolus cerebralis, furunculus Aeromonas salmonicida and the North American strain of viral hemorrhagic septicemia vi

Approved chemical therapeutants are used prophylactically and for the treatment of infectious diseases. Prior to effecting tr use of chemical therapeutants is discussed with an IDFG fish health professional. Fish necropsies are performed on all pro mortalities that satisfy minimum size criteria for the various diagnostic or inspection procedures performed.

All appropriate state permits are secured prior to transporting eggs or fish across state boundaries. Prior to release, pre-libe health sampling occurs for pre-smolt and smolt release groups.

Standard 3.7.8 and associated standards. Predation by artificially produced fish on naturally produced fish is not expected t juvenile releases occur. Juveniles produced by this program hatch from redds constructed in the habitat.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

11.1.2 Indicate whether funding, staffing, and other support logistics are available or committe implementation of the monitoring and evaluation program.

146 Funding is approved through the Northwest Power Planning Council?s Fish and Wildlife Program and provided by the Bonr Administration.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

11.2 Indicate risk aversion measures that will be applied to minimize the likelihood for advers

and ecological effects to listed fish resulting from monitoring and evaluation activities.

Risk aversion measures for monitoring and evaluation activities associated with the Chinook Captive Rearing Program are ESA Section 10 Research and Enhancement Permits (IDFG permit No.1010). A brief summary of the nature of actions take below.

Adult handling and release activities are conducted to minimize impacts to ESA-listed, species. Adult weirs are engineered installed in locations that minimize adverse impacts to both target and non-target species. All trapping facilities are constant minimize a variety of risks (e.g., high water periods, high emigration or escapement periods, security).

147 Post-release, adult spawning behavior observations are conducted to minimize potential risks to all life stages of ESA-listec IDFG conducts formal redd count training annually. During surveys, care is taken to not disturb ESA-listed species and to n impact completed redds. A detailed protocol is in place to conduct spawning behavior observations.

Snorkel surveys conducted primarily to assess juvenile abundance and density are conducted in to minimize disturbance to species. Displacement of fish is kept to a minimum.

Marking and tagging activities are designed to protect ESA-listed species and follow accepted, regional protocols.

Fish husbandry activities follow the region?s best protocols and undergo constant review through the CSCPTOC process.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

Section 12. Research

12.1 Objective or purpose.

The Chinook Captive Rearing Program incorporates a comprehensive research monitoring and evaluation component prim address the reproductive behavior and success of adults released to volitionally spawn. Program research objectives and ta

Objective 1. Produce captive-reared adult chinook salmon with morphological, physiological, and behavioral characteristics naturally produced fish.

Task A. Maintain facilities to produce captive-reared adult chinook salmon and attain objectives.

Task B. Modify facilities (hatchery building well field) to meet water demands, and life support system safety requirements t program rearing needs to atain objectives. Construct and connect new hatchery well. Construct new single family residence

Task C. Demolish failing raceway walls and construct new concrete slab foundation. Reinstall water lines and tanks and en security fencing. Complete additional grounds repair as needed.

Task D. Collect fish/eggs from three stocks to initiate rearing groups. Rear captive chinook salmon through maturation. Cor reared adults to wild/natural conspecifics.

169 Task E. Monitor and adaptively manage culture protocols as they relate to fish survival, fish growth, and fish maturation.

Task F. PIT tag and visual implant tag all fish to facilitate poulation isolation and tracking during captive culture. Vaccinate j chinook for Vibrio and Bacterial Kidney Disease.

Task G. Cryopreserve milt from male captive chinook salmon as needed to preserve future options.

Objective 2. Evaluate spawning behavior and success of out planted (captive-reared) adults.

Task A. Tag adults with externally visible tags prior to out planting and radio-tag a resonable number of fish for field tracking

Task B. Out plant maturing captive-reared chinook salmon to appropriate stream study sections.

Task C. Monitor and document movement, distribution, behavior, and spawning success of out planted fish. Associate prod (juveniles and adults) with potential parents.

Task D. Identify and document location of radio-tagged fish daily.

Task E. Map redd locations and note observed spawning pairings.

Task F. Hydraulically sample completed redds and perform snorkel surveys to verify and estimate production.

Task G. Evaluate gamete quality and survival to the eyed-egg stage of development.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

12.2 Cooperating and funding agencies.

Shoshone-Bannock Tribes ? Funded by the Bonneville Power Administration through the Northwest Power Planning Counc Wildlife Program. The Shoshone-Bannock Tribes provide assistance with adult chinook salmon monitoring, juvenile chinook monitoring, and the planting of eyed-eggs produced from hatchery spawning events.

170 University of Idaho - Funded by the Bonneville Power Administration through the Northwest Power Planning Council?s Fish Program. The U of I provides genetics support for the program.

NOAA Fisheries - Funded by the Bonneville Power Administration through the Northwest Power Planning Council?s Fish ar Program. NOAA Fisheries shares fish culture responsibility for the program.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

12.3 Principle investigator or project supervisor and staff.

Steve Yundt - Idaho Department of Fish and Game Fisheries Research Manager.

Paul Kline - Idaho Department of Fish and Game Principal Fisheries Research Biologist.

171 David Venditti - Idaho Department of Fish and Game Senior Fisheries Research Biologist

Danny Baker - Idaho Department of Fish and Game Hatchery Manager II

Comments:

null

Data source:

Per Paul Kline IDFG 10/22/03

12.4 Status of stock, particularly the group affected by project, if different than the stock(s) c in Section 2.

Snake River sockeye salmon

Snake River spring/summer chinook salmon

172 Snake Basin summer steelhead

Bull trout

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

12.5 Techniques: include capture methods, drugs, samples collected, tags applied.

Chinook salmon for inclusion in the captive rearing program are generally collected as eyed-eggs using the hydraulic samp described by McNeil (1964). This system consists of two main components. The first is a gas-powered pump attached to a diameter aluminum probe, via flexible tubing. Holes drilled near the top of the probe allow air to infuse into the water stream venturi action. The second component is the collection net frame, which consists of a ?D? shaped aluminum frame with exp mesh along its curved portion and netting around the bottom and sides of its straight portion. When the pump is on, water is through the probe, which is worked into the substrate within the net frame. The air/water stream then lifts eggs out of the su they are swept downstream into the net. The expanded plastic screen confines eggs lifted out near the periphery and chann the net. In order to minimize disturbance to the redd, sampling is begun slightly below estimated nest pocket locations and upstream. This prevents the fine materials lifted out of the substrate from settling back into the redd and possibly smotherin Care is also taken to keep people behind or to the side of the net frame to minimize redd trampling. To facilitate eyed-egg c locations of redds are recorded and their corresponding construction and completion dates are estimated. Recording therm located near completed redds to track the number of Celsius temperature units (CTUs) received by the developing embryos sampled when the eggs have received approximately 300-400 CTUs and reached the eyed stage.

Juvenile chinook salmon may also be collected using rotary screw traps (E.G. Solutions, Corvallis, OR) or beach seines. Ro traps are passive capture devices generally positioned in the thalweg of the stream. Stream flow turns a baffled cylinder tha captured fish to a live well for temporary holding. IDFG and cooperator personnel from the Shoshone-Bannock Tribes atten Captured juveniles may be temporarily held in streamside live boxes until transfer to the Sawtooth or Eagle fish hatchery fo Beach seines may also be used to collect juvenile chinook salmon over a broad range of stream distances. Juveniles are lo snorkeling, and a beach seine is positioned downstream of the target assemblage of fish. Fish collected with this method ar temporarily in streamside live boxes until transfer to the IDFG Sawtooth or Eagle fish hatchery.

Eyed-eggs may also be collected from redds spawned by captive-reared chinook salmon to determine fertilization and surv or hatching. These redds are sampled using the procedures described above, with one modification. In order to sample as possible in a short time, sampling begins near the center of anticipated egg pocket locations. Although this probably results additional fine loading, we feel this is acceptable due to the experimental, as opposed to production, nature of the redds. A 10-20 eggs from each redd is preserved and provided to University of Idaho geneticists to determine the number of individu contributed to the spawning population. These eggs are also checked for fertilization to estimate the proportion of eggs that fertilization.

173

Fish released back to their natal streams are unloaded from the transport truck into 100 L coolers equipped with locking lids release locations. Prior to releasing transported fish, transport and receiving water temperatures are tempered to within a 2 each other.

Several tagging methods are employed in this project, including Passive Integrated Transponder (PIT), elastomer, Petersor and radio transmitters. Captive reared juvenile chinook are PIT tagged when they reach appropriate size. Those collected a smolts are PIT tagged upon capture. PIT tags are injected into the peritoneal cavity using standard PIT tagging methodolog protocols (Prentice et al. 1990). PIT tags are used to track individual fish through the captive rearing project along with gene to construct spawning matrices. Latex elastomer tags are used as a secondary marking system to indicate rearing location stream. Fish are marked with elastomer tags by using a hypodermic needle to inject a thin stripe of pigment into the clear tis to the eye. Disc tags having unique color/numeric combinations may be attached to the dorsal surface of released fish, allov identification of individual fish. Floy tags may also be inserted near the dorsal fin to serve a function similar to disc tags. Rad used to facilitate tracking of adult chinook salmon released in various drainages for volitional spawning. Techniques develop et al. (1985) are utilized to implant radio tags in the stomach, via the esophagus. Radio tags have a life span sufficient to en transmitter operation beyond the time of post-spawning mortality. Radio tagging permits individual fish to be easily identified and may allow us to evaluate the spawning behavior of captive-reared individuals over larger stream sections, while interac conspecifics.

Anesthetics and chemical therapeutants are used in the collection and/or rearing of chinook salmon. Anesthetics are used t from physical injury during collection, handling and tagging procedures. Tricaine methanesulfonate (MS-222) buffered with bicarbonate is a Federal Drug Administration (FDA) approved anesthetic utilized during all fish activities requiring anestheti project personnel involved in the utilization of MS-222 stringently follow established protocols.

Chemical therapeutants are utilized during the culture of chinook salmon up to the time of in-hatchery spawning or release i environment. Chemical therapeutants may be used prophylactically or for treatment of acute fish health problems. The mos used antibiotic is Erythromycin, which is used to control bacterial kidney disease (BKD). Erythromycin may be injected intra incorporated into fish diets. Other drugs or treatments which may be utilized include: 1) formalin for the control of fungus on incubation and on adults during final maturation holding, 2) chloramine T for the control of myxobacteria 3) oxytetracycline f of motile aeromonads and myxobacteria, and 4) Ivermectin intubation for the treatment of Salmincola californensis parasite juvenile chinook salmon are vaccinated against Vibrio spp. and BKD prior to transfer to saltwater.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

12.6 Dates or time periods in which research activity occurs.

Research Activity Time Period

Eyed-egg collections August through September

Adult maturation assessment April through July

Adult marking and tagging June through July

174 Adult out-planting July through August

Adult behavioral monitoring August through October

Redd construction success assessment October through November

Juvenile tissue sampling (genetic testing) July - Aug., March - April, Sept. - Oct.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

12.7 Care and maintenance of live fish or eggs, holding duration, transport methods.

The IDFG Eagle Fish Hatchery and the NOAA Manchester Marine Experiment Station are the primary sites for the chinook captive rearing program. Fish culture protocols follow accepted, standard practices and are reviewed on a regular basis at (meetings.

To manage for catastrophic loss in the program, and to provide a location for saltwater rearing, fish culture responsibilities a NOAA Fisheries at their Manchester Marine Experiment Station in Washington State. Initial rearing occurs at the Eagle Fish smoltification, up to 100% of each rearing group is transferred to the NOAA Fisheries site. As adults mature, fish are transfe the Eagle Fish Hatchery and ultimately released to natal streams for natural spawning.

The containers used to transport fish will vary based on the task. In all cases, containers of the proper size and configuratio for the task at hand. Fish will be maintained in water of the proper quality (temperature, oxygen and chemical composition) possible during handling and transfer phases of transportation. Containers will vary from five gallon plastic buckets and 100 coolers for short term holding, to sophisticated truck-mounted tanks for long distance/duration transfers. Eyed-eggs may be from NOAA Fisheries facilities to IDFG facilities and/or between IDFG facilities. Eyed-eggs are packed at a conservative de perforated shipping tubes (27-cm long by 6-cm diameter at approximately 2,000 eggs per tube), capped, and labeled to ide number of eyed-eggs. Tubes are wrapped with hatchery water-saturated cheesecloth and packed in small, insulated cooler added to ensure proper temperature maintenance and coolers are sealed with packing tape. Eggs are monitored hourly du transportation.

Fish are transported to and from rearing locations, release locations, and adult trapping facilities in truck mounted, insulated (typically 1,136 L capacity) with alarm, back-up oxygen systems, and "fresh flow" mechanical water movement units on boa and containers used is dependent upon the size and number of fish and the distance to be hauled. For longer duration trips NOAA Fisheries Washington facilities to Idaho), truck-mounted tanks are available to the program with 1,136 L (300 gal), 3, gal), and 9,463 L (2,500 gal) capacities. Transport guidelines are in place to not exceed 119 g/L (1.0 lb/gal). All trucks are e provide appropriate conditions to facilitate safe transport of fish to the specified destination. All vehicles are equipped with t and cellular phones to provide routine or emergency communications. Fish are monitored regularly during transportation.

Project leaders ensure that fish transport is conducted to provide the best possible conditions for safe transfer of fish betwe destinations. Pathology and fish culture experts provide guidance on all fish transportation events.

Disease histories of brood groups are reviewed and evaluated before, during and post transportation by program pathologis

Prior to transport, fish are fasted for 48 hours to reduce metabolic demand and stress. Transport guidelines are in place to r g/L (1.0 lb/gal). Tanks on transport trucks are disinfected and filled with clean well water prior to transportation. All vehicles to provide the appropriate conditions (temperature, oxygen, capacity) to ensure the safe transport of fish to and from specifi Water temperature in transport tanks is maintained at levels necessitating minimal tempering between source and destinati temperatures. In addition, all vehicles are equipped with two-way radios or cellular phones to provide routine or emergency communication capability. Prior to releasing transported fish at hatchery or remote release locations, transport and receiving temperatures are tempered to within 2.0°C of each other.

175

Sampling regimes are used throughout the program to monitor fish health and to evaluate attainment of program objectives weight measurements are collected from juvenile fish during routine hatchery procedures (e.g., tagging and sample count a fish mature and become more sensitive to handling, the frequency of handling events is reduced to maturation sorts.

Determinations of sex and maturation state in captive-reared chinook salmon are conducted using non-lethal genetic sex de ultrasound, and physical sorting. Genetic sex determinations are conducted by the NOAA Fisheries Northwest Fisheries Sc (Seattle, WA). To facilitate this process, fin tissue is removed from anesthetized chinook salmon at the Eagle Fish Hatchery Manchester Marine Experiment Station. Tissue samples are transferred to the NOAA Fisheries for analysis. Ultrasound ma determine maturation status prior to the time when fish are exhibiting external maturation signs. Physical maturation sorts a during August and September. Fish are examined for detection of changes in body coloration, the development of other sec characteristics, and gonad development. Fish determined to be maturing are isolated, by stock, from non-maturing fish.

Tissue samples are collected from mortalities during necropsies on program fish to monitor for disease. Genetic samples ar collected from mortalities in an effort to develop mitochondrial DNA, and nuclear DNA markers for chinook salmon populatio program.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

12.8 Expected type and effects of take and potential for injury or mortality.

Risk aversion measures for monitoring and evaluation activities associated with the Chinook Salmon Captive Rearing Progr described in ESA Section 10 Research and Enhancement Permits (IDFG permit No.1010). A brief summary of the nature o is provided below.

Juvenile trapping/handling- Collecting eyed-eggs from the field is designed to have minimum impact on listed fish. Redds ar from downstream, and care is taken to avoid trampling the redd. Information from field observations and thermographs is us eggs are collected during their most tolerant stage. Eggs are immediately transferred to small coolers saturated with chilled transfer to the hatchery. The hydraulic sampling system used to collect eggs appears to have little effect on the developing Generally, less than 2% of the collected eggs do not hatch (IDFG unpublished data). When juveniles are collected in screw care is taken to minimize harm. Trap boxes are checked at least twice each day to reduce the time fish spend in the traps a traps are functioning properly. Appropriate conditions (temperature, dissolved oxygen, and flow rate) are maintained in temp structures prior to their transfer to the hatchery.

Juvenile to Adult in-hatchery- Upon arrival at the hatchery, eggs are immediately disinfected in a 100 ppm iodine solution fo This minimizes disease transmission from contaminated rivers. Collection of eyed-eggs also reduces the possibility of disea in culture. Fish collected as eggs have lower incidence of BKD than those collected as parr or fry. In addition, the egg stage susceptible to Myxobolus cerebralis, the organism that causes whirling disease. Juvenile collection at this stage results in h minimizes the risk of contaminating culture facilities, and increases survival of captive individuals. While in culture, disturba minimized by limiting the number of times fish are handled and through tank configuration. Fish are handled up to twice a w approximate four-week period for maturation sorting and only infrequently throughout the remainder of the year during tank sample counts. In addition, tanks are shade covered to minimize disturbance by normal hatchery operations and to provide bright sunlight.

Captive-reared chinook salmon generally appear to be in extremely good condition, but cultured fish differ from wild conspe and fin quality. Both characteristics appear to be influenced by rearing environment. Saltwater reared fish have higher fin qu slightly larger than those reared in fresh water. In accordance with these differences, the majority of fish are reared at the N
176 Manchester Marine Experiment Station (from smoltification through maturation). The remaining fish are reared at the IDFG Hatchery in fresh water. Maintaining rearing activities at both facilities ensures research efforts will continue if either facility catastrophic stock loss.

Adult releases- Captive-reared individuals determined to be maturing are released into their natal streams to assess their s behavior. Frequent observations are made of these fish and of wild chinook salmon in the area for comparative purposes. M disturbance to the fish while attempting to observe normal activity is crucial. Field workers approach fish slowly and obscure presence as much as possible. In no cases are fish handled or unnecessarily disturbed.

Adult blocking weirs are monitored regularly to insure that adverse impacts to listed species are minimized.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

12.9 Level of take of listed fish: number of range or fish handled, injured, or killed by sex, age, not already indicated in Section 2 and the attached "take table" (Table 1).

Steelhead B (East Fork) - Integrated

ESU/Population nya

Activity nya

181 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program Operator nya

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
182 Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take	nya	nya	nya	nya

(specify) (h)

Summer Chinook (Johnson Creek)

181	**ESU/Population**	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

		Annual Take of Listed Fish by life Stage (number of fish)			
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
182	**Observe or harrass (a)**	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (McCall Hatchery)

181	**ESU/Population**	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

		Annual Take of Listed Fish by life Stage (number of fish)			
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
182	**Observe or harrass (a)**	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g.,				

brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook (Rapid River) - Hatchery

	ESU/Population	nya
	Activity	nya
181	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (Pahsimeroi)

	ESU/Population	nya
	Activity	nya
181	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
182	**Removal (e.g., brookstock (e)**	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook (Upper Salmon/Sawtooth)

	ESU/Population	nya
	Activity	nya
181	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook - Natural

	ESU/Population	nya
	Activity	nya
181	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook - Natural

ESU/Population nya

Activity nya

181 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program Operator nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Run (Pahsimeroi)- Hatchery

ESU/Population nya

Activity nya

	Location of hatchery activity	nya
181	**Dates of activity**	nya
	Hatchery Program Operator	nya

	Annual Take of Listed Fish by life Stage (number of fish)				
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Steelhead B (Dworshak)-Hatchery

	ESU/Population	nya
	Activity	nya
181	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

	Annual Take of Listed Fish by life Stage (number of fish)				
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Other take (specify) (h)	nya	nya	nya	nya

Steelhead B-Natural

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

182

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Natural

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

182

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Redfish Lake Sockeye

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

182

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Spring/Summer Chinook (W. Fork Yankee Fork- Salmon River)- Integrated

181

ESU/Population	West Fork Yankee Fork Salmon River Spring/summer Chinook
Activity	Research
Location of hatchery activity	West Fork Yankee Fork Salmon River, 522.303.591.011
Dates of activity	nya
Hatchery Program Operator	IDF&G

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	500	40	nya
Collect for transport (b)	nya	nya	nya	nya

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	100	nya	60
182	**Removal (e.g., brookstock (e)**	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	2	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring/Summer Chinook (East Fork Salmon River)- Integrated

	ESU/Population	nya
	Activity	nya
181	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Lemhi River Spring_Summer Chinook

	ESU/Population	nya
	Activity	nya
181	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

182	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Annual Take of Listed Fish by life Stage (number of fish)

Steelhead A-Run (Sawtooth)- Hatchery

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

182	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Comments:

Data source:

Per Paul Kline IDFG 9/8/03

Per Paul Kline IDFG 9/8/03

12.10 Alternative methods to achieve project objects.

177 None identified.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

12.11 List species similar or related to the threatened species; provide number and causes of r related to this research project.

178 Mortality associated with this project is reported in IDFG Section 10 permit reports to NOAA Fisheries. No impacts to simila been documented.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

12.12 Indicate risk aversion measures that will be applied to minimize the likelihood for advers ecological effects, injury or mortality to listed fish as a result of the proposed research a

The operation of hatchery facilities (weirs, water removal, and effluent discharge), production levels, disease transmission, resources, predation, and negative genetic impact are examples of ecological interactions that could affect listed species in area.

Hatchery facilities - Project hatchery facilities do not withdraw from or discharge water into natural habitat areas occupied b species.

Weirs installed to confine captive adults following release for natural spawning are maintained daily and managed to not ad listed species.

179 Production levels ? Production levels from this program and not expected to adversely affect listed species. Eggs produced constructed by captive-reared adults hatch within a natural time frame and produce juvenile chinook salmon that recruit to t community with wild conspecifics. Natural escapement levels are such that the additional contribution of spawners from this not expected to adversely affect listed species.

Disease Transmission ? IDFG and NOAA Fisheries programs follow stringent disease prevention protocols and produce he quality fish. Pre-liberation fish health monitoring occurs to insure that healthy fish are released to receiving waters. Fish hea in place for common bacterial and viral pathogens and require fish to not exceed CSCPTOC-accepted pathogen prevalenc they can be released.

Competition ? Competition between hatchery-produced and naturally-produced chinook salmon is expected to be minimal. competition between wild and hatchery-produced adults occurs during courting and spawning activities. Eggs produced fro constructed by captive-reared adults hatch within a natural time frame and produce juvenile chinook salmon that recruit to t community with wild conspecifics.

Predation ? Predation is not expected to occur as juvenile chinook salmon produced by captive adults hatch and recruit to t community along with wild conspecifics.

Genetic Impacts - Some genetic change associated with the management of Snake River chinook salmon in the hatchery is unavoidable. However, every opportunity is taken to minimize this change. Eggs collected to source rearing groups for this removed from several redds representing the full range of spawn timing. Numbers of eggs removed from redds is equalizec Fish that hatch from eggs are reared by family (e.g., redd) until they are uniquely marked (e.g., PIT tagged). In-hatchery spa follow protocols developed by University of Idaho and NOAA Fisheries geneticists and are designed to minimize inbreeding genetic diversity.

Comments:

null

Data source:

Per Paul Kline IDFG 9/8/03

Section 13. Attachments and Citations

13.1 Attachments and Citations

197 nya

Comments:

null

Data source:

Section 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

14.1 Certification Language and Signature of Responsible Party

“I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973.”

Name, Title, and Signature of Applicant:

Certified by_______________________________ Date:_____________

Appendix 2-8—Draft Spring Chinook (Rapid River)–Hatchery in the Salmon Subbasin

Hatchery and Genetic Management Plan

Spring Chinook (Rapid River) - Hatchery in the Salmon Subbasin • READ ONLY ACCESS

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

DRAFT

Hatchery Program	Rapid River
Species or Hatchery Stock	Spring chinook salmon
Agency/Operator	IDFG
Watershed and Region	Salmon
Date Submitted	3/20/03
Date Last Updated	nya

1

Section 1: General Program Description

1.1 Name of hatchery or program.

1 Rapid River

1.2 Species and population (or stock) under propagation, and ESA status.

1 Spring chinook salmon

9 ESA Status: Not listed and not a candidate for listing

1.3 Responsible organization and individuals.

Name (and title): Ralph Steiner
Hatchery Manager 2

3 **Agency or Tribe:** IDFG

Address: HC 69 Box 85, Riggins, ID 83549

Telephone: 208-628-3277

Fax: 208-628-3798

Email: rsteiner@idfg.state.id.us

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and exten involvement in the program.

4

Co-operators	Role
Idaho Power	funder
Nez Perce Tribe	outplants adults supplied by hatchery
Oxbow Hatchery	collects adults from Snake River.
nya	nya

1.4 Funding source, staffing level, and annual hatchery program operational costs.

5

Funding Sources
Idaho Power
nya
nya
nya
nya
nya
nya

6

Operational Information	Number
Full time equivalent staff	3
Annual operating cost (dollars)	560,000

Comments:

The bugdet for combined Spring chinook and Steelhead Programs is $416,000 for FY 2004 not including fish feed purchased d

Reviewer Comments:

nc
nc

Data source:

PI
PI, IDFG

1.5 Location(s) of hatchery and associated facilities.

2

Broodstock source	Rapid River
Broodstock collection location (stream, RKm, subbasin)	Rapid River, 1RKm, Salmon
Adult holding location (stream, RKm, subbasin)	Rapid River, 4RKm, Salmon
Spawning location (stream, RKm, subbasin)	Rapid River, 4RKm, Salmon
Incubation location (facility name, stream, RKm, subbasin)	Rapid River, 4RKm, Salmon

Rearing location (facility name, stream, RKm, subbasin) Rapid River, 4RKm, Salmon

Comments:

Rapid River Hatchery also recieves adults from the Oxbow Hatchery trapped at the Hell's Canyon trap. Originally Snake Rive
years Rapid River stock

Data source:

PI

1.6 Type of program.

8 Integrated

Comments:

Data source:

PI

1.7 Purpose (Goal) of program.

9 The purpose of this hatchery program is to provide harvest , to contribute to conservation/recovery and research and educa

10 the purpose of the program is mitigation for hydro impacts and and/or habitat loss.

Comments:

nc
nc

Data source:

PI
PI

1.8 Justification for the program.

- Hatchery fish accessible to fisheries because the fish produced are differentially marked to enable selective harves
- 138 Hatchery fish accessible to fisheries because the fish produced are available in sufficient number to the fisheries (lc gear) that are intended to benefit from the program (i.e. to meet the harvest goals).

Comments:

nc
nc
nc
nc
nc

Data source:

PI

PI
nds
nds
nds

1.9 List of program "Performance Standards".

11 The program adheres to the following fish culture guideline(s) and standard(s):
IHOT
PNFHPC
state
tribal
federal

Comments:

nc

Data source:

HGMP

1.10 List of program "Performance Indicators", designated by "benefits" and "risks".

139

Indicators of Harvest Benefits

Indicator	Performance Standard	Indicator is Monitore
Spawner to spawner survival of hatchery fish	3.3.1	Y
Contribution of hatchery fish to target fisheries	3.1.2, 3.2.1	Y
Angler success (hatchery fish per angler day) in target recreational fisheries	3.1.2, 3.2.1	Y
Contribution of hatchery fish to cultural needs	3.1.1	Y
Selective harvest success (expected benefits of mass marking)	3.1.2, 3.3.2	Y

141

Indicators of Conservation Benefits

Indicator	Performance Standard	Indicator is Monitore
Genetic and life history diversity (over time)	3.4.1, 3.4.3, 3.5.1, 3.5.2,	3.4.1, 3.4.3, 3.5.1, 3.5.2,
Spawner to spawner reproductive success of hatchery fish	3.3.1, 3.4.3,	Y
Reproductive success of the receiving (supplemented) naturally spawning population	3.3.1, 3.3.2, 3.4.3, 3.4.4, 3.5.3	Y
Contribution to the abundance of the naturally spawning population	3.4.2, 3.4.4, 3.5.3, 3.5.6,	Y
Time and location of spawning	3.7.6	Y
Contribution to ecosystem function (e.g. through nutrient enhancement, food web effects, etc.)	3.7.5	Y

140

Indicators of Harvest Risks

Indicator	Performance Standard	Indicator is Monitore
Harvest impacts on co-mingled stocks	3.1.2, 3.1.3	Y
Bias in run size estimation of natural stocks due to masking effect	3.3.1, 3.3.2	Y
Lack of harvest access (under harvest due e.g. to co-mingling with weaker stocks)	3.2.1, 3.2.2	Y

Indicators of Conservation Risks

Indicator	Performance Standard	Indicator is Monitore
Unintended contribution of hatchery fish to		

natural spawning (through straying)	3.4.2	Y
Loss of genetic and life history diversity	3.4.3, 3.5.1	Y
Loss of reproductive success	3.4.2, 3.5.1, 3.5.2	Y
Ecological interactions through competition with natural stocks (by life stage)	3.4.2, 3.4.3, 3.4.4, 3.5.3, 3.5.6	Y
Ecological interactions through predation on natural stocks (by life stage)	3.4.4, 3.5.3, 3.7.8	Y
Adverse effects of hatchery operations and facilities on fish migration Disease transfers	3.7.6, 3.7.7	Y

142

The following plans and methods are proposed to collect data for each Performance Indicator: Monthly Hatchery report, AOP summary reports, Annual Lower Snake River Reports.

Document LSRCP fish rearing and release practices.

Performance Standards and Indicators: 3.2.2, 3.3.2, 3.4.1, 3.4.2, 3.4.3, 3.4.4, 3.5.2, 3.5.4, 3.5.5, 3.6.1, 3.6.2, 3.7.1, 3.7.2, 3.7

Document, report, and archive all pertinent information needed to successfully manage summer chinook salmon rearing and practices. (e.g., number and composition of fish spawned, spawning protocols, spawning success, incubation and rearing tec juvenile mark and tag plans, juvenile release locations, number of juveniles released, size at release, migratory timing and su juveniles, and fish health management).

Document the contribution LSRCP-reared summer chinook salmon make toward meeting mitigation and management object Document juvenile out-migration and adult returns.

144 Performance Standards and Indicators: 3.1.1,3.1.2, 3.1.3, 3.2.1, 3.2.2, 3.3.1, 3.3.2, 3.4.3, 3.4.4, 3.5.1, 3.5.2, 3.5.3, 3.5.4, 3.5 3.6.2, 3.7.6, 3.7.7, 3.7.8

Estimate the number of wild/natural and hatchery-produced chinook salmon escaping to project waters above Lower Granite dam counts, harvest information, spawner surveys, and trap information (e.g., presence/absence of identifying marks and tag species, size, age, length). Conduct creel surveys and angler phone or mail surveys to collect harvest information. Assess ju outmigration success at traps and dams using direct counts, marks, and tags. Reconstruct runs by brood year. Summarize a and tag information (e.g., juvenile out-migration survival, juvenile and adult run timing, adult return timing and survival). Deve of smolt-to-adult survival for wild/natural and hatchery-produced chinook salmon. Use identifying marks and tags and age str to determine the composition of adult chinook salmon.

Identify factors that are potentially limiting program success and recommend operational modifications, based on the outcom studies, to improve overall performance and success.

Performance Standards and Indicators: 3.6.1, 3.6.2

Evaluate potential relationships between rearing and release history and juvenile and adult survival information. Develop hyp experimental designs to investigate practices that may be limiting program success. Implement study recommendations and evaluate outcomes.

143 The program contributes to information gain in the following way(s): Hatchery program contributes to research to improve pe cost effectiveness
New information affects change to the hatchery program through a structured adaptive decision making process
Hatchery program participates in basin wide-coordinated research efforts

Hatchery program actively contributes to public education
Funding for monitoring of performance indicators is adequate

Comments:

Standards and indicators (S&I) are based on legal mandates for Artificial Propagation S&I for anadromous and resident fish p the Pacific Northwest, developed as an outgrowth of discussions of the by the regional Production Review Committee of the Power Planning Council, 1/17/2001.

Note: Performance Standards and Indicators used to develop Sections 1.10.1 and 1.10.2 were taken from the final January 1 version of Performance Standards and Indicators for the Use of Artificial Production for Anadromous and Resident Fish Popu Pacific Northwest. Numbers referenced below correspond to numbers used in the above document.

3.1.1 Standard: Program contributes to fulfilling tribal trust responsibility mandates and treaty rights, as described in applicab such as under U.S. v. Oregon and U.S. v. Washington.

Indicator 1: Total number of fish harvested in tribal fisheries targeting program.

3.1.2 Standard: Program contributes to mitigation requirements.

Indicator 1: Number of fish returning to mitigation requirements estimated.

3.1.3 Standard: Program addresses ESA responsibilities.

Indicator 1: ESA Section 7 Consultation completed.

3.2.1 Standard: Fish are produced and released in a manner enabling effective harvest, as described in all applicable fisherie management plans, while avoiding over harvest of not-target species.

Indicator 1: Number of target fish caught by fishery estimated.

Indicator 2: Number of non-target fish caught in fishery estimated.

Indicator 3: Angler days by fishery estimated.

Indicator 4: Escapement of target fish estimated.

3.2.2 Standard: Release groups sufficiently marked in a manner consistent with information needs and protocols to enable de impacts to natural- and hatchery-origin fish in fisheries.

Indicator 1: Marking rate by type in each release group documented.

Indicator 2: Sampling rate by mark type for each fishery estimated.

Indicator 3: Number of marks by type observed in fishery documented.

3.3.1 Standard: Artificial propagation program contributes to an increasing number of spawners returning to natural spawning

Indicator 1: Annual number of spawners on spawning grounds estimated in specific locations.

Indicator 2: Spawner-recruit ratios estimated is specific locations.

Indicator 3: Number of redds in natural production index areas documented in specific locations.

3.3.2 Standard: Releases are sufficiently marked to allow statistically significant evaluation of program contribution.

Indicator 1: Marking rates and type of mark documented.

Indicator 2: Number of marks identified in juvenile and adult groups documented.

1.10.2) ?Performance Indicators? addressing risks.

3.4.1 Standard: Fish collected for broodstock are taken throughout the return in proportions approximating the timing and age the population.

Indicator 1: Temporal distribution of broodstock collection managed.

Indicator 2: Age composition of broodstock collection managed.

3.4.2 Standard: Broodstock collection does not significantly reduce potential juvenile production in natural areas.

Indicator 1: Number of spawners of natural origin removed for broodstock managed.

Indicator 2: Number and origin of spawners migrating to natural spawning areas managed.

Indicator 3: Number of eggs or juveniles placed in natural rearing areas managed.

3.4.3 Standard: Life history characteristics of the natural population do not change as a result of this program.

Indicator 1: Life history characteristics of natural and hatchery-produced populations are measured (e.g., juvenile dispersal ti size at outmigration, juvenile sex ratio at outmigration, adult return timing, adult age and sex ratio, spawn timing, hatch and s rearing densities, growth, diet, physical characteristics, fecundity, egg size).

3.4.4 Standard: Annual release numbers do not exceed estimated basin-wide and local habitat capacity.

Indicator 1: Annual release numbers, life-stage, size at release, length of acclimation documented.

Indicator 2: Location of releases documented.

Indicator 3: Timing of hatchery releases documented.

3.5.1 Standard: Patterns of genetic variation within and among natural populations do not change significantly as a result of a production.

Indicator 1: Genetic profiles of naturally-produced and hatchery-produced adults developed.

3.5.2 Standard: Collection of broodstock does not adversely impact the genetic diversity of the naturally spawning population

Indicator 1: Total number of natural spawners reaching collection facilities documented.

Indicator 2: Total number of natural spawners estimated passing collection facilities documented.

Indicator 3: Timing of collection compared to overall run timing.

3.5.3 Standard: Artificially produced adults in natural production areas do not exceed appropriate proportion.

Indicator 1: Ratio of natural to hatchery-produced adults monitored (observed and estimated through fishery).

Indicator 2: Observed and estimated total numbers of natural and hatchery-produced adults passing counting stations.

3.5.4 Standard: Juveniles are released off-station, or after sufficient acclimation to maximize homing ability to intended return

Indicator 1: Location of juvenile releases documented.

Indicator 2: Length of acclimation period documented.

Indicator 3: Release type (e.g., volitional or forced) documented.

Indicator 4: Adult straying documented.

3.5.5 Standard: Juveniles are released at fully smolted stage of development.

Indicator 1: Level of smoltification at release documented.

Indicator 1: Release type (e.g., forced or volitional) documented.

3.5.6 Standard: The number of adults returning to the hatchery that exceeds broodstock needs is declining.

Indicator 1: The number of adults in excess of broodstock needs documented in relation to mitigation goals of the program.

3.6.1 Standard: The artificial production program uses standard scientific procedures to evaluate various aspects of artificial

Indicator 1: Scientifically based experimental design with measurable objectives and hypotheses.

3.6.2. Standard: The artificial production program is monitored and evaluated on an appropriate schedule and scale to addre toward achieving the experimental objectives.

Indicator 1: Monitoring and evaluation framework including detailed time line.

Indicator 2: Annual and final reports.

3.7.1 Standard: Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility c
standards and protocols.

Indicator 1: Annual reports indicating level of compliance with applicable standards and criteria.

3.7.2 Standard: Effluent from artificial production facility will not detrimentally affect natural populations.

Indicator 1: Discharge water quality compared to applicable water quality standards.

3.7.3 Standard: Water withdrawals and in stream water diversion structures for artificial production facility operation will not p
to natural spawning areas, affect spawning, or impact juveniles.

Indicator 1: Water withdrawals documented ? no impacts to listed species.

Indicator 2: NMFS screening criteria adhered to.

3.7.4 Standard: Releases do not introduce pathogens not already existing in the local populations and do not significantly inc
levels of existing pathogens.

Indicator 1: Certification of juvenile fish health documented prior to release.

3.7.5 Standard: Any distribution of carcasses or other products for nutrient enhancement is accomplished in compliance with
disease control regulations and guidelines.

Indicator 1: Number and location(s) of carcasses distributed to habitat documented.

3.7.6 Standard: Adult broodstock collection operation does not significantly alter spatial and temporal distribution of natural p

Indicator 1: Spatial and temporal spawning distribution of natural population above and below trapping facilities monitored.

3.7.7 Standard: Weir/trap operations do not result in significant stress, injury, or mortality in natural populations.

Indicator 1: Mortality rates in trap documented. No ESA-listed fish targeted.

Indicator 2: Prespawning mortality rates of trapped fish in hatchery or after release documented. No ESA-listed fish targeted.

3.7.8 Standard: Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of nat

Indicator 1: Size and time of release of juvenile fish documented and compared to size and timing of natural fish.

Standards and indicators (S&I) are based on legal mandates for Artificial Propagation S&I for anadromous and resident fish p
the Pacific Northwest, developed as an outgrowth of discussions of the by the regional Production Review Committee of the
Power Planning Council, 1/17/2001.

Standards and indicators (S&I) are based on legal mandates for Artificial Propagation S&I for anadromous and resident fish p
the Pacific Northwest, developed as an outgrowth of discussions of the by the regional Production Review Committee of the
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the Pacific Northwest, developed as an outgrowth of discussions of the by the regional Production Review Committee of the
Power Planning Council, 1/17/2001.

nc
nc

Data source:

Standards and indicators (S&I) are based on legal mandates for Artificial Propagation S&I for anadromous and resident fish p
the Pacific Northwest, HGMP
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the Pacific Northwest, HGMP
PI
PI

1.11.1 Proposed annual broodstock collection level (maximum number of adult fish).

198 nya

Data source:

nds

1.11.2 Proposed annual fish release levels (maximum number) by life stage and location.

1

Age Class	Maximum Number	Size (ffp)	Release Date	Stream	Location: Release Point (RKm)	Location: Major Watershed	Location: Ecopr
Eggs	nya	nya	nya	nya	nya	nya	nya
Unfed Fry	nya	nya	nya	nya	nya	nya	nya
Fry	nya	nya	nya	nya	nya	nya	nya
Fingerling	nya	nya	nya	nya	nya	nya	nya
Yearling	2,500,000	20	3/16/2003	Rapid River	4	Salmon River	Mounta Snake

Comments:

Spring chinook at the Rapid River hatchery are a combination of adults trapped at the Rapid River weir and at the Hell's Car smolts are released in Hell's Canyon below the dam and in the Little Salmon River at Hazard Creek.

Data source:

Personal Interview (PI) with Ralph Steiner (IDFG, 3/11/03)

1.12 Current program performance, including estimated smolt-to-adult survival rates, adult pr levels, and escapement levels. Indicate the source of these data.

33

Return Year	Total Catch (all ages)	Natural Escapement: NoRs	Natural Escapement: HoRs	Hatchery Spawning: NoRs	Hatchery Spawning: HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Comments:

nc

Data source:

Annual broodyear reports, subbasin catch in harvest reports (Scott Marshall or Sharon Kiefer - IDFG)

Status and Goals of Stocks and Habitats

34

	NoRs		HoRs		Combined (HoRs + NoRs)	
Brood Year	**Smolt to Adult Survival(%)**	**Recruits per Spawner**	**Smolt to Adult Survival(%)**	**Recruits per Spawner**	**Smolt to Adult Survival(%)**	**Recruits per Spawner**
Goal	nya	nya	nya	nya	nya	nya
1988	nya	nya	0.1698	nya	nya	nya
1989	nya	nya	0.0930	nya	nya	nya
1990	nya	nya	0.0022	nya	nya	nya
1991	nya	nya	0.0017	nya	nya	nya
1992	nya	nya	0.0245	nya	nya	nya
1993	nya	nya	0.0285	nya	nya	nya
1994	nya	nya	0.0016	nya	nya	nya
1995	nya	nya	nya	nya	nya	nya
1996	nya	nya	0.2029	nya	nya	nya
1997	nya	nya	0.0057	nya	nya	nya
1998	nya	nya	0.0036	nya	nya	nya
1999	nya	nya	nya	nya	nya	nya

Comments:

SAR from BY1993 or 1994 from CSS; SAR from hatchery data

-HoR SAR data from CWT missing production data for Rapid River Hatchery; incomplete data for 1996-1999

Data source:

CSS report (Sharon), Annual broodyear report -SAR Estimates for Annual Coded Wire Tag Missing Production Groups, Colu
Dart Data Website, University of Washington, 18 March 2003.

1.13 Date program started (years in operation), or is expected to start.

7 The first year of operation for this hatchery was 1966 .

Comments:

Hatchery started operation and collected eggs in 1964. The first year fish were released was 1966.

Data source:

PI

1.14 Expected duration of program.

148 The final year of the program is undetermined.

149 The program is on-going with no planned termination.

Comments:

nc
nc

Data source:

PI
PI

1.15 Watersheds targeted by program.

1 Salmon

1.16 Indicate alternative actions considered for attaining program goals, and reasons why thos are not being proposed.

The hatchery program is a part of a strategy to meet conservation and/or harvest goals for the target stock. The tables below the short- and long-term goals are for the stock in terms of stock status (biological significance and viability), habitat and harv in the table indicate High, Medium, or Low levels for the respective attributes. Changes in these levels from current status inc outcomes for the hatchery program and other strategies (including habitat protection and restoration).

18

	Biological Significance	Viability	Habitat
Current Status	M	H	L
Short-term Goal	M	H	L
Long-term Goal	M	H	M

This table shows current status and goals for harvest opportunity. **H** implies harvest opportunity every year, **M** opportunity mc some years, and **N** no opportunity.

		Location of Fishery				
Fishery type		**Marine**	**L. Columbia**	**Zone 6**	**U. Columbia**	**Subba**
	Current Status	L	L	L	nya	L
Commercial	**Short-term Goal**	L	L	L	nya	L
	Long-term Goal	L	M	M	nya	M
	Current Status	nya	nya	H	nya	H
Ceremonial	**Short-term Goal**	nya	nya	H	nya	H
	Long-term Goal	nya	nya	H	nya	H
	Current Status	nya	nya	H	nya	M
Subsistence	**Short-term Goal**	nya	nya	H	nya	M
	Long-term Goal	nya	nya	H	nya	H
	Current Status	L	L	L	nya	M
Recreational	**Short-term Goal**	L	L	L	nya	M
	Long-term Goal	L	M	M	nya	H
	Current Status	dna	dna	dna	dna	dna
Catch and Release	**Short-term Goal**	dna	dna	dna	dna	dna
	Long-term Goal	dna	dna	dna	dna	dna

19
20
21
22
23

Comments:

be consistent with Hells Canyon SPCH

subbasin is treaty commercial
nc
nc
nc
nc

Data source:

nds
nds
nds
nds
nds

nds

Section 2: Program Effects on ESA-Listed Salmonid Populations

2.1 List all ESA permits or authorizations in hand for the hatchery program.

The program has the following permits or authorizations: Section 7 or Section 10 permit
150 401 certification
.

Comments:

Data source:

PI

2.2.1 Descriptions, status and projected take actions and levels for ESA-listed natural populatic target area.

145 Snake River spring chinook salmon and steelhead and bull trout.

15 nya

32 Listed stocks may be directly affected by nya.

The following ESA listed natural salmonid populations occur in the subbasin where the program fish are released:

ESA listed stock	Viability	Habitat
Summer Chinook (Johnson Creek)	L	L
Summer Chinook (McCall Hatchery)	H	L
Summer Chinook (Pahsimeroi)	L	L
Spring Chinook (Upper Salmon/Sawtooth)	U	L
Spring Chinook - Natural	H	L
Summer Chinook - Natural	H	L
Steelhead B-Natural	L	L
Redfish Lake Sockeye	L	L
Spring/Summer Chinook (W. Fork Yankee Fork- Salmon River)- Integrated	L	L
Spring/Summer Chinook (East Fork Salmon River)- Integrated	L	L
Lemhi River Spring_Summer Chinook	L	L

H, M and L refer to high, medium and low ratings, low implying critical and high healthy.

Comments:

nc
nc
nc
be consistent with Hells Canyon SPCH

Data source:

PI
nds
nds
nc

2.2.2 Status of ESA-listed salmonid population(s) affected by the program.

nya

Most recent available spawning escapement estimates are shown in the table below:

Summer Chinook (Johnson Creek)

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Summer Chinook (McCall Hatchery)

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya

1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Summer Chinook (Pahsimeroi)

Return Year	**Total Catch (all ages)**	**Natural Escapement**		**Hatchery Spawning**	
		NoRs	**HoRs**	**NoRs**	**HoRs**
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Spring Chinook (Upper Salmon/Sawtooth)

Return Year	**Total Catch (all ages)**	**Natural Escapement**		**Hatchery Spawning**	
		NoRs	**HoRs**	**NoRs**	**HoRs**
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	18	19
1996	nya	nya	nya	105	51
1997	nya	nya	nya	155	99
1998	nya	nya	nya	127	26
1999	nya	nya	nya	121	75
2000	nya	nya	nya	535	451
2001	nya	nya	nya	676	1,427

Spring Chinook - Natural

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Summer Chinook - Natural

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Steelhead B-Natural

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	unk	unk	unk	unk	unk
1990	unk	unk	unk	unk	unk
1991	unk	unk	unk	unk	unk
1992	unk	unk	unk	unk	unk
1993	unk	unk	unk	unk	unk
1994	unk	unk	unk	unk	unk
1995	unk	unk	unk	unk	unk
1996	unk	unk	unk	unk	unk
1997	unk	unk	unk	unk	unk
1998	unk	unk	unk	unk	unk
1999	unk	unk	unk	unk	unk
2000	unk	unk	unk	unk	unk
2001	unk	unk	unk	unk	unk

Redfish Lake Sockeye

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	2000	nya	nya	600
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Spring/Summer Chinook (W. Fork Yankee Fork- Salmon River)- Integrated

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs

Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Spring/Summer Chinook (East Fork Salmon River)- Integrated

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Lemhi River Spring_Summer Chinook

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	NA	M	M	NA	NA
1990	M	M	M	NA	NA
1991	M	M	M	NA	NA

1992	M	M	M	NA	NA
1993	M	M	M	NA	NA
1994	M	M	M	NA	NA
1995	M	M	M	NA	NA
1996	M	M	M	NA	NA
1997	M	M	M	NA	NA
1998	M	M	M	NA	NA
1999	M	M	M	NA	NA
2000	M	M	M	NA	NA
2001	M	M	M	NA	NA

Comments:

nc
nc
nc

Data source:

nds
nds
PI

2.2.3 Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimate levels of take.

Steelhead B (East Fork) - Integrated

152

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

153

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya

Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (Johnson Creek)

152

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

153

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (McCall Hatchery)

152

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

153

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue				

sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook (Rapid River) - Hatchery

152

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

153

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (Pahsimeroi)

152

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya

	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
153	**Removal (e.g., brookstock (e)**	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook (Upper Salmon/Sawtooth)

	ESU/Population	nya
	Activity	nya
152	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook - Natural

	ESU/Population	nya
	Activity	nya
152	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program	

Operator nya

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
153 **Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook - Natural

ESU/Population nya

Activity nya

152 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program Operator nya

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
153 **Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Run (Pahsimeroi)- Hatchery

152

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

153

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead B (Dworshak)-Hatchery

152

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

153

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional	nya	nya	nya	nya

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
lethal take (f)				
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead B-Natural

152

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

153

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Natural

152

ESU/Population	Snake River "A" run steelhead and summer chinook salmon
Activity	Trapping
Location of hatchery activity	Rapid River
Dates of activity	3/15-9/15
Hatchery Program Operator	Ralph Steiner

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	NA	nya

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	NA	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
153	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Redfish Lake Sockeye

	ESU/Population	nya
	Activity	nya
152	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

	Annual Take of Listed Fish by life Stage (number of fish)				
	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring/Summer Chinook (W. Fork Yankee Fork- Salmon River)- Integrated

	ESU/Population	nya
	Activity	nya
152	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

	Annual Take of Listed Fish by life Stage (number of fish)				
	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

153

Spring/Summer Chinook (East Fork Salmon River)- Integrated

152

ESU/Population nya

Activity nya

Location of hatchery activity nya

Dates of activity nya

Hatchery Program Operator nya

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

153

Lemhi River Spring_Summer Chinook

152

ESU/Population nya

Activity nya

Location of hatchery activity nya

Dates of activity nya

Hatchery Program Operator nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Run (Sawtooth)- Hatchery

ESU/Population nya

Activity nya

152 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program Operator nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Comments:

nc
nc
nc

Data source:

nds
PI
PI

Section 3: Relationship of Program to Other Management Objectives

3.1 Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hooc Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the *NP Production Review* Report and Recommendations - NPPC document 99-15). Explain any deviations from the plan or policies.

155 This program conforms with the plan and polices to mitigate loss of chinook salmon production caused by the construction of the four dams on the lower Snake River.

Comments:

nc

Data source:

HGMP, PI

3.2 List all existing cooperative agreements, memoranda of understanding, memoranda of agi or other management plans or court orders under which program operates.

156

Document Title	Type
Nez Perce Tribe	MOA
Idaho Power	MOA
FERC	O
nya	nya

Comments:

nc

Data source:

PI

3.3 Relationship to harvest objectives.

157 Annual IDFG fish and harvest and NMFS take guidleines. IDFG, other tribal and agency fish managers work cooperatively t annual production and mark plans. Juvenile production and adult escapement targets were established. IDFG conducts anr angler surveys to assess the contribution program fish make toward meeting program harvest objectives.

Comments:

nc

Data source:

HGMP

3.4 Relationship to habitat protection and recovery strategies.

158 nya

Comments:

nc

Data source:

HGMP

3.5 Ecological interactions.

The following species co-occur to a significant degree with the program fish in either freshwater or early marine life stages.

159
- Steelhead
- Sockeye
- Coho
- Chinook
- Bull Trout

Comments:

nc

Data source:

PI

Section 4. Water Source

4.1 Provide a quantitative and narrative description of the water source (spring, well, surfac quality profile and natural limitations to production attributable to the water source.

The following statements describe the adult holding water source:

12
- The water source is gravity flow.
- The water source is accessible to anadromous fish.
- Water is from the natal stream for the cultured stock.
- The water used results in natural water temperature profiles that provide optimum maturation and gamete developn
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu temperature.
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu ammonia, carbon dioxide, chlorine, pH, copper, dissolved oxygen, hydrogen sulfide, dissolved nitrogen, iron, and zi
- The water supply is protected by flow and/or pond level alarms at the holding pond(s).
- Naturally produced fish do not have access to intake screens.
- Hatchery intake screening complies with Integrated Hatchery Operations Team (IHOT) and National Marine Fisheri facility guidelines.

The following statements describe the incubation water source:

13
- The water source is gravity flow.
- The water source is gravity flow.
- The water source is fish free.
- Water is available from multiple sources.
- Water is from the natal stream for the cultured stock.
- Incubation water can be heated or chilled to approximate natural water temperature profiles.
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu temperature.
- The water supply is protected by flow alarms at the head box.
- The water supply is protected by back-up power generation
- Naturally produced fish do not have access to intake screens.

The following statements describe the rearing water source:

- The water source is gravity flow.

- The water source is accessible to anadromous fish.
- Water is from the natal stream for the cultured stock.
- The water used provides natural water temperature profiles that results in hatching/emergence timing similar to that naturally produced stock.
- The hatchery operates to allow all migrating species of all ages to by-pass or pass through hatchery related structu
- Adequate flows are maintained to provide unimpeded passage of adults and juveniles in the by-pass reach created water withdrawals.
14 - The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu temperature.
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu ammonia, carbon dioxide, chlorine, pH, copper, dissolved oxygen, hydrogen sulfide, dissolved nitrogen, iron, and zi
- The water supply is protected by flow and/or pond level alarms at the holding pond(s)
- Naturally produced fish do not have access to intake screens.
- Hatchery intake screening complies with Integrated Hatchery Operations Team (IHOT) and National Marine Fisheri facility guidelines.

Comments:

Data source:

PI
PI
PI

4.2 Indicate risk aversion measures that will be applied to minimize the likelihood for the ta listed natural fish as a result of hatchery water withdrawal, screening, or effluent discha

15 The facility operates within the limitations established in its National Pollution Discharge Elimination System (NPDES) perm production from this facility falls below the minimum production requirement for an NPDES permit, but the facility operates i with state or federal regulations for discharge and The facility does not have a discharge permit.

Comments:

nc

Data source:

PI

Section 5. Facilities

5.1 Broodstock collection facilities (or methods).

Brookstock for this program is collected:

16
- by volitional return to adult capture pond.
- at another facility.
- from wild by weir.

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Fl (gpm)

188	1	Concrete	12,000	80	25	6	2,600
	1	Gravel	24,000	150	40	4	7,500
	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya

Comments:

b. Occassionally adults are collected from Oxbow Hatchery

nc

Data source:

PI
PI, Hatchery records

5.2 Fish transportation equipment (description of pen, tank, truck, or container used).

99 IHOT guidelines for transportation are followed.

	Equipment Type	Capacity (gallons)	Supplemental Oxygen (y/n)	Temperature Control (y/n)	Normal Transit Time (minutes)	Chemical (s) Used	Dc (p
187	Tanker (smolts)	5,000	Y	Y	330	None	nya
	Tanker (adults)	1,000	Y	Y	30	None	nya
	Tanker	100	Y	Y	30	None	nya
	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya

Comments:

nc
nc

Data source:

PI
PI, Hatchery records

5.3 Broodstock holding and spawning facilities.

Spawning for this program takes place:

16
- in a covered facility.
- at a remote location.** NO STATEMENT PROVIDED FOR THIS CHOICE **

34 Integrated Hatchery Operations Team (IHOT) adult holding guidelines followed for adult holding , density , water quality , alar predator control measures to provide the necessary security for the broodstock.

	Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Fl (gpm)
188	1	Concrete	12,000	80	25	6	2,600
	1	Gravel	24,000	150	40	4	7,500
	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya

Comments:

b. Occassionally adults are collected from Oxbow Hatchery

nc
nc

Data source:

PI
PI
PI, Hatchery records

5.4 Incubation facilities.

	Incubator Type	Units (number)	Flow (gpm)	Volume (cu.ft.)	Loading-Eyeing (eggs/unit)	Loading-Hatcl (eggs/unit
189	Heath trays (Vertical stack)	832	6	NA	4,000	4,000
	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya

Comments:

nc

Data source:

PI, Hatchery records

5.5 Rearing facilities.

	Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Maximum Flow Index	Maxir Den: Ind
190	2	Concrete side, earth bottom	27,312	188	42	3.5	3,700	1.5	0.2
	2	Concrete side, earth bottom	23,232	197	35	3.5	2,900	1.5	0.2
	2	Concrete side, earth bottom	23,181	173	37	3.5	2,900	2.25	0.2
	12	Concrete raceway	1,890	90	6	3.5	850	1.0	0.3

Comments:

nc

Data source:

PI, Hatchery records

5.6 Acclimation/release facilities.

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Maximum Flow Index	Maxir Den: Ind
	Concrete							

	2	side, earth bottom	27,312	188	42	3.5	3,700	1.5	0.2
	2	Concrete side, earth bottom	23,232	197	35	3.5	2,900	1.5	0.2
190	2	Concrete side, earth bottom	23,181	173	37	3.5	2,900	2.25	0.2
	12	Concrete raceway	1,890	90	6	3.5	850	1.0	0.3

Comments:

nc

Data source:

PI, Hatchery records

5.7 Describe operational difficulties or disasters that led to significant fish mortality.

160 None

Comments:

nc

Data source:

PI

5.8 Indicate available back-up systems, and risk aversion measures that will be applied, tha the likelihood for the take of listed natural fish that may result from equipment failure, v flooding, disease transmission, or other events that could lead to injury or mortality.

70 Fish are reared in multiple facilities or with redundant systems to reduce the risk of catastrophic loss.

78 The facility is sited so as to minimize the risk of catastrophic fish loss from flooding.

79 Staff is notified of emergency situations at the facility.

80 The facility is continuously staffed to assure the security of fish stocks on-site.

Comments:

Had a 500 year flood, didn't have any affect.

By an autodialer only.

Staff live at the hatchery.

There are 6 ponds and 12 reaceways for rearing fish.

Data source:

PI

PI
PI
PI

Section 6. Broodstock Origin and Identity

6.1 Source.

17 The broodstock chosen represents natural populations native or adapted to the watersheds in which hatchery fish will be re

Comments:

nc

Data source:

PI

6.2.1 History.

183

Broodstock Source	Origin	Year(s) Used Begin	End
Rapid River	H	1964	Present
nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya

Comments:

Data source:

PI, Hatchery records

6.2.2 Annual size.

22 The program collects sufficient numbers of donors from the natural stock to minimize founder effects.

23

25

27 The program collects sufficient broodstock to maintain an effective population size of 1000 fish per generation.

28

Comments:

The intent of this program is to collect enough adults for egg and brood needs. All others will be placed back in the system f
spawning or harvest.

Broodstock is collected over the entire run entry pattern.

Generally yes in the last few years, but depends on return year.

No wild fish are used.

Data source:

PI
PI
nds
PI

6.2.3 Past and proposed level of natural fish in the broodstock.

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

33

Comments:

nc

Data source:

Annual broodyear reports, subbasin catch in harvest reports (Scott Marshall or Sharon Kiefer - IDFG)

6.2.4 Genetic or ecological differences.

19 The broodstock chosen displays morphological and life history traits similar to the natural population.

Comments:

nc

Data source:

PI

6.2.5 Reasons for choosing.

18 The native stock has been extirpated, however the broodstock chosen is likely to adapt to the system based on life history a evolutionary history.

20

21 The broodstock chosen has the desired life history traits to meet harvest goals.

Comments:

nc
nc
Timing and migration result in full recruitment to target fisheries

Data source:

PI
PI
PI

6.3 Indicate risk aversion measures that will be applied to minimize the likelihood for advers or ecological effects to listed natural fish that may occur as a result of broodstock selecti practices.

The following procedures are in place that maintain broodstock collection within programmed levels:

161

- Excess adults are used for seeding available habitat in accordance with genetic guidelines
- Excess adults are culled at random and sold, buried, or donated to food banks depending on their quality

Comments:

a and b. NA

Data source:

PI

Section 7. Broodstock Collection

7.1 Life-history stage to be collected (adults, eggs, or juveniles).

191

	Adults				
Year	**Females**	**Males**	**Jacks**	**Eggs**	**Juveniles**
Planned	`	nya	nya	nya	nya
1990	1,225	1,311	40	48,929	nya
1991	759	916	238	nya	nya
1992	1,624	1,658	118	nya	nya
1993	2,370	1,950	19	nya	nya
1994	163	126	5	nya	nya
1995	43	61	60	nya	nya
1996	362	307	801	nya	nya
1997	1,710	1,374	3	nya	nya
1998	954	690	7	nya	nya

1999	147	80	66	199,010	nya
2000	1,440	1,018	277	nya	nya
2001	2,269	1,568	128	nya	nya

Comments:

nc

Data source:

PI, Hatchery records

7.2 Collection or sampling design

16
- Broodstock collected by volitional return to adult capture pond.
- Broodstock collected at another facility.
- Broodstock collected from wild by weir.

22 The program collects sufficient numbers of donors from the natural stock to minimize founder effects.

23

24 Representative samples of the population are NOT collected with respect to size, age, sex ratio, run and spawn timing, and important to long-term fitness.

25 The proportion of spawners brought into the hatchery follows a "spread-the-risk" strategy that attempts to improve the proba survival for the entire population.

27 The program collects sufficient broodstock to maintain an effective population size of 1000 fish per generation.)

28 dna

Comments:

The intent of this program is to collect enough adults for egg and brood needs. All others will be placed back in the system f spawning or harvest.

Broodstock is collected over the entire run entry pattern.

Only hatchery fish used for broodstock

Spawners are used throught the entire run.

Generally yes in the last few years, but depends on return year.

No wild fish are used.

Data source:

PI
PI
PI

PI
nds
PI

7.3 Identity.

100

101 100% of the hatchery fish released are marked so that they can be distinguished from the natural population.

102 Marked fish can be identified using non-lethal means.

106 Wild fish make up 0-5% (less than five percent) % of the broodstock for this program.

Comments:

Yearlings and subyearlings are segregated.

nc
nc
Zero wild fish

Data source:

PI
PI
PI
PI, also personal interview with Tom Rodgers and Paul Kline (IDFG) on 4/11/2003.

7.4 Proposed number to be collected:

198 **7.4.1 Program goal (assuming 1:1 sex ratio for adults):**
nya

7.4.2 Broodstock collection levels for the last twelve years (e.g. 1990-2001), or for most recent years availab

		Adults				
	Year	**Females**	**Males**	**Jacks**	**Eggs**	**Juvenile**
	Planned	`	nya	nya	nya	nya
	1990	1,225	1,311	40	48,929	nya
	1991	759	916	238	nya	nya
	1992	1,624	1,658	118	nya	nya
191	**1993**	2,370	1,950	19	nya	nya
	1994	163	126	5	nya	nya
	1995	43	61	60	nya	nya
	1996	362	307	801	nya	nya
	1997	1,710	1,374	3	nya	nya
	1998	954	690	7	nya	nya
	1999	147	80	66	199,010	nya
	2000	1,440	1,018	277	nya	nya
	2001	2,269	1,568	128	nya	nya

Comments:

nc

Data source:

PI, Hatchery records

7.5 Disposition of hatchery-origin fish collected in surplus of broodstock needs.

The following procedures are in place that maintain broodstock collection within programmed levels:

161

- Excess adults are used for seeding available habitat in accordance with genetic guidelines.
- Excess adults are culled at random and sold, buried, or donated to food banks depending on their quality.

Comments:

a and b. NA

Data source:

PI

7.6 Fish transportation and holding methods.

	Equipment Type	Capacity (gallons)	Supplemental Oxygen (y/n)	Temperature Control (y/n)	Normal Transit Time (minutes)	Chemical (s) Used	Do (p
	Tanker (smolts)	5,000	Y	Y	330	None	nya
187	Tanker (adults)	1,000	Y	Y	30	None	nya
	Tanker	100	Y	Y	30	None	nya
	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya

	Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Fl (gpm)
	1	Concrete	12,000	80	25	6	2,600
188	1	Gravel	24,000	150	40	4	7,500
	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya

33 Broodstock is collected and held in a manner that results in less than 10% prespawning mortality.

99 IHOT guidelines for transport are followed for this program.

Comments:

nc
nc
However, mortality varies by year and ranges from 0.8 to 34%. Depends on condition of returning fish.

nc

Data source:

PI, Hatchery records
PI, Hatchery records
PI
PI

7.7 Describe fish health maintenance and sanitation procedures applied.

98 "Fish transfers into the subbasin are inspected and accompanied by notifications as described in IHOT and PNFHPC guide

32 Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection committee (PNFHPC), state or triba are followed for broodstock fish health inspection , transfer of eggs or adults and broodstock holding and disposal of carcas

Comments:

nc
nc

Data source:

PI
PI

7.8 Disposition of carcasses.

32 Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection committee (PNFHPC), state or triba are followed for broodstock fish health inspection , transfer of eggs or adults and broodstock holding and disposal of carcas

103 Hatchery adults are distributed by staff within the subbasin to provide hatchery adults are distributed (by staff) within subba fishing opportunity .

161 The following procedures are in polace that maintain broodstock collection within programmed levels:

- Excess adults are used for seeding available habitat in accordance with genetic guidelines
- Excess adults are culled at random and sold, buried, or donated to food banks depending on their quality

Comments:

nc
nc
a and b. NA

Data source:

PI
PI
PI

7.9 Indicate risk aversion measures that will be applied to minimize the likelihood for advers or ecological effects to listed natural fish resulting from the broodstock collection progra

29 The program has NO guidelines for acceptable contribution of hatchery fish to natural spawning.

30 These guidelines are met for all affected natural stocks.

32 Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection committee (PNFHPC), state or triba are followed for broodstock fish health inspection , transfer of eggs or adults and broodstock holding and disposal of carcas

Comments:

Surplus fish are sometimes outplanted by the Nez Perce Tribe in the Clearwater for the fishery or to naturally spawn.

5-year hatchery run reports.

nc

Data source:

PI
PI with Tom Rodgers, IDFG, 4/11/03
PI

Section 8. Mating

8.1 Selection method.

35 Males and females available on a given day are mated randomly.

39

Comments:

Generally chosen one male to one female for a given day.

Randomly selected by hatchery personnel.

Data source:

PI
PI

8.2 Males.

38 Precocious males are used as a set percentage or in proportion to their contribution to the adult run.

37 Back-up males are used in the spawning protocol.

Comments:

Jacks of all sizes are used.

If needed due to shortage, back-up males are used.

Data source:

PI
PI

8.3 Fertilization.

36 Gametes are pooled prior to fertilization.

39

11 IHOT PNFHPC state tribal federal guidelines are followed for culture practices for this program.

40

Comments:

Usually yes, but sometimes use 2 males/one female at random using IHOT guidelines

Randomly selected by hatchery personnel.

nc
No, only spring chinook salmon are at the hatchery.

Data source:

PI
PI
HGMP
PI

8.4 Cryopreserved gametes.

162 Cryopreserved gametes are not used.

Comments:

nc

Data source:

PI

8.5 Indicate risk aversion measures that will be applied to minimize the likelihood for advers or ecological effects to listed natural fish resulting from the mating scheme.

35 Males and females available on a given day are mated randomly.

36 Gametes are pooled prior to fertilization.

37 Back-up males are used in the spawning protocol.

38 Precocious males are used as a set percentage or in proportion to their contribution to the adult run.

39

Comments:

Generally chosen one male to one female for a given day.

Usually yes, but sometimes use 2 males/one female at random using IHOT guidelines

If needed due to shortage, back-up males are used.

Jacks of all sizes are used.

Randomly selected by hatchery personnel.

Data source:

PI
PI
PI
PI
PI

Section 9. Incubation and Rearing.

9.1.1 Number of eggs taken and survival rates to eye-up and/or ponding.

	Year	Egg Take	Green-Eyed Survival (%)	Eyed-Ponding Survival (%)	Egg Survival Performance Std.	Fry-fingerling Survival (%)	Rearing Survival Performance Std.	Finger Smo Surviva
	1990	4,217,103	92.5	90.8	nya	99.1	nya	97.7
	1991	2,553,218	94.5	93.3	nya	97.8	nya	98.7
	1992	4,534,404	91.3	90.0	nya	98.6	nya	93.2
	1993	4,227,490	93.2	87.3	nya	99.2	nya	99.6
192	**1994**	423,079	91.3	88.7	nya	98.6	nya	99.8
	1995	113,427	87.2	86.3	nya	95.8	nya	99.7
	1996	991,685	93.2	90.9	nya	98.9	nya	99.9
	1997	3,336,167	94.3	82.0	nya	99.3	nya	99.9
	1998	2,815,510	87.7	85.8	nya	99.5	nya	99.9
	1999	807,094	92.9	88.9	nya	99.5	nya	99.7
	2000	3,818,285	91.5	89.8	nya	99.3	nya	99.9
	2001	3,333,314	89.5	99.0	nya	99.3	nya	98.3

Comments:

nc

Data source:

PI, Hatchery records

9.1.2 Cause for, and disposition of surplus egg takes.

163 Annual take of extra eggs to account for a 10% mortality prior to eye-up and another 10% increase for BKD culling.

45 Eggs are not culled randomly over all segments of egg-take.

48 Families are incubated individually.

59 No culling of juveniles occur.

60

61

44 >2 (eggs are culled more than 2 times)

Comments:

nc
One female per tray

nc

nc
No culling

Also culled for BKD once.

Data source:

PI
PI
PI
PI
PI
PI

9.1.3 Loading densities applied during incubation.

51 Integrated Hatchery Operations Team (IHOT) species-specific incubation recommendations were followed for water quality temperature , substrate and incubator capacities.

47 Families within spawning groups are mixed randomly at ponding so that unintentional rearing differences affect families equ

42 Eggs are incubated under conditions that result in equal survival of all segments of the population to ponding.

Comments:

nc
nc

Data source:

PI
PI
PI

9.1.4 Incubation conditions.

49 Incubation takes place in home stream water.

50 The program uses water sources that result in hatching/emergence timing similar to that of the naturally produced populatic

51 Integrated Hatchery Operations Team (IHOT) species-specific incubation recommendations were followed for water quality temperature , substrate and incubator capacities.

53 Eggs are monitored when needed to determine fertilization efficiency and embryonic development.

42 Eggs are incubated under conditions that result in equal survival of all segments of the population to ponding.

47 Families within spawning groups are mixed randomly at ponding so that unintentional rearing differences affect families equ

48 Families are incubated individually.

43

Comments:

In Rapid River

Rapid River water

nc
nc
nc
One female per tray

nc

Data source:

PI
PI
PI
PI
PI
PI
PI
PI

9.1.5 Ponding.

The procedures used for determining when fry are ponded include:

55
- Fry are removed from incubation units when 80-90% of observed fry have yolk-sac material that is 80-90% utilized within body cavity ("button-up")
- Fry are ponded based on visual inspection of the amount of yolk remaining
- Fry are ponded based on reaching a specified number of accumulated temperature units
- Fry are ponded based on the recommendations of the facility s fish health specialist

46 Eggs are NOT incubated in a manner that allows volitional ponding of fry.

Comments:

a. Fry are moved when 100% ar buttoned-up

nc

Data source:

PI
PI

9.1.6 Fish health maintenance and monitoring.

52 Disinfection procedures are implemented during incubation that prevent pathogen transmission between stocks of fish on s

53 Eggs are monitored when needed to determine fertilization efficiency and embryonic development.

54 Following eye-up stage, eggs are inventoried, and dead or undeveloped eggs removed and disposed of as described in the control guidelines.

56 Dead or culled eggs are discarded in a manner that prevents transmission to receiving watershed.

Comments:

Protocols in AOP

nc
Procedures are implemented that follow dissease control guidelines.

Eggs are removed based on IHOT guidelines.

Data source:

PI
PI
PI
PI

9.1.7 Indicate risk aversion measures that will be applied to minimize the likelihood for advers and ecological effects to listed fish during incubation.

47 Families within spawning groups are mixed randomly at ponding so that unintentional rearing differences affect families equ

49 Incubation takes place in home stream water.

50 The program uses water sources that result in hatching/emergence timing similar to that of the naturally produced populatic

51 Integrated Hatchery Operations Team (IHOT) species-specific incubation recommendations were followed for water quality temperature , substrate and incubator capacities.

52 Disinfection procedures are implemented during incubation that prevent pathogen transmission between stocks of fish on s

56 Dead or culled eggs are discarded in a manner that prevents transmission to receiving watershed.

61 dna

Comments:

nc
In Rapid River

Rapid River water

Protocols in AOP

Eggs are removed based on IHOT guidelines.

No culling

Data source:

PI
PI
PI
PI
PI
PI
PI

9.2.1 Provide survival rate data (*average program performance*) by hatchery life stage (fry to f fingerling to smolt) for the most recent twelve years (1990-2001), or for years dependab are available.

Year	Egg Take	Green-Eyed Survival (%)	Eyed-Ponding Survival (%)	Egg Survival Performance Std.	Fry-fingerling Survival (%)	Rearing Survival Performance Std.	Finger Sm Surviva
1990	4,217,103	92.5	90.8	nya	99.1	nya	97.7
1991	2,553,218	94.5	93.3	nya	97.8	nya	98.7
1992	4,534,404	91.3	90.0	nya	98.6	nya	93.2
1993	4,227,490	93.2	87.3	nya	99.2	nya	99.6
192 **1994**	423,079	91.3	88.7	nya	98.6	nya	99.8
1995	113,427	87.2	86.3	nya	95.8	nya	99.7
1996	991,685	93.2	90.9	nya	98.9	nya	99.9
1997	3,336,167	94.3	82.0	nya	99.3	nya	99.9
1998	2,815,510	87.7	85.8	nya	99.5	nya	99.9
1999	807,094	92.9	88.9	nya	99.5	nya	99.7
2000	3,818,285	91.5	89.8	nya	99.3	nya	99.9
2001	3,333,314	89.5	99.0	nya	99.3	nya	98.3

Comments:

nc

Data source:

PI, Hatchery records

9.2.2 Density and loading criteria (goals and actual levels).

71 The juvenile rearing density and loading guidelines used at the facility are based on: standardized agency guidelines , life-s survival studies conducted on-site , life-stage specific survival studies conducted at other facilities and other criteria .

72 IHOT standards are followed for: water quality , alarm systems , predator control measures to provide the necessary securi cultured stock , loading and density.

Comments:

e. Years with reduced egg take result in reduced rearing densities.

Data source:

PI
PI

9.2.3 Fish rearing conditions.

66 The program does NOT use a diet and growth regime that mimics the natural seasonal growth patterns.

67 Settleable solids, unused feed and feces are removed periodically to ensure proper cleanliness of rearing containers.

72 IHOT standards are followed for: water quality , alarm systems , predator control measures to provide the necessary securi cultured stock , loading and density.

71 The juvenile rearing density and loading guidelines used at the facility are based on standardized agency guidelines , life-st survival studies conducted on-site , life-stage specific survival studies conducted at other facilities and other criteria .

Comments:

Smolts reach target size at release bigger than naturals. The amount of feed based on water temperatures, resulting in larg released smolts.

Rearing containers are cleaned every two days.

e. Years with reduced egg take result in reduced rearing densities.

Data source:

PI
PI
PI
PI

9.2.4 Indicate biweekly or monthly fish growth information (average program performance), ir length, weight, and condition factor data collected during rearing, if available.

Rearing Period	Length (mm)	Weight (fpp)	Condition Factor	Growth Rate	Hepatosomatic Index	Bod Moist Cont
February	38.1	1,109	2.7	0.61	nya	nya
March	41.7	809	2.8	0.178	nya	nya
April	49.5	439	3.1	0.267	nya	nya
May	58.2	271	3.1	0.384	nya	nya
June	72.9	136	3.1	0.754	nya	nya
194 July	87.1	79	3.6	0.394	nya	nya
August	98.0	46	3.5	0.417	nya	nya
September	109.5	36	3.5	0.432	nya	nya
October	116.8	30	3.5	0.249	nya	nya
November	118.6	28	3.5	0.058	nya	nya
December	118.6	30	3.4	0.041	nya	nya
January	119.1	29	3.4	0.033	nya	nya

Comments:

February 125.7 26 3.2 0.102

March 131.8 22 3.2 0.188

Data source:

PI, Hatchery records

9.2.5 Indicate monthly fish growth rate and energy reserve data (*average program performanc* available.

64
- Feeding rates are followed so that fish size is within 10% of program goal each year.
- Operator conducts periodic feed quality analysis.
- Feed is stored under proper conditions as described by IHOT guidelines.

65 The correct amount and type of food is provided to achieve the desired growth rate , body composition and condition factorsf and life stages being reared.

194

Rearing Period	Length (mm)	Weight (fpp)	Condition Factor	Growth Rate	Hepatosomatic Index	Boc Moist Cont
February	38.1	1,109	2.7	0.61	nya	nya
March	41.7	809	2.8	0.178	nya	nya
April	49.5	439	3.1	0.267	nya	nya
May	58.2	271	3.1	0.384	nya	nya
June	72.9	136	3.1	0.754	nya	nya
July	87.1	79	3.6	0.394	nya	nya
August	98.0	46	3.5	0.417	nya	nya
September	109.5	36	3.5	0.432	nya	nya
October	116.8	30	3.5	0.249	nya	nya
November	118.6	28	3.5	0.058	nya	nya
December	118.6	30	3.4	0.041	nya	nya
January	119.1	29	3.4	0.033	nya	nya

66 The program does NOT use a diet and growth regime that mimics the natural seasonal growth patterns.

Comments:

nc
nc
February 125.7 26 3.2 0.102

March 131.8 22 3.2 0.188

Smolts reach target size at release bigger than naturals. The amount of feed based on water temperatures, resulting in large released smolts.

Data source:

PI
PI
PI, Hatchery records
PI

9.2.6 Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*averag performance*).

- Feeding rates are followed so that fish size is within 10% of program goal each year.
64
- Operator conducts periodic feed quality analysis.
- Feed is stored under proper conditions as described by IHOT guidelines.

65 The correct amount and type of food is provided to achieve the desired growth rate , body composition and condition factorsf and life stages being reared.

	Rearing Period	Food Type	Application Schedule (#feedings/day)	Feeding Rate Range (% B.W./day)	Lbs. Fed Per gpm of Inflow	Food Conversi During Perioc
	Feb-May	Semi-moist	8	1.4-2.4	0.01-0.04	1-1.07
195	Jun-Mar	Moist	2-5	0.2-2.9	0.03-0.07	1.20-4.46
	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya

Comments:

nc
nc
nc

Data source:

PI
PI
PI, Hatchery records

9.2.7 Fish health monitoring, disease treatment, and sanitation procedures.

62 IHOT fish health guidelines are followed to prevent transmission between lots of fish on site or transmission or amplification the watershed.

63 Vaccines are NOT used, whenever possible, to minimize the use of antimicrobial compounds.

71 The juvenile rearing density and loading guidelines used at the facility are based on standardized agency guidelines , life-st survival studies conducted on-site , life-stage specific survival studies conducted at other facilities and other criteria .

Comments:

nc
IHOT standards are used, and only spring chinook salmon are reared at the hatchery.

e. Years with reduced egg take result in reduced rearing densities.

Data source:

PI
PI
PI

9.2.8 Smolt development indices (e.g. gill ATPase activity), if applicable.

87 The migratory state of the release population is determined by ATPase testing (or other physiological tests) , volitional relea behavior .

Comments:

Most fish are released volitionally.

Data source:

PI

9.2.9 Indicate the use of "natural" rearing methods as applied in the program.

68 The program attempts to better mimic the natural rearing environment by rearing under natural water temperature and activ photoperiod .

69 Fish produced are not similar to natural fish.

66

84 Fish are released at sizes similar to natural fish of the same life stage and species.

88 Fish are released in a manner that simulates natural seasonal migration patterns.

Comments:

nc
No natural fish used, but hatchery fish are bigger than natural fish.

Smolts reach target size at release bigger than naturals. The amount of feed based on water temperatures, resulting in larg released smolts.

Released smolts are similar is size but generally somewhat bigger than what naturals would be.

Both hatchery and natural fish would migrate during spring freshets.

Data source:

PI
PI
PI
PI
PI

9.2.10 Indicate risk aversion measures that will be applied to minimize the likelihood for advers and ecological effects to listed fish under propagation.

60 dna

72 IHOT standards are followed for: water quality , alarm systems , predator control measures to provide the necessary securi cultured stock , loading and density.

80 The facility is continuously staffed to assure the security of fish stocks on-site.

84 Fish are released at sizes similar to natural fish of the same life stage and species.

88 Fish are released in a manner that simulates natural seasonal migration patterns.

98 "Fish transfers into the subbasin are inspected and accompanied by notifications as described in IHOT and PNFHPC guide

76 Fish inventory data accurately reflect rearing vessel population abundance with 10%.

86 Volitional release is practiced during natural out-migration timing.

96 Fish are released in the same subbasin as the final rearing facility.

Comments:

nc

Staff live at the hatchery.

Released smolts are similar is size but generally somewhat bigger than what naturals would be.

Both hatchery and natural fish would migrate during spring freshets.

nc
Number of eggs inventoried within 3% using an electric counter, adipose fin clip, all fish individually handled.

Yes, fish are allowed to leave voluntarily.

Yes for the Rapid River adults, no for the Hell's Canyon Snake River fish.

Data source:

PI
PI
PI
PI
PI
PI
PI
PI
PI

Section 10. Release

10.1 Proposed fish release levels.

					Location			
	Age Class	**Maximum Number**	**Size (ffp)**	**Release Date**	**Stream**	**Release Point (RKm)**	**Major Watershed**	**Ecopr**
	Eggs	nya	nya	nya	nya	nya	nya	nya
1	**Unfed Fry**	nya	nya	nya	nya	nya	nya	nya
	Fry	nya	nya	nya	nya	nya	nya	nya
	Fingerling	nya	nya	nya	nya	nya	nya	nya
	Yearling	2,500,000	20	3/16/2003	Rapid River	4	Salmon River	Mountai Snake

Comments:

Spring chinook at the Rapid River hatchery are a combination of adults trapped at the Rapid River weir and at the Hell's Can smolts are released in Hell's Canyon below the dam and in the Little Salmon River at Hazard Creek.

Data source:

Personal Interview (PI) with Ralph Steiner (IDFG, 3/11/03)

10.2 Specific location(s) of proposed release(s).

1

Age Class	Maximum Number	Size (ffp)	Release Date	Stream	Location: Release Point (RKm)	Location: Major Watershed	Location: Ecopr
Eggs	nya	nya	nya	nya	nya	nya	nya
Unfed Fry	nya	nya	nya	nya	nya	nya	nya
Fry	nya	nya	nya	nya	nya	nya	nya
Fingerling	nya	nya	nya	nya	nya	nya	nya
Yearling	2,500,000	20	3/16/2003	Rapid River	4	Salmon River	Mountai Snake

96 Fish are released in the same subbasin as the final rearing facility.

Comments:

Spring chinook at the Rapid River hatchery are a combination of adults trapped at the Rapid River weir and at the Hell's Can smolts are released in Hell's Canyon below the dam and in the Little Salmon River at Hazard Creek.
Yes for the Rapid River adults, no for the Hell's Canyon Snake River fish.

Data source:

Personal Interview (PI) with Ralph Steiner (IDFG, 3/11/03)
PI

10.3 Actual numbers and sizes of fish released by age class through the program.

>

196

Release Year	Eggs/Unfed Fry Release: Number	Eggs/Unfed Fry Release: Date (MM/DD)	Eggs/Unfed Fry Release: Avg Size (fpp)	Fry Release: Number	Fry Release: Date (MM/DD)	Fry Release: Avg size (fpp)	Fingerling Release: Number	Fingerling Release: Date (MM/DD)	Fingerling Release: Avg Size (fpp)	Yearling: Number	Yearling: D (MM
1991	nya	nya	nya	nya	nya	nya	nya	nya	nya	2,665,000	3/15
1992	nya	nya	nya	nya	nya	nya	100,250	7/23	133.4	3,115,500	3/16
1993	nya	nya	nya	nya	nya	nya	nya	nya	nya	2,260,600	4/16
1994	nya	nya	nya	nya	nya	nya	nya	nya	nya	2,928,146	4/9
1995	nya	nya	nya	nya	nya	nya	nya	nya	nya	3,286,455	3/16
1996	nya	nya	nya	nya	nya	nya	nya	nya	nya	379,167	3/19
1997	nya	nya	nya	nya	nya	nya	nya	nya	nya	85,840	3/17
1998	nya	nya	nya	nya	nya	nya	nya	nya	nya	896,170	3/16
1999	nya	nya	nya	nya	nya	nya	nya	nya	nya	3,347,283	3/18
2000	nya	nya	nya	nya	nya	nya	nya	nya	nya	2,462,354	3/15
2001	nya	nya	nya	nya	nya	nya	nya	nya	nya	736,601	3/15
2002	nya	nya	nya	nya	nya	nya	nya	nya	nya	3,469,689	3/18
Avg	nya	nya	nya	nya	nya	nya	nya	nya	nya	2,136,067	nya

Comments:

nc

Data source:

PI, Hatchery records

10.4 Actual dates of release and description of release protocols.

84 Fish are released at sizes similar to natural fish of the same life stage and species.

85 Fish are released at a time, size, location, and in a manner that achieves harvest goals for the stock.

86 Volitional release during natural out-migration timing is practiced.

88 Fish are released in a manner that simulates natural seasonal migration patterns.

89

90

91 Fish are released at a time and size specified in an established juvenile production goal.

92 The carrying capacity of the subbasin has been taken into consideration in sizing this program.

87 The migratory state of the release population is determined by ATPase testing (or other physiological tests) , volitional relea behavior .

Comments:

Yes, fish are allowed to leave voluntarily.

nc
Released smolts are similar is size but generally somewhat bigger than what naturals would be.

Both hatchery and natural fish would migrate during spring freshets.

All volitionally released during higher spring flows and not based on studies.

nc
Volitional release

Volitional release based on pit-tag studies (184,000 fish tagged).

Most fish are released volitionally.

Data source:

PI
PI
PI

PI
PI
PI
PI
PI
PI

10.5 Fish transportation procedures, if applicable.

96 Fish are released in the same subbasin as the final rearing facility.

	Equipment Type	Capacity (gallons)	Supplemental Oxygen (y/n)	Temperature Control (y/n)	Normal Transit Time (minutes)	Chemical (s) Used	Do (I
	Tanker (smolts)	5,000	Y	Y	330	None	nya
187	Tanker (adults)	1,000	Y	Y	30	None	nya
	Tanker	100	Y	Y	30	None	nya
	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya

Comments:

Yes for the Rapid River adults, no for the Hell's Canyon Snake River fish.

nc

Data source:

PI
PI, Hatchery records

10.6 Acclimation procedures (*methods applied and length of time*).

166 No acclimation

Comments:

nc

Data source:

PI

10.7 Marks applied, and proportions of the total hatchery population marked, to identify hatcl adults.

100

101 100% of the hatchery fish released are marked so that they can be distinguished from the natural population.

102 Marked fish can be identified using non-lethal means.

Comments:

Yearlings and subyearlings are segregated.

nc
nc

Data source:

PI
PI

PI

10.8 Disposition plans for fish identified at the time of release as surplus to programmed or a levels

167 dna

163 Annual take of extra eggs to account for a 10% mortality prior to eye-up and another 10% increase for BKD culling.

Comments:

nc
nc

Data source:

PI
PI

10.9 Fish health certification procedures applied pre-release.

97 All fish are examined for the presence of “reportable pathogens” as defined in the PNFHPC disease control guidelines, with prior to release.

98 Fish transfers into the subbasin are inspected and accompanied by notifications as described in IHOT and PNFHPC guideli

Comments:

nc
nc

Data source:

PI
PI

10.10 Emergency release procedures in response to flooding or water system failure.

168 Release all fish.

Comments:

nc

Data source:

PI

10.11 Indicate risk aversion measures that will be applied to minimize the likelihood for advers and ecological effects to listed fish resulting from fish releases.

84 Fish are released at sizes similar to natural fish of the same life stage and species.

86 Volitional release during natural out-migration timing is practiced.

88 Fish are released in a manner that simulates natural seasonal migration patterns.

89

91 Fish are released at a time and size specified in an established juvenile production goal.

104 The percent of the naturally spawning population in the subbasin that consists of adults from the program is 0-5% (less tha

105 The percent of hatchery fish spawning in the wild is estimated by:

- Escapement data from a weir or dam

95

94 Fish are released within the historic range for that stock.

93 The carrying capacity of the subbasin was taken into account when determining the number of fish to be released.

Comments:

Released smolts are similar is size but generally somewhat bigger than what naturals would be.

Yes, fish are allowed to leave voluntarily.

Both hatchery and natural fish would migrate during spring freshets.

All volitionally released during higher spring flows and not based on studies.

Volitional release

nc
nc
nc
All released volitionally.

This includes both the Little Salmon and Snake rivers.

Based on information developed by IDFG Fish Policy Bureau and Research Staff information.

Data source:

PI

PI
PI
PI
nds
PI
PI with Tom Rodgers and Paul Klein, IDFG, 4/11/03
PI with Tom Rodgers and Paul Klein, IDFG, 4/11/03
PI
PI, PI with Tom Rodgers (IDFG), 4/11/2003
PI, PI with Tom Rodgers (IDFG), 4/11/2003

Section 11. Monitoring and Evaluation of Performance Indicators

11.1.1 Describe plans and methods proposed to collect data necessary to respond to each "Perf Indicator" identified for the program.

Monthly Hatchery report, AOP, Production summary reports, Annual Lower Snake River Reports.

Document LSRCP fish rearing and release practices.

Performance Standards and Indicators: 3.2.2, 3.3.2, 3.4.1, 3.4.2, 3.4.3, 3.4.4, 3.5.2, 3.5.4, 3.5.5, 3.6.1, 3.6.2, 3.7.1, 3.7.2, 3 3.7.5

Document, report, and archive all pertinent information needed to successfully manage summer chinook salmon rearing an practices. (e.g., number and composition of fish spawned, spawning protocols, spawning success, incubation and rearing t juvenile mark and tag plans, juvenile release locations, number of juveniles released, size at release, migratory timing and s juveniles, and fish health management).

Document the contribution LSRCP-reared summer chinook salmon make toward meeting mitigation and management obje Document juvenile out-migration and adult returns.

Performance Standards and Indicators: 3.1.1,3.1.2, 3.1.3, 3.2.1, 3.2.2, 3.3.1, 3.3.2, 3.4.3, 3.4.4, 3.5.1, 3.5.2, 3.5.3, 3.5.4, 3.
144 3.6.1, 3.6.2, 3.7.6, 3.7.7, 3.7.8

Estimate the number of wild/natural and hatchery-produced chinook salmon escaping to project waters above Lower Granit dam counts, harvest information, spawner surveys, and trap information (e.g., presence/absence of identifying marks and t species, size, age, length). Conduct creel surveys and angler phone or mail surveys to collect harvest information. Assess j outmigration success at traps and dams using direct counts, marks, and tags. Reconstruct runs by brood year. Summarize and tag information (e.g., juvenile out-migration survival, juvenile and adult run timing, adult return timing and survival). Dev of smolt-to-adult survival for wild/natural and hatchery-produced chinook salmon. Use identifying marks and tags and age s analysis to determine the composition of adult chinook salmon.

Identify factors that are potentially limiting program success and recommend operational modifications, based on the outco studies, to improve overall performance and success.

Performance Standards and Indicators: 3.6.1, 3.6.2

Evaluate potential relationships between rearing and release history and juvenile and adult survival information. Develop hy experimental designs to investigate practices that may be limiting program success. Implement study recommendations an evaluate outcomes.

Comments:

nc

Data source:

PI

11.1.2 Indicate whether funding, staffing, and other support logistics are available or committe implementation of the monitoring and evaluation program.

146 The hatchery is funded to conduct monitoring and evaluation at current requirements in the AOP, however need an increas mass marking of 180,000 pit-tags.

Comments:

nc

Data source:

PI

11.2 Indicate risk aversion measures that will be applied to minimize the likelihood for advers and ecological effects to listed fish resulting from monitoring and evaluation activities.

147 The Rapid River smolt trap will be continuously monitored, and checked daily, to minimize the duration of holding and risk c spring chinook and steelhead that may be incidentally captured during the smolt emigration period.

Comments:

nc

Data source:

PI

Section 12. Research

12.1 Objective or purpose.

An extensive monitoring and evaluation program is conducted in the basin to document hatchery practices and evaluate the the hatchery programs at meeting program mitigation objectives, Idaho Department of Fish and Game management objecti monitor and evaluate the success of supplementation programs. The hatchery monitoring and evaluation program identifies rearing and release strategies that will allow the program to meet its mitigation requirements and improve the survival of ha while avoiding negative impacts to natural (including listed) populations.

To properly evaluate this compensation effort, adult returns to facilities, spawning areas, and fisheries that result from hatch are documented. The program requires the cooperative efforts of the Idaho Department of Fish and Game?s hatchery evalu harvest monitoring project, and the coded-wire tag laboratory programs. The Hatchery evaluation study evaluates and prov of certain hatchery operational practices, (e.g., broodstock selection, size and number of fish reared, disease history, and ti Hatchery practices will be assessed in relation to their effects on adult returns. Recommendations for improvement of hatch will be made.

169

The harvest monitoring project provides comprehensive harvest information, which is key to evaluating the success of the p meeting adult return goals. Numbers of hatchery and wild/natural fish observed in the fishery and in overall returns to the pr Idaho are estimated. Data on the timing and distribution of the marked hatchery and wild stocks in the fishery are also colle analyzed to develop harvest management plans. Harvest data provided by the harvest monitoring project are coupled with I data to provide an estimate of returns from program releases. Coded-wire tags continue to be used extensively to evaluate contribution of representative groups of program production releases. However, most of these fish serve experimental purp i.e., for evaluation of hatchery-controlled variables such as size, time, and location of release, rearing densities, etc.

Continuous coordination between the hatchery evaluation study and Idaho Department of Fish and Game?s BPA-funded su research project is required because these programs overlap in several areas for different species including: juvenile outpla broodstock collection, and spawning (mating) strategies.

Comments:

nc

Data source:

All research answers are same as those in the HGMP for the Clearwater Hatchery, PI with Tom Rodgers, IDFG, 4/11/03

12.2 Cooperating and funding agencies.

170 Funding agency is Idaho Power Company.

Comments:

nc

Data source:

HGMP

12.3 Principle investigator or project supervisor and staff.

171 Steve Yundt, Fisheries Research Manager, IDFG

Comments:

nc

Data source:

HGMP

12.4 Status of stock, particularly the group affected by project, if different than the stock(s) c in Section 2.

172 Same stocks listed in question 145.

Comments:

nc

Data source:

HGMP

12.5 Techniques: include capture methods, drugs, samples collected, tags applied.

173 nya

Comments:

nc

Data source:

HGMP

12.6 Dates or time periods in which research activity occurs.

174 nya

Comments:

nc

Data source:

HGMP

12.7 Care and maintenance of live fish or eggs, holding duration, transport methods.

175 Research activities that involve the handling of eggs or fish apply the same protocols reviewed in Section 9 of the HGMP ar questions in this program review. Hatchery staff generally assist with all cooperative activities involving the handling of eggs

Comments:

nc

Data source:

nds

12.8 Expected type and effects of take and potential for injury or mortality.

176 Generally, take for research activities is defined as: "observe/harass", and "capture, handle, mark, tissue sample, release."

Comments:

nc

Data source:

HGMP

12.9 Level of take of listed fish: number of range or fish handled, injured, or killed by sex, age, not already indicated in Section 2 and the attached "take table" (Table 1).

Steelhead B (East Fork) - Integrated

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

182

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

181	***Summer Chinook (Johnson Creek)***	
	ESU/Population	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

182

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

181	***Summer Chinook (McCall Hatchery)***	
	ESU/Population	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

182

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue				

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook (Rapid River) - Hatchery

	ESU/Population	nya
	Activity	nya
181	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (Pahsimeroi)

	ESU/Population	nya
	Activity	nya
181	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya

182

Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook (Upper Salmon/Sawtooth)

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

182

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook - Natural

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program	

Operator nya

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
		Annual Take of Listed Fish by life Stage (number of fish)			
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook - Natural

ESU/Population nya

Activity nya

181 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program Operator nya

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
		Annual Take of Listed Fish by life Stage (number of fish)			
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Run (Pahsimeroi)- Hatchery

181	ESU/Population	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

	Type of Take	Annual Take of Listed Fish by life Stage (number of fish)			
		Egg/Fry	Juvenile/Smolt	Adult	Carcass
182	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Steelhead B (Dworshak)-Hatchery

181	ESU/Population	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

	Type of Take	Annual Take of Listed Fish by life Stage (number of fish)			
		Egg/Fry	Juvenile/Smolt	Adult	Carcass
182	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional	nya	nya	nya	nya

lethal take (f)				
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead B-Natural

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

182

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Natural

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
182	**Intentional lethal take (f)**	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Redfish Lake Sockeye

	ESU/Population	nya
	Activity	nya
181	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring/Summer Chinook (W. Fork Yankee Fork- Salmon River)- Integrated

	ESU/Population	nya
	Activity	nya
181	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

182

Spring/Summer Chinook (East Fork Salmon River)- Integrated

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

182

Lemhi River Spring_Summer Chinook

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya

Dates of activity nya

Hatchery Program Operator nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Run (Sawtooth)- Hatchery

ESU/Population nya

Activity nya

181 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program Operator nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Comments:

nc
nc
nc

Data source:

nds
nds
nds

12.10 Alternative methods to achieve project objects.

177 nya

Comments:

nc

Data source:

HGMP

12.11 List species similar or related to the threatened species; provide number and causes of n related to this research project.

178 N/A

Comments:

nc

Data source:

HGMP

12.12 Indicate risk aversion measures that will be applied to minimize the likelihood for advers ecological effects, injury or mortality to listed fish as a result of the proposed research a

Risk aversion measures for research activities associated with the evaluation of the Lower Snake River Compensation Prog specified in our ESA Section 7 Consultation and Section 10 Permit 1124. A brief summary of the kinds of actions taken is p

Adult handling activities are conducted to minimize impacts to ESA-listed, non-target species. Adult and juvenile weirs and are engineered properly and installed in locations that minimize adverse impacts to both target and non-target species. All t facilities are constantly monitored to minimize a variety of risks (e.g., high water periods, high emigration or escapement pe security).

179 Adult spawner and redd surveys are conducted to minimize potential risks to all life stages of ESA-listed species. The IDFG formal redd count training annually. During surveys, care is taken to not disturb ESA-listed species and to not walk in the vi completed redds.

Snorkel surveys conducted primarily to assess juvenile abundance and density are conducted in index sections only to min disturbance to ESA-listed species. Displacement of fish is kept to a minimum.

Marking and tagging activities are designed to protect ESA-listed species and allow mitigation harvest objectives to be purs Rapid River Hatchery mitigation spring chinook salmon are visibly marked to differentiate them from their wild/natural count

Comments:

nc

Data source:

nds

Section 13. Attachments and Citations

13.1 Attachments and Citations

197 nya

Comments:

nc

Data source:

nds

Section 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

14.1 Certification Language and Signature of Responsible Party

"I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by_______________________________ Date:______________

APPENDIX 2-9—SALMON RIVER SUMMER CHINOOK HATCHERY AND GENETIC MANAGEMENT PLAN

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Salmon River Basin Summer Chinook Salmon. McCall Fish Hatchery.
Species or Hatchery Stock:	Summer Chinook Salmon *Oncorhynchus tshawytscha.*
Agency/Operator:	Idaho Department of Fish and Game
Watershed and Region:	South Fork Salmon River, Idaho.
Date Submitted:	September 30, 2002
Date Last Updated:	September 30, 2002

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Hatchery: McCall Fish Hatchery.
Program: Summer Chinook Salmon.

1.2) Species and population (or stock) under propagation, and ESA status.

Summer Chinook Salmon *Oncorhynchus tshawytscha*.
Components of the hatchery population are and are not ESA-listed according to parental origin. The natural (unmarked) population is ESA-listed.

1.3) Responsible organization and individuals

Lead Contact
Name (and title): Sharon W. Kiefer, Anadromous Fish Manager.
Agency or Tribe: Idaho Department of Fish and Game.
Address: 600 S. Walnut, P.O. Box 25, Boise, ID 83707.
Telephone: (208) 334-3791.
Fax: (208) 334-2114.
Email: skiefer@idfg.state.id.us

On-site Operations Lead
Name (and title): Gene McPherson, Fish Hatchery Manager II.
Agency or Tribe: Idaho Department of Fish and Game.
Address: P.O. Box 448, McCall ID 83638.
Telephone: (208) 634-2690.
Fax: (208) 634-3492.
Email: gmcphers@idfg.state.id.us

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

U.S. Fish and Wildlife Service – Lower Snake River Compensation Plan Office: Administers the Lower Snake River Compensation Plan as authorized by the Water Resources Development Act of 1976.

Nez Perce Tribe – The IDFG coordinates with the Nez Perce Tribe to hold and spawn adult summer chinook salmon for the Tribe's Johnson Creek supplementation program. Juvenile chinook are reared at the McCall Fish Hatchery and generally released as smolts as part of the current hatchery capacity.

Shoshone-Bannock Tribes – The Shoshone-Bannock Tribes may receive summer chinook salmon eggs for an ongoing supplementation program.

1.4) Funding source, staffing level, and annual hatchery program operational costs.

U.S. Fish and Wildlife Service – Lower Snake River Compensation Plan funded.
Staffing level: 5.1 person-years.
Annual budget: $471,000.

1.5) Location(s) of hatchery and associated facilities.

McCall Fish Hatchery – The McCall Fish Hatchery is located approximately 2.25 km south of state highway 55 at 300 Mather Road in the city limits of McCall, Idaho. The facility includes an adult weir and trap located on the South Fork Salmon River approximately 42 km east of Cascade, ID. The hydrologic unit codes for the hatchery and weir are 17050123 and 17060208, respectively.

1.6) Type of program.

The McCall Fish Hatchery program was designed as an *Isolated Harvest Program*. However, some broodstock management, rearing, and juvenile releases support ongoing supplementation research.

1.7) Purpose (Goal) of program.

Define as either: Augmentation, Mitigation, Restoration, Preservation/Conservation, or Research (for Columbia Basin programs, use NPPC document 99-15 for guidance in providing these definitions of "Purpose"). Provide a one sentence statement of the goal of the program, consistent with the term selected and the response to Section 1.6. Example: "The goal of this program is the restoration of spring chinook salmon in the White River using the indigenous stock".

Mitigation - The goal of this program is to return 8,000 summer chinook salmon above Lower Granite Dam to mitigate for survival reductions resulting from construction and operation of the four lower Snake River dams.

1.8) Justification for the program.

The primary purpose of this program is harvest mitigation. The Lower Snake River Compensation Program has been in operation since 1983 to provide for mitigation for lost chinook salmon and steelhead production caused by the construction and operation of the four lower Snake River dams.

Actions taken to minimize adverse effects on listed fish include:

1. Continuing fish health practices to minimize the incidence of infectious disease agents. Follow IHOT, AFS, and PNFHPC guidelines.

2. Marking hatchery-produced spring chinook salmon for broodstock management. Smolts released for supplementation research will be marked differentially from other

hatchery production fish.

3. Not releasing summer chinook salmon for supplementation research in the South Fork Salmon River in excess of estimated carrying capacity.

4. Acclimating a portion of the annual production at an acclimation pond adjacent to the upper South Fork Salmon River.

5. Attempting to program time of release to mimic natural fish for South Fork Salmon hatchery reserve releases.

6. Continuing to use broodstock for general production and supplementation research that exhibit life history characteristics similar to locally evolved stocks.

7. Continuing to segregate female summer chinook salmon broodstock for BKD via ELISA. We will incubate each female's progeny separately and also segregate progeny for rearing. We will continue development of culling and rearing segregation guidelines and practices, relative to BKD.

8. Monitoring hatchery effluent to ensure compliance with National Pollutant Discharge Elimination System permit.

9. Continuing Hatchery Evaluation Studies (HES) to provide comprehensive monitoring and evaluation for LSRCP chinook.

1.9) List of program "Performance Standards".

3.1 Legal Mandates.
3.2 Harvest.
3.3 Conservation of natural spawning populations.
3.4 Life History Characteristics.
3.5 Genetic Characteristics.
3.6 Research Activities.
3.7 Operation of Artificial Production Facilities.

1.10) List of program "Performance Indicators", designated by "benefits" and "risks."

Note: Performance Standards and Indicators used to develop Sections 1.10.1 and 1.10.2 were taken from the final January 17, 2001 version of Performance Standards and Indicators for the Use of Artificial Production for Anadromous and Resident Fish Populations in the Pacific Northwest. Numbers referenced below correspond to numbers used in the above document.

3.1.1 Standard: Program contributes to fulfilling tribal trust responsibility mandates and treaty rights, as described in applicable agreements such as under U.S. v. Oregon and U.S. v. Washington.

Indicator 1: Total number of fish harvested in tribal fisheries targeting program.

3.1.2 Standard: Program contributes to mitigation requirements.

Indicator 1: Number of fish returning to mitigation requirements estimated.

3.1.3 Standard: Program addresses ESA responsibilities.

Indicator 1: ESA Section 7 Consultation completed.

3.2.1 Standard: Fish are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while avoiding over harvest of not-target species.

Indicator 1: Number of target fish caught by fishery estimated.
Indicator 2: Number of non-target fish caught in fishery estimated.
Indicator 3: Angler days by fishery estimated.
Indicator 4: Escapement of target fish estimated.

3.2.2 Standard: Release groups sufficiently marked in a manner consistent with information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries.

Indicator 1: Marking rate by type in each release group documented.
Indicator 2: Sampling rate by mark type for each fishery estimated.
Indicator 3: Number of marks by type observed in fishery documented.

3.3.1 Standard: Artificial propagation program contributes to an increasing number of spawners returning to natural spawning areas.

Indicator 1: Annual number of spawners on spawning grounds estimated in specific locations.
Indicator 2: Spawner-recruit ratios estimated is specific locations.
Indicator 3: Number of redds in natural production index areas documented in specific locations.

3.3.2 Standard: Releases are sufficiently marked to allow statistically significant evaluation of program contribution.

Indicator 1: Marking rates and type of mark documented.
Indicator 2: Number of marks identified in juvenile and adult groups documented.

1.10.2) "Performance Indicators" addressing risks.

3.4.1 Standard: Fish collected for broodstock are taken throughout the return in proportions approximating the timing and age structure of the population.

Indicator 1: Temporal distribution of broodstock collection managed.
Indicator 2: Age composition of broodstock collection managed.

3.4.2 Standard: Broodstock collection does not significantly reduce potential juvenile production in natural areas.

Indicator 1: Number of spawners of natural origin removed for broodstock managed.
Indicator 2: Number and origin of spawners migrating to natural spawning areas managed.
Indicator 3: Number of eggs or juveniles placed in natural rearing areas managed.

3.4.3 Standard: Life history characteristics of the natural population do not change as a result of this program.

Indicator 1: Life history characteristics of natural and hatchery-produced populations are measured (e.g., juvenile dispersal timing, juvenile size at outmigration, juvenile sex ratio at outmigration, adult return timing, adult age and sex ratio, spawn timing, hatch and swim-up timing, rearing densities, growth, diet, physical characteristics, fecundity, egg size).

3.4.4 Standard: Annual release numbers do not exceed estimated basin-wide and local habitat capacity.

Indicator 1: Annual release numbers, life-stage, size at release, length of acclimation documented.
Indicator 2: Location of releases documented.
Indicator 3: Timing of hatchery releases documented.

3.5.1 Standard: Patterns of genetic variation within and among natural populations do not change significantly as a result of artificial production.

Indicator 1: Genetic profiles of naturally-produced and hatchery-produced adults developed.

3.5.2 Standard: Collection of broodstock does not adversely impact the genetic diversity of the naturally spawning population.

Indicator 1: Total number of natural spawners reaching collection facilities documented.
Indicator 2: Total number of natural spawners estimated passing collection facilities documented.
Indicator 3: Timing of collection compared to overall run timing.

3.5.3 Standard: Artificially produced adults in natural production areas do not exceed appropriate proportion.

Indicator 1: Ratio of natural to hatchery-produced adults monitored (observed and estimated through fishery).
Indicator 2: Observed and estimated total numbers of natural and hatchery-produced adults passing counting stations.

3.5.4 Standard: Juveniles are released off-station, or after sufficient acclimation to maximize homing ability to intended return locations.

Indicator 1: Location of juvenile releases documented.
Indicator 2: Length of acclimation period documented.
Indicator 3: Release type (e.g., volitional or forced) documented.
Indicator 4: Adult straying documented.

3.5.5 Standard: Juveniles are released at fully smolted stage of development.

Indicator 1: Level of smoltification at release documented.
Indicator 1: Release type (e.g., forced or volitional) documented.

3.5.6 Standard: The number of adults returning to the hatchery that exceeds broodstock needs is declining.

Indicator 1: The number of adults in excess of broodstock needs documented in relation to mitigation goals of the program.

3.6.1 Standard: The artificial production program uses standard scientific procedures to evaluate various aspects of artificial production.

Indicator 1: Scientifically based experimental design with measurable objectives and hypotheses.

3.6.2. Standard: The artificial production program is monitored and evaluated on an appropriate schedule and scale to address progress toward achieving the experimental objectives.

Indicator 1: Monitoring and evaluation framework including detailed time line.
Indicator 2: Annual and final reports.

3.7.1 Standard: Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols.

Indicator 1: Annual reports indicating level of compliance with applicable standards and criteria.

3.7.2 Standard: Effluent from artificial production facility will not detrimentally affect natural populations.

Indicator 1: Discharge water quality compared to applicable water quality standards.

3.7.3 Standard: Water withdrawals and in stream water diversion structures for artificial production facility operation will not prevent access to natural spawning areas, affect spawning, or impact juveniles.

Indicator 1: Water withdrawals documented – no impacts to listed species.
Indicator 2: NMFS screening criteria adhered to.

3.7.4 Standard: Releases do not introduce pathogens not already existing in the local populations and do not significantly increase the levels of existing pathogens.

Indicator 1: Certification of juvenile fish health documented prior to release.

3.7.5 Standard: Any distribution of carcasses or other products for nutrient enhancement is accomplished in compliance with appropriate disease control regulations and guidelines.

Indicator 1: Number and location(s) of carcasses distributed to habitat documented.

3.7.6 Standard: Adult broodstock collection operation does not significantly alter spatial and temporal distribution of natural population.

Indicator 1: Spatial and temporal spawning distribution of natural population above and below trapping facilities monitored.

3.7.7 Standard: Weir/trap operations do not result in significant stress, injury, or mortality in natural populations.

Indicator 1: Mortality rates in trap documented. No ESA-listed fish targeted.
Indicator 2: Prespawning mortality rates of trapped fish in hatchery or after release documented. No ESA-listed fish targeted.

3.7.8 Standard: Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of natural fish.

Indicator 1: *Size and time of release of juvenile fish documented and compared to size and timing of natural fish.*

1.11) Expected size of program.

1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).

Adult spawn target: approximately 380 females and 760 males needed to produce approximately one million smolts.

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location.

Note: the following abbreviations are used in the table:

NPT supplementation = Nez Perce Tribe Johnson Creek Supplementation Studies
ISS = Idaho Supplementation Studies
LSRCP = Lower Snake River Compensation Program.

The IDFG anticipates that the production of progeny associated with the Idaho Supplementation Studies project (ISS) will end with the development of the 2002 brood group.

Life Stage	Release Location	Annual Release Level
Eyed Eggs		
Unfed Fry		
Fry		
Fingerling	South Fork Salmon River – Stolle Pond acclimation site - ISS	60,000, ventral clip or CWT only
Yearling	South Fork Salmon River – Knox Bridge – LSRCP South Fork Salmon River – Knox Bridge - ISS Johnson Creek – NPT	1,000,000, 100% ad-clipped, evaluation CWT and PIT groups 100,000, ventral clip or CWT only 100,000 100% VIE, CWT, evaluation PIT groups.

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

The most recent Idaho Department of Fish and Game performance data for the South Fork Salmon River hatchery program is presented below. **Adult return information**

after 1995 does not include unmarked fish. As such, numbers presented in the following tables may be lower than numbers presented in subsequent tables in this HGMP. In addition, any loss of adults due to harvest or straying has not been accounted for in the following tables. As such, SAR information presented below are minimum estimates.

South Fork Salmon River Adult Weir

			Return Age From BY				
Brood Year	Number Released	Year Released	1-ocean	2-ocean	3-ocean	Total	SAR (%)
1980	122,247	1982	504	713	151	1,368	1.12
1981	183,896	1983	595	1,259	203	2,057	1.12
1982	269,880	1984	828	1,259	202	2,289	0.85
1983	564,405	1985	1,228	2,117	1,416	4,761	0.84
1984	100,149 970,483	1985 1986	386	927	90	1,403	0.15
1985	177,606 958,300	1986 1987	50	350	8	408	0.04
1986	118,400 1,060,400	1987 1988	495	933	43	1,471	0.14
1987	757,582 947,395	1988 1989	28	348	42	418	0.04
1988	791,900 1,032,500	1989 1990	821	2,597	683	4,101	0.40
1989	708,600	1991	209	1,994	416	2,619	0.37
1990	901,500	1992	20	43	17	80	0.01
1991	607,298	1993	68	171	35	274	0.05
1992	1,060,163	1994	87	312	113	512	0.05
1993	51,163 1,074,598	1994 1995	no data 695	no data 3,198	no data 486	no data 4,379	no data 0.41
1994	559,226	1996	41	264	226	531	0.09
1995	238,647	1997	64	752	62	878	0.37
1996	24,990 393,873	1997 1998	4 688	11 3,032	0 205	15 3,925	0.06 1.00
1997	48,376 1,143,083	1998 1999	- 2,988	- 8,384	- -	- -	- -
1998	1,039,930	2000	-	-	-	-	-

The IDFG developed and implemented standardized procedures for counting chinook salmon redds in the early 1990s. Single peak count surveys are made over each trend area each year in Salmon and Clearwater basin streams. The surveys are timed to coincide with the period of maximum spawning activity on a particular stream. Recent redd count data for Idaho streams are presented in Attachment 2. of this HGMP.

1.13) Date program started (years in operation), or is expected to start.

The McCall Fish Hatchery was completed in 1979.

1.14) Expected duration of program.

This program is expected to continue indefinitely to provide mitigation under the Lower Snake River Compensation Plan.

1.15) Watersheds targeted by program.

Listed by hydrologic unit code –

South Fork Salmon River: 17060208

1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

The McCall Fish Hatchery was constructed to mitigate for fish losses caused by construction and operation of the four lower Snake River federal hydroelectric dams. The McCall Fish Hatchery has a federally authorized goal of returning 8,000 adult summer chinook salmon back to the project area upstream of Lower Granite Dam. The Idaho Department of Fish and Game's objective is to ensure that harvestable components of hatchery-produced chinook salmon are available to provide fishing opportunity, consistent with meeting spawning escapement and preserving the genetic integrity of natural populations (IDFG 1992). The Idaho Department of Fish and Game has not considered alternative actions for obtaining program goals. Stated goals are mandated by the U.S. Fish and Wildlife Service and administered through the Lower Snake River Compensation Program. Any change in the original mandate brought about by substantive changes in the hydropower corridor would be initiated by the U.S. Fish and Wildlife Service.

SECTION 2. PROGRAM EFFECTS ON NMFS ESA-LISTED SALMONID POPULATIONS. (USFWS ESA-Listed Salmonid Species and Non-Salmonid Species are addressed in Addendum A)

2.1) List all ESA permits or authorizations in hand for the hatchery program.

Section 7 Consultation with U.S. Fish and Wildlife Service (April 2, 1999) resulting in NMFS Biological Opinion for the Lower Snake River Compensation Program.

Section 10 Permit Number 921 for McCall Fish Hatchery trapping and spawning activities (expired, reapplied for 1/10/00).

2.2) Provide descriptions, status, and projected take actions and levels for NMFS ESA-listed natural populations in the target area.

2.2.1) <u>Description of NMFS ESA-listed salmonid population(s) affected by the program.</u>

The following excerpts on the present status of Salmon River spring and summer chinook salmon were taken from the Draft Subbasin Summary for the Salmon Subbasin of the Mountain Snake Province (NPPC 2001).

Idaho's stream-type chinook salmon are truly unique. Smolts leaving their natal rearing areas migrate 700 to 950 miles downstream every spring to reach the Pacific Ocean. Mature adults migrate the same distance upstream, after entering freshwater, to reach their place of birth and spawn. The life history characteristics of spring and summer chinook are well documented by IDFG et al. (1990); Healey (1991); NMFS: 57 FR 14653 and 58FR68543). Kiefer's (1987) An Annotated Bibliography on Recent Information Concerning Chinook Salmon in Idaho, prepared for the Idaho Chapter of the American Fisheries Society, provides a reference of information available through the mid-1980s on life history, limiting factors, mitigation efforts, harvest, agency planning, and legal issues.

Snake River spring and summer chinook salmon, of which spawning populations in the Salmon Subbasin are a part, were listed as Threatened under the Endangered Species Act in 1992 (57 FR 14653); critical habitat was designated in 1993 (58 FR 68543). Recent and ongoing research has provided managers with more specific knowledge of the Salmon Subbasin stocks. Intensive monitoring of summer parr and juvenile emigrants from nursery streams has provided insights into freshwater rearing and migration behavior (Walters et al. 2001; Achord et al. 2000; Hansen and Lockhart 2001; Nelson and Vogel 2001). Recovered tags and marks on returning adults at hatchery weirs and on spawning grounds have indirectly provided stock specific measures of recruitment and fidelity (Walters et al. 2001; Berggren and Basham 2000). Since 1992, most hatchery-produced chinook have been marked to distinguish them from naturally produced fish.

Age-length frequencies and age composition of individual stocks are currently being refined for specific stocks (Kiefer et al. 2001). Distribution and abundance of spawning is being monitored with intensity in specific watersheds (Walters et al. 2001; Nelson and Vogel 2001).

Ongoing since the mid-1980s, annual standard surveys continue to provide trends in abundance and distribution of summer parr (Hall-Griswold and Petrosky 1997). Resultant data show an erratic trend toward lower abundance of juvenile chinook salmon in their preferred habitat (Rosgen C-type channels), both in hatchery-influenced streams and in areas serving as wild fish sanctuaries.

Analysis of recent stock-recruitment data (Kiefer et al. 2001) indicates that much of the freshwater spawning/rearing habitat of Snake River spring/summer chinook salmon is still productive. The average production for brood years 1990-1998 was 243 smolts/female. Stock-recruitment data show modestly density-dependent survival for the escapement levels observed in recent years and have been used to estimate smolt-to-adult survival necessary to maintain or rebuild the chinook salmon populations. A survival rate of 4.0% would result in an escapement at Lower Granite Dam of approximately 40,000 wild adult spring/summer chinook salmon.

In the mid-1990s, the Salmon Subbasin produced an estimated 39% of the spring and 45% of the summer chinook salmon that returned as adults to the mouth of the Columbia River. Natural escapements approached 100,000 spring and summer chinook salmon from 1955 to 1960; with total escapements declining to an average of about 49,300 (annual average of 29,300 spring chinook salmon and 20,000 summer chinook salmon) during the 1960s. Smolt production within the Salmon Subbasin is estimated to have ranged from about 1.5 million to 3.4 million fish between 1964 and 1970.

Populations of stream-type (spring and summer) chinook salmon in the subbasin have declined drastically and steadily since about 1960. This holds true despite substantial capacities of watersheds within the subbasin to produce natural smolts and significant hatchery augmentation of many populations. For example, counts of spring/summer chinook salmon redds in IDFG standard survey areas within the subbasin declined markedly from 1957 to 1999. The total number of spring and summer chinook salmon redds counted in these areas surveys ranged from 11,704 in 1957 to 166 in 1995. Stream-type chinook salmon redds counted in all of the subbasin's monitored spawning areas have averaged only 1,044 since 1980, compared to an average 6,524 before 1970. Land management activities have affected habitat quality for the species in many areas of the subbasin, but spawner abundance declines have been common to populations in both high-quality and degraded spawning and rearing habitats (IDFG 1998).

Kucera and Blenden (1999) have reported that all five "index populations" (spawning aggregations) of stream-type chinook in the Salmon Subbasin, fish that spawn in specific areas of the Middle Fork and South Fork Salmon watersheds, exhibited highly significant ($p<0.01$) declines in abundance during the period 1957-95. The NMFS (2000) estimated that the population growth rates (lambda) for these populations during the 1990s were all substantially less than needed for the fish to replace themselves: Poverty Flats (lambda = 0.757), Johnson Creek (0.815), Bear Valley/Elk Creek (0.812), Marsh Creek (0.675), and Sulphur Creek (0.681). Many wild populations of stream-type chinook in the subbasin are now at a remnant status and it is likely that there will be complete losses of some spawning populations. Annual redd counts for the index populations have dropped to zero three times in Sulphur Creek and twice in Marsh Creek, and zero counts have been observed in spawning areas elsewhere within the Salmon Subbasin. All of these chinook populations are in significant decline, are at low levels of abundance, and at high risk of localized extinction (Oosterhout and Mundy 2001).

- Identify the NMFS ESA-listed population(s) that will be <u>directly</u> affected by the program

Snake River Spring/Summer-run chinook salmon ESU (T – 4/92).

- Identify the NMFS ESA-listed population(s) that may be <u>incidentally</u> affected by the program.

Snake River Spring/Summer-run chinook salmon ESU (T – 4/92)

Snake River Basin steelhead ESU (T – 8/97)

Bull trout (T – 6/98)

2.2.2) <u>Status of NMFS ESA-listed salmonid population(s) affected by the program.</u>

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds.

Critical and viable population thresholds have not been identified. The NMFS has identified interim abundance and productivity targets for Columbia Basin salmon and steelhead listed under the ESA. Snake River chinook salmon abundance targets for local spawning aggregates area:

1) South Fork Salmon River: 9,200

The following excerpts were taken from the Status Review for Spring and Summer Snake River Chinook Salmon (Matthews and Waples 1991) produced by NMFS as part of the federal process to determine ESA listing status.

During this century, man's activities have resulted in a severe and continued decline of the once robust runs of Snake River spring and summer chinook salmon. Nearly 95% of the total reduction in estimated abundance occurred prior to the mid-1900s. Over the last 30-40 years, the remaining population was further reduced nearly tenfold to about 0.5% of the estimated historical abundance. Over the last 26 years, redd counts in all index areas combined (excluding the Clearwater River) have also shown a steady decline. This is in spite of the fact that all in-river fisheries have been severely limited since the mid-1970s (Chapman et al. 1991). The 1990 redd count represented only 14.3% of the 1964 count.

To obtain insight into the likely persistence times of the ESU given present conditions, we applied the stochastic extinction model of Dennis et al. (1991) to a 33-year record of redds counted in index areas. The 33-year period is the longest possible, as redd counting in the Snake River began in 1957. We examined both sets of redd counts described previously: a 33-year series excluding the Grande Ronde River and a 26-year series that began with the first count of redds in the Grand Ronde River in 1964. We feel it is prudent to include the Grande Ronde River in at least part of the analysis because it has contributed between 10 and 20% of the total number of redds in the Snake River since

1964. Five-year running sums of redd counts (hereafter referred to as the "index value") were used to approximate the number of redds in single generations. These index values were the input data for the Dennis model; output was the probability that the index value would fall below a threshold value in a given time. An "endangered" threshold was defined as the index value at which the probability of reaching extinction (index value < 1) within the next 100 years is 5%; a "threatened" threshold was defined as the index value at which the probability of reaching the "endangered" threshold within the next 10 years is 50%.

For the 33-year time series (excluding the Grande Ronde River), the current index value of 8,456 redds is well below the threatened index value of 15,474 redds and only slightly above the endangered index value of 7,065 redds. According to the model, the probability of extinction in 100 years is 0.032, and the probability of reaching the endangered threshold in 10 years is 0.943. For the 26-year time series (including the Grande Ronde River), the current index value of 10,258 redds is somewhat above the threatened index value of 7,730 redds. According to the model, the probability of extinction in 100 years is < 0.001, and the probability of reaching the endangered threshold in 10 years is 0.270. The different results are primarily attributable to the fact that the initial index value was higher and the current index value lower in the former analysis. As previously discussed, the use of redd counts means that results of the model provide a conservative perspective of the rate of decline in abundance of adult salmon; hence, the model predictions are also conservative.

The results from the Dennis model should be regarded as rough approximations, given that the model's simplicity undoubtedly fails to consider all of the factors that can affect population viability. In particular, the model does not consider compensatory or depensatory effects that may be important at small population sizes. Nevertheless, considered together, results of the two analyses suggest that the ESU is at risk of extinction.

Other factors besides total abundance are also relevant to a threshold determination. Although the most recent data suggest that several thousand wild spring and summer chinook salmon currently return to the Snake River each year, these fish are thinly spread over a large and complex river system. In many local areas, the number of spawners in some recent years has been low. For example, in the small index area of upper Valley Creek, redd counts averaged 215 (range 83 to 350) from 1960 through 1970 (White and Cochnauer 1989). However, from 1980 through 1990, redd counts averaged only 10 (range 1 to 31). Similarly, in the large index area of the entire Middle Fork of the Salmon River, redd counts averaged 1,603 (range 1,026 to 2,180) from 1960 through 1970 but only 283 (range 38 to 972) from 1980 through 1990. If significant population subdivision occurs within the Snake River Basin (as evidence discussed above suggests may be the case), the size of some local populations may have declined to levels at which risks associated with inbreeding or other random factors become important considerations. As numbers decline, fish returning to spawn may also have difficulty finding mates if they are widely distributed in space and time of spawning.

Short-term projections for spring and summer chinook salmon in the Snake River are not optimistic. The recent series of drought years undoubtedly impacted the number of outmigrating juveniles that will produce returning adults in the next few years. The very low number of jacks returning over Lower Granite Dam in 1990 provides additional reason for concern for the ESU.

Collectively, these data indicate that spring and summer chinook salmon in the Snake River are in jeopardy: Present abundance is a small fraction of historical abundance, the Dennis model provides evidence that the ESU is at risk, threats to individual subpopulations may be greater still, and the short-term projections indicate a continuation of the downward trend in abundance. We do not feel the evidence suggests that the ESU is in imminent danger of extinction throughout a significant portion of its range; however, we do feel it is likely to become endangered in the near future if corrective measures are not taken.

- Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.

The following information was taken from Kiefer et al. (2001). For brood years 1990–1998, estimated wild/natural (W/N) smolt production ranged from 161,157 to 1,560,298. During this period, smolts/female production averaged 243 smolts/female, and ranged from 92-406 smolts/female.

Brood Year	**1990**		**1991**		**1992**	
Run	Spring	Summer	Spring	Summer	Spring	Summer
Dam Counts	17,315	5,093	6,623	3,809	21,391	3,014
% Females	48	44	44	52	49	43
# of Females	8,368	2,246	2,906	1,961	10,482	1,294
# of Females in Hatcheries	3,395	421	1,330	252	2,747	462
Adjustment for Migration Mortality	4,244	526	1,663	350	3,434	578
# of Females in Harvest	796	10	1	0	897	43
Female Escapement	3,328	1,710	1,292	1,611	6,151	673
Combined Female Escapement	5,038		2,853		6,824	
Combined W/N Smolts	527,000		627,037		627,942	
# of Smolts/Female	105		220		92	

Brood Year	**1993**		**1994**		**1995**	
Run	Spring	Summer	Spring	Summer	Spring	Summer
Dam Counts	21,035	7,889	3,120	795	1,105	694
% Females	55	55	55	60	41	52
# of Females	11,535	4,340	1,706	478	452	361
# of Females in Hatcheries	4,861	528	686	164	153	100
Adjustment for Migration Mortality	6,076	660	858	205	191	125
# of Females in Harvest	658	0	83	5	0	1
Female Escapement	4,801	3,680	765	268	261	235
Combined Female Escapement	8,481		1,033		496	
Combined W/N Smolts	1,558,786		419,826		161,157	
# of Smolts/Female	184		406		325	

Brood Year	**1996**		**1997**		**1998**	
Run	Spring	Summer	Spring	Summer	Spring	Summer
Dam Counts	4,215	2,608	33,855	10,709	9,854	4,355
% Females	38	40	55	44	54	54
# of Females	2,023	1,032	18,620	4,766	5,333	2,346
# of Females in Hatcheries	1.036	148	5,503	894	2,229	365
Adjustment for Migration Mortality	1,295	185	6,879	1,118	2,786	456
# of Females in Harvest	20	0	3,183	322	643	67
Female Escapement	708	847	8,558	3,326	1,904	1,823
Combined Female Escapement	1,555		11,884		3,727	
Combined W/N Smolts	599,159		1,560,298		1,344,382	
# of Smolts/Female	385		131		361	

- Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

Return Year	McCall Fish Hatchery Total Returns (Hatchery-Produced/Natural)	Total Number of Natural Adults Released Upstream of Weir
1995	307 (269/38)	23
1996	1,199 (1,042/157)	124
1997	3,659 (3,371/288)	186
1998	974 (822/152)	62
1999	1,961 (1,670/291)	216
2000	6,812 (6,093/719)	660
2001	10,922 (9,144/1,778)	1,740
2002	8,603 (7,322/1,281)	1,160

- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

Numbers of natural-origin summer chinook salmon released for natural spawning are presented in the above table for the McCall Fish Hatchery.

2.2.3) <u>Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of NMFS listed fish in the target area, and provide estimated annual levels of take.</u>

See below.

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

ESA-listed, summer chinook salmon are trapped during broodstock collections periods at the South Fork Salmon River trap.

The McCall Fish Hatchery collects broodstock to meet LSRCP mitigation objectives in addition to objectives associated with an ongoing supplementation experiment. Annually, natural-origin, hatchery-origin, and supplementation adults may be trapped at this facility. Supplementation adults have resulted from hatchery x natural crosses. Based on federal permit and consultation language and on agreements with supplementation studies cooperators, annual weir management plans are developed. Depending on run size and composition, supplementation and natural-origin adults may be retained in the hatchery to produce future supplementation broodstocks. Generally, a minimum of 50% of the natural-origin adults that return annually are released upstream for natural spawning. At this time, brood year 2002 was the last year that supplementation broodstocks were developed at the McCall Fish Hatchery to meet IDFG supplementation study objectives.

- Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish

The following reviews the number of natural-origin adult spring chinook salmon retained ("ponded") in the hatchery and incorporated in annual spawning designs for supplementation research.

Return Year	McCall Fish Hatchery Trapping History (Hatchery-Produced/Natural)	Total Spawned (H/N)	Total Males Spawned (H/N)	Total Females Spawned (H/N)
1995	307 (269/38)	171 (159/12)	114 (106/8)	57 (53/4)
1996	1,199 (1,042/157)	333 (303/30)	222 (202/20)	111 (101/10)
1997	3,659 (3,371/288)	1,689 (1,587/102)	1,126 (1,058/68)	563 (529/34)
1998	974 (822/152)	897 (807/90)	598 (538/60)	299 (269/30)
1999	1,961 (1,670/291)	1,281 (1,212/69)	854 (808/46)	427 (404/23)
2000	6,812 (6,093/719)	1,083 (1,032/51)	722 (688/34)	361 (344/17)
2001	10,922 (9,144/1,778)	1,251 (1,221/30)	834 (814/20)	417 (407/10)
2002	8,603 (7,322/1,281)	1,143 (1,029/114)	762 (686/76)	381 (343/38)

- Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).

See Table 1 (attached).

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

It is unlikely that take levels for natural-origin summer chinook salmon will exceed projected take levels presented in Table 1 (attached). The Idaho Supplementation Studies project is beginning to phase out of developing new supplementation broodstocks. As such, beginning in 2003, we anticipate that all natural-origin chinook salmon will be released upstream for natural spawning. However, in the unlikely event that stated levels of take are exceeded, the IDFG will consult with NMFS Sustainable Fisheries Division or Protected Resource Division staff and agree to an action plan. We assume that any contingency plan will include a provision to discontinue hatchery-origin, steelhead trapping activities.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.

This program conforms with the plans and policies of the Lower Snake River Compensation Program administered by the U.S. Fish and Wildlife Service to mitigate for the loss of steelhead production caused by the construction and operation of the four dams on the lower Snake River.

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.

Cooperative Agreement between the U.S. Fish and Wildlife Service and the Idaho Department of Fish and Game, USFWS Agreement No.: 141102J010 (for Lower Snake River Compensation Plan monitoring and evaluation studies).

Cooperative Agreement between the U.S. Fish and Wildlife Service and the Idaho Department of Fish and Game, USFWS Agreement No.: 141102J009 (for Lower Snake River Compensation Plan hatchery operations).

Current Interim Management Agreement for Upriver Spring Chinook, Summer Chinook and Sockeye pursuant to United States of America v. State of Oregon, U.S. District Court, District of Oregon.

3.3) Relationship to harvest objectives.

The Lower Snake River Compensation Plan defined replacement of adults "in place" and "in kind" for appropriate state management purposes. The Idaho Department of Fish and Game, the U.S. Fish and Wildlife Service, and the Nez Perce Tribe work cooperatively to develop annual production and mark plans. Juvenile production and adult escapement targets were established at the outset of the LSRCP program.

As part of its harvest management and monitoring program, the IDFG conducts annual creel and angler surveys to assess the contribution program fish make toward meeting program harvest objectives.

3.3.1) Describe fisheries benefiting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

Sport fishery information for the South Fork Salmon River is presented in the following table.

Year	*Estimated Number of Angler Visits*	*Estimated Angler Effort (hours)*	*Estimated Sport Angler Harvest*
1990	*no fishery held*	*n/a*	*n/a*
1991	no fishery held	*n/a*	*n/a*
1992	no fishery held	*n/a*	*n/a*
1993	no fishery held	*n/a*	*n/a*
1994	no fishery held	*n/a*	*n/a*
1995	no fishery held	*n/a*	*n/a*
1996	no fishery held	*n/a*	*n/a*
1997	*2,217*	*10,876*	*434*
1998	no fishery held	*n/a*	*n/a*
1999	no fishery held	*n/a*	*n/a*
2000	*1,773*	*9,400*	*868*
2001	*9,963*	*53,208*	*6,082*
2002	*13,660*	*75,946*	*6,844*

3.4) Relationship to habitat protection and recovery strategies.

Hatchery production for harvest mitigation is influenced but not linked to habitat protection strategies in the Salmon Subbasin and other areas. The NMFS has not developed a recovery plan specific to Snake River chinook salmon, but the Salmon River spring chinook program is operated consistent with existing Biological Opinions.

3.5) Ecological interactions. [Please review Addendum A before completing this section. If it is necessary to complete Addendum A, then limit this section to NMFS jurisdictional species. Otherwise complete this section as is.]

We considered hatchery water withdrawal in the South Fork Salmon River to have no effect upon listed salmon. Water is only temporarily diverted from the river on a seasonal basis (June 1, through September 15) for holding and spawning adults. The annual average use of water is 9 to 12 cfs. We have not observed dewatered redds as a result of water diversion.

There is no gauge station at the South Fork Salmon River weir to allow determination of the amount of river flow diverted. Chinook salmon juveniles are found in the vicinity of the intake so we assume that water volume is sufficient for chinook salmon rearing and that water diversion is not detrimental. We believe that flows during summer chinook salmon release operations are sufficient for all life history stages of listed species in the short stretches of river between where water is extracted and returned.

We considered hatchery discharge to have no effect on listed salmon and steelhead because discharge from adult holding ponds is consistently within NPDES standards.

Hatchery water discharge is not expected to have an effect on rearing listed salmon and steelhead. Hatchery discharge is consistently within NPDES standards.

Potential adverse effects to listed salmon could occur from the release of hatchery-produced summer chinook juveniles through the following interactions: predation, competition, behavior modification, and disease transmission.

There are potential adverse effects to listed adult summer chinook salmon and their progeny from the release of hatchery summer chinook salmon upstream of the South Fork Salmon River weir for natural spawning. None will result in direct mortality of adults. These effects include: changes in fitness, growth, survival and disease resistance of the listed population. The effects may result in decreased productivity or long-term adaptability (Kapuscinski and Jacobson 1987; Bowles and Leitzinger 1991). These changes are more likely when the hatchery and natural stocks are not genetically similar or locally adapted. However, some increase in natural production can be expected when hatchery-reared fish are sufficiently similar to wild fish and natural rearing habitats are not at capacity (Reisenbichler 1983). We believe this is the case with the South Fork Salmon River recognizing that releasing hatchery summer chinook salmon to spawn naturally can increase natural production, but not necessarily productivity.

From the work of Sankovich and Bjornn (1992), it appears that hatchery adults released upstream of the South Fork Salmon River weir spawn with listed summer chinook salmon. By trucking many of the hatchery fish to Stolle Meadows in 1992 and 1993, we minimized the interaction, although some adults released at the weir did move upstream to Stolle Meadows in 1994. Currently, the IDFG is summarizing the results of outplanting work continued through 1996. Preliminary results suggest that progeny of trucked adults develop a fidelity to spawn in ideal upstream locations on the South Fork Salmon River. Subsequent generations of natural adults have exhibited similar spawning site fidelity. Bowles and Leitzinger (1991) stated that introduction of locally adapted adults appears to minimize negative interaction potential between their offspring and offspring of wild fish. The IDFG (in cooperation with NMFS) has developed criteria to avoid totally swamping natural production with hatchery fish (the 50:50 guideline). However, we believe that returning hatchery reserve adults must continue to play a role in natural production, particularly in under-escaped years.

Sankovich and Bjornn (1992) concluded that the native South Fork Salmon River run has been integrated into the hatchery with most fish having some hatchery lineage influence. They also determined that spawning times for hatchery and natural fish were similar. Their work suggested that neither hatchery or natural adults were restrictive in mate selection, although they did not witness many spawning acts. Sankovich and Bjornn (1992) also concluded that though hatchery adults appeared slightly longer at a given age than natural adults (1 to 2 cm difference), the differences were not such that hatchery fish would have a reproductive advantage in terms of fecundity or competition for mates. Waples et al. (1991) found little evidence of genetic change in brood years 1981 – 1982 and brood year 1988 summer chinook salmon tissue samples from the McCall Fish Hatchery. Their interpretations, applied to the combined hatchery/wild population, was that effective population size was not too small and that straying and transfers of genetically distinct stocks into the hatchery were not an important factor during the 1981 – 1988 period. The hatchery has not been managed as a closed population as broodstock have been developed from a mixture of hatchery and naturally produced adults. Genetically, the McCall Fish Hatchery summer chinook salmon clustered closely with Secesh drainage chinook salmon, which have been managed as a native, summer-run population. Our assumption is that both production components of the South Fork Salmon River summer chinook salmon run are genetically similar.

There is potential that returning hatchery-produced adults pose a genetic risk to listed salmon by straying. Strays or wandering adults may spawn with natural adults. This is most likely to occur just below the South Fork Salmon River weir. The primary risk associated with straying is loss of genetic diversity due to genetic drift (Bowles and Leitzinger 1991). In the South Fork Salmon River, this risk is minimized due to the fact that broodstock for this program were sourced from locally adapted wild fish (Waples et al. 1991).

Idaho Department of Fish and Game information collected from PIT and coded wire tags indicate that hatchery-produced adults of McCall Hatchery origin rarely, if at all, are identified at other stream or hatchery locations.

The IDFG does not believe that the release of juvenile summer chinook salmon in the South Fork Salmon River will affect listed sockeye salmon in the free-flowing migration corridor. Adults and juveniles of these two runs of salmon are temporally and spatially separated with juvenile sockeye having a later outmigration timing than summer chinook salmon released in April. The NMFS (1994) agreed that there appeared to be some separation in run timing in the migration corridor, which would minimize effects to listed sockeye salmon.

Although it is possible that both hatchery-produced summer chinook salmon smolts and fall chinook salmon fry could be present in the Snake River at the same time, we believe that hatchery smolts released in late March and April will be out of the Snake River production area when fall chinook salmon emerge in late April and early May (IFRO 1992). Because of their larger size, summer chinook salmon smolts migrating through the lower Salmon and Snake rivers will probably be using different habitat than emerging fall chinook salmon fry (Everest 1969). Thus, we assume that there is no effect to fall chinook salmon juveniles in the production area or free-flowing migration corridor from the LSRCP summer chinook salmon releases in the South Fork Salmon River. Fall chinook salmon adults would be temporally and spatially separated from summer chinook salmon adults returning from the release as well.

Unlisted, reserve summer chinook salmon smolts are spatially separated from listed species during early rearing. Therefore, effects are possible only in the migration corridor, primarily with listed spring/summer chinook salmon and steelhead. Wild chinook salmon fry are just beginning to emerge from the gravel during the release period and few would be available as food to hatchery chinook salmon smolts.

Hatchery-produced smolts are spatially separated from listed species during early rearing so effects are likely to occur only in the migration corridor after release. Perry and Bjornn (1992) documented that natural, chinook salmon fry movement in the upper Salmon river began in early March, peaked in late April, and early May, and then decreased into the early summer as the fish grew to parr size. Average mean length of spring chinook salmon fry ranged from 32.9 – 34.9 mm through late April in the upper Salmon River. Mean fry size increased to 39.8 mm by mid-June (Perry and Bjornn 1992). Assuming that hatchery-produced chinook salmon smolts could feed on prey up to 1/3 of their body length, natural fry would be in a size range to be potential prey. However, emigration from release sites generally occurs within a few days and the IDFG does not believe that hatchery-produced smolts would convert from a hatchery diet to a natural diet in such a short time (USFWS 1992, 1993). Buettner and Nelson (1990, 1991) reported travel times for freeze-branded hatchery-produced summer chinook salmon juveniles released in the South Fork Salmon River to their Snake River smolt trap. They reported migration times ranging from five to 18 miles per day (eight to 29 km per day).

At these migration rates, hatchery-product smolts would quickly leave the South Fork Salmon River production area. Additionally, the IDFG is unaware of any literature that suggests that juvenile chinook salmon are piscivorous.

The release of a large number of prey items, which may concentrate predators, has been identified as a potential effect on listed salmon and steelhead. Hillman and Mullan (1989) reported that predaceous rainbow trout (>200 mm) concentrated on wild salmon within a moving group of hatchery-produced age-0 chinook salmon juveniles. Releasing fish over a number of days is expected to minimize the risk associated with this situation.

The literature suggests that the effects of behavioral or competitive interactions between hatchery-produced and natural chinook salmon juveniles would be difficult to evaluate or quantify (USFWS 1992, 1993). There is limited information describing adverse behavioral effects of summer releases of hatchery-produced chinook salmon fingerlings (age 0) on natural chinook salmon fingerlings. Hillman and Mullan (1989) reported that larger hatchery-produced fingerlings apparently “pulled” smaller chinook salmon from their stream margin stations as the hatchery fish drifted downstream. The hatchery-produced fish were approximately twice as large as the natural juveniles. In this study, spring releases of steelhead smolts had no observable effect on natural chinook fry or smolts. However, effects of emigrating yearling, hatchery-produced chinook salmon on natural chinook salmon fry or yearlings is unknown. There may be potential for the larger hatchery-produced fish, presumably migrating in large schools, to “pull” natural chinook salmon juveniles with them as they migrate. It this occurs, effects of large, single-site releases on natural survival may be adverse. We do not know if this occurs, or the magnitude of the potential effect. In the upper Salmon River, IDFG biologists observed chinook salmon fry in typical areas during steelhead sampling in April – June, 1992 even though 1.27 million spring chinook salmon smolts had been released in mid-March (IDFG 1993).

The IDFG believes that competition for food, space, and habitat between hatchery-produced chinook salmon smolts and natural fry and smolts should be minimal due to: 1) spatial segregation, 2) foraging efficiency of hatchery-produced fish, 3) rapid emigration in free flowing river sections, and 4) differences in migration timing. If competition occurs, it would be localized at sites of large group releases (Petrosky 1984).

Chinook salmon habitat preference criteria studies have illustrated that spatial habitat segregation occurs (Hampton 1988). Larger juveniles (hatchery-produced) select deeper water and faster velocities than smaller juveniles (natural fish). This mechanism should help minimize competition between emigrating hatchery-produced chinook salmon and natural fry in free-flowing river sections.

The time taken for hatchery-produced juvenile chinook salmon to adjust to the natural environment reduces the effect of hatchery-produced fish on natural fish. Foraging and habitat selection deficiencies of hatchery-produced fish have been noted (Ware 1971; Bachman 1984; Marnell 1986). Various behavior studies have noted the inefficiency of hatchery-produced when fish placed in the natural environment (including food selection). Because of this, and the time it takes for hatchery-produced fish to adapt to their new environment, the IDFG believes competition between hatchery-produced and natural origin chinook salmon is minimal; particularly soon after release.

The IDFG does not believe that the combined release of hatchery mitigation and supplementation chinook salmon in the upper Salmon River exceeds the carrying capacity of the free-flowing migration corridor. Food, space, and habitat should not be limiting factors in the Salmon River and free-flowing Snake River.

The spring smolt outmigration of naturally produced chinook salmon is generally more protracted than the hatchery-produced smolt outmigration. Data illustrating arrival timing at Lower Granite Dam support this observation (Kiefer 1993). This factor may lessen the potential for competition in the river.

Summer chinook salmon reared at the McCall Fish Hatchery have a history of chronic bacterial kidney disease (BKD) incidence. Current control measures at the McCall Fish Hatchery include: 1) adult antibiotic injections, 2) egg disinfection, 3) egg culling based on BKD ELISA value, 4) egg segregation incubation, 5) juvenile segregation rearing, and 6) juvenile antibiotic feedings.

Bacterial kidney disease and other diseases can be horizontally transmitted from hatchery fish to natural, listed species. However, in a review of the literature, Steward and Bjornn (1990) stated that there was little evidence to suggest that horizontal transmission of disease from hatchery-produced smolts to natural fish is widespread in the production area or free-flowing migration corridor. However, little additional research has occurred in this area. Hauck and Munson (IDFG, unpublished) stated that hatcheries with open water supplies (river water) may derive pathogen problems from natural populations. The hatchery often promotes environmental conditions favorable for the spread of specific pathogens. When liberated, infected hatchery-produced fish have the potential to perpetuate and carry pathogens into the wild population.

The IDFG monitors the health status of hatchery-produced summer chinook salmon from the time adults are ponded at the South Fork Salmon River weir until juveniles are released as pre-smolts or smolts. Sampling protocols follow those established by the PNFHPC and AFS Fish Health Section.

All pathogens require a critical level of challenge dose to establish an infection in their host. Factors of dilution, low water temperature, and low population density in the South Fork Salmon River minimize the potential for disease transmission to naturally-produced chinook salmon. However, none of these factors preclude the risk of transmission (Pilcher and Fryer 1980; LaPatra et al. 1990; Lee and Evelyn 1989). Even with consistent monitoring, it is difficult to attribute a particular occurrence of disease to actions of the LSRCP hatchery summer chinook program in the South Fork Salmon River.

SECTION 4. WATER SOURCE

4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

McCall Fish Hatchery **–** The hatchery receives water through an underground 36 inch gravity line from Payette Lake. Water may be withdrawn from the surface or up to a depth of 50 ft. The IDFG has an agreement with the Payette Lake Reservoir Company to withdraw up to 20 cfs.

South Fork Salmon River Weir **–** The weir receives water directly from the South Fork Salmon River. Water is supplied through a 33 inch underground pipeline.

4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

The intake screens are in compliance with NMFS screen criteria by design of the Corp of Engineers.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Adult summer chinook salmon are collected at the South Fork Salmon River weir. The facility consists of a removable weir, fish ladder, trap, two adult holding ponds (10 ft x 90 ft), and a covered spawning area. The holding capacity for the facility is approximately 1,000 adult salmon. Adults are collected and spawned at this facility. Fertilized eggs are transported to the McCall Fish Hatchery for incubation, hatch, and rearing through release.

5.2) Fish transportation equipment (description of pen, tank truck, or container used).

The following transportation equipment is available for use by the Clearwater Fish Hatchery:

1. 10 wheel smolt transport truck fitted with three 1,000 gallon compartments supplied with oxygen and fresh flow agitator systems.

2. Two ton, 1,000 gallon tank with oxygen and fresh flows.

5.3) Broodstock holding and spawning facilities.

McCall Fish Hatchery – No adult holding occurs at the main hatchery facility.

South Fork Salmon River Weir – Adult summer chinook salmon are collected at the

South Fork Salmon River weir. The facility consists of a removable weir, fish ladder, trap, two adult holding ponds (10 ft x 90 ft), and a covered spawning area. The holding capacity for the facility is approximately 1,000 adult salmon. Adults are collected and spawned at this facility. Fertilized eggs are transported to the McCall Fish Hatchery for incubation, hatch, and rearing through release.

5.4) Incubation facilities.

The McCall Fish Hatchery has 26 eight-tray vertical incubation stacks (Heath-type) available for incubating eggs.

5.5) Rearing facilities.

Rearing facilities at the McCall Fish Hatchery include 14 concrete vats (4 ft wide x 40 ft long x 2 ft deep) used for early rearing, two concrete ponds (4 ft wide x 196 ft long x 4 ft deep) used for intermediate rearing, and one concrete collection basin (15 ft wide x 101 ft long x 4 ft deep).

5.6) Acclimation/release facilities.

Smolts are transported and released into the South Fork Salmon River at Knox Bridge. Releases occur in early April. River water is pumped into transport vehicles where fish acclimate for a short period of time. Smolt releases take place over a period of four to five days.

Parr may be released to an acclimation pond in Stolle Meadows (South Fork Salmon River) during summer months. Fish remain in the pond through winter and volitionally out-migrate through the following spring.

5.7) Describe operational difficulties or disasters that led to significant fish mortality.

No significant mortality associated with this program has occurred.

5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

McCall Fish Hatchery – The McCall Fish Hatchery water supply operates on a gravity flow principal from Payette Lake. The hatchery has a flow alarm installed that automatically dials an emergency provider that notifies hatchery personnel when flow is interrupted. An emergency generator in installed to accommodate periods of power interruption.

South Fork Salmon River Weir – No flow alarms are installed at this adult collection and holding facility. During periods of the year when adult chinook salmon are being held, the facility is permanently staffed.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.

The program was founded with adult summer chinook salmon collected between 1974 and 1979 at Ice Harbor, Little Goose, and Lower Granite dams. Adults were collected from the summer run period at the dams to collect fish that were locally adapted to the South Fork Salmon River. Early collections established an egg bank program prior to the completion of the hatchery. Between 1976 and 1980, smolts produced from these early collections were planted in the South Fork Salmon River upstream of the present location of the weir. Since 1981, all adults used for broodstock purposes have been collected at the South Fork Salmon River weir.

6.2) Supporting information.

6.2.1) History.

See Section 6.1 above.

6.2.2) Annual size.

Approximately 380 females and 760 males are needed annually to produce to meet smolt production targets.

6.2.3) Past and proposed level of natural fish in broodstock.

Summer chinook salmon adult return numbers (natural-origin and hatchery-origin) for the McCall Fish Hatchery are presented in the following table. Beginning in 1995, hatchery-origin and natural-origin adults were identifiable based on marks.

Return Year	McCall Fish Hatchery Total Returns (Hatchery-Produced/Natural)	Total Spawned (H/N)	Total Males Spawned (H/N)	Total Females Spawned (H/N)
1995	307 (269/38)	171 (159/12)	114 (106/8)	57 (53/4)
1996	1,199 (1,042/157)	333 (303/30)	222 (202/20)	111 (101/10)
1997	3,659 (3,371/288)	1,689 (1,587/102)	1,126 (1,058/68)	563 (529/34)
1998	974 (822/152)	897 (807/90)	598 (538/60)	299 (269/30)
1999	1,961 (1,670/291)	1,281 (1,212/69)	854 (808/46)	427 (404/23)
2000	6,812 (6,093/719)	1,083 (1,032/51)	722 (688/34)	361 (344/17)
2001	10,922 (9,144/1,778)	1,251 (1,221/30)	834 (814/20)	417 (407/10)
2002	8,603 (7,322/1,281)	1,143 (1,029/114)	762 (686/76)	381 (343/38)

6.2.4) Genetic or ecological differences.

The following excerpt was taken from:

Myers, et al. 1998. Status Review of Chinook Salmon from Washington, Idaho, Oregon, and California. NOAA Technical Memorandum NMFS-NWFSC-35.

One of the earliest studies of chinook salmon genetics in the Columbia River was by Kristiansson and McIntyre (1976), who reported allelic frequencies for 4 polymorphic loci in samples from 10 hatcheries, 5 of which were located along the coast and 5 in the lower Columbia River Basin. Significant frequency differences for SOD* were detected between spring- and fall-run samples collected at the Little White Salmon Hatchery on the Columbia River, but not for spring- and fall-run samples from the Trask River Hatchery along the northern coast of Oregon. Significant allele-frequency differences were also found between Columbia River samples as a group and Oregon coastal samples for PGM* and MDH*.

Utter et al. (1989) compared allelic frequencies at 12 polymorphic loci in samples of fall-run chinook salmon from the Priest Rapids Hatchery in the mid-Columbia River and from Ice Harbor Dam on the Snake River. These samples were taken over four years at each locality. Significant allele-frequency differences between populations were detected for 5 loci.

Schreck et al. (1986) examined allele-frequency variability at 18 polymorphic loci to infer genetic relationships among 56 Columbia River Basin chinook salmon populations. A hierarchical cluster analysis of genetic correlations between populations identified two major groups. The first contained spring-run chinook salmon east of the Cascade Mountains and summer-run fish in the Salmon River. Within this group they found three subclusters: 1) wild and hatchery spring-run chinook salmon east of the Cascade Mountains, 2) spring-run chinook salmon in Idaho, and 3) widely scattered groups of spring-run chinook salmon in the White Salmon River Hatchery, the Marion Forks Hatchery, and the Tucannon River. A second major group consisted of spring-run chinook salmon west of the Cascade Crest, summer-run fish in the upper Columbia River, and all fall-run fish. Three subclusters also appeared in this group: 1) spring- and fall-run fish in the Willamette River, 2) spring- and fall-run chinook salmon below Bonneville Dam, and 3) summer- and fall-run chinook salmon in the upper Columbia River. Schreck et al. (1986) also surveyed morphological variability among areas, and these results were reviewed in the Life History section of this status review.

Waples et al. (1991a) examined 21 polymorphic loci in samples from 44 populations of chinook salmon in the Columbia River Basin. A UPGMA tree of Nei's (1978) genetic distances between samples showed three major clusters of Columbia River Basin chinook salmon: 1) Snake River spring- and summer-run chinook salmon, and mid- and upper Columbia River spring-run chinook salmon, 2) Willamette River spring-run chinook salmon, 3) mid- and upper Columbia River fall- and summer-run chinook salmon, Snake

River fall-run chinook salmon, and lower Columbia River fall- and spring-run chinook salmon. These results indicate that the timing of chinook salmon returns to natal rivers was not necessarily consistent with genetic subdivisions. For example, summer-run chinook salmon in the Snake River were genetically distinct from summer-run chinook salmon in the mid and upper Columbia River, but still had similar adult run timings. Spring-run populations in the Snake, Willamette and lower, mid, and upper Columbia Rivers were also genetically distinct from each other but had similar run timings. Conversely, some populations with similar run timings, such as lower Columbia River "tule" fall-run fish and upper Columbia River "bright" fall-run fish, were genetically distinct from one another. Juvenile outmigration also differed among some groups with similar adult run timing. For example, summer-run juveniles in the upper Columbia River exhibit ocean-type life-history characteristics, but summer-run chinook salmon in the Snake River migrate exhibit stream-type life-history characteristics.

In a status review of Snake River fall chinook salmon, Waples et al. (1991b) examined genetic relationships among fall-run chinook salmon in the Columbia and Snake Rivers (Group 3 of Waples et al. 1991a) in more detail. A UPGMA cluster analysis of Nei's unbiased genetic distance, based on 21 polymorphic loci, indicated that "bright" fall-run chinook salmon in the upper Columbia River were genetically distinct from those in the Snake River. Populations in the two groups were characterized by allele-frequency differences of about 10-20% at several loci, and these differences remained relatively constant from year to year in the late 1970s and early 1980s. However, allele-frequency shifts from 1985 to 1990 for samples of fall-run chinook salmon at Lyons Ferry Hatchery in the Snake River suggested that mixing with upper Columbia River fish had occurred. This is consistent with reports that stray hatchery fish from the upper Columbia River were inadvertently used as brood stock at the Lyons Ferry Hatchery. Samples of "bright" fall-run chinook salmon from the Deschutes River and the Marion Drain irrigation channel in the Yakima River Basin also appeared in the same cluster with samples of fall-run chinook salmon from the Snake River.

In a study of genetic effects of hatchery supplementation on naturally spawning populations in the upper Snake River Basin, Waples et al. (1993) examined allele-frequency variability at 35 polymorphic loci in 14 wild (no hatchery supplementation), naturally spawning (some hatchery supplementation), and hatchery populations of spring- and summer-run chinook salmon. Most populations were sampled over two years. An analysis of these data indicated that 96.6% of the genetic diversity existed as genetic differences among individuals within populations. Most of the remaining 3.4% was due to differences between localities, and only a negligible amount was due to allele-frequency differences between spring- and summer-run chinook salmon. Results reveal a close genetic affinity in the upper Snake River between natural spawners that suggests either gene flow between populations or a recent common ancestry. Comparisons between hatchery and natural populations in the same river indicated that the degree of genetic similarity between them reflected the source of the brood stock in the hatchery. As expected, the genetic similarity between wild and hatchery fish, for which local wild fish were used as brood stock, was high.

In a study of upper Columbia River chinook salmon, Utter et al. (1995) examined allele-frequency variability at 36 loci in samples of 16 populations. A UPGMA tree of Nei's (1972) genetic distances between samples indicated that spring-run populations were distinct from summer- and fall-run populations. The average genetic distance between samples from the two groups was about eight times the average of genetic distances between samples within each group. Allele-frequency variability among spring-run populations was considerably greater than that among summer- and fall-run populations in the upper Columbia River. The lack of strong allele-frequency differentiation between summer- and fall-run samples indicated minimal reproductive isolation between these two groups of fish. Hatchery populations of spring-run chinook salmon were genetically distinct from wild spring-run populations, but hatchery populations of fall-run chinook salmon were not genetically distinct from wild fall-run populations.

Some studies have indicated that Snake River spring- and summer-run chinook salmon have reduced levels of genetic variability. Utter et al. (1989) estimated gene diversities with 25 polymorphic loci for 65 population units and found that gene diversities in the Snake River were lower than those in the Columbia River. Winans (1989) estimated levels of gene diversity with 33 loci for spring-, summer-, and fall-run chinook salmon at 28 localities in the Columbia River Basin. Fall-run chinook salmon tended to have significantly greater levels of gene diversity (N=12, mean H=0.081) than both spring- (N=17, H=0.065) and summer-run (N=3, mean H=0.053) chinook salmon. Spring-run fish in the Snake River had the lowest gene diversities (N=4, mean H=0.044). However, Waples et al. (1991a) found that, with a larger sample of 65 loci, gene diversities in Snake River spring-run and summer-run chinook salmon were not as low as that suggested by earlier studies.

Recent, but unpublished, data are available for chinook salmon and will be discussed in the next section. However the results of the foregoing studies of Columbia and Snake River chinook salmon permit the following generalizations:

1) Populations of chinook salmon in the Columbia and Snake Rivers are genetically discrete from populations along the coasts of Washington and Oregon.

2) Strong genetic differences exist between populations of spring-run and fall-run fish in the upper Columbia and Snake Rivers. In the lower Columbia River, however, spring-run fish are genetically more closely allied with nearby fall-run fish in the lower Columbia River than with spring-run fish in the Snake and upper Columbia Rivers.

3) Summer-run fish are genetically related to spring-run fish in some areas (e.g., Snake River), but to fall-run fish in other areas (e.g., upper Columbia River).

4) Populations of fall-run fish are subdivided into several genetically discrete geographical groups in the Columbia and Snake Rivers (these populations will be discussed in detail in the next section).

5) Hatchery populations of chinook salmon tend to be genetically similar to the

respective source populations used to found or augment the hatchery populations.

6.2.5) Reasons for choosing.

The South Fork Salmon River endemic summer chinook salmon stock was used to found this program. Reasons for choosing include: availability, and local adaptability.

6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

The selection of natural-origin adults for broodstock purposes conforms with federal ESA permit and biological opinion language. Annually, escapement targets are prioritized to insure that a minimum number of natural-origin adults escape to spawn. Similarly, the release hatchery-origin adults in natural production areas is managed.

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Adult chinook salmon are collected for this program. Three groups of chinook salmon adults are collected at the McCall Fish Hatchery weir: natural (unmarked), supplementation (CWT marked or ventral fin clipped) and hatchery reserve (adipose fin-clipped). Supplementation broodstocks have been developed at the McCall Fish Hatchery as part of the cooperative Idaho Supplementation Studies project and are developed according to ISS genetic criteria.

7.2) Collection or sampling design.

Natural escapement criteria drives the selection process. Typically, this entails releasing a minimum of natural females, adult males and jack returns above the South Fork Salmon River weir to spawn naturally. The component of the adult return released above the weir to spawn may include up to 50% of hatchery or supplementation origin Surplus supplementation adult returns will be passed *over* the weir to supplement natural production up to natural equivalents. Supplementation adults surplus to management criteria for the South Fork Salmon River may be utilized for other purposes such as outplanting. Juvenile targets of supplementation broodstock are estimated to match natural smolt production upstream of the weir

7.3) Identity.

All harvest mitigation hatchery-produced fish are marked with an adipose fin clip and are progeny of hatchery x hatchery crosses. Releases for supplementation programs may be marked with a pelvic fin clip or CWT and no fin clip.

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults):

Approximately 380 female and 760 male chinook salmon are needed annually to meet state and federal production objectives for the McCall Fish Hatchery.

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

Information for 1995 through 2002 is presented below. Beginning in 1995, adult chinook salmon of hatchery origin were identifiable based on marks.

McCall Fish Hatchery broodstock collection history.

Return Year	McCall Fish Hatchery Total Returns (Hatchery-Produced/Natural)	Total Spawned (H/N)	Total Males Spawned (H/N)	Total Females Spawned (H/N)
1995	307 (269/38)	171 (159/12)	114 (106/8)	57 (53/4)
1996	1,199 (1,042/157)	333 (303/30)	222 (202/20)	111 (101/10)
1997	3,659 (3,371/288)	1,689 (1,587/102)	1,126 (1,058/68)	563 (529/34)
1998	974 (822/152)	897 (807/90)	598 (538/60)	299 (269/30)
1999	1,961 (1,670/291)	1,281 (1,212/69)	854 (808/46)	427 (404/23)
2000	6,812 (6,093/719)	1,083 (1,032/51)	722 (688/34)	361 (344/17)
2001	10,922 (9,144/1,778)	1,251 (1,221/30)	834 (814/20)	417 (407/10)
2002	8,603 (7,322/1,281)	1,143 (1,029/114)	762 (686/76)	381 (343/38)

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.

The disposition of surplus, hatchery-origin chinook salmon could include the sacrifice of fish and the distribution of carcasses to the tribes or to human assistance organizations for subsistance. In addition, surplus fish may be released in South Fork Salmon River tributary locations where potential interaction with natural spawners is expected to be minimal to non existent (e.g., East Fork of the South Fork Salmon River) or spawned to produce eggs for the Shoshone-Bannock Tribes experimental egg box program.

7.6) Fish transportation and holding methods.

Adult summer chinook salmon are trapped and spawned at the South Fork Salmon River trap site. Fish are held in two 10 ft wide x 90 ft long holding ponds. Trapped adults are sorted, checked for mark types, and separated by sex.

7.7) Describe fish health maintenance and sanitation procedures applied.

Fish receive routine treatments with formalin (167 ppm) to control the spread of fungus. At spawning, eggs from females exhibiting gross clinical signs of bacterial kidney disease may be culled. Tissue is sampled from each female spawned and analyzed for viral pathogens and for the causative agent responsible for bacterial kidney disease.

7.8) Disposition of carcasses.

Carcasses that result from adult holding and spawning are returned to the river (both upstream and downstream of the weir) or disposed of in a landfill.

7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

Broodstock selection criteria has been established to comply with ESA Section 10 permit and 7 consultation language in addition to meeting IDFG and cooperator mitigation and supplementation objectives.

SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1) Selection method.

Spawning protocols at the McCall Fish Hatchery follow plans developed annually (pursuant to ESA Section 7 and Section 10 language) to maintain a hatchery-reserve component and a supplementation component. Female spring chinook salmon are sorted two times per week. Generally, two spawn days occur each week. Males are randomly selected for spawning on each spawning day.

As each male is spawned it receives an opercle punch and is placed back into the holding pond. Males are generally not used more than two times. Every effort is made to use all returning fish for spawning during the spawning year. At least five to ten percent of the jacks will be used during the spawning process.

8.2) Males.

See Section 8.1.

8.3) Fertilization.

A spawning ratio of two males to one female is used. Each female sub-family is fertilized using a different male. Following fertilization, sub-family eggs are recombined into one container, disinfected in 100 ppm Iodophor for 60 minutes, and packed in perforated egg tubes for transportation to incubator stacks at the McCall Fish Hatchery.

8.4) Cryopreserved gametes.

Milt is not cryopreserved as part of this program and no cryopreserved gametes are used in this program. However, the Nez Perce Tribe may harvest milt for their gamete preservation program.

8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

Prior to spawning, adults may receive an antibiotic treatment to control the presence of the bacterium responsible for causing bacterial kidney disease. In addition, adults may receive formalin treatments to control the spread of fungus and fungus-related pre-spawn mortality. At spawning, ELISA optical density values for female spawners are used to establish criteria for egg culling and isolation incubation needs.

SECTION 9. INCUBATION AND REARING -

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

9.1) Incubation:

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.

The original Lower Snake River Compensation Program production target of 8,000 adults back to the project area upstream of Lower Granite Dam was based on a smolt-to-adult survival rate of 0.8 to 0.87%. With the exception of return year 2000 and 2001, the program has not met its adult return target. This is not due to lower than expected "in-hatchery" performance. Typically, egg survival to the eyed stage of development averages 80% or better for the McCall Fish Hatchery. Survival from ponding to release is typically greater than 80%. Egg survival information is presented in the following table.

Spawn Year	Green Eggs Taken	Eyed-eggs	Survival to Eyed Stage (%)
1992	1,428,819	1,220,600	85.4
1993	1,731,515	1,584,938	91.5
1994	689,039	607,733	88.2
1995	238,344	n/a	n/a
1996	486,644	436,509	89.7
1997	1,970,644	1,698,695	86.2
1998	1,433,237	1,053,017	73.5
1999	1,624,771	1,359,934	83.7
2000	1,487,809	1,149,313	77.3
2001	1,793,667	1,139,385	63.5
2002	1,683,642	1,469,819	87.3

Note: Survival to the eyed-stage of development data presented in the above table includes losses experienced from culling eggs for the management of BKD. As an example, in spawn year 2001, 1,793,667 green eggs were taken; 361,301 were picked as bad, and 270,523 eggs from females with high ELISA O.D. values were culled. The survival to eye value presented was calculated by adding the bad and culled egg total and dividing by the total number of green eggs taken. Therefore, egg survival information presented above may be lower than what was actually experienced.

9.1.2) Cause for, and disposition of surplus egg takes.

Surplus eggs may be generated (~ 10% above need) to provide a buffer against culling associated with the presence of bacterial kidney disease.

9.1.3) Loading densities applied during incubation.

Fertilized chinook salmon eggs are loaded in incubation trays at densities not to exceed 9,000 eggs per tray. If chinook salmon spawn targets are met (number of females spawned), eggs produced from crossing hatchery-reserve adults (adipose fin-clipped) are typically loaded in trays at a density of two females per tray. Eggs produced from crossing supplementation and natural adults are loaded at a density of one female per tray. This protocol is followed to better accommodate BKD culling criteria.

9.1.4) Incubation conditions.

The McCall Fish Hatchery has 26 eight-tray vertical incubation stacks (Heath-type) available for incubating eggs. In years where hatchery spawn targets are met (number of females spawned), eggs are typically loaded in incubation trays at densities not to exceed 9,000 eggs per tray. In years where spawn targets are not met, eggs from single females are typically loaded in incubator trays. Incubator flows are set at 5 to 6 gpm. Eggs typically reach the eyed-stage of development at approximately 600 Fahrenheit temperature units (FTUs).

9.1.5) Ponding.

Fry are typically ponded in hatchery vats approximately three days prior to initial feeding. Initial feeding typically occurs when 1,750 to 1,775 FTUs have been accumulated. Water flow to vats is set at approximately 80 gpm. Vats are initially loaded with between 30,000 and 35,000 fry. Fry are initially held in half-vat sections. When density indices (DI) reach between 0.30 and 0.35 (Piper et al. 1982), half-vat screens are pulled.

9.1.6) Fish health maintenance and monitoring.

Following fertilization, eggs are typically water-hardened in a 100 ppm Iodophor solution for up to 60 minutes. During incubation, eggs routinely receive scheduled formalin treatments to control the growth of fungus. Treatments are typically administered three times per week at a concentration of 1667 ppm active ingredient. Formalin treatments are discontinued prior to hatching. Prior to hatching, dead eggs are picked on a regular schedule (approximately 2 times per week) to discourage the spread of fungus.

9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

No adverse genetic or ecological effects to listed fish are anticipated. Eggs destined for supplementation and production releases are maintained in separate incubation trays. To offset potential risk from overcrowding and disease transmission, only eggs from one female (supplementation crosses) are placed in individual incubation trays.

9.2) Rearing:

9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available.

Brood Year	Eyed-Eggs	Number of Fry Ponded to Vats (% survival from eye)	Number of Fingerlings Transferred From Vats to Raceways (% survival from eye)	Number of Smolts Released	Percent Survival From Eyed-Egg to Release
1990	1,020,284	n/a	n/a	901,500	88.4
1991	n/a	n/a	n/a	n/a	n/a
1992	1,220,600	n/a	n/a	1,060,158	86.9
1993	1,584,938	1,341,332 (84.6)	1,091,989 (68.9)	1,074,598	67.8
1994	607,733	594,114 (97.8)	n/a	585,654	96.4
1995	250,599	246,840 (98.5)	239,263 (95.5)	238,647	95.2
1996	436,509	402,235 (92.1)	401,992 (92.1)	393,872	90.2
1997	1,698,695	1,447,670 (85.2)	1,340,370 (78.9)	1,142,036	67.2
1998	1,053,017	1,048,092 (99.5)	n/a	1,039,930	98.8
1999	1,359,934	1,347,660 (99.1)	n/a	1,286,404	94.6
2000	1,149,313	1,113,260 (96.9)	1,066,093 (92.8)	1,064,250	92.6

9.2.2) Density and loading criteria (goals and actual levels).

At the swim-up stage of development, unfed fry are moved to inside vats and distributed as evenly as possible (typically 30,000 to 35,000 fish per vat at ponding). Density (DI) and flow (FI) indices are maintained to not exceed 0.30 and 1.5, respectively (Piper et al. 1982).

9.2.3) Fish rearing conditions

Early rearing space consists of 14 concrete vats. Each vat measures 40 ft long x 4 ft wide x 2 ft deep and contains 320 cubic feet of rearing space. During early rearing, vats are cleaned daily and dead fish removed.

Fish are transferred to outside rearing ponds (two ponds 196 ft long x 40.5 ft wide x 4 ft deep) in early May and early July. Generally, transfer to outside rearing ponds occurs concurrently with fin clipping and tagging. Design capacity for outside rearing ponds is 500,000 fish per pond. Density and flow indices generally average less than 0.3 and 1.5, respectively. During final rearing, outside raceways are cleaned every other day but dead fish are removed daily.

9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.

Juvenile spring chinook salmon are sample-counted monthly. Fish length and weight are recorded. Condition factor and conversion rate are calculated. See Table in Section 9.2.5 below.

9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

First year growth information (monthly length increase) for spring chinook salmon reared at the McCall Fish Hatchery are presented below.

Month in Culture	Growth Increase Per Month (mm)
January	2.1
February	2.5
March	2.6
April	5.0
May	10.2
June	12.7
July	15.3
August	17.7
September	10.2
October	5.1
November	5.1
December	5.0
January	2.6
February	0
March	2.5

9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

During early rearing, summer chinook fry are fed a starter and grower diets produced by BioOregon. During final rearing in outside raceways, summer chinook salmon are fed BioOregon's grower diet. Specific hatchery variables are presented in the following table.

Month	Water Temp (ºC)	Fish Length (mm)	Percent Body Weight Fed Per Day	Conversion Rate
December	4.3	36.0	0.9	4.4
January	3.4	38.1	1.3	3.7
February	3.3	40.6	1.4	1.8
March	3.4	43.2	1.6	1.7
April	3.8	48.2	1.7	1.5
May	5.7	58.4	1.7	1.2
June	8.8	71.1	2.0	1.0
July	11.5	86.4	2.1	1.3
August	11.1	104.1	2.1	1.4
September	9.5	114.3	1.3	1.6
October	7.9	119.4	0.9	2.1
November	6.6	124.5	0.6	1.9
December	4.3	129.5	0.3	1.6
January	3.4	132.1	0.2	2.4
February	3.3	132.1	0.2	2.5
March	3.4	134.6	0.2	n/a

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.

At spawning, all summer chinook salmon are screened for bacterial and viral pathogens. Eggs from females positive for bacterial kidney disease *Renibacterium salmoninarum* (BKD) are culled to an acceptable risk level established annually by all stakeholders.

During rearing at the McCall Fish Hatchery, regular fish health inspections are conducted. If disease agents are suspected or identified, more frequent inspections will be conducted. Recommendations for treating specific disease agents comes from the Idaho Department of Fish and Game Fish Health Laboratory in Eagle, ID.

Prior to release, the Eagle Fish Health Laboratory conducts a final pre-release fish health inspection.

9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.

No smolt development indices are developed in this program.

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.

No semi-natural or natural rearing objectives are applied during chinook salmon incubation or rearing at the McCall Fish Hatchery. The Stolle Meadows acclimation ponds is used for some but not all juveniles released from this program.

9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

At spawning, ELISA optical density values for female spawners are used to establish criteria for egg culling and isolation incubation needs. Fish may receive prophylactic antibiotic treatments to control the spread of infectious disease agents. Fish are maintained at conservative density and flow indices (< 0.3 and < 1.5, respectively). Fish are fed by hand and observed several times daily. Proper disinfection protocols are in place. Rearing vats and raceways are swept on a regular basis.

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.

10.1) Proposed fish release levels.

The following release levels are proposed for release year 2003.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry				
Fingerling	60,000	125	July	Stolle Meadows Pond
Yearling	1,025,000	20	March/April	South Fork Salmon River Knox Bridge

10.2) Specific location(s) of proposed release(s).
Stream, river, or watercourse:

Release point: (*river kilometer location, or latitude/longitude*)
Major watershed: (e.g. "Skagit River")
Basin or Region: *(e.g. "Puget Sound")*

Stream: South Fork Salmon River (Knox Bridge)
Release Point (EPA Number): 17060208
Major Watershed: South Fork Salmon River

Basin or Region: Snake River

Stream: South Fork Salmon River (Stolle Meadows Pond)
Release Point (EPA Number): 17060208
Major Watershed: South Fork Salmon River
Basin or Region: Snake River

10.3) Actual numbers and sizes of fish released by age class through the program.

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1991					0	n/a	708,600	23.8
1992					0	n/a	901,500	23.8
1993					0	n/a	607,298	17.87
1994					51,163	n/a	1,060,163	25.58
1995					0	n/a	1,074,598	21.8
1996					0	n/a	559,226	17.87
1997					24,990	193.9	238,647	18.65
1998					48,376	149.7	393,873	17.50
1999					0	n/a	1,143,083	23.90
2000					54,234	n/a	1,039,930	23.30
2001					46,981	101.0	1,286,404	19.4
2002					61,800	125.0	1,064,250	22.97
Average							839,798	21.00

10.4) Actual dates of release and description of release protocols.

Release data information by life stage is presented for the most recent five-year period in the following table.

Brood Year	Release Year	Life Stage	Release Dates
1995	1997	Yearling	3/19 – 3/21/97
1996	1997	Fingerling	7/7 – 7/10/97
1996	1998	Yearling	3/29 – 4/6/98
1997	1998	Fingerling	no data
1997	1999	Yearling	4/5 – 4/8/99
1998	2000	Yearling	4/3 – 4/6/00
1999	2000	Fingerling	7/23 – 7/31/00

1999	2001	Yearling	3/27 – 3/29/01
2000	2001	Fingerling	7/20/01
2000	2002	Yearling	3/25 – 3/28/02

10.5) Fish transportation procedures, if applicable.

All fish reared at the McCall Fish Hatchery are transported off station for release in the South Fork Salmon River at Knox Bridge or to Stolle Meadows Pond for acclimation prior to release to the South Fork Salmon River. Fish are loaded into transport trucks using a Magic Valley Heliarc fish pump. The loading density guideline for transport vehicles is ½ pound per gallon of water. The transport tanks are insulated to maintain good temperature control. Each tank is fitted with an oxygen system and fresh flow agitators. Maximum transport time is approximately 1 hour.

10.6) Acclimation procedures (*methods applied and length of time*).

Up to approximately 100,000 juvenile summer chinook salmon may be acclimated annually in Stolle Meadows Pond. During the peak outmigration period, outlet screens are removed to allow fish to migrate volitionally. Following the volitional emigration period, the dam boards are removed and fish remaining in the ponds are forced out.

10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

All harvest mitigation fish are marked with an adipose fin clip. To evaluate emigration success and out-migration timing to meet state fisheries management needs, approximately 2,000 PIT tags are inserted in McCall Fish Hatchery release groups annually. Currently, a multi-year comparative survival rate study is underway (Berggren and Basham 2000) to collect additional out-migration to adult survival information. As part of this program, approximately 55,000 additional hatchery mitigation smolts are PIT tagged annually. As part of U.S. v. Canada quidelines, approximately 300,000 smolts are coded wire tagged annually. In addition, fish released to satisfy IDFG and cooperator supplementation studies project design are 100% coded wire tagged. Supplementation juveniles may be ventral fin clipped or 100% CWT tagged with no fin clip. Other studies may dictate additional evaluation marks.

Nez Perce Tribal supplementation juveniles reared at the McCall Fish Hatchery and released in Johnson Creek are typically 100% coded wire tagged and visual implant tagged. Approximately 10,000 PIT tags are inserted in tribal fish annually. Tribal fish are not fin clipped.

The number of juveniles produced to meet IDFG and cooperator supplementation studies objectives may change from year to year. Annual in-season brood stock planning is adapted to actual adult returns for each brood year. The following table reviews the proportion of summer chinook salmon produced at the McCall Fish Hatchery that have been dedicated to supplementation or production strategies for the past five years. As mentioned above, supplementation juveniles are not marked with an adipose fin clip; coded-wire tags and ventral fin clips may used to evaluate adult returns. Supplementation release groups are generally developed from natural x natural or natural x hatchery crosses. Harvest mitigation fish are developed from hatchery x hatchery crosses and are 100% adipose fin-clipped. It is important to note that a combination of evaluation tools including: dam counts, hatchery rack returns, harvest, and spawning ground surveys are used to reconstruct runs and estimate the total, annual contribution LSRCP hatchery programs are making. (see Attachment 1. for a review of the Idaho Supplementation Studies project).

The proportion of fish marked to meet IDFG and LSRCP mitigation and supplementation objectives for the most recent five-year period is presented in the following table.

Brood year	Proportion of annual production dedicated to IDFG supplementation programs	Proportion of annual production dedicated to IDFG and LSRCP harvest mitigation programs (100% ad fin-clipped)
McCall Fish Hatchery spring chinook salmon		
2000	8.0%	92.0%
1999	10.6%	89.4%
1998	18.7%	81.3%
1997	24.8%	75.2%
1996	11.5%	88.5%

10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

Adults may be utilized for fishery recycling, tribal, and non tribal subsistence use. Adults may also be outplanted into production areas that do not conflict with other programs or management. Gametes may be generated for tribal programs such as the Shoshone-Bannock Tribes experimental egg box program.

10.9) Fish health certification procedures applied pre-release.

Between 45 and 30 d prior to release, a 20 fish preliberation sample is taken from each rearing lot to assess the prevalence of viral replicating agents and to detect the pathogens responsible for bacterial kidney disease and whirling disease. In addition, an organosomatic index is developed for each release lot. Diagnostic services are provided by the IDFG Eagle Fish Health Laboratory.

10.10) Emergency release procedures in response to flooding or water system failure.

Emergency procedures are in place to guide activities in the event of potential catastrophic event. Plans at the McCall Fish Hatchery include a trouble shooting and repair process followed by the implementation of an emergency action plan if the problem can not be resolved. Emergency actions include fish consolidations and supplemental oxygenation. The final emergency action is to release early to the South Fork Salmon River.

10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

Actions taken to minimize adverse effects on listed fish include:

1. Continuing fish health practices to minimize the incidence of infectious disease agents. Follow IHOT, AFS, and PNFHPC guidelines.

2. Marking hatchery-produced spring chinook salmon for broodstock management. Smolts released for supplementation research will be marked differentially from other hatchery production fish.

3. Not releasing summer chinook salmon for supplementation research in the South Fork Salmon River in excess of estimated carrying capacity.

4. Continuing to reduce effect of the release of large numbers of hatchery chinook salmon at a single site by spreading the release over a number of days by trucking strategy or volitional release from ponds.

5. Attempting to program time of release to mimic natural fish for South Fork Salmon hatchery reserve releases.

6. Continuing to use broodstock for general production and supplementation research that exhibit life history characteristics similar to locally evolved stocks.

7. Continuing to segregate female summer chinook salmon broodstock for BKD via ELISA. We will incubate each female's progeny separately and also segregate progeny for rearing. We will continue development of culling and rearing segregation guidelines and practices, relative to BKD.

8. Monitoring hatchery effluent to ensure compliance with National Pollutant Discharge Elimination System permit.

9. Continuing Hatchery Evaluation Studies (HES) to provide comprehensive monitoring and evaluation for LSRCP chinook.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1) Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

11.1.1) Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

Document LSRCP fish rearing and release practices.

Performance Standards and Indicators: 3.2.2, 3.3.2, 3.4.1, 3.4.2, 3.4.3, 3.4.4, 3.5.2, 3.5.4, 3.5.5, 3.6.1, 3.6.2, 3.7.1, 3.7.2, 3.7.3, 3.7.4, 3.7.5

Document, report, and archive all pertinent information needed to successfully manage summer chinook salmon rearing and release practices. (e.g., number and composition of fish spawned, spawning protocols, spawning success, incubation and rearing techniques, juvenile mark and tag plans, juvenile release locations, number of juveniles released, size at release, migratory timing and success of juveniles, and fish health management).

Document the contribution LSRCP-reared summer chinook salmon make toward meeting mitigation and management objectives. Document juvenile out-migration and adult returns.

Performance Standards and Indicators: 3.1.1,3.1.2, 3.1.3, 3.2.1, 3.2.2, 3.3.1, 3.3.2, 3.4.3, 3.4.4, 3.5.1, 3.5.2, 3.5.3, 3.5.4, 3.5.5, 3.5.6, 3.6.1, 3.6.2, 3.7.6, 3.7.7, 3.7.8

Estimate the number of wild/natural and hatchery-produced chinook salmon escaping to project waters above Lower Granite Dam using dam counts, harvest information, spawner surveys, and trap information (e.g., presence/absence of identifying marks and tags, number, species, size, age, length). Conduct creel surveys and angler phone or mail surveys to collect harvest information. Assess juvenile outmigration success at traps and dams using direct counts, marks, and tags. Reconstruct runs by brood year. Summarize annual mark and tag information (e.g., juvenile out-migration survival, juvenile and adult run timing, adult return timing and survival). Develop estimates of smolt-to-adult survival for wild/natural and hatchery-produced chinook salmon. Use identifying marks and tags and age structure analysis to determine the composition of adult chinook salmon.

Identify factors that are potentially limiting program success and recommend operational modifications, based on the outcome applied studies, to improve overall performance and success.

Performance Standards and Indicators: 3.6.1, 3.6.2

Evaluate potential relationships between rearing and release history and juvenile and adult survival information. Develop hypotheses and experimental designs to investigate practices that may be limiting program success. Implement study recommendations and monitor and evaluate outcomes.

11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

Yes, funding, staffing and support logistics are dedicated to the existing monitoring and evaluation program through the LSRCP program. Additional monitoring and evaluation activities (that contribute effort and information to addressing similar or common objectives) are associated with BPA Fish and Wildlife programs referenced in Section 12, below.

11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

Risk aversion measures for research activities associated with the evaluation of the Lower Snake River Compensation Program are specified in our ESA Section 7 Consultation and Section 10 Permit 1124. A brief summary of the kinds of actions taken is provided.

Adult handling activities are conducted to minimize impacts to ESA-listed, non-target species. Adult and juvenile weirs and screw traps are engineered properly and installed in locations that minimize adverse impacts to both target and non-target species. All trapping facilities are constantly monitored to minimize a variety of risks (e.g., high water periods, high emigration or escapement periods, security).

Adult spawner and redd surveys are conducted to minimize potential risks to all life stages of ESA-listed species. The IDFG conducts formal redd count training annually. During surveys, care is taken to not disturb ESA-listed species and to not walk in the vicinity of completed redds.

Snorkel surveys conducted primarily to assess juvenile abundance and density are conducted in index sections only to minimize disturbance to ESA-listed species. Displacement of fish is kept to a minimum.

Marking and tagging activities are designed to protect ESA-listed species and allow mitigation harvest objectives to be pursued/met. All McCall Fish Hatchery mitigation summer chinook salmon are visibly marked to differentiate them from their wild/natural counterpart.

SECTION 12. RESEARCH

12.1) Objective or purpose.

An extensive monitoring and evaluation program is conducted in the basin to document hatchery practices and evaluate the success of the hatchery programs at meeting program mitigation objectives, Idaho Department of Fish and Game management objectives, and to monitor and evaluate the success of supplementation programs. The hatchery monitoring and evaluation program identifies hatchery rearing and release strategies that will allow the program to meet its mitigation requirements and improve the survival of hatchery fish while avoiding negative impacts to natural (including listed) populations.

To properly evaluate this compensation effort, adult returns to facilities, spawning areas, and fisheries that result from hatchery releases are documented. The program requires the cooperative efforts of the Idaho Department of Fish and Game's hatchery evaluation study, regional harvest monitoring project, and the coded-wire tag laboratory programs. The Hatchery evaluation study evaluates and provides oversight of certain hatchery operational practices, (e.g., broodstock selection, size and number of fish reared, disease history, and time of release). Hatchery practices will be assessed in relation to their effects on adult returns. Recommendations for improvement of hatchery operations will be made.

The regional harvest monitoring project provides comprehensive harvest information, which is key to evaluating the success of the program in meeting adult return goals. Numbers of hatchery and wild/natural fish observed in the fishery and in overall returns to the project area in Idaho are estimated. Data on the timing and distribution of the marked hatchery and wild stocks in the fishery are also collected and analyzed to develop harvest management plans. Harvest data provided by the harvest monitoring project are coupled with hatchery return data to provide an estimate of returns from program releases. Coded-wire tags continue to be used extensively to evaluate fisheries contribution of representative groups of program production releases. However, most of these fish serve experimental purposes as well, i.e., for evaluation of hatchery-controlled variables such as size, time, and location of release, rearing densities, etc.

Continuous coordination between the hatchery evaluation study and Idaho Department of Fish and Game's BPA-funded supplementation research project is required because these programs overlap in several areas for different species including: juvenile outplanting, broodstock collection, and spawning (mating) strategies. Readers are referred to Attachment 1. for a review of the IDFG supplementation studies project.

12.2) Cooperating and funding agencies.

U.S. Fish and Wildlife Service – Lower Snake River Compensation Plan Office.

U.S. Forest Service

Nez Perce Tribe.

Shoshone Bannock Tribes.

12.3) Principle investigator or project supervisor and staff.

Steve Yundt – Fisheries Research Manager, Idaho Department of Fish and Game.

12.4) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

N/A

12.5) Techniques: include capture methods, drugs, samples collected, tags applied.

Research techniques associated with the operation of the McCall Fish Hatchery summer chinook salmon program involve: hatchery staff; LSRCP hatchery evaluation, and coded-wire tag laboratory staff; Idaho supplementation studies staff, and IDFG regional fisheries management staff.

Hatchery staff routinely investigate hatchery variables (e.g., diet used, ration fed, vat or raceway environmental conditions, release timing, size at release, acclimation, etc.) to improve program success. Hatchery-oriented research generally involves the cooperation of LSRCP hatchery evaluation staff. In most cases, PIT and coded-wire tags are used to measure the effect of specific treatments. The IDFG works cooperatively with the Nez Perce Tribe and the U.S. Fish and Wildlife Service to develop annual mark plans for summer chinook salmon juveniles produced at the McCall Fish Hatchery. Cooperation with regional harvest monitoring and LSRCP coded-wire tag laboratory staff is required to thoroughly track the distribution of tags in adult salmon. Generally, most hatchery-oriented research occurs prior to the release of fall pre-smolt or spring smolt groups. As such, no field trapping occurs.

Regional harvest monitoring staff assemble information on chinook salmon sport fisheries. Estimates of harvest, pressure, and catch per unit effort are developed in years when sport fisheries occur. The contribution LSRCP-produced fish make to the fishery is also assessed.

Idaho supplementation studies and IDFG regional fisheries management staff work cooperatively to assemble annual juvenile chinook salmon out-migration and adult return data sets. Weir traps and screw traps are used to capture emigrating juvenile chinook salmon. Generally, all target species captured are anesthetized and handled. A portion of captured juveniles may be fin clipped or PIT tagged (See Attachment 1. for Idaho supplementation studies detail). Adult information is assembled from a variety of information sources including: dam and weir counts, fishery information, coded-wire tag information, redd surveys, and spawning surveys.

Idaho Department of Fish and Game and cooperator staff may sample adult chinook carcasses to collect tissue samples for subsequent genetic analysis. Additionally, otoliths, scales, or fins may be collected for age analysis.

12.6) Dates or time period in which research activity occurs.

Fish culture practices are monitored throughout the year by hatchery and hatchery evaluation research staff.

Adult escapement is monitored at downstream dams and above Lower Granite Dam during the majority of the year. Harvest information is collected during periods when sport and tribal fisheries occur. The PSMFC Regional Mark Information System is queried on a year-round basis to retrieve adult coded-wire tag information.

Juvenile out-migration is monitored during fall, spring, and summer trapping seasons in Idaho. Out-migration through the hydro system corridor is typically monitored from March through December. Juvenile chinook salmon population abundance and density is monitored during late spring and summer months. Juvenile tagging and marking occurs during late summer, fall, and spring periods of movement. The PSMFC PIT Tag Information System is queried on a year-round basis to retrieve juvenile PIT tag information.

Fish health monitoring occurs year round.

12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.

Research activities that involve the handling of eggs or fish apply the same protocols reviewed in Section 9 above. Hatchery staff generally assist with all cooperative activities involving the handling of eggs or fish.

12.8) Expected type and effects of take and potential for injury or mortality.

See Table 1. Generally, take for research activities is defined as: "observe/harass", and "capture, handle, mark, tissue sample, release."

12.9) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1).

See Table 1.

12.10) Alternative methods to achieve project objectives.

Alternative methods to achieve research objectives have not been developed.

12.11) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

N/A.

12.12) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.

See Section 11.2 above.

SECTION 13. ATTACHMENTS AND CITATIONS

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Attachment 1.

The following excerpts were taken from:

Bowles, E., and E. Leitzinger. 1991. Salmon Supplementation Studies in Idaho Rivers. Experimental Design. Prepared for U.S. Department of Energy. Bonneville Power Administration. Environment, Fish and Wildlife. Project No. 89-098, Contract No. 89-BI-01466. Portland, OR.

Note: as this information first appeared in the original 1991 experimental design document for this program, some information may be outdated. The text has not been modified.

Study Streams

Study streams were classified into two categories based on the existing status and history of the chinook population. Target streams without existing natural populations are classified as supplementation-restoration streams; streams with existing natural populations are classified as supplementation-augmentation. Our design utilizes 11 treatment and 10 control streams classified as having existing natural populations. This classification pertains to all of our study streams in the upper Salmon River drainage and six streams (Red River and Crooked Fork, Lolo, Clear, Bear, and Brushy Fork creeks) in the Clearwater River drainage. We will utilize nine treatment streams to evaluate supplementation-restoration in areas without existing natural populations. These streams are all located in the Clearwater River drainage, except Slate Creek located in the lower Salmon River drainage.

General Criteria

Several basic assumptions or approaches were used to guide development of production plans for each treatment stream.

- For upriver chinook stocks, supplementation cannot be considered an alternative to reducing downriver mortalities. Success is dependent on concurrent improvement in flows, passage and harvest constraints.
- Supplementation can increase natural production (i.e. numbers) but not natural productivity (i.e. survival), except possibly in situations where natural populations are suffering severe inbreeding depression. Reductions in natural productivity can be minimized through proper supplementation strategies so that enhanced production more than compensates for reduced natural productivity.
- Supplementation can potentially benefit only those populations limited by density-independent or depensatory smolt-to-adult mortality. Existing natural smolt production must be limited by adult escapement and not spawning or rearing habitat.
- For supplementation-augmentation programs to be successful, the hatchery component must provide a net survival benefit (adult-to-adult) for the target stock as compared to the natural component.
- Supplementation programs should be kept separate and isolated from traditional

harvest augmentation programs. We hypothesize that some of the past failures of supplementation have been because we have tried to supplement with the wrong product. Conventional hatchery programs are driven by the logical goal to maximize in-hatchery survival and adult returns. This approach may not necessarily be conducive to producing a product that is able to return and produce viable offspring in the natural environment.

- Supplementation strategies (e.g.. broodstock, rearing and release techniques) should be selected to maximize compatibility and introgression with the natural stock and minimize reduction in natural productivity. Harvest augmentation strategies should be selected to maximize adult returns for harvest and minimize interaction/introgression with natural populations.
- Success of hatchery supplementation programs are dependent upon our ability to circumvent some early life history mortality without compromising natural selective processes or incurring hatchery selective mortality. Supplementation programs should be designed to minimize mortality events operating randomly (non-selective) and duplicate mortality events operating selectively on chinook in the natural environment. This, in essence, is the only role of a supplementation hatchery, to reduce random mortality effects in order to produce a net gain in productivity.
- Although our experimental design does not pursue the above assumption vigorously, we encourage implementation of hatchery practices in an adaptive framework to investigate this assumption. Some of this will be initiated in our small-scale studies, or through the LSRCP Hatchery Evaluation Study. Careful design, monitoring and evaluation with treatment and control groups will be necessary to avoid confounding our study results.
- In areas with existing (target) natural populations, we recommend supplementation should not exceed a 50:50 balance between hatchery and natural fish spawning or rearing in the target streams. Under this criteria, supplementation programs are driven by natural fish escapement or rearing abundance, not necessarily hatchery fish availability. Adherence to this criteria results in a slow, patient supplementation approach when existing stocks are at only 10% to 20% carrying capacity, which is typical in Idaho. This concept is nothing new and is promulgated in the IDFG Anadromous Five Year Plan (IDFG 1991) and Oregon's Wild Fish Management Policy (Oregon Administrative Rule 635-07-525 through 529).
- In areas with existing natural populations, we recommend supplementation broodstocks incorporate a relatively high proportion (~40%) of natural fish selected systematically from the target stock. This approach will minimize domestication effects and naturalize hatchery fish as quickly as possible.
- By following the criteria of using natural broodstock and mimicking natural selective pressures to some degree, we anticipate supplementation programs will experience lower in-hatchery survival than is typical of conventional hatchery programs. We believe the very causes of higher in-hatchery mortality will also provide for substantially higher release-to-adult survival and long term fitness. Our modeling indicates that enhanced survival during this post-release stage is critical to the success of supplementation, much more so than the pre-release.
- In areas without existing (target) natural populations, we recommend supplementation-restoration programs be designed to provide 25% to 50% of the

natural summer rearing capacity within one or two generations, depending on hatchery fish availability.

- In all instances, once interim management goals for natural production have been met (e.g. 70% summer carrying capacity), surplus natural and supplementation adults would be available for harvest or other broodstock needs. This criteria does not preclude flexibility for limited harvest prior to reaching management goals.

Supplementation Protocols

We have partitioned specific production plans into eight broad components: existing program, supplementation broodstock management, spawning, incubation, rearing, release, adult returns, and risk assessment. Where feasible, all phases will follow genetic guidelines currently being developed for the Basin (Currens et al. 1991; Emlen et al. 1991; Kapuscinski et al. 1991). The following provides a generalization for each component of the production plans.

Existing Programs

To minimize risk, the majority of our study (70%) is proposed for areas with existing hatchery programs that include supplementation objectives. Five of eight total treatment streams in the Salmon drainage and six of twelve in the Clear-water drainages have existing hatchery programs. An additional three treatment streams have hatchery programs planned independent to our supplementation research.

Existing programs in areas with viable natural populations typically include a weir to trap adults for broodstock and a hatchery facility nearby or in an adjacent sub-basin. Broodstock is collected systematically from adult returns comprised of an unknown proportion of hatchery and natural fish. Typically, one out of every three (33%) females and males is passed over the weir to spawn naturally and the remaining two out of three (67%) are brought into the hatchery for broodstock. Fish are spawned non-selectively throughout the run at a 1:l sex ratio. Progeny are incubated in stacked, horizontal trays (Heath) and reared in concrete raceways or pods. Rearing Density Index typically averages less than 0.3 lbs/ft/in and Flow Indexes typically range from 1 to 2 lbs/in x gal/min (T. Rogers, IDFG, personal communication).

Most fish are reared to smolt and released unmarked during mid April. Releases are typically on-site or trucked to a single release site without an acclimation period. Some programs outplant progeny into on-site rearing and acclimation ponds in June and implement a forced release of presmolts from the ponds in October. The supplementation aspect of these programs is represented by the passage of an unknown component of hatchery adult returns over the weir to spawn naturally. In general, monitoring and evaluation of this supplementation is limited to trend redd counts and in some cases, trend parr density estimates. No evaluation of adult returns is possible because fish cannot be differentiated between hatchery and natural origin.

Existing programs in areas without currently viable natural populations typically include outplanting Parr, presmolts and smolts developed from non-local hatchery broodstocks. In areas where hatchery returns to the target stream have been. used for brood stock, progeny are usually "topped off" with other fish to meet hatchery production and site-specific release goals.

Supplementation Broodstocks

Broodstocks used for target streams with existing natural populations will typically utilize weirs to collect natural and hatchery adults returning to the target stream. Using the target stock as a donor source for supplementation corresponds to the first priority choice specified for genetic conservation by Kapuscinski et al. (1991).

We are currently unable to differentiate hatchery and natural returns in areas with existing hatchery programs. Beginning with BY 1991 all hatchery fish released in study areas will be marked to differentiate supplementation fish, general hatchery production fish and natural fish. During this first (transitional) generation, supplementation broodstocks will be similar to general hatchery production broodstocks, comprised of an unknown component of hatchery and natural origin fish selected systematically from 33% to 50% of the returns. As soon as returns are comprised of known-origin fish (approximately 1996), broodstock selection will be modified.

Natural escapement criteria will drive the selection process. Typically this will entail releasing a minimum of two out of every three (67%) natural female, adult male and jack returns above the weir to spawn naturally. No more than 33% of the natural run will be brought into the hatchery for broodstock. This natural component will comprise a minimum of 50% of the supplementation broodstock. Thus hatchery returns can comprise no more than 50% of the supplementation broodstock. Surplus supplementation adult returns will be passed *over* the weir to supplement natural production up to natural equivalents; fish surplus to this need will be used for the general hatchery production broodstock.

Broodstocks used to supplement areas without existing natural production will be selected from existing hatchery broodstocks based on similarity to historical stocks, availability of fish, and expected or proven performance in the wild. Although this donor source represents the last alternative for broodstock selection as identified by Kapuscinski et al. (1991), it meets the criteria for first priority based on potential risk of collecting broodstock from severely depleted natural populations nearby. These broodstocks will typically be used for only one to two generations.

Spawning

Spawning protocols will typically follow existing hatchery practices. Sexes will be spawned 1:l as they ripen, without selection for size, age, appearance and hatchery-natural origin. The only selection will be to segregate known disease carriers (BKD) from supplementation broodstock. Spawn timing will be dependent on ripeness, which is assumed to correspond with run timing. For stocks with low effective population sizes (N,), factorial crosses or diallele crosses will be utilized to increase allelic diversity and N, (Kapuscinski et al. 1991). Once differentiation of hatchery and natural returns is possible (1996), mating composition (e.g. HxH, NxH, NxN) will be documented to track relative survival to emergence, and for use as a covariate in our long-term productivity studies.

Incubation

Incubation protocols will typically follow existing hatchery practices. Where feasible, individual matings will be kept separate in incubation trays and isolated from disease vectors. Incubation water is typically a mixture of well and river water resulting in more thermal units and earlier emergence than occurs in nature.

Rearing

Rearing protocols will typically follow existing hatchery practices. Emergent fry are loaded into early rearing vats from mid December through February for feed training and reared to approximately 100 fish/pound (mid June) before release as parr or transfer into advanced rearing ponds or raceways. Rearing containers will be typically concrete or plastic with single-pass flow systems derived from well or river water. Baffles will be used in some hatcheries to facilitate cleaning and provide variable water velocity environments. Rearing density will range from 0.5 to 1.5 lbs/ft3 and may be modified based on results of the rearing density study currently underway at Sawtooth and Dworshak hatcheries. Feeding is done manually at regular intervals throughout the ponds and raceways with moist commercial products.

Marking

All supplementation and general production fish released in study areas will be marked with a pelvic fin or maxillary clip until alternative marks are proven. Marks will be administered during early rearing, just prior to the transfer of fish from vats into advanced rearing raceways and ponds. Fish size will be approximately 75 mm and 100 fish/pound. Randomly selected fish will be PIT tagged at this time for parr and presmolt releases, and late summer for fish released as smelts.

Releases

Supplementation smelts will be released off site at multiple release points distributed throughout the treatment stream. Smelts will be trucked to release points and released directly into the stream without acclimation ponding, although natural slackwater areas such as side channels and beaver ponds will be utilized if available. Water temperature acclimation will be administered in the trucks if necessary (i.e. >5ºC differential).

Where possible (e.g. Lemhi River), size and time of release will be programmed to mimic natural fish. This will require releasing smelts mid April at approximately 90-100 mm (48-66 fish/pound). Efforts will be made to coincide releases with environmental cues (e.g. lowering barometric pressure, freshets; Kiefer and Forster 1991). At present, most existing facilities do not have the ability to mimic the time and size of natural smolt emigration. Size and time of release is typically 20 smelts/pound released in March, whereas natural smelts emigrate from the upper Salmon River at approximately 66 fish/pound during mid April (Kiefer and Forster 1991). Chillers would be required on most of our hatcheries to meet these criteria. Our research is not proposing these modifications during the first generation of rearing.

Fall presmolts released for supplementation will be released directly from on-site rearing ponds or trucked to multiple release points throughout the study area. Fish will typically be released mid September to October to correspond with peak natural fall emigration (Kiefer and Forster 1990). Fish size will be slightly larger (100 mm vs. 80 mm) than the natural fish as a result of thermal constraints during incubation and early rearing.

Supplementation parr will be released off site at multiple release points distributed throughout the treatment stream. These unacclimated releases will be by helicopter or trucks. Fish will be released mid June, just prior to transfer from vats to advanced rearing containers. Fish size (>75 mm) will be substantially larger than expected for natural fish (40-50 mm) so fry and parr releases will only occur in streams without existing natural populations (except Lemhi River). One of our small scale studies will investigate the effects of hatchery parr size on natural fry and parr.

Adult Returns

Until interim management goals for escapement (e.g. 70% carrying capacity) are met, enough natural and supplementation fish (marked differently from harvest fish) need to be escaped through terminal fisheries to allow adequate rebuilding and evaluation. This will require non-lethal gear restrictions and catch and release of natural and supplementation fish in terminal areas, if fisheries targeting hatchery stocks are deemed prudent. Studies in British Columbia indicate that hooking mortality of chinook in terminal area catch and release fisheries will be approximately 5%, which is similar for steelhead (T. Gjernes, B.C. Dept. of Fish. and Oceans, personal communication). If lethal gear is used, weak-stock harvest guotas will be regulated to maintain minimal exploitation (e.g.no more than 10%) on natural and supplementation fish. In all instances, terminal fisheries on study stocks will require precise and accurate creel survey data.

Weir management for returning adults will include passing an established proportion of natural fish (e.g. 67%, 75% or 80%), which will in turn determine the number of supplementation fish to pass. Non-supplementation hatchery returns will not be passed over the weir.

Risk Assessment

Our risk assessment of supplementation is based primarily on genetic concerns and follows guidelines currently being developed in the Basin (Busack 1990;Currens et al.1991; Emlen et al.1991; Kapuscinski et al. 1991). All upriver stocks of chinook salmon are currently experiencing severe genetic risks to long-term stock viability (Riggs 1990; Mathews and Waples 1991;Nehlsen et al. 1991). We believe the major contributors to this genetic "bottlenecking" are system modifications (e.g. harvest, flows, and passage) which exert tremendous mortality and artificial selection pressures. These system constraints have forced many upriver stocks into a genetically vulnerable status warranting probable protection under the Endangered Species Act.

In addition to the overriding genetic risks imposed by system modifications, there are also genetic risks to natural stocks associated with the operation of mitigation hatcheries (Busack 1990; Kapuscinski 1990; RASP 1991). Busack (1990) identified four main types of genetic risk associated with hatchery activities: extinction, loss of within population variability, loss of population identity, and inadvertent selection. Kapuscinski et al. (1991) provides a discussion of these risks, possible causative hatchery practices, and the associated genetic process.

Most of our experimental treatments will be implemented in areas with existing hatchery programs that have at least partial supplementation objectives. In general the genetic risk of our experimental design is quite low relative to these existing hatchery programs.

Broodstock management and non-selective spawning protocols should minimize risks to population variability and identity. In areas with existing natural populations, supplementation programs will typically utilize local broodstocks comprised of hatchery and natural fish. During the first generation (5 years) the relative composition will be unknown because of unmarked hatchery fish. By the second generation, all hatchery returns will be marked and a natural component criteria (e.g. >40% natural fish) will determine broodstock collection. In all cases, natural escapement criteria (e.g.67%, 75% or 80% of natural run) will drive the programs.

Mating procedures will be non-selective for age, size or appearance, with pairings at 1:l sex ratios or factorial crosses. Progeny will typically be isolated from general hatchery production fish and marked prior to release. Releases will be timed to coincide with known environmental cues or peak natural emigration activity. In all instances, general hatchery production returns will not be passed over weirs to spawn naturally.

The greatest source of genetic risk associated with our supplementation programs is inadvertent selection resulting from hatchery rearing environments. Most of our experimental design will utilize existing hatcheries with ongoing production programs. These hatcheries were designed and are operated to maximize in-hatchery survival within the constraints of fish marking and production targets. These facilities were not designed to simulate selective pressures associated with natural rearing. In spite of the dramatic egg-to-release survival advantage experienced in the hatchery (up to 8-fold) it may be possible that those fish best suited for survival in the natural environment are the very fish lost in the hatchery environment (Reisenbichler and McIntyre 1977; Chilcote et al. 1986). In addition to this direct selection, there are indirect selection risks associated with hatchery environments not providing the necessary "training" required to maximize post-release survival. These risks are best alleviated by designing hatchery facilities and programs to simulate natural selective pressures and minimize mortality from random natural mortality events.

As discussed previously, we are not proposing dramatic modifications to hatchery facilities and programs during this first generation. Movement in this direction will be a result of LSRCP evaluations and recommendations. Although static and standardized hatchery facilities and practices would be best for statistically powerful inferences from our supplementation treatments, we do not recommend nor anticipate this scenario. We do recommend that changes in hatcheries follow adaptive management procedures and are fully monitored and evaluated with controls to avoid confounding our results.

The major risks associated with supplementation of extirpated populations is straying and introgression/interaction with adjacent natural populations. Introgression from straying can result in genetic drift, loss of identity and outplanting depression. To reduce this risk, selection of donor broodstocks followed criteria proposed by Kapuscinski et al. (1991) and Currens et al. (1991). Regrettably, suitable neighboring or out-of-basin natural stocks are typically unavailable or too vulnerable to extinction themselves to provide brood. As a result, hatchery broodstocks were selected based on the outplanting history of the target stream, location, availability of brood, and demonstrated performance.

Recent studies indicate high homing integrity to release sites for hatchery chinook (Fulton and Pearson 1981; Quinn and Fresh 1984; Sankovich 1990). Straying or wandering is apparently more probable in downriver areas than terminal areas, and is often accentuated if environmental factors (e.g. temperature, flows) inhibit passage (Phinney 1990). In general, our restoration treatment areas are located in areas without adjacent natural populations. We recommend that all general hatchery production fish released in natural production areas be imprinted on morpholine to minimize straying. Although inconclusive, chinook and other fish have been shown to imprint on dilute concentrations of morpholine, resulting in enhanced homing integrity to release site drip stations.

Genetic risks to other naturally reproducing fish populations (e.g. steelhead, cutthroat, rainbow) are minimal. All areas to be supplemented historically have maintained viable chinook populations which co-evolved with these populations. The main risks are associated with potential overestimation of carrying capacity resulting in a swamping of available habitats; elevated exposure to pathogens carried by hatchery fish; and, supplementation fish exhibiting characteristics (e.g. size, behavior, run timing, residualism, etc.) not evolved in the local habitat. These risks will be minimized by maintaining releases at less than 50% of estimated carrying capacity, only releasing fish certified to be free of detectable pathogens, and selecting donor stocks for supplementation that exhibit life history characteristics similar to locally evolved stocks.

Once again, we are weak in areas of hatchery induced behavioral and size differences. We will program size and time of release of supplementation fish to match the natural component as best possible, given the constraints of our facilities. In situations where the hatchery product represents an obvious risk, we will not incorporate it into our long term studies until the risk is assessed. For example, our inability to mimic natural incubation and early rearing growth conditions results in hatchery fry being larger than natural chinook fry at any given time. We will assess the competitive interaction associated with this size disparity prior to incorporating a large-scale fry or parr release into areas with existing natural chinook populations.

Potential Harvest Opportunities

Although it is not the role of ISS to recommend additional management strategies, nor would we presume that prerogative, we do feel it is important to address harvest augmentation opportunities. The justifiably high demand for recreational, ceremonial and subsistence fisheries may have a direct impact on the acceptance and long-term integrity of ISS. The 1.5s Design does not preclude potential harvest opportunities. Implementation of harvest augmentation programs using strategies designed to minimize risks to natural populations can provide for needed fisheries. These interim measures will also buy time and support for the slow, patient rebuilding process required to supplement natural populations. The IDFG Anadromous Fisheries Management Plan provides a detailed discussion of harvest opportunities and programs (IDFG 1991).

Attachment 2. Idaho Department of Fish and Game redd count data for Salmon and Clearwater index streams.

Stream	Basin	Year	Stream Length	Number of Redds Counted	Redds per kilometer	New Length	New Redds	New Redds/km	Comments
American River	Clearwater	2001	34.6	390	11.27	34.60	390	11.272	
American River	Clearwater	2000	34.6	130	3.76	34.60	130	3.757	
American River	Clearwater	1999	34.6	1	0.03	34.60	1	0.029	
American River	Clearwater	1998	34.6	112	3.24	34.60	112	3.237	
American River	Clearwater	1997	34.6	311	8.99	34.60	311	8.988	
American River	Clearwater	1996	34.6	9	0.26	34.60	9	0.260	
American River	Clearwater	1995	34.6	0	0.00	34.60	0	0.000	
American River	Clearwater	1994	34.6	9	0.26	34.60	9	0.260	
American River	Clearwater	1993	34.6	209	6.04	34.60	209	6.040 [c]	
American River	Clearwater	1992	33.3	5	0.15	33.30	5	0.150	
Big Flat Creek	Clearwater	2001	4.8	14	2.92	4.80	14	2.917	
Big Flat Creek	Clearwater	2000	4.8	0	0.00	4.80	0	0.000	
Big Flat Creek	Clearwater	1999	NC[d]	NC					
Big Flat Creek	Clearwater	1998	NC[d]	NC					
Big Flat Creek	Clearwater	1997	4.8	7	1.46	4.80	7	1.458	
Big Flat Creek	Clearwater	1996	1.5	0	0.00	4.8	0	0.000	New length adjusted for comparisons
Big Flat Creek	Clearwater	1995	5.6	0	0.00	4.8	0	0.000	3.6 miles walked but no redds found
Big Flat Creek	Clearwater	1994	NC	NC					
Big Flat Creek	Clearwater	1993	6	3	0.50	6	3	0.500	
Big Flat Creek	Clearwater	1992	8	8	1.00	8	8	1.000	
Brushy Fork and Spruce Creek	Clearwater	2001	16.1	143	8.88	12.1	127	10.496	
Brushy Fork and Spruce Creek	Clearwater	2000	16.1	16	0.99	12.1	16	1.322	
Brushy Fork and Spruce Creek	Clearwater	1999	16.1	3	0.19	12.1	3	0.248	
Brushy Fork and Spruce Creek	Clearwater	1998	16.1	19	1.18	12.1	19	1.570	
Brushy Fork and Spruce Creek	Clearwater	1997	20.7	75	3.62	12.1	74	6.116	The entire section from the mouth to spruce was surveyed. 12 redds were observed from the mouth to the lower meadow. While the lower meadow is above Pestle Rock, we were unable to determine where the redds were. Since we see very few redds below Pestle Rock, we decided to put all 12 redds above Pestle Rock and truncate the distance to 12.1 km
Brushy Fork and Spruce Creek	Clearwater	1996	21.5	5	0.23	12.1	5	0.413	
Brushy Fork and Spruce Creek	Clearwater	1995	14	5	0.36	8.5	5	0.588	
Brushy Fork and Spruce Creek	Clearwater	1994	21.5	0[h]	0.00	12.1	0	0.000 [h]	
Brushy Fork and Spruce Creek	Clearwater	1993	18.1	25	1.38	12.1	25	2.066	The entire section from the mouth to spruce was surveyed but no redds were observed from the mouth to pestle rock so we truncated the distance to 12.1 km
Brushy Fork and Spruce Creek	Clearwater	1992	14	7	0.50	12.1	7	0.579	Redd number not verified
Clear Creek	Clearwater	2001	20.2	166s	8.2	18.2	127	6.978	
Clear Creek	Clearwater	2000	20.2	30	1.50	18.2	19	1.044	
Clear Creek	Clearwater	1999	16.1	0	0.00	18.2	0	0.000	
Clear Creek	Clearwater	1998	18.5	2	0.11	18.2	1	0.055	
Clear Creek	Clearwater	1997	18.5	17	0.92	18.2	12	0.659	
Clear Creek	Clearwater	1996	16.1	3	0.19	18.2	3	0.165	
Clear Creek	Clearwater	1995	16.1	0	0.00	18.2	0	0.000	

Clear Creek	Clearwater	1994	16.1	1	0.06	18.2	1	0.055	
Clear Creek	Clearwater	1993	16.1	7	0.43	18.2	7	0.385	
Clear Creek	Clearwater	1992	16.1	1	0.06	18.2	1	0.055	
Clear Creek	Clearwater	1991	16.1	4	0.25	16.1	4	0.248	
Colt Killed Creek	Clearwater	2001	50.2	113	2.25	31.6	92	2.911	Ground count from mouth to Heather Cr.
Colt Killed Creek	Clearwater	2000	50.2	2	0.04	26.1	2	0.077	Aerial survey from mouth to big flat
Colt Killed Creek	Clearwater	1999	50.2	0	0.00	26.1	0	0.000 [m]	Aerial survey from mouth to big flat
Colt Killed Creek	Clearwater	1998	50.2	2	0.04	26.1	0	0.000 [m]	Aerial survey from mouth to big flat
Colt Killed Creek	Clearwater	1997	35.7	22	0.62	30.9	22	0.712 [n]	Ground count from mouth to 3 mi above big flat
Colt Killed Creek	Clearwater	1996	6.8	0	0.00	26.1	1	0.038	Aerial survey from mouth to big flat
Colt Killed Creek	Clearwater	1995	2.6	0	0.00	26.1	1	0.038	Aerial survey from mouth to big flat
Colt Killed Creek	Clearwater	1994	NC[d]	NC		26.1	1	0.038	Aerial survey from mouth to big flat
Colt Killed Creek	Clearwater	1993	7	2	0.29	36	6	0.167	4 redds in aerial survey from mouth to big flat; 2 redds from ground count big flat to pack box creek
Colt Killed Creek	Clearwater	1992	11.5	3	0.26	11.5	3	0.261	No raw data - not verified
Crooked Fork Creek	Clearwater	2001	18	229	12.72	16.5	229	13.879	
Crooked Fork Creek	Clearwater	2000	18	100	5.56	16.5	100	6.061 [p]	
Crooked Fork Creek	Clearwater	1999	18	8	0.44	16.5	8	0.485	
Crooked Fork Creek	Clearwater	1998	18	17	0.94	16.5	17	1.030	
Crooked Fork Creek	Clearwater	1997	19	118	6.21	16.5	114	6.909 [o]	Subtracted 4 redds above shotgun cr.
Crooked Fork Creek	Clearwater	1996	21.5	76	3.53	16.5	75	4.545 [e]	Subtracted one redd above shotgun creek.
Crooked Fork Creek	Clearwater	1995	19	4	0.21	16.5	4	0.242	2 miles between Devoto and MP167, and one half mile from Shotgun Creek down not surveyed but included in total distance.
Crooked Fork Creek	Clearwater	1994	21.5	0	0.00	16.5	0	0.000 [f]	
Crooked Fork Creek	Clearwater	1993	28	10	0.36	16.5	10	0.606 [g]	
Crooked Fork Creek	Clearwater	1992	29.5	11	0.37	16.5	11	0.667 [b]	
Crooked River	Clearwater	2001	20.9	136	6.51	20.9	136	6.507	
Crooked River	Clearwater	2000	20.9	93	4.45	20.9	93	4.450	
Crooked River	Clearwater	1999	20.9	1	0.05	20.9	1	0.048	
Crooked River	Clearwater	1998	20.9	30	1.44	20.9	30	1.435	
Crooked River	Clearwater	1997	20.9	62	2.97	20.9	62	2.967	
Crooked River	Clearwater	1996	21.9	6	0.27	21.9	6	0.274 [b]	
Crooked River	Clearwater	1995	21.9	0	0.00	21.9	0	0.000	
Crooked River	Clearwater	1994	21.9	4	0.18	21.9	4	0.183	
Crooked River	Clearwater	1993	21.9	54	2.47	21.9	54	2.466	
Crooked River	Clearwater	1992	21.9	54	2.47	21.9	54	2.466	
Crooked River	Clearwater	1991	21.9	4	0.18	21.9	4	0.183	
Eldorado Creek	Clearwater	2001	3.5	4	1.14	3.5	4	1.143	
Eldorado Creek	Clearwater	2000	3.5	1	0.29	3.5	0	0.000	Based on index count
Eldorado Creek	Clearwater	1999	3.5	0	0.00	3.5	0	0.000	
Eldorado Creek	Clearwater	1998	3.5	0	0.00	3.5	0	0.000	
Eldorado Creek	Clearwater	1997	3.5	0	0.00	3.5	0	0.000	
Eldorado Creek	Clearwater	1996	3.5	0	0.00	3.5	0	0.000	
Eldorado Creek	Clearwater	1995	3.5	0	0.00	3.5	0	0.000	
Eldorado Creek	Clearwater	1994	3.5	0	0.00	3.5	0	0.000	
Eldorado Creek	Clearwater	1993	3.5	2	0.57	3.5	2	0.571	
Eldorado Creek	Clearwater	1992	3.5	0	0.00	3.5	0	0.000	
Lolo and Yoosa Creek	Clearwater	2001	16.7	398	23.83	21.1	428	20.284	Based on index count
Lolo and Yoosa Creek	Clearwater	2000	16.7	98	5.87	21.1	100	4.739	Based on index count

Lolo and Yoosa Creek	Clearwater	1999	16.7	9	0.54	21.1	9	0.427	Based on index count
Lolo and Yoosa Creek	Clearwater	1998	16.7	26	1.56	21.1	31	1.469	Based on index count
Lolo and Yoosa Creek	Clearwater	1997	16.7	139	8.32	21.1	110	5.213	Based on index count
Lolo and Yoosa Creek	Clearwater	1996	16.7	21	1.26	21.1	21	0.995	Based on index count
Lolo and Yoosa Creek	Clearwater	1995	16.7	6	0.36	21.1	6	0.284	Based on index count
Lolo and Yoosa Creek	Clearwater	1994	16.7	7	0.42	21.1	7	0.332	Based on index count
Lolo and Yoosa Creek	Clearwater	1993	16.7	23	1.38	21.1	24	1.137	Based on index count
Lolo and Yoosa Creek	Clearwater	1992	16.7	19	1.14	21.1	19	0.900	Based on index count
Newsome Creek	Clearwater	2001	15.1	221	14.64	15.1	221	14.636	
Newsome Creek	Clearwater	2000	15.1	51	3.38	15.1	5	0.331	Based on index count
Newsome Creek	Clearwater	1999	15.1	0	0.00	15.1	0	0.000	
Newsome Creek	Clearwater	1998	15.1	32	2.12	15.1	32	2.119	
Newsome Creek	Clearwater	1997	15.1	67	4.44	15.1	67	4.437	
Newsome Creek	Clearwater	1996	15.1	4	0.26	15.1	4	0.265	
Newsome Creek	Clearwater	1995	15.1	0	0.00	15.1	0	0.000	
Newsome Creek	Clearwater	1994	15.1	0	0.00	15.1	0	0.000	
Newsome Creek	Clearwater	1993	15.1	55	3.64	15.1	55	3.642 [a]	
Newsome Creek	Clearwater	1992	15.1	2	0.13	15.1	2	0.132	
Papoose Creek	Clearwater	2001	6	194	32.33	6	194	32.333	
Papoose Creek	Clearwater	2000	6	41	6.83	6	41	6.833	
Papoose Creek	Clearwater	1999	6	4	0.67	6	4	0.667	
Papoose Creek	Clearwater	1998	6.8	13	1.91	6.8	13	1.912	
Papoose Creek	Clearwater	1997	6.8	62	9.12	6.8	62	9.118	
Papoose Creek	Clearwater	1996	3	7	2.33	3	7	2.333	
Papoose Creek	Clearwater	1995	3	1	0.33	3	1	0.333	
Papoose Creek	Clearwater	1994	3	0	0.00	3	0	0.000	
Papoose Creek	Clearwater	1993	3	15	5.00	3	15	5.000	
Papoose Creek	Clearwater	1992	3	10	3.33	3	10	3.333	
Pete King Creek	Clearwater	2001	8	17	2.1	8	17	2.125	
Pete King Creek	Clearwater	2000	8	2	0.25	8	2	0.250	
Pete King Creek	Clearwater	1999	8	0	0.00	8	0	0.000	
Pete King Creek	Clearwater	1998	8	0	0.00	8	0	0.000	
Pete King Creek	Clearwater	1997	8	1	0.13	8	1	0.125	
Pete King Creek	Clearwater	1996	8	0	0.00	8	0	0.000	
Pete King Creek	Clearwater	1995	8	0	0.00	8	0	0.000	
Pete King Creek	Clearwater	1994	8	0	0.00	8	0	0.000	
Pete King Creek	Clearwater	1993	8	0	0.00	8	0	0.000	
Pete King Creek	Clearwater	1992	8	0	0.00	8	0	0.000	
Pete King Creek	Clearwater	1991	8	0	0.00	8	0	0.000	
Red River	Clearwater	2001	44.2	348	7.87	44.2	348	7.873	
Red River	Clearwater	2000	39.6	235	5.93	39.6	235	5.934	
Red River	Clearwater	1999	39.6	14	0.35	39.6	14	0.354	
Red River	Clearwater	1998	44.2	93	2.10	44.2	93	2.104	
Red River	Clearwater	1997	44.2	344	7.78	44.2	344	7.783	
Red River	Clearwater	1996	34.1	41	1.20	34.1	41	1.202	
Red River	Clearwater	1995	43	17	0.40	43	17	0.395	
Red River	Clearwater	1994	43	23	0.53	43	23	0.535	
Red River	Clearwater	1993	38.5	69	1.79	38.5	69	1.792	
Red River	Clearwater	1992	43	44	1.02	43	44	1.023	
Red River	Clearwater	1991	23.6	6	0.25	23.6	6	0.254	

Squaw Creek	Clearwater	2001	6	64	10.67	6	64	10.667
Squaw Creek	Clearwater	2000	6	4	0.67	6	4	0.667
Squaw Creek	Clearwater	1999	6	4	0.67	6	4	0.667
Squaw Creek	Clearwater	1998	6	11	1.83	6	11	1.833
Squaw Creek	Clearwater	1997	6	17	2.83	6	17	2.833
Squaw Creek	Clearwater	1996	6	1	0.17	6	1	0.167
Squaw Creek	Clearwater	1995	6	0	0.00	6	0	0.000
Squaw Creek	Clearwater	1994	6	0	0.00	6	0	0.000
Squaw Creek	Clearwater	1993	6	0	0.00	6	0	0.000
Squaw Creek	Clearwater	1992	6	1	0.17	6	1	0.167
White Cap Creek	Clearwater	2001	19.8	19	0.96	19.8	19	0.960
White Cap Creek	Clearwater	2000	19.8	8	0.40	19.8	8	0.404
White Cap Creek	Clearwater	1999	12.9	0	0.00	12.9	0	0.000
White Cap Creek	Clearwater	1998	19.8	4	0.20	19.8	4	0.202
White Cap Creek	Clearwater	1997	19.8	0	0.00	19.8	0	0.000
White Cap Creek	Clearwater	1996	19.8	3	0.15	19.8	3	0.152
White Cap Creek	Clearwater	1995	19.8	0	0.00	19.8	0	0.000
White Cap Creek	Clearwater	1994	19.8	2	0.10	19.8	2	0.101
White Cap Creek	Clearwater	1993	19.8	6	0.30	19.8	6	0.303
White Cap Creek	Clearwater	1992	19.8	2	0.10	19.8	2	0.101
Bear Valley Creek	Salmon	2001	35.7	153	4.29	35.7	153	4.286
Bear Valley Creek	Salmon	2000	35.7	59	1.65	35.7	59	1.653
Bear Valley Creek	Salmon	1999	35.7	26	0.73	35.7	26	0.728
Bear Valley Creek	Salmon	1998	35.7	64	1.79	35.7	64	1.793
Bear Valley Creek	Salmon	1997	35.7	30	0.84	35.7	30	0.840
Bear Valley Creek	Salmon	1996	35.7	12	0.34	35.7	12	0.336
Bear Valley Creek	Salmon	1995	35.7	3	0.08	35.7	3	0.084
Bear Valley Creek	Salmon	1994	35.7	4	0.11	35.7	4	0.112
Bear Valley Creek	Salmon	1993	35.7	138	3.87	35.7	138	3.866
Bear Valley Creek	Salmon	1992	35.7	26	0.73	35.7	26	0.728
East Fork Salmon River	Salmon	2001	27	25	0.93	27	25	0.926
East Fork Salmon River	Salmon	2000	27	2	0.07	27	2	0.074
East Fork Salmon River	Salmon	1999	27	8	0.30	27	8	0.296
East Fork Salmon River	Salmon	1998	27	21	0.78	27	21	0.778
East Fork Salmon River	Salmon	1997	27	0	0.00	27	0	0.000
East Fork Salmon River	Salmon	1996	27	2	0.07	27	2	0.074
East Fork Salmon River	Salmon	1995	27	0	0.00	27	0	0.000
East Fork Salmon River	Salmon	1994	27	5	0.19	27	5	0.185
East Fork Salmon River	Salmon	1993	27	19	0.70	27	19	0.704
East Fork Salmon River	Salmon	1992	27	1	0.04	27	1	0.037
Herd Creek	Salmon	2001	17.1	22	1.29	17.1	22	1.287
Herd Creek	Salmon	2000	17.1	3	0.18	17.1	3	0.175
Herd Creek	Salmon	1999	17.1	3	0.18	17.1	3	0.175
Herd Creek	Salmon	1998	17.1	10	0.58	17.1	10	0.585
Herd Creek	Salmon	1997	17.1	14	0.82	17.1	14	0.819
Herd Creek	Salmon	1996	17.1	0	0.00	17.1	0	0.000
Herd Creek	Salmon	1995	17.1	0	0.00	17.1	0	0.000
Herd Creek	Salmon	1994	17.1	4	0.23	17.1	4	0.234
Herd Creek	Salmon	1993	17.1	43	2.51	17.1	43	2.515
Herd Creek	Salmon	1992	14.1	3	0.21	14.1	3	0.213

Johnson Creek[i]	Salmon	2001	40	387	9.68	25.32	387	15.284[q]	From est redds/km
Johnson Creek[i]	Salmon	2000	40	29	0.73	25.32	33	1.303[r]	From est redds/km
Johnson Creek[i]	Salmon	**1999**	40[i]	**24**	0.60	25.32	24	0.948	From est redds/km
Johnson Creek[i]	Salmon	1998	38[iii]	**96**	2.53	25.32	96	3.791(ii)	From est redds/km
Johnson Creek[i]	Salmon	**1997**	**31**	**97**	3.13	25.32	114.86	4.536	From est redds/km
Johnson Creek[i]	Salmon	1996	31	22	0.71	25.32	25.78	1.018	From est redds/km
Johnson Creek[i]	Salmon	1995	31	5	0.16	25.32	5.86	0.231	From est redds/km
Johnson Creek[i]	Salmon	1994	31	26	0.84	25.32	30.47	1.203	From est redds/km
Johnson Creek[i]	Salmon	1993	20.8	170	8.17	25.32	199.24	7.869j	From est redds/km
Johnson Creek[i]	Salmon	1992	20.8	60	2.88	25.32	70.32	2.777	From est redds/km
Johnson Creek[i]	Salmon	1991	20.8	69	3.32	20.8	69	3.32	New redds not verified
Lake Creek	Salmon	2001	20.76	337	16.23	20.76	337	16.233	From est redds/km
Lake Creek	Salmon	2000	20.76	179	8.62	20.76	179	8.622	From est redds/km
Lake Creek	Salmon	1999	20.76	24	1.16	20.76	24	1.156	From est redds/km
Lake Creek	Salmon	1998	20.76	50	2.41	20.76	50	2.408	From est redds/km
Lake Creek	Salmon	1997	20.8	55	2.64	20.76	55	2.649	From est redds/km
Lake Creek	Salmon	1996	13.6	31	2.28	20.76	36.14	1.741	From est redds/km
Lake Creek	Salmon	1995	13.6	12	0.88	20.76	13.99	0.674	From est redds/km
Lake Creek	Salmon	1994	13.6	12	0.88	20.76	13.99	0.674	From est redds/km
Lake Creek	Salmon	1993	13.6	44	3.24	20.76	51.3	2.471	From est redds/km
Lake Creek	Salmon	1992	13.6	43	3.16	20.76	50.13	2.415	From est redds/km
Lake Creek	Salmon	1991	13.6	34	2.50	13.6	34	2.50	New redds not verified
Lemhi River	Salmon	2001	51.7	339	6.56	51.7	339	6.557	
Lemhi River	Salmon	2000	51.7	93	1.80	51.7	93	1.799	
Lemhi River	Salmon	1999	51.7	48	0.93	51.7	48	0.928	
Lemhi River	Salmon	1998	51.7	41	0.79	51.7	41	0.793	
Lemhi River	Salmon	1997	51.7	50	0.97	51.7	50	0.967	
Lemhi River	Salmon	1996	51.7	29	0.56	51.7	29	0.561	
Lemhi River	Salmon	1995	51.7	9	0.17	51.7	9	0.174	
Lemhi River	Salmon	1994	51.7	20	0.39	51.7	20	0.387	
Lemhi River	Salmon	1993	51.7	37	0.72	51.7	37	0.716	
Lemhi River	Salmon	1992	51.7	15	0.29	51.7	15	0.290[m]	
Marsh Creek[k]	Salmon	2001	11	110	10.00	11	110	10.000	
Marsh Creek[k]	Salmon	2000	11	30	2.73	11	30	2.727	
Marsh Creek[k]	Salmon	1999	11	0	0.00	11	0	0.000	
Marsh Creek[k]	Salmon	1998	11	41	3.73	11	41	3.727	
Marsh Creek[k]	Salmon	1997	11	38	3.45	11	38	3.455	
Marsh Creek[k]	Salmon	1996	11	6	0.55	11	6	0.545	
Marsh Creek[k]	Salmon	1995	11	0	0.00	11	0	0.000	
Marsh Creek[k]	Salmon	1994	11	9	0.82	11	9	0.818	
Marsh Creek[k]	Salmon	1993	11	45	4.09	11	45	4.091[b]	
Marsh Creek[k]	Salmon	1992	9.8	66	6.73	9.8	66	6.735[l]	
North Fork Salmon River	Salmon	2001	36.8	102	2.77	36.8	102	2.772	
North Fork Salmon River	Salmon	2000	15.2	11	0.72	15.2	11	0.724	
North Fork Salmon River	Salmon	1999	36.8	2	0.05	36.8	2	0.054	
North Fork Salmon River	Salmon	1998	36.8	3	0.08	36.8	3	0.082	
North Fork Salmon River	Salmon	1997	36.8	10	0.27	36.8	10	0.272	
North Fork Salmon River	Salmon	1996	36.8	5	0.14	36.8	5	0.136	
North Fork Salmon River	Salmon	1995	36.8	1	0.03	36.8	1	0.027	
North Fork Salmon River	Salmon	1994	36.8	3	0.08	36.8	3	0.082	

North Fork Salmon River	Salmon	1993	36.8	17	0.46	36.8	17	0.462	
North Fork Salmon River	Salmon	1992	36.8	12	0.33	36.8	12	0.326	
North Fork Salmon River	Salmon	1991	36.8	8	0.22	36.8	8	0.217	
Pahsimeroi River	Salmon	2001	24.5	146	5.96	24.5	146	5.959	Redds upstream of PBS1 and P8A removed
Pahsimeroi River	Salmon	2000	24.5	46	1.88	17.8	46	2.584	Redds upstream of PBS1 and P8A removed
Pahsimeroi River	Salmon	1999	24.5	61	2.49	17.8	61	3.427	Redds upstream of PBS1 and P8A removed
Pahsimeroi River	Salmon	1998	31.1	31	1.00	17.8	28	1.573	Redds upstream of PBS1 and P8A removed
Pahsimeroi River	Salmon	1997	15.7	23	1.46	16	23	1.438	Hatchery weir to PBS1. Did not count above Patterson Cr. on the main Pahsimeroi R.
Pahsimeroi River	Salmon	1996	14.5	13	0.90	16.5	13	0.788	Did not do PBS1 to mouth
Pahsimeroi River	Salmon	1995	15.5	11	0.71	16.5	11	0.667	Did not do PBS1 to mouth
Pahsimeroi River	Salmon	1994	16.5	19	1.15	17.8	19	1.067 [f]	Aerial count on 9/7, only ground count was from dowton lane to p11
Pahsimeroi River	Salmon	1993	23	63	2.74	16.5	63	3.818	Did not do PBS1 to mouth
Pahsimeroi River	Salmon	1992	26.5	32	1.21	26.5	32	1.208	It is likely that areas where fish do not spawn were surveyed but we were unable to find any data sheets that listed areas walked or redd distribution
Secesh River	Salmon	2001	32.1	381	11.87	11.9	239	20.084	Based on index count
Secesh River	Salmon	2000	32.1	148	4.61	11.9	104	8.739	Based on index count
Secesh River	Salmon	1999	32.1	42	1.31	11.9	34	2.857	Based on index count
Secesh River	Salmon	1998	32.1	69	2.15	11.9	50	4.202	Based on index count
Secesh River	Salmon	1997	32.1	90	2.80	11.9	74	6.218	Based on index count
Secesh River	Salmon	1996	10.3	42	4.08	11.9	41	3.445	Based on index count
Secesh River	Salmon	1995	10.3	18	1.75	11.9	18	1.513	Based on index count
Secesh River	Salmon	1994	10.3	21	2.04	11.9	21	1.765	Based on index count
Secesh River	Salmon	1993	10.3	91	8.83	11.9	91	7.647	Based on index count
Secesh River	Salmon	1992	10.3	66	6.41	11.9	66	5.546	Based on index count
Secesh River	Salmon	1991	10.3	62	6.02	10.3	62	6.02	New redds not verified
Slate Creek	Salmon	2001	34.61	26	0.75	5.53	18	3.255	Based on index count
Slate Creek	Salmon	2000	34.61	5	0.14	5.53	4	0.723	Based on index count
Slate Creek	Salmon	1999	34.61	2	0.06	5.53	2	0.362	Based on index count
Slate Creek	Salmon	1998	28.6	8	0.28	5.53	6	1.085	Based on index count
Slate Creek	Salmon	1997	15	8	0.53	5.53	5	0.904	Based on index count
Slate Creek	Salmon	1996	5.5	0	0.00	5.53	0	0.000	Based on index count
Slate Creek	Salmon	1995	5.5	3	0.55	5.53	3	0.542	Based on index count
Slate Creek	Salmon	1994	5.5	1	0.18	5.53	2	0.362	Based on index count
Slate Creek	Salmon	1993	5.5	1	0.18	5.53	1	0.181	Based on index count
Slate Creek	Salmon	1992	5.5	4	0.73	5.53	4	0.723	Based on index count
Slate Creek	Salmon	1991	5.5	6	1.09	5.5	6	1.09	New redds not verified
South Fork Salmon River	Salmon	2001	24.5	493	20.12	20.2	430	21.287	Removed tributaries from survey
South Fork Salmon River	Salmon	2000	24.5	315	12.86	20.2	290	14.356	Removed tributaries from survey
South Fork Salmon River	Salmon	1999	22.6	281	12.43	20.2	259	12.822	Removed tributaries from survey
South Fork Salmon River	Salmon	1998	20.2	149	7.38	20.2	149	7.376	
South Fork Salmon River	Salmon	1997	20.2	264	13.07	20.2	264	13.069	
South Fork Salmon River	Salmon	1996	20.2	78	3.86	20.2	78	3.861	
South Fork Salmon River	Salmon	1995	20.2	61	3.02	20.2	61	3.020	
South Fork Salmon River	Salmon	1994	20.2	76	3.76	20.2	76	3.762	
South Fork Salmon River	Salmon	1993	20.2	694	34.36	20.2	694	34.356	
South Fork Salmon River	Salmon	1992	20.2	454	22.48	20.2	454	22.475	
Upper Salmon River	Salmon	2001	59	257	4.36	59	257	4.356	Aerial survey

Upper Salmon River	Salmon	2000	59	146	2.47	59	146	2.475	Aerial survey
Upper Salmon River	Salmon	1999	59	14	0.24	59	14	0.237	Aerial survey
Upper Salmon River	Salmon	1998	59	25	0.42	59	25	0.424	Aerial survey
Upper Salmon River	Salmon	1997	59	8	0.14	59	8	0.136	Aerial survey
Upper Salmon River	Salmon	1996	59	14	0.24	59	14	0.237	Aerial survey
Upper Salmon River	Salmon	1995	59	0	0.00	59	0	0.000	Aerial survey
Upper Salmon River	Salmon	1994	59	22	0.37	59	22	0.373	Aerial survey
Upper Salmon River	Salmon	1993	59	127	2.15	59	127	2.153	Aerial survey
Upper Salmon River	Salmon	1992	59	27	0.46	59	27	0.458	Aerial survey
Valley Creek	Salmon	2001	32.2	59	1.83	32.2	59	1.832	
Valley Creek	Salmon	2000	33.2	23	0.69	33.2	23	0.693	
Valley Creek	Salmon	1999	33.2	18	0.54	33.2	18	0.542	
Valley Creek	Salmon	1998	33.2	33	0.99	33.2	33	0.994	
Valley Creek	Salmon	1997	33.2	5	0.15	33.2	5	0.151	
Valley Creek	Salmon	1996	48.7	1	0.02	48.7	1	0.021	
Valley Creek	Salmon	1995	48.7	0	0.00	48.7	0	0.000	
Valley Creek	Salmon	1994	43.7	4	0.09	43.7	4	0.092	
Valley Creek	Salmon	1993	52.3	73	1.40	52.3	73	1.396	
Valley Creek	Salmon	1992	33.2	7	0.21	33.2	7	0.211	
West Fork Yankee Fork Salmon River	Salmon	2001	11.6	36	3.10	11.6	36	3.103	
West Fork Yankee Fork Salmon River	Salmon	2000	11.6	4	0.34	11.6	4	0.345	
West Fork Yankee Fork Salmon River	Salmon	1999	11.6	0	0.00	11.6	0	0.000	
West Fork Yankee Fork Salmon River	Salmon	1998	11.6	12	1.03	11.6	12	1.034	
West Fork Yankee Fork Salmon River	Salmon	1997	11.6	6	0.52	11.6	6	0.517	
West Fork Yankee Fork Salmon River	Salmon	1996	11.6	7	0.60	11.6	7	0.603	
West Fork Yankee Fork Salmon River	Salmon	1995	11.6	0	0.00	11.6	0	0.000	
West Fork Yankee Fork Salmon River	Salmon	1994	11.6	9	0.78	11.6	9	0.776	
West Fork Yankee Fork Salmon River	Salmon	1993	11.6	14	1.21	11.6	14	1.207	
West Fork Yankee Fork Salmon River	Salmon	1992	11.6	6	0.52	11.6	6	0.517	

Notes:

[a] 125 adult pairs were outplanted from Rapid River Hatchery.
[b] Two additional redds occurred below the juvenile trap.
[c] 150 adult pairs were outplanted from Rapid River Hatchery.
[d] NC = No count (stream was not surveyed).
[e] Six additional redds occurred below the juvenile trap.
[f] Distance reported is for the IDFG trend area; number of redds is from Nemeth et al. (1996).
[g] Three additional redds occurred below the juvenile trap.
[h] A single adult chinook salmon was seen in Brushy Fork Creek during snorkeling activities.
[i] Moose Creek to Burnt Log Creek section (6.2 km) not surveyed 1991-1993; from 1994-present, Burnt Log Creek, from the mouth to 2.0 km above Buck Creek (4.0 km total), was included in the count.
[j] This number is conservative as one section of stream, Moose Creek to Burnt Log trail crossing, was not counted, but was known to have redds.
[k] Includes Knapp Creek.
[l] Section from Knapp Cr. to Dry Cr. was not surveyed in 1992.
[m] Aerial count.
[n] Seven of the redds counted were located in Colt Creek, a tributary of Colt Killed Creek.
[o] Nine additional redds were located between the mouth of Crooked Fk Cr and the juvenile screw trap.

[p] Nine additional redds located below the screw trap
[q] Nez Perce Tribe removed 149 adults for culture
[r] Nez Perce Tribe removed 73 adults for culture
[s] An estimated 408 adults escaped above weir in addition to the 90 known adults.

SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

“I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973.”

Name, Title, and Signature of Applicant:

Certified by______________________________ Date:_____________

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: ________ ESU/Population: ________ Activity: ________				
Location of hatchery activity:________ Dates of activity:________ Hatchery program operator:________				
Type of Take	**Annual Take of Listed Fish By Life Stage** (***Number of Fish***)			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)				
Capture, handle, tag/mark/tissue sample, and release d)			Entire run	
Removal (e.g. broodstock) e)			Section 7.2	
Intentional lethal take f)				
Unintentional lethal take g)			Pre-spawn mortality varies and may be as high as 15%.	
Other Take (specify) h) Carcass sampling				50

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

***Instructions*:**

1. *An entry for a fish to be taken should be in the take category that describes the greatest impact.*
2. *Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).*
3. *If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.*

APPENDIX 2-10—SALMON RIVER JOHNSON CREEK SUMMER CHINOOK HATCHERY AND GENETIC MANAGEMENT PLAN

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Johnson Creek Artificial Propagation Enhancement (JCAPE) Project
Species or Hatchery Stock:	Snake River Summer Chinook (*Oncorhynchus tshawytscha*)
Agency/Operator:	Nez Perce Tribe
Watershed and Region:	Columbia River, Snake basin, Salmon River subbasin, South Fork of the Salmon River, Johnson Creek
Date Submitted:	17 March, 2000
Date Last Updated:	03 February, 2003

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Johnson Creek Artificial Propagation Enhancement (JCAPE) Project

1.2) Species and population (or stock) under propagation, and ESA status.

Johnson Creek summer chinook salmon (*Oncorhynchus tshawytscha*). Listed as threatened 22, April 1992.

1.3) Responsible organization and individuals

Name(and title):	John Gebhards, JCAPE Project Leader
Organization:	Nez Perce Tribe, Department of Fisheries Resources Management
Address:	125 S Mission St., P.O. Box 1942, McCall, ID. 83638
Telephone:	208-634-5290
Fax:	208-634-4097
Email:	johng@nezperce.org

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

IDFG- Operator of McCall Fish Hatchery (MFH) facility.

FishPro, Inc. - Design engineering of MFH expansion and satellite facilities on Johnson Creek.

USFWS, LSRCP-owner of MFH facility

BIA-Policy and Technical Support

CRITFC-Technical and Policy Support

1.4) Funding source, staffing level, and annual hatchery program operational costs.

The Nez Perce Tribe (Tribe) is the lead fisheries management agency for the JCAPE project, a Bonneville Power Administration (BPA) funded fisheries project. BPA provides for cost reimbursement on an annual basis for the JCAPE project. Until long-term facilities are completed, specific funding levels for annual operating costs will not be finalized. Approximately eight full time equivalents (FTE's) are required for operation of the JCAPE.

1.5) Location(s) of hatchery and associated facilities.

MFH, North Fork Payette River, McCall, Idaho.

MFH is operated by the Idaho Department of Fish and Game (IDFG) for summer chinook incubation and rearing to smolt stage (MFH 1996). MFH was completed in 1981 and is located on the North Fork of the Payette River in McCall, Idaho. MFH will provide both interim and long-term egg incubation and juvenile rearing facilities for the JCAPE project. In addition, the MFH South Fork Salmon River (SFSR) adult facility may be used in the interim to hold Johnson Creek adult broodstock, until an adult facility is constructed on Johnson Creek. The services of FishPro were contracted to design an expansion of the MFH facility, and additional facilities for adult holding and acclimation sites on Johnson Creek.

1.6) Type of program.

Integrated Recovery.

1.7) Purpose (Goal) of program.

Preservation/Conservation

The goal of the JCAPE project is to provide for the maintenance of genetic variability and demographic stability of the Johnson Creek spawning aggregate until such time as the factors responsible for the initial decline are addressed allowing recovery.

Recovery will require that adult to adult replacement of the naturally spawning population component is at least one. This suggests that smolt to adult return rate (SAR) must be increased to 2%-6%. Therefore, until the factors resulting in low survival are addressed, the primary goal of the JCAPE will be to forestall extinction and avoid further losses of the genetic variation that may be necessary to recover the stock.

1.8) Justification for the program.

Analysis of the existing demographic and genetic data for the Johnson Creek spawning aggregate suggest that demographic risks and the probability of genetic deterioration are unacceptably high. The geometric mean recruit per spawner relationship for Johnson Creek from 1985-1990 was 0.64 (Mundy 1999). In 19 of the past 25 years, the rate of rare allele loss within the Johnson Creek aggregate was higher than that recommended within the body of peer-reviewed, published literature (PRRG 2000). The JCAPE program will address this concern by employing non-selective broodstock collection and rearing procedures to increase egg to smolt survival within Johnson Creek. Broodstock collection and escapement goals were formulated to maximize the maintenance of rare alleles and minimize demographic risks for both population components.

The JCAPE is one of 15 high-priority supplementation projects identified through a consensus of fishery managers in the region. These projects were submitted to the Northwest Power Planning Council (Council) and approved in April 1996. The Council recommended these projects to BPA for funding under the Council's fish and wildlife program. BPA subsequently approved funding for the JCAPE and planning began in 1996.

1.9) List of program "Performance Standards".

1.10) List of program "Performance Indicators", designated by "benefits" and "risks."

1.10.1) "Performance Indicators" addressing benefits.
(e.g. "*Evaluate smolt-to-adult return rates for program fish to harvest, hatchery broodstock, and natural spawning.*").

1.10.2) "Performance Indicators" addressing risks.
(*e.g. "Evaluate predation effects on listed fish resulting from hatchery fish releases."*).

Sections 1.9, 1.10, 1.10.1, and 1.10.2 are addressed in Appendix A.

1.11) Expected size of program.

We propose to collect up to 232 (116 female) endemic summer chinook salmon adults annually from Johnson Creek for a minimum of four to five summer chinook salmon generations (20-25 years) and rear the juveniles to smolt stage at the MFH. The supplementation objective of the program is an annual acclimated release of approximately 310,068 summer chinook salmon smolts into Johnson Creek. These fish would be transported from the MFH as smolts to final rearing/acclimation facilities adjacent to Johnson Creek. Smolts would be held for a 21 to 42 day period before they would be volitionally released into Johnson Creek.

1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).

A maximum of 232 (116 female) endemic Johnson Creek summer chinook of natural and hatchery origin will be collected yearly for a minimum of 20-25 years, or until adult:adult replacement rates for the naturally spawned population component suggest that the population is naturally sustainable. During the first 3-5 years of operation, the JCAPE will function at approximately 1/3 of the proposed capacity (100,000 smolts; 64 adults), while facility expansion is occurring.

Adult take levels and broodstock goals were formulated based on the probability of rare allele retention. Given a 0.25 N_b/N ratio in Johnson Creek (Waples *et al*. 1993; PRRG 2000), approximately 232 adult returns are necessary to maintain a 95% probability of rare allele retention (PRRG 2000). Therefore, to avoid the loss of genetic variability, we suggest that when possible, broodstock should be large enough to provide at least 232 adult returns. The 1981-90 geometric mean adult to adult replacement rate was 1.64 for the MFH, therefore if the JCAPE exhibits a similar return rate approximately 142 adults would be required as broodstock to maintain this goal.

Although, the NPT highly value natural spawning, we recognize that below some critical threshold, adults cannot be expected to mature at similar rates and find one another to spawn effectively within Johnson Creek. Unfortunately, quantifying a minimum escapement is difficult. In the best professional judgement of the NPT staff, the release of fewer than 20 adults would preclude effective spawning, therefore when adult returns are fewer than 162, all adults intercepted at the Johnson Creek weir will be retained as broodstock.

Sliding Scale for Broodstock Collection

When adult returns are fewer that 162, all adults intercepted at the Johnson Creek weir will be retained as broodstock (Table 1). Between 162 and 284, a minimum of 142 adults will be retained for broodstock, and the remainder (a minimum of 20 adults) will be released for natural spawning. Between 285 and 464 adult returns, 50% of the adult returns will be retained for broodstock, and the remainder will be released for natural spawning. Finally, when adult returns are greater than 464, a minimum of 232 adults will be retained for broodstock, and the remainder will be released for natural spawning. Whenever possible, those adults retained for broodstock will represent the adult return by age. For example, at adult returns between 285 and 464, 50% of the returning age 4 males, and 50% of the age 4 females will be retained. Since, the JCAPE program is intended to produce hatchery-reared progeny that are identical to naturally spawned progeny in every way, broodstock collection goals are not altered by the proportions of hatchery and naturally reared adult returns. However, given that the potential exists for indirect artificial selection in the hatchery environment, naturally spawned adult returns will be preferentially selected as broodstock whenever possible.

Subsequent to authorization, the JCAPE expansion of the existing MFH will require approximately three years. During this period, incubation and rearing constraints of the existing facilities limit the JCAPE to 100,000 smolts (approximately 32 females). During this period, the JCAPE program will collect up to 32 males and 32 females (Table 2).

Table 1. Long-term sliding scale for JCAPE broodstock collection.

Number of Adult Returns	Number of Adults Retained for Broodstock	Number of Adults Released for Natural Spawning
<162	100%	0
162-282	142	Remainder (Minimum of 20)
285-464	50% (Minimum of 142)	Remainder (Minimum of 143)
>464	Minimum of 232	Remainder (Minimum of 232)

Table 2. Interim sliding scale for JCAPE broodstock collection.

Number of Adult Returns	Number of Adults Retained for Broodstock	Number of Adults Released for Natural Spawning
<64	100%	0
64-84	Remainder	Minimum of 20
>84	Maximum of 64 Adults	Minimum of 20

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location.

Table 3. Proposed location and magnitude of JCAPE smolt releases.

Life Stage	Release Location	Annual Release Level
Eyed Eggs		
Unfed Fry		
Fry		
Fingerling		
Yearling	Wapiti Meadows Ranch acclimation site on Johnson Creek.	Approximately 310,068

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

Since the JCAPE is does not have completed information for any given broodyear, we use performance of the MHF (in the neighboring SFSR mainstem) as a proxy for the expected production of the JCAPE (Table 4).

1.13) Date program started (years in operation), or is expected to start.

Broodstock was first collected in 1998. The program resumed annual operations in 2000.

1.14) Expected duration of program.

The expected duration of the Johnson Creek program will be dependent on mitigation for the sources of mortality resulting in the initial decline of the stock. If these factors are not addressed the JCAPE will be forced to operate over a much longer time scale. Assuming current survival rates, the NMFS delisting criteria for the Johnson Creek aggregate (350 naturally spawned adult returns) will likely be reached in approximately 15 years (3 generations) of supplementation (PRRG 2000). The mid-term goal of the JCAPE (1,017 adult returns of hatchery and natural origin) will likely require 25 years or more (PRRG 2000). However, if survival rates increase, these goals will likely be reached over a much shorter period of time. Unfortunately, regardless of the magnitude of adult returns to Johnson Creek, natural spawning will likely remain unsustainable unless adult:adult return rates are improved through mitigation of the sources of mortality. Therefore, in the short-term, the JCAPE is a means to forestall extinction, recovery (defined as sustainable natural reproduction) will only be possible through mitigation for the sources of mortality affecting the Johnson Creek aggregate.

Table 4. Performance measures for the JCAPE program.

Total Number of Adult Females Taken	116	**Calculations**	**Results**
Pre-spawning Mortality [1]	15%	116 x .85	99 females spawned

Fecundity [2]	4,500	99 x 4,500	445,500 green eggs
Green Egg to Fry Survival [3]	80%	445,500 x .80	356,400 fry
Fry to Smolt Survival	87%	356,400 x .87	310,068 smolts
Smolt to Adult Survival [4]	0.086%	310,068 x .00086	267 returning adults

1) We anticipate a 15% adult female mortality prior to spawning. The ten year average adult female mortality for the South Fork Salmon facility is 11.5%. The 15% value for Johnson Creek adult salmon takes into account trap and weir mortality, handling and transportation stress (FishPro 1999).
2) We assume adult female salmon fecundity of 4,500 eggs per female. This value is the average fecundity of adult salmon spawned at the South Fork Salmon River trap (FishPro 1999).
3) We anticipate a green egg to fry survival of 80%. This value is essentially equivalent to that achieved at the McCall Fish Hatchery for production of salmon fry from green eggs taken at the South Fork Salmon River trap. This value also takes into account marking mortality (FishPro 1999).
4) This value represents the 5 year (1988-1992) average smolt to adult survival rate experienced on the South Fork Salmon River from the release of chinook salmon reared at the McCall Fish Hatchery.

1.15) Watersheds targeted by program.

The Johnson Creek tributary of the East Fork of the South Fork Salmon River is the target of the JCAPE (Figure 1).

Latitude and Longitude of relevant program components:

Smolt Trap: 44° 55' 0263 N
115° 29' 0032 W

Adult Holding: 44° 53' 5375 N
115° 29' 3027 W

Weir (Adult Capture): 44° 54' 0491 N
115° 29' 1806 W

Smolt Acclimation Site (Wapiti Meadows): 44° 51' 3747 N
115° 30' 3095 W

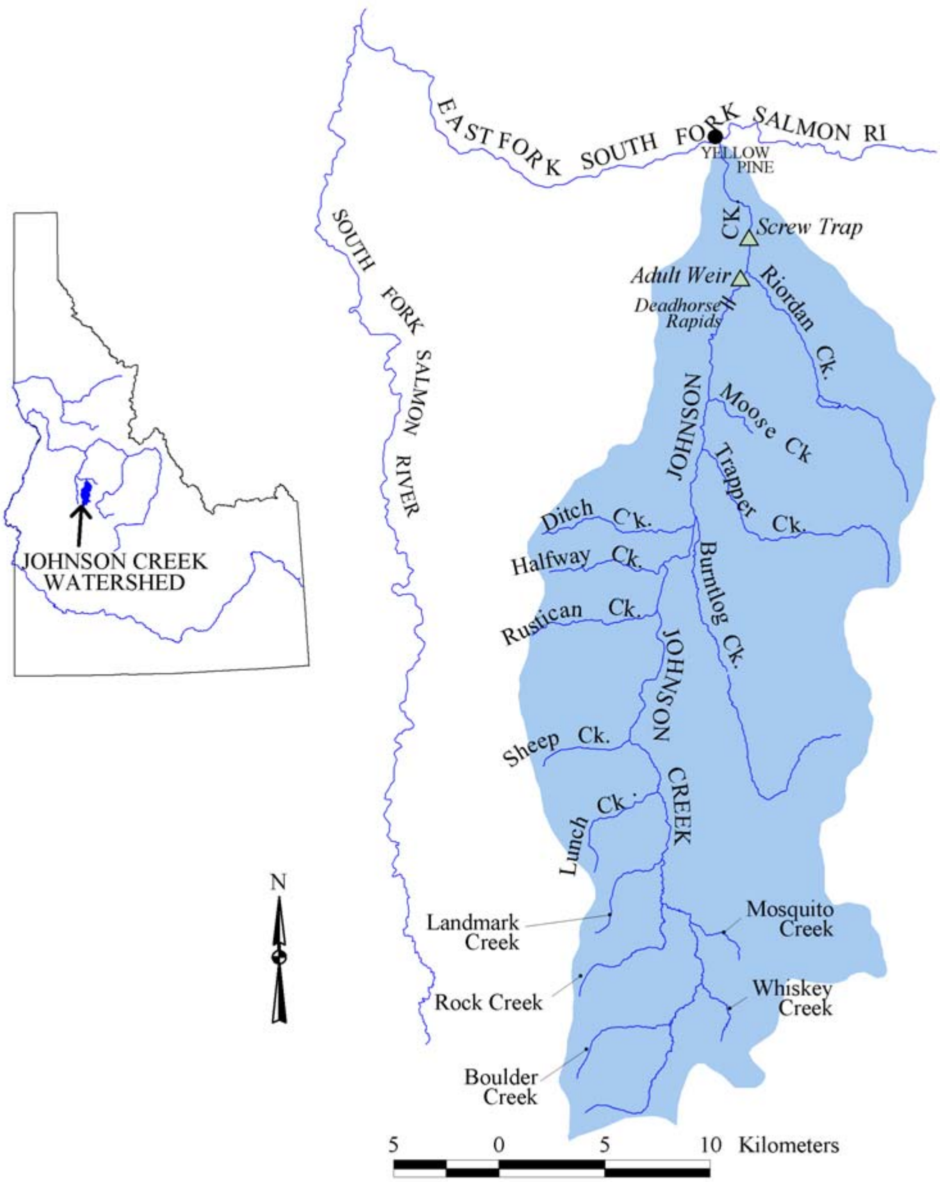
Downstream Extent of Redd Index Area: 44° 53' 2790 N
115° 29' 5020 W

Upstream Extent of Redd Index Area: 44° 51' 0459 N
115° 30' 3485 W

1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

The proposed JCAPE program will operate as a traditional supplementation program. That is, some fraction of the adult returns captured at the Johnson Creek weir will be randomly allocated for retention as broodstock and spawned. Gametes derived from adults retained as broodstock will be transported to the MFH where they will be fertilized and reared using elements of the NATURES (Maynard *et al*. 1996) rearing program. Prior to release in Johnson Creek as yearling smolts, the progeny will be acclimated at Wapiti Meadows Ranch on Johnson Creek water. This program is designed to minimize artificial selection while maximizing egg to smolt survival. However, several potential supportive breeding strategies were considered before proposing this method of supplementation. Alternate methods of supportive breeding considered by the NPT included; eyed-egg outplants, fry/fingerling outplants, and captive broodstock.

Figure 1. Map of Johnson Creek, including location of the screw trap and weir.



The NPT recognizes that the first goal of the JCAPE program must be to increase the absolute number of adult returns in order to address the demographic risks faced by the Johnson Creek spawning aggregate. Unfortunately, with the exception of captive broodstock programs, supplementation can only address survival from egg to smolt development. Therefore, the NPT propose to use the supportive breeding strategy that would maximize survival during these life-history stages. Egg to smolt survival for the JCAPE, as proposed, is expected to be around 70% (FishPro 1999), which is a substantial increase over wild survival rates, which are typically around 5 to 20% for chinook salmon (Groot and Margolis 1991). Due to high mortality from the egg to smolt stage within the Salmon River (74.8%; Kiefer and Lockhart 1997), we conclude that outplanting eyed-eggs is unlikely to substantially increase survival over naturally spawned egg to smolt survival rates. In the upper Salmon River parr to smolt survival was only 24.9% between 1988 and 1994 (Kiefer and Lockhart 1997), suggesting that parr outplants are unlikely to stimulate a large enough increase in egg-smolt survival to be effective.

Survival data for the various life history stages of spring/summer chinook in the Snake River basin are sparse. However, available data indicate that mortality among naturally spawned fish is substantial through every life-history stage from egg to smolt. This suggests that supportive breeding programs within the Snake River basin may be required to implement strategies to minimize mortality for all life history stages from green egg to smolt release. Therefore, we conclude that the JCAPE program, as proposed, offers the highest likelihood of benefiting the Johnson Creek aggregate.

Another alternative is captive broodstock, which increases survival from the parr to adult life history stages. The NPT recognizes that the benefits to survival of Johnson Creek summer chinook salmon from captive broodstock are substantial. However, within the SFSR, facilities capable of maintaining a captive broodstock are unavailable, and construction of adequate facilities may not occur within the time frame necessary to prevent extirpation of the Johnson Creek stock. Due to the added cost and possible delays involved with captive broodstock technology, we conclude that the JCAPE program, as proposed, is more likely to benefit Johnson Creek summer chinook. However, a further analysis of the risks and potential benefits of captive rearing within Johnson Creek may be warranted.

SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS.

2.1) List all ESA permits or authorizations in hand for the hatchery program.

The JCAPE program received a one-year ESA section 10 permit for collection of broodstock and rearing the resulting progeny. This section 10 permit (1147) expired and no current ESA permits have been issued for the JCAPE program. The JCAPE program submitted a new ESA section 10 permit application in March 2000. This permit is still under review by NMFS in April 2001.

2.2) Provide descriptions, status, and projected take actions and levels for ESA-listed natural populations in the target area.

2.2.1) Description of ESA-listed salmonid population(s) affected by the program.

Length at age trends calculated from 1987 to 2000 carcass data yields an age composition of 8% age 3, 41.75% age 4 and 50.25% age 5 (Table 5). Sex ratios within age classes are unequal, however pooled age classes yield a roughly equal sex ratio (Table 6).

Table 5. Age Class Composition of Johnson Creek Summer Chinook Salmon 1987 to 1998.

Year	Sample Size	Number Age 3 [1]	Number Age 4	Number Age 5
1987	32	1	20	11
1988	163	4	33	126
1989	53	0	23	30
1990	45	0	34	11
1991	49	3	13	33
1992	79	4	67	8
1993	149	0	30	119
1994	6	0	2	4
1995	2	0	1	1
1996	19	5	9	5
1997	153	0	120	33
1998	174	3	13	158
1999	22	3	13	6
2000	152	66	75	11
Totals	1111	89	464	558
	Percent Age Composition	8.0%	41.75%	50.25%

1) All age 3 fish recovered in the carcass surveys were Jacks.

All information in this table is based on length measurements taken from carcasses collected from Johnson Creek from 1987 to 1997 and 1999. In 1998 and 2000, length measurements are a combination of measures taken at an adult trap and from field carcass recovery. Because length measurements were used for these age delineations, rather than scales or other aging techniques, it is assumed that there may be some overlap in the actual age classes.

Table 6. Sex ratios by age class, from 1987-2000 Johnson Creek carcass surveys.

Age	% Female	%Male
3 (<67 cm)	1.12%	98.88%
4 (67-82 cm)	34.5%	65.5%
5 (>82 cm)	62.97%	37.03%
Combined	46.08%	53.92%

The age at length scale was constructed from scale analysis of adult returns to the mainstem SFSR.

Adult summer chinook migrate to Johnson Creek from late June through early September. Approximately 40 kilometers are surveyed for spawning activity within Johnson Creek. Roughly 90% (or more) of the spawning occurs in a 4.8 kilometer section from above Deadhorse Rapids (approximately 9 kilometers upstream of the mouth) to the confluence of Moose Creek. However, in 1985 four migration barriers from Burnt Log Cr. to Trout Cr. were removed by IDFG (Petrosky and Holubetz, 1985). This enabled the passage of chinook salmon during low and moderate flows and increased spawning and rearing habitat by 395,000 m^2 (IDFG 1990). Today spawning distribution extends upstream to Whiskey Creek, although very little spawning activity has been noted in these upstream areas.

Spawning starts in early August, peaks in the last week of August through the first week of September, and limited spawning continues through the end of September.

Emigration studies in Johnson Creek collected juvenile summer chinook salmon as they emigrated from rearing areas to obtain emigration timing and emigration estimates. A screw trap is operated in Johnson Creek during three trapping seasons: summer (July 1 to August 31), fall (September 1 to December 31), and spring (January 1 to June 30). However, high stream flows, ice conditions, routine repair and maintenance, and adjustments keep from continuos operation during all seasons. These three seasons correspond to the following life stages of the fish: summer season fish are at the parr stage, fall fish are presmolts, and spring fish are smolts.

Brood years 1997 and 1998 emigration and emigration estimates have been completed. Brood year 1997 fish emigrated out of Johnson Creek 67% as parr, 23% as presmolts, and 10% as smolts for a combined emigration of 122,159 fish. Brood year 1998 fish emigrated out of Johnson Creek 58% as parr, 31% as presmolts, and 11% as smolts for a combined emigration of 45,435 fish.

Identify the ESA-listed population(s) that will be <u>directly</u> affected by the program.

The summer chinook spawning aggregate in Johnson Creek will be the only stock directly effected by the JCAPE program. Direct impacts will include; subsampling for collection of broodstock, introgression of hatchery-reared conspecifics from the hatchery component, and potential capture and handling at the Johnson Creek weir. Sampling of juvenile and adult summer chinook for monitoring and evaluation will be non-lethal (ie. fin clips).

Identify the ESA-listed population(s) that may be <u>incidentally</u> affected by the program.

The JCAPE program might incidentally impact the summer chinook spawning aggregates in the mainstem SFSR, EFSF Salmon River, and the Secesh River, as well as other Columbia basin aggregates through straying. Using the MHF as a proxy, the projected magnitude and destination of JCAPE migrants suggests that effects to other Columbia basin stocks will be minimal (Table 7).

We anticipate that there will be no negative effects to bull trout (*Salvelinus confluentus*) or steelhead (*Oncorhynchus mykiss*) that may be present in Johnson Creek as a result of JCAPE activities.

Table 7. Projected destination and magnitude of JCAPE migrants.

Location	Number of Strays	% of Total Strays
Deschutes	14.9	84.4%
Cowlitz Hatchery	0.1	0.4%
Dworshak Hatchery	0.1	0.8%
Lewis River	0.3	1.9%
Lewis River Hatchery	0.1	0.4%
Lookinglass Hatchery	0.1	0.4%
Little White Salmon Hatchery	0.3	1.9%
Rapid River Hatchery	0.4	2.1%
Round Butte Hatchery	0.1	0.7%
Sawtooth Hatchery	0.4	2.5%
Wells Dam Spawning Channe	0.4	2.1%
White River	0.2	1.2%
Wind River	0.2	1.1%
Total	17.7	100%
	Expanded	Expanded %
Home Successfully	572	97%
Out-Of -Basin Migrants	18	3%
Total (Expanded)	590	100%

Notes:
1. These data were obtained from the RMIS system; http://www.psmfc.org/rmpc/.
2. Expansion factor is based on proportion of individuals tagged (e.g. if 33% were tagged within a brood year, each observed recapture from that brood year would be multiplied by three). This factor does not take into consideration sampling efficiency at the recapture location.
3. These samples include only marks from BY 1974-1990, and recaptures from 1974-1997. Recaptures after 1994 may be incomplete.
4. These calculations assume that tagged and untagged fish return at the same rate.
5. These estimates are valid only if JCAPE adults exhibit homing and straying patterns similar to adults originating from the MHF.

2.2.2) Status of ESA-listed salmonid population(s) affected by the program.

Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds

Demographic Viability
The demographic "critical population threshold" can be defined as the ability of a population to remain self-sustaining within the context of a stochastic environment. To address this criteria, we suggest that adult:adult return rates must be equal to or greater than one. The geometric mean recruit per spawner relationship for Johnson Creek from 1985-1990 was 0.64 (Mundy 1999), suggesting that the spawning aggregate in Johnson Creek is at risk from demographic and depensatory effects.

Genetic Viability
To address the genetic "critical population threshold" we define the Population Critical Level (PCL). The PCL is the number of yearly adult returns necessary to maintain a 95% probability of rare allele (p=0.01) retention for three generations. For these calculations, we assume an N_b/N ratio of 0.25 in Johnson Creek (Waples *et al*. 1993, PRRG 2000) for the hatchery-reared component of the Johnson Creek aggregate and an N_b/N ratio of 0.10 for the naturally spawning population component in Johnson Creek. Using the binomial distribution to define the probability of rare allele retention, approximately 232 adults are required for broodstock, and 785 for natural escapement. Using this criterion, the spawning aggregate in Johnson Creek has been below the PCL for 19 of the previous 25 years. This suggests that the population has lost, and will continue to lose, rare alleles at an unacceptable rate.

Given the small population size, recruitment below replacement, and high probability of loss of rare genetic variation we suggest that the Johnson Creek spawning aggregate has a negligible probability of unaided survival for a period of 100 years. This information suggests that the Johnson Creek spawning aggregate is well below any viable population threshold.

Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.

Table 8. Recruit per spawner functions calculated for Johnson Creek, brood years 1957-92 (after PATH analysis; Kucera 1998).

Year	Recruit/Spawner	Year	Recruit/Spawner
1957	0.485	1975	0.131
1958	2.687	1976	0.721
1959	0.973	1977	0.551
1960	0.565	1978	0.615
1961	0.576	1979	0.431
1962	0.857	1980	2.253
1963	0.652	1981	1.396
1964	0.542	1982	1.458
1965	2.124	1983	2.472
1966	1.375	1984	2.647
1967	0.786	1985	0.497
1968	2.472	1986	4.56
1969	0.474	1987	0.586
1970	0.944	1988	1.285
1971	0.36	1989	0.854
1972	0.134	1990	0.119
1973	0.638	1991	0.055
1974	0.296	1992	0.013

Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

Table 9. Redd counts, estimated adult escapement, and estimated smolt production within Johnson Creek from 1957-1997 (Elms-Cockrum 1998).

Year	Redds	Estimated Adult Escapement	Estimated Smolt Production
1957	319	798	479,012
1958	82	205	123,132
1959	278	695	417,446
1960	486	1,215	729,780
1961	201	503	301,823
1962	295	738	442,973
1963	266	665	399,427
1964	310	775	465,498
1965	116	290	174,186
1966	110	275	165,177
1967	286	715	429,459
1968	127	318	190,704
1969	273	683	409,938

1970	130	325	195,209
1971	183	458	274,794
1972	220	550	330,353
1973	271	678	406,935
1974	107	268	160,672
1975	69	173	103,611
1976	68	170	102,109
1977	81	203	121,630
1978	113	283	169,681
1979	36	90	54,058
1980	24	60	36,039
1981	45	113	67,572
1982	37	93	55,559
1983	63	158	94,601
1984	17	43	25,527
1985	75	188	112,620
1986	53	133	79,585
1987	72	180	108,116
1988	137	343	205,720
1989	42	105	63,067
1990	56	140	84,090
1991	64	160	96,103
1992	76	190	114,122
1993	142	355	213,228
1994	20	50	30,032
1995	9	23	13,514
1996	23	58	34,537
1997	94	235	141,151

*Redd counts from Elms-Cockrom (1998), adult estimates obtained by assuming 2.5 spawners/redd (Matthews and Waples 1991).

The NPPC Presence/Absence Database lists the smolt carrying capacity of Johnson Creek as 510,048, suggesting that adult returns to Johnson Creek have been insufficient to use the available habitat in all but one year for those years that we have data. Further, the adult carrying capacity of Johnson Creek is estimated at 1,681 (SRSRT 1994), also suggesting that adult returns are insufficient to use the available habitat.

- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

The JCAPE program released 78,950 hatchery-reared progeny into Johnson Creek in March 2000. This first smolt release was from brood year 1998 Johnson Creek stock. In addition, from 1985-1989, approximately 1,290,306 fry and/or fingerlings of MFH origin were stocked in Johnson Creek (Table 10).

Table 10. Previous dates and magnitude of hatchery intervention in Johnson Creek.

SFSR Brood Year	Release Date	Number of Fish Released	Fish Size	Release Stream
BY 1984	8/02/85	50,000	Fry	Johnson Creek
BY 1985	5/09/86	177,606	Fry	Johnson Creek
BY 1986	5/05/87	90,000	Fry	Johnson Creek
BY 1986	6/12/87	28,400	Fry	Johnson Creek
BY 1987	5/09/88	194,600	Fry	Johnson Creek
BY 1987	5/31/88	259,200	Fry	Johnson Creek
BY 1988	5/08/89	200,500	Fry	Johnson Creek
BY 1988	8/8-10/89	290,000	Fingerling	Johnson Creek
Total Fish Released		1,290,306	Fry/Fingerling	Johnson Creek

2.2.3) <u>Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimated annual levels of take</u>.

Broodstock collection will result in the direct take of between 64-232 adult summer chinook yearly within Johnson Creek. Monitoring and evaluation will employ non-lethal data collection, such as fin clips for genetic analyses. Capture and tagging of adults and juveniles has previously resulted in very low mortality, so we expect incidental take to be very low. For example, juvenile collection and tagging resulted in the mortality of 0.43% (157 mortalities out of 36,622 handled fish) within 24 hours of handling (Nelson and Vogel 1998, Jason Vogel personal communication).

Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

There is the potential that B-run steelhead or bull trout might be captured at the Johnson Creek weir. However, neither species has been captured to date in the trap box on Johnson Creek. Should non-target species be captured, they would be immediately released upstream or downstream of the weir trap or screwtrap (dependent on direction of travel), with minimal handling.

Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish.

In 1998, 54 and in 2000, 73 adult and jack summer chinook were retained as broodstock for the JCAPE program. In addition 157 out of the 36,622 juvenile chinook captured at the screw trap on Johnson Creek died within 24 hours of handling and/or tagging.

Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).

See Table 16

Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

If adult collection exceeds broodstock goals, those adults not required for the JCAPE will be released upstream of the Johnson Creek weir.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.

We are not aware of any NMFS "ESU-wide" hatchery plan for Snake River spring/summer chinook.

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.

Cooperating Agencies:
Nez Perce Tribe
Columbia River Inter-Tribal Fish Commission
United States Fish and Wildlife Service; Lower Snake River Compensation Plan Office
Idaho Department of Fish and Game
National Marine Fisheries Service
Northwest Power Planning Council
Bonneville Power Administration

Relationship to Other Fish Plans, Programs and Projects Affecting the Johnson Creek Watershed

Wy-Kan-Ush-Mi Wa-Kish-Wit: The Columbia River Anadromous Fish Restoration Plan of the Nez Perce Tribe, Umatilla, Warm Springs and Yakama Tribes
This Tribal Restoration Plan (CRITFC 1995) focuses on restoring salmon runs to the rivers and streams of the Columbia River system and embodies the tribal management philosophy of gravel-to-gravel management. This approach differs from many of the existing state and federal

plans which are focused more on providing fish for sport and commercial harvest and returning fish to concrete hatcheries. The plan recognizes the need to ensure that salmon throughout the life cycle from the freshwater to the ocean are protected, managed or restored.

A key element in the restoration is the use of hatchery technology to supplement the natural runs rather than supplant the natural runs as with state and federal hatchery programs. Supplementation as defined in the Tribal Restoration Plan is the act of releasing young, artificially propagated fish into natural spawning and rearing habitat. As adults, these fish will return to spawn naturally in the stream where they were released rather than returning to the propagation facility. The supplementation programs that will be implemented through the construction of proposed facilities are supported in Wy-Kan-Ush-Mi Wa-Kish-Wit.

Lower Snake River Fish and Wildlife Compensation Plan
Production in the South Fork Salmon River (SFSR) is currently conducted under the Lower Snake River Compensation Plan (LSRCP)-a program to mitigate for spring chinook and summer steelhead losses caused by the four federal dams constructed on the lower Snake River. Mitigation goals under the LSRCP are to produce 8,000 summer chinook adults for the SFSR. The hatchery is located on the North Fork Payette River in McCall, while the adult trapping and spawning facility is located on the SFSR. Since the program was initiated in 1981, the LSRCP has attempted to increase the number of summer chinook returning to the SFSR subbasin.

Idaho Department of Fish and Game (IDFG)
IDFG is a co-manager with the JCAPE in the McCall Fish Hatchery (MFH) operation. MFH will provide both interim and long-term egg incubation and juvenile rearing facilities for the JCAPE project. In addition, the MFH SFSR adult facility may be used in the interim to hold Johnson Creek adult broodstock, until an adult facility is constructed on Johnson Creek. Recovery plans under JCAPE will be implemented solely by NPT.

The Proposed Recovery Plan for Snake River Salmon
The ESA requires development and implementation of recovery plans. NMFS issued a Proposed Recovery Plan in March 1995. In order for the Recovery Plan to yield at least a stable, non-declining run, there must be an improvement made on the relationship between the number of smolts that leave the subbasin and the number of adults that return. The smolt to adult survival rate for Johnson Creek summer chinook salmon must be increased by at least two-fold. Improvements in smolt to adult survival will focus on human controlled factors such as harvest rates and downstream and upstream passage at dams. The efforts made to improve survival for listed endangered stocks will benefit hatchery and non-listed stocks in the same manner.

The success of hatchery or natural runs of salmon ultimately depends on salmon recovery efforts (including Snake River Recovery Plan, the Tribal Restoration Plan, and the Fish and Wildlife Program of the Northwest Power Planning Council).

ISRP Artificial Production Review
Artificial propagation facilities proposed under this project are consistent with those recommended by the Independent Scientific Advisory Board Scientific Review Team (SRT 1998). Proposed facilities are intended to be small-scale, low-cost, temporary/portable in nature,

and located in the natal watershed of the population being supplemented. We propose to use the Natural Rearing Enhancement System (NATURES) developed and researched by NMFS (Maynard et al. 1996) to incubate and rear fish. The NATURES concept modifies standard hatchery aquaculture practices in an attempt to mimic natural conditions. For example, water temperature, photoperiod, density, and/or rearing containers during each life history stage can be modified or managed to mimic natural conditions. The overall goal is to produce a fish that has similar life history characteristics to its wild counterpart in an attempt to avoid domestication and increase post-release survival.

Snake River Subbasin Plan (NPPC)
In 1987, the Northwest Power Planning Council (NPPC) directed the regional fish and wildlife agencies and Indian tribes to develop a system wide plan consisting of 31 integrated subbasin plans for major river drainages in the Columbia Basin. A subbasin plan was developed for the Salmon River.

The main goal of the Plan was to develop options and strategies for doubling salmon and steelhead populations in the Columbia River Basin. The Plan:

1. Provides a basis for salmon and steelhead production
2. Attempts to document current and potential production
3. Summarizes agency and tribal management goals and objectives
4. Documents current efforts
5. Identifies problems and opportunities associated with increasing salmon and steelhead numbers
6. Presents preferred and alternative management strategies

The Subbasin Plans are dynamic and adaptive management tools that seek to evaluate procedures and adjust for implementation of the best available strategies.

Pacific Northwest Power Planning and Conservation Act (1980)
The Northwest Power Act established a Council for the purpose of developing and implementing a program to protect, mitigate, and enhance fish and wildlife, including related spawning grounds and habitat for the Columbia River and it tributaries. The rationale for this program was that the development operation, and management of hydroelectric projects within the basin had negatively affected fish and wildlife resources. The Act represented an unprecedented cooperative effort to produce the first system wide approach to resolving the multiple resource use conflicts in the Columbia Basin. The program developed under the Act is known as the Fish and Wildlife Program. Its provisions, as funded by Bonneville Power Administration, have profound consequences for the fisheries resources of the Johnson Creek basin. Actions of the Council and its implementing partner, the BPA, are constrained to conform with ESA implementation.

Columbia River Fish Management Plan (CRFMP)
The Columbia River Fish Management Plan (CRFMP) is a court approved settlement between the parties in U.S. v Oregon, a case addressing treaty fishing rights in the Columbia River basin. The signatories to the settlement are the United States of America acting through the Department

of the Interior and the Department of Commerce; the Nez Perce Tribe; the Confederated Tribes of the Umatilla Indian Reservation; the Confederated Tribes of the Warm Springs Reservation of Oregon; the Confederated Tribes and bands of the Yakama Nation and the states of Oregon, Idaho and Washington. The plan is a framework for these parties to protect, rebuild, and enhance Columbia River Fish runs while providing fish for both treaty Indian and non-Indian fisheries. The agreement establishes procedures to facilitate communication and resolve disputes through a Policy Committee composed of the parties. Two technical committees guide management decisions of the Policy Committee. The Production Advisory Committee (PAC) responds to hatchery production issues; the Technical Advisory Committee (TAC) responds to harvest issues

Since the escapement goals for salmon to the Snake River basin are viewed as hard constraints on harvest by the regulators within the Columbia River basin, the nature of these goals is critical to the sustainable management of all salmon and steelhead. Although the Johnson Creek summer chinook is part of an aggregate escapement goal for areas above Lower Granite Dam, the CRFMP has no explicit escapement goal for Johnson Creek summer chinook.

The NPT, as co-managers and CRFMP signatories, would be responsible for consultation with the other parties to CRFMP to ensure that hatchery management and operations are in compliance with the CRFMP with regard to production issues, harvest in the ocean and mainstem Columbia River and harvest in the Clearwater River in Idaho.

Biological Opinion on Hatchery Operations in the Columbia River Basin
In its 1995-1998 Biological Opinion, NMFS determined that proposed hatchery operations described by USFWS, NMFS, BPA, COE and BIA at federal hatcheries are likely to jeopardize the continued existence of listed Snake River sockeye salmon, Snake River spring/summer chinook salmon and Snake River fall chinook salmon. NMFS described a reasonable and prudent alternative to hatchery operations that will reduce impacts on endangered chinook and sockeye salmon. The alternative included these measures addressed in the Proposed Recovery plan for Snake River salmon.

USFS Management plans
Johnson Creek is considered a candidate into the Wild and Scenic River System to be managed according to the Wild and Scenic Rivers Act (WSRA) of 1968. The Act required the Forest Service to develop a management Plan within three years of designation.

The management plan seeks to manage for the intent of wild and scenic rivers without compromising the ESA. The WSRA requires a river to be free flowing and to possess one or more “outstandingly remarkable values”. Populations and habitat of threatened and endangered fishes are considered an outstandingly remarkable value.

Upstream Report
On November 8, 1995, the National Research Council, under the National Academy of Sciences organized the Committee on Protection and Management of Pacific Northwest Anadromous Salmonids. The purpose of the committee was to identify factors that have contributed to the declines and extinction of salmonid stocks, and to propose management strategies for the

prevention of further declines. The report addresses issues of genetic diversity, fish passage, watershed management, habitat and harvest. The Research Council calls for an end to fragmented recovery approaches. The Report emphasizes hatchery management based on minimum sustainable escapement rather than maximum sustainable yield and requires drastic changes in ocean harvest practices. The Plan maintains that sustained productivity of salmon is only possible if genetic resources are maintained, therefore, management must protect the genetic diversity of salmon. Condition of spawning and rearing habitat is also defined as a focal point for preventing salmon declines.

Return to the River: Restoration of Salmonid Fishes in the Columbia River Ecosystem
In December , 1994, the Northwest Power Planning Council (NPPC) called on Bonneville Power Administration (BPA) to fund the Independent Scientific Group (ISG). The function of the ISG was to conduct an Annual Review of the science underlying salmon and steelhead recovery efforts in the Columbia River Basin. The purpose of the project was to provide a conceptual and scientific foundation for public policy to be developed by the NPPC and other decision making bodies. The review does not recommend policies for recovery and restoration, nor does it recommend specific measures or strategies or deal with institutional structures.

Magnuson-Stevens Fisheries Conservation and Management Act
The Fisheries Conservation and Management Act was signed into law on April 13, 1976 (FCMA; 16 U.S.C. 1801-1882; Pub. L. 94-265). It marked the beginning of a new era in fisheries management because federal authorities assumed responsibility for all continental shelf fishery resources and all anadromous species throughout their migratory range. In the case of salmon, the states of Oregon, Washington and California were constrained to fisheries that conform to the will of the federal Fishery Management Council which was established by the Act. Fisheries management actions within the Councils waters are constrained to support the Pacific Salmon Treaty, and they are bound to be consistent with the orders of the federal courts, such as those of U.S. v Oregon and U.S. v Washington. Actions by the councils are also constrained to conform with ESA implementation.

The Act was re-authorized in October 1996 (H.R. 39 and S. 39) and it was renamed the Magnuson-Stevens FCMA. Both the House and Senate bills focused on major challenges falling roughly into four areas of concern: habitat degradation, over fishing, bycatch (reducing or eliminating discards or other waste) and funding. The issue of bycatch is particularly relevant to summer chinook, since they are distributed farther offshore than are other Columbia River salmon life history types, with the exception of steelhead. The offshore distribution of summer chinook and steelhead increase their vulnerability as bycatch in fisheries managed under the Act by the North Pacific and Pacific Fishery Management Councils. Summer chinook have been landed in fisheries regulated by the Pacific Fishery Management Council.

Relationship to other recovery projects in the South Fork Salmon River subbasin and Columbia River Basin

This project is closely allied with other NPT supplementation projects (Nez Perce Tribal Hatchery – 8335000, Imnaha and Lostine Hatchery, and Pittsburg Landing, Capt. John Rapids, Big Canyon Acclimation Facilities – 9801005). These projects will share knowledge on development of NATURES incubation and rearing techniques, production operations, and results from monitoring and evaluation studies. The M&E Plan for NPTH (Steward 1996) has proven useful for planning these supplementation projects by providing a template for similar M&E studies. Technology developed from the Yakama Fisheries Project will also be integrated into JCAPE facilities.

Other BPA funded projects that will be involved with the proposed facilities and fish:

- 8909802 – Salmon Supplementation Studies in Idaho Rivers. Evaluate various supplementation strategies for maintaining and rebuilding spring/summer chinook populations in Idaho.
- 9403300 - Fish Passage Center's Smolt Monitoring Project. Juvenile and natural salmon produced in relation to these facilities will provide release and migration data for in-river information on migration timing and survival.
- 9600800 - PATH (Plan for Analyzing and Testing Hypotheses). Naturally produced juveniles from targeted streams will provide data for life cycle model
- 9703800 - Listed Stock Chinook Salmon Gamete Preservation (Cryopreservation)

3.3) Relationship to harvest objectives.

The NPT do not foresee recommending sport or commercial harvest of the Johnson Creek stock for at least 15 years. When a harvestable surplus is produced, the NPT will employ adaptive management to set harvest goals.

3.3.1) Describe fisheries benefiting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

It is likely that a fraction of JCAPE adults will be captured in commercial ocean and in-river fisheries. Currently, the contribution of Snake River spring/summer chinook to ocean fisheries is less than 1%, with in-river recreational and commercial fisheries accounting from 3.43-3.92%[1] (Berkson 1991) to 3% to 8% (PATH 1998). These harvest rates likely have a minimal effect on Snake River spring/summer chinook stocks. The contribution of JCAPE adults to these fisheries will be assessed through coded wire tag recoveries. It would be premature to project future harvest rates until the JCAPE is fully operational and data are available to assess potential harvest opportunities.

3.4) Relationship to habitat protection and recovery strategies.

Factors Affecting Natural Production

Matthews and Waples (1991), suggest that overfishing, irrigation diversions, logging, mining, grazing, obstacles to migration, hydropower development, and questionable management were the primary contributors to the decline of summer chinook in the Snake River basin. Currently, the contribution of Snake River spring/summer chinook to ocean fisheries is less than 1%, with in-river recreational and commercial fisheries accounting from 3.43-3.92%[1] (Berkson 1991) to

[1] In-river harvest estimated for McCall Hatchery summer chinook brood years 1976 to 1986.

3% to 8% (PATH 1998). These harvest rates likely have a minimal effect on Snake River spring/summer chinook stocks, however historical overharvest may have played an important role in declines among these populations. Between 1938 and 1944, harvest rates are estimated to have been as high as 88% for Snake River summer chinook (Raymond 1988). Summer chinook have not been targeted for in-river commercial harvest since 1963, and recreational harvest targeting summer chinook was halted in 1974 (NMFS 1991).

Currently, Johnson Creek is proposed for designation as a wild and scenic river. During the petition process the USFS has, and will continue to, manage Johnson Creek as a wild and scenic river in order to maintain the streams eligibility for such a designation. Should this designation be accepted, the Johnson Creek watershed would be protected from many of the land use practices thought to have been partially responsible for the decline in the Johnson Creek stock. Currently very little logging is occurring in Johnson Creek, suggesting that forestry impacts are minimal.

Hydropower development has substantial impacts on Snake River spring/summer chinook, which must pass eight mainstem dams on the seaward migration. The PATH (1996) analysis suggests that emigrating Snake River juvenile spring/summer chinook suffer 89% mortality due to the hydrosystem. Between 16 % and 26% of the adults returning to the SFSR are lost due to dam related mortality from the Ice Harbor to Lower Granite Dam alone. These data suggest that substantial changes to mainstem hydropower operation need to be pursued to ensure the survival of Snake River salmon.

Short and Long-Term Effects of Mitigation

Habitat improvements in Johnson Creek resulting from management as a wild and scenic river will likely take decades to accrue. As a result of the wild and scenic designation, we expect that habitat quality within Johnson Creek will improve, however habitat improvements such as decreased sedimentation will require years. Therefore, in the short-term habitat will be protected from poor land-use practices, and in the long-term habitat quality should increase. Increases in habitat quality would be expected to improve egg to smolt survival, although the actual increase in survival is difficult to predict.

3.5) Ecological interactions.

Predation

The potential exists for hatchery-reared juveniles from the JCAPE program to prey on naturally spawned Johnson Creek summer chinook. The impact of direct predation by JCAPE juveniles is expected to be minimal because: 1) juvenile spring/summer chinook primarily feed on insects, 2) hatchery-reared smolts will be similar in size to naturally-reared smolts, and 3) emigration is expected to occur immediately after volitional release from acclimation sites. In addition, JCAPE progeny might prey on steelhead smolts, however the emigration of steelhead smolts within Johnson Creek does not overlap with the projected dates that JCAPE progeny would be present.

It is also possible that steelhead and bull trout juveniles and adults could prey on JCAPE progeny. However, the occurrence of these species within Johnson Creek during the period when JCAPE progeny would be present is infrequent.

Environmental Benefits
Construction of redds promotes gravel recruitment, and may change the dimensions and stability of a streambed or channel (NRC 1996). For example, redd construction along the banks of a stream may widen the channel. It follows that a wider streambed may be less prone to erosion and scouring during flood events, providing a stable environment for aquatic biota (NRC 1996). Restoring salmonid populations may be directly beneficial to other species by providing a pathway for recruitment of marine nutrients, or as a source of prey. Recruitment of marine nutrients is expected to play an important role in estuarine food webs (Fujiwara and Highsmith 1997), freshwater and riparian vegetative growth, and the growth of periphyton (NRC 1999). Avian predators, marine and terrestrial mammals, and insects among other biota may benefit from live and dead salmonids (Hewson 1995, NRC 1996).

SECTION 4. WATER SOURCE

4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

1. Adult Holding Facilities:
Interim: The water supply to the SFSR adult trap facility is supplied from the South Fork Salmon River through a 33 inch underground pipeline. The head box for this line is located approximately ¼ mile upstream from the facility. Water is supplied to the facility through gravity flow and is at ambient stream water temperatures (range 6-17˚C).

Long-Term: The water supply to the JCAPE adult trap/holding facility will be supplied from Johnson Creek through a 24 inch underground pipeline. The head box for this line will be located approximately 900 feet upstream from the facility. Water will be supplied to the facility through gravity flow and is at ambient stream water temperatures (range 6-17˚C). The supply line would be capable of delivering five (5) cubic feet per second (cfs) of water, though only one (1) cfs is estimated to satisfy biological oxygen demand (remainder is used as attracting flow in the fishway). NMFS screening requirements will be met at this facility.

2. McCall Fish Hatchery:

Interim: An agreement with the Payette Lake Reservoir Company, allows for a 20 cubic feet per second (cfs) water flow for hatchery use. Water gravity fed from Payette Lake and the North Fork Payette River at the outlet of the lake via a 36 inch underground pipeline. Water taken at the river is used to maintain optimum rearing water temperatures.

Water quality analyses yield a somewhat "distilled" system for rearing fish. Total hardness ranges from 6.3 to 7.06 mg $CaCO_3$/l, while pH stays nearly constant at 6.8. There is no indication of problems with heavy metals and the water temperature is maintained at 52 to 56 degrees Fahrenheit, with a winter low of 37 degrees Fahrenheit.

Long Term: As the project design is developed additional water sources may be incorporated to provide optimal rearing conditions for the JCAPE program.

Since the JCAPE will be expanding the existing MFH facility, NPDES permits maintained by the MFH will be shared by the JCAPE. Similarly, since the water supply for the MFH and JCAPE is shared, screening criteria applied to the MFH will be applied to the JCAPE as well.

3. Release Facilities:
Exact locations of the acclimation facilities have yet to be finalized. However, acclimation facilities will be supplied with ambient temperature stream water (range 4-13°C). Back-up pumping systems and alarms will be in place and the facility will be manned 24 hrs/day when in use. Acclimation facilities will be designed to incorporate NATURES rearing approaches where appropriate.

4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

Hatchery water is obtained from Payette Lake, which no longer supports listed fish species. Effluent water is discharged into the North Fork of the Payette River, which is not known to support listed fish species, although bull trout may be present (but there is no documented record of sighting).

The SFSR satellite facility (interim adult holding facility) is equipped with a low water alarm consisting of a high decibel siren and flashing light. A security trailer is located on site and continuously occupied while fish are in the facility. The intake screens are checked daily and water flows are measured every other day. A two-way radio is located in the security trailer for 24 hour assistance. Adult holding facilities on Johnson Creek will be occupied and monitored 24 hours a day and will be equipped with similar alarm systems.

McCall Fish Hatchery includes an emergency alarm system for monitoring water levels and flows, and fire and electrical failures. All residences and the dormitory are connected to the alarm system through a telephone dialer. The water supply is gravity fed and does not require electrical power to operate. An emergency generator is on line to provide electrical power to the hatchery building lights, alarm system, and incubation water disinfection in case of power failure.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Acquisition of Broodstock:

The JCAPE program will derive broodstock from wild/natural adults captured at the Johnson Creek weir (river kilometer 6.84). This site provides easy access to the stream banks, and a streambed with gradient and substrate conducive to weir installation and operation. The site is located on private property (leased from the landowner), affording protection from vandalism and fish harassment.

The weir will be installed between the end of June and the first of July each year when flow in Johnson Creek drops to a level that allows safe installation. The United States Geological Survey (USGS) maintains a gauging station at the mouth of Johnson Creek that may prove useful in predicting when the weir can be safely installed. The trap and weir will remain in operation until September 30th each year.

A portable weir and trap unit consisting of aluminum tripods, picket panels and an adjustable trap/holding box will be utilized to collect adult summer chinook salmon. The trap/holding box dimensions will be at a minimum 8 feet by 12 feet and expandable to 12 feet by 24 feet.

5.2) Fish transportation equipment (description of pen, tank truck, or container used).

In the interim, the JCAPE project will depend on transporting adult summer chinook salmon from the Johnson Creek weir to the MFH SFSR adult holding facility. Long-term adult holding and spawning facilities are being designed for location on Johnson Creek.

A. Mode:

Adult Salmon: Transportation of adult salmon will be conducted using a large capacity (300-400 gallon) fish tank equipped with oxygen injection systems, aeration systems, and dissolved oxygen meters on a 1 or 2 ton rated vehicle. Nez Perce Tribe Fisheries personnel will be responsible for the transportation of adult salmon.

Eggs: Fertilized eggs will be taken from Johnson Creek or the SFSR facility in egg box containers in an enclosed utility vehicle. Nez Perce Tribe Fisheries and Idaho Department of Fish and Game personnel will be responsible for the transportation of fertilized eggs to MFH. Eggs collected from adults spawned on Johnson Creek may be transported from Johnson Creek to the MFH by fixed wing aircraft. Eggs would be packaged for transport in egg box containers and then flown to the McCall airport.

Smolt: Transportation of progeny as smolts will be conducted using a large capacity (300-400 gallon) fish tank, equipped with oxygen injection systems, aeration systems with multiple circuits, and dissolved oxygen meters on a 1 or 2 ton rated vehicle. Nez Perce Tribe Fisheries personnel will be responsible for the transportation of smolts/pre-smolt to acclimation facilities on Johnson Creek.

B. Length of time for adult transport: Adult transportation time from the Johnson Creek trap facility to the SFSR adult facility is approximately 1 to 1.5 hours depending on road conditions, traffic, and route selection.

C. Length of time for egg and juvenile transport:

Eggs: Fertilized eggs or unfertilized gametes taken from adult salmon spawned at SFSR facility will be transported to the MFH. Ground travel time to transport fertilized eggs from SFSR facility to MFH is approximately 45 minutes to 1 hour. Ground travel time from Johnson Creek is approximately 2.25 to 2.5 hours. Air transportation to McCall airport from Johnson Creek is approximately 20 to 30 minutes. An additional 10 minutes of ground transportation would be needed to transport fertilized eggs or gametes to the Johnson Creek airstrip and from the McCall airport to the MFH.

Juveniles: Juveniles will be transported from the MFH to acclimation and volitional release facilities on Johnson Creek. Transportation time required to reach these locations is approximately 2 to 3.5 hours. Spring smolt releases will require longer travel time from the MFH to Johnson Creek due to limited access because of winter road conditions. In the event that all roads are closed into these locations, smolts may be transported via some other conveyance, such as helicopter or snow vehicle. These situations are rare and could either increase or decrease the travel time to Johnson Creek.

D. Qualifications of transport (drivers):

The qualifications of individuals conducting transport of adults, eggs, and smolts/pre-smolts will be kept on file at the Nez Perce Fisheries McCall Regional Office in McCall, Idaho.

E. Description of transport units:

Adult: The primary transport vessel is a single compartment aluminum tank mounted on a 1 or 2 ton rated vehicle. The tank has a 300-400 gallon working water volume capacity and is insulated to minimize the environmental effects on water temperature. The tank compartment is provided with a rear release gate which allows adult fish to be released directly into the adult holding pond. At the adult holding pond site the adult fish will be unloaded by opening a rear release gate and allowing the fish to be released down a flume directly into the holding pond. Males and females will be discharged into separate holding ponds. If both males and females are transported together, they will be removed from the tank using a dip net and placed into the appropriate pond. Each holding pond will be clearly marked to avoid accidental mixing of fish.

Oxygen will be supplied to the tanks through diffusers located on the tank bottom and delivery is provided to manifolded flow meter through a common regulator. Electrical agitators provide water recirculation in both tanks to maintain dissolved oxygen at 98% saturation. Gauges located inside the vehicle cab will display the temperature and oxygen levels, providing the operator a visual view of water conditions during transport. An alarm located inside the vehicle will alert the operator when tank conditions are below normal.

The number of adults to be hauled per day is expected to be small, less than 10 fish. As such, the normal hauling rate guidelines (1lb/gal) will not be approached on any given day. Beyond this, operational decisions made at the time of transfer must consider temperature (water and air), fish health, time of hauling, water conditions (clean/dirty), equipment or any other factor which may influence tank loading rates.

It is imperative that the operation of all fish transport equipment be verified prior to the onset of the fish transport season and routinely throughout the transport season. The preliminary effort must include dynamic operation of the equipment under simulated working conditions. Daily checks of the transport vehicle will verify fuel, oil levels and function levels of lights, brakes and electrical systems. Check agitator operation, alarm system and verify that valves are properly set for the days activity.

Eggs: Transportation of egg will be conducted using 80 quart insulated coolers. Eggs will be placed in individual egg tubes to keep individual female egg takes separate from other females. Approximately 20-30 egg tubes will be placed in each cooler. Ice is added to each cooler to prevent spillage of egg tubes and to keep eggs chilled during transport. Each cooler is sealed with tape to prevent leakage of water.

Smolt: The primary transport vessel is a single compartment aluminum tank mounted on a 1 or 2 ton rated vehicle. The tank has a 300-400 gallon working water volume capacity and is insulated to minimize the environmental effects on water temperature. The tank compartment is provided with a rear release gate that allows juvenile fish to be released directly into the acclimation ponds.

Oxygen will be supplied to the tanks through diffusers located on the tank bottom and delivery is provided to manifolded flow meter through a common regulator. Electrical agitators provide water recirculation in both tanks to maintain dissolved oxygen at 98% saturation. Gauges located inside the vehicle cab will display the temperature and oxygen levels, providing the operator a visual view of water conditions during transport. An alarm located inside the vehicle will alert the operator when tank conditions are below normal.

F. Special Care:

Every reasonable effort will be made to spread the risk associated with transportation of listed fish. In most cases only a portion of any stock will be transported in one container at one time. The transport vehicles will be equipped with a two-way radio and/or a cell phone. Back-up or supplemental systems will be provided for all oxygenation equipment. No anesthetic or media will be added to the transport water. The vehicle operator will monitor the oxygen flows and agitator performance from gauges mounted inside the vehicle cab. The driver will make at least one visual check of the fish within one hour of travel. Onsite stream tempering of transport tank will be conducted if receiving water exceeds a 3ºC difference.

5.3) Broodstock holding and spawning facilities.

Adult Holding/Spawning Facility:

Interim: Fish trapped in Johnson Creek may be transported to the SFSR adult salmon trap facility. These fish would be ponded with fish captured at the SFSR trap facility. Fish from Johnson Creek will be differentially marked with two visual marks to avoid mixing stocks during spawning. The SFSR facility has two adult holding ponds, one for males and one for females. Each adult pond is 90 ft x 10 ft x 3.5 ft (water depth) and has a maximum holding capacity of 1,500 adult salmon (average maximum density of 2.22 lb/cubic foot of space).

After the primary sort of adult fish, all Johnson Creek males will be transferred to a 16 foot diameter circular tank (5 foot water depth). The tank is supplied with SFSR water and is equipped with a jump barrier cover and water level alarms. In addition, the tank is has a backup pumping and oxygen system in place. The tank allows for decreased handling and overall stress of the Johnson Creek males during spawning.

Long-Term: Fish trapped from Johnson Creek will be processed on site and transferred into adult holding ponds adjacent to the fish trap. The facility will have two adult holding ponds, one for males and one for females. Each pond will be 50 ft x 10 ft x 3.5 ft (water depth) and will be capable of holding 125 adult salmon.

5.4) Incubation facilities.

Egg incubation and rearing will take place at the McCall Fish Hatchery, which is owned by USFWS-LSRCP and operated by the Idaho Department of Fish and Game. Hatchery facilities, as they currently exist, are adequate for short-term JCAPE egg incubation and rearing requirements.

However, in the long-term, JCAPE will require modification of the MFH. Proposed modifications to the MFH include: increased egg incubation facilities, additional indoor rearing tanks, additional outdoor rearing ponds, expansion of the present effluent settling pond, and/or addition of solid waste removal capabilities.

It is projected that expansion of the facilities for JCAPE will not require any additional water flow above the current above the current 20 cfs allotted the MFH by the Payette Lake Reservoir Company.

Water will be obtained by gravity flow from Payette Lake and the North Fork Payette River at the outlet of the lake, through underground pipeline.

Water taken at the river is used to control maximum optimum rearing water temperatures. Water quality analysis reveals a somewhat "distilled" system for rearing fish. Total hardness ranges from 6.3 to 7.06 mg $CaCO_3$/l, while pH stays nearly constant at 6.8. There is no indication of problems with heavy metals and the water temperature is maintained at 52° to 56° F, with a winter low of 37° F.

Egg Incubation Facilities:

Interim: Egg incubation is accomplished in 8-tray single stack FAL (Flex-A-Lite, Consolidated) vertical flow (Heath type) incubators within the existing hatchery building.

Long-Term: Egg incubation would be accomplished with the addition sixteen 8-tray stacks of vertical flow (Heath type) incubators to be located in an addition to the existing hatchery building. Eggs from one female will be placed in a single tray for incubation.

5.5) Rearing facilities.

Rearing of progeny will occur at the McCall Fish Hatchery with smolt acclimation occurring at Johnson Creek for volitional release back into Johnson Creek. The rearing protocol has been modified from IDFG's MFH rearing protocol.

Juvenile Rearing Facilities

Juvenile rearing will consist of two components. The first component is initial fry rearing and second component is smolt rearing. Concrete rearing vats will provide the majority of the early rearing while large outdoor rearing ponds will be utilized for smolt rearing.

Rearing Vats: MFH has a total of 14 rearing vats of 4 ft x 40 ft x 2 ft (water depth) dimensions with 320 cu ft of rearing area per vat.

Fry are set out into initial rearing vats at approximately 1,750 temperature units (TU's). Indoor rearing vats are initially set up at half length (20' x 4' x 2') and a water flow of 80 gpm. Lighting over the vat is turned off, with shade covers placed over the vat until complete swim-up occurs. Initial rearing density will be determined from an eyed-egg count. Generally, 70,000 to 80,000 fry will be placed in each vat.

Initial feeding begins once swim-up is completed. Once fish begin to feed, the lights are turned back on over the vats and the shade covers removed. Lights are on a timer and rheostat system to simulate daylight and dark conditions. Cleaning baffles are installed once fry have started feeding. Vats are extended to full length (40' x 4' x 2') as rearing densities increase. Water flow is monitored and adjusted as the vats are extended.

Interim: The JCAPE program will utilize one to two of the existing rearing vats as is needed to meet the interim production numbers. The JCAPE program will be able to rear up to 100,000 smolts within the existing MFH until new facilities are constructed. These fish will remain in these vats until late September when the collection basin becomes available.

Long-Term: The JCAPE program will be adding two to three additional rearing vats in the existing hatchery building in order to accommodate the needs of the JCAPE program at this facility.

Outdoor Rearing Ponds: Fish would be transferred into the outdoor rearing ponds in late May or early June of each year and reared in these facilities until transfer to smolt acclimation facilities in March of each year.

Interim: Until additional outdoor rearing ponds are constructed, the JCAPE program will utilize the collection basin at the tail race of the existing two outdoor rearing ponds. The fish would be transferred into this pond in late September once other programs have stopped using this pond.

Long-Term: Two additional outdoor rearing ponds will be constructed to accommodate the JCAPE program. Water for these ponds will be supplied with second pass hatchery water that will be pumped from the existing collection basin. This water will be filtered, sterilized (UV), and re-aerated (stack column) before entering the ponds. Back up pumps, alarms, generators, and an unfiltered gravity water supply system will be incorporated into the water re-use system.

5.6) Acclimation/release facilities.

Interim: No interim release facilities have been identified. Design and construction approval process will not be completed in time for the next scheduled release of smolts from the JCAPE project. Therefore, a direct release is being proposed for the release of broodyear 2000 and possibly 2001 smolts. All subsequent broodyears should have functional acclimation facilities available for smolt releases. Attempts will be made to acclimate the broodyear 2000 and 2001 smolts, but specific detail and locations have yet to be determined. It is likely that temporary side-channel acclimation or net pen acclimation may be considered.

Long-Term: Long-term acclimation facilities will primarily consist of using natural-type side channels adjacent to Johnson Creek on the Wapiti Meadows Ranch. Water supply lines, water control structures and fish screens would be placed into an existing side channel. These improvements would provide a total rearing volume of 25,000 cubic feet and would be capable of acclimating 300,000 smolts at a smolt densities of 0.10 - 0.20 lbs/cu.ft/inch length of fish. The use of natural side channels will provide a NATURES (Maynard et al. 1996) approach to mimic natural stream conditions and will be supplied with ambient temperature water from Johnson Creek. This natural side channels being proposed for smolt acclimation occurs within or above existing major adult spawning and juvenile rearing habitat for summer chinook salmon in Johnson Creek.

5.7) Describe operational difficulties or disasters that led to significant fish mortality.

The McCall Hatchery has never experienced operational difficulties or disasters that led to significant fish mortality.

5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

Adult holding and smolt acclimation facilities on Johnson Creek will be staffed full time during the period of their operation. Low water alarm systems and other risk aversion technology will be employed as appropriate. In the event of water loss, backup pumps will be employed. If backup pumps prove to inadequate, the fish would be immediately released into Johnson Creek.

Incubation and rearing facilities at the MFH/JCAPE facilities will be staffed full time. The facilities are equipped with low water alarm systems. Over the course of its operation, the MFH has never suffered mortality from water supply problems.

The SFSR satellite facility (interim adult holding facility) is equipped with a low water alarm. A security trailer is located on site and manned while fish are in the facility. The intake screens are checked daily and water flows monitored by measuring the flow every other day. A two-way radio is located in the security trailer thus providing for 24 hour assistance. Adult holding facilities on Johnson Creek will be manned and monitored 24 hours a day and will be equipped with similar alarm systems.

McCall Fish Hatchery includes an emergency alarm system monitoring water levels and flows, and fire and electrical failures. All residences and the dormitory are connected to the alarm system through a telephone dialer. The water supply is a gravity flow system and does not require electrical power to operate. An emergency generator is on line to provide electrical power to the hatchery building lights, alarm system, and incubation water disinfection in case of power failure.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.

List all historical sources of broodstock for the program. Be specific (e.g., natural spawners from Bear Creek, fish returning to the Loon Creek Hatchery trap, etc.).

Initially JCAPE will derive broodstock from wild Johnson Creek summer chinook. Adult summer chinook salmon chosen for broodstock will be collected at a temporary adult weir and trap site on Johnson Creek at approximately river kilometer 6.84. Long-term broodstock collection will incorporate naturally spawned adult returns to Johnson Creek, and hatchery-reared adults as necessary to meet broodstock goals.

6.2) Supporting information.

6.2.1) History.

Historically, the South Fork Salmon River (SFSR) was the single most important summer chinook salmon spawning stream in the Columbia River basin, producing a substantial proportion of all Snake river summer chinook salmon (Mallet, 1974). Approximately 50% of Idaho's summer chinook salmon redds were counted in the SFSR. As recently as 1957, adult summer chinook salmon returns to the SFSR were estimated to range between 10,000 and 15,000 fish.

Natural escapement declines in the SFSR basin have paralleled those of other Snake River stocks. Reduced spawner numbers combined with human manipulation have resulted in decreased spawning distribution and population fragmentation.

Johnson Creek, a part of the SFSR subbasin, has experienced similar population declines in chinook salmon to the SFSR and other Snake River stocks. Index area redd counts in Johnson Creek have declined from a high of 486 redds in 1960 to a low of five redds in 1995. Provisional adult salmon escapement objectives for Johnson Creek are 1,681 fish (SRSRT, 1994.) These numbers, along with index area redd counts, indicate that Johnson Creek is well below its potential adult and smolt carrying capacity. These critically low levels of wild/natural production of summer chinook salmon may effect the genetic resources and the long-term survival of this stock in Johnson Creek.

On December 28, 1993 (USGFR 1993; 58 FR 68543), critical habitat was designated for Snake River summer chinook salmon listed under the Endangered Species Act. This designation provides notice to Federal agencies and the public that these areas and features are vital to the conservation of the species. The SFSR and Johnson Creek are designated as critical habitat for Snake River summer chinook salmon.

The demographic "critical population threshold" can be defined as the ability of a population to remain self-sustaining within the context of a stochastic environment. To address this criteria, we suggest that adult:adult return rates must be equal to or greater than one. The geometric mean recruit per spawner relationship for Johnson Creek from 1985-1990 was 0.64 (Mundy 1999), suggesting that the spawning aggregate in Johnson Creek is at risk from demographic and depensatory effects.

To address the genetic "critical population threshold" we define the Population Critical Level (PCL). The PCL is the number of yearly adult returns necessary to maintain a 95% probability of rare allele (p=0.01) retention for three generations. For these calculations, we assume an N_b/N ratio of 0.25 in Johnson Creek (Waples *et al*. 1993, PRRG 2000) for the hatchery-reared component of the Johnson Creek aggregate and an N_b/N ratio of 0.10 for the naturally spawning population component in Johnson Creek. Using the binomial distribution to define the probability of rare allele retention, approximately 232 adults are required for broodstock, and 785 for natural escapement. Using this criterion, the spawning aggregate in Johnson Creek has been below the PCL for 19 of the previous 25 years. This suggests that the population has lost, and will continue to lose, rare alleles at an unacceptable rate.

Given the small population size, recruitment below replacement, and high probability of loss of rare genetic variation we suggest that the Johnson Creek spawning aggregate has a negligible probability of unaided survival for a period of 100 years. This information suggests that the Johnson Creek spawning aggregate is well below any viable population threshold.

6.2.2) Annual size.

Preferably, naturally spawned adults will be the sole source of broodstock for the JCAPE program for the duration of its operation. However, if naturally-spawned adult returns are insufficient to meet broodstock collection goals, the minimum number of hatchery-reared adult returns to Johnson Creek will be incorporated.

Until the JCAPE expansion of the MFH is complete, broodstock goals for the JCAPE will range from 64-84 adults (assuming an equal sex ratio), depending on the availability of incubation and rearing space at the MFH. The long-term broodstock goal for the JCAPE is 232 adults (assuming an equal sex ratio; see sliding scale Tables 1 and 2).

6.2.3) Past and proposed level of natural fish in broodstock.

In 1998, 114 and in 2000, 152, naturally spawned summer chinook adults were intercepted at the Johnson Creek weir. Of the adults intercepted, 54 were collected in 1998, and 73 were collected in 2000, retained and spawned, then their progeny transported to the MFH for incubation and rearing. To date, these have been the only broodstock collected for the JCAPE program.

Broodstock collection for the JCAPE program resumed annual collection in 2000. Since hatchery-reared fish have been infrequently outplanted in Johnson Creek, we expect that broodstock collection will consist solely of naturally spawned adults. To avoid repeated indirect artificial selection, which may result from rearing in the hatchery environment, broodstock collection will favor naturally spawned adults. When possible, the JCAPE broodstock will consist of 100% naturally spawned adults.

6.2.4) Genetic or ecological differences.

The JCAPE program will derive broodstock from adult returns captured at the Johnson Creek weir. Therefore, we do not anticipate genotypic, phenotypic, or behavioral divergence of the naturally spawning and hatchery-reared population components.

6.2.5) Reasons for choosing.

The endemic Johnson Creek summer chinook stock was selected as the donor stock for the JCAPE program. It is our hope that we will be able to take advantage of the centuries of selection which have acted to optimize genetic, phenotypic, and behavioral traits of this summer chinook stock.

6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

While not all sources of artificial selection can be avoided, artificial selection can be minimized by proper collection and rearing protocols. The JCAPE program limits artificial selection through incorporation of randomized broodstock collection procedures, maximizing the contribution of naturally spawned adults, and incorporation of the NATURES rearing techniques. NATURES techniques are intended to mimic natural conditions within the hatchery by incorporation of natural substrate, natural coloration, overhead cover, and decreased density during rearing and acclimation.

Unfortunately, broodstock collection at the JCAPE weir may be hindered by high flow conditions. Therefore, in some years adult returns may commence before the weir can be installed. Consequently, broodstock collection may unintentionally select against earlier returning adults. Since only two years of data exists, the proportion of the run potentially missed is difficult to project. However, the JCAPE monitoring and evaluation program (Vogel and Hesse 2000 draft; Appendix B) includes monitoring of weir efficiency and escapement. If the proportion of the run missed is large, a more aggressive weir will be pursued.

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Three to six year old adult summer chinook returning to Johnson Creek will be the sole source of broodstock for the JCAPE program.

7.2) Collection or sampling design.

Captured adults will be tagged (opercle, PIT, floy, or other) such that the location and date of capture is known for each individual. Adults will be collected systematically throughout the run (whenever possible) to avoid artificial selection for early or late returning adults. Broodstock collection will follow the guidelines listed below (PRRG 2000):

1. Brood fish will be collected throughout the entire adult run.

2. Returning natural fish will be collected with the highest priority.

3. Returning hatchery fish will be the second priority.

The JCAPE Annual Operations Plan (AOP) and HGMP will be reviewed annually as additional information becomes available.

The JCAPE benefit/risk assessment (PRRG 2000) recommends that the following protocols be implemented to maintain the genetic viability of the Johnson Creek stock:

a. The weir will be installed and broodstock collection initiated as early each year as is physically possible.

b. All fish that return to the weir site will be captured (within the capacity of weir efficiency). A maximum number of 232 (116 females) naturally produced adult salmon may be kept each year for the first five years of the project. In order to minimize collection bias, a range of age/size groups will be retained for artificial propagation. The remainder of the fish will be passed upstream of the weir to spawn naturally (see sliding scale Tables 1 and 2).

c. After the fourth year, we anticipate that returns of supplementation fish would be available to incorporate into our broodstock. Hatchery-reared adult returns will be retained as broodstock only when naturally spawned adult returns are insufficient to meet broodstock goals.

d. No limit will be placed on the number of returning hatchery-reared adults that may be released above the weir to spawn naturally.

7.3) Identity.

Only one summer Chinook spawning aggregate is recognized in Johnson Creek. Hatchery-reared adults will be identified by a visual elastomer tag (VIE) and coded wire tag (CWT).

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults):

Up to 232 (116 female) summer Chinook will be retained for broodstock at the Johnson Creek weir (assuming full JCAPE capacity). During construction (roughly three years), the JCAPE will function at approximately 1/3 capacity (64-84 adults; Tables 1 and 2).

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-2000), or for most recent years available:

Table 11. Broodstock collection for the JCAPE program.

Year	Adults Females	Males	Jacks	Eggs	Juveniles
1988					
1989					
1990					
1991					
1992					
1993					
1994					
1995					
1996					
1997					
1998	34	18	2	83,957 (eyed)	78,950 (03/00)
1999	0				
2000	16	25	32	55,971 (eyed)	

Data source: (Link to appended Excel spreadsheet using this structure. Include hyperlink to main database)

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.

There will be no limits placed on the number of hatchery-reared adults allowed to spawn naturally within Johnson Creek. All collected fish in excess of the number required for broodstock purposes will be immediately released above the Johnson Creek weir for natural spawning.

7.6) Fish transportation and holding methods.

In the interim, the JCAPE project will depend on transporting adult summer chinook salmon from the Johnson Creek weir to the MFH South Fork Salmon River adult holding facility. Long-term adult holding and spawning facilities are being designed for location on Johnson Creek. Fish transportation and holding methods are described in detail in section 5.2.

7.7) Describe fish health maintenance and sanitation procedures applied.

Fish Health Monitoring: A systematic fish health monitoring and disease control program will be conducted on all life stages of Johnson Creek summer chinook salmon that are used in this supplementation program. Fish health monitoring and disease control will be conducted using the plans outlined below. It is the goal of these evaluations and control measures to:

- Document occurrence of disease(s) in wild/natural population.
- Monitor adult mortalities and spawned adults for presence of viral, bacterial, fungal and parasitic agents.
- Conduct monthly monitoring of hatchery reared juveniles to assess presence of viral, bacterial, fungal, and parasitic agents.
- Conduct examinations at all life stages when unusual loss occurs to determine cause of loss and recommend preventative and therapeutic treatment.

Fish Health Monitoring and Disease Control Program Plans:

Disease control and monitoring practices would conform with standards developed by the Nez Perce Tribe Fish Health Policy (NPT 1994), the Integrated Hatchery Operations Team (IHOT 1995), and other standard fish culture disease monitoring protocols. The Nez Perce Tribe Fish Health Policy defines policies, goals, and performance standards for fish health management, including measures to minimize impacts to wild fish (NPT 1994).

There are no reliable non-lethal or non-invasive sampling techniques for infectious diseases that could potentially occur in the summer chinook. Among the infectious diseases that could occur are: bacterial kidney disease (BKD), erythrocytic inclusion body syndrome (EIBS), bacterial cold water disease (CWD), enteric redmouth disease (ERM), bacterial gill disease (BGD), furunculosis, columnaris and infectious hematopoietic necrosis (IHN). External fungus on the body or gills is always a threat and infestations by ectoparasites are possible.

Because there are no reliable non-lethal or non-invasive sampling techniques for any of the agents causing the infections or infestations listed above, monitoring of morbidity and mortality is critical. This will provide the primary basis for the need for antibiotic or chemical treatments for diseases for which these therapies are appropriate. Daily observations of the fish by hatchery personnel and periodic inspections by fish pathology personnel may also help to identify conditions requiring treatment before clinical disease occurs. While there are capabilities for invasive sampling for some disease agents, these pose a greater risk and stress than can be justified for routine monitoring purposes. Below are some specific monitoring and therapy protocols for each of the conditions identified above.

Bacterial Kidney Disease (BKD): Kidneys of mortality (moribund fish may be sacrificed at the discretion of the responsible fish pathologist - hematocrits should be measured and plasma collected from any moribund fish sacrificed) will be assayed by the ELISA and/or DFAT.

Erythromycin treatments would be initiated if a weekly mortality rate of ≥ 1.2% (3/250) attributable to BKD occurs in any rearing unit. This would not apply if the fish had received a treatment within the prior 30 days. Dietary prophylactic treatments should be every four months at a dosage of 100 mg/kg/day as Aquamycin for 28 consecutive days. Fish should be monitored closely for any signs of toxicity and should not be handled during or for 14 days following the treatment. If toxicity is confirmed the feeding should be terminated. Additional treatments may be implemented depending on adjustments to water temperature profiles that may need to be made, or if the severity of BKD indicates such treatments are needed. The use of oral erythromycin for BKD must be under an INAD protocol.

At the time fish are sorted for sexual maturation, injectable erythromycin should be given to those fish sorted for spawning via dorsal sinus injection at a dosage of 10 mg/kg. If this occurs before July 10, a second injection can be given in early August if loss to BKD indicates this is needed (the BKD history of the stock during the entire rearing cycle should be taken into account). Any mortality should be evaluated for BKD and erythromycin toxicity. If toxicity is prevalent or if other Gram-negative infections are indicated injectable oxytetracycline may be considered. Otherwise, only one injection of erythromycin should be given. The use of injectable erythromycin for BKD must be under an INAD protocol or by a prescription from a consulting veterinarian.

External Fungus: Hatchery and pathology personnel will monitor for external lesions at all opportunities. Any rearing unit in which a fungused fish is observed will immediately be treated with three consecutive days of formalin flushes for one hour (taking into account turnover time) at 200 ppm (1:5,000) at water temperatures below 50F and at 167 ppm (1:6,000) at water temperatures above 50F. Baths can be used in lieu of flushes if this does not cause undo stress on the fish. Feed should be withheld on afternoons before treatment days and on days of treatment. Fish may be fed a few hours following treatment if no treatment is scheduled the following day. Persistent fungus problems may require an every other day treatment on Monday, Wednesday and Friday with minimal feedings on non treatment days. Fungus treatment may well require an adaptive approach that is dependent upon the fish culture environment. The use of formalin for external fungus must be under an INAD protocol.

After fish are sorted for sexual maturation, formalin flushes or baths should be given on Monday, Wednesday and Friday at 167 ppm (1:6,000) each week until spawning is completed. If 167 ppm does not result in significant reduction in fungal lesions the dose will be raised to 200 ppm (1:5,000). Again, an adaptive approach may be required but the above treatments are commonly effective. The use of formalin for external fungus on adults must be under and INAD protocol. External fungus treatment of eggs will be accomplished following IHOT (1995) guidelines and INAD protocol.

Erythrocytic Inclusion Body Syndrome (EIBS) and Coho Anemia Disease (CAD): Monitoring can be done by lifting the operculum and observing for pale gills (anemia). This requires mild anesthesia and handling of the fish. If this condition is observed and confirmation deemed necessary, a blood sample from fish showing these signs will be taken from the Duct of Cuvier. This will be examined to confirm if EIBS is the cause of the anemia. CAD is diagnosed by necropsies of moribund fish. If EIBS or CAD are confirmed any activities that may be stressful must be minimized. If secondary infections are indicated appropriate antibiotic therapy will be initiated.

Systemic Gram Negative Infections (Cold Water Disease, Columnaris, Enteric Redmouth & Furunculosis): Monitoring will be by streaking smears from kidneys for morbidity and mortality on TYE or TYES and TSA agar plates incubated at 18C. Dietary oxytetracycline treatment would be initiated if a weekly mortality rate of $\geq$ 1.0% (2/250) to any single agent occurs in a tank or raceway. The same treatment would be initiated if external lesions typical of CWD were observed. Romet would be used for furunculosis if oxytetracycline resistance were indicated. The use of oxytetracycline for CWD and ERM must be under an INAD protocol. After fish are sorted for sexual maturation, injectable oxytetracycline could be given as a single intraperitoneal injection at 5.0 mg/kg. This can be given under extra-label use with a prescription from a consulting veterinarian.

Internal Fungus: Monitoring by making kidney smears on agar as for Gram negative infections above. There is no established treatment for fish.

Bacterial Gill Disease (BGD): Monitoring will be by culturing smears from gills of all morbidity and mortality, and by daily observations by hatchery personnel for signs typical of BGD. Anytime BGD is suspected, wet mounts of gill tissue from moribund or fresh-dead fish will immediately be made and smears from gills collected on sterile cotton swabs will be made on TYE agar plates incubated at 18ºC. If gill disease bacteria are observed microscopically or if gill disease bacteria are isolated, chloramine-T treatments according to INAD protocols will begin immediately in the rearing unit involved. The treatment regimen will depend on the degree of BGD determined. The use of chloramine-T must be under an INAD protocol.

Infectious Hematopoietic Necrosis (IHN): If a $\geq$ 1.2% (3/250) mortality per week occurs without identification of etiological agents or causes, or if signs consistent with IHN are observed, assays for IHN and other viruses from morbidity and mortality would be made according to Fish Health Section Bluebook methods. There are no treatments for IHN. Management of the disease could be attempted through density reduction if conditions warranted such measures.

Ectoparasites: Daily monitoring by hatchery personnel for flashing, and body and gill wet mounts of any moribund fish sampled by fish pathology personnel. Formalin flushes as for fungus would be initiated if behavior indicative of external parasites were observed or if they were detected on moribund or fresh-dead fish at levels to warrant treatment. Treatment for external parasites does not require an INAD protocol and therapies can be given that meet the needs of the particular situation.

Most of the treatments listed above are standard and quite specific in some cases. It is often necessary, however, to make adjustments from standard protocols to accomplish recovery of fish from infections and infestations. Optimal fish culture techniques and only minimal and essential handling are vital to long term survival in confinement. By keeping the fish at very low densities and minimizing handling it is unlikely that many of the infections and infestations listed above would occur, and if they did, fish-to-fish transmission would be minimal. BKD and fungus are primary concerns and unknown conditions can be expected.

Health and Disease Monitoring at Spawning: Individual fish (both male and female) will be sampled using standard protocols for culturable viruses, EIBS, systemic bacteria including *Renibacterium salmoninarum,* and *Myxobolus cerebralis*. Additional sampling could be done as new techniques are developed. An external evaluation for lesions and fungus will be made, and gill and internal organ structure will be grossly examined. If anomalies are indicated, appropriate tissues will be taken for histopathological examination. All observations will be maintained in a data base.

Sanitation practices: Standard chemicals and dosages approved for hatchery applications will be used for equipment and rearing units. Separate nets, brushes, mort-pickers, sampling equipment, and other paraphernalia will be used for each rearing unit. This equipment will not be used in multiple tanks and will be sanitized and rinsed before and after each use and kept in individual racks at each tank. Personnel will disinfect their hands/and or gloves and any exposed apparel surfaces when moving between rearing units. The frequency of cleaning rearing units will be determined on the basis of need. It will be often enough to maintain hygienic conditions but not so often as to induce undo stress.

An example of the current standard chemical and dosages approved for hatchery applications is as follows: Argentyne is a brand name of a currently approved iodine disinfectant (with 1% free iodine). Argentyne is used at 50 ppm for contact disinfection of equipment such as nets, pond cleaning brushes, rain gear, boots and all sampling equipment. Used exclusively as primary treatment for disinfection of rearing units (troughs) both before and after use. Concentrations of between 50 ppm are used for foot baths and contiguous rearing area floor disinfection.

7.8) Disposition of carcasses.

Adult Holding and Spawning: Mortalities that occur at the adult holding facilities or from spawning activities will be handled in the following manner:

Trap tenders at the adult salmon trap will check the adult holding ponds daily for any dead fish. Any mortality will be removed from the ponds and the appropriate samples collected from the carcass. Data collection on pond mortality will be recorded on a log sheet and include: Origin (Johnson Creek or South Fork), date, fish control number, cause of death if known, body condition (fungus, discoloration, scaring), and sex. Any biological samples needed will be collected by the trap tender, placed in sample containers with proper labels, and stored for later analysis. Following completion of examination and sampling for age/size, genetic, and disease analysis, mortalities and fish that have been spawned will be distributed throughout spawning reaches in Johnson Creek for nutrient enrichment. No adult carcasses will be placed in landfills.

Incubation and Rearing: All mortalities that occur during the incubation and rearing stage will be disposed of by freezing them until disposal in a landfill. A variety of samples may be collected from these mortalities to include, but are not limited to, length and weight measures, mark/tag retention evaluation, disease sampling, and tissue sampling for genetic evaluation. Any sampling will occur prior to freezing of the specimens.

7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

To avoid adverse genetic effects resulting from broodstock collection, thresholds were formulated that result in the highest probability of maintaining rare alleles and decreasing demographic risks. Every attempt will be made to represent the range of genetically based phenotypic and behavioral traits of the Johnson Creek spawning aggregate. When adult returns are above the minimum threshold suggested in the sliding scales (Tables 1 and 2), a minimum of 20 adults will be released above the weir for natural spawning within Johnson Creek.

Fish Health Monitoring: A systematic fish health monitoring and disease control program will be conducted on all life stages of Johnson Creek summer chinook salmon that are used in this supplementation program. Fish health monitoring and disease control will be conducted using the plans outlined in Question 7.7. It is the goal of these evaluations and control measures to:

- Document occurrence of disease(s) in wild/natural population.
- Monitor adult mortalities and spawned adults for presence of viral, bacterial, fungal and parasitic agents.
- Conduct monthly monitoring of hatchery reared juveniles to assess presence of viral, bacterial, fungal, and parasitic agents.

Conduct examinations at all life stages when unusual loss occurs to determine cause of loss and recommend preventative and therapeutic treatment.

SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1) Selection method.

Adults captured at the Johnson Creek weir will be classified as “natural” or “hatchery”. Fish are counted when captured and assigned an “order of Capture” number in each category, i.e., “natural” fish 1, “natural” fish 2, etc, or “hatchery” fish 1, “hatchery” fish 2, etc. (Kincaid 1997). At this time, all fish are tagged with an opercle tag. Fish retained for hatchery broodstock, of natural or hatchery origin, may also be tagged with PIT tags to provide an additional identity mark so that a spawning matrix can be created. When possible, returning adults will be fingerprinted using DNA screening so that a spawning matrix can be constructed to maximize the genetic variability of the founding population and the retention of rare alleles. The purpose of using a spawning matrix is to fully utilize all genetic material and minimize or eliminate inbreeding. All matings (natural x natural, natural x hatchery, hatchery x hatchery) will focus on mating unrelated individuals. Relatedness will be determined by tag recovery and/or DNA analysis so that genetic variability is maximized and all half- or full-sibling matings are avoided.

8.2) Males.

No male will be spawned more than two times unless male holding mortality exceeds projections. Males spawned a second time will be used as “backup males” to avoid the loss of egg lots by male sterility.

8.3) Fertilization.

Depending on the number of adult returns, any of three mating schedules modified from the JCAPE BRA (PRRG 2000) may be employed by the JCAPE. Fertilization will occur either on-site at the adult holding facilities on Johnson Creek, or gametes will be taken to the MFH and fertilized.

Diallel mating will be employed when there are fewer than five returning male/female pairs. Diallel mating maximizes the distribution of diversity in resulting progeny by mating each individual with every individual of the opposite sex. For example, if five males and five females return, gametes from each female will be separated into five aliquots, each of which will be fertilized using the milt of a different male. Whenever possible, a backup male will be used to ensure fertilization.

Systematic mating will be used when between 6 and 15 male/female pairs return (<30 adult fish). Fish will be numbered sequentially as they mature (each sex will be numbered independently), female egg-lots will be divided into equal parts, and each fertilized by a different male. If there is an excess of one sex, they will be used in a second mating. For example, if 10 males mature on one date, and only one mature female is available, eggs will be divided into 10 lots, and each fertilized by a different male. Whenever possible, each female will be spawned with at least two males (each egg lot will be divided equally), and a backup male will be used to ensure fertilization.

Single pair mating will be used when there are 15 or more returning adult pairs (> 30 adults). Individuals of each gender will be numbered sequentially depending on the state of maturity. Fish maturing on a given date will be paired randomly with a mature mate of the opposite sex in a single-pair mating. Unlike the systematic mating matrix, excess males will be held until the next spawning date or have their gametes cryopreserved. When there is an excess of females, mature males will be paired with a second female, until all females are spawned. Whenever possible, each female will be spawned with two males (egg lots will be equally divided), and a backup male will be used to ensure fertilization.

Ripe fish are will be sorted from the other fish in the holding pond. Once all ripe fish have been sorted, up to 20 fish will be placed in the live well. A count of the number of females to be spawned will be maintained to determine how many males will be sorted.

Prior to killing any females all items will be prepared. Water activation buckets (white) numbering twice the number of females to be spawned (depending on the number of males available) will be laid out in pairs and filled to the brim. Disinfection buckets (brown) equal to the number of females to be spawned will be readied with 1 gallon of well water to 38 ml of buffered Argentyne. To prevent thermal shock to the eggs, no more then 2 spawning sets of 5 buckets each should be made up at a time.

Prior to killing of females for spawning, each female will be rechecked by experienced personnel. Typically, females will be spawned in groups of 4 to 6. Females will be killed with a blow to the head. Once a group of females has been killed and bled, personnel will wash them down with well water to remove blood that may clog the micropyles.

Females are spawned using a spawning knife and slit from the vent up around a pelvic fin up between the pectoral fins and past another 2-3 inches. Eggs are emptied into a colander. After all of the potentially viable eggs have been removed from the skeins, eggs will be split into approximately two equal groups (depending on the number of available males). Spawning ratios will be 2 male : 1 female whenever possible. Milt from separate males will be used on each colander of eggs (to increase genetic viability). Once an adequate amount of milt has been expressed, the male is re-ponded. Approximately 3% of the jacks ponded will be utilized in spawning.

If sufficient males are not available to use only once, males will be marked and used a second time. No males should be used more then two times throughout the spawning process if this can be avoided. No males will be sacrificed until there are enough live males present to complete spawning of all ponded females. Male gametes may also be cryopreserved and stored for later use and to gene bank germplasm as a gene conservation measure.

Each colander will be placed in a separate bucket (white) of activation water. Eggs/milt will be gently stirred by hand. After approximately 1.5 minutes the eggs from the same female will be recombined into one colander and allowed to sit in one of the activation buckets for an additional one or two minutes. The colander is then removed from the activation bucket and the eggs will be gently transferred into the one of the disinfection buckets. A handful of ice is added to the bucket to keep it cool. The buckets are placed in sequential spawning order in the bucket rack and monitored as the eggs are water hardened. Additional ice will be added as necessary.

Fertilized eggs will be water hardened in a buffered iodine solution for approximately one hour before transferring them into individually numbered egg transport tubes. Eggs will be rinsed to remove Argentyne and any blood/sperm residue before being placed in transport tubes. Eggs will be placed in the egg tubes and each tube is secured with caps. Once the egg box is filled with egg tubes, the egg box will be filled with ice to keep eggs chilled during transport to the hatchery. Each box will be taped shut and secured in the transportation vehicle with tarps to minimize water spillage.

8.4) Cryopreserved gametes.

The Nez Perce Tribe (Tribe) strives to ensure availability of a representative genetic sample of the original male population by establishing and maintaining a germplasm repository (separate project from JCAPE). Gamete cryopreservation permits the creation of a genetic repository, but is not a cure for decreasing fish stock problems. The Tribe was funded in 1997 by the Bonneville Power Administration to coordinate gene banking of male gametes from Endangered Species Act (ESA) listed spring and summer chinook salmon in the Snake River basin. In 2000, a total of 35 viable chinook salmon semen cryopreservation samples were taken from Johnson

Creek. A total of 64 cryopreserved samples from Johnson Creek summer chinook salmon, from 1997 through 2000, are in two independent locations at the University of Idaho and Washington State University.

Endangered Species Act Section 10 research permits are applied for genetic purposes. Fish handling protocol training is provided to all personnel prior to collection and handling of adult male salmon to minimize handling stress. Each team member is assigned a specific duty to improve the efficiency of sample collection. All adult salmon sampled are collected by hand or dip net. Pre-measured MS-222 is used to anaesthetize all adult salmon, along with a sodium bicarbonate buffering compound to buffer the acidic effect of the MS-222. Fish biological information (length, general condition, and external marks) is recorded following collection. Extra care is taken with gamete collection to ensure the quality of preserved samples. Gamete samples will be collected and shipped to storage facilities for genetic processing within 24 hours. Scales are taken for scale pattern analysis to determine wild or hatchery origin and age classes. Following sampling and data collection the anesthetized salmon are immediately returned to a slow water area and assisted until recovered. Concurrently, the gamete samples are placed in two separately labeled Whirl Pak bags, and placed in a covered insulated cooler on wet ice on top of newspaper

8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

Diallel mating will be employed when fewer than five returning male/female pairs are retained for broodstock. Diallel mating maximizes the distribution of diversity in resulting progeny by mating each individual with every individual of the opposite sex. For example, if five males and five females return, gametes from each female will be separated into five aliquots, each of which will be fertilized using the milt of a different male. Whenever possible, a backup male will be used to ensure fertilization.

When greater than five returning male/female pairs are retained as broodstock, each female will be spawned with two or three males whenever possible. Female egg lots will be equally divided, each fertilized using milt from a different male, when possible a third male will be used as a backup shortly after initial fertilization. Following broodstock collection, females will be sorted daily, and ripe females will be spawned with the first available ripe males as discussed above.

SECTION 9. INCUBATION AND REARING -

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

9.1) Incubation:

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.

Specific survival rates have yet to be determined for the JCAPE program, since the facilities are not yet operational. However, we expect survival rates to be similar to those of the MFH program (80% green egg to fry; 87% fry to smolt; FishPro 1999).

9.1.2) Cause for, and disposition of surplus egg takes.

If survival goals for incubation and rearing are not met, additional eggs may be taken to achieve outplanting goals.

If fecundity or survival from egg to parr exceeds expectations, fish will be outplanted as eyed eggs or parr within Johnson Creek. We will not consider any eggs, parr, or smolts to constitute "surplus" production.

9.1.3) Loading densities applied during incubation.

Incubation requirements: 8 tray vertical cabinet incubation units (1/2 stacks), each tray load with the eggs from one female. Flow to each stack = 5 gpm for normal operations, but design for flow capacity of 10 gpm per stack. Egg trays are loaded with the eggs from one female (3,000-5000) per tray. Loading densities allow for up to 8000 chinook salmon eggs, never to exceed 10,000.

9.1.4) Incubation conditions.

Eggs will be monitored daily by qualified hatchery personnel to detect tray defects and any abnormal incubation parameters. Temperatures during incubation (August through February) range from 55 degrees Fahrenheit to 37 degrees Fahrenheit. Dissolved oxygen will remain at a minimum of 10ppm influent and 7ppm effluent. Sediment trays will be siphoned clean at least every other day. Light rodding of trays may be initiated once eggs have developed a light eye (approximately 450 –500 TU's) to remove sediments once a week. Following the hard eye stage, this rodding can be more vigorous: maintaining the same schedule through initial ponding. If increased sediment loads are observed, the rodding schedule will be increased to twice per week.

9.1.5) Ponding.

Fish will be ponded once the majority of fish in a tray have reached complete button up. This occurs at approximately 1,750 TU's. The first lots of fish will be ponded in early December while the last Lot may not be ponded until February.

9.1.6) Fish health maintenance and monitoring.

Formaline treatments for fungus control on eggs will be administered daily at a rate of 1667 ppm. Treatments will commence three days following fertilization and continue until the first fry are observed to have hatched.

At 600 TU's eggs are visually inspected for a hard eye and then shocked. Shocking will consist of siphoning eggs into a collection bucket and then siphoned back into the tray. The following day shocked eggs will be picked using the hatchery egg picker. The enumeration of bad eggs is taken from the egg picker/counter and the good egg count is determined by using an electronic egg counter. Eggs trays will be picked, enumerated, and returned to the same stack/tray location. When a tray is picked all screens and the main tray will be cleaned and inspected for any potential problems, and corrected as necessary. Following a complete hatch each tray of eggs will be inspected, tray lids cleaned of accumulated egg shells, and a second pick performed by hand as necessary. A third pick by hand will be performed prior to initial ponding.

9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

All water is used for incubation passes through an ultra-violet filtration system to eliminate bacteria before passing through the incubators. The incubation flow system is equipped with an alarm system which detects high and low pressure due to siltation or debris. The head box, which screens the initial entry of water into the hatchery system is also equipped with an alarm system to detect low water levels.

9.2) Rearing:

9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available.

Rearing conditions and practices can potentially influence the physiological, morphological, and behavioral characteristics of hatchery fish. These characteristics in turn could affect the magnitude and types of interactions between hatchery and wild chinook and their ability to survive in the wild. The size of fish released is an important consideration since hatchery fish, if larger than wild fish, may enjoy a competitive advantage and reduce the survival of wild fish (Solazzi, et al., 1983). Hatchery fish that are too small are less likely to develop on schedule and have life history patterns that are consistent with the targeted population.

JCAPE has been designed to incubate and rear fish under as natural conditions as possible to maximize their survival following release. Rearing density, temperature, light, water velocity, feeding, and other environmental attributes will be maintained at levels that foster the development and expression of wild-type behaviors and other survival related traits among hatchery fish. Because of the use of techniques to maintain wild-type characteristics among hatchery fish, the potential impact on wild populations is expected to be low.

Specific survival rates have yet to be determined for the JCAPE program, since the facilities are not yet operational. However, we expect survival rates to be similar to the MFH program (80% green egg to fry; 87% fry to smolt; FishPro 1999).

9.2.2) Density and loading criteria (goals and actual levels).

Initial rearing density will be determined once an approximate count of eyed-eggs is determined. Raceways are four ft x 40 ft x 2.0 ft (water depth) with a total rearing volume per raceway = 320 cubic feet. Generally, fry will be loaded at 70,000 to 80,000 fry per raceway. Initial water flows will be set at 80 gpm. Raceways are set up at half length for initial ponding and then extended once the density index reaches 0.04. Flows are then monitored and adjusted as needed.

9.2.3) Fish rearing conditions

The dissolved oxygen level should never drop below 7 ppm. Total hardness ranges from 6.3 to 7.06 mg $CaCO_3$/l, while pH stays nearly constant at 6.8. There is no indication of problems with heavy metals and the water temperature is maintained at 52 to 56 degrees Fahrenheit, with a winter low of 37 degrees Fahrenheit. Hatchery personnel monitor rearing raceways on a daily basis, 7 days a week. Raceways will be cleaned daily. Screens will be brushed and sediment removed by flushing. Moralities will be removed daily.

9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.

See Table 12**.**

9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

See table in section 9.2.4.

Table 12. McCall Fish Hatchery historic data, monthly averages 1990-99.

Month	AVG. TEMP	FPP[1]	TL[2]	CONV[3]	30DL[4]	FPP/MO.[5]	HC[6]	%BW[7]	CF[8]
DEC.	39.4	1,152.2	1.43	4.4	0.04	82.1	2.10	1.47	0.000296
JAN.	38.1	1,065.6	1.48	3.9	0.05	86.7	2.28	1.54	0.000290
FEB.	37.9	898.4	1.58	1.7	0.10	167.2	1.50	0.96	0.000285
MAR.	38.1	662.5	1.73	1.7	0.15	235.8	2.43	1.41	0.000294
APR.	38.8	471.9	1.93	1.6	0.20	190.6	2.90	1.51	0.000297
MAY	42.1	287.9	2.29	1.3	0.37	184.0	4.54	1.98	0.000288
JUN.	47.2	154.3	2.77	1.1	0.47	141.5	4.82	1.74	0.000306
JUL.	52.9	85.6	3.36	1.3	0.59	74.1	7.44	2.21	0.000308
AUG.	52.2	50.9	4.02	1.5	0.66	34.8	9.16	2.28	0.000302
SEP.	49.6	34.2	4.50	1.5	0.48	16.7	6.37	1.41	0.000320
OCT.	46.4	28.5	4.68	2.2	0.18	5.6	3.92	0.84	0.000342
NOV.	43.6	25.2	4.84	1.8	0.16	3.4	2.28	0.47	0.000350
DEC.	39.5	23.4	5.04	1.7	0.20	1.7	2.66	0.53	0.000334
JAN.	38.1	21.3	5.19	3.0	0.10	1.1	2.82	0.54	0.000336
FEB.	37.9	20.8	5.24	2.4	0.05	0.5	0.62	0.12	0.000333
MAR.	38.2	20.3	5.36	0.4	0.11	0.5	0.18	0.03	0.000320

1) fish per pound, 2) total length, 3) feed conversion, 4) average daily increase in length, 5) average number of fish per pound by month, 6) hatchery constant, 7) percent body weight, 8) condition factor

Initial Feeding

Initial feeding at MFH will begin approximately 3 to 4 days after fry have been ponded and swim-up is complete. Initial feed used will consist of starter feed #2 for two to three weeks. Fry will be fed a minimum of 8 times per day, with an hourly interval. Amounts of feed used is determined by using computer projections; manipulating projected conversion and growth rates.

Fry Feeding

Fry Feeding: Fry will be switched to a 50:50 mixture of starter #2 and #3 feed at approximately 2 to 3 weeks and continued at this feeding mixture for 1 to 2 weeks. Mixing feed will be used for all size transitions. However, this period will shorten to 2 to 3 days for the larger feed sizes. Monitoring pound counts will determine when to switch to a larger feed size (Table 13). Present protocol allow for two 21 day medicated feed regimes of Aquamycin-100 during a brood years rearing cycle. The first medicated treatment occurs prior to fish marking (approximately April once water temperatures begin to rise). The second medicated treatment occurs after marking (approximately September prior to water temperatures declining).

Attempts will be made to modify both the food delivery system and to incorporate live/natural feeds into the diet of JCAPE juveniles. Food delivery system modifications may include demand feeders, submerged food delivery, or other methods as they become available. Live/natural feeds will be used as a supplement to normal feed to enhance the nutrition of the JCAPE fish and to expose them to live/natural food sources.

Table 13. Fry feed type, size, and treatment information.

FEED SIZE	FISH PER POUND	TREATMENT
Starter #2	1300 - 900	None
Mix #2/#3	900 - 700	None
Starter #3	700 - 600	None
Mix #3/1.0	600 - 500	None
1.0 mm	500 - 400	Medicated
1.3 mm	400 - 300	None
1.5 mm	250 - 100	None
2.5 mm	100 - 50	None
3.0 mm	50 - 20	Medicated

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures. Hatcheries may introduce diseases into the natural environment either by direct contact or through contaminated wastes (BPA et al 1997). Free-living fish may be exposed to increased levels of pathogens and may contract diseases when they come in contact with pathogen-bearing water. Some past releases of hatchery fish have introduced pathogens into the natural environment, leading to novel or additional health risks for wild fish (Hastein and Lindstad, 1991; Hindar, et al., 1991).

Disease management protocols will be reviewed and revised as needed to ensure they protect wild/natural populations. Integrated Hatchery Operations Team policies (IHOT 1995), Pacific Northwest Fish Health Protection Committee (PNWFHPC 1989) fish health model program, and state and tribal policies and protocols for disease management in hatcheries will be followed with emphasis on the protection of naturally spawning populations.

A systematic fish health monitoring and disease control program will be conducted on all life stages of Johnson Creek summer chinook salmon that are used in this supplementation program. It is the goal of these evaluations and control measures to:

- Document occurrence of disease(s) in wild/natural population.
- Monitor adult mortalities and spawned adults for presence of viral, bacterial, fungal and parasitic agents.
- Conduct monthly monitoring of hatchery reared juveniles to assess presence of viral, bacterial, fungal, and parasitic agents.
- Conduct examinations at all life stages when unusual loss occurs to determine cause of loss and recommend preventative and therapeutic treatment.

Fish are anesthetized with 60mg/L MS 222 prior to all sampling and tagging. When being held at the adult facility prior to spawning, adults receive an interperitoneal injection of Erythromycin-200 at a rate of 10mg/kg body weight, once or twice during holding. In addition, adults may receive an interperitoneal injection of oxytetracycline. They receive a flow through formalin treatment up to three times per week as a prophylactic treatment. Juveniles are treated with Aquamycin-100 medicated feed two times during rearing. In addition, other treatments are conducted as deemed necessary by pathologists.

9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.

Not applicable.

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.

Maynard et al. (1996) have developed a natural rearing system (NATURES) that allow cultured fish to maintain their wild characteristics by decreasing rearing stress, reducing domestication, and better acclimating fish to their post-release environment. The premise of their research is that the culture of Pacific salmon in raceways fitted with overhead cover, instream structure, substrate, and non-intrusive feed delivery systems will produce fish with physiological, behavioral, morphological, and survival characteristics similar to wild conspecifics.

9.2.10) Indicate risk aversion measures that will be applied to minimize the

likelihood for adverse genetic and ecological effects to listed fish under propagation.

JCAPE juveniles will be reared to the smolt stage using NATURES rearing methods as appropriate. Acclimation will occur in natural side channel of Johnson Creek for a minimum of 21 days before volitional release. It is our hope that employing NATURES rearing methods will minimize artificial selection, and that acclimation and volitional release within Johnson Creek will maximize homing.

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.

10.1) Proposed fish release levels.

Table 14. Proposed release numbers and sizes for the JCAPE.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry				
Fingerling				
Yearling	310,068	25-40 fpp	3/21-4/14 annually	Johnson Creek

10.2) Specific location(s) of proposed release(s).

Stream, river, or watercourse: Johnson Creek
Release point: Wapiti Meadows Ranch
Major watershed: South Fork Salmon River
Basin or Region: Snake basin

10.3) Actual numbers and sizes of fish released by age class through the program.

See Table 15.

10.4) Actual dates of release and description of release protocols.

Fish would be transported from the MFH as smolts to final rearing/acclimation facilities adjacent to Johnson Creek and held for a 21 to 42 day period before they would be released into Johnson Creek in early spring. Chinook smolts would be allowed to leave volitionally from acclimation facilities into Johnson Creek after a minimum of 21 days. Fish will be transported to acclimation facilities around March first.

Table 15. Actual size and number of fish released from the JCAPE.

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1988								
1989								
1990								
1991								
1992								
1993								
1994								
1995								
1996								
1997								
1998								
1999								
2000							78,950	28.66 fpp
Average							78,950	28.66 fpp

Data source: (Link to appended Excel spreadsheet using this structure. Include hyperlink to main database)

The first release of JCAPE progeny occurred in March 2000. Broodstock collection resumed in 2000, and the next release of progeny will occur in 2002.

Smolts have been chosen as the preferred life stage to release fish because they have proven to provide a substantial egg-to-adult survival advantage when compared to the survival to adult of eyed egg outplants or pre-smolt releases. The smolt release strategy is, because of the critical need to promote the survival of these stocks into the future, the most effective short term strategy.

10.5) Fish transportation procedures, if applicable.

See section 5.2 for a detailed description of transportation protocols.

10.6) Acclimation procedures.

Fish will be acclimated for 21 to 45 days prior to release, at one or two sites supplied with

Johnson Creek water. Acclimation and subsequent release would begin around the first week of march each year. Following an initial acclimation period of 21 days, fish control structures would be repositioned to allow smolts to volitionally migrate from these facilities. Any fish remaining after the acclimation period would be forced from the acclimation facilities into Johnson Creek.

Smolt acclimation and release would take place in natural-type side channel to Johnson Creek at a site known as Wapiti Meadows Ranch. The site would utilize existing river channel features to create short-term acclimation channels for smolt releases.

10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

Adults kept for supplementation purposes would be held from the time of capture until they are spawned. Adults that would be released upstream of the adult weir and trap on Johnson Creek would be held no more than 24 hours before they are released from the trap.

Adults that will be kept for broodstock will be double tagged with a combination of tags. These may include floy tags, opercule tags, jaw tags, fin dyes, or other options. Adults released above the weir will receive an opercule tag and jaw punch and possibly a PIT tag for monitoring purposes.

All juveniles that are reared at the hatchery will receive a coded wire tag (CWT) and a visual elastomer tag (VIE). Coded wire tags will be implanted in the snout using standard protocols and automatic injectors. In addition, a representative 2,000 - 20,000 parr will be tagged with passive integrative transponders (PIT tags). PIT tags will be injected into the peritoneal cavity using a twelve gauge needle and a modified hypodermic syringe. The needles and tags will be sterilized in 70% ethanol for 10 minutes prior to injection. All fish will be anesthetized with MS 222 prior to tagging.

10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

The release goals for the JCAPE program is 310,068 acclimated smolts. However, since the naturally spawned and hatchery-reared population components of the JCAPE are not expected to differ genetically, behaviorally, or phenotypically, the NPT do not consider any progeny produced by the JCAPE program to be “surplus”. Therefore, if densities are not adversely affected in the hatchery, those fish produced in excess of the 310,068 smolt goal will be released as acclimated smolts in Johnson Creek. If densities in the hatchery are adversely affected, a random sample of eggs or parr will be released in Johnson Creek.

10.9) Fish health certification procedures applied pre-release.

Idaho Department of Fish and Game or USFWS will provide a pathologist for pre-release fish health certification. Tests are conducted for BKD (ELISA) levels and viral testing is done as well. A general fish health report will be provided prior to release.

10.10) Emergency release procedures in response to flooding or water system failure.

The JCAPE will follow the emergency release procedures developed for the MFH.

10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

Summer chinook from the JCAPE program will be acclimated in natural side channels of Johnson Creek for a minimum of 21 days. After 21 days, gates will be lifted allowing volitional release. Emigration is expected to occur shortly after volitional release, minimizing the opportunity for interaction with naturally spawned summer chinook.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1) Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

11.1.1) Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

See Appendix A

11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

The monitoring and evaluation program for the JCAPE is fully funded and staffed at the levels necessary to achieve the objectives listed in appendices A and B.

11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

The Johnson Creek smolt trap is continuously monitored to minimize the holding period of summer chinook and bycatch of other species. Handling and tagging has previously resulted in the direct mortality of 0.43%. Tagged individuals are held for a period of 10-12 hours to assess tagging mortality and allow recovery.

SECTION 12. RESEARCH

12.1) Objective or purpose.

See Appendix B.

12.2) Cooperating and funding agencies.

12.3) Principle investigator or project supervisor and staff.

12.4) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

12.5) Techniques: include capture methods, drugs, samples collected, tags applied.

12.6) Dates or time period in which research activity occurs.

12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.

12.8) Expected type and effects of take and potential for injury or mortality.

12.9) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 16).

12.10) Alternative methods to achieve project objectives.

12.11) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

12.12) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.

SECTION 13. ATTACHMENTS AND CITATIONS

Include all references cited in the HGMP. In particular, indicate hatchery databases used to provide data for each section. Include electronic links to the hatchery databases used (if feasible), or to the staff person responsible for maintaining the hatchery database referenced (indicate email address). Attach or cite (where commonly available) relevant reports that describe the hatchery operation and impacts on the listed species or its critical habitat. Include any EISs, EAs, Biological Assessments, benefit/risk assessments, or other analysis or plans that provide pertinent background information to facilitate evaluation of the HGMP.

SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the foregoing information is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by_____________________________ Date:_____________

Table 16. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: Summer Chinook Salmon		**ESU/Population: Johnson Creek**		
Activity: JCAPE				
Location of hatchery activity: Johnson Creek and McCall Fish Hatchery		**Dates of activity: Annually**		
Hatchery program operator: Nez Perce Tribe				
Type of Take	**Annual Take of Listed Fish By Life Stage (*Number of Fish*)**			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)			1,072	
Collect for transport b)		310,068[4]	232[1]	
Capture, handle, and release c)			Approximately 50% of the Total Adult Return[2, 3]	
Capture, handle, tag/mark/tissue sample, and release d)		310,068[5]		
Removal (e.g. broodstock) e)			64-232	
Intentional lethal take f)			232[2]	
Unintentional lethal take g)		0.43% of Total Handled (for marking)	15% of Collected Adults	
Other Take (specify) h)	89,000[6]	46,000[7]		

1. This is the maximum number of adults retained for broodstock, and are the same fish identified under lethal take. They will either be held at adult facilities on Johnson Creek (long-term), or transported to the adult facility for the MFH on the SFSR until JCAPE facilities are constructed (interim).
2. These are maximum take numbers, yearly take will vary depending on the total adult return.
3. All adults released above the weir will be tagged prior to release.
4. These fish will be transported from the MFH as smolts for acclimation and release within Johnson Creek.
5. All juvenile fish released in Johnson Creek will be tagged.
6. We expect approximately 20% mortality from the egg to fry stage during rearing at the MFH.
7. We anticipate 13% total mortality from the juvenile to smolt release stage.

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Appendix A.

1.10) List of program "Performance Indicators", designated by "benefits" and "risks."

To avoid egregious redundancy, we have combined these two sections. Performance standards and their associated indicators (NPPC 1999) will be followed by the specific M&E actions proposed to assess them (in bold font; for greater detail see Appendix B). Since the JCAPE program is a proposed program, data necessary to address many of these criteria are not available.

1.10.1) "Performance Indicators" addressing benefits.
(e.g. "*Evaluate smolt-to-adult return rates for program fish to harvest, hatchery broodstock, and natural spawning.*").

BENEFITS

1. Performance standards

Provide predictable, stable and increased harvest opportunity.
- Treaty/Executive Order and non-treaty
- C&S obligation
- Recreation (consumptive and non-consumptive)
- Apply Scientific Review Team (SRT) Guideline (G)171

1. Performance indicators

Predictable, stable, and increased harvest opportunities met. Managed for increasing, stable, or decreasing trend line, comparing past trend with future. Developed RM&E plan by species to measure and collect data. Evaluated juvenile, smolt to adult survival or contribution to harvest trends.

1. Anadromous
   a. Recreational– Increased number of angler days and harvest
      - Catch/unit effort/year
      - Catch #'s/harvest/year
      - Units of effort/year
      - Established baseline at Year One, compare with 5 year survey or one generation
   b. Commercial – Tribal treaty and non-treaty fishery harvest needs met.
      - Deviations from 50% of the ocean and river fishery for fall chinook and steelhead allocation, and other specific determined by species
      - Report annually on deviation from 50% allocation of all fisheries, Tribal and Non-Tribal hatcheries above Bonneville
      - Absolute # harvested
      (a) all fisheries (ocean, in-river)
      (b) Tribal fisheries (ocean, in-river)
      - Number of pounds and value (quantity) harvested

The long-term (30 year) goal for the JCAPE program is the return of a combined (hatchery-reared and naturally spawned) adult return of at least 1,017. When this goal is achieved, tribal, recreational, and commercial harvest will be addressed. Harvest goals will be formulated to allow maximum take levels while maintaining positive population growth within Johnson Creek. In the short-term, tribal, recreational, and commercial harvest is not an objective of the JCAPE program. When adult returns and SAR is sufficient to allow fisheries targeting the Johnson Creek stock, catch will be enumerated by coded wire tag recoveries, or other methods as available. In the short-term, contribution to ocean and in-river harvest will be enumerated via coded wire tag recoveries.

2. Resident (native or non-native)

a. Recreational – Tribal Treaty /

Executive Order and Non-Treaty fishery. Key statistic is increasing number of angler days to be able to harvest fish with as little effort as possible. Indicators measured should be population specific by species

- Numbers, length, weight, age, and pounds harvested or released
- Deviations from 50% harvest allocation
- Area and time of harvest
- Production cost of hatchery fish harvested
- Deviation from sport minimum threshold by species
- Perceived value of fish harvested
- Angler satisfaction determined every 5 years or after one generation
- Condition factor of fish in creel
- Catch per unit effort goals

The JCAPE program does not include a resident species component.

3. Complied, where applicable, with HGMP

2. Performance Standard

Conservation of genetic and life history diversity

- Establish baseline for hatchery and/or wild populations
- similar to wild or
- isolated from wild
- Evaluate at yearly increments depending upon generation time for the selected species
- Make changes to correct for divergence from baseline
- Apply SRT – G1-2, 4-17

2. Performance Indicators

A. Used number of adults necessary to achieve minimum effective population size (MEPS). Trend target in 4 out of 5 years + 10%

The broodstock goal of the JCAPE program is 232 adults, which provides a 95% probability of rare allele retention (p=0.01) for three generations. A minimum of three

years after implementation will be required for facility construction for the JCAPE. In the interim, broodstock collection will be limited by available rearing space at the MFH (approximately 64 adults). Further, given low adult escapement in recent years, the JCAPE will be unlikely to meet broodstock goals for the first generation (5 years) of operation.

B. Evaluated whether life history characteristics were maintained by comparing baseline at year 1 with 5 year survey, or after one generation. Life history characteristics measured:

1. Age composition
2. Fecundity (#, and size)
3. Body size (size, length, weight, age, and maturity index)
4. Sex ratio
5. Juvenile migration timing
6. Adult run timing
7. Distribution and straying
8. Time and location of spawning
9. Food habits

The JCAPE monitoring and evaluation program (Vogel and Hesse 2000 draft) will address items 1-8 in the previous list. For greater detail reference appendix B.

C. Evaluated broodstock genetically in year 1 and compare after 5 years, or one generation, in terms of DNA or allozyme profile

The JCAPE monitoring and evaluation program includes tissue sampling from adult and juvenile naturally and hatchery-reared summer chinook from Johnson Creek and the JCAPE program. Genetic broodstock evaluations will be conducted yearly.

D. Captive broodstock

1. Increased number of individuals in captivity to substantially greater numbers than wild survival standard (% survival standard)
2. Progeny represented full range of life history traits of parent population in the wild. Surrogate: genetic analysis (DNA or allozyme frequencies)
3. Implemented RM&E plan to document survival of juveniles and returning adults
4. Followed NMFS interim standards for captive broodstock

Captive broodstock is the lowest priority for Johnson Creek at this time. Should captive broodstock become necessary, NMFS captive broodstock protocols will be incorporated as necessary.

E. Cryopreservation

1. Implemented RM&E plan to represent full range of life history traits (see Risk A10, 1-9)
2. Equaled or exceeded quality control standard for sperm viability

When possible, sperm from naturally spawning males will be cryopreserved. Cryopreserved sperm may be used in the future to increase contribution of wild fish to broodstock and increase effective population size.

F. Promoted regional gene bank to preserve existing populations not under threat of extinction

The NPT cryopreservation program has collected sperm from 64 males in Johnson Creek to date, and these activities will continue for the duration of the JCAPE program. All cryopreserved gametes from Johnson Creek summer chinook will be included in the NPT gene bank program.

G. Complied, where applicable, with HGMP
H. Relevant APR-SRT guidelines evaluated and implemented

3. Performance Standard
Enhance tribal, local, state, regional and national economies

3. Performance Indicators

A. Established increasing trend in the value of harvest by documenting:

1. Commercial and sport fisheries value
2. Economic return from ex vessel, wholesale value
3. Opportunity or angler days translated to dollars
4. Cannot value tribal fisheries only in dollar terms for the commercial and sport fishery
5. Production cost of hatchery fish harvested

B. Developed overall economic impact model to compute direct, indirect and induced effects from hatchery production.

The JCAPE program is not expected to produce a harvestable surplus of adults for at least 30 years. Relevant performance indicators will be formulated at that time.

4. Performance Standard
Fulfill legal/policy obligations

4. Performance Indicators

A. Legal and policy obligations of the hatchery goal met, in terms of numbers of hatchery fish to the fishery in 4 out of 5 years + 10%

1. Marine and freshwater fisheries

2. Resident fisheries in pounds of fish harvested

B. Decreased litigation

The JCAPE is intended as a conservation program, and therefore is not subject to legal/policy obligations relating to harvest.

5. Performance Standard

Contribution of hatchery fish carcasses to ecosystem function by subbasin and by hatchery

-Stream/river nutrification from hatchery carcasses

-Nutrient input for fisheries and wildlife

-Food web impacts

5. Performance Indicator

A. Hatcheries developed RM&E plans with stringent disease standards as identified by PNWFHPC and IHOT protocols for using the carcasses as a nutrient source

1. Collaborative agency, tribal and university research implemented a pilot project

Carcasses from the JCAPE program will be placed within or above spawning areas of Johnson Creek following disease protocols suggested by the PNWFHCP and IHOT.

6. Performance Standard

Provide fish to satisfy legally mandated harvest in a manner which eliminates impacts on weak hatchery and broodstock wild populations

- Apply SRT – G17

6. Performance Indicators

A. Developed harvest management plan for hatchery fish

B. Computed ratio of wild fish to harvest

1. Evaluated trend analysis of past/present hatchery contributions to harvest.
2. Defined an upper maximum ratio of wild fish allowed in the harvest

The JCAPE program is not projected to produce a harvestable surplus for at least 30 years. Harvest management plans will be formulated when adult returns are sufficient to allow fishing pressure. When harvest management plans are formulated, naturally and hatchery-reared adults will be treated as two components of the same population, and harvest goals will be commensurate with the size of the total population.

C. Documented total harvest of hatchery fish

1. Used appropriate techniques of selective harvest and rearing by separation in time, space, gear and hatchery fish identification, where appropriate

Naturally and hatchery-reared adults from Johnson Creek will be regarded as components of the same population for the purposes of harvest.

D. Determined that total harvest of wild populations of concern does not exceed upper maximum of absolute number of wild fish

Since the naturally and hatchery-reared population components of the Johnson Creek population are expected to be identical in every way, harvest will be set by the total population size of Johnson Creek regardless of hatchery or natural origin. Therefore, harvest will not be set by an upper limit of natural origin captures.

E. Established and met natural population escapement goal, where applicable, in 4 out of 5 years ± 10 %

Goals for escapement will be set as an absolute number of adults, regardless of natural or hatchery origin.

F. Hatchery broodstock goals and objectives established and met in 4 out of 5 years ± 10%
G. Complied, where applicable, with HGMP
H. Relevant APR-SRT guidelines evaluated and implemented

7. Performance Standard
Will achieve within hatchery performance standards
 - Apply SRT – G1-2, 4-13, 16, 19

7. Performance Indicators
A. IHOT standards achieved
B. Relevant APR-SRT guidelines evaluated and implemented
C. Complied, where applicable, with HGMP

Performance goals for the JCAPE program were formulated by performance at the MFH. If the JCAPE achieves egg to smolt survival with roughly equal success to the MFH, within hatchery performance will be judged acceptable. There is the potential that NATURES rearing and natural acclimation will result in higher mortality within the JCAPE program by comparison to the MFH. However, higher mortality, within reason, may be offset by the potential to decrease artificial selection through the use of these novel rearing methods.

8. Performance Standard
Restore and create viable naturally spawning populations
 - Apply SRT – G1-2, G4-16

8. Performance Indicators
A. Managed for increasing trend of redd counts as index of natural spawning
B. Managed for increasing numbers of adult fish
C. Managed for increasing trend in adult resident fish
D. Managed for increasing trend in juvenile anadromous or resident fish rearing densities in #'s/m2 by habitat
E. Managed for increasing trend in nutrients from adult carcasses in tributaries
F. Managed for increasing F2 spawners
G. Complied, where applicable, with HGMP
H. Relevant APR-SRT guidelines evaluated and implemented

Performance indicators A, B, D, E, and F will be evaluated yearly for the JCAPE program.

9. Performance Standard
Plan and provide fish with coordinated mainstem passage and habitat research in the Columbia Basin
- Apply SRT – G17

9. Performance Indicator
A. Developed a project with a regional perspective for a multi-year funded research plan with funding support
B. Described funding umbrella to provide context for individual project research
C. Developed plan consistent with subbasin goals, objectives and strategies, including Mainstem

Performance indicators A and B will be achieved through BPA funding. Relation to subbasin goals, objectives, and strategies are addressed in detail in section 3 of this report. Mainstem passage issues will be addressed by PIT tagging up to 20,000 JCAPE smolts, and tracking progress through the mainstem (see Appendix B). These data will be provided to hydrosystem mangers in an attempt to maximize passage survival of hatchery and naturally reared Johnson Creek juveniles.

10. Performance Standard
Conduct within hatchery research, improve the performance or cost effectiveness of artificial production hatcheries to address the other four purposes
- Apply SRT – G1-2, 4-13, 15-17

10 Performance Indicators
A. Developed comprehensive regionally coordinated RM&E plan that includes a website for all hatcheries in the basin

1. Bonneville Power Administration, National Marine Fisheries Service, United State Geological Survey/Biological Research Division, Federal Energy Regulatory Commission, universities, private aquaculture industry, utilities, states, tribes, land management agencies, etc.

The monitoring and evaluation program for the JCAPE (Vogel and Hesse 2000 draft; Appendix B) is designed specifically to address M&E needs of the JCAPE program. However, data generated by these efforts will be useful in other management contexts, and will be made available through annual reports and presentations. Development of a comprehensive website would exceed funding levels dedicated to the JCAPE.

B. Developed a research study plan which:

1. Implemented genetic studies of straying, introgression, and outbreeding depression at a specific hatchery by species

Straying of JCAPE adults will be assessed via coded wire tag recoveries, and estimated via genetic analyses. Spawning by hatchery-reared adults of JCAPE origin within Johnson Creek will not be considered introgression since naturally and hatchery-reared JCAPE adults are considered components of the same population. Similarly, since broodstock for the JCAPE will be collected annually from naturally and hatchery-reared adult returns to Johnson Creek, outbreeding depression is not a concern.

2. Conducted focused carrying capacity study

Adult carrying capacity for Johnson Creek is estimated to be 1,600 (SRSRT 1994). Smolt carrying capacity is estimated to be 510,048 (NPPC Presence/ Absence Database). Since these parameters have already been estimated, carrying capacity estimates will not be generated by the JCAPE program.

3. Evaluated potential hatchery/wild competition by ecosystem

Since hatchery-reared JCAPE juveniles and adults are expected to be identical in every way to naturally spawned juveniles and adults, we consider both components to form one population. Further, since the goal of the JCAPE is to restore a spawning population commensurate with historical abundances, competition should not be greater than it was historically. Therefore, the JCAPE will not seek to assess competition between the hatchery and naturally reared population components, since it would be incorrect to assume that they are two populations competing in some way.

4. Evaluated the fate of hatchery population mimicking the wild population in terms of adult return or yield to the creel

The JCAPE M&E program (appendix B) will assess the SAR and adult to adult return rate of both population components.

5. Conducted hatchery evaluations on selected hatcheries within eco-systems to estimate post-release survival by tributary, mainstem, estuary, and ocean in order to accurately evaluate hatchery performance by species by hatchery

The JCAPE M&E program (Appendix B) will assess post-release survival through Johnson Creek and the mainstem Snake and Columbia via PIT tag detections. Estuary and ocean survival will not be directly addressed for either population component, with the exception of ocean harvest that will be addressed via coded wire tag recoveries.

C. Integrated hatchery and programs into subbasin management plan within 3 years using:

1. Hatchery Genetic Management Plan (HGMP)

as part of the plan by species
2. RM&E plan
3. Hatchery specific harvest management plan

The HGMP will serve as the integrating document for this purpose.

D. Improved marine survival and yield of adults in the fishery or spawning grounds

Adult return will be compared to pre-supplementation abundance yearly.

E. Research priorities have been set by evaluating performance indicators which haven't been met. Standard is adaptive management

Adaptive management will be used to increase the effectiveness of the JCAPE program through yearly evaluations and improvement in management actions.

11. Performance Standard
Minimize management, administrative and overhead costs.
- Reduce process
- Respond to performance indicators
- Conduct annual performance review
- Reduced manpower / overhead rates
- Integrate with other programs
- Apply SRT – G19

11. Performance Indicators
A. Managed the process to accomplish declining expenditures for administrative overhead
B. Achieved annual budgeting based on a results-oriented, performance-based management framework
C. Annual reports addressed
1. Program performance based on indicators
2. Consistency with Columbia River Fish Management Plan (CRFMP) production reports
D. IHOT audits conducted as scheduled and results integrated into future funding and program decisions
E. Implementation of IHOT policies and procedures and hatcheries documented

Yearly evaluation of the Johnson Creek program will be used as a means to identify and implement cost-reducing strategies.

12. Performance Standard
Improve performance indicators to better measure performance standards
- Apply SRT – G18

12. Performance Indicators
A. Evaluated effectiveness of performance indicators using adaptive management in order to

more accurately measure performance through audit process.
B. Relevant APR-SRT guidelines evaluated and implemented

More effective performance indicators will be implemented as identified by yearly evaluations.

1.10.2) "Performance Indicators" addressing risks.
(*e.g. "Evaluate predation effects on listed fish resulting from hatchery fish releases."*).

RISKS

1. Performance Standard
Develop harvest management plan to protect weak populations where mixed fisheries exist
- Apply SRT G17

The JCAPE program is not expected to produce a harvestable surplus for at least 30 years after implementation. Harvest policies will be set at this time based on the total size of the Johnson Creek population. Since the hatchery and naturally reared population components are regarded as indistinguishable, no attempt will be made to base harvest on the number of naturally-spawned adult returns.

1. Performance Standard
A. Maximum allowable impact to weak populations not exceeded in 4 out of 5 years ±10 %
B. Life history characteristics of weak populations monitored for change from baseline by comparing at year 1 with 5-year survey or after one generation
C. Maintenance of unique life history characteristics evaluated by comparing baseline at year 1 with a 5 year survey, or after one generation.
Characteristics measured:

a. Age composition
b. Fecundity (#, and size)
c. Body size (size, length, weight, age, maturity index)
d. Sex ratio
e. Juvenile migration timing
f. Adult run timing
g. Distribution and straying
h. Time and location of spawning
i. Food habits

Life history characteristics a-h from the list above will be evaluated yearly in accordance with the JCAPE M&E plan (Appendix B). These characteristics will be compared with the pre-supplementation baseline yearly.

D. Documented that natural population escapement goal not adversely affected in 4 out of 5 years ± 10 % for specific species and populations

The natural escapement goal of the JCAPE is 785 adults. We project that this goal will likely require 30 years of supplementation. In the interim, escapement for natural spawning will likely be at least 20 adults when possible (see Tables 1 and 2).

E. Relevant APR-SRT guidelines evaluated and implemented

2. Performance Standard
Do not exceed carrying capacity of fluvial, lacustrine, estuarine and ocean habitats
- Apply SRT G1-2, G4-13, G17

2. Performance Indicators
A. Developed an appropriate RM&E plan
1. Freshwater
a. Snorkel survey conducted to quantify microhabitat partitioning
b. Emigration rate, growth, food habits, condition factor, and survival rate evaluated
2. Conducted control vs. treatment carrying capacity evaluation
a. estimated #/m 2 by year class by habitat type

Adult and juvenile carrying capacity has been estimated as 1,600 (SRSRT 1994) and 510,048 (NPPC Presence/Absence Database) respectively. Assessing lacustrine and ocean carrying capacity is not a goal of the JCAPE.

B. Reservoir, estuarine, and ocean research, monitoring, and evaluation plan developed – implemented ISRP recommendation to define monitoring and evaluation research approach
C. Relevant APR-SRT guidelines evaluated and implemented

3. Performance Standard
Assess detrimental genetic impacts among hatchery vs. wild where interaction exists
- Apply SRT G1-2, 4-18

3. Performance Indicators
A. Initially, it is assumed that stray rate is a surrogate for a thorough and more complex measurement of genetic impact. More specific measurements to be implemented on a selected basis:
1. Experimental design for evaluating genetic impact recommended by ISRP.
2. Evaluated hatchery population agains standard stray rate (<5% non-indigenous populations; <20% indigenous populations – NMFS standard)
3. Measured introgression by comparing allele frequencies between hatchery and wild

4. Implemented an appropriate experimental design to quantitatively measure outbreeding depression
5. Conducted RM&E on selected basis at a specific hatchery and/or on selected species
6. Experimental design for evaluating genetic impact recommended by ISRP.

Introgression and outbreeding depression are not concerns within Johnson Creek, since the hatchery and naturally reared components are expected to be genetically, phenotypically, and behaviorally indistinguishable. Straying of JCAPE adults into non-natal spawning aggregates will be assessed via coded wire tag recoveries. If hatchery-reared JCAPE adults do not stray at a greater rate than naturally reared Johnson Creek adults, straying will not be considered detrimental regardless of the rate.

B. Implemented HGMP where appropriate.
C. Relevant APR-SRT guidelines evaluated and implemented

4. Performance Standard
Unpredictable egg supply leading to poor programming of hatchery production to maintain Treaty/Executive Order and non-treaty fisheries and broodstock escapement

4. Performance Indicators
A. Achieved percent egg take goal in 4 out of 5 years

Egg take goals will be difficult to achieve for at least the first 15 years (3 generations) of the JCAPE program, due to low adult returns.

B. Achieved MEPS in 4 out of 5 years ± 10 %

The natural escapement and broodstock collection goals of the JCAPE are unlikely to be achieved for at least 30 years after JCAPE implementation.

C. Implemented PNWFHPC, IHOT disease protocols, and HGMP, where appropriate, in terms of egg transfer to the hatchery

Relevant PNWFHPC and IHOT protocols will be followed, where appropriate, for egg transfer to the MFH.

5. Performance Standard
Production cost of program outweighs the benefit
- Apply SRT G18-19

5. Performance Indicators
A. Evaluated trends in the ratio of hatchery juvenile production cost per cost of juvenile production from habitat projects by subbasin by hatchery per adult production

1. Hatchery production cost is equal to or less than 1 in 4 out of 5 years ± 10 %

B. Relevant APR-SRT guidelines evaluated and implemented

The NPT considers Johnson Creek to be an irreplaceable and invaluable resource. If the JCAPE is successful in maintaining the genetic, phenotypic, and behavioral aspects of this stock, the benefits of the JCAPE will be considered beneficial regardless of the cost.

6. Performance Standard
Cost effectiveness of hatchery ranked lower than other actions in subregion or subbasin
- Apply SRT G19

The NPT considers Johnson Creek to be an irreplaceable and invaluable resource. If the JCAPE is successful in maintaining the genetic, phenotypic, and behavioral aspects of this stock, the benefits of the JCAPE will be considered beneficial regardless of the cost.

6. Performance Indicators
A. Developed cost effective methods of producing benefits to recreation fishery such as:
1. Cost per angler day
a. Habitat and fish passage compared to hatchery
b. Self-sustaining population compared to continuing artificial production
2. Cost per experience (economic model)
3. Cost per fish harvested in the recreational fishery

B. Achieved highest numerical ratio of returning adults or recovery to healthy viable resident population levels per cost of action (habitat, passage, hatchery)
C. Achieved highest ratio of intrinsic social value (satisfaction survey) of returning adults or recovery of healthy viable population levels per cost of action
D. Achieved highest ratio of value of harvest per cost of hatchery by species to the non-treaty commercial fishery
E. Achieved least cost production of behaviorally adapted juveniles complying with NMFS interim standards for captive broodstock
F. Relevant APR-SRT guidelines evaluated and implemented

7. Performance Standard
Will not achieve within hatchery performance standards
- Apply SRT G1-2, 4-13, 16, 19

7. Performance Indicators
A. Conducted comparative evaluation of actual within hatchery performance and exceeded or equaled performance standards as enumerated by IHOT
B. Defined resident fish within hatchery performance standards if different from IHOT and equaled or exceeded standard
C. Conducted an audit to determine compliance with IHOT standards

If the JCAPE is successful at obtaining egg to smolt survival equivalent to the McCall Hatchery, the program will be deemed successful. This goal will be evaluated yearly.

8. Performance Standard
Evaluate habitat use and potential detrimental ecological interactions
- Apply SRT G4-5, 8, 17-18

8. Performance Indicators
A. Selected tributaries by subbasin and hatchery by species (anadromous and resident) – conducted comparative evaluation of prestocking population with post stocking after five years or after one generation by measuring some of these parameters:

1. Evaluated emigration rate
a. Anadromous or resident stocked fish and naturally reproducing anadromous or resident population
2. Conducted comparative evaluation of rearing densities
(# / m2) by habitat before and after stocking hatchery fish vs. wild fish
3. Computed growth rate, condition factor, and survival of 1a above
4. Evaluated direct intra- and inter-specific competitive interaction between stocked anadromous or resident fish and wild resident fish
5. Conducted snorkel surveys to quantify microhabitat partitioning by species
6. Computed prey composition in diet of 1a above
7. Determined predation rate
a. Fish, birds, marine mammals
b.

Items 1 and 2 in the previous list will be evaluated by the JCAPE M&E program (appendix B).

B. Implemented tributary RM&E plan by subbasin by specific hatchery by species, and extrapolated to other subbasins and hatcheries in the basin

The performance of the JCAPE program will be compared to the MFH.

C. Developed and implemented RM&E plan for reservoir habitat

1. Trophic level disruptions
a. Species and prey population composition before and after stocking
2. Implemented experimental design for specific research applications recommended by ISRP

D. Developed RM&E plan for estuary and near shore marine habitat

1. Implemented experimental design recommended by ISRP

E. Natural habitat improved to double survival by species by specific life history stage within 10 years
F. Implemented HGMP where appropriate
G. Relevant APR-SRT guidelines evaluated and implemented

9. Performance Standard
Avoid disease transfer from hatchery to wild fish and vice versa
- Apply SRT G17, 19

9. Performance Indicators
A. Established comparative annual sampling of disease in hatchery and wildpopulations
B. Complied with IHOT standards and PNWFHPC guidelines
C. Applied disease standards to resident fish rearing and stocking activities, including net pens, acclimation ponds, and direct releases
D. Evaluated incidence of drug resistant pathogens by comparing to baseline in year 1 to survey every five years
E. Implemented HGMP where appropriate
F. Relevant APR-SRT guidelines evaluated and implemented

Relevant IHOT and PNWFHPC protocols will be employed, where appropriate, for juvenile and adult summer chinook affected by the JCAPE program.

10. Performance Standard
Evaluate impacts on life history traits of wild and hatchery fish, from harvest and spawning escapement
- Apply SRT G1-15, 18

10. Performance Indicators
A. Tracked trends to evaluate change by comparing a baseline at year 1 with a 5-year survey, or after one generation. Specific life history characteristics measured are:

1. Age distribution
2. Fecundity (#, and size)
3. Body size (length, weight, age, maturity index)
4. Sex ratio
5. Juvenile size and migration timing
6. Adult run timing
7. Distribution and straying
8. Time and location of spawning
9. Food habits

Items 1-8 will be evaluated yearly, and compared to the pre-supplementation baseline in accordance with the JCAPE M&E program (Appendix B).

B. Conducted RM&E program on selected hatchery by species and extrapolated to others

C. Implemented experimental design recommended by ISRP
D. Implemented HGMP where appropriate
E. Relevant APR-SRT guidelines evaluated and implemented

11. Performance Standard
Assess survival of captive broodstock progeny vs. wild cohorts
- Apply SRT G1-10, 13-19

11. Performance Indicators
A. Achieved increased survival threshold for captive broodstock over wild adults –
Implemented RM&E plan with appropriate experimental design to measure:

1. % survival of viable eggs, fry, and offspring
2. % survival to release
3. Pre-release juvenile quality, equal to or exceeded physiological, morphological, and behavioral threshold compared to wild population
4. Achieved post-release criteria in terms of survival, growth, condition factor, and behavioral adaptation

B. Implemented HGMP where appropriate
C. Relevant APR-SRT guidelines evaluated and implemented

The JCAPE program does not currently include a captive broodstock.

12. Performance Standard
Depleting existing population spawning in the wild through broodstock collection
- Apply SRT G8, 10, 12, 15-17

12. Performance Indicators
A. Documented stable or increasing trend of redd counts as index of natural spawning
B. Documented stable or increasing numbers of adult fish.
C. Documented stable or increasing trend in adult resident fish.
D. Documented hatchery spawner to recruit ratio equal to or greater than 1
E. Relevant APR-SRT guidelines evaluated and implemented

Items A, B, and D will be assessed yearly by the JCAPE M&E program (Appendix B).

APPENDIX 2-11—DRAFT SPRING CHINOOK (PAHSIMEROI) IN THE SALMON SUBBASIN

HATCHERY AND GENETIC MANAGEMENT PLAN

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

DRAFT

	Hatchery Program	Pahsimeroi
	Species or Hatchery Stock	Summer chinook salmon
	Agency/Operator	IDFG
1	**Watershed and Region**	Salmon
	Date Submitted	3/27/03
	Date Last Updated	nya

Section 1: General Program Description

1.1 Name of hatchery or program.

1 Pahsimeroi

1.2 Species and population (or stock) under propagation, and ESA status.

1 Summer chinook salmon

9 ESA Status: Threatened

1.3 Responsible organization and individuals.

Name (and title): Sharon Keifer
Anadromous Fish Manager

3 **Agency or Tribe:** IDFG

Address: 600 S. Walnut, PO Box 25, boise, ID 83707

Telephone: 208-334-3791
Fax: 208-334-2114
Email: skeifer@idfg.state.id.us

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and exten involvement in the program.

	Co-operators	Role
4	Idaho Power	Funds Oxbow, Pahsimeroi, and Niagara Springs hatcl
	nya	nya
	nya	nya
	USFWS- LSRCP	Funds Magic Valley, Hagerman, and Sawtooth hatche

1.4 Funding source, staffing level, and annual hatchery program operational costs.

	Funding Sources
5	Idaho Power
	USFWS through LSRCP funds Magic Valley, Clearwater and Sawtooth fish hatcheries
	nya
	nya
	nya
	nya
	nya

	Operational Information	Number
6	Full time equivalent staff	2
	Annual operating cost (dollars)	205,000

Comments:

MVH: 4 staff; $750,000

Reviewer Comments:

nc
nc

Data source:

HGMP, PI
HGMP, PI

1.5 Location(s) of hatchery and associated facilities.

2	**Broodstock source**	Salmon River
	Broodstock collection location (stream, RKm, subbasin)	Pahsimeroi River, 2.5 Rkm, Salmon River
	Adult holding location (stream, RKm, subbasin)	Pahsimeroi River, 2.5 Rkm, Salmon River
	Spawning location (stream, RKm, subbasin)	Pahsimeroi River, 2.5 Rkm, Salmon River
	Incubation location (facility name, stream, RKm,	Pahsimeroi River, 2.5 Rkm, Salmon River

subbasin)

Rearing location (facility name, stream, RKm, subbasin) Pahsimeroi River, 2.5 Rkm, Salmon River

Comments:

A new facility is being developed 7 miles upstream on the Pahsimerio River.

Data source:

PI

1.6 Type of program.

8 Integrated

Comments:

Data source:

PI, HGMP

1.7 Purpose (Goal) of program.

9 The purpose of this hatchery program is to provide harvest and to contribute to conservation/recovery .

10 the purpose of the program is mitigation for hydro impacts and and/or habitat loss.

Comments:

The goal of this program is to mitigate anadromous fish losses due to the construction of the Hell's Canyon Complex (Browi and Hell's Canyon dams) on the Snake River.

nc

Data source:

PI, HGMP
PI, HGMP

1.8 Justification for the program.

- Hatchery fish accessible to fisheries because the fish produced are differentially marked to enable selective harves
138 - Hatchery fish accessible to fisheries because the fish produced are available in sufficient number to the fisheries (lc gear) that are intended to benefit from the program (i.e. to meet the harvest goals).

Comments:

nc
nc
nc
nc
nc

Data source:

PI, HGMP

PI
nds
nds
nds

1.9 List of program "Performance Standards".

11 The program adheres to the following fish culture guideline(s) and standard(s):
IHOT
PNFHPC
state
tribal
federal

Comments:

nc

Data source:

PI

1.10 List of program "Performance Indicators", designated by "benefits" and "risks".

139

Indicators of Harvest Benefits

Indicator	Performance Standard	Indicator is Monitore
Spawner to spawner survival of hatchery fish	3.3.1	Y
Contribution of hatchery fish to target fisheries	3.1.2, 3.2.1	Y
Angler success (hatchery fish per angler day) in target recreational fisheries	3.1.2, 3.2.1	Y
Contribution of hatchery fish to cultural needs	3.1.1	Y
Selective harvest success (expected benefits of mass marking)	3.1.2, 3.3.2	Y

141

Indicators of Conservation Benefits

Indicator	Performance Standard	Indicator is Monitore
Genetic and life history diversity (over time)	3.4.1, 3.4.3, 3.5.1, 3.5.2,	3.4.1, 3.4.3, 3.5.1, 3.5.2,
Spawner to spawner reproductive success of hatchery fish	3.3.1, 3.4.3	Y
Reproductive success of the receiving (supplemented) naturally spawning population	3.3.1, 3.3.2, 3.4.3, 3.4.4, 3.5.3	Y
Contribution to the abundance of the naturally spawning population	3.4.2, 3.4.4, 3.5.3, 3.5.6,	Y
Time and location of spawning	3.7.6	Y
Contribution to ecosystem function (e.g. through nutrient enhancement, food web effects, etc.)	3.7.5	Y

140

Indicators of Harvest Risks

Indicator	Performance Standard	Indicator is Monitore
Harvest impacts on co-mingled stocks	3.1.2, 3.1.3	Y
Bias in run size estimation of natural stocks due to masking effect	3.3.1, 3.3.2	Y
Lack of harvest access (under harvest due e.g. to co-mingling with weaker stocks)	3.2.1, 3.2.2	Y

Indicators of Conservation Risks

Indicator	Performance Standard	Indicator is Monitore
Unintended contribution of hatchery fish to		

	natural spawning (through straying)	3.4.2	Y
	Loss of genetic and life history diversity	3.4.3, 3.5.1	Y
	Loss of reproductive success	3.4.2, 3.5.1, 3.5.2	Y
142	**Ecological interactions through competition with natural stocks (by life stage)**	3.4.2, 3.4.3, 3.4.4, 3.5.3, 3.5.6	Y
	Ecological interactions through predation on natural stocks (by life stage)	3.4.4, 3.5.3, 3.7.8	Y
	Adverse effects of hatchery operations and facilities on fish migration Disease transfers	3.7.6, 3.7.7	Y

144

The program contributes to information gain in the following way(s): Hatchery program contributes to research to improve pe
cost effectiveness
143 New information affects change to the hatchery program through a structured adaptive decision making process
Hatchery program participates in basin wide-coordinated research efforts
Hatchery program actively contributes to public education

Comments:

Standards and indicators (S&I) are based on legal mandates for Artificial Propagation S&I for anadromous and resident fish p the Pacific Northwest, developed as an outgrowth of discussions of the by the regional Production Review Committee of the Power Planning Council, 1/17/2001.

Note: Performance Standards and Indicators used to develop Sections 1.10.1 and 1.10.2 were taken from the final January 1 version of Performance Standards and Indicators for the Use of Artificial Production for Anadromous and Resident Fish Popu Pacific Northwest. Numbers referenced below correspond to numbers used in the above document.

3.1.1 Standard: Program contributes to fulfilling tribal trust responsibility mandates and treaty rights, as described in applicab such as under U.S. v. Oregon and U.S. v. Washington.

Indicator 1: Total number of fish harvested in tribal fisheries targeting program.

3.1.2 Standard: Program contributes to mitigation requirements.

Indicator 1: Number of fish returning to mitigation requirements estimated.

3.1.3 Standard: Program addresses ESA responsibilities.

Indicator 1: ESA Section 7 Consultation completed.

3.2.1 Standard: Fish are produced and released in a manner enabling effective harvest, as described in all applicable fisherie management plans, while avoiding over harvest of not-target species.

Indicator 1: Number of target fish caught by fishery estimated.

Indicator 2: Number of non-target fish caught in fishery estimated.

Indicator 3: Angler days by fishery estimated.

Indicator 4: Escapement of target fish estimated.

3.2.2 Standard: Release groups sufficiently marked in a manner consistent with information needs and protocols to enable de impacts to natural- and hatchery-origin fish in fisheries.

Indicator 1: Marking rate by type in each release group documented.

Indicator 2: Sampling rate by mark type for each fishery estimated.

Indicator 3: Number of marks by type observed in fishery documented.

3.3.1 Standard: Artificial propagation program contributes to an increasing number of spawners returning to natural spawning

Indicator 1: Annual number of spawners on spawning grounds estimated in specific locations.

Indicator 2: Spawner-recruit ratios estimated is specific locations.

Indicator 3: Number of redds in natural production index areas documented in specific locations.

3.3.2 Standard: Releases are sufficiently marked to allow statistically significant evaluation of program contribution.

Indicator 1: Marking rates and type of mark documented.

Indicator 2: Number of marks identified in juvenile and adult groups documented.

1.10.2) ?Performance Indicators? addressing risks.

3.4.1 Standard: Fish collected for broodstock are taken throughout the return in proportions approximating the timing and age the population.

Indicator 1: Temporal distribution of broodstock collection managed.

Indicator 2: Age composition of broodstock collection managed.

3.4.2 Standard: Broodstock collection does not significantly reduce potential juvenile production in natural areas.

Indicator 1: Number of spawners of natural origin removed for broodstock managed.

Indicator 2: Number and origin of spawners migrating to natural spawning areas managed.

Indicator 3: Number of eggs or juveniles placed in natural rearing areas managed.

3.4.3 Standard: Life history characteristics of the natural population do not change as a result of this program.

Indicator 1: Life history characteristics of natural and hatchery-produced populations are measured (e.g., juvenile dispersal ti size at outmigration, juvenile sex ratio at outmigration, adult return timing, adult age and sex ratio, spawn timing, hatch and s rearing densities, growth, diet, physical characteristics, fecundity, egg size).

3.4.4 Standard: Annual release numbers do not exceed estimated basin-wide and local habitat capacity.

Indicator 1: Annual release numbers, life-stage, size at release, length of acclimation documented.

Indicator 2: Location of releases documented.

Indicator 3: Timing of hatchery releases documented.

3.5.1 Standard: Patterns of genetic variation within and among natural populations do not change significantly as a result of a production.

Indicator 1: Genetic profiles of naturally-produced and hatchery-produced adults developed.

3.5.2 Standard: Collection of broodstock does not adversely impact the genetic diversity of the naturally spawning population

Indicator 1: Total number of natural spawners reaching collection facilities documented.

Indicator 2: Total number of natural spawners estimated passing collection facilities documented.

Indicator 3: Timing of collection compared to overall run timing.

3.5.3 Standard: Artificially produced adults in natural production areas do not exceed appropriate proportion.

Indicator 1: Ratio of natural to hatchery-produced adults monitored (observed and estimated through fishery).

Indicator 2: Observed and estimated total numbers of natural and hatchery-produced adults passing counting stations.

3.5.4 Standard: Juveniles are released off-station, or after sufficient acclimation to maximize homing ability to intended return

Indicator 1: Location of juvenile releases documented.

Indicator 2: Length of acclimation period documented.

Indicator 3: Release type (e.g., volitional or forced) documented.

Indicator 4: Adult straying documented.

3.5.5 Standard: Juveniles are released at fully smolted stage of development.

Indicator 1: Level of smoltification at release documented.

Indicator 1: Release type (e.g., forced or volitional) documented.

3.5.6 Standard: The number of adults returning to the hatchery that exceeds broodstock needs is declining.

Indicator 1: The number of adults in excess of broodstock needs documented in relation to mitigation goals of the program.

3.6.1 Standard: The artificial production program uses standard scientific procedures to evaluate various aspects of artificial p

Indicator 1: Scientifically based experimental design with measurable objectives and hypotheses.

3.6.2. Standard: The artificial production program is monitored and evaluated on an appropriate schedule and scale to addres toward achieving the experimental objectives.

Indicator 1: Monitoring and evaluation framework including detailed time line.

Indicator 2: Annual and final reports.

3.7.1 Standard: Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility o standards and protocols.

Indicator 1: Annual reports indicating level of compliance with applicable standards and criteria.

3.7.2 Standard: Effluent from artificial production facility will not detrimentally affect natural populations.

Indicator 1: Discharge water quality compared to applicable water quality standards.

3.7.3 Standard: Water withdrawals and in stream water diversion structures for artificial production facility operation will not p to natural spawning areas, affect spawning, or impact juveniles.

Indicator 1: Water withdrawals documented ? no impacts to listed species.

Indicator 2: NMFS screening criteria adhered to.

3.7.4 Standard: Releases do not introduce pathogens not already existing in the local populations and do not significantly inc levels of existing pathogens.

Indicator 1: Certification of juvenile fish health documented prior to release.

3.7.5 Standard: Any distribution of carcasses or other products for nutrient enhancement is accomplished in compliance with disease control regulations and guidelines.

Indicator 1: Number and location(s) of carcasses distributed to habitat documented.

3.7.6 Standard: Adult broodstock collection operation does not significantly alter spatial and temporal distribution of natural p

Indicator 1: Spatial and temporal spawning distribution of natural population above and below trapping facilities monitored.

3.7.7 Standard: Weir/trap operations do not result in significant stress, injury, or mortality in natural populations.

Indicator 1: Mortality rates in trap documented. No ESA-listed fish targeted.

Indicator 2: Prespawning mortality rates of trapped fish in hatchery or after release documented. No ESA-listed fish targeted.

3.7.8 Standard: Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of nat

Indicator 1: Size and time of release of juvenile fish documented and compared to size and timing of natural fish.

Standards and indicators (S&I) are based on legal mandates for Artificial Propagation S&I for anadromous and resident fish p the Pacific Northwest, developed as an outgrowth of discussions of the by the regional Production Review Committee of the Power Planning Council, 1/17/2001.

Standards and indicators (S&I) are based on legal mandates for Artificial Propagation S&I for anadromous and resident fish p
the Pacific Northwest, developed as an outgrowth of discussions of the by the regional Production Review Committee of the
Power Planning Council, 1/17/2001.

Standards and indicators (S&I) are based on legal mandates for Artificial Propagation S&I for anadromous and resident fish p
the Pacific Northwest, developed as an outgrowth of discussions of the by the regional Production Review Committee of the
Power Planning Council, 1/17/2001.

e. Funding for monitoring and evaluation is a separate budget.

nc

Data source:

Standards and indicators (S&I) are based on legal mandates for Artificial Propagation S&I for anadromous and resident fish p
the Pacific Northwest, HGMP
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the Pacific Northwest, HGMP
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the Pacific Northwest, HGMP
PI
HGMP

1.11.1 Proposed annual broodstock collection level (maximum number of adult fish).

198 nya

Data source:

nds

1.11.2 Proposed annual fish release levels (maximum number) by life stage and location.

1

Age Class	Maximum Number	Size (ffp)	Release Date	Location: Stream	Release Point (RKm)	Major Watershed	Ecopr
Eggs	nya	nya	nya	nya	nya	nya	nya
Unfed Fry	nya	nya	nya	nya	nya	nya	nya
Fry	nya	nya	nya	nya	nya	nya	nya
Fingerling	nya	nya	nya	nya	nya	nya	nya
Yearling	1,000,000	10-14	4/15	Pahsimeroi River	17.5	Salmon River	Mounta Snake

Comments:

nc

Data source:

HGMP, Personal interview (PI) with Todd Garlie and Doug Engem on 3/26/03 at the Pahsimeroi Hatchery. Brood year repor

1.12 Current program performance, including estimated smolt-to-adult survival rates, adult pı levels, and escapement levels. Indicate the source of these data.

Return Year	Total Catch (all ages)	Natural Escapement NoRs	Natural Escapement HoRs	Hatchery Spawning NoRs	Hatchery Spawning HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya

	1993	nya	nya	nya	nya	nya
	1994	nya	nya	nya	nya	nya
	1995	nya	nya	nya	nya	nya
	1996	nya	nya	nya	nya	nya
33	**1997**	nya	nya	nya	nya	nya
	1998	nya	nya	nya	nya	nya
	1999	nya	nya	nya	nya	nya
	2000	nya	nya	nya	nya	nya
	2001	nya	nya	nya	nya	nya

Comments:

nc

Data source:

annual broodyear and run reports; Jeff Lutch (IDFG Nampa, ID) for the ISS component; stock summary report covers years 1990s (see Lars)

Status and Goals of Stocks and Habitats

		NoRs		HoRs		Combined (HoRs + NoRs)	
	Brood Year	**Smolt to Adult Survival(%)**	**Recruits per Spawner**	**Smolt to Adult Survival(%)**	**Recruits per Spawner**	**Smolt to Adult Survival(%)**	**Recruits per Spawner**
	Goal	nya	nya	nya	nya	nya	nya
	1988	nya	nya	nya	nya	nya	nya
	1989	nya	nya	nya	nya	nya	nya
	1990	nya	nya	nya	nya	nya	nya
34	**1991**	nya	nya	nya	nya	nya	nya
	1992	nya	nya	nya	nya	nya	nya
	1993	nya	nya	nya	nya	nya	nya
	1994	nya	nya	nya	nya	nya	nya
	1995	nya	nya	nya	nya	nya	nya
	1996	nya	nya	nya	nya	nya	nya
	1997	nya	nya	nya	nya	nya	nya
	1998	nya	nya	nya	nya	nya	nya
	1999	nya	nya	nya	nya	nya	nya

Comments:

Data source:

Hatchery broodyear reports (SAR), ISS (SAR and maybe S/R for natural component)

1.13 Date program started (years in operation), or is expected to start.

7 The first year of operation for this hatchery was 1967 .

Comments:

data above is for Pahsimeroi

MVH: 1988

Sawtooth: 1988

HNFH: 1980

Niagara: 1966

Data source:

PI, HGMP

1.14 Expected duration of program.

148 The final year of the program is undetermined.

149 The program is on-going with no planned termination.

Comments:

nc
nc

Data source:

PI
PI

1.15 Watersheds targeted by program.

1 Salmon

1.16 Indicate alternative actions considered for attaining program goals, and reasons why thos are not being proposed.

The hatchery program is a part of a strategy to meet conservation and/or harvest goals for the target stock. The tables below the short- and long-term goals are for the stock in terms of stock status (biological significance and viability), habitat and harv in the table indicate High, Medium, or Low levels for the respective attributes. Changes in these levels from current status inc outcomes for the hatchery program and other strategies (including habitat protection and restoration).

18

	Biological Significance	Viability	Habitat
Current Status	H	L	L
Short-term Goal	H	L	M
Long-term Goal	H	M	H

This table shows current status and goals for harvest opportunity. **H** implies harvest opportunity every year, **M** opportunity mo some years, and **N** no opportunity.

19
20
21
22
23

Fishery type		Marine	L. Columbia	Zone 6	U. Columbia	Subba
		Location of Fishery				
Commercial	**Current Status**	nya	nya	nya	nya	N
	Short-term Goal	nya	nya	nya	nya	N
	Long-term Goal	nya	nya	nya	nya	N
Ceremonial	**Current Status**	nya	nya	nya	nya	L
	Short-term Goal	nya	nya	nya	nya	L
	Long-term Goal	nya	nya	nya	nya	H
Subsistence	**Current Status**	nya	nya	H	nya	L
	Short-term Goal	nya	nya	H	nya	L
	Long-term Goal	nya	nya	H	nya	H
Recreational	**Current Status**	nya	nya	nya	nya	N
	Short-term Goal	nya	nya	nya	nya	N

	Long-term Goal	nya	nya	nya	nya	H
Catch and Release	**Current Status**	dna	dna	dna	dna	dna
	Short-term Goal	dna	dna	dna	dna	dna
	Long-term Goal	dna	dna	dna	dna	dna

Comments:

spawning and rearing habitat limited in the subbasin (irrigation); mainstem migratory habitat limited
same as McCall summer chinook - zone 6
check with CRITFIC for zone 6; check with Sho-Ban (Keith Kutchins, Chad)
check with Sho-Ban

nc
nc

Data source:

nds
nds
nds
nds
nds
nds

Section 2: Program Effects on ESA-Listed Salmonid Populations

2.1 List all ESA permits or authorizations in hand for the hatchery program.

150 The program has the following permits or authorizations: Section 7 or Section 10 permit
401 certification
.

Comments:

nc

Data source:

PI

2.2.1 Descriptions, status and projected take actions and levels for ESA-listed natural populatic target area.

145 Snake River steelhead and summer/spring chinook salmon, bull trout, and sockeye salmon.

15 nya

32 Listed stocks may be directly affected by nya.

The following ESA listed natural salmonid populations occur in the subbasin where the program fish are released:

ESA listed stock	Viability	Habitat
Summer Chinook (Johnson Creek)	L	L
Summer Chinook (McCall Hatchery)	H	L
Summer Chinook (Pahsimeroi)	L	L
Spring Chinook (Upper Salmon/Sawtooth)	U	L
Spring Chinook - Natural	H	L
Summer Chinook - Natural	H	L
Steelhead B-Natural	L	L
Redfish Lake Sockeye	L	L

Spring/Summer Chinook (W. Fork Yankee Fork- Salmon River)- Integrated	L	L
Spring/Summer Chinook (East Fork Salmon River)- Integrated	L	L
Lemhi River Spring_Summer Chinook	L	L

H, M and L refer to high, medium and low ratings, low implying critical and high healthy.

Comments:

nc
nc
nc
spawning and rearing habitat limited in the subbasin (irrigation); mainstem migratory habitat limited

Data source:

PI
nds
nds
nc

2.2.2 Status of ESA-listed salmonid population(s) affected by the program.

nya

Most recent available spawning escapement estimates are shown in the table below:

Summer Chinook (Johnson Creek)

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Summer Chinook (McCall Hatchery)

	Total Catch	Natural Escapement	Hatchery Spawning

Return Year	(all ages)	NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Summer Chinook (Pahsimeroi)

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Spring Chinook (Upper Salmon/Sawtooth)

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya

1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	18	19
1996	nya	nya	nya	105	51
1997	nya	nya	nya	155	99
1998	nya	nya	nya	127	26
1999	nya	nya	nya	121	75
2000	nya	nya	nya	535	451
2001	nya	nya	nya	676	1,427

Spring Chinook - Natural

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Summer Chinook - Natural

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya

1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Steelhead B-Natural

Return Year	**Total Catch (all ages)**	**Natural Escapement**		**Hatchery Spawning**	
		NoRs	**HoRs**	**NoRs**	**HoRs**
Goal	unk	unk	unk	unk	unk
1990	unk	unk	unk	unk	unk
1991	unk	unk	unk	unk	unk
1992	unk	unk	unk	unk	unk
1993	unk	unk	unk	unk	unk
1994	unk	unk	unk	unk	unk
1995	unk	unk	unk	unk	unk
1996	unk	unk	unk	unk	unk
1997	unk	unk	unk	unk	unk
1998	unk	unk	unk	unk	unk
1999	unk	unk	unk	unk	unk
2000	unk	unk	unk	unk	unk
2001	unk	unk	unk	unk	unk

Redfish Lake Sockeye

Return Year	**Total Catch (all ages)**	**Natural Escapement**		**Hatchery Spawning**	
		NoRs	**HoRs**	**NoRs**	**HoRs**
Goal	nya	2000	nya	nya	600
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya

1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Spring/Summer Chinook (W. Fork Yankee Fork- Salmon River)- Integrated

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Spring/Summer Chinook (East Fork Salmon River)- Integrated

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya

2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Lemhi River Spring_Summer Chinook

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	NA	M	M	NA	NA
1990	M	M	M	NA	NA
1991	M	M	M	NA	NA
1992	M	M	M	NA	NA
1993	M	M	M	NA	NA
1994	M	M	M	NA	NA
1995	M	M	M	NA	NA
1996	M	M	M	NA	NA
1997	M	M	M	NA	NA
1998	M	M	M	NA	NA
1999	M	M	M	NA	NA
2000	M	M	M	NA	NA
2001	M	M	M	NA	NA

Comments:

nc
nc
nc

Data source:

nds
nds
PI

2.2.3 Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimate levels of take.

Steelhead B (East Fork) - Integrated

	ESU/Population	nya
	Activity	nya
152	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (Johnson Creek)

	ESU/Population	nya
	Activity	nya
152	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (McCall Hatchery)

	ESU/Population	nya
152	**Activity**	nya
	Location of hatchery	

activity nya

Dates of activity nya

Hatchery Program Operator nya

153

Type of Take	Annual Take of Listed Fish by life Stage (number of fish) Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook (Rapid River) - Hatchery

152

ESU/Population nya

Activity nya

Location of hatchery activity nya

Dates of activity nya

Hatchery Program Operator nya

153

Type of Take	Annual Take of Listed Fish by life Stage (number of fish) Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya

Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (Pahsimeroi)

ESU/Population Snake River summer chinook salmon

Activity trapping/spawning

152 **Location of hatchery activity** Pahsimeroi Hatchery

Dates of activity 6/20-10/5

Hatchery Program Operator IDFG

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	1,122	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	299	nya
153 **Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	823	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook (Upper Salmon/Sawtooth)

ESU/Population nya

Activity nya

152 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program Operator nya

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
153 **Capture, handle, and release (c)**	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook - Natural

152

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

153

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook - Natural

152

ESU/Population	Summer chinook salmon
Activity	Trapping/spawning
Location of hatchery activity	Pahsimeroi Hatchery
Dates of activity	June 20 to October 5
Hatchery Program Operator	IDFG

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	1,122	nya
Collect for transport (b)	nya	nya	nya	nya

	Capture, handle, and release (c)	nya	nya	299	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
153	Removal (e.g., brookstock (e)	nya	nya	823	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Run (Pahsimeroi)- Hatchery

152	**ESU/Population**	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Steelhead B (Dworshak)-Hatchery

152	**ESU/Population**	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

153	Annual Take of Listed Fish by life Stage (number of fish)				
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

152

Steelhead B-Natural

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

153	Annual Take of Listed Fish by life Stage (number of fish)				
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Natural

ESU/Population	nya
Activity	nya

Location of hatchery activity nya

152 **Dates of activity** nya

Hatchery Program Operator nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Redfish Lake Sockeye

ESU/Population nya

Activity nya

152 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program Operator nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Other take (specify) (h)	nya	nya	nya	nya

Spring/Summer Chinook (W. Fork Yankee Fork- Salmon River)- Integrated

	ESU/Population	nya
	Activity	nya
152	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring/Summer Chinook (East Fork Salmon River)- Integrated

	ESU/Population	nya
	Activity	nya
152	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
153	**Collect for transport (b)**	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya

Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Lemhi River Spring_Summer Chinook

152

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

153

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Run (Sawtooth)- Hatchery

152

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya

Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

153

Comments:

ESA-listed, spring chinook salmon are trapped during broodstock collections periods at the Pahsimeroi Fish Hatchery.

All adult spring chinook salmon (hatchery- and natural-origin) are trapped and handled at the Pahsimeroi Fish Hatchery weir of natural-origin adults varies annually. Beginning in 2003, the IDFG anticipates that all natural-origin adults will be passed u spawning as the development of supplementation broodstocks is expected to conclude. Following capture, natural-origin fish marked and tissue sampled before release.

Prior to adult return year 2003, a protion of natural adults were retained for broodstock purposes.

Numbers of hatchery- and natural-origin spring chinook salmon released for natural spawning are presented in the HGMP fo Sawtooth Fish Hatchery and East Fork Salmon River Satellite facilities. Current guidelines pursuant to the Idaho Supplemen project design state that up to 50% of the adults released upstream of the Pahsimeroi Fish Hatchery weir may be of hatchery specifically of supplementation cross origin (hatchery x natural).

nc
The 823 fish are removed from trap and ponded for broodstock

Data source:

HGMP
PI

PI

Section 3: Relationship of Program to Other Management Objectives

3.1 Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hooc Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the *NP Production Review* Report and Recommendations - NPPC document 99-15). Explain any | deviations from the plan or policies.

155 This program conforms with the plan and polices to mitigate loss of chinook salmon production caused by the construction a of the four dams on the lower Snake River.

Comments:

nc

Data source:

HGMP, PI

3.2 List all existing cooperative agreements, memoranda of understanding, memoranda of agr or other management plans or court orders under which program operates.

156

Document Title	Type
HGMP	MP
IDWR Water Right	CA
LSRCP	MP
US v Oregon	CO

Comments:

nc

Data source:

PI

3.3 Relationship to harvest objectives.

157 The LSRP defined replacement of adults "in place" and "in kind" for appropriate state management purposes. IDFG, USFW and agency fish managers work cooperatively to develop annual production and mark plans. Juvenile production and adult targets were established at the outset of the LSRCP program. IDFG conducts annual creel and angler surveys to assess th program fish make toward meeting program harvest objectives.

Comments:

nc

Data source:

HGMP

3.4 Relationship to habitat protection and recovery strategies.

158 nya

Comments:

nc

Data source:

HGMP

3.5 Ecological interactions.

The following species co-occur to a significant degree with the program fish in either freshwater or early marine life stages.

159
- Steelhead
- Sockeye
- Coho
- Chinook
- Bull Trout

Comments:

nc

Data source:

PI

Section 4. Water Source

4.1 Provide a quantitative and narrative description of the water source (spring, well, surfac quality profile and natural limitations to production attributable to the water source.

The following statements describe the adult holding water source:

12
- The water source is gravity flow.
- The water source is accessible to anadromous fish.
- Water is from the natal stream for the cultured stock.
- The water used results in natural water temperature profiles that provide optimum maturation and gamete developn
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu temperature.
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu ammonia, carbon dioxide, chlorine, pH, copper, dissolved oxygen, hydrogen sulfide, dissolved nitrogen, iron, and zi
- Naturally produced fish do not have access to intake screens.
- Hatchery intake screening complies with Integrated Hatchery Operations Team (IHOT) and National Marine Fisheri facility guidelines.

The following statements describe the incubation water source:

13
- The water source is gravity flow.
- The water source is pumped.
- The water source is pathogen-free.
- The water source is specific-pathogen free.
- Incubation water can be heated or chilled to approximate natural water temperature profiles.
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu temperature.
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu ammonia, carbon dioxide, chlorine, pH, copper, dissolved oxygen, hydrogen sulfide, dissolved nitrogen, iron, and zi
- The water supply is protected by flow alarms at the intake(s).
- The water supply is protected by flow and/or pond level alarms at the holding pond(s).
- Naturally produced fish do not have access to intake screens.

The following statements describe the rearing water source:

14
- The water source is gravity flow.
- The water source is accessible to anadromous fish.
- Water is from the natal stream for the cultured stock.
- The water used provides natural water temperature profiles that results in hatching/emergence timing similar to that naturally produced stock.
- The hatchery operates to allow all migrating species of all ages to by-pass or pass through hatchery related structu
- Adequate flows are maintained to provide unimpeded passage of adults and juveniles in the by-pass reach created water withdrawals.
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu temperature.
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu ammonia, carbon dioxide, chlorine, pH, copper, dissolved oxygen, hydrogen sulfide, dissolved nitrogen, iron, and zi

- Hatchery intake screening complies with Integrated Hatchery Operations Team (IHOT) and National Marine Fisheri facility guidelines.

Comments:

answers above for Pahsimeroi

Answers above for Pahsimeroi to eye-up egg stage only. Incubation water supply is alarmed at the holding tank for both wa power failure.

Niagara:a,c,d,e,j,m,q,r=true; n,p=do not apply; l-exceed stds for iron.

HNFH:a,k,l,=true; p,r=do not apply.

MVH:a,g,l,n(supply line)=true; p=NA

Rearing water source only for summer chinook salmon

Data source:

PI
PI
PI

4.2 Indicate risk aversion measures that will be applied to minimize the likelihood for the ta listed natural fish as a result of hatchery water withdrawal, screening, or effluent discha

15 The facility operates within the limitations established in its National Pollution Discharge Elimination System (NPDES) perm facility does not have a discharge permit.

Comments:

nc

Data source:

PI

Section 5. Facilities

5.1 Broodstock collection facilities (or methods).

Brookstock for this program is collected:

16

- by volitional return to adult capture pond.
- from wild by weir. ** NO STATEMENT PROVIDED FOR THIS CHOICE **

188

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Fl (gpm)
2	Concrete	6,720	70	16	6	5,238
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya

Comments:

nc
nc

Data source:

PI
PI

5.2 Fish transportation equipment (description of pen, tank, truck, or container used).

99 IHOT guidelines for transportation are followed.

Equipment Type	Capacity (gallons)	Supplemental Oxygen (y/n)	Temperature Control (y/n)	Normal Transit Time (minutes)	Chemical (s) Used	Dc (p
Tank	500	Y	Y	30-60	None	nya
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya

187

Comments:

nc
nc

Data source:

PI
PI

5.3 Broodstock holding and spawning facilities.

Spawning for this program takes place:

16

- in a covered facility. ** NO STATEMENT PROVIDED FOR THIS CHOICE **** NO STATEMENT PROVIDED FOR TI

34 Integrated Hatchery Operations Team (IHOT) adult holding guidelines followed for adult holding , density , water quality and p measures to provide the necessary security for the broodstock.

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Fl (gpm)
2	Concrete	6,720	70	16	6	5,238
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya

188

Comments:

nc
nc
nc

Data source:

PI
PI
PI

5.4 Incubation facilities.

	Incubator Type	Units (number)	Flow (gpm)	Volume (cu.ft.)	Loading-Eyeing (eggs/unit)	Loading-Hatcl (eggs/unit
189	Vertical flow heath trays	300- 15 tray stacks	5-6	nya	1female/tray	nya
	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya

Comments:

nc

Data source:

PI, brood year reports

5.5 Rearing facilities.

	Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Maximum Flow Index	Maxir Dens Ind
190	2	Earthen ponds	60,000	300	40	5	4,490	1.5	0.5
	4	Concrete raceways	1,200	100	4	3	264-568	1.5	0.5
	nya	nya	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya	nya	nya

Comments:

nc

Data source:

PI, Brood year reports

5.6 Acclimation/release facilities.

	Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Maximum Flow Index	Maxir Dens Ind
190	2	Earthen ponds	60,000	300	40	5	4,490	1.5	0.5
	4	Concrete raceways	1,200	100	4	3	264-568	1.5	0.5
	nya	nya	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya	nya	nya

Comments:

nc

Data source:

PI, Brood year reports

5.7 Describe operational difficulties or disasters that led to significant fish mortality.

160 Whirling disease, with no SPF water for early rearing, magnitude of problem is cyclic and not quantified.

Comments:

nc

Data source:

PI

5.8 Indicate available back-up systems, and risk aversion measures that will be applied, tha the likelihood for the take of listed natural fish that may result from equipment failure, v flooding, disease transmission, or other events that could lead to injury or mortality.

70 Fish are reared in multiple facilities or with redundant systems to reduce the risk of catastrophic loss.

78 The facility is sited so as to minimize the risk of catastrophic fish loss from flooding.

79 Staff is notified of emergency situations at the facility.

80 The facility is continuously staffed to assure the security of fish stocks on-site.

Comments:

nc
At incubation only.

Staff is housed at hatchery.

Well water is used to reduce whirling disease.

Data source:

PI
PI
PI
PI

Section 6. Broodstock Origin and Identity

6.1 Source.

17 The broodstock chosen represents natural populations native or adapted to the watersheds in which hatchery fish will be re

Comments:

nc

Data source:

PI

6.2.1 History.

Broodstock Source	Origin	Year(s) Used

			Begin	End
	Pahsimeroi River summer chinook, hatchery and natural origin stock used	H	1960s	Present
	Pahsimeroi River summer chinook, hatchery and natural origin stock used	N	1960s	Present
	nya	nya	nya	nya
	nya	nya	nya	nya
	nya	nya	nya	nya
183	nya	nya	nya	nya
	nya	nya	nya	nya
	nya	nya	nya	nya
	nya	nya	nya	nya
	nya	nya	nya	nya
	nya	nya	nya	nya
	nya	nya	nya	nya

Comments:

Data source:

PI

6.2.2 Annual size.

22 The program collects sufficient numbers of donors from the natural stock to minimize founder effects.

23

25

27 The program collects sufficient broodstock to maintain an effective population size of 1000 fish per generation.

28 More than 10% of the broodstock is derived from wild fish each year.

Comments:

Summer chinook salmon donors are a combination of hatchery and wild fish

No artifical selection is practiced at Pahsimeroi. We spawn randomly between year classes.

Sometimes yes sometimes no, depends on the number of returning fish.

Usually greater than 35% of the broodstock is wild.

Data source:

PI
PI
PI
PI

6.2.3 Past and proposed level of natural fish in the broodstock.

33

Return Year	Total Catch (all ages)	Natural Escapement NoRs	Natural Escapement HoRs	Hatchery Spawning NoRs	Hatchery Spawning HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Comments:

nc

Data source:

annual broodyear and run reports; Jeff Lutch (IDFG Nampa, ID) for the ISS component; stock summary report covers years 1990s (see Lars)

6.2.4 Genetic or ecological differences.

19 The broodstock chosen displays morphological and life history traits similar to the natural population.

Comments:

nc

Data source:

PI

6.2.5 Reasons for choosing.

18 dna

20

21 The broodstock chosen has the desired life history traits to meet harvest goals.

Comments:

Broodstock never extirpated

nc
They are no different than wild fish

Data source:

PI
PI
PI

6.3 Indicate risk aversion measures that will be applied to minimize the likelihood for advers or ecological effects to listed natural fish that may occur as a result of broodstock selecti practices.

The following procedures are in place that maintain broodstock collection within programmed levels:

161

- The collection plan for natural origin adults is in place that prevents collection of surplus fish
- Excess adults are culled at random and sold, buried, or donated to food banks depending on their quality

Comments:

nc

Data source:

PI

Section 7. Broodstock Collection

7.1 Life-history stage to be collected (adults, eggs, or juveniles).

		Adults				
	Year	**Females**	**Males**	**Jacks**	**Eggs**	**Juvenile:**
	Planned	250	225	25	1,176,500	1,000,000
	1990	156	180	19	662,641	605,900
	1991	90	58	14	437,157	375,000
	1992	35	49	3	172,139	130,510
	1993	29	22	4	167,200	147,429
191	**1994**	0	0	0	0	0
	1995	36	15	2	153,838	122,017
	1996	18	15	5	85,660	65,648
	1997	40	33	0	171,836	135,669
	1998	17	23	7	74,105,	53,837
	1999	92	73	35	371,354	283,063
	2000	149	137	24	633,906	508,340
	2001	429	337	23	1,699,991	1,206,000*

Comments:

* - smolts to be released on 4/15/03, final numbers not tallied.

Data source:

PI, brood year reports

7.2 Collection or sampling design

16
- Broodstock collected by volitional return to adult capture pond.
- Broodstock collected from wild by weir.

22 The program collects sufficient numbers of donors from the natural stock to minimize founder effects.

23

24 Representative samples of the population are collected with respect to size, age, sex ratio, run and spawn timing, and othe
important to long-term fitness.

25 The proportion of spawners brought into the hatchery follows a “spread-the-risk” strategy that attempts to improve the proba
survival for the entire population.

27 The program collects sufficient broodstock to maintain an effective population size of 1000 fish per generation.)

28 More than 10% of the broodstock is derived from wild fish each year.

Comments:

Summer chinook salmon donors are a combination of hatchery and wild fish

No artifical selection is practiced at Pahsimeroi. We spawn randomly between year classes.

Yes, especially run and spawn timing.

Fish used for spawning are taken throughout the runs.

Sometimes yes sometimes no, depends on the number of returning fish.

Usually greater than 35% of the broodstock is wild.

Data source:

PI
PI
PI
PI,HGMP
PI
PI

7.3 Identity.

100 Marking techniques are used to distinguish among hatchery population segments.

101 100% of the hatchery fish released are marked so that they can be distinguished from the natural population.

102 Marked fish can be identified using non-lethal means.

106 Wild fish make up 5-30% (between five and thirty percent) % of the broodstock for this program.

Comments:

Chinook are marked differently for two populations, with the ISS fish receiving a different mark.

nc
nc
nc

Data source:

PI
PI
PI
PI

7.4 Proposed number to be collected:

198 **7.4.1 Program goal (assuming 1:1 sex ratio for adults):**
nya

7.4.2 Broodstock collection levels for the last twelve years (e.g. 1990-2001), or for most recent years availab

			Adults			
	Year	**Females**	**Males**	**Jacks**	**Eggs**	**Juvenile**
	Planned	250	225	25	1,176,500	1,000,000
	1990	156	180	19	662,641	605,900
	1991	90	58	14	437,157	375,000
191	**1992**	35	49	3	172,139	130,510
	1993	29	22	4	167,200	147,429
	1994	0	0	0	0	0
	1995	36	15	2	153,838	122,017
	1996	18	15	5	85,660	65,648
	1997	40	33	0	171,836	135,669
	1998	17	23	7	74,105,	53,837

1999	92	73	35	371,354	283,063
2000	149	137	24	633,906	508,340
2001	429	337	23	1,699,991	1,206,000*

Comments:

* - smolts to be released on 4/15/03, final numbers not tallied.

Data source:

PI, brood year reports

7.5 Disposition of hatchery-origin fish collected in surplus of broodstock needs.

The following procedures are in place that maintain broodstock collection within programmed levels:

161

- The collection plan for natural origin adults is in place that prevents collection of surplus fish.
- Excess adults are culled at random and sold, buried, or donated to food banks depending on their quality.

Comments:

nc

Data source:

PI

7.6 Fish transportation and holding methods.

	Equipment Type	Capacity (gallons)	Supplemental Oxygen (y/n)	Temperature Control (y/n)	Normal Transit Time (minutes)	Chemical (s) Used	Dc (p
	Tank	500	Y	Y	30-60	None	nya
187	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya

	Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Fl (gpm)
	2	Concrete	6,720	70	16	6	5,238
188	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya

33 Broodstock is collected and held in a manner that results in less than 10% prespawning mortality.

99 IHOT guidelines for transport are followed for this program.

Comments:

nc
nc
Mostly yes, but sometimes there has been mortalities of around 12%.

nc

Data source:

PI
PI
PI
PI

7.7 Describe fish health maintenance and sanitation procedures applied.

98

32 Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection committee (PNFHPC), state or triba
are followed for broodstock fish health inspection , transfer of eggs or adults and broodstock holding and disposal of carcas

Comments:

nc
nc

Data source:

PI
PI

7.8 Disposition of carcasses.

32 Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection committee (PNFHPC), state or triba
are followed for broodstock fish health inspection , transfer of eggs or adults and broodstock holding and disposal of carcas

103 Hatchery adults are distributed by staff within the subbasin to provide hatchery adults are distributed (by staff) within the sul
provide natural production.

161 The following procedures are in polace that maintain broodstock collection within programmed levels:

- The collection plan for natural origin adults is in place that prevents collection of surplus fish
- Excess adults are culled at random and sold, buried, or donated to food banks depending on their quality

Comments:

nc
nc
nc

Data source:

PI
PI
PI

7.9 Indicate risk aversion measures that will be applied to minimize the likelihood for advers or ecological effects to listed natural fish resulting from the broodstock collection progra

29 The program has guidelines for acceptable contribution of hatchery fish to natural spawning.

30 These guidelines are met for all affected natural stocks.

32 Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection committee (PNFHPC), state or triba
are followed for broodstock fish health inspection , transfer of eggs or adults and broodstock holding and disposal of carcas

Comments:

Sometimes 50-60% hatchery fish

Annual Broodstock Planning, IDFG Management Agreements US v Oregon.

nc

Data source:

PI
PI
PI

Section 8. Mating

8.1 Selection method.

35 Males and females available on a given day are mated randomly.

39 Fish are allowed to select their own mates and go through all normal spawning behavior.

Comments:

All spawning fish are randomly selected based on time of arrival.

Fish passed to spawn in the river go through natural spawning behavior for mate selection, but not at hatchery.

Data source:

PI
PI

8.2 Males.

38 Precocious males are used as a set percentage or in proportion to their contribution to the adult run.

37 Back-up males are used in the spawning protocol.

Comments:

No mini's used and generally male spawners consist of less than 10% jacks.

Sometimes more than one male per female is used.

Data source:

PI
PI

8.3 Fertilization.

36 Gametes are NOT pooled prior to fertilization.

39 Fish are allowed to select their own mates and go through all normal spawning behavior.

11 IHOT PNFHPC state tribal federal guidelines are followed for culture practices for this program.

40 Disinfection procedures that prevent pathogen transmission between stocks of fish are implemented during spawning.

Comments:

nc
Fish passed to spawn in the river go through natural spawning behavior for mate selection, but not at hatchery.

nc
IHOT protocols

Data source:

PI
PI
PI
PI

8.4 Cryopreserved gametes.

162 Cryopreserved gametes are not used.

Comments:

Cryopreserved gametes are collected but currently not used.

Data source:

PI

8.5 Indicate risk aversion measures that will be applied to minimize the likelihood for advers or ecological effects to listed natural fish resulting from the mating scheme.

35 Males and females available on a given day are mated randomly.

36 Gametes are NOT pooled prior to fertilization.
37 Back-up males are used in the spawning protocol.
38 Precocious males are used as a set percentage or in proportion to their contribution to the adult run.
39 Fish are allowed to select their own mates and go through all normal spawning behavior.

Comments:

All spawning fish are randomly selected based on time of arrival.

nc
Sometimes more than one male per female is used.

No mini's used and generally male spawners consist of less than 10% jacks.

Fish passed to spawn in the river go through natural spawning behavior for mate selection, but not at hatchery.

Data source:

PI
PI
PI
PI
PI

Section 9. Incubation and Rearing.

9.1.1 Number of eggs taken and survival rates to eye-up and/or ponding.

192

Year	Egg Take	Green-Eyed Survival (%)	Eyed-Ponding Survival (%)	Egg Survival Performance Std.	Fry-fingerling Survival (%)	Rearing Survival Performance Std.	Finger Sm Surviva
1990	622,641	95.3	97.7	nya	98.5	nya	99.7
1991	437,157	96.7	NA**	nya	NA**	nya	98.5
1992	172,139	97.6	98.7	nya	79.2	nya	99.4
1993	167,200	94.8	95.8	nya	97.9	nya	99.1
1994	0	NA	NA	NA	NA	NA	NA

1995	153,838	91.8	94.9	nya	89.9	nya	98.5
1996	85,660	93.6	94.2	nya	87.1	nya	99.8
1997	171,836	90.4	95.6	nya	91.4	nya	99.8
1998	74,105	79.6	95.0	nya	96.2	nya	99.8
1999	371,354	82.2	95.6	nya	97.1	nya	99.8
2000	633,906	83.5	97.6	nya	97.6	nya	99.7
2001	1,699,991	88.7	NA**	nya	NA**	nya	NA*

Comments:

* - smolts not yet released

** - Production split between SFH/PFH

Data source:

Brood Year Reports, PI

9.1.2 Cause for, and disposition of surplus egg takes.

163 Surplus eggs are collected mainly as a safeguard against potential incubation loses.

45 Eggs are not culled randomly over all segments of egg-take.

48 Families are incubated individually.

59 No culling of juveniles occur.

60

61

44 0 (eggs are never culled)

Comments:

nc
One female per tray

nc
nc
Always use one female per tray.

nc

Data source:

PI
PI
PI
PI
PI
PI

9.1.3 Loading densities applied during incubation.

51 Integrated Hatchery Operations Team (IHOT) species-specific incubation recommendations were followed for water quality temperature , substrate and incubator capacities.

47 Families within spawning groups are NOT mixed randomly at ponding, thus unintentional rearing differences may affect fam differently.

42 Eggs are incubated under conditions that result in equal survival of all segments of the population to ponding.

Comments:

nc
nc
nc

Data source:

PI
PI
PI

9.1.4 Incubation conditions.

49 Incubation takes place in home stream water.

50 The program uses water sources that result in hatching/emergence timing similar to that of the naturally produced populatic

51 Integrated Hatchery Operations Team (IHOT) species-specific incubation recommendations were followed for water quality temperature , substrate and incubator capacities.

53 Eggs are monitored when needed to determine fertilization efficiency and embryonic development.

42 Eggs are incubated under conditions that result in equal survival of all segments of the population to ponding.

47 Families within spawning groups are NOT mixed randomly at ponding, thus unintentional rearing differences may affect fan differently.

48 Families are incubated individually.

43

Comments:

nc
nc
nc
nc
nc
nc
One female per tray

nc

Data source:

PI
PI
PI
PI
PI
PI
PI
PI

9.1.5 Ponding.

The procedures used for determining when fry are ponded include:

55
- Fry are removed from incubation units when 80-90% of observed fry have yolk-sac material that is 80-90% utilized within body cavity ("button-up")
- Fry are ponded based on visual inspection of the amount of yolk remaining
- Fry are ponded based on reaching a specified number of accumulated temperature units
- Fry are ponded based on the recommendations of the facility s fish health specialist

46 Eggs are NOT incubated in a manner that allows volitional ponding of fry.

Comments:

nc
nc

Data source:

PI
PI

9.1.6 Fish health maintenance and monitoring.

52 Disinfection procedures are implemented during incubation that prevent pathogen transmission between stocks of fish on s

53 Eggs are monitored when needed to determine fertilization efficiency and embryonic development.

54 Following eye-up stage, eggs are inventoried, and dead or undeveloped eggs removed and disposed of as described in the control guidelines.

56 Dead or culled eggs are discarded in a manner that prevents transmission to receiving watershed.

Comments:

nc
nc
Yes, all disease control guidelines are followed, with eggs inventoried and dead and undeveloped eggs removed.

Eggs are culled and disgarded at the dump.

Data source:

PI
PI
PI
PI

9.1.7 Indicate risk aversion measures that will be applied to minimize the likelihood for advers and ecological effects to listed fish during incubation.

47 Families within spawning groups are NOT mixed randomly at ponding, thus unintentional rearing differences may affect fam differently.

49 Incubation takes place in home stream water.

50 The program uses water sources that result in hatching/emergence timing similar to that of the naturally produced populatic

51 Integrated Hatchery Operations Team (IHOT) species-specific incubation recommendations were followed for water quality temperature , substrate and incubator capacities.

52 Disinfection procedures are implemented during incubation that prevent pathogen transmission between stocks of fish on s

56 Dead or culled eggs are discarded in a manner that prevents transmission to receiving watershed.

61 Families are NOT culled to minimize family size variation.

Comments:

nc
nc
nc
nc
nc
Eggs are culled and disgarded at the dump.

Always use one female per tray.

Data source:

PI
PI
PI
PI
PI
PI
PI

9.2.1 Provide survival rate data (*average program performance*) by hatchery life stage (fry to f fingerling to smolt) for the most recent twelve years (1990-2001), or for years dependab are available.

192

Year	Egg Take	Green-Eyed Survival (%)	Eyed-Ponding Survival (%)	Egg Survival Performance Std.	Fry-fingerling Survival (%)	Rearing Survival Performance Std.	Finger Smo Surviva
1990	622,641	95.3	97.7	nya	98.5	nya	99.7
1991	437,157	96.7	NA**	nya	NA**	nya	98.5
1992	172,139	97.6	98.7	nya	79.2	nya	99.4
1993	167,200	94.8	95.8	nya	97.9	nya	99.1
1994	0	NA	NA	NA	NA	NA	NA
1995	153,838	91.8	94.9	nya	89.9	nya	98.5
1996	85,660	93.6	94.2	nya	87.1	nya	99.8
1997	171,836	90.4	95.6	nya	91.4	nya	99.8
1998	74,105	79.6	95.0	nya	96.2	nya	99.8
1999	371,354	82.2	95.6	nya	97.1	nya	99.8
2000	633,906	83.5	97.6	nya	97.6	nya	99.7
2001	1,699,991	88.7	NA**	nya	NA**	nya	NA*

Comments:

* - smolts not yet released

** - Production split between SFH/PFH

Data source:

Brood Year Reports, PI

9.2.2 Density and loading criteria (goals and actual levels).

71 The juvenile rearing density and loading guidelines used at the facility are based on: standardized agency guidelines and st (e.g. trial and error) .

72 IHOT standards are followed for: water quality , loading and density.

Comments:

IHOT guidelines and past hatchery records are used.

nc

Data source:

PI
PI

9.2.3 Fish rearing conditions.

66 The program uses a diet and growth regime that mimics natural seasonal growth patterns.

67 Settleable solids, unused feed and feces are removed periodically to ensure proper cleanliness of rearing containers.

72 IHOT standards are followed for: water quality , loading and density.

71 The juvenile rearing density and loading guidelines used at the facility are based on standardized agency guidelines and st (e.g. trial and error) .

Comments:

Hatchery fish have similar growth rates are natural fish.

Yes, IHOT and AOP guidleines are followed.

nc
IHOT guidelines and past hatchery records are used.

Data source:

PI
PI
PI
PI

9.2.4 Indicate biweekly or monthly fish growth information (average program performance), in length, weight, and condition factor data collected during rearing, if available.

194

Rearing Period	Length (mm)	Weight (fpp)	Condition Factor	Growth Rate	Hepatosomatic Index	Boc Moist Conte
February*	42	691	3.2	0.158"	nya	nya
March*	49	370	3.6	0.308"	nya	nya
April*	65	172	3.5	0.598"	nya	nya
May*	78	91	3.76	0.520"	nya	nya
June*	96	47.6	3.86	0.710"	nya	nya
July*	107	34.5	3.83	0.440	nya	nya
August*	116	26	3.95	0.370"	nya	nya
September**	104	36.2	3.95	NA	nya	nya
October**	113	28.4	3.96	0.34"	nya	nya
November**	116	27.3	3.76	0.14"	nya	nya
December-January**	Maintenance	nya	nya	nya	nya	nya
February**	133	19.1	3.62	0.28"	nya	nya

Comments:

nc

Data source:

PI, Brood Year summaries 2001 * - data through 8/31/2002 for Pahsimeroi ISS group fish retained at Pahsimeroi ** - data fro mix of Pahsimeroi ISS group fish and reserve group fish early reared at Sawtooth Hatchery.

9.2.5 Indicate monthly fish growth rate and energy reserve data (*average program performanc* available.

64
- Feeding rates are followed so that fish size is within 10% of program goal each year.
- Feed is stored under proper conditions as described by IHOT guidelines.

65 The correct amount and type of food is provided to achieve the desired growth rate , body composition and condition factorsf and life stages being reared.

194

Rearing Period	Length (mm)	Weight (fpp)	Condition Factor	Growth Rate	Hepatosomatic Index	Boc Moist Conte
February*	42	691	3.2	0.158"	nya	nya
March*	49	370	3.6	0.308"	nya	nya
April*	65	172	3.5	0.598"	nya	nya
May*	78	91	3.76	0.520"	nya	nya
June*	96	47.6	3.86	0.710"	nya	nya
July*	107	34.5	3.83	0.440	nya	nya
August*	116	26	3.95	0.370"	nya	nya
September**	104	36.2	3.95	NA	nya	nya
October**	113	28.4	3.96	0.34"	nya	nya
November**	116	27.3	3.76	0.14"	nya	nya
December-January**	Maintenance	nya	nya	nya	nya	nya
February**	133	19.1	3.62	0.28"	nya	nya

66 The program uses a diet and growth regime that mimics natural seasonal growth patterns.

Comments:

The feed manufacturer conducts feed quality nutritional analysis.
nc
nc
Hatchery fish have similar growth rates are natural fish.

Data source:

PI
PI
PI, Brood Year summaries 2001 * - data through 8/31/2002 for Pahsimeroi ISS group fish retained at Pahsimeroi ** - data fro mix of Pahsimeroi ISS group fish and reserve group fish early reared at Sawtooth Hatchery.
PI

9.2.6 Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*averag performance*).

64
- Feeding rates are followed so that fish size is within 10% of program goal each year.
- Feed is stored under proper conditions as described by IHOT guidelines.

65 The correct amount and type of food is provided to achieve the desired growth rate , body composition and condition factorsf and life stages being reared.

Rearing Period	Food Type	Application Schedule (#feedings/day)	Feeding Rate Range (% B.W./day)	Lbs. Fed Per gpm of Inflow	Food Conversi During Perioc
Jan.- March	#2/#3 Starter*,	12 hr. belt	3-4.5%	nya	1.7

		1.0 mm pellet				
	Apr.- June	1.0/1.3/1.5 2.0 mm pellet	12hr belt, 12 hr clock	2-4%	nya	1.0
195	July-Sept	2.0/2.5/ 3.0 mm pellet	12 hr clock	1-2%	nya	1.0
	Oct-Dec.	3.0 mm pellet	12 hr clock	1-2%	nya	1.7
	Jan-March	3.0 mm pellet	12 hr. clock	1-2%	nya	1.5
	April 1-15	3.0 mm pellet	12 hr. clock	1.2-1.5%	nya	1.5

Comments:

The feed manufacturer conducts feed quality nutritional analysis.
nc
* - Bio-diet grower used throughout rearing cycle

Data source:

PI
PI
Brood year report- 2001, PI

9.2.7 Fish health monitoring, disease treatment, and sanitation procedures.

62 IHOT fish health guidelines are followed to prevent transmission between lots of fish on site or transmission or amplification the watershed.

63 Vaccines are NOT used, whenever possible, to minimize the use of antimicrobial compounds.

71 The juvenile rearing density and loading guidelines used at the facility are based on standardized agency guidelines and st (e.g. trial and error) .

Comments:

Vaccines are not used at Pahsimeroi for summer chinook juvenille production, hence no risk posed of developing antibiotic commonly used drugs.
Yes, guidelines in IHOT, AOP, and the Intra-IDFG Fish Health Polices are all followed.

IHOT guidelines and past hatchery records are used.

Data source:

PI
PI
PI

9.2.8 Smolt development indices (e.g. gill ATPase activity), if applicable.

87 The migratory state of the release population is determined by volitional release , behavior , physical appearance and other

Comments:

Releases based on timing, river conditions, size of fish, and moon phase.

Data source:

PI

9.2.9 Indicate the use of "natural" rearing methods as applied in the program.

68 The program attempts to better mimic the natural rearing environment by reducing rearing density below agency or other gu rearing under natural water temperature , actively simulating photoperiod , providing a range of hydraulic characteristics , p avoidance training and providing natural or artificial cover.

69 Fish produced are qualitatively similar to natural fish in morphology , behavior , growth rate , physiological status and health

66 The program uses a diet and growth regime that mimics natural, seasonal growth patterns.

84 Fish are released at sizes similar to natural fish of the same life stage and species.

88 Fish are released in a manner that simulates natural seasonal migration patterns.

Comments:

nc
nc
Hatchery fish have similar growth rates are natural fish.

Smolts only

Releases occur over several weeks, depending on fish and river conditions.

Data source:

PI
PI
PI
PI
PI

9.2.10 Indicate risk aversion measures that will be applied to minimize the likelihood for advers and ecological effects to listed fish under propagation.

60 dna

72 IHOT standards are followed for: water quality , loading and density.

80 The facility is continuously staffed to assure the security of fish stocks on-site.

84 Fish are released at sizes similar to natural fish of the same life stage and species.

88 Fish are released in a manner that simulates natural seasonal migration patterns.

98

76 Fish inventory data accurately reflect rearing vessel population abundance with 10%.

86 Volitional release is practiced during natural out-migration timing.

96 Fish are released in the same subbasin as the final rearing facility.

Comments:

nc
nc
Staff is housed at hatchery.

Smolts only

Releases occur over several weeks, depending on fish and river conditions.

nc

nc
Volitional releases occur over several weeks depending on environmental factors.

nc
Data source:

PI
PI
PI
PI
PI
PI
PI
PI
PI

Section 10. Release

10.1 Proposed fish release levels.

	Age Class	Maximum Number	Size (ffp)	Release Date	Location: Stream	Location: Release Point (RKm)	Location: Major Watershed	Location: Ecopro
1	**Eggs**	nya	nya	nya	nya	nya	nya	nya
	Unfed Fry	nya	nya	nya	nya	nya	nya	nya
	Fry	nya	nya	nya	nya	nya	nya	nya
	Fingerling	nya	nya	nya	nya	nya	nya	nya
	Yearling	1,000,000	10-14	4/15	Pahsimeroi River	17.5	Salmon River	Mountai Snake

Comments:

nc

Data source:

HGMP, Personal interview (PI) with Todd Garlie and Doug Engem on 3/26/03 at the Pahsimeroi Hatchery. Brood year report:

10.2 Specific location(s) of proposed release(s).

	Age Class	Maximum Number	Size (ffp)	Release Date	Location: Stream	Location: Release Point (RKm)	Location: Major Watershed	Location: Ecopro
1	**Eggs**	nya	nya	nya	nya	nya	nya	nya
	Unfed Fry	nya	nya	nya	nya	nya	nya	nya
	Fry	nya	nya	nya	nya	nya	nya	nya
	Fingerling	nya	nya	nya	nya	nya	nya	nya
	Yearling	1,000,000	10-14	4/15	Pahsimeroi River	17.5	Salmon River	Mountai Snake

96 Fish are released in the same subbasin as the final rearing facility.

Comments:

nc
nc

Data source:

HGMP, Personal interview (PI) with Todd Garlie and Doug Engem on 3/26/03 at the Pahsimeroi Hatchery. Brood year reports
PI

10.3 Actual numbers and sizes of fish released by age class through the program.

>

	Eggs/Unfed Fry Release			Fry Release			Fingerling Release			Yearling	
Release Year	Number	Date (MM/DD)	Avg Size (fpp)	Number	Date (MM/DD)	Avg size (fpp)	Number	Date (MM/DD)	Avg Size (fpp)	Number	D (MM
1991	nya	nya	nya	nya	nya	nya	227,500	3/13-3/22	15.5	nya	nya
1992	nya	nya	nya	nya	nya	nya	605,900	3/13-3/20	15.25	nya	nya
1993	nya	nya	nya	nya	nya	nya	375,000	4/14-4/19	13.7	nya	nya
1994	nya	nya	nya	nya	nya	nya	130,510	4/8-4/12	13.3	nya	nya
196 1995	nya	nya	nya	nya	nya	nya	147,429	4/11-4/14	12.25	nya	nya
1996	nya	nya	nya	nya	nya	nya	0	NA	NA	nya	nya
1997	nya	nya	nya	nya	nya	nya	122,017	4/8-4/21	7.2	nya	nya
1998	nya	nya	nya	nya	nya	nya	65,648	4/15-5/4	11.1	nya	nya
1999	nya	nya	nya	nya	nya	nya	135,669	4/14-4/19	9.92	nya	nya
2000	nya	nya	nya	nya	nya	nya	53,837	4/12-4/17	10.94	nya	nya
2001	nya	nya	nya	nya	nya	nya	283,063	4/15-4/21	8.05	nya	nya
2002	nya	nya	nya	nya	nya	nya	508,340	4/15-4/22	10.84	nya	nya
Avg	nya	nya	nya	nya	nya	nya	241,265	nya	11.6	nya	nya

Comments:

nc

Data source:

Pi, Brood Year Reports

10.4 Actual dates of release and description of release protocols.

84 Fish are released at sizes similar to natural fish of the same life stage and species.
85 Fish are released at a time, size, location, and in a manner that achieves harvest goals for the stock.
86 Volitional release during natural out-migration timing is practiced.
88 Fish are released in a manner that simulates natural seasonal migration patterns.
89 Fish are released at an optimum time and size that has been determined by an on-site survival study.
90
91 Fish are released at a time and size specified in an established juvenile production goal.
92 The carrying capacity of the subbasin has been taken into consideration in sizing this program.
87 The migratory state of the release population is determined by volitional release , behavior , physical appearance and other

Comments:

Volitional releases occur over several weeks depending on environmental factors.

nc
Smolts only

Releases occur over several weeks, depending on fish and river conditions.

Fall releases were also tried, but IDFG research studies showed returns decreased with these releases.

nc
nc
Releases based on flow conditions.

Releases based on timing, river conditions, size of fish, and moon phase.

Data source:

PI
PI
PI
PI
PI
PI
PI
PI
PI

10.5 Fish transportation procedures, if applicable.

96 Fish are released in the same subbasin as the final rearing facility.

Equipment Type	Capacity (gallons)	Supplemental Oxygen (y/n)	Temperature Control (y/n)	Normal Transit Time (minutes)	Chemical (s) Used	Do (I
Tank	500	Y	Y	30-60	None	nya
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya

187

Comments:

nc
nc

Data source:

PI
PI

10.6 Acclimation procedures (*methods applied and length of time*).

166 No fish acclimation proceedures are used, fish are directly releases into the river, have tried acclimation but found not differ survival.

Comments:

nc

Data source:

PI

10.7 Marks applied, and proportions of the total hatchery population marked, to identify hatcl adults.

100 Marking techniques are used to distinguish among hatchery population segments.

101 100% of the hatchery fish released are marked so that they can be distinguished from the natural population.

102 Marked fish can be identified using non-lethal means.

Comments:

Chinook are marked differently for two populations, with the ISS fish receiving a different mark.

nc
nc

Data source:

PI
PI
PI

10.8 Disposition plans for fish identified at the time of release as surplus to programmed or a levels

167 No surplus fish

163 Surplus eggs are collected mainly as a safeguard against potential incubation loses.

Comments:

nc
nc

Data source:

PI
PI

10.9 Fish health certification procedures applied pre-release.

97 All fish are examined for the presence of “reportable pathogens” as defined in the PNFHPC disease control guidelines, with prior to release.

98 dna

Comments:

nc
nc

Data source:

PI
PI

10.10 Emergency release procedures in response to flooding or water system failure.

168 Release all fish.

Comments:

nc

Data source:

PI

10.11 Indicate risk aversion measures that will be applied to minimize the likelihood for advers and ecological effects to listed fish resulting from fish releases.

84 Fish are released at sizes similar to natural fish of the same life stage and species.

86 Volitional release during natural out-migration timing is practiced.

88 Fish are released in a manner that simulates natural seasonal migration patterns.

89 Fish are released at an optimum time and size that has been determined by an on-site survival study.

91 Fish are released at a time and size specified in an established juvenile production goal.

104 The percent of the naturally spawning population in the subbasin that consists of adults from the program is >30% (greater percent).

105 The percent of hatchery fish spawning in the wild is estimated by:

- Annual stream surveys (e.g. carcasses)
- Escapement data from a weir or dam

95

94 Fish are released within the historic range for that stock.

93 The carrying capacity of the subbasin was taken into account when determining the number of fish to be released.

Comments:

Smolts only

Volitional releases occur over several weeks depending on environmental factors.

Releases occur over several weeks, depending on fish and river conditions.

Fall releases were also tried, but IDFG research studies showed returns decreased with these releases.

nc
nc
nc
nc
Fish are only released as smolts in the spring. Early studies indicated that chinook juvenilles released in the fall had a lowe than those released in the spring.

nc
Based on information developed by IDFG Fish Policy Bureau and Research Staff information.

Data source:

PI
PI
PI
PI
nds
PI

PI
PI
PI
PI
PI, PI with Tom Rodgers (IDFG), 4/11/2003

Section 11. Monitoring and Evaluation of Performance Indicators

11.1.1 Describe plans and methods proposed to collect data necessary to respond to each "Perf Indicator" identified for the program.

144 nya

Comments:

nc

Data source:

HGMP

11.1.2 Indicate whether funding, staffing, and other support logistics are available or committe implementation of the monitoring and evaluation program.

146 The hatchery is funded by Idaho Power for fish tagging.

Comments:

nc

Data source:

PI with Tom Rodgers (IDFG), 4/11/03

11.2 Indicate risk aversion measures that will be applied to minimize the likelihood for advers and ecological effects to listed fish resulting from monitoring and evaluation activities.

Risk aversion measures for research activities associated with the evaluation of the Lower Snake River Compensation Prog specified in ESA Section 7 Consultation documents, ESA Section 10 Incidental Take Permits (IDFG permit Nos. 919, 920, summary of the nature of actions taken is provided below.

Adult handling activities are conducted to minimize impacts to ESA-listed, non-target species. Adult and juvenile weirs and are engineered properly and installed in locations that minimize adverse impacts to both target and non-target species. All t facilities are constantly monitored to minimize a variety of risks (e.g., high water periods, high emigration or escapement pe security).

147 Adult spawner and redd surveys are conducted to minimize potential risks to all life stages of ESA-listed species. The IDFG formal redd count training annually. During surveys, care is taken to not disturb ESA-listed species and to not walk in the vi completed redds.

Snorkel surveys conducted primarily to assess juvenile abundance and density are conducted in index sections only to min disturbance to ESA-listed species. Displacement of fish is kept to a minimum.

Marking and tagging activities are designed to protect ESA-listed species and allow mitigation harvest objectives to be purs hatchery-produced, mitigation steelhead are visibly marked to differentiate them from their wild/natural counterpart.

Comments:

nc

Data source:

HGMP

Section 12. Research

12.1 Objective or purpose.

An extensive monitoring and evaluation program is conducted in the basin to document hatchery practices and evaluate the the hatchery program at meeting program mitigation objectives, IDFG managment objectives, and to monitor and evaluate t supplementation programs. The hatchery monitoring and evaluation program identifies hatchery rearing and release strateg allow the program to meet its mitigation requirements and improve the survival of hatchery fish while avoiding negative impa (including listed) populations.

169 To accomplish this effort, adult returns to facilities, spawning areas, and fisheries that result originate from hatchery release This IDFG evaluation program includes a harvest monitoring project and the coded-wire tag laboratory program. The hatche study evaluates and provides oversight of certain hatchery operational practices (e.g., broodstock selection, size and numb reared, disease history, and time of release).

Continuous coordination between this study and IDFG's BPA-funded supplementation research is required because thse pr overlap in several areas for different species, including juvenile outplanting, broodstock collection, and spawning strategies

Comments:

nc

Data source:

HGMP

12.2 Cooperating and funding agencies.

170 BPA, IDFG- Nampa Fish research

Comments:

nc

Data source:

PI

12.3 Principle investigator or project supervisor and staff.

171 Jeff Lutch, Brian Letch, Paul Klein, IDFG

Comments:

nc

Data source:

PI

12.4 Status of stock, particularly the group affected by project, if different than the stock(s) c in Section 2.

172 Summer chinook salmon

Comments:

nc

Data source:

PI

12.5 Techniques: include capture methods, drugs, samples collected, tags applied.

173 Screw traps, snorkling transects

Comments:

nc

Data source:

PI

12.6 Dates or time periods in which research activity occurs.

174 March 1 to December 1

Comments:

nc

Data source:

PI

12.7 Care and maintenance of live fish or eggs, holding duration, transport methods.

Research activities involving handling of eggs or fish apply the same protocols reviewed in Section 9 of the HGMP's, with h generally assisting with handling of fish and eggs.

175

At spawning, ELISA optical density values for female spawners are used to establish criteria for egg culling and isolation in needs. Fish may receive prophylactic antibiotic treatments to control the spread of infectious disease agents. Fish are main conservative density and flow indices (< 0.3 and < 1.5, respectively). Fish are fed by hand and observed several times daily disinfection protocols are in place. Rearing vats and raceways are swept on a regular basis.

Comments:

nc

Data source:

HGMP

12.8 Expected type and effects of take and potential for injury or mortality.

176 Generally, take for research activities is defined as: observe/harass, capture/handle/release and capture, handle, mark, tiss release.

Comments:

nc

Data source:

HGMP

12.9 Level of take of listed fish: number of range or fish handled, injured, or killed by sex, age, not already indicated in Section 2 and the attached "take table" (Table 1).

Steelhead B (East Fork) - Integrated

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

182

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (Johnson Creek)

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

182

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya

Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (McCall Hatchery)

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

182

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook (Rapid River) - Hatchery

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya

182	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (Pahsimeroi)

181	**ESU/Population**	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
182	**Observe or harrass (a)**	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook (Upper Salmon/Sawtooth)

181	**ESU/Population**	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

182

Spring Chinook - Natural

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

182

Summer Chinook - Natural

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya

Dates of activity nya

Hatchery Program Operator nya

182 Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Annual Take of Listed Fish by life Stage (number of fish)			
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Run (Pahsimeroi)- Hatchery

ESU/Population nya

Activity nya

181 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program Operator nya

182 Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Annual Take of Listed Fish by life Stage (number of fish)			
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead B (Dworshak)-Hatchery

181		
	ESU/Population	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

182					
		Annual Take of Listed Fish by life Stage (number of fish)			
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Steelhead B-Natural

181		
	ESU/Population	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

182					
		Annual Take of Listed Fish by life Stage (number of fish)			
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya

Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Natural

181	**ESU/Population**	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
182	**Observe or harrass (a)**	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Redfish Lake Sockeye

181	**ESU/Population**	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
182	**Intentional lethal take (f)**	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring/Summer Chinook (W. Fork Yankee Fork- Salmon River)- Integrated

	ESU/Population	nya
	Activity	nya
181	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring/Summer Chinook (East Fork Salmon River)- Integrated

	ESU/Population	nya
	Activity	nya
181	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass

182	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Lemhi River Spring_Summer Chinook

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
182	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Run (Sawtooth)- Hatchery

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya

Dates of activity nya

Hatchery Program Operator nya

182

Type of Take	Annual Take of Listed Fish by life Stage (number of fish) Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Comments:

nc
nc
nc

Data source:

nds
nds
nds

12.10 Alternative methods to achieve project objects.

177 nya

Comments:

nc

Data source:

HGMP

12.11 List species similar or related to the threatened species; provide number and causes of r related to this research project.

178 dna

Comments:

nc

Data source:

HGMP

12.12 Indicate risk aversion measures that will be applied to minimize the likelihood for advers ecological effects, injury or mortality to listed fish as a result of the proposed research a

179 nya

Comments:

nc

Data source:

HGMP

Section 13. Attachments and Citations

13.1 Attachments and Citations

197 nya

Comments:

nc

Data source:

nds

Section 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

14.1 Certification Language and Signature of Responsible Party

"I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by______________________________ Date:_____________

Appendix 2-12—Draft Steelhead A-Run (Pahsimeroi)–Hatchery in the Salmon Subbasin

Hatchery and Genetic Management Plan

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

DRAFT

1

Hatchery Program	Pahsimeroi
Species or Hatchery Stock	Steelhead A-run
Agency/Operator	IDFG
Watershed and Region	Salmon River
Date Submitted	3/31/03
Date Last Updated	nya

Section 1: General Program Description

1.1 Name of hatchery or program.

1 Pahsimeroi

1.2 Species and population (or stock) under propagation, and ESA status.

1 Steelhead A-run

9 ESA Status: Not listed and not a candidate for listing

1.3 Responsible organization and individuals.

3

Name (and title): Todd Garlie
Pahsimeroi Hatchery Manager

Agency or Tribe: IDFG

Address: 22 Hatchery Loop, Ellis, ID 83707

Telephone: 208-876-4475

Fax: 208-876-4279

Email: tgarlie@idfg.state.id.us

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and exten involvement in the program.

	Co-operators	Role
4	Idaho Power	Funds Oxbow, Pahsimeroi, and Niagara Springs hatcl
	nya	nya
	nya	nya
	USFWS- LSRCP	Funds Magic Valley, Hagerman, and Sawtooth hatche

1.4 Funding source, staffing level, and annual hatchery program operational costs.

Funding Sources

Idaho Power - Oxbow, Pahsimeroi, and Niagara Springs

USFWS (LSRCP) - Hagerman, Magic Valley and Sawtooth

5 nya

nya

nya

nya

nya

	Operational Information	Number
6	Full time equivalent staff	2
	Annual operating cost (dollars)	205,000

Comments:

Sawtooth Fish Hatchery:

Staffing level: 5 FTE.

Annual budget: $850,000.

Magic Valley Fish Hatchery:

Staffing level: 4 FTE.

Annual budget: $750,000.

Hagerman National Fish Hatchery:

Staffing level: 9 FTE.

Annual budget: $783,716.

Niagara Springs Fish Hatchery:

Staffing level: 6 FTE.

Annual budget: $780,000.

Reviewer Comments:

nc
nc

Data source:

PI
HGMP, PI

1.5 Location(s) of hatchery and associated facilities.

	Broodstock source	Snake River A-run Summer Steelhead
	Broodstock collection location (stream, RKm, subbasin)	Pahsimeroi River, 2.5RKm, Salmon
	Adult holding location (stream, RKm, subbasin)	Pahsimeroi River, 2.5RKm, Salmon
2	**Spawning location (stream, RKm, subbasin)**	Pahsimeroi River, 2.5RKm, Salmon
	Incubation location (facility name, stream, RKm, subbasin)	Pahsimeroi, Oxbow and Sawtooth Hatcheries, NA, Snake/Salmon rivers
	Rearing location (facility name, stream, RKm, subbasin)	Niagara Springs (Niagara Springs Creek, NA, Snake River), Magic Valley (Crystal S NA, Snake River), Hagerman NFH (springs, NA, Snake River)

Comments:

The Sawtooth Fish Hatchery functions as the broodstock collection and spawning station. Eggs produced at the Sawtooth Fis incubated through the eyed stage of development on station. Eyed-eggs are then transferred to the Magic Valley Fish Hatche Hagerman National Fish Hatchery for final incubation, hatch, and rearing to release. Eggs from the Pahsimeroi hatchery may fill this program if annual shortages exist. Incubation of steelhead eggs at the Pahsimeroi Hatchery is only up to the eyed stag

Eggs are also taken at Pahsimeroi Hatchery, incubated until eyed at Sawtooth Hatchery and shipped to Niagara Springs Hatc incubation and rearing through release.

Data source:

PI HGMPs

1.6 Type of program.

8 Integrated

Comments:

Lower Snake River Compensation Plan - The upper Salmon River A-run steelhead program was designed as an Isolated H Program but is now classified as a Integrated Harvest Program. Some broodstock management, eyed-egg production, and production occurs to support ongoing Shoshone-Bannock Tribes streamside and in stream incubation programs and smolt programs for natural production augmentation pursuant to U.S. v. Oregon agreements. The Sawtooth Fish Hatchery, Magic Hatchery, Hagerman National Fish Hatchery, Niagara Springs, and Pahsimeroi are associated with the Salmon River A-run program.

Data source:

PI, HGMP

1.7 Purpose (Goal) of program.

9 The purpose of this hatchery program is to provide harvest and to contribute to conservation/recovery .

10 the purpose of the program is mitigation for hydro impacts and and/or habitat loss.

Comments:

Mitigation - The goal of the Lower Snake River Compensation Plan is to return approximately 25,000 adult steelhead to the above Lower Granite Dam to mitigate for survival reductions resulting from construction and operation of the four lower Sna dams.

The second goal of this program is to mitigate losses of anadromous fish due to the construction of the Hells'Canyon Comp Oxbow, and Hell's Canyon dams). This program provides harvestable returns of summer steelhead, with the goal of trappin summer steelhead to produce 1.5 million eggs, incubate to the eyed stage (Pahsimeroi, Oxbow,or Sawtooth hatcheries) an eyed eggs to Niagara Springs Hatchery for rearing to smolts.

nc

Data source:

PI, HGMP
PI, HGMP

1.8 Justification for the program.

- Hatchery fish accessible to fisheries because the fish produced are temporally and/or spatially separated from weal
- 138 Hatchery fish accessible to fisheries because the fish produced are differentially marked to enable selective harves
- Hatchery fish accessible to fisheries because the fish produced are available in sufficient number to the fisheries (lc gear) that are intended to benefit from the program (i.e. to meet the harvest goals).

Comments:

nc
nc
nc
nc
nc

Data source:

PI, HGMP
PI
nds
nds
nds

1.9 List of program "Performance Standards".

11 The program adheres to the following fish culture guideline(s) and standard(s):
IHOT
PNFHPC
state
tribal
federal

Comments:

nc

Data source:

PI

1.10 List of program "Performance Indicators", designated by "benefits" and "risks".

139

Indicators of Harvest Benefits

Indicator	Performance Standard	Indicator is Monitore
Spawner to spawner survival of hatchery fish	3.3.1	Y
Contribution of hatchery fish to target fisheries	3.1.2, 3.2.1	Y
Angler success (hatchery fish per angler day) in target recreational fisheries	3.1.2, 3.2.1	Y
Contribution of hatchery fish to cultural needs	3.1.1	Y
Selective harvest success (expected benefits of mass marking)	3.1.2, 3.3.2	Y

141

Indicators of Conservation Benefits

Indicator	Performance Standard	Indicator is Monitore
Genetic and life history diversity (over time)	3.4.1, 3.4.3, 3.5.1, 3.5.2,	3.4.1, 3.4.3, 3.5.1, 3.5.2,
Spawner to spawner reproductive success of hatchery fish	3.3.1, 3.4.3	Y
Reproductive success of the receiving (supplemented) naturally spawning population	3.3.1, 3.3.2, 3.4.3, 3.4.4, 3.5.3	Y
Contribution to the abundance of the naturally spawning population	3.4.2, 3.4.4, 3.5.3, 3.5.6,	Y
Time and location of spawning	3.7.6	Y
Contribution to ecosystem function (e.g. through nutrient enhancement, food web effects, etc.)	3.7.5	Y

140

Indicators of Harvest Risks

Indicator	Performance Standard	Indicator is Monitore
Harvest impacts on co-mingled stocks	3.1.2, 3.1.3	Y
Bias in run size estimation of natural stocks due to masking effect	3.3.1, 3.3.2	Y
Lack of harvest access (under harvest due e.g. to co-mingling with weaker stocks)	3.2.1, 3.2.2	Y

Indicators of Conservation Risks

Indicator	Performance Standard	Indicator is Monitore
Unintended contribution of hatchery fish to natural spawning (through straying)	3.4.2	Y
Loss of genetic and life history diversity	3.4.3, 3.5.1	Y
Loss of reproductive success	3.4.2, 3.5.1, 3.5.2	Y

	Ecological interactions through competition with natural stocks (by life stage)	3.4.2, 3.4.3, 3.4.4, 3.5.3, 3.5.6	Y
142	**Ecological interactions through predation on natural stocks (by life stage)**	3.4.4, 3.5.3, 3.7.8	Y
	Adverse effects of hatchery operations and facilities on fish migration Disease transfers	3.7.6, 3.7.7	Y

144

The program contributes to information gain in the following way(s): Hatchery program contributes to research to improve pe
cost effectiveness
143 New information affects change to the hatchery program through a structured adaptive decision making process
Hatchery program participates in basin wide-coordinated research efforts
Hatchery program actively contributes to public education

Comments:

Standards and indicators (S&I) are based on legal mandates for Artificial Propagation S&I for anadromous and resident fish
the Pacific Northwest, developed as an outgrowth of discussions of the by the regional Production Review Committee of the
Power Planning Council, 1/17/2001.

Note: Performance Standards and Indicators used to develop Sections 1.10.1 and 1.10.2 were taken from the final January 1
version of Performance Standards and Indicators for the Use of Artificial Production for Anadromous and Resident Fish Popu
Pacific Northwest. Numbers referenced below correspond to numbers used in the above document.

3.1.1 Standard: Program contributes to fulfilling tribal trust responsibility mandates and treaty rights, as described in applicab
such as under U.S. v. Oregon and U.S. v. Washington.

Indicator 1: Total number of fish harvested in tribal fisheries targeting program.

3.1.2 Standard: Program contributes to mitigation requirements.

Indicator 1: Number of fish returning to mitigation requirements estimated.

3.1.3 Standard: Program addresses ESA responsibilities.

Indicator 1: ESA Section 7 Consultation completed.

3.2.1 Standard: Fish are produced and released in a manner enabling effective harvest, as described in all applicable fisherie
management plans, while avoiding over harvest of not-target species.

Indicator 1: Number of target fish caught by fishery estimated.

Indicator 2: Number of non-target fish caught in fishery estimated.

Indicator 3: Angler days by fishery estimated.

Indicator 4: Escapement of target fish estimated.

3.2.2 Standard: Release groups sufficiently marked in a manner consistent with information needs and protocols to enable de impacts to natural- and hatchery-origin fish in fisheries.

Indicator 1: Marking rate by type in each release group documented.

Indicator 2: Sampling rate by mark type for each fishery estimated.

Indicator 3: Number of marks by type observed in fishery documented.

3.3.1 Standard: Artificial propagation program contributes to an increasing number of spawners returning to natural spawning

Indicator 1: Annual number of spawners on spawning grounds estimated in specific locations.

Indicator 2: Spawner-recruit ratios estimated is specific locations.

Indicator 3: Number of redds in natural production index areas documented in specific locations.

3.3.2 Standard: Releases are sufficiently marked to allow statistically significant evaluation of program contribution.

Indicator 1: Marking rates and type of mark documented.

Indicator 2: Number of marks identified in juvenile and adult groups documented.

1.10.2) ?Performance Indicators? addressing risks.

3.4.1 Standard: Fish collected for broodstock are taken throughout the return in proportions approximating the timing and age the population.

Indicator 1: Temporal distribution of broodstock collection managed.

Indicator 2: Age composition of broodstock collection managed.

3.4.2 Standard: Broodstock collection does not significantly reduce potential juvenile production in natural areas.

Indicator 1: Number of spawners of natural origin removed for broodstock managed.

Indicator 2: Number and origin of spawners migrating to natural spawning areas managed.

Indicator 3: Number of eggs or juveniles placed in natural rearing areas managed.

3.4.3 Standard: Life history characteristics of the natural population do not change as a result of this program.

Indicator 1: Life history characteristics of natural and hatchery-produced populations are measured (e.g., juvenile dispersal ti size at outmigration, juvenile sex ratio at outmigration, adult return timing, adult age and sex ratio, spawn timing, hatch and s rearing densities, growth, diet, physical characteristics, fecundity, egg size).

3.4.4 Standard: Annual release numbers do not exceed estimated basin-wide and local habitat capacity.

Indicator 1: Annual release numbers, life-stage, size at release, length of acclimation documented.

Indicator 2: Location of releases documented.

Indicator 3: Timing of hatchery releases documented.

3.5.1 Standard: Patterns of genetic variation within and among natural populations do not change significantly as a result of a production.

Indicator 1: Genetic profiles of naturally-produced and hatchery-produced adults developed.

3.5.2 Standard: Collection of broodstock does not adversely impact the genetic diversity of the naturally spawning population

Indicator 1: Total number of natural spawners reaching collection facilities documented.

Indicator 2: Total number of natural spawners estimated passing collection facilities documented.

Indicator 3: Timing of collection compared to overall run timing.

3.5.3 Standard: Artificially produced adults in natural production areas do not exceed appropriate proportion.

Indicator 1: Ratio of natural to hatchery-produced adults monitored (observed and estimated through fishery).

Indicator 2: Observed and estimated total numbers of natural and hatchery-produced adults passing counting stations.

3.5.4 Standard: Juveniles are released off-station, or after sufficient acclimation to maximize homing ability to intended return

Indicator 1: Location of juvenile releases documented.

Indicator 2: Length of acclimation period documented.

Indicator 3: Release type (e.g., volitional or forced) documented.

Indicator 4: Adult straying documented.

3.5.5 Standard: Juveniles are released at fully smolted stage of development.

Indicator 1: Level of smoltification at release documented.

Indicator 1: Release type (e.g., forced or volitional) documented.

3.5.6 Standard: The number of adults returning to the hatchery that exceeds broodstock needs is declining.

Indicator 1: The number of adults in excess of broodstock needs documented in relation to mitigation goals of the program.

3.6.1 Standard: The artificial production program uses standard scientific procedures to evaluate various aspects of artificial p

Indicator 1: Scientifically based experimental design with measurable objectives and hypotheses.

3.6.2. Standard: The artificial production program is monitored and evaluated on an appropriate schedule and scale to addre toward achieving the experimental objectives.

Indicator 1: Monitoring and evaluation framework including detailed time line.

Indicator 2: Annual and final reports.

3.7.1 Standard: Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility c standards and protocols.

Indicator 1: Annual reports indicating level of compliance with applicable standards and criteria.

3.7.2 Standard: Effluent from artificial production facility will not detrimentally affect natural populations.

Indicator 1: Discharge water quality compared to applicable water quality standards.

3.7.3 Standard: Water withdrawals and in stream water diversion structures for artificial production facility operation will not p to natural spawning areas, affect spawning, or impact juveniles.

Indicator 1: Water withdrawals documented ? no impacts to listed species.

Indicator 2: NMFS screening criteria adhered to.

3.7.4 Standard: Releases do not introduce pathogens not already existing in the local populations and do not significantly inc levels of existing pathogens.

Indicator 1: Certification of juvenile fish health documented prior to release.

3.7.5 Standard: Any distribution of carcasses or other products for nutrient enhancement is accomplished in compliance with disease control regulations and guidelines.

Indicator 1: Number and location(s) of carcasses distributed to habitat documented.

3.7.6 Standard: Adult broodstock collection operation does not significantly alter spatial and temporal distribution of natural p

Indicator 1: Spatial and temporal spawning distribution of natural population above and below trapping facilities monitored.

3.7.7 Standard: Weir/trap operations do not result in significant stress, injury, or mortality in natural populations.

Indicator 1: Mortality rates in trap documented. No ESA-listed fish targeted.

Indicator 2: Prespawning mortality rates of trapped fish in hatchery or after release documented. No ESA-listed fish targeted.

3.7.8 Standard: Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of nat

Indicator 1: Size and time of release of juvenile fish documented and compared to size and timing of natural fish.

Standards and indicators (S&I) are based on legal mandates for Artificial Propagation S&I for anadromous and resident fish p
the Pacific Northwest, developed as an outgrowth of discussions of the by the regional Production Review Committee of the
Power Planning Council, 1/17/2001.

Standards and indicators (S&I) are based on legal mandates for Artificial Propagation S&I for anadromous and resident fish p
the Pacific Northwest, developed as an outgrowth of discussions of the by the regional Production Review Committee of the
Power Planning Council, 1/17/2001.

Standards and indicators (S&I) are based on legal mandates for Artificial Propagation S&I for anadromous and resident fish p
the Pacific Northwest, developed as an outgrowth of discussions of the by the regional Production Review Committee of the
Power Planning Council, 1/17/2001.

e. Funding for monitoring and evaluation is a separate budget.

nc

Data source:

Standards and indicators (S&I) are based on legal mandates for Artificial Propagation S&I for anadromous and resident fish p
the Pacific Northwest, HGMP
Standards and indicators (S&I) are based on legal mandates for Artificial Propagation S&I for anadromous and resident fish p
the Pacific Northwest, HGMP
Standards and indicators (S&I) are based on legal mandates for Artificial Propagation S&I for anadromous and resident fish p
the Pacific Northwest, HGMP
Standards and indicators (S&I) are based on legal mandates for Artificial Propagation S&I for anadromous and resident fish p
the Pacific Northwest, HGMP
PI
HGMP

1.11.1 Proposed annual broodstock collection level (maximum number of adult fish).

198 nya

Data source:

nds

1.11.2 Proposed annual fish release levels (maximum number) by life stage and location.

	Age Class	Maximum Number	Size (ffp)	Release Date	Location: Stream	Release Point (RKm)	Major Watershed	Ecopr
1	Eggs	300,000	nya	nya	Salmon River tributaries	nya	Salmon River	Mounta Snake
	Unfed Fry	nya	nya	nya	nya	nya	nya	nya
	Fry	nya	nya	nya	nya	nya	nya	nya
	Fingerling	nya	nya	nya	nya	nya	nya	nya
	Yearling	3,465,000	4.4	3/20-5/12	Salmon River	nya	Salmon River	Mounta

tributaries Snake

Comments:

Pahsimeroi and Sawtooth A-run sthd managed as one stock. Data reflects total releases of Salmon River A-run summer ste
Niagara Springs, Magic Valley and Hagerman hatcheries within the Salmon River basin.

Life Stage Facility Release Location Annual Release Level and purpose

Yearling Magic Valley Lemhi River 40,000 production

Yearling Magic Valley Salmon River, Lewis & Clark 50,000 production

Yearling Magic Valley Salmon River, Wagonhammer 40,000 production

Yearling Magic Valley Salmon River, Red Rock 40,000 production

Yearling Magic Valley Salmon River, Shoup Bridge 60,000 production

Yearling Magic Valley Salmon River, Eye Hole 50,000 production

Yearling Magic Valley Salmon River, Colston Corner 60,000 production

Yearling Magic Valley Salmon River, Lemhi Hole 80,000 production

Yearling Magic Valley Salmon River, Tunnel Rock 40,000 production

Yearling Magic Valley Salmon River, McNabb Pt. 80,000 production

Yearling Magic Valley Pahsimeroi Trap 30,000 production

Yearling Magic Valley Salmon River, Cottonwood 40,000 production

Yearling Magic Valley Salmon River, Hwy 93 40,000 production

Yearling Magic Valley Salmon River, Hammer Crk. 180,000 production

Yearling Magic Valley Lemhi River 80,000 U.S. v. Or.

Yearling Magic Valley Yankee Fork Salmon Riv. 30,000 U.S. v. Or.

Yearling Magic Valley Valley Creek 30,000 U.S. v. Or.

Yearling Magic Valley Yankee Fork Salmon Riv. 160,000 U.S. v. Or.

yearling Hagerman Nat. Sawtooth Hatchery weir 750,000 production

Yearling Hagerman Nat. Yankee Fork Salmon River 140,000 U.S. v. Or.

Yearling Hagerman Nat. Little Salmon River, Stinky Sp. 160,000 U.S. v. Or.

Yearling Hagerman Nat. Little Salmon River, Hazard Cr. 40,000 U.S. v. Or.

yearling Niagara Springs Little Whits Salmon River 415,000

yearling Niagara Springs Pahsimeroi River 830,000

Eyed-eggs Sawtooth Salmon River Tributaries 370,000 SBT

Eyed-eggs Pahsimeroi Salmon River Tributaries 625,000 SBT

Data source:

PI HGMPs

1.12 Current program performance, including estimated smolt-to-adult survival rates, adult pı levels, and escapement levels. Indicate the source of these data.

Total Catch	Natural Escapement	Hatchery Spawning

Return Year	(all ages)	NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

33

Comments:

nc

Data source:

LSRCP hatchery evaluation reports, LSCRP HGMP, annual broodyear reports, annual run reports

Status and Goals of Stocks and Habitats

	NoRs		HoRs		Combined (HoRs + NoRs)	
Brood Year	Smolt to Adult Survival(%)	Recruits per Spawner	Smolt to Adult Survival(%)	Recruits per Spawner	Smolt to Adult Survival(%)	Recruits per Spawner
Goal	nya	nya	nya	nya	nya	nya
1988	nya	nya	nya	nya	nya	nya
1989	nya	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya	nya

34

Comments:

Sho-Ban will intitiate eggbox program, CWT and PIT tag studies for SAR

Data source:

LSRCP hatchery evaluation reports, LSCRP HGMP, annual broodyear reports, annual run reports; Paul Kline for SAR info

1.13 Date program started (years in operation), or is expected to start.

7 The first year of operation for this hatchery was 1967 .

Comments:

data above is for Pahsimeroi

MVH: 1988

Sawtooth: 1988

HNFH: 1980

Niagara: 1966

Data source:

PI, HGMP

1.14 Expected duration of program.

148 The final year of the program is undetermined.

149 The program is on-going with no planned termination.

Comments:

nc
nc

Data source:

PI
PI

1.15 Watersheds targeted by program.

1 Salmon River

1.16 Indicate alternative actions considered for attaining program goals, and reasons why thos are not being proposed.

The hatchery program is a part of a strategy to meet conservation and/or harvest goals for the target stock. The tables below the short- and long-term goals are for the stock in terms of stock status (biological significance and viability), habitat and harv in the table indicate High, Medium, or Low levels for the respective attributes. Changes in these levels from current status inc outcomes for the hatchery program and other strategies (including habitat protection and restoration).

18

	Biological Significance	Viability	Habitat
Current Status	M	H	M
Short-term Goal	M	H	M
Long-term Goal	M	H	M

This table shows current status and goals for harvest opportunity. **H** implies harvest opportunity every year, **M** opportunity mo some years, and **N** no opportunity.

Fishery type		Marine	L. Columbia	Zone 6	U. Columbia	Subba
		Location of Fishery				
Commercial	Current Status	nya	nya	H	nya	N
	Short-term Goal	nya	nya	H	nya	N
	Long-term Goal	nya	nya	H	nya	N
Ceremonial	Current Status	dna	dna	dna	dna	dna
	Short-term Goal	dna	dna	dna	dna	dna
	Long-term Goal	dna	dna	dna	dna	dna
Subsistence	Current Status	nya	nya	H	nya	H
	Short-term Goal	nya	nya	H	nya	H
	Long-term Goal	nya	nya	H	nya	H
Recreational	Current Status	N	H	H	H	H
	Short-term Goal	nya	nya	nya	nya	H
	Long-term Goal	nya	nya	nya	nya	H
Catch and Release	Current Status	dna	dna	dna	dna	dna
	Short-term Goal	dna	dna	dna	dna	dna
	Long-term Goal	dna	dna	dna	dna	dna

19
20
21
22
23

Comments:

high viability in hatchery but low in natural environment.

Habitat limited by migratory corridor.

Spawning/rearing habitat condition probably good for integrated component (check?).

tribes only

nc
nc
check for marine, Lower Columbia., Zone 6 and Upper Columbia

nc

Data source:

nds
nds
nds
nds
nds
nds

Section 2: Program Effects on ESA-Listed Salmonid Populations

2.1 List all ESA permits or authorizations in hand for the hatchery program.

The program has the following permits or authorizations: Section 7 or Section 10 permit
150 401 certification
.

Comments:

nc

Data source:

PI

2.2.1 Descriptions, status and projected take actions and levels for ESA-listed natural populatic target area.

145 Snake River steelhead and summer/spring chinook salmon, bull trout, and sockeye salmon.

15 nya

32 Listed stocks may be directly affected by nya.

The following ESA listed natural salmonid populations occur in the subbasin where the program fish are released:

ESA listed stock	Viability	Habitat
Summer Chinook (Johnson Creek)	L	L
Summer Chinook (McCall Hatchery)	H	L
Summer Chinook (Pahsimeroi)	L	L
Spring Chinook (Upper Salmon/Sawtooth)	U	L
Spring Chinook - Natural	H	L
Summer Chinook - Natural	H	L
Steelhead B-Natural	L	L
Redfish Lake Sockeye	L	L
Spring/Summer Chinook (W. Fork Yankee Fork- Salmon River)-Integrated	L	L
Spring/Summer Chinook (East Fork Salmon River)- Integrated	L	L
Lemhi River Spring_Summer Chinook	L	L

H, M and L refer to high, medium and low ratings, low implying critical and high healthy.

Comments:

nc
nc
nc
high viability in hatchery but low in natural environment.

Habitat limited by migratory corridor.

Spawning/rearing habitat condition probably good for integrated component (check?).

Data source:

PI
nds
nds
nc

2.2.2 Status of ESA-listed salmonid population(s) affected by the program.

nya

Most recent available spawning escapement estimates are shown in the table below:

Summer Chinook (Johnson Creek)

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Summer Chinook (McCall Hatchery)

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Summer Chinook (Pahsimeroi)

Total	Natural Escapement	Hatchery Spawning

Return Year	Catch (all ages)	NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Spring Chinook (Upper Salmon/Sawtooth)

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	18	19
1996	nya	nya	nya	105	51
1997	nya	nya	nya	155	99
1998	nya	nya	nya	127	26
1999	nya	nya	nya	121	75
2000	nya	nya	nya	535	451
2001	nya	nya	nya	676	1,427

Spring Chinook - Natural

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya

1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Summer Chinook - Natural

Return Year	**Total Catch (all ages)**	**Natural Escapement**		**Hatchery Spawning**	
		NoRs	**HoRs**	**NoRs**	**HoRs**
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Steelhead B-Natural

Return Year	**Total Catch (all ages)**	**Natural Escapement**		**Hatchery Spawning**	
		NoRs	**HoRs**	**NoRs**	**HoRs**
Goal	unk	unk	unk	unk	unk
1990	unk	unk	unk	unk	unk
1991	unk	unk	unk	unk	unk
1992	unk	unk	unk	unk	unk

1993	unk	unk	unk	unk	unk
1994	unk	unk	unk	unk	unk
1995	unk	unk	unk	unk	unk
1996	unk	unk	unk	unk	unk
1997	unk	unk	unk	unk	unk
1998	unk	unk	unk	unk	unk
1999	unk	unk	unk	unk	unk
2000	unk	unk	unk	unk	unk
2001	unk	unk	unk	unk	unk

Redfish Lake Sockeye

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	**HoRs**	**NoRs**	**HoRs**
Goal	nya	2000	nya	nya	600
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Spring/Summer Chinook (W. Fork Yankee Fork- Salmon River)- Integrated

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	**HoRs**	**NoRs**	**HoRs**
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya

1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Spring/Summer Chinook (East Fork Salmon River)- Integrated

Return Year	**Total Catch (all ages)**	**Natural Escapement**		**Hatchery Spawning**	
		NoRs	**HoRs**	**NoRs**	**HoRs**
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Lemhi River Spring_Summer Chinook

Return Year	**Total Catch (all ages)**	**Natural Escapement**		**Hatchery Spawning**	
		NoRs	**HoRs**	**NoRs**	**HoRs**
Goal	NA	M	M	NA	NA
1990	M	M	M	NA	NA
1991	M	M	M	NA	NA
1992	M	M	M	NA	NA
1993	M	M	M	NA	NA
1994	M	M	M	NA	NA
1995	M	M	M	NA	NA
1996	M	M	M	NA	NA
1997	M	M	M	NA	NA
1998	M	M	M	NA	NA

1999	M	M	M	NA	NA
2000	M	M	M	NA	NA
2001	M	M	M	NA	NA

Comments:

nc
nc
nc

Data source:

nds
nds
PI

2.2.3 Describe hatchery activities, including associated monitoring and evaluation and researcl programs, that may lead to the take of listed fish in the target area, and provide estimate levels of take.

Steelhead B (East Fork) - Integrated

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

152

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

153

Summer Chinook (Johnson Creek)

152

ESU/Population	nya
Activity	nya
Location of hatchery	

activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (McCall Hatchery)

	ESU/Population	nya
	Activity	nya
152	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook (Rapid River) - Hatchery

ESU/Population nya

Activity nya

152 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program Operator nya

		Annual Take of Listed Fish by life Stage (number of fish)			
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (Pahsimeroi)

ESU/Population nya

Activity nya

152 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program Operator nya

		Annual Take of Listed Fish by life Stage (number of fish)			
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
153	**Collect for transport (b)**	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook (Upper Salmon/Sawtooth)

	ESU/Population	nya
	Activity	nya
152	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook - Natural

	ESU/Population	nya
	Activity	nya
152	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya

	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
153	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook - Natural

	ESU/Population	nya
	Activity	nya
152	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

		Annual Take of Listed Fish by life Stage (number of fish)			
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Run (Pahsimeroi)- Hatchery

	ESU/Population	Snake RIver summer steelhead
	Activity	Adult brood stock collection
152	**Location of hatchery activity**	Pahsimeroi Hatchery trap
	Dates of activity	March-May 12
	Hatchery Program Operator	Todd Garlie

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Annual Take of Listed Fish by life Stage (number of fish)			
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	378	nya
153 Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead B (Dworshak)-Hatchery

ESU/Population nya

Activity nya

152 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program Operator nya

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Annual Take of Listed Fish by life Stage (number of fish)			
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
153 Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead B-Natural

ESU/Population nya

Activity nya

Location of hatchery activity	nya
152 **Dates of activity**	nya
Hatchery Program Operator	nya

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
153 **Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Natural

ESU/Population	nya
Activity	nya
152 **Location of hatchery activity**	nya
Dates of activity	nya
Hatchery Program Operator	nya

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
153 **Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya

Other take (specify) (h)	nya	nya	nya	nya

Redfish Lake Sockeye

152

ESU/Population nya

Activity nya

Location of hatchery activity nya

Dates of activity nya

Hatchery Program Operator nya

153

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Spring/Summer Chinook (W. Fork Yankee Fork- Salmon River)- Integrated

152

ESU/Population nya

Activity nya

Location of hatchery activity nya

Dates of activity nya

Hatchery Program Operator nya

153

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya

	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring/Summer Chinook (East Fork Salmon River)- Integrated

	ESU/Population	nya
	Activity	nya
152	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Lemhi River Spring_Summer Chinook

	ESU/Population	nya
	Activity	nya
152	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
153	**Removal (e.g., brookstock (e)**	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Run (Sawtooth)- Hatchery

	ESU/Population	nya
	Activity	nya
152	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

		Annual Take of Listed Fish by life Stage (number of fish)			
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Comments:

nc
nc
The 378 represents the 2002 total of unmarked steelehad.

Data source:

nds
PI
PI

Section 3: Relationship of Program to Other Management Objectives

3.1 Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hooc Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the *NP Production Review* Report and Recommendations - NPPC document 99-15). Explain any deviations from the plan or policies.

155 This program conforms with the plan and polices to mitigate loss of chinook salmon production caused by the construction of the four dams on the lower Snake River.

Comments:

nc

Data source:

HGMP, PI

3.2 List all existing cooperative agreements, memoranda of understanding, memoranda of agı or other management plans or court orders under which program operates.

Document Title	Type
HGMP	MP
IDWR Water Right	CA
LSRCP	MP
US v Oregon	CO

156

Comments:

nc

Data source:

PI

3.3 Relationship to harvest objectives.

The Lower Snake River Compensation Plan defined replacement of adults "in place" and "in kind" for appropriate state mar purposes. The Idaho Department of Fish and Game, the U.S. Fish and Wildlife Service, and the Shoshone-Bannock Tribes cooperatively to develop annual production and mark plans. Juvenile production and adult escapement targets were establi outset of the LSRCP program.

157 As part of its harvest management and monitoring program, the IDFG conducts annual creel and angler surveys to assess program fish make toward meeting program harvest objectives.

Natural (unmarked) steelhead adults trapped as part of this program and progeny produced by this program are not targete fisheries. However, they may be utilized in Columbia River and tributary treaty fisheries.

Comments:

nc

Data source:

HGMP

3.4 Relationship to habitat protection and recovery strategies.

158 nya

Comments:

nc

Data source:

HGMP

3.5 Ecological interactions.

The following species co-occur to a significant degree with the program fish in either freshwater or early marine life stages.

159

- Steelhead
- Sockeye
- Coho
- Chinook
- Bull Trout

Comments:

nc

Data source:

PI

Section 4. Water Source

4.1 Provide a quantitative and narrative description of the water source (spring, well, surfac quality profile and natural limitations to production attributable to the water source.

The following statements describe the adult holding water source:

12

- The water source is gravity flow.
- The water source is accessible to anadromous fish.
- Water is from the natal stream for the cultured stock.
- The water used results in natural water temperature profiles that provide optimum maturation and gamete developn
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu temperature.
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu ammonia, carbon dioxide, chlorine, pH, copper, dissolved oxygen, hydrogen sulfide, dissolved nitrogen, iron, and zi
- Naturally produced fish do not have access to intake screens.
- Hatchery intake screening complies with Integrated Hatchery Operations Team (IHOT) and National Marine Fisheri facility guidelines.

The following statements describe the incubation water source:

13

- The water source is gravity flow.
- The water source is pumped.
- The water source is pathogen-free.
- The water source is specific-pathogen free.
- The water source is accessible to anadromous fish.
- Water is available from multiple sources.
- Incubation water can be heated or chilled to approximate natural water temperature profiles.
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu temperature.
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu ammonia, carbon dioxide, chlorine, pH, copper, dissolved oxygen, hydrogen sulfide, dissolved nitrogen, iron, and zi
- The water supply is protected by flow alarms at the intake(s).
- The water supply is protected by flow and/or pond level alarms at the holding pond(s).
- The water supply is protected by back-up power generation
- Naturally produced fish do not have access to intake screens.

The following statements describe the rearing water source:

- The water source is gravity flow.

- Adequate flows are maintained to provide unimpeded passage of adults and juveniles in the by-pass reach created water withdrawals.

14

- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu ammonia, carbon dioxide, chlorine, pH, copper, dissolved oxygen, hydrogen sulfide, dissolved nitrogen, iron, and zi

Comments:

answers above for Pahsimeroi

Answers above for Pahsimeroi to eye-up egg stage only The entire incubation system water supply at Pahsimeroi is alarme water level in the holding tank, as well as power failure.

Niagara:a,c,d,e,j,m,q,r=true; n,p=do not apply; l-exceed stds for iron.

HNFH:a,k,l,=true; p,r=do not apply.

MVH:a,g,l,n(supply line)=true; p=NA

Data for MVH above.j,k,l=NA

Niagara:a,s=true; j,k,l,r=NA

Hagerman:a,e=true; j,k,l,r=NA

Data source:

PI
PI
PI

4.2 Indicate risk aversion measures that will be applied to minimize the likelihood for the ta listed natural fish as a result of hatchery water withdrawal, screening, or effluent discha

15 The facility operates within the limitations established in its National Pollution Discharge Elimination System (NPDES) perm

Comments:

nc

Data source:

PI

Section 5. Facilities

5.1 Broodstock collection facilities (or methods).

Brookstock for this program is collected:

16

- by volitional return to adult capture pond.

- from wild by weir. ** NO STATEMENT PROVIDED FOR THIS CHOICE **

188

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Fl (gpm)
2	Concrete	6,720	70	16	6	5,238
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya

Comments:

nc
Data above for Pahsimeroi.

Data source:

PI
PI

5.2 Fish transportation equipment (description of pen, tank, truck, or container used).

99 IHOT guidelines for transportation are followed.

187

Equipment Type	Capacity (gallons)	Supplemental Oxygen (y/n)	Temperature Control (y/n)	Normal Transit Time (minutes)	Chemical (s) Used	Do (p
Tank	500	Y	Y	60	None	nya
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya

Comments:

Niagra Springs Hatchery

Pahsimeroi data above.

NSH: 5,000 gal tank with O2, no temperature control or other chemicals used; transit time 240-360 min.

MVH, HNFH: Loading and transportation procedures are similar among rearing hatcheries. Generally, yearlings are crowded and pumped into 5,000 gallon transport trucks using an 8 inch Magic Valley Heliarc pump and dewatering tower. Transport wa temperature is chilled to approximately 7.2ºC . Approximately 5,000 pounds of fish are loaded into each truck. Transport dura sites is ranges from 4 to 9 hours. Trucks are equipped with oxygen and fresh flow agitator systems. Fish are not fed for up to to loading and transporting.

Data source:

PI
PI

5.3 Broodstock holding and spawning facilities.

Spawning for this program takes place:

16

- in a covered facility. ** NO STATEMENT PROVIDED FOR THIS CHOICE **** NO STATEMENT PROVIDED FOR TH

34 Integrated Hatchery Operations Team (IHOT) adult holding guidelines followed for adult holding , density , water quality and p
measures to provide the necessary security for the broodstock.

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Fl (gpm)
2	Concrete	6,720	70	16	6	5,238
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya

188

Comments:

nc
nc
Data above for Pahsimeroi.

Data source:

PI
PI
PI

5.4 Incubation facilities.

Incubator Type	Units (number)	Flow (gpm)	Volume (cu.ft.)	Loading-Eyeing (eggs/unit)	Loading-Hatcl (eggs/unit
Vertical Flow Heath Trays	300- 20 stcks	5-6	nya	9K-12K	nya
nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya

189

Comments:

Data above for Pahsimeroi.

NSH: Eager 15"diam; 1-2/vat and 21 vats; >25gpm; loading to hatching= 30,000-70,000.

Sawtooth Fish Hatchery: Incubation facilities at the Sawtooth Fish Hatchery consist of a well water supplied system of 100 sta
incubator frames containing 800 incubation trays. The maximum incubation capacity at the Sawtooth Fish Hatchery is 7 millio
eggs. Incubation flows are set at 5 to 6 gpm per eight tray incubation stack. Typically, eggs from two females are incubated p
(approximately 8,500 to 10,000 eggs per tray).

Magic Valley Fish Hatchery: Incubation facilities at the Magic Valley Fish Hatchery consist primarily of 40, 12 gallon upwelling
Each container is capable of incubating and hatching 50,000 to 75,000 eyed steelhead eggs. Two incubators are placed over
vat. A total of 20 vats are available. Vats measure 40 ft long x 4 ft wide x 3 ft deep. Each vat has the capacity to rear 115,000
steelhead to 200 fish per pound.

Hagerman National Fish Hatchery: Eyed-eggs are incubated in upwelling incubators as described for the Magic Valley Fish H

Data source:

PI

5.5 Rearing facilities.

	Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Maximum Flow Index	Maxir Dens Ind
190	19	concrete	6,790	290	10	2.34	2,850	1.09	.47
	21	fiberglass	37.5	7.5	2.5	2	50	.77	1.02
	nya	nya	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya	nya	nya

Comments:

Niagra Springs Hatchery data above.

The Magic Valley Fish Hatchery and the Hagerman National Fish Hatchery function as juvenile rearing facilities for the LSRC River A-run steelhead program.

Magic Valley Fish Hatchery ? The Magic Valley Fish Hatchery has 32 outside raceways available for juvenile steelhead rearir raceway measures 200 ft long x 10 ft wide x 3 ft deep. Each raceway has the capacity to rear approximately 65,000 fish to rel Raceways may be subdivided to create 64 rearing sections. A movable bridge, equipped with 16 automatic Neilsen fish feede raceway complex. Two 30,000 bulk feed bins equipped with fish feed fines shakers and a feed conveyor complete the outside system.

Hagerman National Fish Hatchery - Early rearing occurs in fiberglass troughs inside the hatchery building. As fish outgrow fib troughs, they are transferred to a series of outside raceways where they remain until transfer for release. Raceways measure 10 ft wide.

For the Salmon River A-run steelhead program, acclimation occurs in outside production raceways (when feasible). Generally destined for release at the Sawtooth Fish Hatchery weir are acclimated prior to release (approximately 750,000 annually). All released directly to receiving waters.

Data source:

PI, HGMP

5.6 Acclimation/release facilities.

	Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Maximum Flow Index	Maxir Dens Ind
190	19	concrete	6,790	290	10	2.34	2,850	1.09	.47
	21	fiberglass	37.5	7.5	2.5	2	50	.77	1.02
	nya	nya	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya	nya	nya

Comments:

Niagra Springs Hatchery data above.

The Magic Valley Fish Hatchery and the Hagerman National Fish Hatchery function as juvenile rearing facilities for the LSRC River A-run steelhead program.

Magic Valley Fish Hatchery ? The Magic Valley Fish Hatchery has 32 outside raceways available for juvenile steelhead rearir raceway measures 200 ft long x 10 ft wide x 3 ft deep. Each raceway has the capacity to rear approximately 65,000 fish to rel Raceways may be subdivided to create 64 rearing sections. A movable bridge, equipped with 16 automatic Neilsen fish feede raceway complex. Two 30,000 bulk feed bins equipped with fish feed fines shakers and a feed conveyor complete the outside system.

Hagerman National Fish Hatchery - Early rearing occurs in fiberglass troughs inside the hatchery building. As fish outgrow fib troughs, they are transferred to a series of outside raceways where they remain until transfer for release. Raceways measure 10 ft wide.

For the Salmon River A-run steelhead program, acclimation occurs in outside production raceways (when feasible). Generally destined for release at the Sawtooth Fish Hatchery weir are acclimated prior to release (approximately 750,000 annually). All released directly to receiving waters.

Data source:

PI, HGMP

5.7 Describe operational difficulties or disasters that led to significant fish mortality.

Pahsimeroi: Whirling disease, with no SPF water for early rearing, magnitude of problem is cyclic and not quantified.

MVH, HNFH, Sawtooth: No operational difficulties or disasters have led to significant fish mortality.

160 NSH: Before the rectangular incubation vats wer installed, suffocation occurred in most of the six-foot circular vats from ove Suffocation could occur again if densities are not artificially thinned in the hatchery building each year by moving fry out ear eggs to other hatcheries for incubation. Before 1993, a leak in the water chiller cooling system caused refridgerant to enter kill fish in the tanker truck. In 1998, fish on tanker truck developed oxygen problems that caused the loss of 1,000 pounds o middle compartment of the tanker.

Comments:

nc

Data source:

PI, HGMPs

5.8 Indicate available back-up systems, and risk aversion measures that will be applied, tha the likelihood for the take of listed natural fish that may result from equipment failure, v flooding, disease transmission, or other events that could lead to injury or mortality.

70 Fish are reared in multiple facilities or with redundant systems to reduce the risk of catastrophic loss.

78 The facility is sited so as to minimize the risk of catastrophic fish loss from flooding.

79 Staff is not notified of emergency situations at the facility through the use of alarms, autodialer and pagers.

80 The facility is continuously staffed to assure the security of fish stocks on-site.

Comments:

nc
Pahsimeroi: Yes at incubation only

MVH, HNFH: No

Niagara: alarms present but no autodialer or pager system.
Staff is housed at hatchery.

Eggs incubated at Pahsimeroi, Sawtooth and Oxbow hatcheries. Fish reared at Niagra Springs, Magic Valley and Hagerma

Data source:

PI
PI
PI
PI

Section 6. Broodstock Origin and Identity

6.1 Source.

17 The broodstock chosen does not represent natural populations native or adapted to the watersheds in which hatchery fish v released.

Comments:

Snake River fish

Data source:

PI

6.2.1 History.

183

Broodstock Source	Origin	Year(s) Used	
		Begin	End
Pahsimeroi River Hatchery summer steelhead A-run	H	1990	2003
Sawtooth Hatchery summer steelhead A-run	H	1990	2003
nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya

nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya
nya	nya	nya	nya

Comments:

Snake River steelhead and indigenous Salmon River steelhead were used to found all hatchery A-run programs in Idaho. The Pahsimerc program was initiated with progeny of adult steelhead trapped at Oxbow and Hells Canyon dams from 1966 through 1968. Beginning in 1 steelhead produced from spawning events that resulted from these collections were released in the Pahsimeroi River. However, Oxbow-c were released into the Pahsimeroi River and the upper Salmon River intermittently through 1970. Adult broodstock collections were initiat Pahsimeroi Hatchery in 1969. Returning Snake River stock and some indigenous Salmon River stock were trapped and used as broodstc Sawtooth Fish Hatchery broodstock was founded with adults that returned from hatchery-produced smolt releases and from natural steell trapped at the facility. Naturally-produced steelhead adults were integrated into the hatchery broodstock until the early 1990s. It is likely tl component of the upper Salmon River is hatchery influenced.

Additionally, B-run steelhead smolts of Dworshak National Fish Hatchery origin were released into the Pahsimeroi River in 1974 and 197

Data source:

PI, HGMP

6.2.2 Annual size.

22

23 Intentional, artificial selection of broodstock for desired life history traits is practiced.

25

27 The program collects sufficient broodstock to maintain an effective population size of 1000 fish per generation.

28 More than 10% of the broodstock is not derived from wild fish each year.

Comments:

nc

Yes, especially run or spawn timing. The selection of late spawners for the Niagara Springs Hatchery egg request is to shift timing back to the historical timing of the original stock. (Niagara Springs Hatchery produces the smolts that are outplanted Pahsimeroi wier.) This practice will result in later eggs for Niagara Springs Hatchery. This will allow Niagara Springs to proc quality smolts because they will not reach target size prematurely and have to be taken off feed while smolting. This should returns to the rack; hence this practice should actually assist the hatchery in meeting program goals, rather than preventing meeting program goals.

Yes, there has always been sufficient brood stock for this program.

Usually very few, if any, wild fish are collected.

Data source:

PI
PI
PI
PI, HGMP

6.2.3 Past and proposed level of natural fish in the broodstock.

33

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Comments:

nc

Data source:

LSRCP hatchery evaluation reports, LSCRP HGMP, annual broodyear reports, annual run reports

6.2.4 Genetic or ecological differences.

19 The broodstock chosen displays morphological and life history traits similar to the natural population.

Comments:

nc

Data source:

PI

6.2.5 Reasons for choosing.

18 dna

20

21 The broodstock chosen has the desired life history traits to meet harvest goals.

Comments:

Broodstock never extirpated

nc
They are no different than wild fish

Data source:

PI
PI
PI

6.3 Indicate risk aversion measures that will be applied to minimize the likelihood for advers or ecological effects to listed natural fish that may occur as a result of broodstock selecti practices.

The following procedures are in place that maintain broodstock collection within programmed levels:

161

- Excess adults are culled at random and sold, buried, or donated to food banks depending on their quality

Comments:

nc

Data source:

PI

Section 7. Broodstock Collection

7.1 Life-history stage to be collected (adults, eggs, or juveniles).

191

	Adults				
Year	**Females**	**Males**	**Jacks**	**Eggs**	**Juvenile**
Planned	1,000	1,000	nya	1,100,000	850,000
1990	1,225	749	nya	1,720,306	610,100
1991	343	350	nya	1,107,606	727,706
1992	820	868	nya	1,019,540	761,800
1993	1,169	1,082	nya	927,451	864,388
1994	488	326	nya	1,043,401	829,277
1995	742	659	nya	1,222,797	820,410

1996	1,554	1,369	nya	1,159,322	830,654
1997	985	1,254	nya	1,132,786	801,541
1998	1,146	948	nya	1,132,786	829,100
1999	829	862	nya	920,426	830,316
2000	940	1,006	nya	1,418,658	889,955
2001	1,712	1,895	nya	1,502,313	836,713

Comments:

Pahsimeroi Hatchery Summer Steelhead HGMP, run reports, and smolt release numbers (to Pahsimeroi Wier) provided by N

Data source:

PI

7.2 Collection or sampling design

16
- Broodstock collected by volitional return to adult capture pond.
- Broodstock collected from wild by weir.

22 dna

23 Intentional, artificial selection of broodstock for desired life history traits is practiced.

24 Representative samples of the population are collected with respect to size, age, sex ratio, run and spawn timing, and othe important to long-term fitness.

25 The proportion of spawners brought into the hatchery follows a “spread-the-risk” strategy that attempts to improve the proba survival for the entire population.

27 The program collects sufficient broodstock to maintain an effective population size of 1000 fish per generation.)

28 More than 10% of the broodstock is not derived from wild fish each year.

Comments:

nc
Yes, especially run or spawn timing. The selection of late spawners for the Niagara Springs Hatchery egg request is to shift timing back to the historical timing of the original stock. (Niagara Springs Hatchery produces the smolts that are outplanted Pahsimeroi wier.) This practice will result in later eggs for Niagara Springs Hatchery. This will allow Niagara Springs to prod quality smolts because they will not reach target size prematurely and have to be taken off feed while smolting. This should returns to the rack; hence this practice should actually assist the hatchery in meeting program goals, rather than preventing meeting program goals.

No wild fish are collected. We do not have a permit to retain unmarked steelhead for broodstock.

Fish used for spawning are taken throughout the runs.

Yes, there has always been sufficient brood stock for this program.

Usually very few, if any, wild fish are collected.

Data source:

PI
PI
PI,HGMP
PI,HGMP
PI
PI, HGMP

7.3 Identity.

100 Marking techniques are used to distinguish among hatchery population segments.

101 100% of the hatchery fish are NOT marked so they can be distinguished from the natural population.

102 Marked fish can be identified using non-lethal means.

106 Wild fish make up 0-5% (less than five percent) % of the broodstock for this program.

Comments:

MVH, NSH: subsamples of fish are differentially marked to distinguish between release groups.

HNFH: no

Niagra Springs Hatchery: 100% marked

HNFH, MVH: portion of fish unmarked for natural recovery and to fulfill tribal obligations.

All harvest mitigation fish are marked with an adipose fin clip. To evaluate emigration success and timing to main stem dam inserted in production release groups annually. To evaluate adult return success, CWT tags are inserted in release groups Coded wire-tagged fish may receive an additional ventral fin clip. Other releases may be released unmarked.

nc
"Zero"

Data source:

PI
PI
PI
PI

7.4 Proposed number to be collected:

198 **7.4.1 Program goal (assuming 1:1 sex ratio for adults):**
nya

7.4.2 Broodstock collection levels for the last twelve years (e.g. 1990-2001), or for most recent years availab

	Adults				
Year	**Females**	**Males**	**Jacks**	**Eggs**	**Juveniles**
Planned	1,000	1,000	nya	1,100,000	850,000
1990	1,225	749	nya	1,720,306	610,100
1991	343	350	nya	1,107,606	727,706
1992	820	868	nya	1,019,540	761,800
191 **1993**	1,169	1,082	nya	927,451	864,388
1994	488	326	nya	1,043,401	829,277
1995	742	659	nya	1,222,797	820,410
1996	1,554	1,369	nya	1,159,322	830,654
1997	985	1,254	nya	1,132,786	801,541
1998	1,146	948	nya	1,132,786	829,100
1999	829	862	nya	920,426	830,316
2000	940	1,006	nya	1,418,658	889,955
2001	1,712	1,895	nya	1,502,313	836,713

Comments:

Pahsimeroi Hatchery Summer Steelhead HGMP, run reports, and smolt release numbers (to Pahsimeroi Wier) provided by N

Data source:

PI

7.5 Disposition of hatchery-origin fish collected in surplus of broodstock needs.

The following procedures are in place that maintain broodstock collection within programmed levels:

161

- Excess adults are culled at random and sold, buried, or donated to food banks depending on their quality.

Comments:

nc

Data source:

PI

7.6 Fish transportation and holding methods.

	Equipment Type	Capacity (gallons)	Supplemental Oxygen (y/n)	Temperature Control (y/n)	Normal Transit Time (minutes)	Chemical (s) Used	Dc (p
	Tank	500	Y	Y	60	None	nya
187	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya

	Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Fl (gpm)
	2	Concrete	6,720	70	16	6	5,238
188	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya

33 Broodstock is collected and held in a manner that results in less than 10% prespawning mortality.

99 IHOT guidelines for transport are followed for this program.

Comments:

Pahsimeroi data above.

NSH: 5,000 gal tank with O2, no temperature control or other chemicals used; transit time 240-360 min.

MVH, HNFH: Loading and transportation procedures are similar among rearing hatcheries. Generally, yearlings are crowded and pumped into 5,000 gallon transport trucks using an 8 inch Magic Valley Heliarc pump and dewatering tower. Transport w temperature is chilled to approximately 7.2ºC . Approximately 5,000 pounds of fish are loaded into each truck. Transport dura sites is ranges from 4 to 9 hours. Trucks are equipped with oxygen and fresh flow agitator systems. Fish are not fed for up to to loading and transporting.

Data above for Pahsimeroi.

nc
Niagra Springs Hatchery

Data source:

PI
PI
PI
PI

7.7 Describe fish health maintenance and sanitation procedures applied.

98 "Fish transfers into the subbasin are inspected and accompanied by notifications as described in IHOT and PNFHPC guide

32 Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection committee (PNFHPC), state or triba are followed for broodstock fish health inspection , transfer of eggs or adults and broodstock holding and disposal of carcas

Comments:

Niagra Springs Hatchery

nc

Data source:

PI
PI

7.8 Disposition of carcasses.

32 Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection committee (PNFHPC), state or triba are followed for broodstock fish health inspection , transfer of eggs or adults and broodstock holding and disposal of carcas

103 Hatchery adults are distributed by staff within the subbasin to provide hatchery adults are distributed (by staff) within subba fishing opportunity and hatchery adults are distributed (by staff) within the subbasin to provide natural production.

161 The following procedures are in polace that maintain broodstock collection within programmed levels:

- Excess adults are culled at random and sold, buried, or donated to food banks depending on their quality

Comments:

nc
Becasue of whirling disease at the hatchery, adults are not distributed for nutrients.

nc

Data source:

PI
PI

PI

7.9 Indicate risk aversion measures that will be applied to minimize the likelihood for advers or ecological effects to listed natural fish resulting from the broodstock collection progra

29 The program has guidelines for acceptable contribution of hatchery fish to natural spawning.

30 These guidelines are met for all affected natural stocks.

32 Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection committee (PNFHPC), state or triba are followed for broodstock fish health inspection , transfer of eggs or adults and broodstock holding and disposal of carcas

Comments:

nc
Annual Broodstock Planning, IDFG Management Agreements US v Oregon.

nc

Data source:

PI
PI
PI

Section 8. Mating

8.1 Selection method.

35 Males and females available on a given day are mated randomly.

39 Fish are allowed to select their own mates and go through all normal spawning behavior.

Comments:

All spawning fish are randomly selected based on time of arrival.

Fish passed to spawn in the river go through natural spawning behavior for mate selection, but not at hatchery.

Data source:

PI
PI

8.2 Males.

38 Precocious males are used as a set percentage or in proportion to their contribution to the adult run.

37 Back-up males are used in the spawning protocol.

Comments:

No mini's used and generally male spawners consist of less than 10% jacks.

Sometimes more than one male per female is used.

Data source:

PI
PI

8.3 Fertilization.

36 Gametes are NOT pooled prior to fertilization.

39 Fish are allowed to select their own mates and go through all normal spawning behavior.

11 IHOT PNFHPC state tribal federal guidelines are followed for culture practices for this program.

40 Disinfection procedures that prevent pathogen transmission between stocks of fish are implemented during spawning.

Comments:

nc
Fish passed to spawn in the river go through natural spawning behavior for mate selection, but not at hatchery.

nc
IHOT protocols

Data source:

PI
PI
PI
PI

8.4 Cryopreserved gametes.

162 Cryopreserved gametes are not used.

Comments:

Cryopreserved gametes are collected but currently not used.

Data source:

PI

8.5 Indicate risk aversion measures that will be applied to minimize the likelihood for advers or ecological effects to listed natural fish resulting from the mating scheme.

35 Males and females available on a given day are mated randomly.

36 Gametes are NOT pooled prior to fertilization.

37 Back-up males are used in the spawning protocol.

38 Precocious males are used as a set percentage or in proportion to their contribution to the adult run.

39 Fish are allowed to select their own mates and go through all normal spawning behavior.

Comments:

All spawning fish are randomly selected based on time of arrival.

nc
Sometimes more than one male per female is used.

No mini's used and generally male spawners consist of less than 10% jacks.

Fish passed to spawn in the river go through natural spawning behavior for mate selection, but not at hatchery.

Data source:

PI
PI
PI

PI
PI

Section 9. Incubation and Rearing.

9.1.1 Number of eggs taken and survival rates to eye-up and/or ponding.

	Year	Egg Take	Green-Eyed Survival (%)	Eyed-Ponding Survival (%)	Egg Survival Performance Std.	Fry-fingerling Survival (%)	Rearing Survival Performance Std.	Finger Sm Surviva
	1990	5,807,913	67.7	nya	nya	nya	nya	85.0
	1991	1,855,681	88.7	nya	nya	nya	nya	67.2
	1992	4,020,454	93.8	nya	nya	nya	nya	76.7
	1993	4,729,711	89.0	nya	nya	nya	nya	62.4
192	1994	2,365,000	89.9	nya	nya	87.2	nya	79.4
	1995	3,500,000	78.7	94.3	nya	77.5	nya	67.7
	1996	5,398,600	80.7	92.2	nya	80.7	nya	73.2
	1997	3,910,369	82.9	nya	nya	71.7	nya	62.2
	1998	5,366,086	84.5	nya	nya	76.8	nya	72.9
	1999	3,962,649	86.1	nya	nya	91.9	nya	90.1
	2000	4,411,135	86.0	nya	nya	97.2	nya	95.9
	2001	4,764,652	74.1	nya	nya	97.1	nya	94.4

Comments:

Pahsimeroi data above for eggtake and green-eyed survival. Eyed eggs subsequently sent to NSH, MVH, and HNFH.

NSH data above for eyed-ponding, fry-fingerling, and fingerling-smolt survival.

Sawtooth Fish Hatchery egg take and survival information below. Information produced from Sawtooth Fish Hatchery annual

BY Green Eggs Taken Eyed-eggs Survival to Eyed Stage (%)

1988 1,561,300 1,366,382 87.5

1989 1,696,700 1,557,398 91.8

1990 1,071,165 956,245 89.3

1991 132,630 116,430 87.8

1992 1,406,360 1,182,500 84.1

1993 1,131,635 1,031,635 91.2

1994 725,205 660,989 91.1

1995 630,300 543,100 86.2

1996 1,091,143 982,600 90.1

1997 1,994,076 1,805,200 91.0

1998 1,116,350 984,600 88.2

1999 1,526,046 1,338,178 87.7

2000 3,950,103 3,516,250 89.0

2001 2,867,634 2,300,978 80.0

Magic Valley Fish Hatchery survival information by hatchery life stage for A-run steelhead from hatch through release (includ
received from Pahsimeroi, Sawtooth, and Oxbow fish hatcheries). Information produced from Magic Valley Fish Hatchery an

BY Spawn.Hatch. Eyed-Eggs Rcvd Eyed-Hatch Eyed-Smolt Number ofSmoltsReleased

1988 Pahsimeroi 2,047,748 n/a 90.3% 1,849,500

1989 Pahsimeroi 1,306,674 n/a 91.7% 1,198,700

1990 Pahsimeroi 1,269,100 n/a 86.2% 1,094,200

1991 - - - - -

1992 Pahsimeroi 1,031,274 99.0% 88.8% 915,400

1993 Pahsimeroi 1,081,500 99.5% 88.0% 951,990

1994 Pahsimeroi 800,785 97.5% 85.4% 684,035

1995 Pahsimeroi 803,000 98.0% 91.9% 738,133

1996 Sawtooth 95,796 99.0% 88.4% 84,715

1996 Pahsimeroi 852,000 98.0% 89.8% 765,340

1997 Sawtooth 530,000 98.5% 77.4% 410,225

1997 Pahsimeroi 325,000 98.0% 89.3% 291,625

1998 Pahsimeroi 887,000 99.0% 92.4% 819,902

1998 Oxbow 123,540 94.0% 86.6% 106,950

1999 Sawtooth 389,982 99.0% 91.8% 358,025

1999 Pahsimeroi 515,375 99.0% 93.5% 481,712

1999 Oxbow 174,000 98.0% 94.3% 164,123

2000 Sawtooth 991,665 99.0% 88.3% 876,085

2000 Pahsimeroi 946,319 99.0% 83.5% 790,258

Hagerman National Fish Hatchery survival information by hatchery life stage for A-run steelhead from hatch through release
received from Pahsimeroi, Sawtooth, and Oxbow fish hatcheries). Information produced from Hagerman National Fish Hatch
reports.

BY Spawn.Hatch. Eyed-Eggs Rcvd Eyed-Hatch Eyed-Smolt Number ofSmoltsReleased

1989 Sawtooth 1,491,956 99.3% 65.8% 981,764

1990 Sawtooth 592,302 96.9% 62.1% 979,799

1990 Saw & Pah 986,523 95.9%

1991 Sawtooth 112,398 96.3% 85.5% 850,189

1991 Pahsimeroi 881,538 95.3%

1992 Sawtooth 1,256,701 97.1% 63.8% 1,487,842

1992 Pahsimeroi 1,076,009 97.8%

1993 Sawtooth 1,014,960 97.2% 75.2% 1,519,168

1993 Pahsimeroi 1,005,013 96.3%

1994 Sawtooth 593,953 92.6% 68.8% 1,151,544

1994 Pahsimeroi 362,118 98.9%

1994 Oxbow 717,576 96.6%

1995 Sawtooth 562,513 98.5% 80.2% 1,324,593

1995 Pahsimeroi 345,164 97.5%

1995 Oxbow 744,888 96.8%

1996 Sawtooth 898587 98.3% 81.8% 1,148,370

1996 Pahsimeroi 505,291 97.1%

1997 Sawtooth 836,648 97.5% 83.6% 1,032,407

1997 Pahsimeroi 398,452 96.7%

1998 Sawtooth 803,057 98.2% 83.7% 1,133,825

1998 Oxbow 552,261 98.2%

1999 Sawtooth 899,444 98.0% 80.8% 1,174,882

1999 Oxbow 554,520 96.1%

2000 Sawtooth 946,595 98.7% 90.7% 1,052,659

2000 Pahsimeroi 213,977 98.1%

Data source:

Pahsimeroi Hatchery summer steelehad run reports, PI, HGMPs

9.1.2 Cause for, and disposition of surplus egg takes.

163 Surplus eggs are collected mainly as a safeguard against potential incubation loses.

45 Eggs are not culled randomly over all segments of egg-take.

48 Families are NOT incubated individually.

59 No culling of juveniles occur.

60

61

44 1 (eggs are culled once)

Comments:

We cull eggs from earlier spawn takes for the reasons discussed in question #23.

Niagra Springs Hatchery

Niagra Springs Hatchery

Pahsimeroi:Always use one female per tray.

No culling of eggs at Niagara, Hagerman or Magic Valley

Data source:

PI
PI
PI
PI
PI
PI

9.1.3 Loading densities applied during incubation.

51 Integrated Hatchery Operations Team (IHOT) species-specific incubation recommendations were followed for water quality incubator capacities.

47 Families within spawning groups are mixed randomly at ponding so that unintentional rearing differences affect families equ

42 Eggs are incubated under conditions that result in equal survival of all segments of the population to ponding.

Comments:

Niagra Springs Hatchery

nc

Data source:

PI
PI
PI

9.1.4 Incubation conditions.

49 Incubation does not take place in home stream water.

50 The program does NOT use water sources that result in hatching/emergence timing similar to that of the naturally producec

51 Integrated Hatchery Operations Team (IHOT) species-specific incubation recommendations were followed for water quality incubator capacities.

53 Eggs are monitored when needed to determine fertilization efficiency and embryonic development.

42 Eggs are incubated under conditions that result in equal survival of all segments of the population to ponding.

47 Families within spawning groups are mixed randomly at ponding so that unintentional rearing differences affect families equ

48 Families are NOT incubated individually.

43

Comments:

Eggs incubated at multiple facilities in different basin on multiple water supplies.

Niagra Springs Hatchery

Niagra Springs Hatchery

nc
nc

nc

Data source:

PI
PI
PI
PI
PI
PI
PI
PI

9.1.5 Ponding.

The procedures used for determining when fry are ponded include:

55

- Fry are ponded based on visual inspection of the amount of yolk remaining

46 Eggs are NOT incubated in a manner that allows volitional ponding of fry.

Comments:

Niagra Springs:a,b,c

Done at Niagra Springs Hatchery.

Data source:

PI
PI

9.1.6 Fish health maintenance and monitoring.

52 Disinfection procedures are implemented during incubation that prevent pathogen transmission between stocks of fish on s

53 Eggs are monitored when needed to determine fertilization efficiency and embryonic development.

54 Following eye-up stage, eggs are inventoried, and dead or undeveloped eggs removed and disposed of as described in the control guidelines.

56 Dead or culled eggs are discarded in a manner that prevents transmission to receiving watershed.

Comments:

Niagra Springs Hatchery

nc
Yes, all disease control guidelines are followed, with eggs inventoried and dead and undeveloped eggs removed.

Eggs are culled and disgarded at the dump.

Data source:

PI
PI
PI
PI

9.1.7 Indicate risk aversion measures that will be applied to minimize the likelihood for advers and ecological effects to listed fish during incubation.

47 Families within spawning groups are mixed randomly at ponding so that unintentional rearing differences affect families equ

49 Incubation does not take place in home stream water.

50 The program does NOT use water sources that result in hatching/emergence timing similar to that of the naturally producec

51 Integrated Hatchery Operations Team (IHOT) species-specific incubation recommendations were followed for water quality incubator capacities.

52 Disinfection procedures are implemented during incubation that prevent pathogen transmission between stocks of fish on s

56 Dead or culled eggs are discarded in a manner that prevents transmission to receiving watershed.

61 Families are NOT culled to minimize family size variation.

Comments:

Eggs incubated at multiple facilities in different basin on multiple water supplies.

Niagra Springs Hatchery

Niagra Springs Hatchery

Niagra Springs Hatchery

Eggs are culled and disgarded at the dump.

Pahsimeroi:Always use one female per tray.

Data source:

PI
PI
PI
PI
PI
PI
PI

9.2.1 Provide survival rate data (*average program performance*) by hatchery life stage (fry to f fingerling to smolt) for the most recent twelve years (1990-2001), or for years dependab are available.

Year	Egg Take	Green-Eyed Survival (%)	Eyed-Ponding Survival (%)	Egg Survival Performance Std.	Fry-fingerling Survival (%)	Rearing Survival Performance Std.	Finger Smo Surviva
1990	5,807,913	67.7	nya	nya	nya	nya	85.0
1991	1,855,681	88.7	nya	nya	nya	nya	67.2
1992	4,020,454	93.8	nya	nya	nya	nya	76.7
1993	4,729,711	89.0	nya	nya	nya	nya	62.4
192 **1994**	2,365,000	89.9	nya	nya	87.2	nya	79.4
1995	3,500,000	78.7	94.3	nya	77.5	nya	67.7
1996	5,398,600	80.7	92.2	nya	80.7	nya	73.2
1997	3,910,369	82.9	nya	nya	71.7	nya	62.2
1998	5,366,086	84.5	nya	nya	76.8	nya	72.9
1999	3,962,649	86.1	nya	nya	91.9	nya	90.1
2000	4,411,135	86.0	nya	nya	97.2	nya	95.9
2001	4,764,652	74.1	nya	nya	97.1	nya	94.4

Comments:

Pahsimeroi data above for eggtake and green-eyed survival. Eyed eggs subsequently sent to NSH, MVH, and HNFH.

NSH data above for eyed-ponding, fry-fingerling, and fingerling-smolt survival.

Sawtooth Fish Hatchery egg take and survival information below. Information produced from Sawtooth Fish Hatchery annual

BY	Green Eggs Taken	Eyed-eggs	Survival to Eyed Stage (%)
1988	1,561,300	1,366,382	87.5
1989	1,696,700	1,557,398	91.8
1990	1,071,165	956,245	89.3
1991	132,630	116,430	87.8
1992	1,406,360	1,182,500	84.1
1993	1,131,635	1,031,635	91.2
1994	725,205	660,989	91.1
1995	630,300	543,100	86.2
1996	1,091,143	982,600	90.1
1997	1,994,076	1,805,200	91.0
1998	1,116,350	984,600	88.2
1999	1,526,046	1,338,178	87.7
2000	3,950,103	3,516,250	89.0
2001	2,867,634	2,300,978	80.0

Magic Valley Fish Hatchery survival information by hatchery life stage for A-run steelhead from hatch through release (includ
received from Pahsimeroi, Sawtooth, and Oxbow fish hatcheries). Information produced from Magic Valley Fish Hatchery an

BY	Spawn.Hatch.	Eyed-Eggs Rcvd	Eyed-Hatch	Eyed-Smolt	Number ofSmoltsReleased
1988	Pahsimeroi	2,047,748	n/a	90.3%	1,849,500
1989	Pahsimeroi	1,306,674	n/a	91.7%	1,198,700
1990	Pahsimeroi	1,269,100	n/a	86.2%	1,094,200
1991	-	-	-	-	-
1992	Pahsimeroi	1,031,274	99.0%	88.8%	915,400
1993	Pahsimeroi	1,081,500	99.5%	88.0%	951,990
1994	Pahsimeroi	800,785	97.5%	85.4%	684,035
1995	Pahsimeroi	803,000	98.0%	91.9%	738,133
1996	Sawtooth	95,796	99.0%	88.4%	84,715
1996	Pahsimeroi	852,000	98.0%	89.8%	765,340
1997	Sawtooth	530,000	98.5%	77.4%	410,225
1997	Pahsimeroi	325,000	98.0%	89.3%	291,625
1998	Pahsimeroi	887,000	99.0%	92.4%	819,902
1998	Oxbow	123,540	94.0%	86.6%	106,950
1999	Sawtooth	389,982	99.0%	91.8%	358,025
1999	Pahsimeroi	515,375	99.0%	93.5%	481,712
1999	Oxbow	174,000	98.0%	94.3%	164,123
2000	Sawtooth	991,665	99.0%	88.3%	876,085

2000 Pahsimeroi 946,319 99.0% 83.5% 790,258

Hagerman National Fish Hatchery survival information by hatchery life stage for A-run steelhead from hatch through release received from Pahsimeroi, Sawtooth, and Oxbow fish hatcheries). Information produced from Hagerman National Fish Hatch reports.

BY Spawn.Hatch. Eyed-Eggs Rcvd Eyed-Hatch Eyed-Smolt Number ofSmoltsReleased

1989 Sawtooth 1,491,956 99.3% 65.8% 981,764

1990 Sawtooth 592,302 96.9% 62.1% 979,799

1990 Saw & Pah 986,523 95.9%

1991 Sawtooth 112,398 96.3% 85.5% 850,189

1991 Pahsimeroi 881,538 95.3%

1992 Sawtooth 1,256,701 97.1% 63.8% 1,487,842

1992 Pahsimeroi 1,076,009 97.8%

1993 Sawtooth 1,014,960 97.2% 75.2% 1,519,168

1993 Pahsimeroi 1,005,013 96.3%

1994 Sawtooth 593,953 92.6% 68.8% 1,151,544

1994 Pahsimeroi 362,118 98.9%

1994 Oxbow 717,576 96.6%

1995 Sawtooth 562,513 98.5% 80.2% 1,324,593

1995 Pahsimeroi 345,164 97.5%

1995 Oxbow 744,888 96.8%

1996 Sawtooth 898587 98.3% 81.8% 1,148,370

1996 Pahsimeroi 505,291 97.1%

1997 Sawtooth 836,648 97.5% 83.6% 1,032,407

1997 Pahsimeroi 398,452 96.7%

1998 Sawtooth 803,057 98.2% 83.7% 1,133,825

1998 Oxbow 552,261 98.2%

1999 Sawtooth 899,444 98.0% 80.8% 1,174,882

1999 Oxbow 554,520 96.1%

2000 Sawtooth 946,595 98.7% 90.7% 1,052,659

2000 Pahsimeroi 213,977 98.1%

Data source:

Pahsimeroi Hatchery summer steelehad run reports, PI, HGMPs

9.2.2 Density and loading criteria (goals and actual levels).

71 The juvenile rearing density and loading guidelines used at the facility are based on: standardized agency guidelines , life-s survival studies conducted on-site , life-stage specific survival studies conducted at other facilities , staff experience (e.g. tri and other criteria .

72 IHOT standards are followed for: water quality , predator control measures to provide the necessary security for the culture loading and density.

Comments:

Niagra Springs Hatchery:a,b(1992),d,e(Piper et al., IHOT)

HNFH:a(Lower Snake Performance Stds), d

MVH:a,b,d,e(IHOT)

b: not completely alarmed, but major seismic event would have to occur for any of the water sources to fail.

Data source:

PI
PI

9.2.3 Fish rearing conditions.

66 The program does NOT use a diet and growth regime that mimics the natural seasonal growth patterns.

67 Settleable solids, unused feed and feces are removed periodically to ensure proper cleanliness of rearing containers.

72 IHOT standards are followed for: water quality , predator control measures to provide the necessary security for the culture loading and density.

71 The juvenile rearing density and loading guidelines used at the facility are based on standardized agency guidelines , life-st survival studies conducted on-site , life-stage specific survival studies conducted at other facilities , staff experience (e.g. tri and other criteria .

Comments:

Fish reared on constant water temperature.

Niagra Springs Hatchery

b: not completely alarmed, but major seismic event would have to occur for any of the water sources to fail.

Niagra Springs Hatchery:a,b(1992),d,e(Piper et al., IHOT)

HNFH:a(Lower Snake Performance Stds), d

MVH:a,b,d,e(IHOT)

Data source:

PI
PI
PI
PI

9.2.4 Indicate biweekly or monthly fish growth information (average program performance), in length, weight, and condition factor data collected during rearing, if available.

Rearing Period	Length (mm)	Weight (fpp)	Condition Factor	Growth Rate	Hepatosomatic Index	Boc Moist Conte
june	1.20	1733.30	3.338	0.0803	nya	nya
july	1.74	629.15	3.017	0.0474	nya	nya
aug	2.73	142.94	3.438	0.0306	nya	nya
sept	3.36	70.98	3.714	0.0210	nya	nya
oct	4.07	40.31	3.679	0.0819	nya	nya
194 nov	5.02	21.5	3.676	0.0363	nya	nya
dec	5.86	13.23	3.756	0.0283	nya	nya
jan	6.88	8.09	3.795	0.0367	nya	nya
feb	7.70	5.79	3.783	0.0303	nya	nya
mar	8.47	4.33	3.800	0.0264	nya	nya
apr	8.60	4.33	3.630	0.0203	nya	nya
may	8.60	4.14	3.797	0.0132	nya	nya

Comments:

Niagra Springs Hatchery 2001-2002 data in table above. Condition factors=C*10^(-4). Growth rate="/d/mon.

Magic Valley and Hagerman National fish hatcheries rear juvenile steelhead under constant water temperature (15.0ºC) conc such, both facilities experience similar growth rates and design feeding schedules to produce fish between 180 and 250 to th release. Length gained per month for the first three months of culture at both facilities is typically between 0.8 and 1.0 inches mm). Fish gain approximately 0.65 to 0.75 inches per month (16.5 to 19.1 mm) thereafter. To meet the release size target, fis on an intermittent schedule beginning in their fourth month of culture.

Data source:

PI, HGMP

9.2.5 Indicate monthly fish growth rate and energy reserve data (*average program performanc* available.

64
- Feeding rates are followed so that fish size is within 10% of program goal each year.

65 The correct amount and type of food is provided to achieve the desired growth rate and condition factorsfor the species and l being reared.

	Rearing Period	Length (mm)	Weight (fpp)	Condition Factor	Growth Rate	Hepatosomatic Index	Boc Moist Cont
	june	1.20	1733.30	3.338	0.0803	nya	nya
	july	1.74	629.15	3.017	0.0474	nya	nya
	aug	2.73	142.94	3.438	0.0306	nya	nya
	sept	3.36	70.98	3.714	0.0210	nya	nya
194	oct	4.07	40.31	3.679	0.0819	nya	nya
	nov	5.02	21.5	3.676	0.0363	nya	nya
	dec	5.86	13.23	3.756	0.0283	nya	nya
	jan	6.88	8.09	3.795	0.0367	nya	nya
	feb	7.70	5.79	3.783	0.0303	nya	nya
	mar	8.47	4.33	3.800	0.0264	nya	nya
	apr	8.60	4.33	3.630	0.0203	nya	nya
	may	8.60	4.14	3.797	0.0132	nya	nya

66 The program does NOT use a diet and growth regime that mimics the natural seasonal growth patterns.

Comments:

Niagra Springs Hatchery:a=true; c-need to insulate bulk tanks for IHOT compliance.

HNFH:a,b,c=true

MVH:a,c=true

HNFH: b also (GOEDES Index)

Niagra Springs Hatchery 2001-2002 data in table above. Condition factors=C*10^(-4). Growth rate="/d/mon.

Magic Valley and Hagerman National fish hatcheries rear juvenile steelhead under constant water temperature (15.0ºC) cond such, both facilities experience similar growth rates and design feeding schedules to produce fish between 180 and 250 to th release. Length gained per month for the first three months of culture at both facilities is typically between 0.8 and 1.0 inches mm). Fish gain approximately 0.65 to 0.75 inches per month (16.5 to 19.1 mm) thereafter. To meet the release size target, fis on an intermittent schedule beginning in their fourth month of culture.

Fish reared on constant water temperature.

Data source:

PI

PI
PI, HGMP
PI

9.2.6 Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*averag performance*).

64 • Feeding rates are followed so that fish size is within 10% of program goal each year.

65 The correct amount and type of food is provided to achieve the desired growth rate and condition factorsfor the species and l being reared.

195

Rearing Period	Food Type	Application Schedule (#feedings/day)	Feeding Rate Range (% B.W./day)	Lbs. Fed Per gpm of Inflow	Food Conversi During Perioc
year	Rangen, Moore Clark	8-12	0.93-5.0	0.076-1.81	1.06
nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya

Comments:

Niagra Springs Hatchery:a=true; c-need to insulate bulk tanks for IHOT compliance.

HNFH:a,b,c=true

MVH:a,c=true

HNFH: b also (GOEDES Index)

Niagra Springs Hatchery data above.

Magic Valley Fish Hatchery ? Dry and semi-moist diets have been used at the Magic Valley Fish Hatchery in the past. Currer fed the Rangen 440 extruded salmon dry diet. First feeding fry are fed at a rate of approximately 5% body weight per day. As percent body weight fed per day decreases. Fry are fed with Loudon solenoid activated feeders while located in early rearing Following transfer to outside raceways, fish are fed by hand and with the assistance of the traveling bridge. First feeding fry a up to eight times per day. Prior to release, pre-smolts are typically fed four times per day. Feed conversion averages 1.18 po fed for every pound of weight gain (from first feeding through release).

Hagerman National Fish Hatchery - Fry receive their first feeding when approximately 80% of the population has reached the stage of development. First feedings are generally light. Starter diets are typically sifted prior to feeding. Fry are generally fec 5% of their body weight per day. Fry are fed a semi-moist diet at a rate of eight to ten times per day until they reach approxin per pound. Steelhead are transferred to outside raceways at approximately 200 fish per pound and converted to a dry diet. A are fed approximately 3.7 percent body weight per day. When fish reach approximately 20 to the pound, demand feeders are

Data source:

PI
PI

PI, HGMP

9.2.7 Fish health monitoring, disease treatment, and sanitation procedures.

62 IHOT fish health guidelines are followed to prevent transmission between lots of fish on site or transmission or amplification the watershed.

63 Vaccines are NOT used, whenever possible, to minimize the use of antimicrobial compounds.

71 The juvenile rearing density and loading guidelines used at the facility are based on standardized agency guidelines , life-st survival studies conducted on-site , life-stage specific survival studies conducted at other facilities , staff experience (e.g. tri and other criteria .

Comments:

Vaccines used at Niagara Springs for ERM and furunculosis.

Yes, guidelines in IHOT, AOP, and the Intra-IDFG Fish Health Polices are all followed.

Niagra Springs Hatchery:a,b(1992),d,e(Piper et al., IHOT)

HNFH:a(Lower Snake Performance Stds), d

MVH:a,b,d,e(IHOT)

Data source:

PI
PI
PI

9.2.8 Smolt development indices (e.g. gill ATPase activity), if applicable.

87 The migratory state of the release population is determined by other criteria.

Comments:

Use previous data to determine migration window. Releases occur within this window as regulated by NMFS permits or trar limitations.

NSH: d-found fish released prior to March 24 residualized. After this time fish on-site begin pushing against tail screens.

HNFH: f-fish are smolted by third week in April.

Data source:

PI

9.2.9 Indicate the use of "natural" rearing methods as applied in the program.

68 The program attempts to better mimic the natural rearing environment by actively simulating photoperiod .

69 Fish produced are qualitatively similar to natural fish in morphology , behavior , physiological status and health .

66

84 Fish are NOT released at sizes similar to natural fish of the same stage and species.

88 Fish are released in a manner that simulates natural seasonal migration patterns.

Comments:

All fish reared outside.

HNFH:a also, rear at densities below IHOT

Niagara:e-use slow sinking feed, not floating feed

Fish reared on constant water temperature.

Produce 1-yr smolt released Apr-May
also a function of transportation limitations.

Data source:

PI
PI
PI
PI
PI

9.2.10 Indicate risk aversion measures that will be applied to minimize the likelihood for advers and ecological effects to listed fish under propagation.

60 dna

72 IHOT standards are followed for: water quality , predator control measures to provide the necessary security for the culture loading and density.

80 The facility is continuously staffed to assure the security of fish stocks on-site.

84 Fish are NOT released at sizes similar to natural fish of the same stage and species.

88 Fish are released in a manner that simulates natural seasonal migration patterns.

98 "Fish transfers into the subbasin are inspected and accompanied by notifications as described in IHOT and PNFHPC guide

76 Fish inventory data accurately reflect rearing vessel population abundance with 10%.

86 Volitional release is NOT practiced during natural out-migration timing.

96 Fish are NOT released in the same subbasin as the rearing facility.

Comments:

Niagra Springs Hatchery

b: not completely alarmed, but major seismic event would have to occur for any of the water sources to fail.

Staff is housed at hatchery.

Produce 1-yr smolt released Apr-May
also a function of transportation limitations.

Niagra Springs Hatchery

Niagra Springs Hatchery
Niagra Springs Hatchery

All fish reared in Snake River subbasin.

Data source:

PI
PI
PI
PI
PI
PI
PI
PI
PI

Section 10. Release

10.1 Proposed fish release levels.

	Age Class	Maximum Number	Size (ffp)	Release Date	Location: Stream	Location: Release Point (RKm)	Location: Major Watershed	Location: Ecopro
	Eggs	300,000	nya	nya	Salmon River tributaries	nya	Salmon River	Mountai Snake
1	**Unfed Fry**	nya	nya	nya	nya	nya	nya	nya
	Fry	nya	nya	nya	nya	nya	nya	nya
	Fingerling	nya	nya	nya	nya	nya	nya	nya
	Yearling	3,465,000	4.4	3/20-5/12	Salmon River tributaries	nya	Salmon River	Mountai Snake

Comments:

Pahsimeroi and Sawtooth A-run sthd managed as one stock. Data reflects total releases of Salmon River A-run summer stee Niagara Springs, Magic Valley and Hagerman hatcheries within the Salmon River basin.

Life Stage Facility Release Location Annual Release Level and purpose

Yearling Magic Valley Lemhi River 40,000 production

Yearling Magic Valley Salmon River, Lewis & Clark 50,000 production

Yearling Magic Valley Salmon River, Wagonhammer 40,000 production

Yearling Magic Valley Salmon River, Red Rock 40,000 production

Yearling Magic Valley Salmon River, Shoup Bridge 60,000 production

Yearling Magic Valley Salmon River, Eye Hole 50,000 production

Yearling Magic Valley Salmon River, Colston Corner 60,000 production

Yearling Magic Valley Salmon River, Lemhi Hole 80,000 production

Yearling Magic Valley Salmon River, Tunnel Rock 40,000 production

Yearling Magic Valley Salmon River, McNabb Pt. 80,000 production

Yearling Magic Valley Pahsimeroi Trap 30,000 production

Yearling Magic Valley Salmon River, Cottonwood 40,000 production

Yearling Magic Valley Salmon River, Hwy 93 40,000 production

Yearling Magic Valley Salmon River, Hammer Crk. 180,000 production

Yearling Magic Valley Lemhi River 80,000 U.S. v. Or.

Yearling Magic Valley Yankee Fork Salmon Riv. 30,000 U.S. v. Or.

Yearling Magic Valley Valley Creek 30,000 U.S. v. Or.

Yearling Magic Valley Yankee Fork Salmon Riv. 160,000 U.S. v. Or.

yearling Hagerman Nat. Sawtooth Hatchery weir 750,000 production

Yearling Hagerman Nat. Yankee Fork Salmon River 140,000 U.S. v. Or.

Yearling Hagerman Nat. Little Salmon River, Stinky Sp. 160,000 U.S. v. Or.

Yearling Hagerman Nat. Little Salmon River, Hazard Cr. 40,000 U.S. v. Or.

yearling Niagara Springs Little Whits Salmon River 415,000

yearling Niagara Springs Pahsimeroi River 830,000

Eyed-eggs Sawtooth Salmon River Tributaries 370,000 SBT

Eyed-eggs Pahsimeroi Salmon River Tributaries 625,000 SBT

Data source:

PI HGMPs

10.2 Specific location(s) of proposed release(s).

					Location			
	Age Class	**Maximum Number**	**Size (ffp)**	**Release Date**	**Stream**	**Release Point (RKm)**	**Major Watershed**	**Ecopro**
1	**Eggs**	300,000	nya	nya	Salmon River tributaries	nya	Salmon River	Mountai Snake
	Unfed Fry	nya	nya	nya	nya	nya	nya	nya
	Fry	nya	nya	nya	nya	nya	nya	nya
	Fingerling	nya	nya	nya	nya	nya	nya	nya
	Yearling	3,465,000	4.4	3/20-5/12	Salmon River tributaries	nya	Salmon River	Mountai Snake

96 Fish are NOT released in the same subbasin as the rearing facility.

Comments:

Pahsimeroi and Sawtooth A-run sthd managed as one stock. Data reflects total releases of Salmon River A-run summer stee Niagara Springs, Magic Valley and Hagerman hatcheries within the Salmon River basin.

Life Stage Facility Release Location Annual Release Level and purpose

Yearling Magic Valley Lemhi River 40,000 production

Yearling Magic Valley Salmon River, Lewis & Clark 50,000 production

Yearling Magic Valley Salmon River, Wagonhammer 40,000 production

Yearling Magic Valley Salmon River, Red Rock 40,000 production

Yearling Magic Valley Salmon River, Shoup Bridge 60,000 production

Yearling Magic Valley Salmon River, Eye Hole 50,000 production

Yearling Magic Valley Salmon River, Colston Corner 60,000 production

Yearling Magic Valley Salmon River, Lemhi Hole 80,000 production

Yearling Magic Valley Salmon River, Tunnel Rock 40,000 production

Yearling Magic Valley Salmon River, McNabb Pt. 80,000 production

Yearling Magic Valley Pahsimeroi Trap 30,000 production

Yearling Magic Valley Salmon River, Cottonwood 40,000 production

Yearling Magic Valley Salmon River, Hwy 93 40,000 production

Yearling Magic Valley Salmon River, Hammer Crk. 180,000 production

Yearling Magic Valley Lemhi River 80,000 U.S. v. Or.

Yearling Magic Valley Yankee Fork Salmon Riv. 30,000 U.S. v. Or.

Yearling Magic Valley Valley Creek 30,000 U.S. v. Or.

Yearling Magic Valley Yankee Fork Salmon Riv. 160,000 U.S. v. Or.

yearling Hagerman Nat. Sawtooth Hatchery weir 750,000 production

Yearling Hagerman Nat. Yankee Fork Salmon River 140,000 U.S. v. Or.

Yearling Hagerman Nat. Little Salmon River, Stinky Sp. 160,000 U.S. v. Or.

Yearling Hagerman Nat. Little Salmon River, Hazard Cr. 40,000 U.S. v. Or.

yearling Niagara Springs Little Whits Salmon River 415,000

yearling Niagara Springs Pahsimeroi River 830,000

Eyed-eggs Sawtooth Salmon River Tributaries 370,000 SBT

Eyed-eggs Pahsimeroi Salmon River Tributaries 625,000 SBT
All fish reared in Snake River subbasin.

Data source:

PI HGMPs
PI

10.3 Actual numbers and sizes of fish released by age class through the program.

>

Eggs/Unfed Fry Release	Fry Release	Fingerling Release	Yearling
Avg	Avg	Avg	

	Release Year	Number	Date (MM/DD)	Size (fpp)	Number	Date (MM/DD)	size (fpp)	Number	Date (MM/DD)	Size (fpp)	Number	D (MM
	1991	nya	nya	nya	nya	nya	nya	nya	nya	nya	610,100	April
	1992	nya	nya	nya	nya	nya	nya	nya	nya	nya	727,706	April
	1993	nya	nya	nya	nya	nya	nya	nya	nya	nya	761,800	April
	1994	nya	nya	nya	nya	nya	nya	nya	nya	nya	864,388	April
	1995	nya	nya	nya	nya	nya	nya	nya	nya	nya	829,277	April
196	**1996**	nya	nya	nya	nya	nya	nya	nya	nya	nya	820,410	April
	1997	nya	nya	nya	nya	nya	nya	nya	nya	nya	830,654	April
	1998	nya	nya	nya	nya	nya	nya	nya	nya	nya	801,541	April
	1999	nya	nya	nya	nya	nya	nya	nya	nya	nya	829,199	April
	2000	nya	nya	nya	nya	nya	nya	nya	nya	nya	830,316	April
	2001	nya	nya	nya	nya	nya	nya	nya	nya	nya	889,955	April
	2002	nya	nya	nya	nya	nya	nya	nya	nya	nya	836,713	April
	Avg	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya	nya

Comments:

nc

Data source:

Niagara Springs Hatchery annual Reports

10.4 Actual dates of release and description of release protocols.

84 Fish are NOT released at sizes similar to natural fish of the same stage and species.
85 Fish are released at a time, size, location, and in a manner that achieves harvest goals for the stock.
86
88 Fish are released in a manner that simulates natural seasonal migration patterns.
89 Fish are released at an optimum time and size that has been determined by an on-site survival study.
90 Fish are released at an optimum time and size that has been determined by survival studies from another facility.
91 Fish are released at a time and size specified in an established juvenile production goal.
92 The carrying capacity of the subbasin has been taken into consideration in sizing this program.
87 The migratory state of the release population is determined by other criteria .

Comments:

Niagra Springs Hatchery

Niagra Springs Hatchery

Produce 1-yr smolt released Apr-May
also a function of transportation limitations.

Niagra Springs Hatchery: Found lower residualism for fish released after April 9.

Previous basin-wide studies and M&E programs - data available from USFWS

Niagra Springs Hatchery - 4.5 fpp

MVH - NMFS limits size of fish to minimize potential predation on chinook.

Niagra Springs Hatchery: no. spread releases over outmigration window.

MVH: coordinate releases with snow melt, river temps, and irrigation withdrawals

HNFH: coordinate releases with weather, spring flows and river temps

Use previous data to determine migration window. Releases occur within this window as regulated by NMFS permits or trar limitations.

NSH: d-found fish released prior to March 24 residualized. After this time fish on-site begin pushing against tail screens.

HNFH: f-fish are smolted by third week in April.

Data source:

PI
PI
PI
PI
PI
PI
PI
PI
PI

10.5 Fish transportation procedures, if applicable.

96 Fish are NOT released in the same subbasin as the rearing facility.

	Equipment Type	Capacity (gallons)	Supplemental Oxygen (y/n)	Temperature Control (y/n)	Normal Transit Time (minutes)	Chemical (s) Used	Dc (I
	Tank	500	Y	Y	60	None	nya
187	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya
	nya	nya	nya	nya	nya	nya	nya

Comments:

All fish reared in Snake River subbasin.

Pahsimeroi data above.

NSH: 5,000 gal tank with O2, no temperature control or other chemicals used; transit time 240-360 min.

MVH, HNFH: Loading and transportation procedures are similar among rearing hatcheries. Generally, yearlings are crowded and pumped into 5,000 gallon transport trucks using an 8 inch Magic Valley Heliarc pump and dewatering tower. Transport w temperature is chilled to approximately 7.2°C . Approximately 5,000 pounds of fish are loaded into each truck. Transport dura sites is ranges from 4 to 9 hours. Trucks are equipped with oxygen and fresh flow agitator systems. Fish are not fed for up to to loading and transporting.

Data source:

PI
PI

10.6 Acclimation procedures (*methods applied and length of time*).

166 No fish acclimation proceedures are used, fish are directly releases into the river, have tried acclimation but found not differ survival.

Comments:

nc

Data source:

PI

10.7 Marks applied, and proportions of the total hatchery population marked, to identify hatcl adults.

100 Marking techniques are used to distinguish among hatchery population segments.

101 100% of the hatchery fish are NOT marked so they can be distinguished from the natural population.

102 Marked fish can be identified using non-lethal means.

Comments:

MVH, NSH: subsamples of fish are differentially marked to distinguish between release groups.

HNFH: no

Niagra Springs Hatchery: 100% marked

HNFH, MVH: portion of fish unmarked for natural recovery and to fulfill tribal obligations.

All harvest mitigation fish are marked with an adipose fin clip. To evaluate emigration success and timing to main stem dam inserted in production release groups annually. To evaluate adult return success, CWT tags are inserted in release groups Coded wire-tagged fish may receive an additional ventral fin clip. Other releases may be released unmarked.

nc

Data source:

PI
PI
PI

10.8 Disposition plans for fish identified at the time of release as surplus to programmed or a levels

167 No surplus fish

163 Surplus eggs are collected mainly as a safeguard against potential incubation loses.

Comments:

nc
nc

Data source:

PI
PI

10.9 Fish health certification procedures applied pre-release.

97 All fish are examined for the presence of “reportable pathogens” as defined in the PNFHPC disease control guidelines, with prior to release.

98 Fish transfers into the subbasin are inspected and accompanied by notifications as described in IHOT and PNFHPC guideli

Comments:

Niagra Springs Hatchery

Data source:

PI
PI

10.10 Emergency release procedures in response to flooding or water system failure.

Pahsimeroi:Release all fish.

168 NSH:Flooding would only occur if dams were breached. In hatchery building-If the main water supply pipeline is compromis immediately be piped to outside raceways. Each vat is equipped with a sliding gate valve for fast discharge of fish to outsid Eyed eggs could be transported to MVH with pathologist's approval, or be placed in outside raceways with different water s fry could also be placed in outside raceways. NSH main hatchery water supply - If Niagara Springs ceases to flow immedia concrete intake pipeline is broken, fish will be forcibly released (by pulling tailscreens and dam boards) into Niagara Spring immediate ride to the Snake River, if all other options will cause loss of fish. If flows are reduced instantly, pure oxygen can into air cleaning lines already in bottom of racewyas until densities can be reduced or flows restored.

Sawtooth, MVH, HNFH: Emergency procedures are in place to guide activities in the event of potential catastrophic event. I trouble shooting and repair process followed by the implementation of an emergency action plan if the problem can not be r Emergency actions include fish consolidations, transfers to other rearing hatcheries in the Hagerman Valley, and suppleme oxygenation.

Comments:

nc

Data source:

PI, HGMPs

10.11 Indicate risk aversion measures that will be applied to minimize the likelihood for advers and ecological effects to listed fish resulting from fish releases.

84 Fish are NOT released at sizes similar to natural fish of the same stage and species.

86

88 Fish are released in a manner that simulates natural seasonal migration patterns.

89 Fish are released at an optimum time and size that has been determined by an on-site survival study.

91 Fish are released at a time and size specified in an established juvenile production goal.

104 The percent of the naturally spawning population in the subbasin that consists of adults from the program is 0-5% (less tha

The percent of hatchery fish spawning in the wild is estimated by:

105

- Escapement data from a weir or dam

95

94 Fish are released within the historic range for that stock.

93 The carrying capacity of the subbasin was taken into account when determining the number of fish to be released.

Comments:

Produce 1-yr smolt released Apr-May
Niagra Springs Hatchery

also a function of transportation limitations.

Niagra Springs Hatchery: Found lower residualism for fish released after April 9.

Niagra Springs Hatchery - 4.5 fpp

MVH - NMFS limits size of fish to minimize potential predation on chinook.

nc
nc
nc
Produce 1-yr smolt released Apr-May

nc
Based on information developed by IDFG Fish Policy Bureau and Research Staff information.

Data source:

PI
PI
PI
PI
nds

PI
PI
PI
PI
PI
PI, PI with Tom Rodgers (IDFG), 4/11/2003

Section 11. Monitoring and Evaluation of Performance Indicators

11.1.1 Describe plans and methods proposed to collect data necessary to respond to each "Perf Indicator" identified for the program.

144 nya

Comments:

nc

Data source:

HGMP

11.1.2 Indicate whether funding, staffing, and other support logistics are available or committe implementation of the monitoring and evaluation program.

146 Yes, funding, staffing and support logistics are dedicated to the existing monitoring and evaluation program through the LSI and the Idaho Power Company. Additional monitoring and evaluation activities (that contribute effort and information to add or common objectives) are associated with BPA Fish and Wildlife programs.

Comments:

nc

Data source:

PI

11.2 Indicate risk aversion measures that will be applied to minimize the likelihood for advers and ecological effects to listed fish resulting from monitoring and evaluation activities.

Risk aversion measures for research activities associated with the evaluation of the Lower Snake River Compensation Prog specified in ESA Section 7 Consultation documents, ESA Section 10 Incidental Take Permits (IDFG permit Nos. 919, 920, summary of the nature of actions taken is provided below.

Adult handling activities are conducted to minimize impacts to ESA-listed, non-target species. Adult and juvenile weirs and are engineered properly and installed in locations that minimize adverse impacts to both target and non-target species. All t facilities are constantly monitored to minimize a variety of risks (e.g., high water periods, high emigration or escapement pe security).

147 Adult spawner and redd surveys are conducted to minimize potential risks to all life stages of ESA-listed species. The IDFG formal redd count training annually. During surveys, care is taken to not disturb ESA-listed species and to not walk in the vi completed redds.

Snorkel surveys conducted primarily to assess juvenile abundance and density are conducted in index sections only to min disturbance to ESA-listed species. Displacement of fish is kept to a minimum.

Marking and tagging activities are designed to protect ESA-listed species and allow mitigation harvest objectives to be purs hatchery-produced, mitigation steelhead are visibly marked to differentiate them from their wild/natural counterpart.

Comments:

nc

Data source:

HGMP

Section 12. Research

12.1 Objective or purpose.

169 dna

Comments:

nc

Data source:

PI, HGMP

12.2 Cooperating and funding agencies.

U.S. Fish and Wildlife Service ? Lower Snake River Compensation Plan Office.

Shoshone-Bannock Tribes

170 U.S. v. Oregon parties

Idaho Power Company

Comments:

nc

Data source:

PI, HGMP

12.3 Principle investigator or project supervisor and staff.

171 Steve Yundt, Fisheries Research Manager, Idaho Department of Fish and Game.

Comments:

nc

Data source:

PI, HGMP

12.4 Status of stock, particularly the group affected by project, if different than the stock(s) c in Section 2.

172 dna

Comments:

null

Data source:

PI, HGMP

12.5 Techniques: include capture methods, drugs, samples collected, tags applied.

173 dna

Comments:

nc

Data source:

PI, HGMP

12.6 Dates or time periods in which research activity occurs.

174 dna

Comments:

nc

Data source:

PI, HGMP

12.7 Care and maintenance of live fish or eggs, holding duration, transport methods.

175 Research activities that involve the handling of eggs or fish apply the same protocols reviewed in Section 9 of HGMP. Hatcl generally assist with all cooperative activities involving the handling of eggs or fish.

Comments:

nc

Data source:

PI, HGMP

12.8 Expected type and effects of take and potential for injury or mortality.

176 See Table 1, HGMP. Generally, take for research activities is defined as: ?observe/harass?, ?capture/handle/release? and handle, mark, tissue sample, release.?

Comments:

nc

Data source:

PI, HGMP

12.9 Level of take of listed fish: number of range or fish handled, injured, or killed by sex, age, not already indicated in Section 2 and the attached "take table" (Table 1).

Steelhead B (East Fork) - Integrated

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

	Annual Take of Listed Fish by life Stage (number of fish)				
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (Johnson Creek)

ESU/Population nya

Activity nya

181 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program Operator nya

	Annual Take of Listed Fish by life Stage (number of fish)				
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (McCall Hatchery)

ESU/Population nya

Activity nya

	Location of hatchery activity	nya
181	**Dates of activity**	nya
	Hatchery Program Operator	nya

	Annual Take of Listed Fish by life Stage (number of fish)				
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook (Rapid River) - Hatchery

	ESU/Population	nya
	Activity	nya
181	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

	Annual Take of Listed Fish by life Stage (number of fish)				
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya

Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (Pahsimeroi)

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

182

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook (Upper Salmon/Sawtooth)

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

182

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya

Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook - Natural

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

182

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook - Natural

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
182	**Removal (e.g., brookstock (e)**	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Run (Pahsimeroi)- Hatchery

181	**ESU/Population**	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	entire run	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	2	nya
	Other take (specify) (h)	nya	nya	nya	10

Steelhead B (Dworshak)-Hatchery

181	**ESU/Population**	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

182

Type of Take	Annual Take of Listed Fish by life Stage (number of fish) Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

181

Steelhead B-Natural

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

182

Type of Take	Annual Take of Listed Fish by life Stage (number of fish) Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Natural

ESU/Population	nya
Activity	nya

	Location of hatchery activity	nya
181	**Dates of activity**	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Redfish Lake Sockeye

	ESU/Population	nya
	Activity	nya
181	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
182	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya

Other take (specify) (h)	nya	nya	nya	nya

Spring/Summer Chinook (W. Fork Yankee Fork- Salmon River)- Integrated

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

182

Type of Take	**Annual Take of Listed Fish by life Stage (number of fish)**			
	Egg/Fry	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Spring/Summer Chinook (East Fork Salmon River)- Integrated

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

182

Type of Take	**Annual Take of Listed Fish by life Stage (number of fish)**			
	Egg/Fry	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya

Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Lemhi River Spring_Summer Chinook

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

182

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Run (Sawtooth)- Hatchery

181

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya

	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
182	**Removal (e.g., brookstock (e)**	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Comments:

nc
not filled out in Table 1 of HGMP

nc

Data source:

PI, HGMP Table 1
nds
HGMP

12.10 Alternative methods to achieve project objects.

177 dna

Comments:

nc

Data source:

PI, HGMP

12.11 List species similar or related to the threatened species; provide number and causes of r related to this research project.

178 NA

Comments:

nc

Data source:

PI, HGMP

12.12 Indicate risk aversion measures that will be applied to minimize the likelihood for advers ecological effects, injury or mortality to listed fish as a result of the proposed research a

179 dna

Comments:

nc

Data source:

PI, HGMP

Section 13. Attachments and Citations

13.1 Attachments and Citations

197 nya

Comments:

nc

Data source:

HGMPs

Section 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

14.1 Certification Language and Signature of Responsible Party

“I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973.”

Name, Title, and Signature of Applicant:

Certified by_____________________________ Date:_____________

APPENDIX 2-13—SALMON RIVER A-RUN STEELHEAD HATCHERY AND GENETIC MANAGEMENT PLAN

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	**Salmon River Basin, A-Run Steelhead** Sawtooth Fish Hatchery Magic Valley Fish Hatchery Hagerman National Fish Hatchery
Species or Hatchery Stock:	Summer Steelhead A-run *Oncorhynchus mykiss.*
Agency/Operator:	Idaho Department of Fish and Game
Watershed and Region:	Salmon River, Idaho.
Date Submitted:	September 30, 2002
Date Last Updated:	September 30, 2002

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Hatchery: Sawtooth Fish Hatchery
Magic Valley Fish Hatchery
Hagerman National Fish Hatchery

Program: A-Run Steelhead

1.2) Species and population (or stock) under propagation, and ESA status.

Summer Steelhead *Oncorhynchus mykiss*.
Hatchery population not ESA-listed.

1.3) Responsible organization and individuals

Lead Contact
Name (and title): Sharon W. Kiefer, Anadromous Fish Manager.
Agency or Tribe: Idaho Department of Fish and Game.
Address: 600 S. Walnut, P.O. Box 25, Boise, ID 83707.
Telephone: (208) 334-3791.
Fax: (208) 334-2114.
Email: skiefer@idfg.state.id.us

On-site Operations Lead
Name (and title): Brent Snider, Fish Hatchery Manager II, Sawtooth Fish Hatchery.
Agency or Tribe: Idaho Department of Fish and Game.
Address: HC 64 Box 9905 Stanley, ID 83278.
Telephone: (208) 774-3684.
Fax: (208) 774-3413.
Email: bsnider@idfg.state.id.us

Name (and title): Rick Lowell, Fish Hatchery Manager II, Magic Valley Fish Hatchery.
Agency or Tribe: Idaho Department of Fish and Game.
Address: 2036 River Road, Filer, ID 83328.
Telephone: (208) 326-3230.
Fax: (208) 326-3354.
Email: rlowell@idfg.state.id.us

Name (and title): Bryan Kenworthy, Hatchery Manager, Hagerman Nat. Fish Hatchery.
Agency or Tribe: U.S. Fish and Wildlife Service.
Address: 3059-D National Fish Hatchery Rd., Hagerman, ID
Telephone: (208) 837-4896.
Fax: (208) 837-6225.
Email: bryan_kenworthy@fws.gov

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

U.S. Fish and Wildlife Service – Lower Snake River Compensation Plan Office: Administers the Lower Snake River Compensation Plan as authorized by the Water Resources Development Act of 1976.

U.S v. Oregon Parties – The Sawtooth Fish Hatchery may incubate A-run steelhead eggs for streamside and or in stream incubation programs as identified in interim management agreements associated with the development of the Columbia River Fish Management Plan under the U.S. V. Oregon process.

1.4) Funding source, staffing level, and annual hatchery program operational costs.

Sawtooth Fish Hatchery
U.S. Fish and Wildlife Service – Lower Snake River Compensation Plan funded.
Staffing level: 5 FTE.
Annual budget: $850,000.

Magic Valley Fish Hatchery
U.S. Fish and Wildlife Service – Lower Snake River Compensation Plan funded.
Staffing level: 4 FTE.
Annual budget: $750,000.

Hagerman National Fish Hatchery
U.S. Fish and Wildlife Service – Lower Snake River Compensation Plan funded.

1.5) Location(s) of hatchery and associated facilities.

Sawtooth Fish Hatchery – The Sawtooth Fish Hatchery is located on the upper Salmon River approximately 8.0 kilometers south of Stanley, Idaho. The river kilometer code for the facility is 503.303.617. The hydrologic unit code for the facility is 17060201.

Magic Valley Fish Hatchery – The Magic Valley Fish Hatchery is located adjacent to the Snake River approximately 11.2 kilometers northwest of Filer, Idaho. There is no river kilometer code for the facility. The hydrologic unit code for the facility is 17040212.

Hagerman National Fish Hatchery - The Hagerman National Fish Hatchery is located approximately 4.8 kilometers south and 3.2 kilometers east of Hagerman, Idaho. There is no river kilometer code for the facility. The hydrologic unit code for the facility is 17040212.

1.6) Type of program.

Lower Snake River Compensation Plan - The upper Salmon River A-run steelhead program was designed as an *Isolated Harvest Program*. However, some broodstock management, eyed-egg production, and smolt production may occur to support ongoing Shoshone-Bannock Tribes streamside and in stream incubation programs and smolt release programs for natural production augmentation pursuant to U.S. v. Oregon agreements. The Sawtooth Fish Hatchery, Magic Valley Fish Hatchery and the Hagerman National Fish Hatchery are associated with the Salmon River A-run steelhead program.

1.7) Purpose (Goal) of program.

Mitigation - The goal of the Lower Snake River Compensation Plan is to return approximately 25,000 adult steelhead to the project area above Lower Granite Dam to mitigate for survival reductions resulting from construction and operation of the four lower Snake River dams.

1.8) Justification for the program.

The primary purpose of this program is harvest mitigation. The Lower Snake River Compensation Program has been in operation since 1983 to provide for mitigation for lost steelhead production caused by the construction and operation of the four lower Snake River dams. The 1999 NMFS Biological Opinion on Artificial Propagation in the Columbia River Basin (NMFS 1999) concluded that Snake River summer steelhead artificial propagation actions are expected to adversely affect listed Snake River summer steelhead. The release of hatchery steelhead into natural production areas is expected to result in predation and competition with listed steelhead juveniles. The Biological Opinion provided reasonable and prudent alternatives to avoid jeopardy.

The LSRCP steelhead program in the Salmon River is managed as an integrated program with Idaho Power Company hatcheries. Idaho Power Company hatcheries are operated by the IDFG. These hatcheries, Pahsimeroi and Niagara Springs, are privately funded and not included in this federally sponsored HGMP.

Actions taken to minimize adverse effects on listed fish include:

1. Continuing fish health practices to minimize the incidence of infectious disease agents. Follow IHOT, AFS, and PNFHPC guidelines.

2. Reducing the number of steelhead released in the primary upper Salmon River salmon production area. The primary upper Salmon River production area includes the Salmon River from Warm Springs Creek upstream to the headwaters of the Salmon and East Fork Salmon rivers.

3. Acclimating steelhead at the Sawtooth Fish Hatchery for at least 2 weeks (when feasible). This action may increase smoltification and thus decrease the potential for residualism. We are evaluating this action to determine its benefit for reducing

residualism and increasing steelhead survival, which may lead to reduced release numbers.

4. Volitionally releasing acclimated steelhead at the Sawtooth Fish Hatchery prior to forced release (when feasible).

5. Moving release sites for steelhead not released at Sawtooth Fish Hatchery downstream to reduce potential for predation on chinook fry emerging or migrating from mainstem Salmon River and East Fork Salmon River redds.

6. Continuing to release steelhead in the lower Salmon River where natural chinook production is minimal or nonexistent.

7. Minimizing the number of smolts in the release population which are larger than 225 mm (or about 4 fpp).

8. Not releasing adult steelhead into chinook production areas, such as above weirs, in excess of estimated carrying capacity.

9. Continuing to reduce effect of the release of large numbers of juvenile steelhead at a single site by spreading the release over a number of days.

10. Programming time of release to mimic natural fish for releases, given the constraints of transportation.

11. Continuing research to improve post-release survival of steelhead to potentially reduce numbers released to meet management objectives.

12. Monitoring hatchery effluent to ensure compliance with National Pollutant Discharge Elimination System permit.

13. Continuing to externally mark hatchery steelhead released for harvest purposes with an adipose fin clip.

14. Continuing Hatchery Evaluation Studies (HES) to provide comprehensive monitoring and evaluation for LSRCP steelhead.

1.9) List of program "Performance Standards".

3.1 Legal Mandates.
3.2 Harvest.
3.3 Conservation of natural spawning populations.
3.4 Life History Characteristics.
3.5 Genetic Characteristics.
3.6 Research Activities.

3.7 Operation of Artificial Production Facilities.

1.10) List of program “Performance Indicators”, designated by "benefits" and "risks."

Note: Performance Standards and Indicators used to develop Sections 1.10.1 and 1.10.2 were taken from the final January 17, 2001 version of Performance Standards and Indicators for the Use of Artificial Production for Anadromous and Resident Fish Populations in the Pacific Northwest. Numbers referenced below correspond to numbers used in the above document.

3.1.1 Standard: Program contributes to fulfilling tribal trust responsibility mandates and treaty rights, as described in applicable agreements such as under U.S. v. Oregon and U.S. v. Washington.

Indicator 1: Total number of fish harvested in tribal fisheries targeting program.

3.1.2 Standard: Program contributes to mitigation requirements.

Indicator 1: Number of fish returning to mitigation requirements estimated.

3.1.3 Standard: Program addresses ESA responsibilities.

Indicator 1: ESA Section 7 Consultation completed.

3.2.1 Standard: Fish are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while avoiding over harvest of not-target species.

Indicator 1: Number of target fish caught by fishery estimated.
Indicator 2: Number of non-target fish caught in fishery estimated.
Indicator 3: Angler days by fishery estimated.
Indicator 4: Escapement of target fish estimated.

3.2.2 Standard: Release groups sufficiently marked in a manner consistent with information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries.

Indicator 1: Marking rate by type in each release group documented.
Indicator 2: Sampling rate by mark type for each fishery estimated.
Indicator 3: Number of marks by type observed in fishery documented.

3.3.1 Standard: Artificial propagation program contributes to an increasing number of spawners returning to natural spawning areas.

Indicator 1: Annual number of spawners on spawning grounds estimated in specific locations.

Indicator 2: Spawner-recruit ratios estimated is specific locations.
Indicator 3: Number of redds in natural production index areas documented in specific locations.

3.3.2 Standard: Releases are sufficiently marked to allow statistically significant evaluation of program contribution.

Indicator 1: Marking rates and type of mark documented.
Indicator 2: Number of marks identified in juvenile and adult groups documented.

1.10.2) "Performance Indicators" addressing risks.

3.4.1 Standard: Fish collected for broodstock are taken throughout the return in proportions approximating the timing and age structure of the population.

Indicator 1: Temporal distribution of broodstock collection managed.
Indicator 2: Age composition of broodstock collection managed.

3.4.2 Standard: Broodstock collection does not significantly reduce potential juvenile production in natural areas.

Indicator 1: No spawners of natural origin removed for broodstock.
Indicator 2: All natural origin spawners released to migrate to natural spawning areas.
Indicator 3: Number of adults, eggs or juveniles placed in natural rearing areas managed.

3.4.3 Standard: Life history characteristics of the natural population do not change as a result of this program.

Indicator 1: Life history characteristics of natural and hatchery-produced populations are measured (e.g., juvenile dispersal timing, juvenile size at outmigration, juvenile sex ratio at outmigration, adult return timing, adult age and sex ratio, spawn timing, hatch and swim-up timing, rearing densities, growth, diet, physical characteristics, fecundity, egg size).

3.4.4 Standard: Annual release numbers do not exceed estimated basin-wide and local habitat capacity.

Indicator 1: Annual release numbers, life-stage, size at release, length of acclimation documented.
Indicator 2: Location of releases documented.
Indicator 3: Timing of hatchery releases documented.

3.5.1 Standard: Patterns of genetic variation within and among natural populations do not change significantly as a result of artificial production.

Indicator 1: Genetic profiles of naturally-produced and hatchery-produced adults developed.

3.5.2 Standard: Collection of broodstock does not adversely impact the genetic diversity of the naturally spawning population.

Indicator 1: Total number of natural spawners reaching collection facilities documented.
Indicator 2: Total number of natural spawners estimated passing collection facilities documented.
Indicator 3: Timing of collection compared to overall run timing.

3.5.3 Standard: Artificially produced adults in natural production areas do not exceed appropriate proportion.

Indicator 1: Ratio of natural to hatchery-produced adults monitored (observed and estimated through fishery).
Indicator 2: Observed and estimated total numbers of natural and hatchery-produced adults passing counting stations.

3.5.4 Standard: Juveniles are released on-station, or after sufficient acclimation to maximize homing ability to intended return locations.

Indicator 1: Location of juvenile releases documented.
Indicator 2: Length of acclimation period documented.
Indicator 3: Release type (e.g., volitional or forced) documented.
Indicator 4: Adult straying documented.

3.5.5 Standard: Juveniles are released at fully smolted stage of development.

Indicator 1: Level of smoltification at release documented.
Indicator 1: Release type (e.g., forced or volitional) documented.

3.5.6 Standard: The number of adults returning to the hatchery that exceeds broodstock needs is declining.

Indicator 1: The number of adults in excess of broodstock needs documented in relation to mitigation goals of the program.

3.6.1 Standard: The artificial production program uses standard scientific procedures to evaluate various aspects of artificial production.

Indicator 1: Scientifically based experimental design with measurable objectives and hypotheses.

3.6.2. Standard: The artificial production program is monitored and evaluated on an appropriate schedule and scale to address progress toward achieving the experimental objectives.

Indicator 1: Monitoring and evaluation framework including detailed time line.
Indicator 2: Annual and final reports.

3.7.1 Standard: Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols.

Indicator 1: Annual reports indicating level of compliance with applicable standards and criteria.

3.7.2 Standard: Effluent from artificial production facility will not detrimentally affect natural populations.

Indicator 1: Discharge water quality compared to applicable water quality standards.

3.7.3 Standard: Water withdrawals and in stream water diversion structures for artificial production facility operation will not prevent access to natural spawning areas, affect spawning, or impact juveniles.

Indicator 1: Water withdrawals documented – no impacts to listed species.
Indicator 2: NMFS screening criteria adhered to.

3.7.4 Standard: Releases do not introduce pathogens not already existing in the local populations and do not significantly increase the levels of existing pathogens.

Indicator 1: Certification of juvenile fish health documented prior to release.

3.7.5 Standard: Any distribution of carcasses or other products for nutrient enhancement is accomplished in compliance with appropriate disease control regulations and guidelines.

Indicator 1: Number and location(s) of carcasses distributed to habitat documented.

3.7.6 Standard: Adult broodstock collection operation does not significantly alter spatial and temporal distribution of natural population.

Indicator 1: Spatial and temporal spawning distribution of natural population above and below trapping facilities monitored.

3.7.7 Standard: Weir/trap operations do not result in significant stress, injury, or mortality in natural populations.

Indicator 1: Mortality rates in trap documented. No ESA-listed fish targeted.
Indicator 2: Prespawning mortality rates of trapped fish in hatchery or after release documented. No ESA-listed fish targeted.

3.7.8 Standard: Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of natural fish.

Indicator 1: *Size and time of release of juvenile fish documented and compared to size and timing of natural fish.*

1.11) Expected size of program.

1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).

The Sawtooth Fish Hatchery functions as the broodstock collection and spawning station. Eggs produced at the Sawtooth Fish Hatchery are incubated through the eyed stage of development on station. Eyed-eggs are then transferred to the Magic Valley Fish Hatchery and Hagerman National Fish Hatchery for final incubation, hatch, and rearing to release. Eggs from the Pahsimeroi hatchery may be utilized to fill this program if annual shortages exist.

Sawtooth Fish Hatchery - A minimum of 450 A-run, summer steelhead females are needed to meet current program management objectives. The ratio of males to females needed is approximately 50:50 necessitating the need to trap and collect approximately 450 males. The maximum number of adult steelhead that can be held at the Sawtooth Fish Hatchery is approximately 2,500.

Magic Valley Fish Hatchery – No broodstock collection.

Hagerman National Fish Hatchery – No broodstock collection.

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location.

Note: the following abbreviations are used in the table:

Production = Lower Snake River Compensation Program,
SBT = Shoshone-Bannock Tribe streamside and in stream incubation.
U.S. v. Or. = U.S. V. Oregon agreement actions.

Life Stage	Facility	Release Location	Annual Release Level and purpose
Yearling	Magic Valley	Lemhi River	40,000 production
Yearling	Magic Valley	Salmon River, Lewis & Clark	50,000 production

Yearling	Magic Valley	Salmon River, Wagonhammer	40,000 production
Yearling	Magic Valley	Salmon River, Red Rock	40,000 production
Yearling	Magic Valley	Salmon River, Shoup Bridge	60,000 production
Yearling	Magic Valley	Salmon River, Eye Hole	50,000 production
Yearling	Magic Valley	Salmon River, Colston Corner	60,000 production
Yearling	Magic Valley	Salmon River, Lemhi Hole	80,000 production
Yearling	Magic Valley	Salmon River, Tunnel Rock	40,000 production
Yearling	Magic Valley	Salmon River, McNabb Pt.	80,000 production
Yearling	Magic Valley	Pahsimeroi Trap	30,000 production
Yearling	Magic Valley	Salmon River, Cottonwood	40,000 production
Yearling	Magic Valley	Salmon River, Hwy 93	40,000 production
Yearling	Magic Valley	Salmon River, Hammer Crk.	180,000 production
Yearling	Magic Valley	Lemhi River	80,000 U.S. v. Or.
Yearling	Magic Valley	Yankee Fork Salmon Riv.	30,000 U.S. v. Or.
Yearling	Magic Valley	Valley Creek	30,000 U.S. v. Or.
Yearling	Magic Valley	Yankee Fork Salmon Riv.	160,000 U.S. v. Or.
Yearling	Hagerman Nat.	Sawtooth Hatchery weir	750,000 production
Yearling	Hagerman Nat.	Yankee Fork Salmon River	140,000 U.S. v. Or.
Yearling	Hagerman Nat.	Little Salmon River, Stinky Sp.	160,000 U.S. v. Or.
Yearling	Hagerman Nat.	Little Salmon River, Hazard Cr.	40,000 U.S. v. Or.
Eyed-eggs	Sawtooth	Salmon River Tributaries	370,000 SBT
Eyed-eggs	Pahsimeroi	Salmon River Tributaries	625,000 SBT

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

Estimated smolt-to-adult survival rates are not available for the Salmon River A-run steelhead program due to the number of off-site release locations. Hatchery-produced adult return information for the last 12 years is presented below for the Sawtooth Fish Hatchery.

Sawtooth Fish Hatchery A-run steelhead adult return history. All natural fish are released upstream to spawn.

Return Year	Total Returns (Hatchery-Produced/Natural)	Total Ponded	Total Released	Total Male Returns	Total Female Returns
1991	261 (249/12)	170	91	213	48
1992	1,705 (1,661/44)	1,051	654	1,206	499
1993	1,591 (1,584/7)	923	668	1,154	437
1994	338 (332/6)	278	60	174	164
1995	532 (528/4)	434	98	379	153

1996	553 (545/8)	499	54	299	254
1997	1,243 (1,229/14)	1,089	361	767	476
1998	768 (762/6)	615	153	506	262
1999	933 (923/10)	869	64	529	404
2000	2,061 (2,046/15)	1,866	195	1,082	979
2001	3,055(3,018/37)	1,649	1,406	1,689	1,366
2002	7,104(7,009/95)	5,809	1,295	3,499	3,605

1.13) Date program started (years in operation), or is expected to start.

Sawtooth Fish Hatchery – In operation since 1985.

Magic Valley Fish Hatchery - The hatchery has been in operation since 1983. A new facility was constructed in 1988.

Hagerman National Fish Hatchery – In operation since 1980.

1.14) Expected duration of program.

This program is expected to continue indefinitely to provide mitigation under the Lower Snake River Compensation Plan and the Hells Canyon Settlement Agreement.

1.15) Watersheds targeted by program.

Listed by hydrologic unit code –

Salmon River (North Fork to Pahsimeroi River):	17060203
Salmon River (Pahsimeroi River to headwaters):	17060201
Lemhi River:	17060204
Pahsimeroi River:	17060202
Little Salmon River:	17060210
Main Salmon River:	17060209
Yankee Fork Salmon River:	17060201
Valley Creek:	17060201

1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

Lower Snake River Compensation Plan hatchery were constructed to mitigate for fish losses caused by construction and operation of the four lower Snake River federal hydroelectric dams. Lower Snake River Compensation Plan hatcheries have a combined goal of returning approximately 25,000 A-run, adult steelhead to the project area above Lower Granite Dam. The Idaho Department of Fish and Game's objective is to ensure that harvestable components of hatchery-produced steelhead are available to provide fishing opportunity, consistent with meeting spawning escapement and preserving the genetic integrity of natural populations (IDFG 1992). The Idaho Department of Fish and Game has not considered alternative actions for obtaining program goals. Stated goals are mandated by the U.S. Fish and Wildlife Service and through agreements with the Idaho Power Company.

SECTION 2. PROGRAM EFFECTS ON NMFS ESA-LISTED SALMONID POPULATIONS. (USFWS ESA-Listed Salmonid Species and Non-Salmonid Species are addressed in Addendum A)

2.1) List all ESA permits or authorizations in hand for the hatchery program.

Section 7 Consultation with U.S. Fish and Wildlife Service (April 2, 1999) resulting in NMFS Biological Opinion for the Lower Snake River Compensation Program.

2.2) Provide descriptions, status, and projected take actions and levels for NMFS ESA-listed natural populations in the target area.

2.2.1) Description of NMFS ESA-listed salmonid population(s) affected by the program.

The following excerpts on the present status of Salmon River basin steelhead were taken from the Draft Subbasin Summary for the Salmon Subbasin of the Mountain Snake Province (NPPC 2001) and from the Status Review of West Coast Steelhead from Washington, Idaho, Oregon, and California (Busby et al. 1996).

The 1999 NMFS Biological Opinion on Artificial Propagation in the Columbia River Basin (NMFS 1999) concluded that Snake River summer steelhead artificial propagation actions are expected to adversely effect listed Snake River summer steelhead. The release of hatchery steelhead into natural production areas is expected to result in predation and competition with listed steelhead juveniles.

The Salmon River basin steelhead ESU occupies the Snake River Basin of southeast Washington, northeast Oregon, and Idaho. This region is ecologically complex and supports a diversity of steelhead populations; however, genetic and meristic data suggest that these populations are more similar to each other than they are to steelhead populations occurring outside of the Snake River Basin. Snake River Basin steelhead spawning areas are well isolated from other populations and include the highest elevations for spawning (up to 2,000 m) as well as the longest migration distance from the ocean (up to 1,500 km). Snake River steelhead are often classified into two groups, A- and B-run, based on migration timing, ocean age, and adult size. While total (hatchery + natural) run size for Snake River steelhead has increased since the mid-1970s, the increase has resulted from increased production of hatchery fish, and there has been a severe recent decline in natural run size. The majority of natural stocks for which we have data within this ESU have been declining. Parr densities in natural production areas have been substantially below estimated capacity in recent years. Downward trends and low parr densities indicate a particularly severe problem for B-run steelhead, the loss of which would substantially reduce life history diversity within this ESU. The BRT had a strong concern about the pervasive opportunity for genetic introgression from hatchery stocks within the ESU. There was also concern about the degradation of freshwater habitats within the region, especially the effects of grazing, irrigation diversions, and hydroelectric dams.

Areas of the subbasin upstream of the Middle Fork have been stocked with hatchery steelhead, and the IDFG has classified these runs of steelhead as natural. The majority of these steelhead are progeny of introduced hatchery stocks from the Snake River. With the construction of Hell's Canyon Dam in the 1960s, the US Fish and Wildlife Service, Army Corps of Engineer, US Forest Service, Bonneville Power Administration, Bureau of Reclamation, and Idaho Department of Fish and Game attempted to mitigate the affects of the dam by establishing a hatchery-managed, sport fishery in the upper Salmon River. Naturally produced steelhead upstream of the Middle Fork are classified as A- run, based upon characteristics of size, ocean age, and timing. Out of subbasin Snake River A-run steelhead have been released extensively in this area, and it is unlikely any wild, native populations still exist.

Both recent and historical data on the spawning populations of steelhead in specific streams within the Salmon Subbasin are very limited. Mallet (1974) estimated that historically 55% of all Columbia River steelhead trout originated from the Snake River basin, which includes the Salmon Subbasin. Though not quantified, it is likely a large proportion of these fish were produced in the Salmon Subbasin. Monitoring data from subbasins within the Mountain Snake Province (of which the Salmon Subbasin is a primary component) shows a general decline in parr densities for steelhead.

- Identify the NMFS ESA-listed population(s) that will be directly affected by the program

The operation of the hatcheries described in this HGMP is expected to have no direct affect on ESA-listed species.

- Identify the NMFS ESA-listed population(s) that may be incidentally affected by the program.

Snake River Fall-run chinook salmon ESU (T – 4/92)

Snake River Spring/Summer-run chinook salmon ESU (T – 4/92)

Snake River sockeye salmon ESU (E – 11/91)

Snake River Basin steelhead ESU (T – 8/97)

Bull trout (T – 6/98)

2.2.2) Status of NMFS ESA-listed salmonid population(s) affected by the program.

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds.

Hatchery-origin A-run steelhead at Sawtooth Fish Hatchery are excluded from the ESU. No wild/natural, ESA-listed steelhead adults or juveniles are collected or directly affected as part of the hatchery mitigation programs described in this HGMP. See Section 2.2.1 above. The NMFS has identified interim abundance and productivity targets for Columbia Basin salmon and steelhead listed under the ESA. Snake River A-run steelhead abundance targets for local spawning aggregates area:

1) Upper Salmon River: 4,700

- Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.

Hatchery-origin A-run steelhead at Sawtooth Fish Hatchery are excluded from the ESU. No wild/natural, ESA-listed summer steelhead adults or juveniles are collected or directly affected as part of the hatchery mitigation programs described in this HGMP.

- Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

Hatchery-origin A-run steelhead at Sawtooth Fish Hatchery are excluded from the ESU. No wild/natural, ESA-listed summer steelhead adults or juveniles are collected or directly affected as part of the hatchery mitigation programs described in this HGMP.

- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

Hatchery-origin A-run steelhead at Sawtooth Fish Hatchery are excluded from the ESU. No wild/natural, ESA-listed summer steelhead adults or juveniles are collected or directly affected as part of the hatchery mitigation programs described in this HGMP.

2.2.3) Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of NMFS listed fish in the target area, and provide estimated annual levels of take.

See below.

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

ESA-listed, A-run steelhead are collected during broodstock collections at Sawtooth Fish Hatchery. Adults are passed upstream with a minimum of delay and handling. Incidental take of ESA- listed Snake River chinook or sockeye salmon is unlikely during steelhead broodstock collection. Steelhead broodstock collection occurs in the upper Salmon River from March through early May. Fall chinook salmon are not present in the upper Salmon River (Mendel et al. 1992). Neither adult spring/summer chinook nor sockeye salmon are usually present in the upper Salmon River until mid-May or later (Sankovich and Bjornn 1992). Therefore, we believe there will be no adverse from broodstock collection at current hatchery weirs, or weirs developed in the future to accommodate additional hatchery steelhead broodstock collection.

- Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish.

Known take of ESA-listed Snake River steelhead at Sawtooth Fish Hatchery. Readers should note that Snake River steelhead were listed in August of 1997. For perspective, the past 10 years of weir data are presented.

Trap year	Natural fish trapped at Sawtooth Hatchery
1992	44
1993	7
1994	6
1995	4
1996	8
1997	14
1998	6
1999	10
2000	15
2001	37
2002	95

- Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).

All adult steelhead (hatchery- and natural-origin) are trapped and handled at the Sawtooth Fish Hatchery weir. The numbers of natural-origin adults varies annually (see above table). Currently, all natural-origin adults are passed upstream for spawning. Following capture, natural-origin fish may be marked and tissue sampled before release. See Table 1 (attached).

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this

plan for the program.

It is unlikely that take levels for natural A-run steelhead will exceed projected take levels presented in Table 1 (attached). However, in the unlikely event that this occurs, the IDFG will consult with NMFS Sustainable Fisheries Division or Protected Resource Division staff and agree to an action plan. We assume that any contingency plan will include a provision to discontinue hatchery-origin, steelhead trapping activities.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.

This program conforms with the plans and policies of the Lower Snake River Compensation Program administered by the U.S. Fish and Wildlife Service to mitigate for the loss of steelhead production caused by the construction and operation of the four dams on the lower Snake River.

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.

Cooperative Agreement between the U.S. Fish and Wildlife Service and the Idaho Department of Fish and Game, USFWS Agreement No.: 141102J010 (for Lower Snake River Compensation Plan monitoring and evaluation studies).

Cooperative Agreement between the U.S. Fish and Wildlife Service and the Idaho Department of Fish and Game, USFWS Agreement No.: 141102J009 (for Lower Snake River Compensation Plan hatchery operations).

1999 through 2002 Management Agreement for upper Columbia River Fall Chinook, Steelhead and Coho pursuant to United States of America v. State of Oregon, U.S. District Court, District of Oregon.

3.3) Relationship to harvest objectives.

The Lower Snake River Compensation Plan defined replacement of adults “in place” and “in kind” for appropriate state management purposes. The Idaho Department of Fish and Game, the U.S. Fish and Wildlife Service, and other tribal and agency fish managers work cooperatively to develop annual production and mark plans. Juvenile production and adult escapement targets were established at the outset of the LSRCP program.

As part of its harvest management and monitoring program, the IDFG conducts annual creel and angler surveys to assess the contribution program fish make toward meeting program harvest objectives.

3.3.1) Describe fisheries benefiting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

Information presented in the following table includes release and harvest data for all A-run steelhead released from the Magic Valley, Hagerman National, and Niagara Springs fish hatcheries.

Salmon River Releases and Sport Harvest of "A" Steelhead, 1988 - 1997

Release Year	No. Fish Released	Release Site	Rearing Hatchery	Est. No. Harvested	Hatchery Returns	Total	SAR (#Ret/#Rel)
1997	84,715	Sawtooth Hatchery	MVFH	177	88	265	0.31
1997	601,349	Sawtooth Hatchery	HNFH	1,262	622	1,884	0.31
1997	65,420	Salmon River at Torrey's Hole	HNFH	228	60	288	0.44
1997	154,471	Salmon River at McNabb's Point	MVFH	249	219	468	0.30
1997	75,946	Salmon River at McNabb's Point	HNFH	122	108	230	0.30
1997	150,280	Salmon River at Bruno's Bridge	MVFH	242	214	456	0.30
1997	830,654	Pahsimeroi Hatchery	NSFH	1,433	1,168	2,601	0.31
1997	241,510	Salmon River at Lemhi River	MVFH	595	344	939	0.39
1997	134,310	Salmon River at North Fork Salmon River	MVFH	545	190	735	0.55
1997	137,833	Salmon River at Hammer Creek	NSFH	329	329	658	0.48
1997	29,700	Salmon River at Pine Bar Rapids	NSFH	73	73	146	0.49
1997	342,281	Little Salmon River	HNFH	161	746	907	0.26
1997	94,815	Little Salmon River at Warm Springs Bridge	NSFH	0	162	162	0.17
1997	**2,943,284**	**Subtotal 1997 'A' Releases**		**5,416**	**4,323**	**9,739**	**0.33**
1996	708,109	Sawtooth Hatchery	HNFH	2,141	628	2,769	0.39
1996	66,022	Salmon River at Torrey's Hole	HNFH	201	47	248	0.38
1996	201,968	Salmon River at McNabb's Point	MVFH	800	345	1,145	0.57
1996	207,245	Salmon River at Bruno's Bridge	MVFH	509	306	815	0.39
1996	799,220	Pahsimeroi River at Trap	NSFH	3,842	1,754	5,596	0.70
1996	21,196	Pahsimeroi Ponds	HNFH	102	47	149	0.70
1996	201,212	Salmon River at Lemhi River	MVFH	921	462	1,383	0.69
1996	127,708	Salmon River at North Fork Salmon River	MVFH	997	365	1,362	1.07
1996	106,025	Salmon River at Hammer Creek	NSFH	39	39	78	0.07
1996	30,090	Salmon River at Pine Bar Rapids	NSFH	11	11	22	0.07
1996	529,266	Little Salmon River	HNFH	1,224	1,224	2,448	0.46
1996	158,008	Little Salmon River	NSFH	46	46	92	0.06
1996	**3,156,069**	**Subtotal 1996 'A' Releases**		**10,833**	**5,274**	**16,107**	**0.51**
1995	184,435	Sawtooth Hatchery	HNFH	674	214	888	0.48
1995	500,571	Sawtooth Hatchery (246,302 - PFH)	HNFH	3196	1059	4255	0.85
1995	64,167	Salmon River at Torrey's Hole	HNFH	262	104	366	0.57
1995	207,845	Salmon River at McNabb's Point	MVFH	1,106	414	1,520	0.73

1995	162,870	Salmon River at Bruno's Bridge	MVFH	1,095	440	1,535	0.94
1995	829,278	Pahsimeroi	NSFH	3,890	2,425	6,315	0.76
1995	198,270	Salmon River at Lemhi River	MVFH	1,018	689	1,707	0.86
1995	115,050	Salmon River at North Fork Salmon River	MVFH	934	464	1,398	1.22
1995	97,221	Salmon River at Hammer Creek	NSFH	115	115	230	0.24
1995	29,400	Salmon River at Pine Bar Rapids	NSFH	35	35	70	0.24
1995	131,157	Little Salmon River	NSFH	625	625	1,250	0.95
1995	84,853	Little Salmon River	HNFH	98	98	196	0.23
1995	316,011	Little Salmon River (43,988 - PFH)	HNFH	554	553	1107	0.35
1995	**2,921,128**	**Subtotal 1995 'A' Releases**		**13,602**	**7,235**	**20,837**	**0.71**
1994	773,134	Sawtooth Hatchery	HNFH	2,027	484	2,511	0.32
1994	182,083	Salmon River at Bruno's Bridge	HNFH	415	183	598	0.33
1994	199,962	Salmon River at Challis	NSFH	1,010	229	1,239	0.62
1994	484,440	Pahsimeroi Hatchery	MVFH	1,955	1,178	3,133	0.65
1994	379,948	Pahsimeroi River	NSFH	1,464	1,778	3,242	0.85
1994	235,788	Salmon River at Lemhi River	HNFH	646	256	902	0.38
1994	134,979	North Fork Salmon River	NSFH	802	442	1,244	0.92
1994	193,022	Salmon River at Hammer Creek	NSFH	82	91	173	0.09
1994	21,070	Salmon River at Pine Bar Rapids	NSFH	10	8	18	0.09
1994	328,163	Little Salmon River	HNFH	72	72	144	0.04
1994	467,550	Little Salmon River	MVFH	132	132	264	0.06
1994	**3,400,139**	**Subtotal 1994 'A' Releases**		**8,615**	**4,853**	**13,468**	**0.40**
1993	125,129	Sawtooth Hatchery	HNFH	251	70	321	0.26
1993	604,391	Sawtooth Hatchery (140,626 - SFH)	HNFH	2674	611	3285	0.54
1993	260,600	Salmon River at Challis	MVFH	488	283	771	0.30
1993	266,300	Salmon River at Ellis Bridge	MVFH	312	201	513	0.19
1993	760,800	Pahsimeroi Trap	NSFH	1,698	1,415	3,113	0.41
1993	198,500	Salmon River at Lemhi River	MVFH	255	179	434	0.22
1993	190,500	Salmon River at North Fork Salmon River	MVFH	327	199	526	0.28
1993	547,316	Little Salmon River	HNFH	423	423	846	0.15
1993	211,006	Salmon River at Hammer Creek	HNFH	55	55	110	0.05
1993	**3,164,542**	**Subtotal 1993 'A' Releases**		**6,483**	**3,436**	**9,919**	**0.31**
1992	622,060	Sawtooth Hatchery	HNFH	768	168	936	0.15
1992	117,300	Sawtooth Hatchery	MVFH	95	39	134	0.11
1992	223,406	Pahsimeroi River	HNFH	439	201	640	0.29
1992	503,180	Pahsimeroi Ponds and Trap	NSFH	786	326	1,112	0.22
1992	282,300	Salmon River at Hammer Creek	NSFH	-	-	-	
1992	1,001,900	Little Salmon River	MVFH	1,066	1,066	2,132	0.21
1992	**2,750,146**	**Subtotal 1992 'A' Releases**		**3,154**	**1,800**	**4,954**	**0.18**
1991	1,284,706	Sawtooth Hatchery	HNFH	3,662	945	4,607	0.36
1991	364,700	Sawtooth Hatchery	MVFH	1343	343	1686	0.46
1991	475,000	Pahsimeroi River	NSFH	1,863	1,492	3,355	0.71
1991	135,100	Pahsimeroi River	MVFH	650	509	1159	0.86
1991	174,400	Salmon River at Ellis Bridge	NSFH	519	547	1,066	0.61
1991	97,800	Salmon River at Shoup Bridge	MVFH	346	63	409	0.42
1991	48,200	Salmon River at Shoup Bridge	NSFH	-	-	-	-
1991	186,300	Salmon River at Hammer Creek	MVFH	316	316	632	0.34
1991	158,400	Salmon River at North Fork Salmon River	NSFH	703	497	1,200	0.76

1991	310,300	Little Salmon River	MVFH	527	526	1,053	0.34
1991	**3,234,906**	**Subtotal 1991 'A' Releases**		**9,929**	**5,238**	**15,167**	**0.47**
1990	301,156	Sawtooth Hatchery	HNFH	2,468	619	3,087	1.03
1990	1,198,700	Sawtooth Hatchery	MVFH	4,807	1,040	5,847	0.49
1990	200,246	Salmon River at Shoup Bridge	HNFH	326	173	499	0.25
1990	501,600	Pahsimeroi River	NSFH	487	1,335	1,822	0.36
1990	200,295	Salmon River at Ellis Bridge	HNFH	508	192	700	0.35
1990	199,602	Salmon River at North Fork Salmon River	HNFH	501	176	677	0.34
1990	229,000	Salmon River at Hammer Creek	NSFH	180	95	275	0.12
1990	80,465	Little Salmon River	HNFH	63	63	126	0.16
1990	225,500	Little Salmon River	NSFH	178	86	264	0.12
1990	**3,136,564**	**Subtotal 1990 'A' Releases**		**9,518**	**3,779**	**13,297**	**0.42**
1989	636,551	Sawtooth Hatchery	HNFH	754	194	948	0.15
1989	857,300	Sawtooth Hatchery	MVFH	1,053	274	1,327	0.15
1989	104,400	Yankee Fork Salmon River	MVFH	157	42	199	0.19
1989	508,300	Pahsimeroi River	NSFH	298	377	675	0.13
1989	209,700	Salmon River at Shoup Bridge	NSFH	106	137	243	0.12
1989	208,500	Salmon River at North Fork Salmon River	NSFH	106	135	241	0.12
1989	136,000	Salmon River at Hammer Creek	MVFH	124	124	248	0.18
1989	7,200	Salmon River at Hammer Creek	NSFH	-	-	-	-
1989	450,400	Little Salmon River	MVFH	404	404	808	0.18
1989	300,600	Slate Creek (section 11)	MVFH	274	275	549	0.18
1989	**3,418,951**	**Subtotal 1989 'A' Releases**		**3,276**	**1,962**	**5,238**	**0.15**
1988	1,195,745	Sawtooth Hatchery	HNFH	2,825	887	3,712	0.31
1988	176,000	Yankee Fork Salmon River	MVFH	382	120	502	0.29
1988	665,800	Pahsimeroi River	NSFH	1,259	1,374	2,633	0.40
1988	147,500	Salmon River at Shoup Bridge	MVFH	74	77	151	0.10
1988	103,500	Salmon River at Shoup Bridge	NSFH	126	95	221	0.21
1988	253,100	Salmon River at North Fork Salmon River	MVFH	127	132	259	0.10
1988	162,800	Panther Creek	MVFH	198	207	405	0.25
1988	102,800	Panther Creek	NSFH	73	76	149	0.14
1988	100,000	Salmon River at French Creek	MVFH	134	134	268	0.27
1988	701,252	Little Salmon River	MVFH	939	939	1,878	0.27
1988	50,725	Slate Creek (section 11)	HNFH	38	38	76	0.15
1988	346,100	Slate Creek (section 11)	MVFH	282	282	564	0.16
1988	87,200	Salmon River at Hammer Creek	MVFH	117	117	234	0.27
1988	**4,092,522**	**Subtotal 1988 'A' Releases**		**6,574**	**4,478**	**11,052**	**0.27**

3.4) Relationship to habitat protection and recovery strategies.

Hatchery production for harvest mitigation is influenced but not specifically linked to habitat protection strategies in the Salmon subbasin or other areas. The NMFS has not developed a recovery plan specific to Snake River steelhead, but the Salmon River A-run steelhead program is operated consistent with existing Biological Opinions.

3.5) Ecological interactions. [Please review Addendum A before completing this section. If it is necessary to complete Addendum A, then limit this section to NMFS jurisdictional species. Otherwise complete this section as is.]

Hatchery-origin adult steelhead may be released above the adult weir on the Salmon River. The IDFG believes the release of adult hatchery steelhead above the weir to meet supplementation objectives will not adversely affect ESA-listed steelhead. All releases are conducted as outlined per discussion with the National Marine Fisheries Service. Hatchery-origin adults are generally released upstream (6 – 12 pair) into weired-in sections of Beaver and Frenchman creeks for the BPA-funded Steelhead Supplementation Studies project to estimate juvenile production from hatchery adult outplants. Any additional hatchery steelhead released upstream are to equalize sex ratios of natural steelhead. In addition, the release of hatchery-origin steelhead above weirs is unlikely to adversely affect young-of-the-year chinook salmon. Chinook salmon fry emerge in the upper Salmon and Pahsimeroi rivers in March through May (R. Kiefer, IDFG, pers. comm.). We believe the peak of steelhead spawning is in mid-May, based on steelhead redd counts. This is later than the mid-April peak of fry emergence. It is apparent that low numbers of steelhead are spawning and there is some temporal separation between chinook salmon fry emergence and steelhead spawning.

We assumed potential adverse effects to listed salmon and steelhead could occur from the release of hatchery-origin steelhead smolts in the Salmon and Pahsimeroi rivers through the following interactions: predation, competition, behavior modification, and disease transmission.

We have tried to consider potential interactions between listed steelhead and salmon and hatchery steelhead and their effect in the migration corridor of the Salmon River and downstream. Timing of hatchery-origin steelhead in the migration corridor overlaps with listed spring/summer chinook salmon, steelhead, and to a lesser degree with listed sockeye salmon. Steelhead from the LSRCP program are more temporally separated from listed fall chinook salmon in the Snake River and Lower Granite Reservoir based on different migration periods. The National Marine Fisheries Service has identified potential competition for food and space and behavioral interactions in the migration corridor as a concern (M. Delarm, NMFS, pers. comm.).

Because of their size and timing, chinook salmon fry are probably the most vulnerable life stage to predation. Hillman and Mullan (1989) observed substantial predation of newly emerged chinook salmon by hatchery and wild steelhead in the Wenatchee River. Cannamela (1992) used existing literature to evaluate potential predation of chinook salmon fry by hatchery steelhead smolts. He evaluated a 1-1.3 million steelhead smolt release in the upper Salmon River primary production area, where steelhead were released in the vicinity of redds and migrated over redds for several miles. He assumed steelhead smolts at least 105 mm could consume chinook salmon fry, 35-37 mm in length. Cannamela estimated potential predation by utilizing various percentages of fry in the diet, residualism, and predator size. Using ranges of assumptions, he calculated estimated fry losses to predation by steelhead smolts and residuals for up to a 70 day period from smolt release to June 25. According to his calculations, his scenario of 500,000 steelhead predators utilizing fish as 1 percent of their diet for 40 days resulted in potential consumption of 34,500 fry. Empirical information collected in 1992 infers that this may be an overestimate. IDFG biologists attempted to quantify chinook salmon fry predation by hatchery steelhead in the upper Salmon River. Their samples were collected from a release of 774,000 hatchery steelhead in the upper Salmon River primary production area where steelhead would migrate directly over redds. The fish were released in early April. The biologists sampled 6,762 steelhead and found that 20 contained fish parts in the cardiac stomach. Of these, three contained 10 chinook salmon fry. The biologists estimated that the proportion of hatchery steelhead that consumed fry was 0.000444. The estimated predation rate of steelhead smolts on chinook salmon fry was 1.48×10^{-3} (95% CI 0.55×10^{-3} to 2.41×10^{-3}) for the 6,762 hatchery steelhead smolts examined that consumed the ten chinook fry. Biologists used this consumption rate to estimate that the total number of chinook fry consumed during the sample period, April 3-June 3, was 24,000 fry (IDFG 1993). We believe that the potential consumption for steelhead released in the lower Salmon River would be much lower because steelhead are not released in the immediate vicinity of redds and emerging fry.

By using Cannamela's calculations and scenarios of 0.05-1.0 percent fish in the diet and 10-25 percent residualism, we predict a range of potential loss of 2,300-51,000 chinook fry for a 1.25 million smolt release in the Salmon River primary production area. Cannamela (1992) estimated fry losses would occur for up to a 70 day period from smolt release to June 25. He noted that there is an assumed mechanism for chinook salmon fry to avoid predation by steelhead since they are coevolved populations. However, literature references were scant about this theory although Peery and Bjornn (1992) documented that fry tend to move at night. Cannamela concluded that only assumptions could be made about the availability and vulnerability of fry to steelhead predators.

Martin et al. (1993) collected 1,713 steelhead stomachs from the Tucannon River and three contained juvenile spring chinook salmon. They estimated that 456-465 juvenile spring chinook salmon were consumed by hatchery steelhead in the Tucannon River from a total release of 119,082 steelhead smolts. Biologists found that rate of predation increased from the time of steelhead release through September 31. Predation rates increased from 9.4×10^{-3} to 4.3×10^{-2}. Martin et al. (1993) theorized that although numbers of steelhead decreased, remaining fish may have learned predatory behavior. By October, juvenile salmon were too large to be prey, and stream temperature had dropped.

No precise data are available to estimate the importance of chinook salmon fry in a steelhead smolt's diet (USFWS 1992). The USFWS cited several studies where the contents of steelhead stomachs had been examined. Few, if any, salmonids were found. They concluded that the limited empirical data suggested that the number of chinook salmon fry/fingerlings consumed by steelhead is low. Schriever (IDFG, pers. comm.) sampled 52 hatchery steelhead in the lower Salmon and Clearwater rivers in 1991 and 1992 and found no fish in their stomach contents.

The percentage of steelhead residualism in the upper Salmon River appeared to be about 4 percent in 1992 (IDFG 1993). We do not know the rate of residualism for steelhead released in the lower Salmon River. In 1992, the steelhead smolt migration in the Salmon River primary production area began around May 10 and about 95% of the hatchery steelhead had left the upper Salmon River study area by May 21. IDFG biologists found that after one week, hatchery steelhead smolts were consuming natural prey items such as insects and appeared to be effectively making the transition to natural food (IDFG 1993). It is unknown if smolts continued to feed as they actively migrated. Biologists observed that the environmental conditions during the 1992 study were atypical. Water velocity was much lower, while water temperature and clarity were higher than normal for the study period. Furthermore, about 637,500 of the smolts had been acclimated for up to three weeks at Sawtooth Fish Hatchery prior to release, but these fish were not fed during acclimation. It is unknown if acclimation reduced residualism. Biologists concluded that within the framework of 1992 conditions, chinook fry consumption by hatchery steelhead smolts and residuals was very low.

Kiefer and Forster (1992) were concerned that predation on natural chinook salmon smolts by hatchery steelhead smolts released into the Salmon River at Sawtooth Fish Hatchery could be causing mortality. They compared PIT tag detection rates of upper Salmon River natural chinook salmon emigrating before and after the steelhead smolt releases for the previous three years. They found no significant difference and concluded that the hatchery steelhead smolts were not preying upon the natural chinook smolts to any significant degree.

The release of a large number of prey items which may concentrate predators has been identified as a potential effect on listed salmon. Hillman and Mullan (1989) reported that predaceous rainbow trout (>200 mm) concentrated on wild salmon within a moving group of hatchery age-0 chinook salmon. The wild salmon were being "pulled" downstream from their stream margin stations as the hatchery fish moved by. It is unknown if the wild fish would have been less vulnerable had they remained in their normal habitat. Hillman and Mullan (1989) also observed that the release of hatchery age-0 steelhead did not pull wild salmon from their normal habitat. During their sampling in 1992, IDFG biologists did not observe predator concentration. We have no further information that supports or disproves concern that predators may concentrate and affect salmon because of the release of large numbers of hatchery steelhead.

There is potential for hatchery steelhead smolts and residuals to compete with chinook salmon and natural steelhead juveniles for food and space, and to potentially modify their behavior. The literature suggests that the effects of behavioral or competitive interactions would be difficult to evaluate or quantify (Cannamela 1992, USFWS 1993). Cannamela (1992) concluded that existing information was not sufficient to determine if competitive or behavioral effects occur to salmon juveniles from hatchery steelhead smolt releases.

Our strategy of acclimation and releases over several days should reduce release densities at a single site.

Cannamela's (1992) literature search indicated that there were different habitat preferences between steelhead and chinook salmon that would minimize competition and predation. Spatial segregation appeared to hinge upon fish size. Distance from shore and surface as well as bottom velocity and depth preferences increased with fish size. Thus, chinook salmon fry and steelhead smolts and residuals are probably not occupying the same space. Cannamela theorized that if interactions occur, they are probably restricted to a localized area because steelhead, which do not emigrate, do not move far from the release site. Within the localized area, spatial segregation based on size differences would place chinook salmon fry and fingerlings away from steelhead smolts and residuals. This would further reduce the likelihood of interactions. Martin et al. (1993) reported that in the Tucannon River, spring chinook salmon and steelhead did exhibit temporal and spatial overlap, but they discuss that the micro-habitats of the two species were likely very different.

The USFWS (1992) theorized that the presence of a large concentration of steelhead at and near release sites could modify the behavior of chinook. However, they cited Hillman and Mullan (1989) who found no evidence that April releases of steelhead altered normal movement and habitat use of age-0 chinook. Throughout their study, IDFG biologists (IDFG 1993) noted concentrations of fry in typical habitat areas, whether steelhead were present or not.

Cannamela (1992) also described the potential for effects resulting from the release of a large number of steelhead smolts in a small area over a short period of time. He theorized that high concentrations of steelhead smolts could limit chinook salmon foraging opportunities or limit available food. However, the effect would be of limited duration because most steelhead smolts emigrate or are harvested within two months of release. He found no studies to support or refute his hypothesis. Cannamela also discussed threat of predation as a potentially important factor causing behavioral changes by stream salmonids. The literature was not specific to interactions of steelhead smolts and chinook fry. It is assumed that coevolved populations would have some mechanism to minimize this interaction.

There is a potential effect to listed salmon from diseases transmitted from hatchery-origin steelhead adults. Pathogens that could be transmitted from adult hatchery steelhead to naturally produced chinook salmon include Infectious Hematopoietic Necrosis Virus (IHNV) and Bacterial Kidney Disease (BKD) (K. Johnson, IDFG, pers. comm..). Although adult hatchery-origin steelhead may carry pathogens of chinook, such as BKD and Whirling Disease, which could be shed into the drainage, these diseases are already present in the Salmon River headwaters in naturally produced chinook and steelhead populations. The prevalence of BKD is less in hatchery-origin steelhead than in naturally produced chinook salmon. Idaho chinook salmon are rarely affected by IHNV (D. Munson, IDFG, pers. comm). Idaho Department of Fish and Game disease monitoring will continue as part of the IDFG fish health program. We do not believe that the release of hatchery-origin steelhead adults above the Sawtooth and East Fork weirs will increase the prevalence of disease in naturally produced chinook salmon or steelhead.

Hauck and Munson (IDFG, unpublished) provide a thorough review of the epidemiology of major chinook pathogens in the Salmon River drainage. The possibility exists for horizontal transmission of diseases to listed chinook salmon or natural steelhead from hatchery-origin steelhead in the migration corridor. Current hatchery practices include measures to control pathogens at all life stages in the hatchery. Factors of dilution, low water temperature, and low population density of listed anadromous species in the production area reduce the potential of disease transmission. However, none of these factors preclude the existence of disease risk (Pilcher and Fryer 1980, LaPatra et al. 1990, Lee and Evelyn 1989). In a review of the literature, Steward and Bjornn (1990) stated there was little evidence to suggest that horizontal transmission of disease from hatchery smolts to naturally produced fish is widespread in the production area or free-flowing migration corridor. However, little research has been done in this area.

Transfers of hatchery steelhead between any facility and the receiving location conforms to PNFHPC guidelines. IDFG and USFWS personnel monitor the health status of hatchery steelhead using protocols approved by the Fish Health Section, AFS. Disease sampling protocol, in accordance to the PNFHPC and AFS Bluebook is followed. IDFG hatchery and fish health personnel sample the steelhead throughout the rearing cycle and a pre-release sample is analyzed for pathogens and condition. Baseline disease monitoring of naturally produced chinook salmon has been implemented in the upper Salmon River, but the program is in its infancy. At this time, we have no evidence that horizontal transmission of disease from the hatchery steelhead release in the upper Salmon River has an adverse effect on listed species. Even with consistent monitoring, it would be difficult to attribute a particular incidence or presence of disease to actions of the LSRCP steelhead program.

We considered hatchery water withdrawal in the upper Salmon and Pahsimeroi rivers to acclimate steelhead or collect steelhead broodstock to have no effect upon ESA-listed salmon or steelhead. Water is only temporarily diverted from rivers.

SECTION 4. WATER SOURCE

4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

Sawtooth Fish Hatchery – The Sawtooth Fish Hatchery receives water from the Salmon River and from four wells. River water enters an intake structure located approximately 0.8 km upstream of the hatchery facility. River water intake screens comply with NMFS criteria. River waters flows from the collection site to a control box located in the hatchery building where it is screened to remove fine debris. River water can be distributed to indoor vats, outside raceways, or adult holding raceways. The hatchery water right for river water use is approximately 60 cfs. Incubation and early rearing water needs are met by two primary wells. A third well provides tempering water to control the build up of ice on the river water intake during winter months. The fourth well provides domestic water for the facility. The hatchery water right for well water is approximately 9 cfs. River water temperatures range from 0.0ºC in the winter to 20.0ºC in the summer. Well water temperatures range from 3.9ºC in the winter to 11.1ºC in the summer.

Magic Valley Fish Hatchery – The Magic Valley Fish Hatchery receives water from a spring on the north wall of the Snake River canyon. The spring (Crystal Springs) is covered to prevent contamination. Water is delivered to the hatchery (125.5 cfs maximum) through a 42 inch pipe that crosses the Snake River. Water temperature remains a constant 15.0ºC year-round.

Hagerman National Fish Hatchery – The Hagerman National Fish Hatchery receives water from several springs emanating from the Snake River aquifer. Approximately 70 cfs are available to supply the hatchery. Water temperature remains a constant 15.0ºC year-round.

4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

Intake screens at all facilities are in compliance with NMFS screen criteria by design of the Corp of Engineers.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

The Sawtooth Fish Hatchery functions as primary broodstock collection facility for the LSRCP Salmon River A-run steelhead program. Additional eggs may be utilized from the Pahsimeroi Fish Hatchery (integrated Sawtooth and Pahsimeroi broodstock) if annual shortages exist.

Sawtooth Fish Hatchery – Adult collection at the Sawtooth Fish Hatchery is facilitated by a permanent weir that spans the Salmon River. Weir panels are installed to prevent the upstream migration of adult steelhead. Fish are allowed to volitionally migrate into the adult trap where they are manually sorted into adult holding raceways. The hatchery has three 167 ft long x 16 ft wide x 5 ft deep holding raceways and an enclosed spawning building. Each raceway has the capacity to hold approximately 1,300 adults.

5.2) Fish transportation equipment (description of pen, tank truck, or container used).

A variety of transportation vehicles and equipment are available at the various facilities. Generally, adult transportation at both facilities is unnecessary as hatchery-produced adults are trapped on site. However, in the event that adult steelhead return to either facility in excess of specific program needs, adult transportation vehicles (equipped with oxygen and fresh flow agitator systems) may be used to transfer fish to a variety of locations to maximize sport fishing opportunities.

5.3) Broodstock holding and spawning facilities.

See Section 5.1 above for a review of broodstock holding and spawning facilities.

5.4) Incubation facilities.

Sawtooth Fish Hatchery – Incubation facilities at the Sawtooth Fish Hatchery consist of a well water supplied system of 100 stacks of incubator frames containing 800 incubation trays. The maximum incubation capacity at the Sawtooth Fish Hatchery is 7 million steelhead eggs.

Magic Valley Fish Hatchery – Incubation facilities at the Magic Valley Fish Hatchery consist primarily of 40, 12 gallon upwelling containers. Each container is capable of incubating and hatching 50,000 to 75,000 eyed steelhead eggs. Two incubators are placed over each concrete vat. A total of 20 vats are available. Vats measure 40 ft long x 4 ft wide x 3 ft deep. Each vat has the capacity to rear 115,000 to 125,000 steelhead to 200 fish per pound.

Hagerman National Fish Hatchery – Eyed-eggs are incubated in upwelling incubators as described for the Magic Valley Fish Hatchery.

5.5) Rearing facilities.

The Magic Valley Fish Hatchery and the Hagerman National Fish Hatchery function as juvenile rearing facilities for the LSRCP Salmon River A-run steelhead program.

Magic Valley Fish Hatchery – The Magic Valley Fish Hatchery has 32 outside raceways available for juvenile steelhead rearing. Each raceway measures 200 ft long x 10 ft wide x 3 ft deep. Each raceway has the capacity to rear approximately 65,000 fish to release size. Raceways may be subdivided to create 64 rearing sections. A movable bridge, equipped with 16 automatic Neilsen fish feeders spans the raceway complex. Two 30,000 bulk feed bins equipped with fish feed fines shakers and a feed conveyor complete the outside feeding system.

Hagerman National Fish Hatchery - Early rearing occurs in fiberglass troughs inside the hatchery building. As fish outgrow fiberglass troughs, they are transferred to a series of outside raceways where they remain until transfer for release. Raceways measure 100 ft long by 10 ft wide.

5.6) Acclimation/release facilities.

For the Salmon River A-run steelhead program, acclimation occurs in outside production raceways (when feasible). Generally, only fish destined for release at the Sawtooth Fish

Hatchery weir are acclimated prior to release (approximately 750,000 annually). All other fish are released directly to receiving waters.

5.7) Describe operational difficulties or disasters that led to significant fish mortality.

No operational difficulties or disasters have led to significant fish mortality at any of the facilities addressed in this HGMP

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5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

Sawtooth Fish Hatchery - The Sawtooth Fish Hatchery is staffed around the clock and equipped with an alarm system. The hatchery well water supply system is backed up by generator power. The inside vat room can be switched to gravity flow with river water in the event of a generator failure. Protocols are in place to guide emergency situations during periods of time when the hatchery well water supply is interrupted. Protocols are also in place to guide the disinfection of equipment and gear to minimize risks associated with the transfer of potential disease agents.

Magic Valley Fish Hatchery – The Magic Valley Fish Hatchery is staffed around the clock. The hatchery receives only gravity flow water, and as such, no generator backup system is in place or needed. Hatchery staff perform routine maintenance checks on gravity lines that supply the hatchery with water. Proper disinfection protocols are in place to prevent the transfer of disease agents.

Hagerman National Fish Hatchery – The hatchery is staffed around the clock. Water flow alarms are in place to detect the interruption of flow. Proper disinfection protocols are in place to prevent the transfer of disease agents.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.

Snake River steelhead and indigenous Salmon River steelhead were used to found all hatchery A-run programs in Idaho. The Pahsimeroi Hatchery program was initiated with progeny of adult steelhead trapped at Oxbow and Hells Canyon dams from 1966 through 1968. Beginning in 1967, juvenile steelhead produced from spawning events that resulted from these collections were released in the Pahsimeroi River. However, Oxbow-origin smolts were released into the Pahsimeroi River and the upper Salmon River intermittently through 1970. Adult broodstock collections were initiated at the Pahsimeroi Hatchery in 1969. Returning Snake River stock and some indigenous Salmon River stock were trapped and used as broodstocks. The Sawtooth Fish Hatchery broodstock was founded with adults that returned from hatchery-produced smolt releases and from natural steelhead adults trapped at the facility. Naturally-produced steelhead adults were integrated into the hatchery broodstock until the early 1990s. It is likely that the natural component of the upper Salmon River is hatchery influenced.

Additionally, B-run steelhead smolts of Dworshak National Fish Hatchery origin were released into the Pahsimeroi River in 1974 and 1978.

6.2) Supporting information.

6.2.1) History.

See Section 6.1 above.

6.2.2) Annual size.

No ESA-listed summer steelhead are collected as part of this program. Annual quidelines for broodstock size are listed below.

6.2.3) Past and proposed level of natural fish in broodstock.

See Section 6.1 above.

6.2.4) Genetic or ecological differences.

Currently, two independent studies are being conducted to characterize the genetic identity of Snake River steelhead. One study, funded by the USFWS, is being conducted by Dr. Paul Moran (National Marine Fisheries Service). The second study, funded by the Bonneville Power Administration through the Northwest Power Planning Council's Fish and Wildlife Program is being conducted by Dr. Jennifer Nielsen (U.S. Geologic Survey). Both studies will include information on hatchery-origin and natural steelhead stocks in Idaho. Study results should be available in 2003.

The following excerpt was taken from Busby et al. 1996. Status Review of West Coast Steelhead from Washington, Idaho, Oregon, and California. NOAA Technical Memorandum NMFS-NWFSC-27.

Snake River Basin--This ESU occupies the Snake River Basin of southeast Washington, northeast Oregon, and Idaho. This region is ecologically complex and supports a diversity of steelhead populations; however, genetic and meristic data suggest that these populations are more similar to each other than they are to steelhead populations occurring outside of the Snake River Basin. Snake River Basin steelhead spawning areas are well isolated from other populations and include the highest elevations for spawning (up to 2,000 m) as well as the longest migration distance from the ocean (up to 1,500 km). Snake River steelhead are often classified into two groups, A- and B-run, based on migration timing, ocean age, and adult size. While total (hatchery + natural) run size for

Snake River steelhead has increased since the mid-1970s, the increase has resulted from increased production of hatchery fish, and there has been a severe recent decline in natural run size. The majority of natural stocks for which we have data within this ESU have been declining. Parr densities in natural production areas have been substantially below estimated capacity in recent years. Downward trends and low parr densities indicate a particularly severe problem for B-run steelhead, the loss of which would substantially reduce life history diversity within this ESU. The BRT had a strong concern about the pervasive opportunity for genetic introgression from hatchery stocks within the ESU. There was also concern about the degradation of freshwater habitats within the region, especially the effects of grazing, irrigation diversions, and hydroelectric dams.

6.2.5) Reasons for choosing.

Naturally-produced steelhead in the upper Salmon River steadily declined during the late 1960s – mid 1970s leading to sport fishery closures between 1973 and 1975. Translocation of native Snake River steelhead, which were losing native habitat due to the Idaho Power Company's Hells Canyon dam complex, was considered an appropriate and feasible alternative to initiate harvest mitigation programs rather than mining a declining wild steelhead resource in the upper Salmon River.

6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

No adverse impacts or effects to the listed population are expected as wild/natural adults are not currently trapped and used for broodstock purposes.

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Only hatchery-origin adults are collected for broodstock purposes.

7.2) Collection or sampling design.

At this time no unmarked (natural origin) fish are incorporated into the hatchery broodstock. All adult fish collected for broodstock at all locations are of hatchery origin.

For Sawtooth and Pahsimeroi fish hatchery programs, all adults that return to racks are generally handled. Hatchery-origin fish incorporated into the spawning design are selected at random and represent the entire run.

7.3) Identity.

All harvest mitigation hatchery produced fish are marked with an adipose fin clip. Unmarked and untagged fish captured at weirs are released above weirs with a minimum of handling and delay.

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults):

No ESA-listed summer steelhead are collected as part of this program. Annual quidelines for broodstock size are listed below.

Sawtooth Fish Hatchery – A minimum of 450 A-run, summer steelhead females are needed to meet current program management objectives. The ratio of males to females needed is approximately 50:50 necessitating the need to trap and collect approximately 450 males.

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

Sawtooth Hatchery adult steelhead spawn history (hatchery-produced fish).

Brood Year	Adults Females	 Males	 Jacks	Green Eggs	Juveniles
1988	308	317	n/a	1,561,300	n/a
1989	301	315	n/a	1,696,700	n/a
1990	226	227	n/a	1,071,165	n/a
1991	33	38	n/a	132,630	n/a
1992	307	362	n/a	1,406,360	n/a
1993	255	530	n/a	1,131,635	n/a
1994	136	141	n/a	725,205	n/a
1995	143	290	n/a	630,300	n/a
1996	226	228	n/a	1,091,143	n/a
1997	429	429	n/a	1,994,076	n/a
1998	246	246	n/a	1,116,350	n/a
1999	364	364	n/a	1,526,046	n/a
2000	870	870	n/a	3,950,103	n/a
2001	633	633	n/a	2,867,634	n/a
2002	542	542	n/a	2,858,525	n/a

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.

Sawtooth Fish Hatchery – The disposition of surplus hatchery-origin steelhead could include: the sacrifice of fish and distribution of carcasses to the public, tribe, or human assistance organizations; the outplanting of adults for natural production; the recycling of fish downstream through the fishery; or the planting of fish in local fishing ponds.

7.6) Fish transportation and holding methods.

Generally, adult steelhead arrive ripe or very close to spawning. No anesthetics or medications are used during handling or holding procedures. Fish are held in adult holding facilities (described above) until they are spawned. An opercle or caudal fin punch may be used to track time of arrival or to indicate previously spawned males.

In the event that fish are transported to different locations to meet other objectives (see Section 7.5), trucks fitted with transport tanks are used. Tanks support both oxygen and fresh flow agitation systems.

7.7) Describe fish health maintenance and sanitation procedures applied.

Adult steelhead held for spawning are typically spawned within two weeks of arrival. No chemicals or drugs are used prior to spawning. Fish health monitoring at spawning includes sampling for viral, bacterial and parasitic disease agents. Ovarian fluid is sampled from females and used in viral assays. Kidney samples are taken from a representative number of females spawned and used in bacterial assays. Head wedges are taken from a representative number of fish spawned and used to assay for presence/absence of the parasite responsible for whirling disease.

Eggs are rinsed with pathogen free well water after fertilization, and disinfected with a 100 ppm buffered iodophor solution for one hour before being placed in incubation trays. Necropsies are performed on pre-spawn mortalities as dictated by the Idaho Department of Fish and Game Fish Health Laboratory.

7.8) Disposition of carcasses.

Typically, adult steelhead carcasses generated during spawning events are distributed to the general public, charitable organizations, and to the Shoshone-Bannock Tribes. Additionally, carcasses may be transported to sanitary landfills or to a rendering facilities.

7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

Only hatchery-origin, non ESA-listed adults are collected for broodstock purposes.

SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1) Selection method.

Adult steelhead are chosen at random but with regard to run timing. Male steelhead may be marked with an opercle or caudal punch and used more than once if needed. Generally, a 1:1 spawn design is followed. Fish are typically checked twice weekly for ripeness.

In an effort to shift Pahsimeroi steelhead run/spawn timing back to a more historic time frame, eggs spawned at this facility and sent to Niagara Springs Fish Hatchery represent the entire run, but are skewed toward the later egg takes.

8.2) Males.

Generally, males are used only once for spawning. Only in those cases where skewed sex ratios exist (fewer males than females) or in situations where males mature late, males may be used twice. Males are chosen at random but with regard to run timing.

8.3) Fertilization.

Spawning ratios of 1 male to 1 female will be used unless the broodstock population contains less than 100 females. If the spawning population contains less than 100 females, then eggs from each female are split into two equal sub-families. Each sub-family is fertilized by a different male. One cup of well water is added to each bucket and set aside for 30 seconds to one minute. The two buckets are then combined.

8.4) Cryopreserved gametes.

Milt is not cryopreserved as part of this program and no cryopreserved gametes are used in this program.

8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

No natural-occurring fish are incorporated into the spawning operation.

SECTION 9. INCUBATION AND REARING -

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on

the success of meeting the desired hatchery goals.

9.1) <u>Incubation</u>:

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.

The original Lower Snake River Compensation Program production target of 25,000 adults back to the project area upstream of Lower Granite Dam was based on a smolt-to-adult survival rate of 0.54 to 0.58%. To date, program SARs have not met these planning guidelines. This is not due to lower than expected "in-hatchery" performance. Typically, egg survival to the eyed stage of development averages 85% for the Sawtooth Fish hatchery.

Sawtooth Fish Hatchery egg take and survival information. Information produced from Sawtooth Fish Hatchery annual reports.

Spawn Year	Green Eggs Taken	Eyed-eggs	Survival to Eyed Stage (%)
1988	1,561,300	1,366,382	87.5
1989	1,696,700	1,557,398	91.8
1990	1,071,165	956,245	89.3
1991	132,630	116,430	87.8
1992	1,406,360	1,182,500	84.1
1993	1,131,635	1,031,635	91.2
1994	725,205	660,989	91.1
1995	630,300	543,100	86.2
1996	1,091,143	982,600	90.1
1997	1,994,076	1,805,200	91.0
1998	1,116,350	984,600	88.2
1999	1,526,046	1,338,178	87.7
2000	3,950,103	3,516,250	89.0
2001	2,867,634	2,300,978	80.0

9.1.2) Cause for, and disposition of surplus egg takes.

Surplus eggs are not intentionally generated at Sawtooth or Pahsimeroi fish hatcheries but may occur in an effort to collect eggs from across the full run spectrum or to account for anticipated hatchery mortality.

9.1.3) Loading densities applied during incubation.

Sawtooth Fish Hatchery – Incubation flows are set at 5 to 6 gpm per eight tray incubation stack. Typically, eggs from two females are incubated per tray (approximately 8,500 to 10,000 eggs per tray).

9.1.4) Incubation conditions.

Sawtooth Fish Hatchery – Pathogen free well water is used for all incubation at the Sawtooth Fish Hatchery. Incubation stacks utilize catch basins to prevent silt and fine sand from circulating through incubation trays. Following 48 hours of incubation, eggs are treated three times per week with formalin (1,667 ppm) to control the spread of fungus. Formalin treatments are discontinued at eye-up. Once eggs reach the eyed stage of development (approximately 360 FTU), they are shocked to identify dead and unfertilized eggs. Dead and undeveloped eggs are then removed with the assistance of an automatic egg picking machine. During this process, the number of eyed and dead eggs is generated. Eyed eggs are generally shipped to receiving hatcheries when they have accumulated approximately 450 FTUs.

Magic Valley, Niagara Springs, and Hagerman National fish hatcheries – Water flow to incubation jars is adjusted so eggs gently roll. Temperature is tracked daily to monitor the accumulation of temperature units. Water temperature at both facilities is a constant 15.0ºC.

9.1.5) Ponding.

No ponding occurs at the Sawtooth Fish Hatchery as eggs are typically shipped to rearing facilities in the Hagerman Valley of Idaho. Eggs are typically disinfected in 100 ppm Iodophor for approximately 10 minutes by receiving hatcheries.

Magic Valley Fish Hatchery – Fry are allowed to volitionally exit upwelling incubators and move directly into early rearing vats through approximately 1,000 FTUs. After that time, fry remaining in incubators are siphoned into vats. Fry are generally ponded between April and early July.

Hagerman National Fish Hatchery – Ponding practices are essentially the same as those described for the Magic Valley Fish Hatchery. Fish are typically fed when 80% of the population has “buttoned-up.”

9.1.6) Fish health maintenance and monitoring.

Following fertilization, eggs are typically water-hardened in a 100 ppm Iodophor solution for a minimum of 30 minutes. During incubation, eggs routinely receive scheduled formalin treatments to control the growth of fungus. Treatments are typically administered three times per week at a concentration of 1667 ppm active ingredient. Dead eggs are removed following shocking. Additional egg picks are performed as needed to remove additional eggs not identified immediately after shocking. Eggs produced at the Sawtooth and Pahsimeroi fish hatcheries are transferred to rearing hatcheries when they have accumulated approximately 450 FTUs.

9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

No adverse genetic or ecological effects to listed fish are anticipated as only hatchery-origin adults are spawned.

9.2) <u>Rearing</u>:

9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available.

Magic Valley Fish Hatchery survival information by hatchery life stage for A-run steelhead from hatch through release (includes eggs received from Pahsimeroi, Sawtooth, and Oxbow fish hatcheries). Information produced from Magic Valley Fish Hatchery annual reports.

Brood Year	Spawning Hatchery	Eyed-Eggs Received	Eyed-Egg To Hatch Survival	Eyed-Egg to Smolt Survival	Number of Smolts Released
1988	Pahsimeroi	2,047,748	n/a	90.3%	1,849,500
1989	Pahsimeroi	1,306,674	n/a	91.7%	1,198,700
1990	Pahsimeroi	1,269,100	n/a	86.2%	1,094,200
1991	-	-	-	-	-
1992	Pahsimeroi	1,031,274	99.0%	88.8%	915,400
1993	Pahsimeroi	1,081,500	99.5%	88.0%	951,990
1994	Pahsimeroi	800,785	97.5%	85.4%	684,035
1995	Pahsimeroi	803,000	98.0%	91.9%	738,133
1996	Sawtooth	95,796	99.0%	88.4%	84,715
1996	Pahsimeroi	852,000	98.0%	89.8%	765,340
1997	Sawtooth	530,000	98.5%	77.4%	410,225
1997	Pahsimeroi	325,000	98.0%	89.3%	291,625
1998	Pahsimeroi	887,000	99.0%	92.4%	819,902
1998	Oxbow	123,540	94.0%	86.6%	106,950
1999	Sawtooth	389,982	99.0%	91.8%	358,025
1999	Pahsimeroi	515,375	99.0%	93.5%	481,712
1999	Oxbow	174,000	98.0%	94.3%	164,123
2000	Sawtooth	991,665	99.0%	88.3%	876,085
2000	Pahsimeroi	946,319	99.0%	83.5%	790,258

Hagerman National Fish Hatchery survival information by hatchery life stage for A-run steelhead from hatch through release (includes eggs received from Pahsimeroi, Sawtooth, and Oxbow fish hatcheries). Information produced from Hagerman National Fish Hatchery annual reports.

Brood Year	Spawning Hatchery	Eyed-Eggs Received	Eyed-Egg To Hatch Survival	Eyed-Egg to Smolt Survival (Brood Year Total)	Number of Smolts Released
1989	Sawtooth	1,491,956	99.3%	65.8%	981,764
1990	Sawtooth	592,302	96.9%	62.1%	979,799
1990	Sawtooth & Pahsimeroi	986,523	95.9%		
1991	Sawtooth	112,398	96.3%	85.5%	850,189
1991	Pahsimeroi	881,538	95.3%		
1992	Sawtooth	1,256,701	97.1%	63.8%	1,487,842
1992	Pahsimeroi	1,076,009	97.8%		
1993	Sawtooth	1,014,960	97.2%	75.2%	1,519,168
1993	Pahsimeroi	1,005,013	96.3%		
1994	Sawtooth	593,953	92.6%	68.8%	1,151,544
1994	Pahsimeroi	362,118	98.9%		
1994	Oxbow	717,576	96.6%		
1995	Sawtooth	562,513	98.5%	80.2%	1,324,593
1995	Pahsimeroi	345,164	97.5%		
1995	Oxbow	744,888	96.8%		
1996	Sawtooth	898587	98.3%	81.8%	1,148,370
1996	Pahsimeroi	505,291	97.1%		
1997	Sawtooth	836,648	97.5%	83.6%	1,032,407
1997	Pahsimeroi	398,452	96.7%		
1998	Sawtooth	803,057	98.2%	83.7%	1,133,825
1998	Oxbow	552,261	98.2%		
1999	Sawtooth	899,444	98.0%	80.8%	1,174,882
1999	Oxbow	554,520	96.1%		
2000	Sawtooth	946,595	98.7%	90.7%	1,052,659
2000	Pahsimeroi	213,977	98.1%		

9.2.2) Density and loading criteria (goals and actual levels).

Magic Valley Fish Hatchery - Density (DI) and flow (FI) indices are maintained to not exceed 0.30 and 1.2, respectively (Piper et al. 1982).

Hagerman National Fish Hatchery - Density and flow indices are maintained to not exceed 0.8, and 1.0, respectively.

9.2.3) Fish rearing conditions

Magic Valley Fish Hatchery – Fish rear on constant 15.0ºC water. Dissolved oxygen, flows, total suspended solids, settable solids, phosphorus, and water temperature are recorded monthly. Density and flow indices are monitored on a regular basis. Rearing groups are split or moved as needed to adhere to these indices. Fish are fed in outside raceways from a traveling bridge fitted with 16 Nielson automatic feeders. Raceway cleaning takes place every two days; raceways are swept manually with brooms. Sample counts are conducted monthly and dead fish are removed daily.

Hagerman National Fish Hatchery - Water temperature and rearing conditions are very similar to those described above for the Magic Valley Fish Hatchery. The Hagerman National Fish Hatchery is not equipped with a traveling bridge.

9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.

Magic Valley and Hagerman National fish hatcheries rear juvenile steelhead under constant water temperature (15.0ºC) conditions. As such, both facilities experience similar growth rates and design feeding schedules to produce fish between 180 and 250 to the pound at release. Length gained per month for the first three months of culture at both facilities is typically between 0.8 and 1.0 inches (20.3 to 25.4 mm). Fish gain approximately 0.65 to 0.75 inches per month (16.5 to 19.1 mm) thereafter. To meet the release size target, fish may be fed on an intermittent schedule beginning in their fourth month of culture.

9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

See Section 9.2.4 above.

9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

Magic Valley Fish Hatchery – Dry and semi-moist diets have been used at the Magic Valley Fish Hatchery in the past. Currently, fish are fed the Rangen 440 extruded salmon dry diet. First feeding fry are fed at a rate of approximately 5% body weight per day. As fish grow, percent body weight fed per day decreases. Fry are fed with Loudon solenoid activated feeders while located in early rearing vats. Following transfer to outside raceways, fish are fed by hand and with the assistance of the traveling bridge. First feeding fry are typically fed up to eight times per day. Prior to release, pre-smolts are typically fed four times per day. Feed conversion averages 1.18 pounds of feed fed for every pound of weight gain (from first feeding through release).

Hagerman National Fish Hatchery - Fry receive their first feeding when approximately 80% of the population has reached the “swim-up” stage of development. First feedings are generally light. Starter diets are typically sifted prior to feeding. Fry are generally fed approximately 5% of their body weight per day. Fry are fed a semi-moist diet at a rate of eight to ten times per day until they reach approximately 300 fish per pound. Steelhead are transferred to outside raceways at approximately 200 fish per pound and converted to a dry diet. At this time, fish are fed approximately 3.7 percent body weight per day. When fish reach approximately 20 to the pound, demand feeders are used.

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.

Magic Valley Fish Hatchery – Routine fish health inspections are conducted by staff from the IDFG Eagle Fish Health Laboratory on a monthly basis. More frequent inspections occur if needed. Therapeutics may be used to treat specific disease agents (e.g., Oxytetracycline). Foot baths with disinfectant are used at the entrance of the hatchery early rearing building. Disinfection protocols are in place for equipment, trucks and nets. All raceways are thoroughly chlorinated after fish have been transferred for release.

Hagerman National Fish Hatchery - Fish health monitoring is periodically conducted by the Idaho Fish Health Center (U.S. Fish and Wildlife Service). Fish samples are sent Fed-Ex on an as needed basis. Disinfection protocols are in place for equipment, nets, and trucks.

9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.

No smolt development indices are developed in this program.

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.

No semi-natural or natural rearing methods are applied.

9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

ESA-listed, natural-origin steelhead are not propagated as part of the Salmon River A-run steelhead program.

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.

10.1) Proposed fish release levels.

Magic Valley Fish Hatchery proposed fish release levels.

Age Class	Maximum Number	Size (fpp)	Release Date	Location	Rearing Hatchery

Age Class	Maximum Number	Size (fpp)	Release Date	Location	Rearing Hatchery
Eggs	300,000*		May - June	Yankee Fork Salmon River	Pahsimeroi & Sawtooth
Unfed Fry					
Fry					
Fingerling					
Yearling	120,000	4.3	4/11-5/2	Lemhi River	Magic Valley
	50,000	4.3	4/11-5/2	Salmon River, Lewis & Clark	Magic Valley
	40,000	4.3	4/11-5/2	Salmon River, Wagonhammer	Magic Valley
	40,000	4.3	4/11-5/2	Salmon River, Red Rock	Magic Valley
	60,000	4.3	4/11-5/2	Salmon River, Shoup Bridge	Magic Valley
	50,000	4.3	4/11-5/2	Salmon River, Eye Hole	Magic Valley
	60,000	4.3	4/11-5/2	Salmon River, Colston Corner	Magic Valley
	80,000	4.3	4/11-5/2	Salmon River, Lemhi Hole	Magic Valley
	40,000	4.3	4/11-5/2	Salmon River, Tunnel Rock	Magic Valley
	80,000	4.3	4/11-5/2	Salmon River, McNabb Pt.	Magic Valley
	30,000	4.3	4/11-5/2	Pahsimeroi Trap	Magic Valley
	40,000	4.3	4/11-5/2	Salmon River, Cottonwood	Magic Valley
	40,000	4.3	4/22-5/2	Salmon River, Hwy 93	Magic Valley
	180,000	4.3	4/11-5/2	Salmon River, Hammer Crk.	Magic Valley
	190,000	4.3	4/11-5/2	Yankee Fork Salmon River	Magic Valley
	30,000	4.3	4/11-5/2	Valley Creek	Magic Valley
	750,000	4.5	4/12-4/25	Sawtooth Hatchery Weir	Hagerman Nat.
	140,000	4.5	4/12-4/25	Yankee Fork Salmon River	Hagerman Nat.
	160,000	4.5	4/12-4/25	Little Salmon River, Stinky Sp.	Hagerman Nat.
	40,000	4.5	4/12-4/25	Little Salmon River, Hazard Cr.	Hagerman Nat.

* If implemented, eyed-eggs are transferred from Sawtooth Fish Hatchery to the Shoshone-Bannock Tribes for planting in streamside or instream incubators. Eggs are not shipped to the Magic Valley Fish Hatchery.

10.2) Specific location(s) of proposed release(s).

Stream, river, or watercourse:
Release point: (*river kilometer location, or latitude/longitude*)
Major watershed: (e.g. "Skagit River")
Basin or Region: *(e.g. "Puget Sound")*

A-run, summer steelhead release locations.

Stream	Release Point	HUC	Major Watershed & Basin
Lemhi River	Lemhi River	17060204	Salmon River
Salmon River	Salmon River, Lewis & Clark	17060203	Salmon River
Salmon River	Salmon River, Wagonhammer	17060203	Salmon River
Salmon River	Salmon River, Red Rock	17060203	Salmon River
Salmon River	Salmon River, Shoup Bridge	17060203	Salmon River
Salmon River	Salmon River, Eye Hole	17060203	Salmon River
Salmon River	Salmon River, Colston Corner	17060203	Salmon River
Salmon River	Salmon River, Lemhi Hole	17060203	Salmon River
Salmon River	Salmon River, Tunnel Rock	17060203	Salmon River
Salmon River	Salmon River, McNabb Pt.	17060203	Salmon River
Pahsimeroi River	Pahsimeroi Trap	17060202	Salmon River
Salmon River	Salmon River, Cottonwood	17060203	Salmon River
Salmon River	Salmon River, Hwy 93	17060203	Salmon River
Salmon River	Salmon River, Hammer Crk.	17060203	Salmon River
Valley Creek	Valley Creek	17060201	Salmon River
Yankee Fork	Yankee Fork Salmon Riv.	17060201	Salmon River
Salmon River	Sawtooth Hatchery weir	17060201	Salmon River
Little Salmon R.	Little Salmon River, Stinky Sp.	17060210	Salmon River
Little Salmon R.	Little Salmon River, Hazard Cr.	17060210	Salmon River

10.3) Actual numbers and sizes of fish released by age class through the program.

In addition to rearing A-run steelhead for Salmon River programs, rearing hatcheries listed below rear steelhead to meet other management objectives. For perspective, a review of brood year 2002 rearing groups if provided. Hatchery steelhead intercepted at the Sawtooth and Pahsimeroi fish hatcheries are managed as an integrated broodstock. Reference to "Sawtooth A-run steelhead" is a geographic reference to broodstock location and does not imply a separate stock.

Rearing Hatchery	Stock	7/1/02 Inventory
Magic Valley	Dworshak B-run sthd	938,441

Magic Valley	Pahsimeroi A-run sthd	840,723
Magic Valley	Upper Salmon B-run sthd	81,206
Magic Valley	E. Fork Salmon R. naturals	32,382
Magic Valley	Sawtooth A-run sthd	379,050
Hagerman National	Sawtooth A-run sthd	934,600
Hagerman National	Pahsimeroi A-run sthd	208,490
Hagerman National	Dworshak B-run sthd	211,109
Niagara Springs	Oxbow A-run Snake R. sthd	710,836
Niagara Springs	Pahsimeroi A-run sthd	1,278,756

The number of A-run steelhead released by rearing hatchery from 1991 through 2001 is presented below.

Release Year	Rearing Hatchery	Life Stage Released	Avg. Size (fish/pound)	Number Released
1991	Magic Valley	Yearling	3.81	1,094,200
1992	Magic Valley	Yearling	4.09	1,148,200
1993	Magic Valley	Yearling	5.47	915,900
1994	Magic Valley	Yearling	4.55	951,990
1995	Magic Valley	Yearling	4.34	684,035
1996	Magic Valley	Yearling	4.69	801,053
1997	Magic Valley	Yearling	4.60	850,055
1998	Magic Valley	Yearling	4.44	701,850
1999	Magic Valley	Yearling	3.86	779,042
2000	Magic Valley	Yearling	4.15	886,528
2001	Magic Valley	Yearling	4.67	1,666,335
		Avg. =	4.42	952,653
1991	Hagerman Nat.	Yearling	4.41	850,189
1992	Hagerman Nat.	Yearling	4.48	1,487,842
1993	Hagerman Nat.	Yearling	4.79	1,519,168
1994	Hagerman Nat.	Yearling	4.62	1,151,544
1995	Hagerman Nat.	Yearling	n/a	1,324,593
1996	Hagerman Nat.	Yearling	5.30	1,148,370
1997	Hagerman Nat.	Yearling	4.50	1,032,407
1998	Hagerman Nat.	Yearling	n/a	1,133,825
1999	Hagerman Nat.	Yearling	n/a	1,174,882
2000	Hagerman Nat.	Yearling	n/a	1,052,659
		Avg. =	4.68	1,187,548

10.4) Actual dates of release and description of release protocols.

See Sections 10.5 and 10.6 for a description of release protocols. Actual dates of release for the past six years is presented below.

Release Year	Rearing Hatchery	Life Stage	Date Released
1996	Magic Valley	Yearling	4/12 – 5/4
1997	Magic Valley	Yearling	4/9 – 4/21
1998	Magic Valley	Yearling	4/10 – 5/4
1999	Magic Valley	Yearling	4/7 – 5/12
2000	Magic Valley	Yearling	4/11 – 5/2
1996	Hagerman National	Yearling	4/16 – 4/24
1997	Hagerman National	Yearling	4/14 – 4/28
1998	Hagerman National	Yearling	4/20 – 4/24
1999	Hagerman National	Yearling	4/19 – 4/23
2000	Hagerman National	Yearling	4/24 – 4/26

10.5) Fish transportation procedures, if applicable.

Loading and transportation procedures are similar among rearing hatcheries. Generally, yearlings are crowded in raceways and pumped into 5,000 gallon transport trucks using an 8 inch Magic Valley Heliarc pump and dewatering tower. Transport water temperature is chilled to approximately 7.2ºC . Approximately 5,000 pounds of fish are loaded into each truck. Transport duration to release sites is ranges from 4 to 9 hours. Trucks are equipped with oxygen and fresh flow agitator systems. Fish are not fed for up to four days prior to loading and transporting.

10.6) Acclimation procedures (*methods applied and length of time*).

For the Salmon River A-run steelhead program, acclimation occurs in outside production raceways (when feasible). Generally, only fish destined for release at the Sawtooth Fish Hatchery weir are acclimated prior to release (approximately 750,000 annually). All other fish are released directly to receiving waters.

10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

All harvest mitigation fish are marked with an adipose fin clip. To evaluate emigration success and timing to main stem dams, PIT tags are inserted in production release groups annually. To evaluate adult return success, CWT tags are inserted in release groups annually. Coded wire-tagged fish may receive an additional ventral fin clip.

Other releases may be released unmarked.

The following table presents the IDFG draft, brood year 2002 A-run steelhead mark and tag management plan.

Rearing Hatchery	AD clip only	CWT/LV/AD tag and clips	CWT/LV/AD/PIT tags and clips	AD/PIT tag and clip	NO CLIP	NO CLIP/PIT
Magic Valley	810,000	180,000	600	1,500	140,000	600
Hagerman National	670,000	80,000	1,200	0	340,000	600

10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

If the surplus is within 10% of the programmed level, it is included in the programmed release. Additional surplus may be transferred as appropriate to the IDFG resident fish stocking program.

10.9) Fish health certification procedures applied pre-release.

Between 45 and 30 d prior to release, a 20 fish preliberation sample is taken from each rearing lot to assess the prevalence of viral replicating agents and to detect the pathogens responsible for bacterial kidney disease and whirling disease. In addition, an organosomatic index is developed for each release lot. Diagnostic services are provided by the IDFG Eagle Fish Health Laboratory and the Idaho Fish Health Center (U.S. Fish and Wildlife Service).

10.10) Emergency release procedures in response to flooding or water system failure.

Emergency procedures are in place to guide activities in the event of potential catastrophic event. Plans include a trouble shooting and repair process followed by the implementation of an emergency action plan if the problem can not be resolved. Emergency actions include fish consolidations, transfers to other rearing hatcheries in the Hagerman Valley, and supplemental oxygenation.

10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

Actions taken to minimize adverse effects on listed fish include:

1. Continuing fish health practices to minimize the incidence of infectious disease agents. Follow IHOT, AFS, and PNFHPC guidelines.

2. Reducing the number of steelhead released in the primary upper Salmon River salmon production area. The primary upper Salmon River production area includes the Salmon River from Warm Springs Creek upstream to the headwaters of the Salmon and East Fork Salmon rivers.

3. Acclimating steelhead at the Sawtooth Fish Hatchery for at least 2 weeks. This action may increase smoltification and thus decrease the potential for residualism. We are evaluating this action to determine its benefit for reducing residualism and increasing steelhead survival, which may lead to reduced release numbers.

4. Volitionally releasing acclimated steelhead at the Sawtooth Fish Hatchery prior to forced release.

5. Moving release sites for steelhead not released at Sawtooth Fish Hatchery downstream to reduce potential for predation on chinook fry emerging or migrating from mainstem Salmon River and East Fork Salmon River redds.

6. Continuing to release steelhead in the lower Salmon River where natural chinook production is minimal or nonexistent.

7. Minimizing the number of smolts in the release population which are larger than 225 mm (or about 4 fpp).

8. Not releasing adult steelhead into chinook production areas, such as above weirs, in excess of estimated carrying capacity.

9. Continuing to reduce effect of the release of large numbers of juvenile steelhead at a single site by spreading the release over a number of days.

10. Programming time of release to mimic natural fish for releases, given the constraints of transportation.

11. Continuing research to improve post-release survival of steelhead to potentially reduce numbers released to meet management objectives.

12. Monitoring hatchery effluent to ensure compliance with National Pollutant Discharge Elimination System permit.

13. Continuing to externally mark hatchery steelhead released for harvest purposes with an adipose fin clip.

14. Continuing Hatchery Evaluation Studies (HES) to provide comprehensive monitoring and evaluation for LSRCP steelhead.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1) Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

11.1.1) Describe plans and methods proposed to collect data necessary to respond

to each "Performance Indicator" identified for the program.

Document LSRCP fish rearing and release practices.

Performance Standards and Indicators: 3.2.2, 3.3.2, 3.4.1, 3.4.2, 3.4.3, 3.4.4, 3.5.2, 3.5.4, 3.5.5, 3.6.1, 3.6.2, 3.7.1, 3.7.2, 3.7.3, 3.7.4, 3.7.5, 3.7.6

Document, report, and archive all pertinent information needed to successfully manage A-run steelhead rearing and release practices. (e.g., number and composition of fish spawned, spawning protocols, spawning success, incubation and rearing techniques, juvenile mark and tag plans, juvenile release locations, number of juveniles released, size at release, migratory timing and success of juveniles, and fish health management).

Document the contribution LSRCP-reared A-run summer steelhead make toward meeting mitigation and management objectives. Document juvenile out-migration and adult returns.

Performance Standards and Indicators: 3.1.1,3.1.2, 3.1.3, 3.2.1, 3.2.2, 3.3.1, 3.3.2, 3.4.3, 3.4.4, 3.5.1, 3.5.2, 3.5.3, 3.5.4, 3.5.5, 3.5.6, 3.6.1, 3.6.2, 3.7.7, 3.7.8

Estimate the number of wild/natural and hatchery-produced steelhead escaping to project waters above Lower Granite Dam using dam counts, harvest information, spawner surveys, and trap information (e.g., presence/absence of identifying marks and tags, number, species, size, age, length). Conduct creel surveys and angler phone or mail surveys to collect harvest information. Assess juvenile outmigration success at traps and dams using direct counts, marks, and tags. Reconstruct runs by brood year. Summarize annual mark and tag information (e.g., juvenile out-migration survival, juvenile and adult run timing, adult return timing and survival). Develop estimates of smolt-to-adult survival for wild/natural and hatchery-produced A-run steelhead. Use identifying marks and tags and age structure analysis to determine the composition of adult A-run steelhead.

Identify factors that are potentially limiting program success and recommend operational modifications, based on the outcome applied studies, to improve overall performance and success.

Performance Standards and Indicators: 3.6.1, 3.6.2

Evaluate potential relationships between rearing and release history and juvenile and adult survival information. Develop hypotheses and experimental designs to investigate practices that may be limiting program success. Implement study recommendations and monitor and evaluate outcomes.

11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

Yes, funding, staffing and support logistics are dedicated to the existing monitoring and evaluation program through the LSRCP program and the Idaho Power Company. Additional monitoring and evaluation activities (that contribute effort and information to addressing similar or common objectives) are associated with BPA Fish and Wildlife programs referenced in Section 12, below.

11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

Risk aversion measures for research activities associated with the evaluation of the Lower Snake River Compensation Program are specified in our ESA Section 7 Consultation and Section 10 Permit 1124. A brief summary of the kinds of actions taken is provided.

Adult handling activities are conducted to minimize impacts to ESA-listed, non-target species. Adult and juvenile weirs and screw traps are engineered properly and installed in locations that minimize adverse impacts to both target and non-target species. All trapping facilities are constantly monitored to minimize a variety of risks (e.g., high water periods, high emigration or escapement periods, security).

Adult spawner and redd surveys are conducted to minimize potential risks to all life stages of ESA-listed species. The IDFG conducts formal redd count training annually. During surveys, care is taken to not disturb ESA-listed species and to not walk in the vicinity of completed redds.

Snorkel surveys conducted primarily to assess juvenile abundance and density are conducted in index sections only to minimize disturbance to ESA-listed species. Displacement of fish is kept to a minimum.

Marking and tagging activities are designed to protect ESA-listed species and allow mitigation harvest objectives to be pursued/met. All hatchery-produced, mitigation steelhead are visibly marked to differentiate them from their wild/natural counterpart.

SECTION 12. RESEARCH

12.1) Objective or purpose.

An extensive monitoring and evaluation program is conducted in the basin to document hatchery practices and evaluate the success of the hatchery programs at meeting program mitigation objectives, Idaho Department of Fish and Game management objectives, and to monitor and evaluate the success of supplementation programs. The hatchery monitoring and evaluation program identifies hatchery rearing and release strategies that will allow the program to meet its mitigation requirements and improve the survival of hatchery fish while avoiding negative impacts to natural (including listed) populations.

To properly evaluate this compensation effort, adult returns to facilities, spawning areas, and fisheries that result from hatchery releases are documented. The program requires the cooperative efforts of the Idaho Department of Fish and Game's hatchery evaluation study, harvest monitoring project, and the coded-wire tag laboratory programs. The Hatchery evaluation study evaluates and provides oversight of certain hatchery operational practices, (e.g., broodstock selection, size and number of fish reared, disease history, and time of release). Hatchery practices will be assessed in relation to their effects on adult returns. Recommendations for improvement of hatchery operations will be made.

Part of the evaluation of hatchery performance includes the identification and collection of suitable broodstock, as well as the evaluation of different methods for releasing juveniles. Current research efforts by the hatchery evaluation team on steelhead are primarily focused in these areas. A project is underway on Squaw Creek to establish a local origin steelhead broodstock by trapping and spawning adults returning to a temporary weir. A second project centered around Squaw Creek deals with evaluating acclimation and volitional release strategies, as well as looking at the adult return performance of locally derived versus out-of-basin broodstocks.

The harvest monitoring project provides comprehensive harvest information, which is key to evaluating the success of the program in meeting adult return goals. Numbers of hatchery and wild/natural fish observed in the fishery and in overall returns to the project area in Idaho are estimated. Data on the timing and distribution of the marked hatchery and wild stocks in the fishery are also collected and analyzed to develop harvest management plans. Harvest data provided by the harvest monitoring project are coupled with hatchery return data to provide an estimate of returns from program releases. Coded-wire tags continue to be used extensively to evaluate fisheries contribution of representative groups of program production releases. However, most of these fish serve experimental purposes as well, i.e., for evaluation of hatchery-controlled variables such as size, time, and location of release, rearing densities, etc.

Continuous coordination between the hatchery evaluation study and Idaho Department of Fish and Game's BPA-funded supplementation research project is required because these programs overlap in several areas for different species including: juvenile outplanting, broodstock collection, and spawning (mating) strategies.

12.2) Cooperating and funding agencies.

U.S. Fish and Wildlife Service – Lower Snake River Compensation Plan Office.

Shoshone-Bannock Tribes

U.S. v. Oregon parties

Idaho Power Company

12.3) Principle investigator or project supervisor and staff.

Steve Yundt – Fisheries Research Manager, Idaho Department of Fish and Game.

12.4) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

N/A

12.5) Techniques: include capture methods, drugs, samples collected, tags applied.

Research techniques associated with the operation of the broodstock and rearing hatcheries identified in this HGMP involve: hatchery staff; LSRCP hatchery evaluation, harvest monitoring, and coded-wire tag laboratory staff; Idaho supplementation studies staff, and IDFG regional fisheries management staff.

Hatchery staff routinely investigate hatchery variables (e.g., diet used, ration fed, vat or raceway environmental conditions, release timing, size at release, acclimation, etc.) to improve program success. Hatchery-oriented research generally involves the cooperation of LSRCP hatchery evaluation staff. In most cases, PIT and coded-wire tags are used to measure the effect of specific treatments. The IDFG works cooperatively with the Shoshone-Bannock Tribes and the U.S. Fish and Wildlife Service to develop annual mark plans for A-run steelhead juveniles produced at the various hatcheries. Cooperation with LSRCP harvest monitoring and coded-wire tag laboratory staff is required to thoroughly track the distribution of tags in adult salmon. Generally, most hatchery-oriented research occurs prior to the release of spring smolt groups.

Harvest monitoring staff (LSRCP monitoring and evaluations) work cooperatively with IDFG regional fisheries management staff to monitor activities associated with steelhead sport fisheries. Estimates of harvest, pressure, and catch per unit effort are developed in years when sport fisheries occur. The contribution LSRCP-produced fish make to the fishery is also assessed.

Idaho supplementation studies and IDFG regional fisheries management staff work cooperatively to assemble annual juvenile steelhead out-migration and adult return data sets. Adult information is assembled from a variety of information sources including: dam and weir counts, rack returns, fishery information, coded-wire tag information, redd surveys, and spawning surveys.

Idaho Department of Fish and Game and cooperator staff may sample adult steelhead to collect tissue samples for subsequent genetic analysis. Additionally, otoliths, scales, or fins may be collected for age analysis.

12.6) Dates or time period in which research activity occurs.

Fish culture practices are monitored throughout the year by hatchery and hatchery evaluation research staff.

Adult escapement is monitored at downstream dams and above Lower Granite Dam during the majority of the year. Harvest information is collected during periods when sport and tribal fisheries occur. The PSMFC Regional Mark Information System is queried on a year-round basis to retrieve adult coded-wire tag information.

Smolt out-migration through the hydro system corridor is typically monitored from March through December. Juvenile steelhead population abundance and density is monitored during late spring and summer months. The PSMFC PIT Tag Information System is queried on a year-round basis to retrieve juvenile PIT tag information.

Fish health monitoring occurs year round.

12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.

Research activities that involve the handling of eggs or fish apply the same protocols reviewed in Section 9 above. Hatchery staff generally assist with all cooperative activities involving the handling of eggs or fish.

12.8) Expected type and effects of take and potential for injury or mortality.

See Table 1. Generally, take for research activities is defined as: "observe/harass", "capture/handle/release" and "capture, handle, mark, tissue sample, release."

12.9) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1).

See Table 1.

12.10) Alternative methods to achieve project objectives.

Alternative methods to achieve research objectives have not been developed.

12.11) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

N/A.

12.12) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.

See Section 11.2 above.

<u>SECTION 13. ATTACHMENTS AND CITATIONS</u>

Literature Cited:

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by_____________________________ Date:_____________

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: ________________________ ESU/Population:______________________________ Activity:__________________

Location of hatchery activity:____________________ Dates of activity:__________________ Hatchery program operator:________________

Type of Take	Annual Take of Listed Fish By Life Stage (*Number of Fish*)			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)				
Capture, handle, tag/mark/tissue sample, and release d)			Entire run	
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)			2	
Other Take (specify) h) Tissue sampling				10

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

Instructions:

1. *An entry for a fish to be taken should be in the take category that describes the greatest impact.*
2. *Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).*
3. *If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.*

APPENDIX 2-14—SALMON RIVER B-RUN STEELHEAD HATCHERY AND GENETIC MANAGEMENT PLAN

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	**Salmon River Basin, B-Run Steelhead** Magic Valley Fish Hatchery. Clearwater Fish Hatchery. Dworshak National Fish Hatchery. Hagerman National Fish Hatchery Sawtooth Fish Hatchery, East Fork Salmon River Satellite facility. Squaw Creek Pond.
Species or Hatchery Stock:	Summer Steelhead B-run *Oncorhynchus mykiss.*
Agency/Operator:	Idaho Department of Fish and Game
Watershed and Region:	Salmon River, Idaho.
Date Submitted:	September 30, 2002
Date Last Updated:	September 30, 2002

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Hatchery: Magic Valley Fish Hatchery
Clearwater Fish Hatchery
Dworshak National Fish Hatchery
Hagerman National Fish Hatchery
Sawtooth Fish Hatchery, East Fork Salmon River Satellite
Squaw Creek Pond

Program: B-Run Steelhead

1.2) Species and population (or stock) under propagation, and ESA status.

Summer Steelhead *Oncorhynchus mykiss*.
Snake River Basin summer steelhead ESU.
Hatchery population not ESA-listed.

1.3) Responsible organization and individuals

Lead Contact
Name (and title): Sharon W. Kiefer, Anadromous Fish Manager.
Agency or Tribe: Idaho Department of Fish and Game.
Address: 600 S. Walnut, P.O. Box 25, Boise, ID 83707.
Telephone: (208) 334-3791.
Fax: (208) 334-2114.
Email: skiefer@idfg.state.id.us

On-site Operations Lead
Name (and title): Rick Lowell, Fish Hatchery Manager II, Magic Valley Fish Hatchery.
Agency or Tribe: Idaho Department of Fish and Game.
Address: 2036 River Road, Filer, ID 83328.
Telephone: (208) 326-3230.
Fax: (208) 326-3354.
Email: rlowell@idfg.state.id.us

Name (and title): Jerry McGehee, Fish Hatchery Manager II, Clearwater Fish Hatchery.
Agency or Tribe: Idaho Department of Fish and Game.
Address: 4156 Ahsahka Rd., Ahsahka, ID 83520.
Telephone: (208) 476-3331.
Fax: (208) 479-3548.
Email: jmcgehee@idfg.state.id.us

Name (and title): Brent Snider, Fish Hatchery Manager II, Sawtooth Fish Hatchery.
Agency or Tribe: Idaho Department of Fish and Game.

Address: HC 64 Box 9905 Stanley, ID 83278.
Telephone: (208) 774-3684.
Fax: (208) 774-3413.
Email: bsnider@idfg.state.id.us

Name (and title): William Miller, Complex Manager, Dworshak National Fish Hatchery.
Agency or Tribe: U.S. Fish and Wildlife Service.
Address: P.O. box 18, 4147 Ahsahka Rd., Ahsahka, ID 83520
Telephone: (208) 476-4591.
Fax: (208) 476-3252.
Email: bill_h_miller@fws.gov

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

U.S. Fish and Wildlife Service – Lower Snake River Compensation Plan Office: Administers the Lower Snake River Compensation Plan as authorized by the Water Resources Development Act of 1976.

Dworshak National Fish Hatchery: Produces B-run steelhead eggs for the Clearwater Fish Hatchery. Eyed-eggs are shipped to the Magic Valley Fish Hatchery for the Salmon River B-run steelhead program.

Hagerman National Fish Hatchery: Prior to 1993, the Hagerman National Fish Hatchery received eyed-eggs for hatch and release back to Salmon River locations (primarily the East Fork Salmon River). As this component of the program is absent today, no hatchery-specific information is presented. Readers are referred to the HGMP produced by the USFWS for this facility.

1.4) Funding source, staffing level, and annual hatchery program operational costs.

Magic Valley Fish Hatchery
U.S. Fish and Wildlife Service – Lower Snake River Compensation Plan funded.
Staffing level: 4 FTE.
Annual budget: $750,000.

Clearwater Fish Hatchery
U.S. Fish and Wildlife Service – Lower Snake River Compensation Plan funded.
Staffing level: 7 FTE.
Annual budget: $1,300,000.

Sawtooth Fish Hatchery
U.S. Fish and Wildlife Service – Lower Snake River Compensation Plan funded.
Staffing level: 5 FTE.
Annual budget: $850,000.

Dwershak National Fish Hatchery
Steelhead program funded by U.S. Army Corps of Engineers

1.5) Location(s) of hatchery and associated facilities.

Magic Valley Fish Hatchery **–** The Magic Valley Fish Hatchery is located adjacent to the Snake River approximately 11.2 kilometers northwest of Filer, Idaho. There is no river kilometer code for the facility. The hydrologic unit code for the facility is 17040212.

Clearwater Fish Hatchery - The Clearwater Fish Hatchery is located at confluence of the North Fork and main Clearwater rivers, river kilometer 65 on the Clearwater River; 121 kilometers upstream from Lower Granite Dam, and 842 kilometers upstream from the mouth of the Columbia River. The Hydrologic Unit Code is 17060306.

Sawtooth Fish Hatchery **–** The Sawtooth Fish Hatchery is located on the upper Salmon River approximately 8.0 kilometers south of Stanley, Idaho. The river kilometer code for the facility is 503.303.617. The hydrologic unit code for the facility is 17060201.

East Fork Salmon River Satellite – The East Fork Salmon River Satellite is located on the East Fork Salmon River approximately 29 kilometers upstream of the confluence of the East Fork with the main stem Salmon River. The river kilometer code for the facility is 522.303.552.029. The hydrologic unit code for the facility is 17060201.

Squaw Creek Pond – The Squaw Creek Pond juvenile acclimation and adult trapping facility is located on Squaw Creek approximately 1 kilometer upstream of the confluence of Squaw Creek with the Salmon River. The river kilometer code for the facility is 522.303.564.001. The hydrologic unit code for the facility is 17060201.

Dworshak National Fish Hatchery **–** The Dworshak National Fish Hatchery is located at the confluence of the North Fork and the Mainstem Clearwater River at river kilometer 65 in the Snake River Basin, Idaho. The Hydrologic Unit Code (EPA Reach Code) is 17060306.

1.6) Type of program.

Lower Snake River Compensation Plan - The Salmon River B-run steelhead program was designed as an *Isolated Harvest Program*. This program was developed specifically for fishery enhancement and was not intended to address supplementation objectives. The original management intent was for it to stand alone without the continual infusion of B-run steelhead juveniles produced in the Clearwater River Basin. However, this objective has not been met.

Spawning occurs at two locations: the Dworshak National Fish Hatchery and at the East Fork Salmon River Satellite operated by the Sawtooth Fish Hatchery. Prior to brood year 1996, all eggs produced at the Dworshak National Fish Hatchery for this program were incubated through the eyed-stage of development at Dworshak. Brood year 1996 eggs were transferred to the Clearwater Fish Hatchery for incubation through the eyed-stage of development. In brood year 1997, green eggs produced at Dworshak National Fish Hatchery were flown to the Sawtooth Fish Hatchery for incubation. Eggs produced in all subsequent brood years (1998 through present) have been incubated through the eyed stage of development at the Clearwater Fish Hatchery. Eyed-eggs are then shipped to the Magic Valley Fish Hatchery.

Prior to 1993, the Hagerman National Fish Hatchery received B-run steelhead eggs from Dworshak National Fish Hatchery for this program.

Green eggs generated at the East Fork Salmon River Satellite are incubated at the Sawtooth Fish Hatchery. Eyed-eggs are then shipped to the Magic Valley Fish Hatchery.

B-run steelhead smolts are released in the Little Salmon River, the East Fork Salmon River, Squaw Creek (tributary to the Salmon River) and in Squaw Creek Pond. Hatchery-produced, B-run adult steelhead that return to the East Fork Salmon River trap and to Squaw Creek Pond are spawned at the East Fork Salmon River trap.

1.7) Purpose (Goal) of program.

Mitigation - The goal of the Lower Snake River Compensation Plan is to return approximately 25,000 adult steelhead to the project area above Lower Granite Dam to mitigate for survival reductions resulting from construction and operation of the four lower Snake River dams. B-run steelhead comprise approximately 15% of the Salmon River steelhead program.

1.8) Justification for the program.

The primary purpose of this program is harvest mitigation. The Lower Snake River Compensation Program has been in operation since 1983 to provide for mitigation for lost steelhead production caused by the construction and operation of the four lower Snake River dams.

The 1999 NMFS Biological Opinion on Artificial Propagation in the Columbia River Basin (NMFS 1999) concluded that Snake River summer steelhead artificial propagation actions are expected to adversely effect listed Snake River summer steelhead. The release of hatchery steelhead into natural production areas is expected to result in predation and competition with listed steelhead juveniles.

Actions taken to minimize adverse effects on listed fish include:

1. Continuing fish health practices to minimize the incidence of infectious disease agents. Follow IHOT, AFS, and PNFHPC guidelines.

2. Reducing the number of steelhead released in the primary upper Salmon River salmon production area. The primary upper Salmon River production area includes the Salmon

River from Warm Springs Creek upstream to the headwaters of the Salmon and East Fork Salmon rivers.

3. Acclimating steelhead at Squaw Pond for at least 2 weeks. This action may increase smoltification and thus decrease the potential for residualism. We are evaluating this action to determine its benefit for reducing residualism and increasing steelhead survival, which may lead to reduced release numbers.

4. Volitionally releasing acclimated steelhead at the Squaw Pond prior to forced release.

5. Moving release sites for steelhead released in the East Fork Salmon River downstream to reduce the potential for negative interaction natural anadromous and resident species.

6. Continuing to release steelhead in the lower Salmon River where natural chinook production is minimal or nonexistent.

7. Minimizing the number of smolts in the release population which are larger than 225 mm (or about 4 fpp).

8. Not releasing adult steelhead into chinook production areas, such as above weirs, in excess of estimated carrying capacity.

9. Continuing to reduce effect of the release of large numbers of juvenile steelhead at a single site by spreading the release over a number of days.

10. Programming time of release to mimic natural fish for releases, given the constraints of transportation.

11. Continuing research to improve post-release survival of steelhead to potentially reduce numbers released to meet management objectives.

12. Monitoring hatchery effluent to ensure compliance with National Pollutant Discharge Elimination System permit.

13. Continuing to externally mark hatchery steelhead released for harvest purposes with an adipose fin clip.

14. Continuing Hatchery Evaluation Studies (HES) to provide comprehensive monitoring and evaluation for LSRCP steelhead.

1.9) List of program “Performance Standards”.

3.1 Legal Mandates.
3.2 Harvest.
3.3 Conservation of natural spawning populations.

3.4 Life History Characteristics.
3.5 Genetic Characteristics.
3.6 Research Activities.
3.7 Operation of Artificial Production Facilities.

1.10) List of program “Performance Indicators”, designated by "benefits" and "risks."

Note: Performance Standards and Indicators used to develop Sections 1.10.1 and 1.10.2 were taken from the final January 17, 2001 version of Performance Standards and Indicators for the Use of Artificial Production for Anadromous and Resident Fish Populations in the Pacific Northwest. Numbers referenced below correspond to numbers used in the above document.

3.1.1 Standard: Program contributes to fulfilling tribal trust responsibility mandates and treaty rights, as described in applicable agreements such as under U.S. v. Oregon and U.S. v. Washington.

Indicator 1: Total number of fish harvested in tribal fisheries targeting program.

3.1.2 Standard: Program contributes to mitigation requirements.

Indicator 1: Number of fish returning to mitigation requirements estimated.

3.1.3 Standard: Program addresses ESA responsibilities.

Indicator 1: ESA Section 7 Consultation completed.

3.2.1 Standard: Fish are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while avoiding over harvest of not-target species.

Indicator 1: Number of target fish caught by fishery estimated.
Indicator 2: Number of non-target fish caught in fishery estimated.
Indicator 3: Angler days by fishery estimated.
Indicator 4: Escapement of target fish estimated.

3.2.2 Standard: Release groups sufficiently marked in a manner consistent with information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries.

Indicator 1: Marking rate by type in each release group documented.
Indicator 2: Sampling rate by mark type for each fishery estimated.
Indicator 3: Number of marks by type observed in fishery documented.

3.3.1 Standard: Artificial propagation program contributes to an increasing number of spawners returning to natural spawning areas.

Indicator 1: Annual number of spawners on spawning grounds estimated in specific locations.
Indicator 2: Spawner-recruit ratios estimated is specific locations.
Indicator 3: Number of redds in natural production index areas documented in specific locations.

3.3.2 Standard: Releases are sufficiently marked to allow statistically significant evaluation of program contribution.

Indicator 1: Marking rates and type of mark documented.
Indicator 2: Number of marks identified in juvenile and adult groups documented.

1.10.2) "Performance Indicators" addressing risks.

3.4.1 Standard: Fish collected for broodstock are taken throughout the return in proportions approximating the timing and age structure of the population.

Indicator 1: Temporal distribution of broodstock collection managed.
Indicator 2: Age composition of broodstock collection managed.

3.4.2 Standard: Broodstock collection does not significantly reduce potential juvenile production in natural areas.

Indicator 1: No spawners of natural origin removed for broodstock.
Indicator 2: All natural origin spawners released to migrate to natural spawning areas.
Indicator 3: Number of adults, eggs or juveniles placed in natural rearing areas managed.

3.4.3 Standard: Life history characteristics of the natural population do not change as a result of this program.

Indicator 1: Life history characteristics of natural and hatchery-produced populations are measured (e.g., juvenile dispersal timing, juvenile size at outmigration, juvenile sex ratio at outmigration, adult return timing, adult age and sex ratio, spawn timing, hatch and swim-up timing, rearing densities, growth, diet, physical characteristics, fecundity, egg size).

3.4.4 Standard: Annual release numbers do not exceed estimated basin-wide and local habitat capacity.

Indicator 1: Annual release numbers, life-stage, size at release, length of acclimation documented.
Indicator 2: Location of releases documented.
Indicator 3: Timing of hatchery releases documented.

3.5.1 Standard: Patterns of genetic variation within and among natural populations do not change significantly as a result of artificial production.

Indicator 1: Genetic profiles of naturally-produced and hatchery-produced adults developed.

3.5.2 Standard: Collection of broodstock does not adversely impact the genetic diversity of the naturally spawning population.

Indicator 1: Total number of natural spawners reaching collection facilities documented.
Indicator 2: Total number of natural spawners estimated passing collection facilities documented.
Indicator 3: Timing of collection compared to overall run timing.

3.5.3 Standard: Artificially produced adults in natural production areas do not exceed appropriate proportion.

Indicator 1: Ratio of natural to hatchery-produced adults monitored (observed and estimated through fishery).
Indicator 2: Observed and estimated total numbers of natural and hatchery-produced adults passing counting stations.

3.5.4 Standard: Juveniles are released on-station, or after sufficient acclimation to maximize homing ability to intended return locations.

Indicator 1: Location of juvenile releases documented.
Indicator 2: Length of acclimation period documented.
Indicator 3: Release type (e.g., volitional or forced) documented.
Indicator 4: Adult straying documented.

3.5.5 Standard: Juveniles are released at fully smolted stage of development.

Indicator 1: Level of smoltification at release documented.
Indicator 1: Release type (e.g., forced or volitional) documented.

3.5.6 Standard: The number of adults returning to the hatchery that exceeds broodstock needs is declining.

Indicator 1: The number of adults in excess of broodstock needs documented in relation to mitigation goals of the program.

3.6.1 Standard: The artificial production program uses standard scientific procedures to evaluate various aspects of artificial production.

Indicator 1: Scientifically based experimental design with measurable objectives and hypotheses.

3.6.2. Standard: The artificial production program is monitored and evaluated on an appropriate schedule and scale to address progress toward achieving the experimental objectives.

Indicator 1: Monitoring and evaluation framework including detailed time line.
Indicator 2: Annual and final reports.

3.7.1 Standard: Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols.

Indicator 1: Annual reports indicating level of compliance with applicable standards and criteria.

3.7.2 Standard: Effluent from artificial production facility will not detrimentally affect natural populations.

Indicator 1: Discharge water quality compared to applicable water quality standards.

3.7.3 Standard: Water withdrawals and in stream water diversion structures for artificial production facility operation will not prevent access to natural spawning areas, affect spawning, or impact juveniles.

Indicator 1: Water withdrawals documented – no impacts to listed species.
Indicator 2: NMFS screening criteria adhered to.

3.7.4 Standard: Releases do not introduce pathogens not already existing in the local populations and do not significantly increase the levels of existing pathogens.

Indicator 1: Certification of juvenile fish health documented prior to release.

3.7.5 Standard: Any distribution of carcasses or other products for nutrient enhancement is accomplished in compliance with appropriate disease control regulations and guidelines.

Indicator 1: Number and location(s) of carcasses distributed to habitat documented.

3.7.6 Standard: Adult broodstock collection operation does not significantly alter spatial and temporal distribution of natural population.

Indicator 1: Spatial and temporal spawning distribution of natural population above and below trapping facilities monitored.

3.7.7 Standard: Weir/trap operations do not result in significant stress, injury, or mortality in natural populations.

Indicator 1: Mortality rates in trap documented. No ESA-listed fish targeted.
Indicator 2: Prespawning mortality rates of trapped fish in hatchery or after release documented. No ESA-listed fish targeted.

3.7.8 Standard: Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of natural fish.

Indicator 1: *Size and time of release of juvenile fish documented and compared to size and timing of natural fish.*

1.11) Expected size of program.

1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).

The Sawtooth Fish Hatchery East Fork Salmon River Satellite, the Squaw Creek Pond facility, and the Dworshak National Fish Hatchery function as broodstock collection and spawning stations. Spawning occurs at two locations: the Dworshak National Fish Hatchery and at the East Fork Salmon River Satellite operated by the Sawtooth Fish Hatchery. Prior to brood year 1996, all eggs produced at the Dworshak National Fish Hatchery for this program were incubated through the eyed-stage of development at Dworshak. Brood year 1996 eggs were transferred to the Clearwater Fish Hatchery for incubation through the eyed-stage of development. In brood year 1997, green eggs produced at Dworshak National Fish Hatchery were flown to the Sawtooth Fish Hatchery for incubation. Eggs produced in all subsequent brood years (1998 through present) have been incubated through the eyed stage of development at the Clearwater Fish Hatchery. Eyed-eggs are then shipped to the Magic Valley Fish Hatchery.

Prior to 1993, the Hagerman National Fish Hatchery received B-run steelhead eggs from Dworshak National Fish Hatchery for this program.

Eggs produced from adults collected at the Squaw Creek Pond site or the East Fork Salmon River Satellite are transferred to the Sawtooth Fish Hatchery for incubation through the eyed stage of development. Eyed-eggs are then transferred to the Magic Valley Fish Hatchery.

Broodstock collection levels are not specifically stated. However, there is a general management target of 1,000,000 B-run hatchery-produced smolts for release into the Salmon River for harvest mitigation. The Dworshak National Fish Hatchery provides the Clearwater Fish Hatchery with an adequate number of green eggs to meet juvenile production targets identified by managers for the Salmon River. Currently, approximately 600,000 B-run steelhead smolts are released in the Little Salmon River and the Salmon River (combined) of Dworshak National Fish Hatchery Origin. In addition, up to 200,000 B-run steelhead smolts are released in the lower East Fork Salmon River from East Fork Salmon River Satellite spawning events. This current level of smolt production (approximately 800,000 smolts) is generated from approximately 200 females.

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location.

Note: the following abbreviations are used in the table:

Production = Lower Snake River Compensation Program
DNFH = From Dworshak National Fish Hatchery spawning events.
EFSR = From East Fork Salmon River Satellite spawning events.

Life Stage	Facility	Release Location	Annual Release Level and purpose
Yearling	Magic Valley	Little Salmon River, Stinky Springs (from DNFH)	275,000 production
Yearling	Magic Valley	Squaw Creek Pond (from DNFH)	70,000 production
Yearling	Magic Valley	Squaw Creek (from DNFH)	200,000 production
Yearling	Magic Valley	Squaw Creek Pond (from EFSR)	70,000 production
Yearling	Magic Valley	Lower East Fork Salmon River (from DNFH)	225,000 production

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

Estimated smolt-to-adult survival rates are not available for the Salmon River B-run steelhead program. Hatchery-produced adult return information is presented below for the East Fork Salmon River Satellite and Slate Creek/Squaw Creek Pond collection sites.

East Fork Salmon River B-run steelhead adult return history.

Return Year	Total Returns (Hatchery-Produced/Natural)	Total Ponded (H/N)	Total Released (H/N)	Total Male Returns (H/N)	Total Female Returns (H/N)
1991	136 (115/21)	85 (85/0)	51 (30/21)	92(80/12)	44 (35/9)
1992	156 (111/45)	90 (90/0)	66 (21/45)	91(68/23)	65 (43/22)
1993	176 (159/17)	100 (100/0)	76 (59/17)	99 (91/8)	77 (68/9)
1994	73 (65/8)	63 (63/0)	10 (2/8)	43 (40/3)	30 (25/5)
1995	38 (36/2)	32 (32/0)	6 (4/2)	21 (21/0)	17 (15/2)
1996	54 (48/6)	47 (47/0)	7 (1/6)	32 (28/4)	22 (20/2)
1997	149 (137/12)	129 (129/0)	20 (8/12)	61 (55/6)	88 (82/6)
1998	27 (13/14)	10 (10/0)	17 (3/14)	12 (10/2)	15 (3/12)

1999	56 (46/10)	38 (38/0)	18 (8/10)	33 (30/3)	23 (16/7)
2000	48 (42/6)	42 (42/0)	6 (6/0)	26 (24/2)	22 (18/4)
2001	62 (51/11)	52 (49/3)	10 (2/8)	25 (22/3)	37 (29/8)
2002	38 (11/27)	21 (11/10)	17 (0/17)	19 (11/8)	19 (0/19)

Squaw Creek/Pond and Slate Creek B-run steelhead adult return history.

Return Year	Total Returns (Hatchery-Produced/Natural)	Total Ponded (H/N)	Total Released (H/N)	Total Male Returns (H/N)	Total Female Returns (H/N)
1996 Slate Cr.	38 (37/1)	22 (22/0)	16 (15/1)	15 (14/1)	23 (23/0)
1997 Slate Cr.	13 (13/0)	13 (13/0)	0	7 (7/0)	6 (6/0)
1998 Slate Cr.	5 (5/0)	5 (5/0)	0	4 (4/0)	1 (1/0)
1999	Not operated - n/a	n/a	n/a	n/a	n/a
2000 Squaw Cr.	1 (1/0)	1 (1/0)	0	1 (1/0)	0
2001 Squaw Cr.	4(4/0)	0	4 (4/0)	3 (3/0)	1 (1/0)
2002 Squaw Cr.	166 (158/8)	32 (32/0)	134 (126/8)	107 (102/5)	59 (56/3)

Note: B-run smolt releases were initially made in Slate Creek, a tributary of the Salmon River upstream of Squaw Creek/Pond. Adults were trapped in Slate Creek through 1998. No adult trapping occurred in 1999. Beginning in 1998, smolt releases were relocated to Squaw Creek and Squaw Pond. Adult trapping has occurred in Squaw Creek since 2000. Adult return numbers for 2000 and beyond reflect total steelhead returns (A-run and B-run combined). In 2000 and 2001, all adults met the minimum length requirement for B-run adults. In 2002, 33 of the 166 adults that returned met the B-run length criteria. Hatchery-origin, B-run adults were transferred to the East Fork Salmon River satellite and incorporated in the spawning design. Hatchery-origin, A-run adults were released in the Salmon River. Eight unmarked steelhead (one B-run and seven A-run) adults were released above the weir.

1.13) Date program started (years in operation), or is expected to start.

Sawtooth Fish Hatchery – In operation since 1985.

East Fork Salmon River Satellite – In operation since 1984.

Magic Valley Fish Hatchery – The hatchery has been in operation since 1983. A new facility was constructed in 1988.

Clearwater Fish Hatchery – In operation since 1991.

Dworshak National Fish Hatchery – The B-run steelhead program for the Salmon River has been in operation since 1978.

Squaw Pond – In operation since 1998.

1.14) Expected duration of program.

This program is expected to continue indefinitely to provide mitigation under the Lower Snake River Compensation Plan.

1.15) Watersheds targeted by program.

Listed by hydrologic unit code –

Salmon River (Pahsimeroi River to East Fork Salmon River):	17060202
East Fork Salmon River:	17060201
Squaw Creek and Pond:	17060204
Little Salmon River:	17060210

1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

Lower Snake River Compensation Plan hatchery were constructed to mitigate for fish losses caused by construction and operation of the four lower Snake River federal hydroelectric dams. Lower Snake River Compensation Plan hatcheries have a combined goal of returning approximately 25,000 adult steelhead to the project area above Lower Granite Dam. The Idaho Department of Fish and Game's objective is to ensure that harvestable components of hatchery-produced steelhead are available to provide fishing opportunity, consistent with meeting spawning escapement and preserving the genetic integrity of natural populations (IDFG 1992). The Idaho Department of Fish and Game has not considered alternative actions for obtaining program goals. Stated goals are mandated by the U.S. Fish and Wildlife Service.

SECTION 2. PROGRAM EFFECTS ON NMFS ESA-LISTED SALMONID POPULATIONS. (USFWS ESA-Listed Salmonid Species and Non-Salmonid Species are addressed in Addendum A)

2.1) List all ESA permits or authorizations in hand for the hatchery program.

Section 7 Consultation with U.S. Fish and Wildlife Service (April 2, 1999) resulting in NMFS Biological Opinion for the Lower Snake River Compensation Program.

2.2) Provide descriptions, status, and projected take actions and levels for NMFS ESA-listed natural populations in the target area.

2.2.1) <u>Description of NMFS ESA-listed salmonid population(s) affected by the program.</u>

The following excerpts on the present status of Salmon River basin steelhead were taken from the Draft Subbasin Summary for the Salmon Subbasin of the Mountain Snake Province (NPPC 2001) and from the Status Review of West Coast Steelhead from Washington, Idaho, Oregon, and California (Busby et al. 1996).

The Salmon River basin steelhead ESU occupies the Snake River Basin of southeast Washington, northeast Oregon, and Idaho. This region is ecologically complex and supports a diversity of steelhead populations; however, genetic and meristic data suggest that these populations are more similar to each other than they are to steelhead populations occurring outside of the Snake River Basin. Snake River Basin steelhead spawning areas are well isolated from other populations and include the highest elevations for spawning (up to 2,000 m) as well as the longest migration distance from the ocean (up to 1,500 km). Snake River steelhead are often classified into two groups, A- and B-run, based on migration timing, ocean age, and adult size. While total (hatchery + natural) run size for Snake River steelhead has increased since the mid-1970s, the increase has resulted from increased production of hatchery fish, and there has been a severe recent decline in natural run size. The majority of natural stocks for which we have data within this ESU have been declining. Parr densities in natural production areas have been substantially below estimated capacity in recent years. Downward trends and low parr densities indicate a particularly severe problem for B-run steelhead, the loss of which would substantially reduce life history diversity within this ESU. The BRT had a strong concern about the pervasive opportunity for genetic introgression from hatchery stocks within the ESU. There was also concern about the degradation of freshwater habitats within the region, especially the effects of grazing, irrigation diversions, and hydroelectric dams.

Areas of the subbasin upstream of the Middle Fork have been stocked with hatchery steelhead, and the IDFG has classified these runs of steelhead as natural. The majority of these steelhead are progeny of introduced hatchery stocks from the Snake River. With the construction of Hell's Canyon Dam in the 1960s, the US Fish and Wildlife Service, Army Corps of Engineer, US Forest Service, Bonneville Power Administration, Bureau of Reclamation, and Idaho Department of Fish and Game attempted to mitigate the affects of the dam by establishing a hatchery-managed, sport fishery in the upper Salmon River. Naturally produced steelhead upstream of the Middle Fork are classified as A- run, based upon characteristics of size, ocean age, and timing. Out of subbasin Snake River A-run steelhead have been released extensively in this area, and it is unlikely any wild, native populations still exist.

Both recent and historical data on the spawning populations of steelhead in specific streams within the Salmon Subbasin are very limited. Mallet (1974) estimated that historically 55% of all Columbia River steelhead trout originated from the Snake River basin, which includes the Salmon Subbasin. Though not quantified, it is likely a large proportion of these fish were produced in the Salmon Subbasin. Monitoring data from subbasins within the Mountain Snake Province (of which the Salmon Subbasin is a primary component) shows a general decline in parr densities for steelhead.

- Identify the NMFS ESA-listed population(s) that will be <u>directly</u> affected by the program

Adult, ESA-listed summer steelhead are directly affected by the operation of the East Fork Salmon River trap and holding facility. Natural adults selected for broodstock purposes (see IDFG East Fork Salmon River Natural Steelhead HGMP) are held for spawning at the facility. Natural adults not selected for broodstock purposes are released upstream of the facility.

The 1999 NMFS Biological Opinion on Artificial Propagation in the Columbia River Basin (NMFS 1999) concluded that Snake River summer steelhead artificial propagation actions are expected to adversely affect listed Snake River summer steelhead.

- Identify the NMFS ESA-listed population(s) that may be <u>incidentally</u> affected by the program.

Snake River Fall-run chinook salmon ESU (T – 4/92)

Snake River Spring/Summer-run chinook salmon ESU (T – 4/92)

Snake River Basin steelhead ESU (T – 8/97)

Bull trout (T – 6/98)

2.2.2) <u>Status of NMFS ESA-listed salmonid population(s) affected by the program.</u>

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds.

Critical and viable population thresholds have not been developed for ESA-listed Snake River B-run steelhead stocks. See Section 2.2.1 above.

- Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.

Progeny-to-parent ratios are not available for Snake River, ESA-listed steelhead stocks.

- Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

Annual spawning abundance estimates are not available.

Refer to Section 1.1.2 for a review of adult steelhead returns to the trapping facilities associated with this program.

- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

This information is not available.

Refer to Section 1.1.2 for a review of adult steelhead returns to the trapping facilities associated with this program.

2.2.3) <u>Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of NMFS listed fish in the target area, and provide estimated annual levels of take.</u>

See below.

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

ESA-listed, B-run steelhead are incidentally collected during broodstock trapping periods at the Dworshak National Fish Hatchery and at Squaw Pond and East Fork Salmon River collection sites. Unmarked adults are passed upstream with a minimum of delay and handling. Incidental take of ESA- listed Snake River chinook or sockeye salmon is unlikely during steelhead broodstock collection. Steelhead broodstock collection occurs in the upper Salmon River from March through early May. Fall chinook salmon are not present in the upper Salmon River (Mendel et al. 1992). Neither adult spring/summer chinook nor sockeye salmon are usually present in the upper Salmon River until mid-May or later (Sankovich and Bjornn 1992). Therefore, we believe there will be no adverse from broodstock collection at current hatchery weirs, or weirs developed in the future to accommodate additional hatchery steelhead broodstock collection.

- Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish.

Known take of ESA-listed Snake River steelhead at Squaw Pond and East Fork Salmon River collection sites. Dworshak National Fish Hatchery information is presented in a separate HGMP produced by the U.S. Fish and Wildlife Service. Readers should note that Snake River steelhead were listed in August of 1997. For perspective, the past 10 years of weir data are presented.

Trap year	Natural fish trapped at the East Fork Salmon River trap.	Natural fish trapped at Slate Creek or Squaw Pond traps.
1988	20	
1989	17	
1990	25	
1991	21	
1992	45	
1993	17	
1994	8	
1995	2	
1996	6	1
1997	12	0
1998	14	0
1999	10	n/a
2000	6	0
2001	11	0
2002	27	8

Note: B-run smolt releases were initially made in Slate Creek, a tributary of the Salmon River upstream of Squaw Creek/Pond. Adults were trapped in Slate Creek through 1998. No adult trapping occurred in 1999. Beginning in 1998, smolt releases were relocated to Squaw Creek and Squaw Pond. Adult trapping has occurred in Squaw Creek since 2000.

- Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).

All adult steelhead (hatchery- and natural-origin) are trapped and handled at the East Fork Salmon River weir and Squaw Creek weir. The numbers of natural-origin adults varies annually (see above table). Currently, this program captures and retains hatchery-origin, B-run steelhead for spawning. Hatchery-origin, B-run steelhead trapped at the Squaw Creek weir are transported to the East Fork Salmon River weir and incorporated into the spawning design. Natural-origin, B-run steelhead are not retained for this program. Following capture, natural-origin fish may be marked and tissue sampled before release. See Table 1 (attached).

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

It is unlikely that take levels for natural B-run steelhead will exceed projected take levels presented in Table 1 (attached). However, in the unlikely event that this occurs, the IDFG will consult with NMFS Sustainable Fisheries Division or Protected Resource Division staff and agree to an action plan. We assume that any contingency plan will include a provision to discontinue hatchery-origin, steelhead trapping activities.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.

This program conforms with the plans and policies of the Lower Snake River Compensation Program administered by the U.S. Fish and Wildlife Service to mitigate for the loss of steelhead production caused by the construction and operation of the four dams on the lower Snake River.

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.

Cooperative Agreement between the U.S. Fish and Wildlife Service and the Idaho Department of Fish and Game, USFWS Agreement No.: 141102J010 (for Lower Snake River Compensation Plan monitoring and evaluation studies).

Cooperative Agreement between the U.S. Fish and Wildlife Service and the Idaho Department of Fish and Game, USFWS Agreement No.: 141102J009 (for Lower Snake River Compensation Plan hatchery operations).

1999 through 2002 Management Agreement for upper Columbia River Fall Chinook, Steelhead and Coho pursuant to United States of America v. State of Oregon, U.S. District Court, District of Oregon.

3.3) Relationship to harvest objectives.

The Lower Snake River Compensation Plan defined replacement of adults “in place” and “in kind” for appropriate state management purposes. The Idaho Department of Fish and Game, the U.S. Fish and Wildlife Service, and other Basin fishery managers work cooperatively to develop annual production and mark plans. Juvenile production and adult escapement targets were established at the outset of the LSRCP program.

As part of its harvest management and monitoring program, the IDFG conducts annual creel and angler surveys to assess the contribution program fish make toward meeting program harvest objectives.

3.3.1) Describe fisheries benefiting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

Fisheries that benefit form the release of hatchery-origin, B-run steelhead include sport, tribal, and commercial fisheries in Oregon, Washington and Idaho. Idaho fisheries for B-run steelhead begin at the Washington-Idaho border and occur in the Clearwater River Basin, the mainstem Snake River, and the Salmon River Basin. Salmon River releases of B-run steelhead occurred in Slate Creek, the East Fork Salmon River, and the Little Salmon River between 1988 and 1996 (the period reported below). The table summarizes sport harvest for releases with complete return years.

Release Year	No. Fish Released	Release Site	Estimated Harvest	Hatchery Returns[a]	Total	Smolt-to-Adult Return Rate
1996	236,297	Slate Creek	27	12	39	0.02
1996	490,374	E.F. Salmon River	182	42	224	0.05
1996	403,281	Little Salmon River	331	331	662	0.16
1995	215,935	Slate Creek	50	2	52	0.02
1995	488,705	E.F. Salmon River	554	39	593	0.12
1995	342,680	Little Salmon River	246	105	351	0.10
1994	211,355	Slate Creek	198	5	203	0.10
1994	516,585	E.F. Salmon River	375	143	518	0.10
1994	238,725	Little Salmon River	98	97	195	0.08
1993	187,100	Slate Creek	169	24	193	0.10
1993	497,400	E.F. Salmon River	225	25	250	0.05
1993	325,300	Little Salmon River	164	164	328	0.10
1992	1,041,200	E.F. Salmon River	66	22	88	0.01
1992	302,335	E.F. Salmon River	304	20	324	0.11
1992	300,534	Little Salmon River	0	0	0	0.00
1991	967,800	E.F. Salmon River	2,416	112	2,528	0.26
1991	540,733	E.F. Salmon River	29	4	33	0.01
1991	577,433	Little Salmon River	362	141	503	0.09
1990	64,150	E.F. Salmon River	23	1	24	0.04
1990	132,071	E.F. Salmon River	243	34	277	0.21
1990	792,129	E.F. Salmon River	686	87	773	0.10
1990	393,352	Little Salmon River	437	437	874	0.22
1990	162,700	Slate Creek	0	0	0	0.00
1989	353,300	E.F. Salmon River	632	73	705	0.20
1989	436,576	E.F. Salmon River	408	41	449	0.10
1989	303,557	E.F. Salmon River	402	134	536	0.18

[a] Includes rack returns and in-river escapement.

3.4) Relationship to habitat protection and recovery strategies.

Hatchery production for harvest mitigation is influenced but not linked to habitat protection strategies in the Salmon Subbasin and other areas. The NMFS has not developed a recovery plan specific to Snake River steelhead, but the Salmon River B-run steelhead program is operated consistent with existing Biological Opinions.

3.5) Ecological interactions. [Please review Addendum A before completing this section. If it is necessary to complete Addendum A, then limit this section to NMFS jurisdictional species. Otherwise complete this section as is.]

The 1999 NMFS Biological Opinion on Artificial Propagation in the Columbia River Basin (NMFS 1999) concluded that Snake River summer steelhead artificial propagation actions are expected to adversely affect listed Snake River summer steelhead. The release of hatchery steelhead into natural production areas is expected to result in predation and competition with listed steelhead juveniles.

Hatchery-origin adult steelhead are not released above weir locations on Slate Creek or Squaw Creek. Generally, hatchery-origin adult steelhead are not released above the trapping location on the East Fork Salmon River (see the IDFG East Fork Salmon River natural steelhead HGMP).

We assumed potential adverse effects to listed salmon and steelhead could occur from the release of hatchery-origin steelhead smolts in the Salmon River, the East Fork Salmon River and Squaw Creek through the following interactions: predation, competition, behavior modification, and disease transmission.

We have tried to consider potential interactions between listed steelhead and salmon and hatchery steelhead and their effect in the migration corridor of the Salmon River and downstream. Timing of hatchery-origin steelhead in the migration corridor overlaps with listed spring/summer chinook salmon, steelhead, and to a lesser degree with listed sockeye salmon. Steelhead from the LSRCP program are more temporally separated from listed fall chinook salmon in the Snake River and Lower Granite Reservoir based on different migration periods. The National Marine Fisheries Service has identified potential competition for food and space and behavioral interactions in the migration corridor as a concern (M. Delarm, NMFS, pers. comm.).

Because of their size and timing, chinook salmon fry are probably the most vulnerable life stage to predation. Hillman and Mullan (1989) observed substantial predation of newly emerged chinook salmon by hatchery and wild steelhead in the Wenatchee River. Cannamela (1992) used existing literature to evaluate potential predation of chinook salmon fry by hatchery steelhead smolts. He evaluated a 1-1.3 million steelhead smolt release in the upper Salmon River primary production area, where steelhead were released in the vicinity of redds and migrated over redds for several miles. He assumed steelhead smolts at least 105 mm could consume chinook salmon fry, 35-37 mm in length. Cannamela estimated potential predation by utilizing various percentages of fry in the diet, residualism, and predator size. Using ranges of assumptions, he calculated estimated fry losses to predation by steelhead smolts and residuals for up to a 70 day period from smolt release to June 25. According to his calculations, his scenario of 500,000 steelhead predators utilizing fish as 1 percent of their diet for 40 days resulted in potential consumption of 34,500 fry. Empirical information collected in 1992 infers that this may be an overestimate. IDFG biologists attempted to quantify chinook salmon fry predation by hatchery steelhead in the upper Salmon River. Their samples were collected from a release of 774,000 hatchery steelhead in the upper Salmon River primary production area where steelhead would migrate directly over redds. The fish were released in early April. The biologists sampled 6,762 steelhead and found that 20 contained fish parts in the cardiac stomach. Of these, three contained 10 chinook salmon fry. The biologists estimated that the proportion of hatchery steelhead that consumed fry was 0.000444. The estimated predation rate of steelhead smolts on chinook salmon fry was 1.48×10^{-3} (95% CI 0.55×10^{-3} to 2.41×10^{-3}) for the 6,762 hatchery steelhead smolts examined that consumed the ten chinook fry. Biologists used this consumption rate to estimate that the total number of chinook fry consumed during the sample period, April 3-June 3, was 24,000 fry (IDFG 1993). We believe that the potential consumption for steelhead released in the lower Salmon River would be much lower because steelhead are not released in the immediate vicinity of redds and emerging fry.

By using Cannamela's calculations and scenarios of 0.05-1.0 percent fish in the diet and 10-25 percent residualism, we predict a range of potential loss of 2,300-51,000 chinook fry for a 1.25 million smolt release in the Salmon River primary production area. Cannamela (1992) estimated fry losses would occur for up to a 70 day period from smolt release to June 25. He noted that there is an assumed mechanism for chinook salmon fry to avoid predation by steelhead since they are coevolved populations. However, literature references were scant about this theory although Peery and Bjornn (1992) documented that fry tend to move at night. Cannamela concluded that only assumptions could be made about the availability and vulnerability of fry to steelhead predators.

Martin et al. (1993) collected 1,713 steelhead stomachs from the Tucannon River and three contained juvenile spring chinook salmon. They estimated that 456-465 juvenile spring chinook salmon were consumed by hatchery steelhead in the Tucannon River from a total release of 119,082 steelhead smolts. Biologists found that rate of predation increased from the time of steelhead release through September 31. Predation rates increased from 9.4×10^{-3} to 4.3×10^{-2}. Martin et al. (1993) theorized that although numbers of steelhead decreased, remaining fish may have learned predatory behavior. By October, juvenile salmon were too large to be prey, and stream temperature had dropped.

No precise data are available to estimate the importance of chinook salmon fry in a steelhead smolt's diet (USFWS 1992). The USFWS cited several studies where the contents of steelhead stomachs had been examined. Few, if any, salmonids were found. They concluded that the limited empirical data suggested that the number of chinook salmon fry/fingerlings consumed by steelhead is low. Schriever (IDFG, pers. comm.) sampled 52 hatchery steelhead in the lower Salmon and Clearwater rivers in 1991 and

1992 and found no fish in their stomach contents.

The percentage of steelhead residualism in the upper Salmon River appeared to be about 4 percent in 1992 (IDFG 1993). We do not know the rate of residualism for steelhead released in the lower Salmon River. In 1992, the steelhead smolt migration in the Salmon River primary production area began around May 10 and about 95% of the hatchery steelhead had left the upper Salmon River study area by May 21. IDFG biologists found that after one week, hatchery steelhead smolts were consuming natural prey items such as insects and appeared to be effectively making the transition to natural food (IDFG 1993). It is unknown if smolts continued to feed as they actively migrated. Biologists observed that the environmental conditions during the 1992 study were atypical. Water velocity was much lower, while water temperature and clarity were higher than normal for the study period. Furthermore, about 637,500 of the smolts had been acclimated for up to three weeks at Sawtooth Fish Hatchery prior to release, but these fish were not fed during acclimation. It is unknown if acclimation reduced residualism. Biologists concluded that within the framework of 1992 conditions, chinook fry consumption by hatchery steelhead smolts and residuals was very low.

Kiefer and Forster (1992) were concerned that predation on natural chinook salmon smolts by hatchery steelhead smolts released into the Salmon River at Sawtooth Fish Hatchery could be causing mortality. They compared PIT tag detection rates of upper Salmon River natural chinook salmon emigrating before and after the steelhead smolt releases for the previous three years. They found no significant difference and concluded that the hatchery steelhead smolts were not preying upon the natural chinook smolts to any significant degree.

The release of a large number of prey items which may concentrate predators has been identified as a potential effect on listed salmon. Hillman and Mullan (1989) reported that predaceous rainbow trout (>200 mm) concentrated on wild salmon within a moving group of hatchery age-0 chinook salmon. The wild salmon were being "pulled" downstream from their stream margin stations as the hatchery fish moved by. It is unknown if the wild fish would have been less vulnerable had they remained in their normal habitat. Hillman and Mullan (1989) also observed that the release of hatchery age-0 steelhead did not pull wild salmon from their normal habitat. During their sampling in 1992, IDFG biologists did not observe predator concentration. We have no further information that supports or disproves concern that predators may concentrate and affect salmon because of the release of large numbers of hatchery steelhead.

There is potential for hatchery steelhead smolts and residuals to compete with chinook salmon and natural steelhead juveniles for food and space, and to potentially modify their behavior. The literature suggests that the effects of behavioral or competitive interactions would be difficult to evaluate or quantify (Cannamela 1992, USFWS 1993). Cannamela (1992) concluded that existing information was not sufficient to determine if competitive or behavioral effects occur to salmon juveniles from hatchery steelhead smolt releases. Our strategy of acclimation and releases over several days should reduce release densities at a single site.

Cannamela's (1992) literature search indicated that there were different habitat preferences between steelhead and chinook salmon that would minimize competition and predation. Spatial segregation appeared to hinge upon fish size. Distance from shore and surface as well as bottom velocity and depth preferences increased with fish size. Thus, chinook salmon fry and steelhead smolts and residuals are probably not occupying the same space. Cannamela theorized that if interactions occur, they are probably restricted to a localized area because steelhead, which do not emigrate, do not move far from the release site. Within the localized area, spatial segregation based on size differences would place chinook salmon fry and fingerlings away from steelhead smolts and residuals. This would further reduce the likelihood of interactions. Martin et al. (1993) reported that in the Tucannon River, spring chinook salmon and steelhead did exhibit temporal and spatial overlap, but they discuss that the micro-habitats of the two species were likely very different.

The USFWS (1992) theorized that the presence of a large concentration of steelhead at and near release sites could modify the behavior of chinook. However, they cited Hillman and Mullan (1989) who found no evidence that April releases of steelhead altered normal movement and habitat use of age-0 chinook. Throughout their study, IDFG biologists (IDFG 1993) noted concentrations of fry in typical habitat areas, whether steelhead were present or not.

Cannamela (1992) also described the potential for effects resulting from the release of a large number of steelhead smolts in a small area over a short period of time. He theorized that high concentrations of steelhead smolts could limit chinook salmon foraging opportunities or limit available food. However, the effect would be of limited duration because most steelhead smolts emigrate or are harvested within two months of release. He found no studies to support or refute his hypothesis. Cannamela also discussed threat of predation as a potentially important factor causing behavioral changes by stream salmonids. The literature was not specific to interactions of steelhead smolts and chinook fry. It is assumed that coevolved populations would have some mechanism to minimize this interaction.

There is a potential effect to listed salmon from diseases transmitted from hatchery-origin steelhead adults. Pathogens that could be transmitted from adult hatchery steelhead to naturally produced chinook salmon include Infectious Hematopoietic Necrosis Virus (IHNV) and Bacterial Kidney Disease (BKD) (K. Johnson, IDFG, pers. comm..). Although adult hatchery-origin steelhead may carry pathogens of chinook, such as BKD and Whirling Disease, which could be shed into the drainage, these diseases are already present in the Salmon River headwaters in naturally produced chinook and steelhead populations. The prevalence of BKD is less in hatchery-origin steelhead than in naturally produced chinook salmon. Idaho chinook salmon are rarely affected by IHNV (D. Munson, IDFG, pers. comm). Idaho Department of Fish and Game disease monitoring will continue as part of the IDFG fish health program. We do not believe that the release of hatchery-origin steelhead adults will increase the prevalence of disease in naturally produced chinook salmon or steelhead.

Hauck and Munson (IDFG, unpublished) provide a thorough review of the epidemiology of major chinook pathogens in the Salmon River drainage. The possibility exists for horizontal transmission of diseases to listed chinook salmon or natural steelhead from hatchery-origin steelhead in the migration corridor. Current hatchery practices include measures to control pathogens at all life stages in the hatchery. Factors of dilution, low water temperature, and low population density of listed anadromous species in the production area reduce the potential of disease transmission. However, none of these factors preclude the existence of disease risk (Pilcher and Fryer 1980, LaPatra et al. 1990, Lee and Evelyn 1989). In a review of the literature, Steward and Bjornn (1990) stated there was little evidence to suggest that horizontal transmission of disease from hatchery smolts to naturally produced fish is widespread in the production area or free-flowing migration corridor. However, little research has been done in this area.

Transfers of hatchery steelhead between any facility and the receiving location conforms to PNFHPC guidelines. IDFG and USFWS personnel monitor the health status of hatchery steelhead using protocols approved by the Fish Health Section, AFS. Disease sampling protocol, in accordance to the PNFHPC and AFS Bluebook is followed. IDFG hatchery and fish health personnel sample the steelhead throughout the rearing cycle and a pre-release sample is analyzed for pathogens and condition. Baseline disease monitoring of naturally produced chinook salmon has been implemented in the upper Salmon River, but the program is in its infancy. At this time, we have no evidence that horizontal transmission of disease from the hatchery steelhead release in the upper Salmon River has an adverse effect on listed species. Even with consistent monitoring, it would be difficult to attribute a particular incidence or presence of disease to actions of the LSRCP steelhead program.

We considered water withdrawal at broodstock trapping sites have no effect upon ESA-listed salmon or steelhead. Water is only temporarily diverted from rivers.

SECTION 4. WATER SOURCE

4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

Sawtooth Fish Hatchery – The Sawtooth Fish Hatchery receives water from the Salmon River and from four wells. River water enters an intake structure located approximately 0.8 km upstream of the hatchery facility. River water intake screens comply with NMFS criteria. River waters flows from the collection site to a control box located in the hatchery building where it is screened to remove fine debris. River water can be distributed to indoor vats, outside raceways, or adult holding raceways. The hatchery water right for river water use is approximately 60 cfs. Incubation and early rearing water needs are met by two primary wells. A third well provides tempering water to control the build up of ice on the river water intake during winter months. The fourth well provides domestic water for the facility. The hatchery water right for well water is approximately 9 cfs. River water temperatures range from 0.0ºC in the winter to 20.0ºC in the summer. Well water temperatures range from 3.9ºC in the winter to 11.1ºC in the summer. The intake screens are in compliance with NMFS screen criteria by design of the Corp of Engineers.

East Fork Salmon River Satellite – The East Fork Salmon River Satellite receives water from the East Fork Salmon River. Approximately 15 cfs is delivered to the facility through a gravity line. Water is delivered to adult holding raceways. A well provides domestic water and pathogen-free water for spawning (egg water-hardening process). No fish rearing occurs at this site. The intake screens are in compliance with NMFS screen criteria by design of the Corp of Engineers.

Squaw Creek Pond – The Squaw Creek Pond adult trapping and juvenile acclimation site receives water from Squaw Creek, a tributary to the Salmon River. Approximately 4.5 cfs is delivered to the facility through a gravity flow pipe line. The intake screens are in compliance with NMFS screen criteria by design of the Corp of Engineers.

Clearwater Fish Hatchery **–** The Clearwater Fish Hatchery receives water through two supply pipelines from Dworshak Reservoir. The warm water intake is attached to a floating platform and can be adjusted from five feet to forty feet below the surface. The cool water intake is stationary at 245 feet below the top of the dam. An estimated 10 cfs of water is provided by the cool water supply and 70 cfs of water from the warm water supply. The cool water supply has remained fairly constant between 38 ^{o}F and 45^{o}F. The warm water can reach 80^{o}F but is adjusted regularly to maintain 56^{o}F for as long as possible throughout the year. When water temperatures drop in the fall, the intake will be moved to the warmest water available until water temperatures rise in the spring. All water is gravity flow to the hatchery. The intake screens are in compliance with NMFS screen criteria by design of the Corp of Engineers.

Dworshak National Fish Hatchery – The main supply for the hatchery is river water pumped from the North Fork Clearwater River. There are six pumps rated at 15,500 gpm each for a total flow of 93,000 gpm or 207 CFS. There is also a reservoir supply source for the hatchery. It consists of a 24 inch warm water supply line and a 14 inch cold water supply line from the distribution box for the Clearwater Hatchery. The supply was designed for 6,400 GPM or 14 cfs for incubation and early rearing. The intake screens are in compliance with NMFS screen criteria by design of the Corp of Engineers.

4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

Intake screens at all facilities are in compliance with NMFS screen criteria by design of the Corp of Engineers.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

The Dworshak National Fish Hatchery acts as the primary broodstock collection facility for the Salmon River B-run steelhead program. Secondary trapping occurs at the East Fork Salmon River Satellite and in Squaw Creek immediately downstream of Squaw Creek acclimation pond.

Dworshak National Fish Hatchery – B-run steelhead adults are trapped at the Dworshak National Fish Hatchery after ascending a fish ladder on the North Fork Clearwater River. Adult steelhead are held in three 75 ft long by 15 ft wide by 8 ft deep raceways.

East Fork Salmon River Satellite – The East Fork Salmon River Satellite was constructed with a velocity barrier fitted with radial gates to prevent upstream passage beyond the trap. Adult steelhead move into a fish ladder and then into two adult holding raceways that measure 68 ft long by 10 ft wide by 4.5 ft deep. Each adult pond has the capacity to hold approximately 500 adults.

Squaw Creek Pond – Adult steelhead may be trapped on Squaw Creek using a temporary picket weir fitted with an upstream holding pen. The temporary weir can also be used on Squaw Creek to divert adult steelhead to an outlet channel that leads to the pond. At the pond, fish enter a short ladder that leads to a small holding cell. Adults are transferred to the East Fork Salmon River Satellite for spawning.

5.2) Fish transportation equipment (description of pen, tank truck, or container used).

A variety of transportation vehicles and equipment are available at the various facilities. Generally, adult transportation is only necessary to transfer steelhead collected at the Squaw Creek facility to the East Fork Salmon River Satellite for spawning. A 500 gallon insulated tank mounted in a truck is used for this purpose. The tank is equipped with oxygen and fresh flow agitator systems.

In the event that adult steelhead return to collection facilities in excess of specific program needs, adult transportation vehicles (equipped with oxygen and fresh flow agitator systems) may be used to transfer fish to a variety of locations to maximize sport fishing opportunities.

5.3) Broodstock holding and spawning facilities.

See Section 5.1 above for a review of broodstock holding and spawning facilities.

5.4) Incubation facilities.

Egg incubation for the Salmon River B-run steelhead program occurs at the following facilities. Generally, eggs are incubated to the eyed-stage of development at the Clearwater and Sawtooth Fish hatcheries however, this may also occur at the Dworshak National Fish Hatchery. Final incubation and rearing to release occurs primarily at the Magic Valley Fish Hatchery.

Sawtooth Fish Hatchery – Incubation facilities at the Sawtooth Fish Hatchery consist of a well water supplied system of 100 stacks of incubator frames containing 800 incubation trays. The maximum incubation capacity at the Sawtooth Fish Hatchery is 7 million steelhead eggs. Typically, B-run steelhead eggs are incubated through the eyed-stage of development at the Sawtooth Fish Hatchery.

Magic Valley Fish Hatchery – Incubation facilities at the Magic Valley Fish Hatchery consist primarily of 40, 12 gallon upwelling containers. Each container is capable of incubating and hatching 50,000 to 75,000 eyed steelhead eggs. Two incubators are placed over each concrete vat. A total of 20 vats are available. Vats measure 40 ft long x 4 ft wide x 3 ft deep. Each vat has the capacity to rear 115,000 to 125,000 steelhead to 200 fish per pound.

Clearwater Fish Hatchery – The Clearwater Hatchery incubation room contains 40 double stack Heath incubators with a total of 640 trays available for egg incubation. The upper and lower half of each stack (eight trays each) has a different water supply and drain. This design aids in segregation of diseased eggs. The maximum capacity of this facility is five million green eggs. The incubation room is supplied with both reservoir water sources to provide the desired temperature for incubation at a flow of 5 to 8 gpm per one-half stack.

Isolation incubation consists of 12 double stack Heath Incubators with a total of 192 trays available for egg incubation. The maximum capacity of this facility is 1.5 million green eggs. The isolation incubation room is supplied with both reservoir water sources to provide the desired temperature for incubation with a flow of 5 to 8 gpm per stack.

5.5) Rearing facilities.

The Magic Valley Fish Hatchery functions as the primary juvenile rearing facility for the Salmon River B-run steelhead program.

Magic Valley Fish Hatchery – The Magic Valley Fish Hatchery has 32 outside raceways available for juvenile steelhead rearing. Each raceway measures 200 ft long x 10 ft wide x 3 ft deep. Each raceway has the capacity to rear approximately 65,000 fish to release size. Raceways may be subdivided to create 64 rearing sections. A movable bridge, equipped with 16 automatic Neilsen fish feeders spans the raceway complex. Two 30,000 bulk feed bins equipped with fish feed fines shakers and a feed conveyor complete the outside feeding system.

5.6) Acclimation/release facilities.

For the Salmon River B-run steelhead program, pre-release acclimation occurs only at the Squaw Pond facility. The Squaw Creek Pond is approximately one half an acre in size. It is supplied with a maximum of 4.5 cfs of water diverted from Squaw Creek through an intake with a 15 inch supply line. At the pond inlet, a paddle wheel driven drum screen prevents debris from entering the pond, and a 10 inch bypass pipe allows fish that enter the water supply to return to Squaw Creek. Smolts transferred to the pond are acclimated for approximately two weeks. During peak emigration periods, fish are allowed to volitionally migrate by adjusting dam boards on the outlet structure and by managing inflow to the pond. Fish that do not volitionally migrate may be forced out, retained in the pond to provide fishing opportunity, or transferred to other catch-out ponds. Approximately 100,000 smolts are acclimated annually in Squaw Creek Pond.

5.7) Describe operational difficulties or disasters that led to significant fish mortality.

No operational difficulties or disasters have led to significant fish mortality at any of the facilities addressed in this HGMP

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5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

Sawtooth Fish Hatchery - The Sawtooth Fish Hatchery serves only an early egg incubation function for the Salmon River B-run steelhead program. The hatchery is staffed around the clock and equipped with an alarm system. The hatchery well water supply system is backed up by generator power. The inside vat room can be switched to gravity flow with river water in the event of a generator failure. Protocols are in place to guide emergency situations during periods of time when the hatchery well water supply is interrupted. Protocols are also in place to guide the disinfection of equipment and gear to minimize risks associated with the transfer of potential disease agents.

East Fork Salmon River Satellite – The East Fork Salmon River Satellite traps adults B-run steelhead and serves as a spawning facility for the program. The facility is generally staffed with one full-time employee during the trapping season. Only adipose fin-clipped fish trapped at this site are incorporated in the spawning program. Non-clipped adult steelhead may be release unharmed or retained for the IDFG East Fork Salmon River natural steelhead broodstock program. Protocols are also in place to guide the disinfection of equipment and gear to minimize risks associated with the transfer of potential disease agents.

Squaw Creek Pond – The Squaw Creek Pond facility functions as an adult collection facility for the program. Adipose fin-clipped adults that meet B-run criteria are transferred to the East Fork Salmon River Satellite for spawning. Non-clipped fish are passed upstream unharmed.

Clearwater Fish Hatchery - The Clearwater Fish Hatchery serves only an early egg incubation function for the Salmon River B-run steelhead program. The Idaho Department of Fish and Game is working with the U.S. Army Corps of Engineers to develop a reliable low water and high temperature alarm system. This project is expected to be completed in the near future. Currently, staff check raceway flows and temperatures manually on a daily schedule. Protocols are also in place to guide the disinfection of equipment and gear to minimize risks associated with the transfer of potential disease agents.

Magic Valley Fish Hatchery – The Magic Valley Fish Hatchery serves final incubation and rearing to release functions for the program. The hatchery is staffed around the clock. The hatchery receives only gravity flow water, and as such, no generator backup system is in place or needed. Hatchery staff perform routine maintenance checks on gravity lines that supply the hatchery with water. Proper disinfection protocols are in place to prevent the transfer of disease agents.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.

North Fork Clearwater River B-run steelhead adults were used to found the program with eggs from Dworshak National Fish Hatchery. Progeny of adults returning to Dworshak National Fish Hatchery are utilized annually as well as progeny from adult returns to the East Fork Salmon River and Squaw Creek Pond.

6.2) Supporting information.

6.2.1) History.

See Section 6.1 above.

6.2.2) Annual size.

No ESA-listed summer steelhead are collected as part of this program. Annual quidelines for broodstock size are listed below.

6.2.3) Past and proposed level of natural fish in broodstock.

See Section 6.1 above.

6.2.4) Genetic or ecological differences.

Currently, two independent studies are being conducted to characterize the genetic identity of Snake River steelhead. One study, funded by the USFWS, is being conducted by Dr. Paul Moran (National Marine Fisheries Service). The second study, funded by the Bonneville Power Administration through the Northwest Power Planning Council's Fish and Wildlife Program is being conducted by Dr. Jennifer Nielsen (U.S. Geologic Survey). Both studies will include information on hatchery-origin and natural steelhead stocks in Idaho. Study results should be available in 2003.

The following excerpt was taken from Busby et al. 1996. Status Review of West Coast Steelhead from Washington, Idaho, Oregon, and California. NOAA Technical Memorandum NMFS-NWFSC-27.

Snake River Basin--This ESU occupies the Snake River Basin of southeast Washington, northeast Oregon, and Idaho. This region is ecologically complex and supports a diversity of steelhead populations; however, genetic and meristic data suggest that these populations are more similar to each other than they are to steelhead populations occurring outside of the Snake River Basin. Snake River Basin steelhead spawning areas are well isolated from other populations and include the highest elevations for spawning (up to 2,000 m) as well as the longest migration distance from the ocean (up to 1,500 km). Snake River steelhead are often classified into two groups, A- and B-run, based on migration timing, ocean age, and adult size. While total (hatchery + natural) run size for Snake River steelhead has increased since the mid-1970s, the increase has resulted from increased production of hatchery fish, and there has been a severe recent decline in natural run size. The majority of natural stocks for which we have data within this ESU have been declining. Parr densities in natural production areas have been substantially below estimated capacity in recent years. Downward trends and low parr densities indicate a particularly severe problem for B-run steelhead, the loss of which would substantially reduce life history diversity within this ESU. The BRT had a strong concern about the pervasive opportunity for genetic introgression from hatchery stocks within the ESU. There was also concern about the degradation of freshwater habitats within the region, especially the effects of grazing, irrigation diversions, and hydroelectric dams.

6.2.5) Reasons for choosing.

The Dworshak hatchery stock was utilized for harvest mitigation purposes in the Salmon River to expand fishery opportunity. These fish are larger at age and generally return later than A-run steelhead and add diversity to the steelhead fishery. Steelhead fisheries on wild B-run stocks returning to the South Fork and Middle Fork Salmon River were terminated with the advent of selective fishing on hatchery A-run stocks in the early 1980s. The original intent was to develop a locally returning hatchery B-run broodstock to the East Fork Salmon River but adult returns have never been sufficient to support the smolt release target.

6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

No adverse impacts or effects to the listed population are expected as wild/natural adults are not currently trapped and used for broodstock purposes.

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Only hatchery-origin adults are collected for broodstock purposes.

7.2) Collection or sampling design.

At this time no unmarked (natural origin) fish are incorporated into the hatchery broodstock. Hatchery-origin fish incorporated into the spawning design are selected at random and represent the entire run.

7.3) Identity.

All harvest mitigation, hatchery-produced fish are marked with an adipose fin clip. Unmarked and untagged fish captured at weirs are released above weirs with a minimum of handling and delay.

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults):

No ESA-listed summer steelhead are collected as part of this program. Annual quidelines for broodstock size are listed below.

The Sawtooth Fish Hatchery East Fork Salmon River Satellite, the Squaw Creek Pond facility, and the Dworshak National Fish Hatchery function as broodstock collection and spawning stations. Eggs produced at the Dworshak National Fish Hatchery are transferred to the Clearwater Fish Hatchery for incubation through the eyed stage of development. Once eggs reached the eyed state, they are transferred to the Magic Valley Fish Hatchery. Eggs may be incubated at the Dworshak National Fish Hatchery through the eyed stage of development and sent directly to the Magic Valley Fish Hatchery.

Eggs produced from adults collected at the Squaw Creek Pond site or the East Fork Salmon River Satellite are transferred to the Sawtooth Fish Hatchery for incubation through the eyed stage of development. Eyed-eggs are then transferred to the Magic Valley Fish Hatchery.

Broodstock collection levels are not specifically stated. The Dworshak National Fish Hatchery provides an adequate number of eggs to meet juvenile production targets identified by managers for the Salmon River. Currently, approximately 600,000 B-run steelhead smolts are released in the Little Salmon River and the Salmon River (combined) of Dworshak National Fish Hatchery Origin. In addition, up to 200,000 B-run steelhead smolts are released in the lower East Fork Salmon River from East Fork Salmon River Satellite spawning events. This current level of smolt production (approximately 800,000 smolts) is generated from approximately 200 females.

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

Broodstock collection levels for the Dworshak National Fish Hatchery are not presented. Annual egg requests for the B-run steelhead program are assembled annually and provided to Dworshak staff . Green eggs are typically received by the Clearwater Fish Hatchery.

Annual broodstock collections levels for the East Fork Salmon River Satellite and the Squaw Creek Pond facility are presented below. Numbers of females and males presented in the table reflect the total number spawned; not the total number trapped. No natural-origin adults have been spawned as part of this program

East Fork Salmon River broodstock collection history.

Brood Year	Adults Females Spawned (hatch./nat.)	Males Spawned (hatch./nat.)	Jacks	Green Eggs	Juveniles
1988	79	59	n/a	448,034	n/a
1989	79	72	n/a	415,000	n/a
1990	105 (105/0)	108 (108/0)	n/a	537,015	n/a
1991	25 (25/0)	31 (31/0)	n/a	100,902	n/a
1992	37 (37/0)	53 (53/0)	n/a	150,790	n/a
1993	43 (43/0)	57 (57/0)	n/a	211,993	n/a
1994	25 (25/0)	38 (38/0)	n/a	103,100	n/a
1995	14 (14/0)	17 (17/0)	n/a	53,370	n/a
1996	35 (35/0)	34 (34/0)	n/a	161,632	n/a
1997	84 (84/0)	55 (55/0)	n/a	435,954	n/a
1998	3 (3/0)	3 (3/0)	n/a	11,550	n/a
1999	16 (16/0)	16 (16/0)	n/a	62,442	n/a
2000	15 (15/0)	15 (15/0)	n/a	67,389	n/a
2001	30 (27/0)	20 (20/0)	n/a	142,348	n/a
2002	17 (7/0)	11 (11/0)	n/a	98,302	n/a

Note: Numbers of females and males spawned and resulting eggs generated for 1988 through 1995 represent East Fork Salmon River events only. From 1996 forward, numbers of fish spawned and eggs generated include Slate Creek and Squaw Creek trap sites.

Squaw Creek Pond broodstock collection history.

Brood Year	Adults Females Spawned (hatch./nat.)	Males Spawned (hatch./nat.)	Jacks	Green Eggs	Juveniles
1996	15 (15/0)	7 (7/0)	n/a	n/a	n/a
1997	6 (6/0)	7 (7/0)	n/a	n/a	n/a
1998	0	0	n/a	n/a	n/a
1999	n/a	n/a	n/a	n/a	n/a
2000	0	0	n/a	n/a	n/a
2001	0	0	n/a	n/a	n/a
2002	17 (17/0)	15 (15/0)	n/a	n/a	n/a

Note: B-run smolt releases were initially made in Slate Creek, a tributary of the Salmon River upstream of Squaw Creek Pond. Adults were trapped in Slate Creek through 1998. No adult trapping occurred in 1999. Beginning in 1998, smolt releases were relocated to Squaw Creek and Squaw Pond. Adult trapping has occurred in Squaw Creek since 2000. No egg data are presented for Squaw Creek. Adults are transferred to the East Fork Salmon River satellite for spawning. Egg totals reported in the East Fork Salmon River table from 1996 forward reflect the addition of eggs from females collected at Slate Creek or Squaw Creek Pond.

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.

To date, surpluses of hatchery-origin, B-run steelhead adults collected at trap sites in the Salmon River have not occurred.

7.6) Fish transportation and holding methods.

Generally, adult steelhead arrive at ripe or very close to spawning. No anesthetics or medications are used during handling or holding procedures. Fish are held in adult holding facilities (described above) until they are spawned. An opercle or caudal fin punch may be used to track time of arrival or to indicate previously spawned males.

In the event that fish are transported to different locations to meet other objectives (see Section 7.5), trucks fitted with transport tanks are used. Tanks support both oxygen and fresh flow agitation systems.

7.7) Describe fish health maintenance and sanitation procedures applied.

Adult steelhead held for spawning are typically spawned within two weeks of arrival. No chemicals or drugs are used prior to spawning. Fish health monitoring at spawning includes sampling for viral, bacterial and parasitic disease agents. Ovarian fluid is sampled from females and used in viral assays. Kidney samples are taken from a representative number of females spawned and used in bacterial assays. Head wedges are taken from a representative number of fish spawned and used to assay for presence/absence of the parasite responsible for whirling disease.

Eggs are rinsed with pathogen free well water after fertilization, and disinfected with a 100 ppm buffered iodophor solution for one hour before being placed in incubation trays. Necropsies are performed on pre-spawn mortalities as dictated by the Idaho Department of Fish and Game Fish Health Laboratory.

Full details on the collection of adults to develop Clearwater B-run steelhead broodstocks and there handling is presented separately in the HGMP for the Dworshak National Fish Hatchery steelhead program.

7.8) Disposition of carcasses.

Typically, adult steelhead carcasses generated during spawning events are distributed to the general public, charitable organizations, and to the Shoshone-Bannock Tribes. Additionally, carcasses may be transported to sanitary landfills or to a rendering facilities.

7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

Only hatchery-origin, non ESA-listed adults are collected for broodstock purposes.

SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1) Selection method.

Adult steelhead are chosen at random but with regard to run timing. Male steelhead may be marked with an opercle or caudal punch and used more than once if needed. Generally, a 1:1 spawn design is followed. Fish are typically checked twice weekly for ripeness.

8.2) Males.

Generally, males are used only once for spawning. Only in those cases where skewed sex ratios exist (fewer males than females) or in situations where males mature late, males may be used twice. Males are chosen at random but with regard to run timing.

8.3) Fertilization.

Spawning ratios of 1 male to 1 female will be used unless the broodstock population contains less than 100 females. If the spawning population contains less than 100 females, then eggs from each female are split into two equal sub-families. Each sub-family is fertilized by a different male. One cup of well water is added to each bucket and set aside for 30 seconds to one minute. The two buckets are then combined.

8.4) Cryopreserved gametes.

Milt is not cryopreserved as part of this program and no cryopreserved gametes are used in this program.

8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

No natural-occurring fish are incorporated into the spawning operation.

SECTION 9. INCUBATION AND REARING -

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

9.1) Incubation:

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.

The original Lower Snake River Compensation Program production target of 25,000 adults back to the project area upstream of Lower Granite Dam was based on a smolt-to-adult survival rate of 0.54 to 0.58%. To date, program SARs have not met these planning guidelines. This is not due to lower than expected "in-hatchery" performance. Typically, egg survival to the eyed stage of development averages 80% or higher for the Sawtooth and Clearwater fish hatcheries. Egg survival information to the eyed stage of development is presented below for the Sawtooth Fish Hatchery B-run steelhead program. Eyed-egg to ponding survival is presented for the Clearwater Fish Hatchery B-run steelhead program.

Sawtooth Fish Hatchery B-run steelhead egg survival information.

Spawn Year	Green Eggs Taken	Eyed-eggs	Survival to Eyed Stage (%)
1988	448,034	357,506	79.8
1989	415,000	333,537	80.4
1990	537,015	465,675	86.7
1991	100,902	87,500	86.7

1992	150,790	135,200	89.7
1993	211,993	178,925	84.4
1994	103,100	76,087	73.8
1995	53,370	40,170	75.3
1996	161,632	143,670	88.9
1997	435,954	366,540	84.0
1998	11,550	7,700	67.0
1999	62,442	57,954	92.8
2000	67,389	51,384	76.2
2001	142,348	81,647	57.4
2002	98,302	81,206	82.6

Magic Valley Fish Hatchery B-run steelhead eyed-egg to release survival. Note: For the "Egg Source" column, EFSR and DNFH refer to eggs received from East Fork Salmon River and Dworshak National Fish Hatchery spawning events, respectively.

Spawn Year	Egg Source	Eyed-eggs Received at Magic V. Fish Hatchery	Percent Survival From Eyed-Egg to Hatch	Number of Smolts Released	Percent Survival from Eyed-Egg to Smolt
1989	EFSR	333,537	n/a	326,600	97.9
1989	DNFH	1,212,066	n/a	760,500	62.7
1990	EFSR	463,730	n/a	334,700	72.2
1990	DNFH	900,000	n/a	633,100	70.3
1991	EFSR	91,317	98.3	84,800	92.9
1991	DNFH	1,107,699	96.4	956,400	86.3
1992	EFSR	133,826	99.0	106,400	79.5
1992	DNFH	1,322,740	98.0	903,400	68.3
1993	EFSR	179,080	99.7	160,040	89.4
1993	DNFH	1,507,033	96.4	1,199,520	79.6
1994	EFSR	75,395	95.5	65,000	86.2

1994	DNFH	1,520,160	96.0	982,300	64.6
1995	EFSR	40,000	97.0	33,890	84.7
1995	DNFH	1,502,200	93.0	1,096,062	73.0
1996	EFSR	139,400	98.0	131,220	94.1
1996	DNFH	940,391	90.0	661,935	70.4
1997	EFSR	356,340	97.8	301,500	84.6
1997	DNFH	1,403,900	88.7	655,475	46.7
1998	EFSR	0	n/a	n/a	n/a
1998	DNFH	1,303,112	98.0	1,121,504	86.1
1999	EFSR	57,954	97.0	51,866	89.5
1999	DNFH	1,446,208	87.0	1,106,133	76.5
2000	EFSR	51,384	97.0	38,024	74.0
2000	DNFH	544,006	87.0	317,650	58.4

9.1.2) Cause for, and disposition of surplus egg takes.

Surplus eggs are not generated for the Salmon River B-run steelhead program.

9.1.3) Loading densities applied during incubation.

Sawtooth and Clearwater fish hatcheries – Incubation flows are set at 5 to 8 gpm per eight tray incubation stack. Typically, eggs from two females are incubated per tray (approximately 8,500 to 10,000 eggs per tray).

Magic Valley Fish Hatchery – Incubation flows are adjusted so eggs roll gently in upwelling incubators. Each incubator is capable of incubating and hatching 50,000 to 75,000 eyed steelhead eggs.

9.1.4) Incubation conditions.

Sawtooth Fish Hatchery – Pathogen free well water is used for all incubation at the Sawtooth Fish Hatchery. Incubation stacks utilize catch basins to prevent silt and fine sand from circulating through incubation trays. Following 48 hours of incubation, eggs are treated three times per week with formalin (1,667 ppm) to control the spread of fungus. Formalin treatments are discontinued at eye-up. Once eggs reach the eyed stage of development (approximately 360 FTU), they are shocked to identify dead and unfertilized eggs. Dead and undeveloped eggs are then removed with the assistance of an automatic egg picking machine. During this process, the number of eyed and dead eggs is generated. Eyed eggs are generally shipped to receiving hatcheries when they have accumulated approximately 450 FTUs.

Clearwater Fish Hatchery - The Clearwater Hatchery incubation room contains 40 double stack Heath incubators with a total of 640 trays available for egg incubation. The maximum capacity of this facility is five million green eggs. The incubation room is supplied with two water sources to provide the desired temperature for incubation with a flow of 5 to 8 gpm per one-half stack. Water flow to each incubator stack is checked periodically to insure that desired flows are maintained. Incubator water temperatures are tracked with recording thermographs and hand thermometers.

Isolation incubation consists of 12 double stack Heath Incubators with a total of 192 trays available for egg incubation. The maximum capacity of this facility is 1.5 million green eggs. The isolation incubation room is supplied with both water sources to provide the desired temperature for incubation with a flow of 5 to 8 gpm per stack.

Magic Valley Fish Hatchery – Incubation facilities at the Magic Valley Fish Hatchery consist primarily of 40, 12 gallon upwelling containers. Each container is capable of incubating and hatching 50,000 to 75,000 eyed steelhead eggs. Two incubators are placed over each concrete vat. A total of 20 vats are available. Vats measure 40 ft long x 4 ft wide x 3 ft deep. Each vat has the capacity to rear 115,000 to 125,000 steelhead to 200 fish per pound. Water flow to incubation jars is adjusted so eggs gently roll. Temperature is tracked daily to monitor the accumulation of temperature units. Water temperature at both facilities is a constant 15.0ºC.

9.1.5) Ponding.

No ponding occurs at the Sawtooth or Clearwater fish hatcheries for the Salmon River B-run steelhead program. Generally, eyed-eggs are shipped to the Magic Valley Fish Hatchery in the Hagerman Valley of Idaho. Eggs are typically disinfected in 100 ppm Iodophor for approximately 10 minutes at transfer.

Magic Valley Fish Hatchery – Fry are allowed to volitionally exit upwelling incubators and move directly into early rearing vats through approximately 1,000 FTUs. After that time, fry remaining in incubators are siphoned into vats. Fry are generally ponded between April and early July.

9.1.6) Fish health maintenance and monitoring.

Following fertilization, eggs are typically water-hardened in a 100 ppm Iodophor solution for a minimum of 30 minutes. During incubation, eggs routinely receive scheduled formalin treatments to control the growth of fungus. Treatments are typically administered three times per week at a concentration of 1667 ppm active ingredient. Dead eggs are removed following shocking. Additional egg picks are performed as needed to remove additional eggs not identified immediately after shocking. Eggs produced at spawning hatcheries are transferred to rearing hatcheries when they have accumulated approximately 450 FTUs.

9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

No adverse genetic or ecological effects to listed fish are anticipated as only hatchery-origin adults are spawned.

9.2) Rearing:

9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available.

Refer to the table in Section 9.1.1 for this information.

9.2.2) Density and loading criteria (goals and actual levels).

Magic Valley Fish Hatchery - Density (DI) and flow (FI) indices are maintained to not exceed 0.30 and 1.2, respectively (Piper et al. 1982).

9.2.3) Fish rearing conditions

Magic Valley Fish Hatchery – Fish rear on constant 15.0ºC water. Dissolved oxygen, flows, total suspended solids, settable solids, phosphorus, and water temperature are recorded monthly. Density and flow indices are monitored on a regular basis. Rearing groups are split or moved as needed to adhere to these indices. Fish are fed in outside raceways from a traveling bridge fitted with 16 Nielson automatic feeders. Raceway cleaning takes place every two days; raceways are swept manually with brooms. Sample counts are conducted monthly and dead fish are removed daily.

9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.

The Magic Valley Fish Hatchery rears juvenile steelhead under constant water temperature (15.0ºC) conditions and feeding schedules are designed to produce fish between 180 and 250 to the pound at release. Length gained per month for the first three months of culture is typically between 0.8 and 1.0 inches (20.3 to 25.4 mm). Fish gain approximately 0.65 to 0.75 inches per month (16.5 to 19.1 mm) thereafter. To meet the release size target, fish may be fed on an intermittent schedule beginning in their fourth month of culture.

9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

See Section 9.2.4 above.

9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

Magic Valley Fish Hatchery – Dry and semi-moist diets have been used at the Magic Valley Fish Hatchery in the past. Currently, fish are fed the Rangen 440 extruded salmon dry diet. First feeding fry are fed at a rate of approximately 5% body weight per day. As fish grow, percent body weight fed per day decreases. Fry are fed with Loudon solenoid activated feeders while located in early rearing vats. Following transfer to outside raceways, fish are fed by hand and with the assistance of the traveling bridge. First feeding fry are typically fed up to eight times per day. Prior to release, pre-smolts are typically fed four times per day. Feed conversion averages 1.18 pounds of feed fed for every pound of weight gain (from first feeding through release).

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.

Magic Valley Fish Hatchery – Routine fish health inspections are conducted by staff from the IDFG Eagle Fish Health Laboratory on a monthly basis. More frequent inspections occur if needed. Therapeutics may be used to treat specific disease agents (e.g., Oxytetracycline). Foot baths with disinfectant are used at the entrance of the hatchery early rearing building. Disinfection protocols are in place for equipment, trucks and nets. All raceways are thoroughly chlorinated after fish have been transferred for release.

9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.

No smolt development indices are developed in this program.

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.

No semi-natural or natural rearing methods are applied.

9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

ESA-listed, natural-origin steelhead are not propagated as part of the Salmon River A-run steelhead program.

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.

10.1) Proposed fish release levels.

Magic Valley Fish Hatchery proposed fish release levels.

Age Class	Maximum Number	Size (fpp)	Release Date	Location	Rearing Hatchery
Eggs					
Unfed Fry					
Fry					
Fingerling					
Yearling	275,000	4.3	4/11 – 5/2	Little Salmon River, Stinky Sp.	Magic Valley
	140,000	4.3	4/11 – 5/2	Squaw Creek Pond	Magic Valley
	200,000	4.3	4/11 – 5/2	Squaw Creek	Magic Valley
	225,000	4.3	4/11 – 5/2	lower East Fork Salmon River	Magic Valley

Currently, smolts produced from East Fork Salmon River spawning events are released in Squaw Creek Pond.

10.2) Specific location(s) of proposed release(s).

Stream, river, or watercourse:
Release point: (*river kilometer location, or latitude/longitude*)
Major watershed: (e.g. "Skagit River")
Basin or Region: *(e.g. "Puget Sound")*

Current B-run, summer steelhead release locations.

Stream	Release Point	HUC	Major Watershed & Basin
Little Salmon R.	Little Salmon River, Stinky Sp.	17060210	Salmon River
Squaw Creek	Squaw Creek Pond	17060204	Salmon River
Squaw Creek	Squaw Creek	17060204	Salmon River
East Fk. Salmon River	lower East Fork Salmon River	17060201	Salmon River

10.3) Actual numbers and sizes of fish released by age class through the program.

In addition to rearing B-run steelhead for Salmon River programs, Magic Valley Fish Hatchery rears A-run steelhead to meet other management objectives. For perspective, a review of brood year 2002 rearing groups is provided.

Rearing Hatchery	Stock	7/1/02 Inventory
Magic Valley	Dworshak B-run sthd	938,441

Magic Valley	Pahsimeroi A-run sthd	840,723
Magic Valley	Upper Salmon B-run sthd	81,206
Magic Valley	E. Fork Salmon R. naturals	32,382
Magic Valley	Sawtooth A-run sthd	379,050

The number of steelhead released by from the Magic Valley Fish Hatchery from 1989 through 2001 is presented below. Prior to 1993, the Hagerman National Fish Hatchery received B-run steelhead eggs from the Dworshak National Fish Hatchery for the East Fork Salmon River program (1980 through 1992). B-run steelhead smolts from the Magic Valley Fish Hatchery have been planted in the East Fork Salmon River continuously since 1989.

The information presented below is for B-run steelhead only. Release sites are described in Section 1. of this HGMP.

Release Year	**Rearing Hatchery**	**Life Stage Released**	**Avg. Size (fish/pound)**	**Number Released**
1989	Magic Valley	Yearling	4.6	1,087,100
1990	Magic Valley	Yearling	4.5	967,800
1991	Magic Valley	Yearling	4.4	1,041,200
1992	Magic Valley	Yearling	5.4	1,009,800
1993	Magic Valley	Yearling	4.9	1,359,560
1994	Magic Valley	Yearling	4.8	1,047,300
1995	Magic Valley	Yearling	4.7	1,129,952
1996	Magic Valley	Yearling	4.7	793,155
1997	Magic Valley	Yearling	4.6	956,975
1998	Magic Valley	Yearling	4.1	1,121,504
1999	Magic Valley	Yearling	4.3	1,157,999
2000	Magic Valley	Yearling	4.6	355,674
		Avg. =	4.63	1,002,335

10.4) Actual dates of release and description of release protocols.

Release Year	Rearing Hatchery	Life Stage	Date Released
1996	Magic Valley	Yearling	4/12 – 5/4
1997	Magic Valley	Yearling	4/9 – 4/21
1998	Magic Valley	Yearling	4/10 – 5/4
1999	Magic Valley	Yearling	4/7 – 5/12
2000	Magic Valley	Yearling	4/11 – 5/2

10.5) Fish transportation procedures, if applicable.

Yearlings are crowded in raceways and pumped into 5,000 gallon transport trucks using an 8 inch Magic Valley Heliarc pump and dewatering tower. Transport water temperature is chilled to approximately 7.2ºC . Approximately 5,000 pounds of fish are loaded into each truck. Transport duration to release sites is ranges from 4 to 9 hours. Trucks are equipped with oxygen and fresh flow agitator systems. Fish are not fed for up to four days prior to loading and transporting.

10.6) Acclimation procedures (*methods applied and length of time*).

For the Salmon River B-run steelhead program, pre-release acclimation occurs only at the Squaw Pond facility. The Squaw Creek Pond is approximately one half an acre in size. It is supplied with a maximum of 4.5 cfs of water diverted from Squaw Creek through an intake with a 15 inch supply line. At the pond inlet, a paddle wheel driven drum screen prevents debris from entering the pond, and a 10 inch bypass pipe allows fish that enter the water supply to return to Squaw Creek. Smolts transferred to the pond are acclimated for approximately two weeks. During peak emigration periods, fish are allowed to volitionally migrate by adjusting dam boards on the outlet structure and by managing inflow to the pond. Fish that do not volitionally migrate may be forced out, retained in the pond to provide fishing opportunity, or transferred to other catch-out ponds. Approximately 100,000 smolts are acclimated annually in Squaw Creek Pond.

10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

All harvest mitigation fish are marked with an adipose fin clip. To evaluate emigration success and timing to main stem dams, PIT tags are inserted in production release groups annually. To evaluate adult return success, CWT tags are inserted in release groups annually. Coded wire-tagged fish may receive an additional ventral fin clip.

The following table presents the IDFG draft, brood year 2002 B-run steelhead mark and tag management plan for the Salmon River program.

Rearing Hatchery	AD clip only	CWT/LV/AD tag and clips	CWT/LV/AD/PIT tags and clips	AD/CWT /PIT tag and clip	AD/PIT tag and clip	AD/ CWT tag and clip
Magic Valley	580,000	120,000	300	1,200	300	140,000

10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

No surplus juvenile B-run fish are generated.

10.9) Fish health certification procedures applied pre-release.

Between 45 and 30 d prior to release, a 20 fish preliberation sample is taken from each rearing lot to assess the prevalence of viral replicating agents and to detect the pathogens responsible for bacterial kidney disease and whirling disease. In addition, an organosomatic index is developed for each release lot. Diagnostic services are provided by the IDFG Eagle Fish Health Laboratory.

10.10) Emergency release procedures in response to flooding or water system failure.

Emergency procedures are in place to guide activities in the event of potential catastrophic event. Plans include a trouble shooting and repair process followed by the implementation of an emergency action plan if the problem can not be resolved. Emergency actions include fish consolidations, transfers to other rearing hatcheries in the Hagerman Valley, and supplemental oxygenation.

10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

Actions taken to minimize adverse effects on listed fish include:

1. Continuing fish health practices to minimize the incidence of infectious disease agents. Follow IHOT, AFS, and PNFHPC guidelines.

2. Reducing the number of steelhead released in the primary upper Salmon River salmon production area. The primary upper Salmon River production area includes the Salmon River from Warm Springs Creek upstream to the headwaters of the Salmon and East Fork Salmon rivers. Hatchery-produced, B-run releases were significantly reduced in the East Fork Salmon River from as high as 1,000,000 to about 250,000 and releases were moved to the lower river. East Fork Salmon River releases were transferred to Slate Creek and then to Squaw Pond.

3. Acclimating steelhead at Squaw Pond for at least 2 weeks. This action may increase smoltification and thus decrease the potential for residualism. We are evaluating this action to determine its benefit for reducing residualism and increasing steelhead survival, which may lead to reduced release numbers.

4. Volitionally releasing acclimated steelhead at the Squaw Pond prior to forced release.

5. Moving release sites for steelhead released in the East Fork Salmon River downstream to reduce the potential for negative interaction natural anadromous and resident species.

6. Continuing to release steelhead in the lower Salmon River where natural chinook production is minimal or nonexistent.

7. Minimizing the number of smolts in the release population which are larger than 225 mm (or about 4 fpp).

8. Not releasing adult steelhead into chinook production areas, such as above weirs, in

excess of estimated carrying capacity.

9. Continuing to reduce effect of the release of large numbers of juvenile steelhead at a single site by spreading the release over a number of days.

10. Programming time of release to mimic natural fish for releases, given the constraints of transportation.

11. Continuing research to improve post-release survival of steelhead to potentially reduce numbers released to meet management objectives.

12. Monitoring hatchery effluent to ensure compliance with National Pollutant Discharge Elimination System permit.

13. Continuing to externally mark hatchery steelhead released for harvest purposes with an adipose fin clip.

14. Continuing Hatchery Evaluation Studies (HES) to provide comprehensive monitoring and evaluation for LSRCP steelhead.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1) Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

11.1.1) Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

Document LSRCP fish rearing and release practices.

Performance Standards and Indicators: 3.2.2, 3.3.2, 3.4.1, 3.4.2, 3.4.3, 3.4.4, 3.5.2, 3.5.4, 3.5.5, 3.6.1, 3.6.2, 3.7.1, 3.7.2, 3.7.3, 3.7.4, 3.7.5, 3.7.6

Document, report, and archive all pertinent information needed to successfully manage B-run steelhead rearing and release practices. (e.g., number and composition of fish spawned, spawning protocols, spawning success, incubation and rearing techniques, juvenile mark and tag plans, juvenile release locations, number of juveniles released, size at release, migratory timing and success of juveniles, and fish health management).

Document the contribution LSRCP-reared B-run summer steelhead make toward meeting mitigation and management objectives. Document juvenile out-migration and adult returns.

Performance Standards and Indicators: 3.1.1,3.1.2, 3.1.3, 3.2.1, 3.2.2, 3.3.1, 3.3.2, 3.4.3, 3.4.4, 3.5.1, 3.5.2, 3.5.3, 3.5.4, 3.5.5, 3.5.6, 3.6.1, 3.6.2, 3.7.7, 3.7.8

Estimate the number of wild/natural and hatchery-produced steelhead escaping to project waters above Lower Granite Dam using dam counts, harvest information, spawner surveys, and trap information (e.g., presence/absence of identifying marks and tags, number, species, size, age, length). Conduct creel surveys and angler phone or mail surveys to collect harvest information. Assess juvenile outmigration success at traps and dams using direct counts, marks, and tags. Reconstruct runs by brood year. Summarize annual mark and tag information (e.g., juvenile out-migration survival, juvenile and adult run timing, adult return timing and survival). Develop estimates of smolt-to-adult survival for wild/natural and hatchery-produced B-run steelhead. Use identifying marks and tags and age structure analysis to determine the composition of adult B-run steelhead.

Identify factors that are potentially limiting program success and recommend operational modifications, based on the outcome applied studies, to improve overall performance and success.

Performance Standards and Indicators: 3.6.1, 3.6.2

Evaluate potential relationships between rearing and release history and juvenile and adult survival information. Develop hypotheses and experimental designs to investigate practices that may be limiting program success. Implement study recommendations and monitor and evaluate outcomes.

11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

Yes, funding, staffing and support logistics are dedicated to the existing monitoring and evaluation program through the LSRCP program. Additional monitoring and evaluation activities (that contribute effort and information to addressing similar or common objectives) are associated with BPA Fish and Wildlife programs referenced in Section 12, below.

11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

Risk aversion measures for research activities associated with the evaluation of the Lower Snake River Compensation Program are specified in ESA Section 7 Consultation documents, ESA Section 10 Incidental Take Permits (IDFG permit Nos. 919, 920, 1124), and ESA 4(d) rules. A brief summary of the nature of actions taken is provided below.

Adult handling activities are conducted to minimize impacts to ESA-listed, non-target species. Adult and juvenile weirs and screw traps are engineered properly and installed in locations that minimize adverse impacts to both target and non-target species. All trapping facilities are constantly monitored to minimize a variety of risks (e.g., high water periods, high emigration or escapement periods, security).

Adult spawner and redd surveys are conducted to minimize potential risks to all life stages of ESA-listed species. The IDFG conducts formal redd count training annually. During surveys, care is taken to not disturb ESA-listed species and to not walk in the vicinity of completed redds.

Snorkel surveys conducted primarily to assess juvenile abundance and density are conducted in index sections only to minimize disturbance to ESA-listed species. Displacement of fish is kept to a minimum.

Marking and tagging activities are designed to protect ESA-listed species and allow mitigation harvest objectives to be pursued/met. All hatchery-produced, mitigation steelhead are visibly marked to differentiate them from their wild/natural counterpart.

SECTION 12. RESEARCH

12.1) Objective or purpose.

An extensive monitoring and evaluation program is conducted in the basin to document hatchery practices and evaluate the success of the hatchery programs at meeting program mitigation objectives, Idaho Department of Fish and Game management objectives, and to monitor and evaluate the success of supplementation programs. The hatchery monitoring and evaluation program identifies hatchery rearing and release strategies that will allow the program to meet its mitigation requirements and improve the survival of hatchery fish while avoiding negative impacts to natural (including listed) populations.

To properly evaluate this compensation effort, adult returns to facilities, spawning areas, and fisheries that result from hatchery releases are documented. The program requires the cooperative efforts of the Idaho Department of Fish and Game’s hatchery evaluation study, harvest monitoring project, and the coded-wire tag laboratory programs. The Hatchery evaluation study evaluates and provides oversight of certain hatchery operational practices, (e.g., broodstock selection, size and number of fish reared, disease history, and time of release). Hatchery practices will be assessed in relation to their effects on adult returns. Recommendations for improvement of hatchery operations will be made.

Part of the evaluation of hatchery performance includes the identification and collection of suitable broodstock, as well as the evaluation of different methods for releasing juveniles. Current research efforts by the hatchery evaluation team on steelhead are primarily focused in these areas. A project is underway on Squaw Creek to establish a local origin steelhead broodstock by trapping and spawning adults returning to a temporary weir. A second project centered around Squaw Creek deals with evaluating acclimation and volitional release strategies, as well as looking at the adult return performance of locally derived versus out-of-basin broodstocks.

The harvest monitoring project provides comprehensive harvest information, which is key to evaluating the success of the program in meeting adult return goals. Numbers of hatchery and wild/natural fish observed in the fishery and in overall returns to the project area in Idaho are estimated. Data on the timing and distribution of the marked hatchery and wild stocks in the fishery are also collected and analyzed to develop harvest management plans. Harvest data provided by the harvest monitoring project are coupled with hatchery return data to provide an estimate of returns from program releases. Coded-wire tags continue to be used extensively to evaluate fisheries contribution of representative groups of program production releases. However, most of these fish serve experimental purposes as well, i.e., for evaluation of hatchery-controlled variables such as size, time, and location of release, rearing densities, etc.

Continuous coordination between the hatchery evaluation study and Idaho Department of Fish and Game's BPA-funded supplementation research project is required because these programs overlap in several areas for different species including: juvenile outplanting, broodstock collection, and spawning (mating) strategies.

12.2) Cooperating and funding agencies.

U.S. Fish and Wildlife Service – Lower Snake River Compensation Plan Office.

12.3) Principle investigator or project supervisor and staff.

Steve Yundt **–** Fisheries Research Manager, Idaho Department of Fish and Game.

12.4) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

N/A

12.5) Techniques: include capture methods, drugs, samples collected, tags applied.

Research techniques associated with the operation of the broodstock and rearing hatcheries identified in this HGMP involve: hatchery staff; LSRCP hatchery evaluation, harvest monitoring, and coded-wire tag laboratory staff; Idaho supplementation studies staff, and IDFG regional fisheries management staff.

Hatchery staff routinely investigate hatchery variables (e.g., diet used, ration fed, vat or raceway environmental conditions, release timing, size at release, acclimation, etc.) to improve program success. Hatchery-oriented research generally involves the cooperation of LSRCP hatchery evaluation staff. In most cases, PIT and coded-wire tags are used to measure the effect of specific treatments. The IDFG works cooperatively with the Shoshone-Bannock Tribes and the U.S. Fish and Wildlife Service to develop annual mark plans for A-run steelhead juveniles produced at the various hatcheries. Cooperation with LSRCP harvest monitoring and coded-wire tag laboratory staff is required to thoroughly track the distribution of tags in adult salmon. Generally, most hatchery-oriented research occurs prior to the release of spring smolt groups.

Harvest monitoring staff (LSRCP monitoring and evaluations) work cooperatively with IDFG regional fisheries management staff to monitor activities associated with steelhead sport fisheries. Estimates of harvest, pressure, and catch per unit effort are developed in years when sport fisheries occur. The contribution LSRCP-produced fish make to the fishery is also assessed.

Idaho supplementation studies and IDFG regional fisheries management staff work cooperatively to assemble annual juvenile steelhead out-migration and adult return data sets. Adult information is assembled from a variety of information sources including: dam and weir counts, rack returns, fishery information, coded-wire tag information, redd surveys, and spawning surveys.

Idaho Department of Fish and Game and cooperator staff may sample adult steelhead to collect tissue samples for subsequent genetic analysis. Additionally, otoliths, scales, or fins may be collected for age analysis.

12.6) Dates or time period in which research activity occurs.

Fish culture practices are monitored throughout the year by hatchery and hatchery evaluation research staff.

Adult escapement is monitored at downstream dams and above Lower Granite Dam during the majority of the year. Harvest information is collected during periods when sport and tribal fisheries occur. The PSMFC Regional Mark Information System is queried on a year-round basis to retrieve adult coded-wire tag information.

Smolt out-migration through the hydro system corridor is typically monitored from March through December. Juvenile steelhead population abundance and density is monitored during late spring and summer months. The PSMFC PIT Tag Information System is queried on a year-round basis to retrieve juvenile PIT tag information.

Fish health monitoring occurs year round.

12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.

Research activities that involve the handling of eggs or fish apply the same protocols reviewed in Section 9 above. Hatchery staff generally assist with all cooperative activities involving the handling of eggs or fish.

12.8) Expected type and effects of take and potential for injury or mortality.

See Table 1. Generally, take for research activities is defined as: “observe/harass”, “capture/handle/release” and “capture, handle, mark, tissue sample, release.”

12.9) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached “take table” (Table

1).

See Table 1.

12.10) Alternative methods to achieve project objectives.

Alternative methods to achieve research objectives have not been developed.

12.11) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

N/A.

12.12) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.

See Section 11.2 above.

SECTION 13. ATTACHMENTS AND CITATIONS

Literature Cited:

Busby, P.J., T.C. Wainwright, G.J. Bryant, L.J. Lierheimer, R.S. Waples, F.W. Walknitz, and I.V. Lagomarsino. 1996. Status review of west coast steelhead from Washington, Idaho, Oregon, and California. NOAA Technical Memorandum NMFS-NWFSC-27. National Marine Fisheries Service. U.S. Department of Commerce.

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Sankovich, P. and T.C. Bjornn. 1992. Distribution and spawning behavior of hatchery and natural adult chinook salmon released upstream of weirs in two Idaho rivers. Technical Report 92-7, Idaho Cooperative Fish and Wi9ldlife Research Unit for Lower Snake River Fish and Wildlife compensation Program, USFWS. University of Idaho, Moscow, ID.

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U.S. Fish and Wildlife Service. 1992. Biological assessment of proposed 1992 Lower Snake River Compensation Plan steelhead and rainbow trout releases. Unpublished Report, Lower Snake River Compensation Plan Office, Boise, ID.

SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by_____________________________ Date:_____________

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: ________________________ ESU/Population:______________________________ Activity:__________________

Location of hatchery activity:____________________ Dates of activity:__________________ Hatchery program operator:________________

Type of Take	Annual Take of Listed Fish By Life Stage (*Number of Fish*)			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)				
Capture, handle, tag/mark/tissue sample, and release d)			Entire run	
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)			2	
Other Take (specify) h) Carcass tissue sampling				10

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

Instructions:

1. *An entry for a fish to be taken should be in the take category that describes the greatest impact.*
2. *Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).*
3. *If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.*

APPENDIX 2-15—EAST FORK SALMON RIVER NATURAL STEELHEAD HATCHERY AND GENETIC MANAGEMENT PLAN

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	**East Fork Salmon River Natural Steelhead** Sawtooth Fish Hatchery, East Fork Salmon River Satellite facility. Magic Valley Fish Hatchery.
Species or Hatchery Stock:	Summer Steelhead *Oncorhynchus mykiss.*
Agency/Operator:	Idaho Department of Fish and Game
Watershed and Region:	Salmon River, Idaho.
Date Submitted:	September 30, 2002
Date Last Updated:	September 30, 2002

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Hatchery: Sawtooth Fish Hatchery, East Fork Salmon River Satellite
Magic Valley Fish Hatchery

Program: East Fork Salmon River Natural Steelhead

1.2) Species and population (or stock) under propagation, and ESA status.

East Fork Salmon River summer steelhead *Oncorhynchus mykiss*.
Unmarked, naturally-produced population is ESA-listed.

1.3) Responsible organization and individuals

Lead Contact
Name (and title): Sharon W. Kiefer, Anadromous Fish Manager.
Agency or Tribe: Idaho Department of Fish and Game.
Address: 600 S. Walnut, P.O. Box 25, Boise, ID 83707.
Telephone: (208) 334-3791.
Fax: (208) 334-2114.
Email: skiefer@idfg.state.id.us

On-site Operations Lead

Name (and title): Brent Snider, Fish Hatchery Manager II, Sawtooth Fish Hatchery.
Agency or Tribe: Idaho Department of Fish and Game.
Address: HC 64 Box 9905 Stanley, ID 83278.
Telephone: (208) 774-3684.
Fax: (208) 774-3413.
Email: bsinder@idfg.state.id.us

Name (and title): Rick Lowell, Fish Hatchery Manager II, Magic Valley Fish Hatchery.
Agency or Tribe: Idaho Department of Fish and Game.
Address: 2036 River Road, Filer, ID 83328.
Telephone: (208) 326-3230.
Fax: (208) 326-3354.
Email: rlowell@idfg.state.id.us

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

U.S. Fish and Wildlife Service – Lower Snake River Compensation Plan Office: Administers the Lower Snake River Compensation Plan as authorized by the Water Resources Development Act of 1976.

The Shoshone Bannock-Tribes, the Columbia River Treaty Tribes, the USFWS, and NMFS participated in the negotiation and development of a management agreement (1999) to implement the East Fork Salmon River natural steelhead supplementation initiative.

1.4) Funding source, staffing level, and annual hatchery program operational costs.

Sawtooth Fish Hatchery
U.S. Fish and Wildlife Service – Lower Snake River Compensation Plan funded.
Staffing level: 5 FTE.
Annual budget: $850,000.

Magic Valley Fish Hatchery
U.S. Fish and Wildlife Service – Lower Snake River Compensation Plan funded.
Staffing level: 4 FTE.
Annual budget: $750,000.

1.5) Location(s) of hatchery and associated facilities.

Sawtooth Fish Hatchery – The Sawtooth Fish Hatchery is located on the upper Salmon River approximately 8.0 kilometers south of Stanley, Idaho. The river kilometer code for the facility is 503.303.617. The hydrologic unit code for the facility is 17060201.

East Fork Salmon River Satellite – The East Fork Salmon River Satellite is located on the East Fork Salmon River approximately 29 kilometers upstream of the confluence of the East Fork with the main stem Salmon River. The river kilometer code for the facility is 522.303.552.029. The hydrologic unit code for the facility is 17060201.

Magic Valley Fish Hatchery – The Magic Valley Fish Hatchery is located adjacent to the Snake River approximately 11.2 kilometers northwest of Filer, Idaho. There is no river kilometer code for the facility. The hydrologic unit code for the facility is 17040212.

1.6) Type of program.

Lower Snake River Compensation Plan - The East Fork Salmon River natural steelhead program is an Integrated Recovery Program. It was designed as small-scale supplementation experiment to spawn a portion of locally returning, naturally produced steelhead. Sufficient broodstock are collected (when adult return numbers are adequate) to produce up to 50,000 smolts. Spawning takes place at the East Fork Salmon River satellite facility operated by the Sawtooth Fish Hatchery. Egg incubation through the eyed stage of development occurs at the Sawtooth Fish Hatchery. Eyed-eggs are then shipped to the Magic Valley Fish Hatchery. Natural steelhead smolts are released in the vicinity of East Fork Salmon River trap.

1.7) Purpose (Goal) of program.

Restoration/Research - The goal of this program is to determine if hatchery propagation can be used to increase natural fish abundance (e.g., supplementation).

1.8) Justification for the program.

The 1999 management agreement for upper Columbia River fall chinook, steelhead, and coho salmon included a provision to spawn locally returning, naturally produced steelhead in the East Fork Salmon River to create up to 50,000 smolts (brood year dependent) for a small-scale supplementation effort.

Actions taken to minimize adverse effects on listed fish include:

1. Use existing naturally returning adults as broodstock.

2. Continuing fish health practices to minimize the incidence of infectious disease agents. Follow IHOT, AFS, and PNFHPC guidelines.

3. Moving release sites for hatchery-produced, mitigation steelhead released in the East Fork Salmon River downstream to reduce the potential for negative interaction with natural anadromous and resident species.

4. Minimizing the number of smolts in the release population which are larger than 225 mm (or about 4 fpp).

5. Programming time of release to mimic natural fish for releases, given the constraints of transportation.

6. Manage adult collection levels to maintain natural spawning and to provide fish for supplementation research.

7. Continuing Hatchery Evaluation Studies (HES) to provide comprehensive monitoring and evaluation for LSRCP steelhead.

8. Continuing research to improve post-release survival of steelhead to potentially reduce numbers released to meet management objectives.

9. Monitoring hatchery effluent to ensure compliance with National Pollutant Discharge Elimination System permit.

10. Continuing to externally mark hatchery steelhead released for harvest purposes with an adipose fin clip.

1.9) List of program "Performance Standards".

3.1 Legal Mandates.
3.2 Harvest.
3.3 Conservation of natural spawning populations.
3.4 Life History Characteristics.
3.5 Genetic Characteristics.
3.6 Research Activities.
3.7 Operation of Artificial Production Facilities.

1.10) List of program "Performance Indicators", designated by "benefits" and "risks."

Note: Performance Standards and Indicators used to develop Sections 1.10.1 and 1.10.2 were taken from the final January 17, 2001 version of Performance Standards and Indicators for the Use of Artificial Production for Anadromous and Resident Fish Populations in the Pacific Northwest. Numbers referenced below correspond to numbers used in the above document.

3.1.1 Standard: Program contributes to fulfilling tribal trust responsibility mandates and treaty rights, as described in applicable agreements such as under U.S. v. Oregon and U.S. v. Washington.

Indicator 1: Total number of fish harvested in tribal fisheries targeting program.

3.2.2 Standard: Release groups sufficiently marked in a manner consistent with information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries.

Indicator 1: Marking rate by type in each release group documented.
Indicator 2: Sampling rate by mark type for each fishery estimated.
Indicator 3: Number of marks by type observed in fishery documented.

3.3.2 Standard: Releases are sufficiently marked to allow statistically significant evaluation of program contribution.

Indicator 1: Marking rates and type of mark documented.
Indicator 2: Number of marks identified in juvenile and adult groups documented.

1.10.2) "Performance Indicators" addressing risks.

3.4.1 Standard: Fish collected for broodstock are taken throughout the return in proportions approximating the timing and age structure of the population.

Indicator 1: Temporal distribution of broodstock collection managed.

Indicator 2: Age composition of broodstock collection managed.

3.4.2 Standard: Broodstock collection does not significantly reduce potential juvenile production in natural areas.

Indicator 1: No spawners of natural origin removed for broodstock.
Indicator 2: All natural origin spawners released to migrate to natural spawning areas.
Indicator 3: Number of adults, eggs or juveniles placed in natural rearing areas managed.

3.4.3 Standard: Life history characteristics of the natural population do not change as a result of this program.

Indicator 1: Life history characteristics of natural and hatchery-produced populations are measured (e.g., juvenile dispersal timing, juvenile size at outmigration, juvenile sex ratio at outmigration, adult return timing, adult age and sex ratio, spawn timing, hatch and swim-up timing, rearing densities, growth, diet, physical characteristics, fecundity, egg size).

3.4.4 Standard: Annual release numbers do not exceed estimated basin-wide and local habitat capacity.

Indicator 1: Annual release numbers, life-stage, size at release, length of acclimation documented.
Indicator 2: Location of releases documented.
Indicator 3: Timing of hatchery releases documented.

3.5.1 Standard: Patterns of genetic variation within and among natural populations do not change significantly as a result of artificial production.

Indicator 1: Genetic profiles of naturally-produced and hatchery-produced adults developed.

3.5.2 Standard: Collection of broodstock does not adversely impact the genetic diversity of the naturally spawning population.

Indicator 1: Total number of natural spawners reaching collection facilities documented.
Indicator 2: Total number of natural spawners estimated passing collection facilities documented.
Indicator 3: Timing of collection compared to overall run timing.

3.5.3 Standard: Artificially produced adults in natural production areas do not exceed appropriate proportion.

Indicator 1: Ratio of natural to hatchery-produced adults monitored (observed and estimated through fishery).
Indicator 2: Observed and estimated total numbers of natural and hatchery-produced adults passing counting stations.

3.5.4 Standard: Juveniles are released on-station, or after sufficient acclimation to maximize homing ability to intended return locations.

Indicator 1: Location of juvenile releases documented.
Indicator 2: Length of acclimation period documented.
Indicator 3: Release type (e.g., volitional or forced) documented.
Indicator 4: Adult straying documented.

3.5.5 Standard: Juveniles are released at fully smolted stage of development.

Indicator 1: Level of smoltification at release documented.
Indicator 1: Release type (e.g., forced or volitional) documented.

3.5.6 Standard: The number of adults returning to the hatchery that exceeds broodstock needs is declining.

Indicator 1: The number of adults in excess of broodstock needs documented in relation to mitigation goals of the program.

3.6.1 Standard: The artificial production program uses standard scientific procedures to evaluate various aspects of artificial production.

Indicator 1: Scientifically based experimental design with measurable objectives and hypotheses.

3.6.2. Standard: The artificial production program is monitored and evaluated on an appropriate schedule and scale to address progress toward achieving the experimental objectives.

Indicator 1: Monitoring and evaluation framework including detailed time line.
Indicator 2: Annual and final reports.

3.7.1 Standard: Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols.

Indicator 1: Annual reports indicating level of compliance with applicable standards and criteria.

3.7.2 Standard: Effluent from artificial production facility will not detrimentally affect natural populations.

Indicator 1: Discharge water quality compared to applicable water quality standards.

3.7.3 Standard: Water withdrawals and in stream water diversion structures for artificial production facility operation will not prevent access to natural spawning areas, affect spawning, or impact juveniles.

Indicator 1: Water withdrawals documented – no impacts to listed species.
Indicator 2: NMFS screening criteria adhered to.

3.7.4 Standard: Releases do not introduce pathogens not already existing in the local populations and do not significantly increase the levels of existing pathogens.

Indicator 1: Certification of juvenile fish health documented prior to release.

3.7.5 Standard: Any distribution of carcasses or other products for nutrient enhancement is accomplished in compliance with appropriate disease control regulations and guidelines.

Indicator 1: Number and location(s) of carcasses distributed to habitat documented.

3.7.6 Standard: Adult broodstock collection operation does not significantly alter spatial and temporal distribution of natural population.

Indicator 1: Spatial and temporal spawning distribution of natural population above and below trapping facilities monitored.

3.7.7 Standard: Weir/trap operations do not result in significant stress, injury, or mortality in natural populations.

Indicator 1: Mortality rates in trap documented. No ESA-listed fish targeted.
Indicator 2: Prespawning mortality rates of trapped fish in hatchery or after release documented. No ESA-listed fish targeted.

3.7.8 Standard: Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of natural fish.

Indicator 1: *Size and time of release of juvenile fish documented and compared to size and timing of natural fish.*

1.11) Expected size of program.

1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).

Broodstock collections levels have been established but remain flexible to insure that natural steelhead adults are passed above the collection facility for volitional spawning. Ideally, no more than 50% of unmarked steelhead adults will be retained at the East Fork Salmon River satellite for broodstock purposes. If adequate adults are available, an effort will be made to meet the following broodstock and production targets:

1) Retain 10 pair (projected to produce approximately 31,000 smolts),

2) Retain 17 pair (projected to produce approximately 50,000 smolts).

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location.

See Section 1.11.1 above.

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

This program has been agreed to since brood year 2000. As such, estimated smolt-to-adult survival rates are not available. However, records of unmarked steelhead returns to the East Fork Salmon River trap have been collected since the mid 1980s and are presented below.

Number of unmarked steelhead captured at the East Fork Salmon River Trap and the number collected for broodstock ( ) beginning in year 2000.

Return Year	Total Returns (Unmarked, Natural-Origin) No. Collected for Broodstock in ( )
1985	6
1986	n/a
1987	14
1988	20
1989	17
1990	25
1991	21
1992	45
1993	17
1994	8
1995	2
1996	6
1997	12
1998	14
1999	10
2000	6 (2)
2001	11 (6)*

2002	27 (18)*

* All males released after partial milt harvest.

1.13) Date program started (years in operation), or is expected to start.

The East Fork Salmon River natural steelhead supplementation research program was initiated in brood year 2000 with smolts first released in 2001 and expected to return beginning in 2003. Facilities associated with the program and their term of operation are presented below.

Sawtooth Fish Hatchery – In operation since 1985.

East Fork Salmon River Satellite – In operation since 1984.

Magic Valley Fish Hatchery – The hatchery has been in operation since 1983. A new facility was constructed in 1988.

1.14) Expected duration of program.

This program has been identified in management agreements that extend through brood year 2003. Tribe, state, and federal management agencies may choose to continue this program beyond that point pursuant to a longer-term Columbia River Fishery Management Agreement.

1.15) Watersheds targeted by program.

Listed by hydrologic unit code –

East Fork Salmon River: 17060201

1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

A no action alternative, which would be a continuation of only natural production, was considered. However, this alternative did not meet the objectives of U.S. v. Oregon parties, including NMFS, to determine if locally returning steelhead broodstock could be used to bolster natural production of steelhead without adverse effect to listed steelhead.

SECTION 2. PROGRAM EFFECTS ON NMFS ESA-LISTED SALMONID POPULATIONS. (USFWS ESA-Listed Salmonid Species and Non-Salmonid Species are addressed in Addendum A)

2.1) List all ESA permits or authorizations in hand for the hatchery program.

As part of the NMFS-adopted 4(d) rule process for establishing "take" prohibitions of Snake Basin steelhead, this HGMP is being prepared and addresses the recommendation to produce HGMPs as outlined in Limit No. 5 – Artificial Propagation.

2.2) Provide descriptions, status, and projected take actions and levels for NMFS ESA-listed natural populations in the target area.

2.2.1) <u>Description of NMFS ESA-listed salmonid population(s) affected by the program.</u>

The following excerpts on the present status of Salmon River basin steelhead were taken from the Draft Subbasin Summary for the Salmon Subbasin of the Mountain Snake Province (NPPC 2001) and from the Status Review of West Coast Steelhead from Washington, Idaho, Oregon, and California (Busby et al. 1996).

The Salmon River basin steelhead ESU occupies the Snake River Basin of southeast Washington, northeast Oregon, and Idaho. This region is ecologically complex and supports a diversity of steelhead populations; however, genetic and meristic data suggest that these populations are more similar to each other than they are to steelhead populations occurring outside of the Snake River Basin. Snake River Basin steelhead spawning areas are well isolated from other populations and include the highest elevations for spawning (up to 2,000 m) as well as the longest migration distance from the ocean (up to 1,500 km). Snake River steelhead are often classified into two groups, A- and B-run, based on migration timing, ocean age, and adult size. While total (hatchery + natural) run size for Snake River steelhead has increased since the mid-1970s, the increase has resulted from increased production of hatchery fish, and there has been a severe recent decline in natural run size. The majority of natural stocks for which we have data within this ESU have been declining. Parr densities in natural production areas have been substantially below estimated capacity in recent years. Downward trends and low parr densities indicate a particularly severe problem for B-run steelhead, the loss of which would substantially reduce life history diversity within this ESU. The BRT had a strong concern about the pervasive opportunity for genetic introgression from hatchery stocks within the ESU. There was also concern about the degradation of freshwater habitats within the region, especially the effects of grazing, irrigation diversions, and hydroelectric dams.

Areas of the subbasin upstream of the Middle Fork have been stocked with hatchery steelhead, and the IDFG has classified these runs of steelhead as natural. The majority of these steelhead are progeny of introduced hatchery stocks from the Snake River. With the construction of Hell's Canyon Dam in the 1960s, the US Fish and Wildlife Service, Army Corps of Engineer, US Forest Service, Bonneville Power Administration, Bureau of Reclamation, and Idaho Department of Fish and Game attempted to mitigate the affects of the dam by establishing a hatchery-managed, sport fishery in the upper Salmon River. Naturally produced steelhead upstream of the Middle Fork are classified as A- run, based upon characteristics of size, ocean age, and timing. Out of subbasin Snake River A-run steelhead have been released extensively in this area, and it is unlikely any wild, native populations still exist.

Both recent and historical data on the spawning populations of steelhead in specific streams within the Salmon Subbasin are very limited. Mallet (1974) estimated that historically 55% of all Columbia River steelhead trout originated from the Snake River basin, which includes the Salmon Subbasin. Though not quantified, it is likely a large proportion of these fish were produced in the Salmon Subbasin. Monitoring data from subbasins within the Mountain Snake Province (of which the Salmon Subbasin is a primary component) shows a general decline in parr densities for steelhead.

- Identify the NMFS ESA-listed population(s) that will be directly affected by the program

Adult, ESA-listed summer steelhead are directly affected by the operation of the East Fork Salmon River trap and holding facility. Adults selected for broodstock purposes are held for spawning at the facility. Adults not selected for broodstock purposes are released upstream of the facility.

The 1999 NMFS Biological Opinion on Artificial Propagation in the Columbia River Basin (NMFS 1999) concluded that Snake River summer steelhead artificial propagation actions are expected to adversely affect listed Snake River summer steelhead.

- Identify the NMFS ESA-listed population(s) that may be incidentally affected by the program.

Snake River Spring/Summer-run chinook salmon ESU (T – 4/92)

Snake River sockeye salmon ESU (E – 11/91)

Snake River Basin steelhead ESU (T – 8/97)

Bull trout (T – 6/98)

2.2.2) Status of NMFS ESA-listed salmonid population(s) affected by the program.

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds.

Critical and viable population thresholds have not been developed for Snake River steelhead. See section 2.2.1 above.

- Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.

This information is not available. Releases were first conducted in 2001. Age-3 adults are expected to potentially return in 2003.

- Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

See table in Section 1.12.

- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

This information is not available

2.2.3) <u>Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of NMFS listed fish in the target area, and provide estimated annual levels of take.</u>

Adult, ESA-listed summer steelhead are trapped at the East Fork Salmon River satellite. Adults selected for broodstock purposes are held for spawning at this facility. Adults not selected for broodstock purposes are released upstream of the facility. In addition, natural males may be held temporarily, partially stripped of milt, and released upstream to spawn. Milt collected from natural males that are subsequently released, is used to perform broodstock spawn crosses with natural females.

Broodstock collections levels have been established but remain flexible to insure that natural steelhead adults are passed above the collection facility for volitional spawning. Ideally, no more than 50% of unmarked steelhead adults will be retained at the East Fork Salmon River satellite for broodstock purposes. If adequate adults are available, an effort will be made to meet the following broodstock and production targets:

1) Retain 10 pair (projected to produce approximately 31,000 smolts),

2) Retain 17 pair (projected to produce approximately 50,000 smolts).

The 1999 NMFS Biological Opinion on Artificial Propagation in the Columbia River Basin (NMFS 1999) concluded that Snake River summer steelhead artificial propagation actions are expected to adversely affect listed Snake River summer steelhead. The release of hatchery steelhead into natural production areas is expected to result in predation and competition with listed steelhead juveniles. The Biological Opinion provided reasonable and prudent alternatives to avoid jeopardy.

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

ESA-listed Snake River summer steelhead and spring chinook salmon (juveniles and adults)are present in the project area. ESA-listed sockeye salmon are not expected to be present in the immediate project area.

Adult spring/summer chinook are not present in the East Fork Salmon River during steelhead trapping periods (late March through early May). As such, activities associated with the collection of steelhead adults for broodstock is not expected to adversely affect adult chinook salmon.

The 1999 NMFS Biological Opinion on Artificial Propagation in the Columbia River Basin (NMFS 1999) concluded that Snake River summer steelhead artificial propagation actions are expected to adversely affect listed Snake River summer steelhead. The release of hatchery steelhead into natural production areas is expected to result in predation and competition with listed steelhead juveniles.

- Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish.

See Table in Section 2.2.2 above. Unmarked steelhead have been retained for spawning at the East Fork Salmon River satellite since 2001. In that year, a total of 11 natural steelhead (three males and eight females) were trapped. Three of the eight unmarked females were incorporated in the natural steelhead broodstock program. Five unmarked steelhead females were released upstream for natural spawning. The three unmarked male steelhead were also released upstream. However, milt was pre-harvested from these individuals prior to release. This milt was used to perform spawn crosses with the three unmarked females that were retained.

In 2002, 27 unmarked steelhead (eight males and nineteen females) were trapped. Ten of the 19 females were retained for broodstock purposes. The remaining nine females and all males were released upstream of the weir. Prior to release, milt was pre-harvested from each male to perform spawn crosses with the unmarked females retained for broodstock purposes.

No adult, unmarked steelhead have been injured or killed as a result of trapping activities since they were listed as threatened in 1997.

- Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).

All adult steelhead (hatchery- and natural-origin) are trapped and handled at the East Fork Salmon River weir. The numbers of natural-origin adults varies annually (see table in Section 1.12). Based on weir management protocols described in Section 6.6.2 of this HGMP, natural-origin, B-run steelhead may be held for spawning annually. In addition, following capture, all natural-origin fish not retained for spawning may be marked and tissue sampled before release. See Table 1 (attached).

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

It is unlikely that take levels for natural steelhead will exceed projected take levels presented in Table 1 (attached). However, in the unlikely event that this occurs, the IDFG will consult with NMFS Sustainable Fisheries Division or Protected Resource Division staff and agree to an action plan. We assume that any contingency plan will include a provision to discontinue activities.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.

This program conforms with the plans and policies of the Lower Snake River Compensation Program administered by the U.S. Fish and Wildlife Service to mitigate for the loss of steelhead production caused by the construction and operation of the four dams on the lower Snake River.

This program also addresses Conservation Recommendation IX. B. 4. of the 1999 Biological Opinion on Artificial Propagation in the Columbia River Basin to:

1) Investigate the feasibility of transitioning to locally-derived A-run steelhead broodstocks for use in the Salmon River. An HGMP should be developed to address the transition.

2) to develop a HGMP using locally adapted B-run summer steelhead in the salmon River.

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.

1999 through 2002 Management Agreement for Upper Columbia River Fall Chinook, Steelhead and Coho pursuant to United States of America v. State of Oregon, U.S. District Court, District of Oregon.

Cooperative Agreement between the U.S. Fish and Wildlife Service and the Idaho Department of Fish and Game, USFWS Agreement No.: 141102J010 (for Lower Snake River Compensation Plan monitoring and evaluation studies).

Cooperative Agreement between the U.S. Fish and Wildlife Service and the Idaho

Department of Fish and Game, USFWS Agreement No.: 141102J009 (for Lower Snake River Compensation Plan hatchery operations).

3.3) Relationship to harvest objectives.

The Lower Snake River Compensation Plan defined replacement of adults "in place" and "in kind" for appropriate state management purposes. The Idaho Department of Fish and Game, the U.S. Fish and Wildlife Service, and the Shoshone-Bannock Tribes work cooperatively to develop annual production and mark plans. Juvenile production and adult escapement targets were established at the outset of the LSRCP program.

As part of its harvest management and monitoring program, the IDFG conducts annual creel and angler surveys to assess the contribution program fish make toward meeting program harvest objectives.

Natural (unmarked) steelhead adults trapped as part of this program and progeny produced by this program are not targeted in sport fisheries. However, they may be utilized in Columbia River and tributary treaty fisheries.

3.3.1) Describe fisheries benefiting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

Natural (unmarked) steelhead adults trapped as part of this program and progeny produced by this program are not targeted in sport fisheries. However, they may be utilized in Columbia River and tributary treaty fisheries.

3.4) Relationship to habitat protection and recovery strategies.

Recovery strategies for the Snake River steelhead ESU have not been developed. This action is consistent with the 1999 Hatchery Biological Opinion Conservation Recommendation.

3.5) Ecological interactions. [Please review Addendum A before completing this section. If it is necessary to complete Addendum A, then limit this section to NMFS jurisdictional species. Otherwise complete this section as is.]

The 1999 NMFS Biological Opinion on Artificial Propagation in the Columbia River Basin (NMFS 1999) concluded that Snake River summer steelhead artificial propagation actions are expected to adversely affect listed Snake River summer steelhead. The release of hatchery steelhead into natural production areas is expected to result in predation and competition with listed steelhead juveniles.

Since listing in 1997, hatchery-origin adult steelhead have not been released upstream of the trapping facility on the East Fork Salmon River. However, since 2000 and the inception of the experimental East Fork Salmon River natural steelhead supplementation program addressed in this HGMP, hatchery-origin adult steelhead were released upstream of the weir in 2001 (2 males). In that year, five unmarked females and 3 unmarked males were released upstream. The two hatchery-origin males were released to help insure that successful spawning occurred.

No hatchery-origin steelhead juveniles (LSRCP mitigation fish) have been released in the vicinity of the East Fork Salmon River satellite since Snake River Basin steelhead were added to the Endangered Species List in 1997.

The juvenile steelhead release target for the East Fork Salmon River natural steelhead program is expected to remain at approximately 50,000 smolts or less annually. As such, the potential for negatively impacting natural steelhead or salmon populations through ecological interactions is considered to be minimal.

However, potential adverse effects to listed salmon and steelhead could occur from the release of hatchery-origin, unmarked steelhead smolts in the East Fork Salmon River through the following interactions: predation, competition, behavior modification, and disease transmission.

We have tried to consider potential interactions between listed steelhead and salmon and hatchery steelhead and their effect in the migration corridor of the Salmon River and downstream. Timing of hatchery-origin steelhead in the migration corridor overlaps with listed spring/summer chinook salmon, steelhead, and to a lesser degree with listed sockeye salmon. Steelhead from the LSRCP program are more temporally separated from listed fall chinook salmon in the Snake River and Lower Granite Reservoir based on different migration periods. The National Marine Fisheries Service has identified potential competition for food and space and behavioral interactions in the migration corridor as a concern (M. Delarm, NMFS, pers. comm.).

Because of their size and timing, chinook salmon fry are probably the most vulnerable life stage to predation. Hillman and Mullan (1989) observed substantial predation of newly emerged chinook salmon by hatchery and wild steelhead in the Wenatchee River. Cannamela (1992) used existing literature to evaluate potential predation of chinook salmon fry by hatchery steelhead smolts. He evaluated a 1-1.3 million steelhead smolt release in the upper Salmon River primary production area, where steelhead were released in the vicinity of redds and migrated over redds for several miles. He assumed steelhead smolts at least 105 mm could consume chinook salmon fry, 35-37 mm in length. Cannamela estimated potential predation by utilizing various percentages of fry in the diet, residualism, and predator size. Using ranges of assumptions, he calculated estimated fry losses to predation by steelhead smolts and residuals for up to a 70 day period from smolt release to June 25. According to his calculations, his scenario of 500,000 steelhead predators utilizing fish as 1 percent of their diet for 40 days resulted in potential consumption of 34,500 fry. Empirical information collected in 1992 infers that this may be an overestimate. IDFG biologists attempted to quantify chinook salmon fry predation by hatchery steelhead in the upper Salmon River. Their samples were collected from a release of 774,000 hatchery steelhead in the upper Salmon River primary production area where steelhead would migrate directly over redds. The fish were released in early April. The biologists sampled 6,762 steelhead and found that 20 contained fish parts in the cardiac stomach. Of these, three contained 10 chinook salmon fry. The biologists estimated that the proportion of hatchery steelhead that consumed fry was 0.000444. The estimated predation rate of steelhead smolts on chinook salmon fry was 1.48×10^{-3} (95% CI 0.55×10^{-3} to 2.41×10^{-3}) for the 6,762 hatchery steelhead smolts examined that consumed the ten chinook fry. Biologists used this consumption rate to estimate that the total number of chinook fry consumed during the sample period, April 3-June 3, was 24,000 fry (IDFG 1993).

By using Cannamela's calculations and scenarios of 0.05-1.0 percent fish in the diet and 10-25 percent residualism, we predict a range of potential loss of 2,300-51,000 chinook fry for a 1.25 million smolt release in the Salmon River primary production area. Cannamela (1992) estimated fry losses would occur for up to a 70 day period from smolt release to June 25. He noted that there is an assumed mechanism for chinook salmon fry to avoid predation by steelhead since they are coevolved populations. However, literature references were scant about this theory although Peery and Bjornn (1992) documented that fry tend to move at night. Cannamela concluded that only assumptions could be made about the availability and vulnerability of fry to steelhead predators.

Martin et al. (1993) collected 1,713 steelhead stomachs from the Tucannon River and three contained juvenile spring chinook salmon. They estimated that 456-465 juvenile spring chinook salmon were consumed by hatchery steelhead in the Tucannon River from a total release of 119,082 steelhead smolts. Biologists found that rate of predation increased from the time of steelhead release through September 31. Predation rates increased from 9.4×10^{-3} to 4.3×10^{-2}. Martin et al. (1993) theorized that although numbers of steelhead decreased, remaining fish may have learned predatory behavior. By October, juvenile salmon were too large to be prey, and stream temperature had dropped.

No precise data are available to estimate the importance of chinook salmon fry in a steelhead smolt's diet (USFWS 1992). The USFWS cited several studies where the contents of steelhead stomachs had been examined. Few, if any, salmonids were found. They concluded that the limited empirical data suggested that the number of chinook salmon fry/fingerlings consumed by steelhead is low. Schriever (IDFG, pers. comm.) sampled 52 hatchery steelhead in the lower Salmon and Clearwater rivers in 1991 and 1992 and found no fish in their stomach contents.

The percentage of steelhead residualism in the upper Salmon River appeared to be about 4 percent in 1992 (IDFG 1993). We do not know the rate of residualism for steelhead released in the lower Salmon River. In 1992, the steelhead smolt migration in the Salmon River primary production area began around May 10 and about 95% of the hatchery steelhead had left the upper Salmon River study area by May 21. IDFG biologists found that after one week, hatchery steelhead smolts were consuming natural prey items such as insects and appeared to be effectively making the transition to natural food (IDFG 1993). It is unknown if smolts continued to feed as they actively migrated.

Biologists observed that the environmental conditions during the 1992 study were atypical. Water velocity was much lower, while water temperature and clarity were higher than normal for the study period. Furthermore, about 637,500 of the smolts had been acclimated for up to three weeks at Sawtooth Fish Hatchery prior to release, but these fish were not fed during acclimation. It is unknown if acclimation reduced residualism. Biologists concluded that within the framework of 1992 conditions, chinook fry consumption by hatchery steelhead smolts and residuals was very low.

Kiefer and Forster (1992) were concerned that predation on natural chinook salmon smolts by hatchery steelhead smolts released into the Salmon River at Sawtooth Fish Hatchery could be causing mortality. They compared PIT tag detection rates of upper Salmon River natural chinook salmon emigrating before and after the steelhead smolt releases for the previous three years. They found no significant difference and concluded that the hatchery steelhead smolts were not preying upon the natural chinook smolts to any significant degree.

The release of a large number of prey items which may concentrate predators has been identified as a potential effect on listed salmon. Hillman and Mullan (1989) reported that predaceous rainbow trout (>200 mm) concentrated on wild salmon within a moving group of hatchery age-0 chinook salmon. The wild salmon were being "pulled" downstream from their stream margin stations as the hatchery fish moved by. It is unknown if the wild fish would have been less vulnerable had they remained in their normal habitat. Hillman and Mullan (1989) also observed that the release of hatchery age-0 steelhead did not pull wild salmon from their normal habitat. During their sampling in 1992, IDFG biologists did not observe predator concentration. We have no further information that supports or disproves concern that predators may concentrate and affect salmon because of the release of large numbers of hatchery steelhead.

There is potential for hatchery steelhead smolts and residuals to compete with chinook salmon and natural steelhead juveniles for food and space, and to potentially modify their behavior. The literature suggests that the effects of behavioral or competitive interactions would be difficult to evaluate or quantify (Cannamela 1992, USFWS 1993). Cannamela (1992) concluded that existing information was not sufficient to determine if competitive or behavioral effects occur to salmon juveniles from hatchery steelhead smolt releases.

Cannamela's (1992) literature search indicated that there were different habitat preferences between steelhead and chinook salmon that would minimize competition and predation. Spatial segregation appeared to hinge upon fish size. Distance from shore and surface as well as bottom velocity and depth preferences increased with fish size. Thus, chinook salmon fry and steelhead smolts and residuals are probably not occupying the same space. Cannamela theorized that if interactions occur, they are probably restricted to a localized area because steelhead, which do not emigrate, do not move far from the release site. Within the localized area, spatial segregation based on size differences would place chinook salmon fry and fingerlings away from steelhead smolts and residuals. This would further reduce the likelihood of interactions. Martin et al. (1993) reported that in the Tucannon River, spring chinook salmon and steelhead did exhibit temporal and spatial overlap, but they discuss that the micro-habitats of the two species were likely very different.

The USFWS (1992) theorized that the presence of a large concentration of steelhead at and near release sites could modify the behavior of chinook. However, they cited Hillman and Mullan (1989) who found no evidence that April releases of steelhead altered normal movement and habitat use of age-0 chinook. Throughout their study, IDFG biologists (IDFG 1993) noted concentrations of fry in typical habitat areas, whether steelhead were present or not.

Cannamela (1992) also described the potential for effects resulting from the release of a large number of steelhead smolts in a small area over a short period of time. He theorized that high concentrations of steelhead smolts could limit chinook salmon foraging opportunities or limit available food. However, the effect would be of limited duration because most steelhead smolts emigrate or are harvested within two months of release. He found no studies to support or refute his hypothesis. Cannamela also discussed threat of predation as a potentially important factor causing behavioral changes by stream salmonids. The literature was not specific to interactions of steelhead smolts and chinook fry. It is assumed that coevolved populations would have some mechanism to minimize this interaction.

There is a potential effect to listed salmon from diseases transmitted from hatchery-origin steelhead adults. Pathogens that could be transmitted from adult hatchery steelhead to naturally produced chinook salmon include Infectious Hematopoietic Necrosis Virus (IHNV) and Bacterial Kidney Disease (BKD) (K. Johnson, IDFG, pers. comm..). Although adult hatchery-origin steelhead may carry pathogens of chinook, such as BKD and Whirling Disease, which could be shed into the drainage, these diseases are already present in the Salmon River headwaters in naturally produced chinook and steelhead populations. The prevalence of BKD is less in hatchery-origin steelhead than in naturally produced chinook salmon. Idaho chinook salmon are rarely affected by IHNV (D. Munson, IDFG, pers. comm). Idaho Department of Fish and Game disease monitoring will continue as part of the IDFG fish health program. We do not believe that the release of hatchery-origin steelhead adults will increase the prevalence of disease in naturally produced chinook salmon or steelhead.

Hauck and Munson (IDFG, unpublished) provide a thorough review of the epidemiology of major chinook pathogens in the Salmon River drainage. The possibility exists for horizontal transmission of diseases to listed chinook salmon or natural steelhead from hatchery-origin steelhead in the migration corridor. Current hatchery practices include measures to control pathogens at all life stages in the hatchery. Factors of dilution, low water temperature, and low population density of listed anadromous species in the production area reduce the potential of disease transmission. However, none of these factors preclude the existence of disease risk (Pilcher and Fryer 1980, LaPatra et al. 1990, Lee and Evelyn 1989). In a review of the literature, Steward and Bjornn (1990) stated there was little evidence to suggest that horizontal transmission of disease from hatchery smolts to naturally produced fish is widespread in the production area or free-flowing migration corridor. However, little research has been done in this area.

Transfers of hatchery steelhead between any facility and the receiving location conforms to PNFHPC guidelines. IDFG and USFWS personnel monitor the health status of hatchery steelhead using protocols approved by the Fish Health Section, AFS. Disease sampling protocol, in accordance to the PNFHPC and AFS Bluebook is followed. IDFG hatchery and fish health personnel sample the steelhead throughout the rearing cycle and a pre-release sample is analyzed for pathogens and condition. Baseline disease monitoring of naturally produced chinook salmon has been implemented in the upper Salmon River, but the program is in its infancy. At this time, we have no evidence that horizontal transmission of disease from the hatchery steelhead release in the upper Salmon River has an adverse effect on listed species. Even with consistent monitoring, it would be difficult to attribute a particular incidence or presence of disease to actions of the LSRCP steelhead program.

We considered hatchery water withdrawal in the East Fork Salmon River to collect steelhead broodstock to have no effect upon ESA-listed salmon or steelhead. Water is only temporarily diverted from the river.

SECTION 4. WATER SOURCE

4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

Sawtooth Fish Hatchery – The Sawtooth Fish Hatchery receives water from the Salmon River and from four wells. River water enters an intake structure located approximately 0.8 km upstream of the hatchery facility. River water intake screens comply with NMFS criteria. River waters flows from the collection site to a control box located in the hatchery building where it is screened to remove fine debris. River water can be distributed to indoor vats, outside raceways, or adult holding raceways. The hatchery water right for river water use is approximately 60 cfs. Incubation and early rearing water needs are met by two primary wells. A third well provides tempering water to control the build up of ice on the river water intake during winter months. The fourth well provides domestic water for the facility. The hatchery water right for well water is approximately 9 cfs. River water temperatures range from 0.0ºC in the winter to 20.0ºC in the summer. Well water temperatures range from 3.9ºC in the winter to 11.1ºC in the summer. The intake screens are in compliance with NMFS screen criteria by design of the Corp of Engineers.

East Fork Salmon River Satellite – The East Fork Salmon River Satellite receives water from the East Fork Salmon River. Approximately 15 cfs is delivered to the facility through a gravity line. Water is delivered to adult holding raceways. A well provides domestic water and pathogen-free water for spawning (egg water-hardening process). No fish rearing occurs at this site. The intake screens are in compliance with NMFS screen criteria by design of the Corp of Engineers.

4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

Intake screens at all facilities are in compliance with NMFS screen criteria by design of the Corp of Engineers.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

East Fork Salmon River Satellite – The East Fork Salmon River Satellite was constructed with a velocity barrier fitted with radial gates to prevent upstream passage beyond the trap. Adult steelhead move into a fish ladder and then into two adult holding raceways that measure 68 ft long by 10 ft wide by 4.5 ft deep. Each adult pond has the capacity to hold approximately 500 adults.

5.2) Fish transportation equipment (description of pen, tank truck, or container used).

No adult steelhead are transported.

5.3) Broodstock holding and spawning facilities.

See Section 5.1 above for a review of broodstock holding and spawning facilities.

5.4) Incubation facilities.

Eggs are incubated to the eyed-stage of development at Sawtooth Fish Hatchery. Final incubation and rearing to release occurs at the Magic Valley Fish Hatchery.

Sawtooth Fish Hatchery – Incubation facilities at the Sawtooth Fish Hatchery consist of a well water supplied system of 100 stacks of incubator frames containing 800 incubation trays. The maximum incubation capacity at the Sawtooth Fish Hatchery is 7 million steelhead eggs. Typically, B-run steelhead eggs are incubated through the eyed-stage of development at the Sawtooth Fish Hatchery.

Magic Valley Fish Hatchery – Incubation facilities at the Magic Valley Fish Hatchery consist primarily of 40, 12 gallon upwelling containers. Each container is capable of incubating and hatching 50,000 to 75,000 eyed steelhead eggs. Two incubators are placed over each concrete vat. A total of 20 vats are available. Vats measure 40 ft long x 4 ft wide x 3 ft deep. Each vat has the capacity to rear 115,000 to 125,000 steelhead to 200 fish per pound.

5.5) Rearing facilities.

The Magic Valley Fish Hatchery functions as the primary juvenile rearing facility for this program.

Magic Valley Fish Hatchery – The Magic Valley Fish Hatchery has 32 outside raceways available for juvenile steelhead rearing. Each raceway measures 200 ft long x 10 ft wide x 3 ft deep. Each raceway has the capacity to rear approximately 65,000 fish to release size. Raceways may be subdivided to create 64 rearing sections. A movable bridge, equipped with 16 automatic Neilsen fish feeders spans the raceway complex. Two 30,000 bulk feed bins equipped with fish feed fines shakers and a feed conveyor complete the outside feeding system.

5.6) Acclimation/release facilities.

Smolts are released directly to the East Fork Salmon River in the vicinity of the trapping and spawning facility.

5.7) Describe operational difficulties or disasters that led to significant fish mortality.

No operational difficulties or disasters have led to significant fish mortality at any of the facilities addressed in this HGMP

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5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

Sawtooth Fish Hatchery - The Sawtooth Fish Hatchery serves only an early egg incubation function for this program. The hatchery is staffed around the clock and equipped with an alarm system. The hatchery well water supply system is backed up by generator power. The inside vat room can be switched to gravity flow with river water in the event of a generator failure. Protocols are in place to guide emergency situations during periods of time when the hatchery well water supply is interrupted. Protocols are also in place to guide the disinfection of equipment and gear to minimize risks associated with the transfer of potential disease agents.

East Fork Salmon River Satellite – The East Fork Salmon River Satellite traps and spawns adult steelhead for this program. The facility is generally staffed with one full-time employee during the trapping season. Only adipose fin-clipped fish trapped at this site are incorporated in the spawning program. Non-clipped adult steelhead may be release unharmed or retained for the IDFG East Fork Salmon River natural steelhead broodstock program. Protocols are also in place to guide the disinfection of equipment and gear to minimize risks associated with the transfer of potential disease agents.

Magic Valley Fish Hatchery – The Magic Valley Fish Hatchery serves final incubation and rearing to release functions for the program. The hatchery is staffed around the clock. The hatchery receives only gravity flow water, and as such, no generator backup system is in place or needed. Hatchery staff perform routine maintenance checks on gravity lines that supply the hatchery with water. Proper disinfection protocols are in place to prevent the transfer of disease agents.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.

East Fork Salmon River unmarked steelhead are used for this program.

6.2) Supporting information.

6.2.1) History.

Information on the presence of an endemic steelhead population in the East Fork Salmon River is sparse. At the inception of the East Fork Salmon River satellite program in the early 1980's, on average, fewer than 25 unmarked adults returned to the facility annually. The IDFG management strategy has been to release unmarked adults above the facility for natural spawning and not incorporate them into the broodstock program.

The contemporary East Fork Salmon River hatchery broodstock program was primarily founded by spawning adults produced from the release of juvenile B-run steelhead that originated from Dworshak National Fish Hatchery stock returning hatchery adults. However, prior to the construction of the present trapping facility, hatchery-produced Salmon River A-run adult steelhead juveniles were periodically released in the East Fork Salmon River (1977 through 1981, and 1983).

Hatchery-produced Salmon River A-run steelhead were developed from Snake River steelhead and indigenous Salmon River steelhead to found the Pahsimeroi Hatchery mitigation program. This program was initiated with progeny of adult steelhead trapped at Oxbow and Hells Canyon dams from 1966 through 1968. Adult broodstock collections were initiated at the Pahsimeroi Hatchery in 1969. Returning Snake River stock and some indigenous Salmon River stock were trapped and used to found the Pahsimeroi broodstock. With the implementation of the Sawtooth Fish Hatchery program, adults from the Pahsimeroi Fish Hatchery were mixed with locally returning adults and used to create the Sawtooth Fish Hatchery broodstock used in the upper Salmon River and East Fork Salmon River. The East Fork Salmon River program transitioned from planting A-run steelhead to B-run steelhead in 1982 and has been primarily supported by annual releases of Dworshak National Fish Hatchery stock with a smaller percentage of locally returning hatchery A-run East Fork Salmon River returns.

6.2.2) Annual size.

Broodstock collections levels have been established but remain flexible to insure that natural steelhead adults are passed above the collection facility for volitional spawning.

Ideally, no more than 50% of unmarked steelhead adults will be retained at the East Fork Salmon River satellite for broodstock purposes. If adequate adults are available, an effort will be made to meet the following broodstock and production targets:

1) Retain 10 pair (projected to produce approximately 31,000 smolts),

2) Retain 17 pair (projected to produce approximately 50,000 smolts).

6.2.3) Past and proposed level of natural fish in broodstock.

East Fork Salmon River weir information.

Return Year	No. of unmarked female steelhead trapped	No. of unmarked female steelhead spawned	No. of unmarked male steelhead trapped	No. of unmarked male steelhead spawned
2000	4	0	2	0
2001	8	3	3	3*
2002	19	10	8	8*

* All males released after partial milt harvest.

See Section 6.2.2. above for a discussion of proposed levels for broodstock collection.

6.2.4) Genetic or ecological differences.

Currently, two independent studies are being conducted to characterize the genetic identity of Snake River steelhead. One study, funded by the USFWS, is being conducted by Dr. Paul Moran (National Marine Fisheries Service). The second study, funded by the Bonneville Power Administration through the Northwest Power Planning Council's Fish and Wildlife Program is being conducted by Dr. Jennifer Nielsen (U.S. Geologic Survey). Both studies will include information on hatchery-origin and natural steelhead stocks in Idaho. Study results should be available in 2003.

The following excerpt was taken from Busby et al. 1996. Status Review of West Coast Steelhead from Washington, Idaho, Oregon, and California. NOAA Technical Memorandum NMFS-NWFSC-27.

Snake River Basin--This ESU occupies the Snake River Basin of southeast Washington, northeast Oregon, and Idaho. This region is ecologically complex and supports a diversity of steelhead populations; however, genetic and meristic data suggest that these populations are more similar to each other than they are to steelhead populations occurring outside of the Snake River Basin. Snake River Basin steelhead spawning areas are well isolated from other populations and include the highest elevations for spawning (up to 2,000 m) as well as the longest migration distance from the ocean (up to 1,500 km). Snake River steelhead are often classified into two groups, A- and B-run, based on migration timing, ocean age, and adult size. While total (hatchery + natural) run size for Snake River steelhead has increased since the mid-1970s, the increase has resulted from increased production of hatchery fish, and there has been a severe recent decline in natural run size. The majority of natural stocks for which we have data within this ESU have been declining. Parr densities in natural production areas have been substantially below estimated capacity in recent years. Downward trends and low parr densities indicate a particularly severe problem for B-run steelhead, the loss of which would substantially reduce life history diversity within this ESU. The BRT had a strong concern about the pervasive opportunity for genetic introgression from hatchery stocks within the ESU. There was also concern about the degradation of freshwater habitats within the region, especially the effects of grazing, irrigation diversions, and hydroelectric dams.

The 1999 NMFS Biological Opinion on Artificial Propagation in the Columbia River Basin (NMFS 1999) concluded that the continued use of non-endemic steelhead stocks for hatchery programs posed a risk to endemic stocks. The East Fork Salmon River natural steelhead supplementation program described in this HGMP uses only locally adapted natural adults as broodstock.

6.2.5) Reasons for choosing.

The East Fork Salmon River was chosen for a locally returning steelhead broodstock supplementation action because of appropriate monitoring and evaluation logistical support (weir in place) and agreement that this stock presented low risk from hatchery intervention because of past management actions.

6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

East Fork Salmon River natural steelhead program broodstock are sourced from local, unmarked anadromous returns. Hatchery-origin (Dworshak B-run steelhead), smolt releases and adult out-plants have been discontinued in the upper East Fork Salmon River.

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Unmarked, adult steelhead are collected.

7.2) Collection or sampling design.

Unmarked adults incorporated into the spawning design are selected at random and represent the entire run.

7.3) Identity.

All harvest mitigation, hatchery-produced fish are marked with an adipose fin clip. Harvest mitigation, hatchery-origin adults collected at the East Fork Salmon River are spawned within group to generate eggs and smolts to meet LSRCP mitigation objectives. Smolts produced from these spawn crosses are released in Squaw Creek Pond.

Natural-origin steelhead broodstock are not marked or tagged.

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults):

Broodstock collections levels have been established but remain flexible to insure that natural steelhead adults are passed above the collection facility for volitional spawning. Ideally, no more than 50% of unmarked steelhead adults will be retained at the East Fork Salmon River satellite for broodstock purposes. If adequate adults are available, an effort will be made to meet the following broodstock and production targets:

1) Retain 10 pair (projected to produce approximately 31,000 smolts),

2) Retain 17 pair (projected to produce approximately 50,000 smolts).

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

East Fork Salmon River natural steelhead program information is available for the following years:

Brood Year	Adults			Eggs	Juveniles
	Females	Males	Jacks		
2000	0	0			n/a
2001	3	3		9,500	n/a
2002	10	8		48,205	n/a

Note: Green egg numbers provided.
Males partially harvested (for milt) and released to spawn naturally.

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.

Generally, the East Fork Salmon River satellite does not receive sufficient hatchery-origin adults to require surplus disposition plans. The release of hatchery-produced steelhead smolts at the East Fork Salmon River satellite was discontinued in the late 1990s. As a result, the number of returning hatchery-origin adults has been decreasing and is expected to continue to decrease.

However, if necessary, the disposition of surplus hatchery-origin steelhead could include: outplanting into appropriate production areas, the sacrifice of fish, and distribution of carcasses to the public, tribe, or human assistance organizations; the incorporation of fish into supplementation studies projects; the recycling fish downstream through the fishery; or the planting of fish in local fishing ponds.

7.6) Fish transportation and holding methods.

Generally, adult steelhead arrive ripe or very close to spawning. No anesthetics or medications are used during handling or holding procedures. Fish are held in adult holding facilities (described above) until they are spawned.

No adult transportation is necessary for this program.

7.7) Describe fish health maintenance and sanitation procedures applied.

Adult steelhead held for spawning are typically spawned within two weeks of arrival. No chemicals or drugs are used prior to spawning. Fish health monitoring at spawning includes sampling for viral, bacterial and parasitic disease agents. Ovarian fluid is sampled from females and used in viral assays. Kidney samples are taken from a representative number of females spawned and used in bacterial assays. Head wedges are taken from a representative number of fish spawned and used to assay for presence/absence of the parasite responsible for whirling disease.

Eggs are rinsed with pathogen free well water after fertilization, and disinfected with a 100 ppm buffered iodophor solution for one hour before being placed in incubation trays. Necropsies are performed on pre-spawn mortalities as dictated by the Idaho Department of Fish and Game Fish Health Laboratory.

7.8) Disposition of carcasses.

Natural-origin carcasses are returned to the East Fork Salmon River or taken to a landfill.

7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

The East Fork Salmon River natural steelhead program is an <u>Integrated Recovery Program</u>. It was designed as small-scale supplementation experiment to spawn a portion of locally returning, naturally produced steelhead. Sufficient broodstock are collected (when adult return numbers are adequate) to produce up to 50,000 smolts (approximately 17 pairs of adults). Annually, no greater than 50% of the unmarked adults trapped at the East Fork Salmon River satellite are incorporated into the broodstock spawning design. The remaining 50% are released upstream of the trap to spawn naturally. Unmarked retained for spawning are selected throughout the run.

SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1) Selection method.

Adult steelhead are chosen at random but with regard to run timing. Due to the low number of natural-origin adults returning to the East Fork Salmon River, some latitude in this policy is required. Generally, a 1:1 spawn design is followed. Fish are typically checked twice weekly for ripeness.

8.2) Males.

Generally, males are used only once for spawning.

8.3) Fertilization.

Spawning ratios of 1 male to 1 female are followed. Eggs from each female are removed and held in buckets. Milt from individual males is harvested and applied to eggs. One cup of well water is added to each bucket and set aside for approximately two minutes. Eggs are rinsed in hatchery water, disinfected and water-hardened in 100 ppm Iodophor, and transferred to the Sawtooth Hatchery for incubation to the eyed stage of development.

8.4) Cryopreserved gametes.

Milt is not cryopreserved as part of this program and no cryopreserved gametes are used in this program.

8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

Due to spawn timing asynchrony and the small number of natural adults available to spawn, 1 x 1 spawning designs have been followed to date. If adult escapement increases and if maturation timing is relatively synchronous, a factorial spawning design will be considered.

SECTION 9. INCUBATION AND REARING -

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

9.1) Incubation:

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.

Sawtooth Fish Hatchery natural steelhead egg survival information to the eyed stage of development.

Brood Year	Green Eggs Taken	Eyed-eggs	Survival to Eyed Stage (%)
2000	0	n/a	n/a
2001	9,500	3,800	40.0
2002	48,205	32,382	67.2

Magic Valley Fish Hatchery natural steelhead eyed-egg to smolt survival is not available.

9.1.2) Cause for, and disposition of surplus egg takes.

Surplus eggs are not generated.

9.1.3) Loading densities applied during incubation.

Sawtooth Fish Hatchery – Incubation flows are set at 5 to 8 gpm per eight tray incubation stack. Typically, eggs from two females are incubated per tray (approximately 8,500 to 10,000 eggs per tray).

Magic Valley Fish Hatchery – Incubation flows are adjusted so eggs roll gently in upwelling incubators. Each incubator is capable of incubating and hatching 50,000 to 75,000 eyed steelhead eggs.

9.1.4) Incubation conditions.

Sawtooth Fish Hatchery – Pathogen free well water is used for all incubation at the Sawtooth Fish Hatchery. Incubation stacks utilize catch basins to prevent silt and fine sand from circulating through incubation trays. Following 48 hours of incubation, eggs are treated three times per week with formalin (1,667 ppm) to control the spread of fungus. Formalin treatments are discontinued at eye-up. Once eggs reach the eyed stage of development (approximately 360 FTU), they are shocked to identify dead and unfertilized eggs. Dead and undeveloped eggs are then removed with the assistance of an automatic egg picking machine. During this process, the number of eyed and dead eggs is generated. Eyed eggs are generally shipped to receiving hatcheries when they have accumulated approximately 450 FTUs.

Magic Valley Fish Hatchery – Incubation facilities at the Magic Valley Fish Hatchery consist primarily of 40, 12 gallon upwelling containers. Each container is capable of incubating and hatching 50,000 to 75,000 eyed steelhead eggs. Two incubators are placed over each concrete vat. A total of 20 vats are available. Vats measure 40 ft long x 4 ft wide x 3 ft deep. Each vat has the capacity to rear 115,000 to 125,000 steelhead to 200 fish per pound. Water flow to incubation jars is adjusted so eggs gently roll.

Temperature is tracked daily to monitor the accumulation of temperature units. Water temperature at both facilities is a constant 15.0ºC.

9.1.5) Ponding.

No ponding occurs at the Sawtooth or Clearwater fish hatcheries for the Salmon River B-run steelhead program. Generally, eyed-eggs are shipped to the Magic Valley Fish Hatchery in the Hagerman Valley of Idaho. Eggs are typically disinfected in 100 ppm Iodophor for approximately 10 minutes at transfer.

Magic Valley Fish Hatchery – Fry are allowed to volitionally exit upwelling incubators and move directly into early rearing vats through approximately 1,000 FTUs. After that time, fry remaining in incubators are siphoned into vats. Fry are generally ponded between April and early July.

9.1.6) Fish health maintenance and monitoring.

Following fertilization, eggs are typically water-hardened in a 100 ppm Iodophor solution for a minimum of 30 minutes. During incubation, eggs routinely receive scheduled formalin treatments to control the growth of fungus. Treatments are typically administered three times per week at a concentration of 1667 ppm active ingredient. Dead eggs are removed following shocking. Additional egg picks are performed as needed to remove additional eggs not identified immediately after shocking. Eggs produced at spawning hatcheries are transferred to rearing hatcheries when they have accumulated approximately 450 FTUs.

9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

Adequate incubation facilities and staffing are available. Proper fish culture protocols applied. Adequate safeguards are in place to guard against a facility water system emergency.

9.2) <u>Rearing</u>:

9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available.

Magic Valley Fish Hatchery survival information by hatchery life stage is not available.

9.2.2) Density and loading criteria (goals and actual levels).

Magic Valley Fish Hatchery - Density (DI) and flow (FI) indices are maintained to not exceed 0.30 and 1.2, respectively (Piper et al. 1982).

9.2.3) Fish rearing conditions

Magic Valley Fish Hatchery – Fish rear on constant 15.0ºC water. Dissolved oxygen, flows, total suspended solids, settable solids, phosphorus, and water temperature are recorded monthly. Density and flow indices are monitored on a regular basis. Rearing groups are split or moved as needed to adhere to these indices. Fish are fed in outside raceways from a traveling bridge fitted with 16 Nielson automatic feeders. Raceway cleaning takes place every two days; raceways are swept manually with brooms. Sample counts are conducted monthly and dead fish are removed daily.

9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.

The Magic Valley Fish Hatchery rears juvenile steelhead under constant water temperature (15.0ºC) conditions and feeding schedules are designed to produce fish between 180 and 250 to the pound at release. Length gained per month for the first three months of culture is typically between 0.8 and 1.0 inches (20.3 to 25.4 mm). Fish gain approximately 0.65 to 0.75 inches per month (16.5 to 19.1 mm) thereafter. To meet the release size target, fish may be fed on an intermittent schedule beginning in their fourth month of culture.

9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

See Section 9.2.4 above.

9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

Magic Valley Fish Hatchery – Dry and semi-moist diets have been used at the Magic Valley Fish Hatchery in the past. Currently, fish are fed the Rangen 440 extruded salmon dry diet. First feeding fry are fed at a rate of approximately 5% body weight per day. As fish grow, percent body weight fed per day decreases. Fry are fed with Loudon solenoid activated feeders while located in early rearing vats. Following transfer to outside raceways, fish are fed by hand and with the assistance of the traveling bridge. First feeding fry are typically fed up to eight times per day. Prior to release, pre-smolts are typically fed four times per day. Feed conversion averages 1.18 pounds of feed fed for every pound of weight gain (from first feeding through release).

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.

Magic Valley Fish Hatchery – Routine fish health inspections are conducted by staff from the IDFG Eagle Fish Health Laboratory on a monthly basis. More frequent inspections occur if needed. Therapeutics may be used to treat specific disease agents (e.g., Oxytetracycline). Foot baths with disinfectant are used at the entrance of the hatchery early rearing building. Disinfection protocols are in place for equipment, trucks and nets. All raceways are thoroughly chlorinated after fish have been transferred for release.

9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.

No smolt development indices are developed in this program.

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.

No semi-natural or natural rearing methods are applied.

9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

Adequate incubation facilities and staffing are available. Proper fish culture protocols applied. Adequate safeguards are in place to guard against a facility water system emergency.

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.

10.1) Proposed fish release levels.

Magic Valley Fish Hatchery proposed fish release levels.

Age Class	Maximum Number	Size (fpp)	Release Date	Location	Rearing Hatchery
Eggs					
Unfed Fry					
Fry					
Fingerling					
Yearling	50,000	4.3	4/11 – 5/2	East Fk. Salmon River Satellite	Magic Valley

10.2) Specific location(s) of proposed release(s).

Stream, river, or watercourse:
Release point: (*river kilometer location, or latitude/longitude*)
Major watershed: (e.g. “Skagit River”)
Basin or Region: *(e.g. “Puget Sound”)*

Natural steelhead release locations.

Stream	Release Point	HUC	Major

			Watershed & Basin
East Fk. Salmon River	East Fk. Salmon River Satellite	17060201	Salmon River

10.3) Actual numbers and sizes of fish released by age class through the program.

The number of natural steelhead smolts released by the Magic Valley Fish Hatchery at the East Fork Salmon River satellite. Note: there has been only one release to date.

Brood Year	Release Year	Rearing Hatchery	Life Stage Released	Avg. Size (fish/pound)	Number Released
2001	2002	Magic Valley	Yearling	4.4	3,800
2002	2003	Magic Valley	Yearling	n/a	n/a
			Avg. =	4.4	3,800

10.4) Actual dates of release and description of release protocols.

Release Year	Rearing Hatchery	Life Stage	Date Released
2002	Magic Valley	Yearling	5/1/02

10.5) Fish transportation procedures, if applicable.

Yearlings are crowded in raceways netted or pumped into 5,000 gallon transport trucks. Transport water temperature is chilled to approximately 7.2°C . Up to approximately 5,000 pounds of fish are loaded into each truck. Transport duration to release sites ranges from 4 to 9 hours. Trucks are equipped with oxygen and fresh flow agitator systems. Fish are not fed for up to four days prior to loading and transporting.

10.6) Acclimation procedures (*methods applied and length of time*).

No acclimation occurs for this program. Yearlings are released directly into the East Fork Salmon River in the vicinity of the satellite facility.

10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

Smolts associated with program are released unmarked.

10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

No surplus juveniles are developed.

10.9) Fish health certification procedures applied pre-release.

Between 45 and 30 d prior to release, a 20 fish preliberation sample is taken from each rearing lot at the Magic Valley Fish Hatchery to assess the prevalence of viral replicating agents and to detect the pathogens responsible for bacterial kidney disease and whirling disease. In addition, an organosomatic index is developed for each release lot. Diagnostic services are provided by the IDFG Eagle Fish Health Laboratory.

10.10) Emergency release procedures in response to flooding or water system failure.

Emergency procedures are in place to guide activities in the event of potential catastrophic event. Plans include a trouble shooting and repair process followed by the implementation of an emergency action plan if the problem can not be resolved. Emergency actions include fish consolidations, transfers to other rearing hatcheries in the Hagerman Valley, and supplemental oxygenation.

10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

Actions taken to minimize adverse effects on listed fish include:

1. Use existing naturally returning adults as broodstock.

2. Continuing fish health practices to minimize the incidence of infectious disease agents. Follow IHOT, AFS, and PNFHPC guidelines.

3. Moving release sites for hatchery-produced, mitigation steelhead released in the East Fork Salmon River downstream to reduce the potential for negative interaction with natural anadromous and resident species.

4. Minimizing the number of smolts in the release population which are larger than 225 mm (or about 4 fpp).

5. Programming time of release to mimic natural fish for releases, given the constraints of transportation.

6. Manage adult collection levels to maintain natural spawning and to provide fish for supplementation research.

7. Continuing Hatchery Evaluation Studies (HES) to provide comprehensive monitoring and evaluation for LSRCP steelhead.

8. Continuing research to improve post-release survival of steelhead to potentially reduce numbers released to meet management objectives.

9. Monitoring hatchery effluent to ensure compliance with National Pollutant Discharge Elimination System permit.

10. Continuing to externally mark hatchery steelhead released for harvest purposes with an adipose fin clip.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1) Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

11.1.1) Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

Document LSRCP fish rearing and release practices.

Performance Standards and Indicators: 3.2.2, 3.3.2, 3.4.1, 3.4.2, 3.4.3, 3.4.4, 3.5.2, 3.5.4, 3.5.5, 3.6.1, 3.6.2, 3.7.1, 3.7.2, 3.7.3, 3.7.4, 3.7.5, 3.7.6

Document, report, and archive all pertinent information needed to successfully manage natural steelhead spawning, rearing, and release practices. (e.g., number and composition of fish spawned, spawning protocols, spawning success, incubation and rearing techniques, juvenile mark and tag plans, juvenile release locations, number of juveniles released, size at release, migratory timing and success of juveniles, and fish health management).

Document the contribution this LSRCP program makes towards meeting management objectives. Document juvenile out-migration and adult returns.

Performance Standards and Indicators: 3.1.1, 3.2.2, 3.3.2, 3.4.3, 3.4.4, 3.5.1, 3.5.2, 3.5.3, 3.5.4, 3.5.5, 3.5.6, 3.6.1, 3.6.2, 3.7.7, 3.7.8

Estimate the number of wild/natural and hatchery-produced steelhead escaping to project waters above Lower Granite Dam using dam counts, harvest information, and trap information (e.g., presence/absence of identifying marks and tags, number, species, size, age, length). Conduct creel surveys and angler phone or mail surveys to collect harvest information. Assess juvenile outmigration success at traps and dams using direct counts, marks, and tags. Reconstruct runs by brood year. Summarize annual mark and tag information (e.g., juvenile out-migration survival, juvenile and adult run timing, adult return timing and survival). Develop estimates of smolt-to-adult survival for wild/natural and hatchery-produced steelhead. Use identifying marks and tags and age structure analysis to determine the composition of adult steelhead runs.

Identify factors that are potentially limiting program success and recommend operational modifications, based on the outcome applied studies, to improve overall performance and success.

Performance Standards and Indicators: 3.6.1, 3.6.2

Evaluate potential relationships between rearing and release history and juvenile and adult survival information. Develop hypotheses and experimental designs to investigate practices that may be limiting program success. Implement study recommendations and monitor and evaluate outcomes.

11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

Yes, funding, staffing and support logistics are dedicated to the existing monitoring and evaluation program through the LSRCP program. Additional monitoring and evaluation activities (that contribute effort and information to addressing similar or common objectives) are associated with BPA Fish and Wildlife programs referenced in Section 12, below.

11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

Risk aversion measures for research activities associated with the evaluation of the Lower Snake River Compensation Program are specified in ESA Section 7 Consultation documents, ESA Section 10 Incidental Take Permits (IDFG permit Nos. 919, 920, 1124), and ESA 4(d) rules. A brief summary of the nature of actions taken is provided below.

Adult handling activities are conducted to minimize impacts to ESA-listed, non-target species. Adult and juvenile weirs and screw traps are engineered properly and installed in locations that minimize adverse impacts to both target and non-target species. All trapping facilities are constantly monitored to minimize a variety of risks (e.g., high water periods, high emigration or escapement periods, security).

Snorkel surveys conducted primarily to assess juvenile abundance and density are conducted in index sections only to minimize disturbance to ESA-listed species. Displacement of fish is kept to a minimum.

Marking and tagging activities are designed to protect ESA-listed species and allow mitigation harvest objectives to be pursued/met. All hatchery-produced, mitigation steelhead are visibly marked to differentiate them from their wild/natural counterpart.

SECTION 12. RESEARCH

12.1) Objective or purpose.

An extensive monitoring and evaluation program is conducted in the basin to document hatchery practices and evaluate the success of the hatchery programs at meeting program mitigation objectives, Idaho Department of Fish and Game management objectives, and to monitor and evaluate the success of supplementation programs. The hatchery monitoring and evaluation program identifies hatchery rearing and release strategies that will allow the program to meet its mitigation requirements and improve the survival of hatchery fish while avoiding negative impacts to natural (including listed) populations.

To properly evaluate this compensation effort, adult returns to facilities, spawning areas, and fisheries that result from hatchery releases are documented. The program requires the cooperative efforts of the Idaho Department of Fish and Game's hatchery evaluation study, harvest monitoring project, and the coded-wire tag laboratory programs. The Hatchery evaluation study evaluates and provides oversight of certain hatchery operational practices, (e.g., broodstock selection, size and number of fish reared, disease history, and time of release). Hatchery practices will be assessed in relation to their effects on adult returns. Recommendations for improvement of hatchery operations will be made.

The harvest monitoring project provides comprehensive harvest information, which is key to evaluating the success of the program in meeting adult return goals. Numbers of hatchery and wild/natural fish observed in the fishery and in overall returns to the project area in Idaho are estimated. Data on the timing and distribution of the marked hatchery and wild stocks in the fishery are also collected and analyzed to develop harvest management plans. Harvest data provided by the harvest monitoring project are coupled with hatchery return data to provide an estimate of returns from program releases. Coded-wire tags continue to be used extensively to evaluate fisheries contribution of representative groups of program production releases. However, most of these fish serve experimental purposes as well, i.e., for evaluation of hatchery-controlled variables such as size, time, and location of release, rearing densities, etc.

Continuous coordination between the hatchery evaluation study and Idaho Department of Fish and Game's BPA-funded supplementation research project is required because these programs overlap in several areas for different species including: juvenile outplanting, broodstock collection, and spawning (mating) strategies.

To date, no specific monitoring and evaluation plan and/or funding has been developed for the East Fork Salmon River natural steelhead effort. Current monitoring and evaluation emphasis is on adult monitoring at the weir until more extensive actions are developed.

12.2) Cooperating and funding agencies.

U.S. Fish and Wildlife Service – Lower Snake River Compensation Plan Office.

Shoshone-Bannock Tribes

12.3) Principle investigator or project supervisor and staff.

Steve Yundt – Fisheries Research Manager, Idaho Department of Fish and Game.

12.4) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

N/A

12.5) Techniques: include capture methods, drugs, samples collected, tags applied.

Research techniques associated with the operation of the broodstock and rearing hatcheries identified in this HGMP involve: hatchery staff; LSRCP hatchery evaluation, harvest monitoring, and coded-wire tag laboratory staff; Idaho supplementation studies staff, and IDFG regional fisheries management staff.

Hatchery staff routinely investigate hatchery variables (e.g., diet used, ration fed, vat or raceway environmental conditions, release timing, size at release, acclimation, etc.) to improve program success. Hatchery-oriented research generally involves the cooperation of LSRCP hatchery evaluation staff. In most cases, PIT and coded-wire tags are used to measure the effect of specific treatments. The IDFG works cooperatively with the Shoshone-Bannock Tribes and the U.S. Fish and Wildlife Service to develop annual mark plans for steelhead juveniles produced at the various hatcheries. Cooperation with LSRCP harvest monitoring and coded-wire tag laboratory staff is required to thoroughly track the distribution of tags in adult salmon. Generally, most hatchery-oriented research occurs prior to the release of spring smolt groups.

Harvest monitoring staff (LSRCP monitoring and evaluations) work cooperatively with IDFG regional fisheries management staff to monitor activities associated with steelhead sport fisheries. Estimates of harvest, pressure, and catch per unit effort are developed in years when sport fisheries occur. The contribution LSRCP-produced fish make to the fishery is also assessed.

Idaho supplementation studies, Idaho steelhead supplementation studies, and IDFG regional fisheries management staff work cooperatively to assemble annual juvenile steelhead out-migration and adult return data sets. Adult information is assembled from a variety of information sources including: dam and weir counts, rack returns, fishery information, coded-wire tag information, redd surveys, and spawning surveys.

Idaho Department of Fish and Game and cooperator staff may sample adult steelhead to collect tissue samples for subsequent genetic analysis. Additionally, otoliths, scales, or fins may be collected for age analysis.

12.6) Dates or time period in which research activity occurs.

Fish culture practices are monitored throughout the year by hatchery and hatchery evaluation research staff.

Adult escapement is monitored at downstream dams and above Lower Granite Dam during the majority of the year. Harvest information is collected during periods when sport and tribal fisheries occur. The PSMFC Regional Mark Information System is queried on a year-round basis to retrieve adult coded-wire tag information.

Smolt out-migration through the hydro system corridor is typically monitored from March through December. Juvenile steelhead population abundance and density is monitored during late spring and summer months. The PSMFC PIT Tag Information System is queried on a year-round basis to retrieve juvenile PIT tag information.

Fish health monitoring occurs year round.

12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.

Research activities that involve the handling of eggs or fish apply the same protocols reviewed in Section 9 above. Hatchery staff generally assist with all cooperative activities involving the handling of eggs or fish.

12.8) Expected type and effects of take and potential for injury or mortality.

See Table 1. Generally, take for research activities is defined as: “observe/harass”, “capture/handle/release” and “capture, handle, mark, tissue sample, release.”

12.9) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached “take table” (Table 1).

See Table 1.

12.10) Alternative methods to achieve project objectives.

Alternative methods to achieve research objectives have not been developed.

12.11) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

N/A.

12.12) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.

See Section 11.2 above.

SECTION 13. ATTACHMENTS AND CITATIONS

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by_____________________________ Date:_____________

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: ________ ESU/Population: ________ Activity: ________				
Location of hatchery activity: ________ Dates of activity: ________ Hatchery program operator: ________				
Type of Take	**Annual Take of Listed Fish By Life Stage (*Number of Fish*)**			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)				
Capture, handle, tag/mark/tissue sample, and release d)			Entire run	
Removal (e.g. broodstock) e)			See 6.2.2	
Intentional lethal take f)				
Unintentional lethal take g)			2	
Other Take (specify) h) Carcass tissue sampling				10

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

***Instructions*:**

1. An entry for a fish to be taken should be in the take category that describes the greatest impact.
2. Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).
3. If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.

APPENDIX 2-16—DRAFT REDFISH LAKE SOCKEYE IN THE SALMON SUBBASIN

HATCHERY AND GENETIC MANAGEMENT PLAN

Redfish Lake Sockeye in the Salmon Subbasin • READ ONLY ACCESS

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

DRAFT

1

Hatchery Program	Redfish Lake Captive Broodstock Program
Species or Hatchery Stock	SockeyeSsalmon
Agency/Operator	IDF&G; NOAA Fisheries
Watershed and Region	Salmon River Watershed,
Date Submitted	March 29,2003
Date Last Updated	September 8, 2003

Section 1: General Program Description

1.1 Name of hatchery or program.

1 Redfish Lake Captive Broodstock Program

1.2 Species and population (or stock) under propagation, and ESA status.

1 SockeyeSsalmon

9 ESA Status: Endangered

1.3 Responsible organization and individuals.

Name (and title): Paul Kline
Principal Fisheries Research Biologist

3 **Agency or Tribe:** IDF&G

Address: 1800 Trout Road, Eagle, ID 83616

Telephone: 208-939-4114
Fax: 208-939-2415
Email: pkline@idfg.state.id.us

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and exten involvement in the program.

	Co-operators	Role
4	Shosone Bannock Tribe	Conducts habitat investigations (lake limnology) and d annual estimates of lake carrying capacity to guide eg fish reintroductions. The SBT also shares smolt monit lake O. nerka biomass estimation responsibility with ID
	NOAA Fisheries	shares captive broodstock development responsibility culture, spawning and rearing)
	University of Idaho	Genetics support
	nya	nya

1.4 Funding source, staffing level, and annual hatchery program operational costs.

	Funding Sources
	Bonneville Power Administration
	nya
	nya
5	nya
	nya
	nya
	nya

	Operational Information	Number
6	Full time equivalent staff	4.2
	Annual operating cost (dollars)	$800,000

Comments:

Per Paul Kline 7/28/03: $550,000 hatchery costs, $250,000 research costs.

Reviewer Comments:

nc
nc

Data source:

Paul Kline

1.5 Location(s) of hatchery and associated facilities.

	Broodstock source	Redfish Lake Sockeye Salmon
	Broodstock collection location (stream, RKm, subbasin)	Redfish Lake Creek Weir (522.303.615.003 and Sawtooth Hatchery Trap (522.303.6 Salmon River
2	**Adult holding location (stream, RKm, subbasin)**	Sawtooth Hatchery (522.303.617) and Eagle Hatchery (HUC 17050114)
	Spawning location (stream, RKm, subbasin)	Eagle Hatchery (HUC 17050114) and NOAA Manchester & Burley Creek Hatcheries

Incubation location (facility name, stream, RKm, subbasin) Eagle Hatchery, Sawtooth Hatchery, NOAA Burley Creek Hatchery

Rearing location (facility name, stream, RKm, subbasin) Eagle Hatchery, Sawtooth Hatchery, NOAA Manchester and Burley Creek Hatcherie

Comments:

Data source:

Paul Kline; Source: Project annual reports to Bonneville Power Administration. Project annual reports to NOAA Fisheries for E
activities.

1.6 Type of program.

8 Integrated

Comments:

Data source:

1.7 Purpose (Goal) of program.

9 The purpose of this hatchery program is to contribute to conservation/recovery and research and education.

10 the purpose of the program is mitigation for hydro impacts .

Comments:

Data source:

Paul Kline
Paul Kline, 10/22/03.

1.8 Justification for the program.

138
- Hatchery fish are not accessible to fisheries.

Comments:

nc
nc
nc

Data source:

Paul Kline, 10/22/03.
Paul Kline, IDFG.
nds
nds
nds

1.9 List of program "Performance Standards".

The program adheres to the following fish culture guideline(s) and standard(s):
IHOT
11 PNFHPC
state
federal
other

Comments:

Other: Stanley Basin Sockeye Technical Oversigth Committee (SBSTOC.A team of technical experts representing the varic and tribes involved with the program in addition to invited experts. The SBSTOC meets periodically to review program activ critical uncertainties, and to adaptively manage future activities.

Data source:

Paul Kline, 9.8.03.

1.10 List of program "Performance Indicators", designated by "benefits" and "risks".

139

Indicators of Harvest Benefits

Indicator	Performance Standard	Indicator is Monitore
Spawner to spawner survival of hatchery fish	NA	NA
Contribution of hatchery fish to target fisheries	NA	NA
Angler success (hatchery fish per angler day) in target recreational fisheries	NA	NA
Contribution of hatchery fish to cultural needs	NA	NA
Selective harvest success (expected benefits of mass marking)	NA	NA

141

Indicators of Conservation Benefits

Indicator	Performance Standard	Indicator is Monitore
Genetic and life history diversity (over time)	3.4.1, 3.4.2, 3.4.3, 3.3.3, 3.5.1, 3.5.2, 3.5.3	3.4.1, 3.4.2, 3.4.3, 3.3.3, 3.5.2, 3.5.3
Spawner to spawner reproductive success of hatchery fish	3.3.1, 3.3.2, 3.5.4, 3.6.1, 3.6.2	Y
Reproductive success of the receiving (supplemented) naturally spawning population	3.3.1, 3.3.2, 3.5.4, 3.6.1, 3.6.2	Y
Contribution to the abundance of the naturally spawning population	3.3.1, 3.3.2, 3.5.4, 3.6.1, 3.6.2	Y
Time and location of spawning	3.3.1, 3.3.2, 3.5.4, 3.6.1, 3.6.2	Y
Contribution to ecosystem function (e.g. through nutrient enhancement, food web effects, etc.)	NA	NA

140

Indicators of Harvest Risks

Indicator	Performance Standard	Indicator is Monitore
Harvest impacts on co-mingled stocks	NA	NA
Bias in run size estimation of natural stocks due to masking effect	NA	NA
Lack of harvest access (under harvest due e.g. to co-mingling with weaker stocks)	NA	NA

142

Indicators of Conservation Risks

Indicator	Performance Standard	Indicator is Monitore
Unintended contribution of hatchery fish to natural spawning (through straying)	3.4.4, 3.5.3	Y
Loss of genetic and life history diversity	3.4.1, 3.4.2, 3.4.3, 3.4.4, 3.5.1, 3.5.2, 3.5.3	Y
Loss of reproductive success	3.3.1, 3.3.2, 3.4.1, 3.4.2, 3.4.3, 3.4.4, 3.5.3, 3.6.1, 3.6.2	Y
Ecological interactions through competition with natural stocks (by life stage)	3.7.6, 3.7.4, 3.7.8	Y
Ecological interactions through predation on natural stocks (by life stage)	3.7.8	Y
Adverse effects of hatchery operations and	3.7.1, 3.7.2, 3.7.3, 3.7.4, 3.7.7	Y

facilities on fish migration Disease transfers

The following plans and methods are proposed to collect data for each Performance Indicator: Note: Performance Standards described in this section of our response were taken from the final January 17, 2001 version of Performance Standards and I the Use of Artificial Production for Anadromous and Resident Fish Populations in the Pacific Northwest. Numbers referenced correspond to numbers used in the above document.

Performance Standards and Indicators addressing ?benefits.?

3.2.2 Standard: Release groups sufficiently marked in a manner consistent with information needs and protocols to enable de impacts to natural- and hatchery-origin fish in fisheries.

Indicator 1: Marking rate by type in each release group documented.

3.3.1 Standard: Artificial propagation program contributes to an increasing number of spawners returning to natural spawning

Indicator 1: Annual number of spawners on spawning grounds estimated in specific locations.

Indicator 2: Spawner-recruit ratios are estimated in specific locations.

Indicator 3: Number of redds in natural production index areas documented.

3.3.2 Standard: Releases are sufficiently marked to allow statistically significant evaluation of program contribution.

Indicator 1: Marking rates and type of mark documented.

Indicator 2: Number of marks identified in juvenile and adult groups documented.

Performance Standards and Indicators addressing ?risks.?

3.4.1 Standard: Fish collected for broodstock are taken throughout the return in proportions approximating the timing and age the population.

Indicator 1: Temporal distribution of broodstock collection managed.

Indicator 2: Age composition of broodstock collection managed.

3.4.2 Standard: Broodstock collection does not significantly reduce potential juvenile production in natural areas.

Indicator 1: A portion of natural-origin, hatchery-produced spawners are collected for broodstock purposes..

Indicator 2: A portion of natural-origin, hatchery-produced spawners are released to migrate to natural spawning areas.

Indicator 3: Number of adults, eggs or juveniles placed in natural rearing areas is managed.

3.4.3 Standard: Life history characteristics of the natural population do not change as a result of this program.

Indicator 1: Life history characteristics of natural and hatchery-produced populations

are measured (e.g., juvenile dispersal timing, juvenile size at out-migration, adult return timing, adult age and sex ratio, natura spawn timing, hatch and swim-up timing, hatchery rearing densities, growth, diet, physical characteristics, fecundity, egg size

3.4.4 Standard: Annual release numbers do not exceed estimated basin-wide and local habitat capacity.

Indicator 1: Annual release numbers, life-stage, size at release, length of acclimation documented.

Indicator 2: Location of releases documented.

Indicator 3: Timing of hatchery releases documented.

3.5.1 Standard: Patterns of genetic variation within and among natural populations do not change significantly as a result of a production.

Indicator 1: Genetic profiles of naturally-produced and hatchery-produced adults developed.

3.5.2 Standard: Collection of broodstock does not adversely impact the genetic diversity of the naturally spawning population

Indicator 1: Total number of natural spawners reaching collection facilities documented.

Indicator 2: Total number of natural spawners estimated passing collection facilities documented.

Indicator 3: Timing of collection compared to overall run timing considered.

3.5.3 Standard: Artificially produced adults in natural production areas do not exceed appropriate proportion.

Indicator 1: Ratio of natural to hatchery-produced adults monitored.

Indicator 2: Observed and estimated total numbers of natural and hatchery-produced adults passing counting stations.

3.5.4 Standard: Juveniles are released on-station, or after sufficient acclimation to maximize homing ability to intended return

Indicator 1: Location of juvenile releases documented.

Indicator 2: Length of acclimation period documented.

Indicator 3: Release type (e.g., volitional or forced) documented.

Indicator 4: Adult straying documented.

3.6.1 Standard: The artificial production program uses standard scientific procedures to evaluate various aspects of artificial p

Indicator 1: Scientifically based experimental design with measurable objectives and hypotheses.

3.6.2. Standard: The artificial production program is monitored and evaluated on an appropriate schedule and scale to addre: toward achieving the experimental objectives.

Indicator 1: Monitoring and evaluation framework including detailed time line.

Indicator 2: Annual and final reports.

3.7.1 Standard: Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility c standards and protocols.

Indicator 1: Annual reports indicating level of compliance with applicable standards and criteria.

3.7.2 Standard: Effluent from artificial production facility will not detrimentally affect natural populations.

Indicator 1: Discharge water quality compared to applicable water quality standards.

3.7.3 Standard: Water withdrawals and in stream water diversion structures for artificial production facility operation will not p to natural spawning areas, affect spawning, or impact juveniles.

144 Indicator 1: Water withdrawals documented ? no impacts to listed species.

Indicator 2: Number of adult fish aggregating and/or spawning immediately below water intake point monitored.

Indicator 3: NMFS screening criteria adhered to.

3.7.4 Standard: Releases do not introduce pathogens not already existing in the local populations and do not significantly inc levels of existing pathogens.

Indicator 1: Certification of juvenile fish health documented prior to release.

Indicator 2: Samples of natural populations for disease occurrence conducted.

Indicator 3: Juvenile densities during artificial rearing managed conservatively.

3.7.6 Standard: Adult broodstock collection operation does not significantly alter spatial and temporal distribution of natural p

Indicator 1: Spatial and temporal spawning distribution of natural population above and below trapping facilities monitored.

3.7.7 Standard: Weir/trap operations do not result in significant stress, injury, or mortality in natural populations.

Indicator 1: Mortality rates in trap documented.

Indicator 2: Pre-spawning mortality rates of trapped fish in hatchery or after release documented.

3.7.8 Standard: Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of nat

Indicator 1: Size and time of release of juvenile fish documented and compared to size and timing of natural fish.

Monitoring and Evaluation of Performance Standards and Indicators:

Standard 3.2.2 and associated Indicators. The program is required by ESA Section 10

permit to visibly mark all reintroduced fish. As such, all pre-smolt, smolt, and adult sockeye salmon released back to the habi clipped. In addition, genetic tissue samples from progeny that result from natural release options (e.g., eyed-egg and pre-spa taken to facilitate individual or release-option genetic assignment test analyses. Specific release groups also receive Passive Transponder (PIT) or coded wire tags.

Standard 3.3.1 and associated Indicators. To date, the program has documented the successful return of over 300 hatchery- anadromous sockeye salmon. Only 16 wild sockeye salmon have returned to the Stanley Basin of Idaho since the inception c in 1991. Adult sockeye salmon are captured at collection weirs on Redfish Lake Creek and on the upper Salmon River at the Hatchery.

Standard 3.3.2 and associated Indicators. To estimate O. nerka out-migrant run size from Redfish, Alturas and Pettit lakes, ID (in cooperation with Shoshone-Bannock Tribe personnel) operate smolt traps on Redfish Lake Creek and on the upper Salmo IDFG Sawtooth Fish Hatchery. In addition, the Shoshone-Bannock Tribes operate smolt traps on Alturas Lake and Pettit Lake Trapping activities are coordinated through the SBSTOC.

Trapping efficiency is determined by releasing PIT-tagged wild and hatchery-produced out-migrants upstream for subsequen Total emigration or out-migration run size is estimated for specific intervals within the total period of out-migration. Intervals a periods of out-migration with similar stream discharge and recapture efficiency. Seasonal out-migrant run size and 95% confi are estimated using maximum likelihood and profile likelihood estimators. Estimates are generated separately for wild/natura produced fish.

Estimates of out-migration are developed by broodstock program release strategy at Redfish, Alturas, and Pettit lake trap site migration estimates by release location and release strategy are also developed at Lower Granite Dam. PIT tag interrogation Granite Dam is retrieved from the Columbia River Basin PIT Tag Information System (PTAGIS). Median travel times to Lowe are calculated (where possible) for wild/natural and hatchery-produced sockeye salmon.

Because systems operations and fish handling potentially differ by date, arrival times to Lower Granite Dam are compared fo and hatchery-produced progeny (by release strategy) using two sample Kolmogorov-Smirnov tests (a = .05). If travel times di evaluation groups, results of subsequent statistical tests are qualified. Multiple, chi-square goodness of fit tests (a = .05) are u compare PIT tag interrogation data at lake outlet trapping locations and at Lower Granite Dam. A priori power analysis for chi was conducted to determine PIT tag sample size.

Standard 3.4.1, 3.4.2, 3.5.3, and associated indicators. All returning adult sockeye are captured at weirs located on Redfish L on the upper Salmon River at the Sawtooth Fish Hatchery. All captured adults are held temporarily on well water at the Sawto Hatchery. Based on marks, tags, and ?real time? genetic analyses conducted by the University of Idaho, decisions to release for spawning are made. Decisions to hold adults for spawning are driven by ?desirability? guidelines established to avoid inbr incorporate unique genetic information into the captive component.

Standard 3.4.3 and associated indicators. Life history characteristics of natural and hatchery-produced juvenile and adult soc are monitored (e.g., adult spawning success and juvenile out-migration success). In-hatchery variables are monitored continu growth, survival, rearing conditions, maturation, age at maturity, spawning success, gamete quality, egg size, fecundity, egg s eyed stage of development, etc.).

Standard 3.4.4, 3.5.3 and associated indicators. Annual release numbers, release strategy selected, size at release, and rele are discussed annually at the SBSTOC level. limnologic conditions and lake carrying capacity estimates are generated by the Bannock Tribes. The prioritization of release strategies considers this information as well as information generated from mon evaluation efforts in place to determine the relative success of the different release strategies used.

Standard 3.5.1, 3.5.2 and associated indicators. The university of Idaho provides genetic support for this program. Genetic pı and hatchery-produced sockeye salmon have been, and continue to be produced. The hatchery population is constantly mor determine such variables as genetic effective population size, loss of genetic variability, and loss of heterozygosity.

Standard 3.5.4 and associated indicators. Eyed-egg, pre-spawn adult, and pre-smolt release options produce juvenile sockey experience acclimation time in Stanley Basin sockeye salmon nursery lakes. Acclimation time varies from approximately seve pre-smolt release groups planted in rearing lakes in October of their first year of life and out-migrating at age-1 to approximat for fish produced from eyed-egg or pre-spawn adult release options that out-migrate from rearing lakes at age-2.

In addition to the release strategies described above, juvenile sockeye salmon may be released to receiving waters as full-te Smolt rearing for this program currently occurs at the IDFG Sawtooth Fish Hatchery. Age-0 sockeye salmon are transferred f supplied with well water to outside raceways supplied with upper Salmon River water approximately eight months in advance

Standard 3.6.1, 3.6.2 and associated indicators. Program goals, objectives, and tasks focus on the preservation / conservatic this effort. Hatchery practices (e.g., spawning, and rearing protocols) are based on current and emerging ?best practices? an constant review at the SBSTOC level. An experimental design has been established to guide the reintroduction of eggs and f habitat. A comprehensive monitoring and evaluation program is in place to track rearing habitat quality and the relative out-m success of the various release strategies used.

Standard 3.7.1, 3.7.2, 3.7.3, 3.7.6, 3.7.7 and associated indicators. The artificial production component of the program adher state and federal policies in place to prevent the spread of infectious pathogens, to insure that facility discharge water quality appropriate standards, and that intake and outflow screens meet appropriate standards. In addition, water removal from adja water systems is monitored and not considered to have any negative impact on native or introduced species.

Adult and juvenile weirs are monitored to not adversely affect target or other fish species. Anadromous sockeye salmon adul distribution below weirs is carefully monitored. Every precaution is taken to insure that trapping does not negatively impact ar adults.

Standard 3.7.4 and associated indicators. IDFG and NOAA fish health facilities process samples for diagnostic and inspectio from captive broodstock sockeye salmon, production sockeye salmon, and anadromous sockeye salmon. Routine fish necro investigations for viral pathogens (infectious pancreatic necrosis virus and infectious hematopoietic necrosis virus), and vario pathogens (e.g., bacterial kidney disease Renibacterium salmoninarium, bacterial gill disease Flavobacterium branchiophilun disease Flavobacterium psychrophilum, and motile aeromonad septicemia Aeromonas spp.). In addition to the above, anadr sockeye salmon are screened for the causative agent of whirling disease Myxobolus cerebralis, furunculus Aeromonas salm North American strain of viral hemorrhagic septicemia virus.

Approved chemical therapeutants are used prophylactically and for the treatment of infectious diseases. Prior to effecting tre use of chemical therapeutants is discussed with an IDFG fish health professional. Fish necropsies are performed on all progr that satisfy minimum size criteria for the various diagnostic or inspection procedures performed.

All appropriate state permits are secured prior to transporting eggs or fish across state boundaries. Prior to release, pre-liber health sampling occurs for pre-smolt and smolt release groups.

Standard 3.7.8 and associated standards. Predation by artificially produced fish on naturally produced fish is not expected in

Diet analysis conducted by the Shoshone-Bannock Tribes has not confirmed the presence of salmonid bones or tissue in the collected to date. Juvenile sockeye salmon size at out-migration and timing of out-migration are monitored by the IDFG and t Bannock Tribes at three locations.

143 The program contributes to information gain in the following way(s): Hatchery program contributes to research to improve pe cost effectiveness
New information affects change to the hatchery program through a structured adaptive decision making process
Hatchery program participates in basin wide-coordinated research efforts
Hatchery program actively contributes to public education
Funding for monitoring of performance indicators is adequate

Comments:

Standards are referenced to NPPC Artificial Production Review (Jan 17, 2001).

Standards are referenced to NPPC Artificial Production Review (Jan 17, 2001).

null

Data source:

Paul Kline, IDFG.
Paul Kline, IDFG.
Paul Kline, IDFG.
Paul Kline, IDFG.
Paul Kline, IDFG.
Paul Kline, IDFG.

1.11.1 Proposed annual broodstock collection level (maximum number of adult fish).

198 Approximately 700 eggs retained from broodstock spawn crosses annually and divided between IDFG and NOAA facilities future broodstock groups.

Data source:

Paul Kline, IDFG, 10.22.03.

1.11.2 Proposed annual fish release levels (maximum number) by life stage and location.

1

Age Class	Maximum Number	Size (ffp)	Release Date	Stream	Location: Release Point (RKm)	Location: Major Watershed	Location: Ecopr
Eggs	50,000	4100	Nov - Dec	Pettit Lake	522.303.633.002	Salmon River	Mounta Snake
Unfed Fry	nya	nya	nya	nya	nya	nya	nya
Fry	nya	nya	nya	nya	nya	nya	nya
Fingerling	100,000	35	October	Pettit Lake	522.303.633.002	Salmon River	Mounta Snake
Yearling	100,000	17	May	Redfish Lake Creek	522.303.615.005	Salmon River	Mounta Snake

Comments:

Additional egg release sites:

Alturas Lake; 522.303.633.011; Salmon River; Mountain Snake

Redfish Lake; 522.303.615.005; Salmon River; Mountain Snake

Additional fingerling release sites:

Alturas Lake; 522.303.633.011; Salmon River; Mountain Snake

Redfish Lake; 522.303.615.005; Salmon River; Mountain Snake

Additional yearling release site:

Sawtooth Hatchery Trap; 522.303.617; Salmon River; Mountain Snake

Adult Release:

Max. Number Size Release Date Stream Release Point Watershed

400 0.25 September Pettit Lake 522.303.633.002 Salmon River

Alturas Lake 522.303.633.011 Salmon River

Redfish Lake 522.303.615.005 Salmon River

Data source:

Paul Kline Project annual reports to Bonneville Power Administration. Project annual reports to NOAA Fisheries for ESA Sec activities.

1.12 Current program performance, including estimated smolt-to-adult survival rates, adult pr levels, and escapement levels. Indicate the source of these data.

33

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	2000	nya	nya	600
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Comments:

NMFS has a short-term goal of 2000 natural spawners (NoR's) for delisting. The hatchery goal is to rear approximately 300 with a minimum of the same number of males. The rearing is spread equally between Eagle Hatchery and NMFS Manchest Station.

Data source:

Status and Goals of Stocks and Habitats

Brood Year	NoRs		HoRs		Combined (HoRs + NoRs)	
	Smolt to Adult Survival(%)	Recruits per Spawner	Smolt to Adult Survival(%)	Recruits per Spawner	Smolt to Adult Survival(%)	Recruits per Spawner
Goal	NA	NA	0.2	1.0	NA	NA
1988	nya	nya	nya	M	M	M

	1989	nya	nya	nya	M	M	M
	1990	nya	nya	nya	M	M	M
	1991	nya	nya	nya	M	M	M
	1992	nya	nya	nya	M	M	M
	1993	nya	nya	nya	M	M	M
34	**1994**	nya	nya	nya	M	M	M
	1995	nya	nya	nya	M	M	M
	1996	nya	nya	nya	M	M	M
	1997	nya	nya	nya	M	M	M
	1998	nya	nya	nya	M	M	M
	1999	nya	nya	nya	M	M	M

Comments:

This is a captive broodstock program with a survival goal of 2.6% smolt to adult. The number of recruits/spawner for the capti is not available.

Data source:

Paul Kline, reviewed 7/28/03.

1.13 Date program started (years in operation), or is expected to start.

7 The first year of operation for this hatchery was 1993 .

Comments:

1993 was the first adult release year. The first juveniles were released in 1994.

Data source:

Paul Kline

1.14 Expected duration of program.

148 The final year of the program is undetermined.

The program is on-going with no planned termination.
149 The program meets goals that cannot be accomplished in any other manner and is expected to continue indefinitely.
The program is expected to end when goals can be met by other means not requiring artificial production.
The program will be terminated when it is determined that the program will not meet its goals.

Comments:

All of the above are true to some extent. The program is expected to continue until NOAA Fisheries interim recovery targets

Data source:

Paul Kline, IDFG.
Paul Kline, IDFG.

1.15 Watersheds targeted by program.

1 Salmon River Watershed,

1.16 Indicate alternative actions considered for attaining program goals, and reasons why thos are not being proposed.

The hatchery program is a part of a strategy to meet conservation and/or harvest goals for the target stock. The tables below the short- and long-term goals are for the stock in terms of stock status (biological significance and viability), habitat and harv in the table indicate High, Medium, or Low levels for the respective attributes. Changes in these levels from current status inc outcomes for the hatchery program and other strategies (including habitat protection and restoration).

		Biological Significance	Viability	Habitat
18	**Current Status**	H	L	L
	Short-term Goal	H	L	L
	Long-term Goal	H	M	M

This table shows current status and goals for harvest opportunity. **H** implies harvest opportunity every year, **M** opportunity mc some years, and **N** no opportunity.

			Location of Fishery				
	Fishery type		**Marine**	**L. Columbia**	**Zone 6**	**U. Columbia**	**Subba**
		Current Status	N	N	N	N	N
	Commercial	**Short-term Goal**	N	N	N	N	N
		Long-term Goal	N	N	N	N	N
		Current Status	N	N	N	N	N
19	**Ceremonial**	**Short-term Goal**	N	N	N	N	N
20 21		**Long-term Goal**	N	N	N	N	N
22		**Current Status**	N	N	N	N	N
23	**Subsistence**	**Short-term Goal**	N	N	N	N	N
		Long-term Goal	N	N	N	N	N
		Current Status	N	N	N	N	N
	Recreational	**Short-term Goal**	N	N	N	N	N
		Long-term Goal	N	N	N	N	N
		Current Status	N	N	N	N	N
	Catch and Release	**Short-term Goal**	N	N	N	N	N
		Long-term Goal	N	N	N	N	N

Comments:

All references to unproductive habitat should be specific to hydro habitat as lake nursery and rearing habitat is not limiting in
N= not applicable, per Paul Kline (IDFG), 10.22.03.
N= Not applicable
N= Not applicable
N= Not applicable in all of the above except in subbasin, where n= no opportunity.
N= Not applicable in all of the above except subbasin, where n= no opportunity.

Data source:

Paul Kline (IDFG), 7.22.03.

Paul Kline (IDFG), 10.22.03.
Paul Kline (IDFG), 10.22.03.
Paul Kline (IDFG), 10.22.03.
Paul Kline (IDFG), 10.22.03.

Section 2: Program Effects on ESA-Listed Salmonid Populations

2.1 List all ESA permits or authorizations in hand for the hatchery program.

150 The program has the following permits or authorizations: Section 7 or Section 10 permit
.

Comments:

Section 10 permit No. 1120.

Data source:

Paul Kline, IDFG.

2.2.1 Descriptions, status and projected take actions and levels for ESA-listed natural populatic target area.

145 The program may incidentally affect Snake River basin summer steelhead, Snake River spring/summer chinook, bull trout.

15 nya

32 Listed stocks may be directly affected by nya.

The following ESA listed natural salmonid populations occur in the subbasin where the program fish are released:

ESA listed stock	Viability	Habitat
Summer Chinook (Johnson Creek)	L	L
Summer Chinook (McCall Hatchery)	H	L
Summer Chinook (Pahsimeroi)	L	L
Spring Chinook (Upper Salmon/Sawtooth)	U	L
Spring Chinook - Natural	H	L
Summer Chinook - Natural	H	L
Steelhead B-Natural	L	L
Redfish Lake Sockeye	L	L
Spring/Summer Chinook (W. Fork Yankee Fork- Salmon River)-Integrated	L	L
Spring/Summer Chinook (East Fork Salmon River)- Integrated	L	L
Lemhi River Spring_Summer Chinook	L	L

H, M and L refer to high, medium and low ratings, low implying critical and high healthy.

Comments:

null
nc
nc
All references to unproductive habitat should be specific to hydro habitat as lake nursery and rearing habitat is not limiting in

Data source:

Paul Kline, IDFG.
nds
nds
nc

2.2.2 Status of ESA-listed salmonid population(s) affected by the program.

nya

Most recent available spawning escapement estimates are shown in the table below:

Summer Chinook (Johnson Creek)

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Summer Chinook (McCall Hatchery)

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Summer Chinook (Pahsimeroi)

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs

Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Spring Chinook (Upper Salmon/Sawtooth)

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	18	19
1996	nya	nya	nya	105	51
1997	nya	nya	nya	155	99
1998	nya	nya	nya	127	26
1999	nya	nya	nya	121	75
2000	nya	nya	nya	535	451
2001	nya	nya	nya	676	1,427

Spring Chinook - Natural

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya

1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Summer Chinook - Natural

Return Year	**Total Catch (all ages)**	**Natural Escapement**		**Hatchery Spawning**	
		NoRs	**HoRs**	**NoRs**	**HoRs**
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Steelhead B-Natural

Return Year	**Total Catch (all ages)**	**Natural Escapement**		**Hatchery Spawning**	
		NoRs	**HoRs**	**NoRs**	**HoRs**
Goal	unk	unk	unk	unk	unk
1990	unk	unk	unk	unk	unk
1991	unk	unk	unk	unk	unk
1992	unk	unk	unk	unk	unk
1993	unk	unk	unk	unk	unk
1994	unk	unk	unk	unk	unk

1995	unk	unk	unk	unk	unk
1996	unk	unk	unk	unk	unk
1997	unk	unk	unk	unk	unk
1998	unk	unk	unk	unk	unk
1999	unk	unk	unk	unk	unk
2000	unk	unk	unk	unk	unk
2001	unk	unk	unk	unk	unk

Redfish Lake Sockeye

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	2000	nya	nya	600
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Spring/Summer Chinook (W. Fork Yankee Fork- Salmon River)- Integrated

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya

1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Spring/Summer Chinook (East Fork Salmon River)- Integrated

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	nya	nya	nya	nya
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Lemhi River Spring_Summer Chinook

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	NA	M	M	NA	NA
1990	M	M	M	NA	NA
1991	M	M	M	NA	NA
1992	M	M	M	NA	NA
1993	M	M	M	NA	NA
1994	M	M	M	NA	NA
1995	M	M	M	NA	NA
1996	M	M	M	NA	NA
1997	M	M	M	NA	NA
1998	M	M	M	NA	NA
1999	M	M	M	NA	NA
2000	M	M	M	NA	NA

2001	M	M	M	NA	NA

Comments:

nc
nc
NMFS has a short-term goal of 2000 natural spawners (NoR's) for delisting. The hatchery goal is to rear approximately 300 with a minimum of the same number of males. The rearing is spread equally between Eagle Hatchery and NMFS Manchest Station.

Data source:

nds
nds
Paul Kline, IDFG.

2.2.3 Describe hatchery activities, including associated monitoring and evaluation and researcl programs, that may lead to the take of listed fish in the target area, and provide estimate levels of take.

Steelhead B (East Fork) - Integrated

ESU/Population	nya
Activity	nya
152 **Location of hatchery activity**	nya
Dates of activity	nya
Hatchery Program Operator	nya

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
153 **Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (Johnson Creek)

ESU/Population	nya
152 **Activity**	nya
Location of hatchery	nya

activity

Dates of activity nya

Hatchery Program Operator nya

153	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Annual Take of Listed Fish by life Stage (number of fish)

152

Summer Chinook (McCall Hatchery)

ESU/Population nya

Activity nya

Location of hatchery activity nya

Dates of activity nya

Hatchery Program Operator nya

Annual Take of Listed Fish by life Stage (number of fish)

153	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya

Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook (Rapid River) - Hatchery

152

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

153

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook (Pahsimeroi)

152

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

153

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook (Upper Salmon/Sawtooth)

ESU/Population nya

Activity nya

152 **Location of hatchery activity** Redfish Lake, Redfish Creek, Pettit/Alturas Lakes, Upper Salmon River

Dates of activity nya

Hatchery Program Operator IDF&G

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	500	150	nya
153 Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Spring Chinook - Natural

ESU/Population nya

Activity nya

152 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program Operator nya

Annual Take of Listed Fish by life Stage (number of fish)

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya

153					
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Summer Chinook - Natural

152		
	ESU/Population	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

153		Annual Take of Listed Fish by life Stage (number of fish)			
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Run (Pahsimeroi)- Hatchery

152		
	ESU/Population	nya
	Activity	nya
	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Annual Take of Listed Fish by life Stage (number of fish)			
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
153 Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead B (Dworshak)-Hatchery

ESU/Population nya

Activity nya

152 **Location of hatchery activity** nya

Dates of activity nya

Hatchery Program Operator nya

Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Annual Take of Listed Fish by life Stage (number of fish)			
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
153 Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Steelhead B-Natural

ESU/Population wild/natural steelhead trout

Activity nya

	Location of hatchery activity	nya
152	**Dates of activity**	nya
	Hatchery Program Operator	IDFG

	Annual Take of Listed Fish by life Stage (number of fish)				
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	0	0	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Natural

	ESU/Population	nya
	Activity	nya
152	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

	Annual Take of Listed Fish by life Stage (number of fish)				
	Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya

Other take (specify) (h)	nya	nya	nya	nya

Redfish Lake Sockeye

152

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

153

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., brookstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

Spring/Summer Chinook (W. Fork Yankee Fork- Salmon River)- Integrated

152

ESU/Population	nya
Activity	nya
Location of hatchery activity	nya
Dates of activity	nya
Hatchery Program Operator	nya

153

	Annual Take of Listed Fish by life Stage (number of fish)			
Type of Take	**Egg/Fry**	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harrass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	nya	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Spring/Summer Chinook (East Fork Salmon River)- Integrated

	ESU/Population	nya
	Activity	nya
152	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	**Capture, handle, tag/mark/tissue sample, and release (d)**	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Lemhi River Spring_Summer Chinook

	ESU/Population	nya
	Activity	nya
152	**Location of hatchery activity**	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

Annual Take of Listed Fish by life Stage (number of fish)

	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya

	Capture, handle, and release (c)	nya	nya	nya	nya
	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
153	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Steelhead A-Run (Sawtooth)- Hatchery

	ESU/Population	nya
	Activity	nya
152	Location of hatchery activity	nya
	Dates of activity	nya
	Hatchery Program Operator	nya

		Annual Take of Listed Fish by life Stage (number of fish)			
	Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
	Observe or harrass (a)	nya	nya	nya	nya
	Collect for transport (b)	nya	nya	nya	nya
	Capture, handle, and release (c)	nya	nya	nya	nya
153	Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
	Removal (e.g., brookstock (e)	nya	nya	nya	nya
	Intentional lethal take (f)	nya	nya	nya	nya
	Unintentional lethal take (f)	nya	nya	nya	nya
	Other take (specify) (h)	nya	nya	nya	nya

Comments:

Data source:

Edits per Paul Kline, IDFG, 10.22.03.

Section 3: Relationship of Program to Other Management Objectives

3.1 Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hooc Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the *NP Production Review* Report and Recommendations - NPPC document 99-15). Explain any | deviations from the plan or policies.

Review of project consistency and alignment with past regional processes:

The Northwest Power Planning Council noted the need to balance increasing the numbers of fish in hatchery-supported po| maintaining the genetic and biological diversity of natural populations in Section 4.1 of its 1994 Fish and Wildlife Program. T further noted that actions aimed at increasing fish numbers and conserving biological diversity are both important to maintai ecosystem. Goals and objectives of the Redfish Lake Sockeye Salmon Captive Broodstock Program are consistent with the Considerable attention and effort are placed on the importance of maintaining the genetic integrity of the Snake River socke ESU. Reintroducing fish to the habitat is also an important component of this program.

Redfish Lake Sockeye Salmon Captive Broodstock Program goals and objectives are also consistent with guidelines and recommendations specifically addressed in the following sections of the 1994 Fish and Wildlife Program: 7.2 ? the need to u propagation to aid depleted populations; 7.4C.1 ? the need for immediate intervention to protect badly damaged population: need to develop captive broodstocks as ?the most cost effective means of accelerating recovery of severely depleted stock use of cryopreservation to ?bank? critical genetic resources and to protect future options; and 7.5A.1 - the recommendation captive broodstock efforts for Snake River sockeye salmon, to produce fish for reintroduction to the habitat, to develop a mc evaluation program, and to develop the facility infrastructure to meet these needs.

Captive broodstock efforts are also consistent with the Recovery Goal presented in Chapter 7 of the 1997 NOAA Fisheries Snake River Salmon Recovery Plan. In addition, sockeye recovery efforts conform to recommendations developed by Colu Fish and Wildlife Authority (CBFWA) co-managers. Specifically, the use of captive broodstock technology to increase numb Lake sockeye salmon is identified as one of several general strategies developed to achieve outcome-based objectives ide 1999 Annual Implementation Work Plan.

Review of project consistency and alignment with current regional processes:

155

Salmon Subbasin Summary - The critical status of Snake River Sockeye salmon is clearly described in Section 4.1.1.a of th Subbasin Summary. Section 4.5.1 identifies the Redfish Lake Sockeye Salmon Captive Broodstock Project as one of two a production programs in place in the Salmon Subbasin addressing recovery goals through the use of conservation hatchery Program goals and objectives are also consistent with existing plans, policies and guidelines presented in Section 5.1 of the Subbasin Summary as developed by Bonneville Power Administration (Section 5.1.1.a), the National Marine Fisheries Serv 5.1.1.b), the Nez Perce Tribe (Section 5.1.2.a), the Shoshone-Bannock Tribes (Section 5.1.2.b) and the Idaho Department Game (Section 5.1.3.a).

Existing Federal, State and Tribal goals, objectives and strategies identified in the Salmon Subbasin Summary (Section 5.2 the primary the principal objectives of the Redfish Lake Sockeye Salmon Captive Broodstock Program. The ?overarching? of the Basinwide Salmon Recovery Strategy (Federal Caucus) is to reduce the genetic, ecological, and management effect: production on natural populations. Specific recommendations that overlap with Objective 1. of the captive broodstock progra using safety net programs on an interim basis to avoid extinction while other recovery actions take place, preserving the ge the most at-risk populations, limiting the adverse effects of hatchery practices on ESA-listed populations, and using genetic broodstocks to stabilize and/or bolster weak populations (Section 5.2.1).

Bonneville Power Administration (Section 5.2.1.a) presented basinwide objectives for implementing actions under the Fede River Power System Biological Opinion and suggested that hatcheries can play a critical role in recovery of anadromous fis increasing the number of biologically-appropriate naturally spawning adults, improving fish health and fitness, and improvin facilities, operation, and management and reducing potential harm to listed fish.? Specific strategies developed by BPA incl the potentially harmful effects of hatcheries, using safety net programs on an interim basis to avoid extinction, and using ha variety of ways to aid recovery. This language is consistent with the primary objectives of the Sockeye Salmon Captive Bro Program.

The goal of NOAA Fisheries in the Salmon Subbasin (Section 5.2.1.b) is to achieve the recovery of Snake River spring/sum chinook, sockeye and steelhead resources. Ultimately, NOAA Fisheries? goal is the achievement of self-sustaining, harves salmon populations which no longer require the protection of the Endangered Species Act. Redfish Lake Sockeye Captive I Program goals and objectives are consistent with this language.

2000 Columbia River Basin Fish and Wildlife Program ? The Redfish Lake Sockeye Salmon Captive Broodstock Program c the general vision of the Fish and Wildlife Program (Section III.A.1.) and its ?overarching? objective to protect, mitigate and fish and wildlife of the Columbia River and its tributaries (Section III.C.1). Specifically, the Primary Artificial Production Strat and Wildlife Program (Section 4.) addresses the need to complement habitat improvements by supplementing native fish p hatchery-produced fish with similar genetics and behavior to their wild counterpart. In addition, Section 4. includes language need to minimize the negative impacts of hatcheries in the recovery process. Redfish Lake Sockeye Salmon Captive Brood goals and objectives are aligned with this philosophy. Program methods receive constant review at the SBSTOC level. Coo to provide hatchery practices that meet Fish and Wildlife Program standards.

FCRPS Biological Opinion ? The Federal Columbia River Power System Biological Opinion includes Artificial Propagation M (Section 9.6.4.) that address reforms to ?reduce or eliminate adverse genetic, ecological, and management effects of artific on natural production while retaining and enhancing the potential of hatcheries to contribute to basinwide objectives for con recovery.? The FCRPS Biological Opinion recognizes that artificial production measures have ?proven effective in many ca alleviating near-term extinction risks.? Many of the Actions to Reform Existing Hatcheries and Artificial Production Programs 9.6.4.2.) are being carried-out in the Redfish Lake Sockeye Salmon Captive Broodstock Program. Specifically, Objective 1. through N. of the captive broodstock program address reform measures dealing with: the management of genetic risk, the p fish from locally adapted stocks, the use of mating protocols designed to avoid genetic divergence from the biologically app population, matching production with habitat carrying capacity, and marking hatchery-produced fish to distinguish natural fr fish. The FCRPS Biological Opinion also reviews the need for the development of NOAA Fisheries-approved Hatchery and Management Plans (HGMP). At the time of this writing, a draft HGMP covering the sockeye salmon artificial production pro final stages of development.

Specific Actions in the FCRPS Biological Opinion that demonstrate logical connections with the sockeye program are conta 9.6.4.3. Action 175. calls for the development of safety net populations of at-risk salmon and steelhead. While ongoing, the Sockeye Salmon Captive Broodstock Program serves as an ?intensely intrusive? example where the entire population of a adults (since 1991) was taken into captivity. Action 177. calls for BPA to begin to implement and sustain NOAA Fisheries-a safety-net projects. This action includes the provision to fund modifications to existing facilities. This obligation will continue circumstances warrant.

The Governors of the states of Idaho, Montana, Oregon and Washington urged regional recovery planners to recognize the aspect of hatcheries, which includes fish production for harvest, supplementation to rebuild naturally spawning populations, brood stock experiments for conservation and restoration (Offices of the Governors 2000, Chapter IV, Hatchery Reforms). T recommended, ?all hatcheries in the Columbia River Basin be reviewed within three years to determine the facilities? speci and potential future uses in support of fish recovery and harvest.? The Redfish Lake Sockeye Salmon Captive broodstock p directly involved with the use of existing and emerging conservation hatchery technologies to develop captive broodstocks f conservation and restoration purposes.

Other Plans and Guidelines ? Goals and objectives of the Redfish Lake Sockeye Salmon Captive Broodstock Program are several guidelines contained in the Review of Artificial Production of Anadromous and Resident Fish in the Columbia River (Scientific Review Team for APR process). Objective 1. through 4. of the captive broodstock program are actively following Guidelines 1., 4., 5., 8., 10., 11., 12., 13., 14., and 15. of the Artificial Production Review. These guidelines address: the hat environment, natural population parameters, habitat carrying capacity, genetic and breeding protocols, germ plasm reposito population life history knowledge. Performance standards and indicators presented in The final Artificial Production Review of issues addressing both benefits and risks to populations. Many of these standards are addressed by objectives identified Lake Sockeye Salmon Captive Broodstock Program. These relationships will be identified in the final HGMP for captive bro program activities.

Relationships described above are substantive in nature and address core guidelines, goals, objectives and strategies iden various planning documents. Techniques and products developed in the Redfish Lake Sockeye Salmon Captive Broodstocl critical components of the overall conceptual framework being developed in the Region.

Comments:

null

Data source:

Paul Kline, IDFG.

3.2 List all existing cooperative agreements, memoranda of understanding, memoranda of agr or other management plans or court orders under which program operates.

	Document Title	T
	Federal Endangered Species Act of 1973	nya
156	Section 10 Permit No. 1120	nya
	2001-2006 Idaho Department of Fish and Game Fisheries Management Plan	nya
	Draft, NOAA Fisheries Salmon Recovery Plans (1995 and 1997)	nya

Comments:

Data source:

Paul Kline, IDFG.

3.3 Relationship to harvest objectives.

157 At the present time, no harvest objectives are in place for the Sockeye Captive Broodstock Program.

Comments:

null

Data source:

Paul Kline, IDFG.

3.4 Relationship to habitat protection and recovery strategies.

158 Hatchery production is linked to habitat improvement strategies in the Salmon subbasin (e.g., Shoshone-Bannock Tribes wl fertilization efforts in sockeye salmon nursery lakes). This work occurs only to augment the ability of nursery lakes to accom salmon released from the captive broodstock program. NOAA Fisheries has not developed a recovery plan specific to Snak salmon, but this program is operated consistent with existing Biological Opinions.

Comments:

null

Data source:

Paul Kline, IDFG.

3.5 Ecological interactions.

The following species co-occur to a significant degree with the program fish in either freshwater or early marine life stages.

159

- Steelhead
- Sockeye
- Chinook
- Bull Trout

Comments:

Data source:

Paul Kline, IDFG.

Section 4. Water Source

4.1 Provide a quantitative and narrative description of the water source (spring, well, surfac quality profile and natural limitations to production attributable to the water source.

The following statements describe the adult holding water source:

- The water source is pumped.
- The water source is pathogen-free.
- The water source is specific-pathogen free.
- The water source is fish free.
- The water source is accessible to anadromous fish.

12

- Water is available from multiple sources.
- The water used results in natural water temperature profiles that provide optimum maturation and gamete developn
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu temperature.
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu ammonia, carbon dioxide, chlorine, pH, copper, dissolved oxygen, hydrogen sulfide, dissolved nitrogen, iron, and zi
- The water supply is protected by flow and/or pond level alarms at the holding pond(s).
- The water supply is protected by back-up power generation.

The following statements describe the incubation water source:

- The water source is pumped.
- The water source is pathogen-free.
- The water source is specific-pathogen free.
- The water source is fish free.

13

- Water is available from multiple sources.
- Water is from the natal stream for the cultured stock.
- The water used provides natural water temperature profiles that results in hatching/emergence timing similar to that naturally produced stock.
- Incubation water can be heated or chilled to approximate natural water temperature profiles.
- The water supply is protected by flow alarms at the head box.
- The water supply is protected by flow and/or pond level alarms at the holding pond(s).

The following statements describe the rearing water source:

- The water source is pumped.
- The water source is pathogen-free.
- The water source is specific-pathogen free.
- The water source is fish free.
- The water source is accessible to anadromous fish.

14

- Water is available from multiple sources.
- The water used provides natural water temperature profiles that results in hatching/emergence timing similar to that naturally produced stock.
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu temperature.
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality gu ammonia, carbon dioxide, chlorine, pH, copper, dissolved oxygen, hydrogen sulfide, dissolved nitrogen, iron, and zi
- The water supply is protected by flow and/or pond level alarms at the holding pond(s)
- The water supply is protected by back-up power generation.

Comments:

Hatchery intake screeining (q.) does not apply, since the water source is from wells.

These answers apply to Eagle Hatchery, not NOAA Manchester or Burley Creek.
Hatchery intake screening (r.) does not apply since water source is from wells.

These answers apply to Eagle Hatchery, not NOAA Manchester or Burley Creek.
Chemical profile (j.) does not apply.

Migrating species (k.) does not apply.

Access to intake screens (s.) does not apply.

Intake screening compliance with IHOT (t.) does not apply since water source is from wells.

These answers apply to Eagle Hatchery, not NOAA Manchester or Burley Creek.

Data source:

Edits per Paul Kline (IDFG), 10.22.03.
Paul Kline, (IDFG), 10.22.03.
Paul Kline, (IDFG) 10.22.03.

4.2 Indicate risk aversion measures that will be applied to minimize the likelihood for the ta listed natural fish as a result of hatchery water withdrawal, screening, or effluent discha

15 The production from this facility falls below the minimum production requirement for an NPDES permit, but the facility opera compliance with state or federal regulations for discharge .

Comments:

a. does not apply.

These answers apply to Eagle Hatchery, not NOAA Manchester or Burley Creek

Sawtooth Hatchery has an NPDES permit. Based on NPDES guidelines; Eagle Hatchery is not required to monitor effluent annual pounds of fish produced.

Data source:

Paul Kline, IDFG.

Section 5. Facilities

5.1 Broodstock collection facilities (or methods).

Brookstock for this program is collected:

16

- at another facility. ** NO STATEMENT PROVIDED FOR THIS CHOICE **

188

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available F (gpm)
4	Fiberglass	230	10	10	2.3	60
4	Fiberglass	313	13	13	1.85	80
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya

Comments:

At the IDFG Eagle Fish Hatchery and the NOAA Burley Creek Fish Hatchery.

Data source:

Paul Kline, IDFG, 10.22.03.
Paul Kline, IDFG. Aquafarms 2000 Inc. specifications manual. Eagle Hatchery historical flow data.

5.2 Fish transportation equipment (description of pen, tank, truck, or container used).

99 IHOT guidelines for transportation are followed.

187

Equipment Type	Capacity (gallons)	Supplemental Oxygen (y/n)	Temperature Control (y/n)	Normal Transit Time (minutes)	Chemical (s) Used	Dc (p
3/4 ton PU w/tank	250	Y	nya	4 hours	none	NA
10 wheel tanker	2700	Y	nya	12 hours	none	NA
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya

Comments:

Data source:

Paul Kline, IDFG.
Paul Kline, IDFG. Project annual reports to Bonneville Power Administration. Project annual reports to NOAA Fisheries for ES
activities.

5.3 Broodstock holding and spawning facilities.

Spawning for this program takes place:

16

- at a remote location.** NO STATEMENT PROVIDED FOR THIS CHOICE **

34 Integrated Hatchery Operations Team (IHOT) adult holding guidelines followed for adult holding , density , water quality , alar
predator control measures to provide the necessary security for the broodstock.

188

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available F (gpm)
4	Fiberglass	230	10	10	2.3	60
4	Fiberglass	313	13	13	1.85	80
nya	nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya	nya

Comments:

At the IDFG Eagle Fish Hatchery and the NOAA Burley Creek Fish Hatchery.

Data source:

Paul Kline, IDFG, 10.22.03.
Paul Kline, IDFG.
Paul Kline, IDFG. Aquafarms 2000 Inc. specifications manual. Eagle Hatchery historical flow data.

5.4 Incubation facilities.

189

Incubator Type	Units (number)	Flow (gpm)	Volume (cu.ft.)	Loading-Eyeing (eggs/unit)	Loading-Hatcl (eggs/unit
Upwelller/downweller	576	.288	.62 gal	800	800
nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya
nya	nya	nya	nya	nya	nya

Comments:

Data source:

Paul Kline, IDFG. Aquafarms 2000 Inc. specifications manual. Eagle Hatchery historical flow data.

5.5 Rearing facilities.

190

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Maximum Flow Index	Maxir Dens Ind
10	Fiberglass	4.3	2.17	2.17	0.917	0.8	1.34	0.25
36	Fiberglass	10.6	3.25	3.25	1.0	2	0.8833	0.1667
20	Fiberglass	50	6.5	6.5	1.2	9.3	0.5376	0.1
10	Fiberglass	228.9	10	10	2.3	42.8	0.1903	0.0357

Comments:

Data source:

Paul Kline, IDFG. Aquafarms 2000 Inc. specifications manual. Eagle Hatchery historical flow data.

5.6 Acclimation/release facilities.

190

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Maximum Flow Index	Maxir Dens Ind
10	Fiberglass	4.3	2.17	2.17	0.917	0.8	1.34	0.25
36	Fiberglass	10.6	3.25	3.25	1.0	2	0.8833	0.1667
20	Fiberglass	50	6.5	6.5	1.2	9.3	0.5376	0.1
10	Fiberglass	228.9	10	10	2.3	42.8	0.1903	0.0357

Comments:

Data source:

Paul Kline, IDFG. Aquafarms 2000 Inc. specifications manual. Eagle Hatchery historical flow data.

5.7 Describe operational difficulties or disasters that led to significant fish mortality.

160 No significant operational disasters have occurred in this program.

Comments:

null

Data source:

Paul Kline, IDFG.

5.8 Indicate available back-up systems, and risk aversion measures that will be applied, tha the likelihood for the take of listed natural fish that may result from equipment failure, v flooding, disease transmission, or other events that could lead to injury or mortality.

70 Fish are reared in multiple facilities or with redundant systems to reduce the risk of catastrophic loss.

78 The facility is sited so as to minimize the risk of catastrophic fish loss from flooding.

79 Staff is notified of emergency situations at the facility.

80 The facility is continuously staffed to assure the security of fish stocks on-site.

Comments:

Fish are reared at Eagle and Sawtooth hatcheries as well as the NOAA fisheries facilities at Manchester and Burley Creek.

Data source:

Paul Kline, IDFG.
Paul Kline, IDFG.
Paul Kline, IDFG.
Paul Kline, IDFG.

Section 6. Broodstock Origin and Identity

6.1 Source.

17 The broodstock chosen represents natural populations native or adapted to the watersheds in which hatchery fish will be re

Comments:

Data source:

Paul Kline, IDFG.

6.2.1 History.

	Broodstock Source	Origin	Year(s) Used Begin	Year(s) Used End
	Redfish Lake stock	N	1991	2002
	nya	nya	nya	nya
	nya	nya	nya	nya
	nya	nya	nya	nya
183	nya	nya	nya	nya
	nya	nya	nya	nya
	nya	nya	nya	nya
	nya	nya	nya	nya
	nya	nya	nya	nya
	nya	nya	nya	nya
	nya	nya	nya	nya
	nya	nya	nya	nya

Comments:

Broodstock development using wild, Redfish Lake sockeye salmon has included anadromous adults, residual adults, and outmigrating sn
sockeye salmon represent the potential infusion of new genetic diversity into the breeding program. Since 1991, all 16 wild, anadromous
salmon that returned to the Stanley Basin have been incorporated into the breeding program. Residual sockeye salmon adults were captu
to develop broodstocks in 1992, 1993, and 1995. Twenty-six residual sockeye salmon adults have contributed to the captive broodstock p
outmigrating smolts from Redfish Lake were captured in 1991 ? 1993, reared through maturation at the IDFG Eagle Fish Hatchery, and s
incorporated in the breeding program. During these collection years, 886 outmigrating smolts were captured and transferred to the Eagle

Collection Year Anadromous Adults Residual Adults Smolts

1991 4 (3 male, 1 female) 759

1992 1 male 5 (4 male, 1 female) 79

1993 8 (6 male, 2 females) 18 (16 males, 2 females) 48

1994 1 female

1995 3 males

1996 1 female

1997

1998 1 male

Data source:

Paul Kline, IDFG.

6.2.2 Annual size.

22 The program collects sufficient numbers of donors from the natural stock to minimize founder effects.

23

25

27 The program does NOT collect sufficient broodstock to maintain an effective population size of 1000 fish per generation.

28 More than 10% of the broodstock is not derived from wild fish each year.

Comments:

The program has taken all naturally returning anadromous adults into the program. In addition 1000 outmigrating smolts an history types have also been incorporated into the program.

All anadromous adults within the basin have been collected. While this is a desireable goal, the Redfish Lake sockeye prog at a considerably lower effective population size level due to the extremely depressed nature of the founding population. Ou tactic in managing genetic risk is to maintain the existing genetic diversity of the population as best we can. Similarly, the pr infuse 10% wild genetics annually into the broodstock as there are no longer any truly wild sockeye salmon available to do

Data source:

Paul Kline, IDFG.
Paul Kline, IDFG.
Paul Kline (IDFG), 7.22.03.
Paul Kline, IDFG.

6.2.3 Past and proposed level of natural fish in the broodstock.

33

Return Year	Total Catch (all ages)	Natural Escapement		Hatchery Spawning	
		NoRs	HoRs	NoRs	HoRs
Goal	nya	2000	nya	nya	600
1990	nya	nya	nya	nya	nya
1991	nya	nya	nya	nya	nya
1992	nya	nya	nya	nya	nya
1993	nya	nya	nya	nya	nya
1994	nya	nya	nya	nya	nya
1995	nya	nya	nya	nya	nya
1996	nya	nya	nya	nya	nya
1997	nya	nya	nya	nya	nya
1998	nya	nya	nya	nya	nya
1999	nya	nya	nya	nya	nya
2000	nya	nya	nya	nya	nya
2001	nya	nya	nya	nya	nya

Comments:

NMFS has a short-term goal of 2000 natural spawners (NoR's) for delisting. The hatchery goal is to rear approximately 300 with a minimum of the same number of males. The rearing is spread equally between Eagle Hatchery and NMFS Manchest Station.

Data source:

6.2.4 Genetic or ecological differences.

19 The broodstock chosen displays morphological and life history traits similar to the natural population.

Comments:

Data source:

Paul Kline, IDFG.

6.2.5 Reasons for choosing.

18 dna

20

21 dna

Comments:

Endemic, local stock selected.

Data source:

Paul Kline, (IDFG) 10.22.03.
Paul Kline, IDFG.
Paul Kline, IDFG.

6.3 Indicate risk aversion measures that will be applied to minimize the likelihood for advers or ecological effects to listed natural fish that may occur as a result of broodstock selecti practices.

The following procedures are in place that maintain broodstock collection within programmed levels:

161

- The collection plan for natural origin adults is in place that prevents collection of surplus fish
- Excess adults are used for seeding available habitat in accordance with genetic guidelines

Comments:

Annual guidelines are developed to spawn full-term hatchery and hatchery-produced anadromous adults. Full-term hatcher hatchery-produced anadromous adults are also released to the habitat to spawn naturally. The proportion of both types of a develop in-hatchery spawn groups and groups released to natural spawn is driven by program guidelines that are in place t inbreeding and to maximize genetics diversity in the hatchery and in the wild. At the present time, no truly wild sockeye saln spawning in the wild.

Data source:

Paul Kline, IDFG.

Section 7. Broodstock Collection

7.1 Life-history stage to be collected (adults, eggs, or juveniles).

191

	Adults				
Year	**Females**	**Males**	**Jacks**	**Eggs**	**Juveniles**
Planned	NA	NA	NA	NA	NA
1990	0	0	0	nya	nya
1991	1 R	3 A	0	nya	759 S
1992	1 R	1 A, 4 R	0	0	79 S
1993	2 A, 2 R	6 A, 16 R	nya	nya	48 S
1994	1 A	0	0	nya	nya
1995	0	3	0	nya	nya
1996	1 A	0	0	nya	nya
1997	0	0	0	nya	nya
1998	0	1 A	0	nya	nya
1999	0	nya	0	nya	nya
2000	0	nya	0	nya	nya
2001	0	nya	0	nya	nya

Comments:

A: Anadromous

R: Residual

S: Smolts

Data source:

Paul Kline, IDFG. IDFG file information. Note: "n/a" is listed in the "planned" row as no wild, anadromous sockeye salmon are return to the program. Updated 10.22.03.

7.2 Collection or sampling design

16 • Broodstock collected at another facility.

22 The program collects sufficient numbers of donors from the natural stock to minimize founder effects.

23

24 Representative samples of the population are collected with respect to size, age, sex ratio, run and spawn timing, and othe important to long-term fitness.

25

27 The program does NOT collect sufficient broodstock to maintain an effective population size of 1000 fish per generation.

28 More than 10% of the broodstock is not derived from wild fish each year.

Comments:

The program has taken all naturally returning anadromous adults into the program. In addition 1000 outmigrating smolts an history types have also been incorporated into the program.

The Redfish Lake sockeye run was nearly extinct, therefore all anadromous adults were incorporated into the program. Thr captive broodstock program, juveniles and adults have now been reintroduced into the natural environment.
All anadromous adults within the basin have been collected. While this is a desireable goal, the Redfish Lake sockeye prog at a considerably lower effective population size level due to the extremely depressed nature of the founding population. Ou tactic in managing genetic risk is to maintain the existing genetic diversity of the population as best we can. Similarly, the pr infuse 10% wild genetics annually into the broodstock as there are no longer any truly wild sockeye salmon available to do

Data source:

Paul Kline, IDFG.
Paul Kline, IDFG.
Paul Kline, IDFG.
Paul Kline, IDFG.
Paul Kline (IDFG), 7.22.03.
Paul Kline, IDFG.

7.3 Identity.

100 Marking techniques are used to distinguish among hatchery population segments.

101 100% of the hatchery fish released are marked so that they can be distinguished from the natural population.

102 Marked fish can be identified using non-lethal means.

106 Wild fish make up 0-5% (less than five percent) % of the broodstock for this program.

Comments:

Data source:

Paul Kline, IDFG.
Paul Kline, IDFG.
Paul Kline, IDFG.
Paul Kline, IDFG.

7.4 Proposed number to be collected:

7.4.1 Program goal (assuming 1:1 sex ratio for adults):

198 Approximately 700 eggs retained from broodstock spawn crosses annually and divided between IDFG and NOAA fa
generate future broodstock groups.

7.4.2 Broodstock collection levels for the last twelve years (e.g. 1990-2001), or for most recent years availab

191

	Adults			
Year	**Females**	**Males**	**Eggs**	**Juv**

APPENDIX 2-17—FINAL ISSUE 12 RESPONSE

REVIEW OF BLUE MOUNTAIN AND MOUNTAIN SNAKE PROVINCE CAPTIVE PROPAGATION PROGRAMS: RESPONSE TO THE NORTHWEST POWER AND CONSERVATION COUNCIL

Prepared by:

Paul Kline, Idaho Department of Fish and Game
Timothy Hoffnagle, Oregon Department of Fish and Wildlife
Thomas Flagg, NOAA Fisheries
Doug Taki, Shoshone-Bannock Tribes
Madison Powell, University of Idaho
Jay Hesse, Nez Perce Tribe
Stephen Boe, Confederated Tribes of the Umatilla Indian Reservation

December 19, 2003

Review of Blue Mountain and Mountain Snake Province Captive Propagation Programs: Response to the Northwest Power and Conservation Council

2001-12A and 2002-14 Deliverables Completion Report

December 19, 2003

Prepared By

Paul Kline
Idaho Department of Fish and Game, 600 South Walnut Street, P.O. Box 25, Boise, Idaho 83707, (208) 939-4114 (phone), (208) 939-2415 (fax), pkline@idfg.state.id.us

Timothy Hoffnagle
Oregon Department of Fish and Wildlife, 211 Inlow Hall, Eastern Oregon University, La Grande, Oregon 97850, (541) 962-3777 (phone), (541) 962-3067 (fax), thoffnag@eou.edu

Thomas Flagg
NOAA Fisheries, Northwest Fisheries Science Center, Resource Enhancement and Utilization Technologies Division, P.O. Box 130, Manchester, Washington 98353, (360) 871-8306 (phone), (206) 842-8364 (fax), tom.flagg@noaa.gov

Doug Taki
Shoshone-Bannock Tribes, Fisheries Department, P.O. Box 306, Fort Hall, Idaho 83203, (208) 238-9397(phone), (208) 478-3986 (fax), dtaki@shoshonebannocktribes.com

Madison Powell
University of Idaho, Hagerman Fish Culture Experiment Station, 3059F National Fish Hatchery Rd., Hagerman, Idaho 83203, (208) 837-9096 (phone), (208) 837-6047 (fax), mpowell@uidaho.edu

Jay Hesse
Nez Perce Tribe, Fisheries Department, P.O. Box 365, Lapwai, Idaho 83540, (208) 843-7145 (phone), (208) 843-9184 (fax), jayh@nezperce.org

Stephen Boe
Confederated Tribes of the Umatilla Indian Reservation, Fisheries Program, 211 Inlow Hall, Eastern Oregon University, La Grande, Oregon 97850, (541) 962-3777 (phone), (541) 962-3067 (fax), sboe@eou.edu

TABLE OF CONTENTS

Page

PREFACE 1

REDFISH LAKE SOCKEYE SALMON CAPTIVE BROODSTOCK PROGRAM 2

LIST OF PROJECT-RELATED ENDANGERED SPECIES ACT SECTION 10 REPORTS 2
LIST OF PROJECT-RELATED BONNEVILLE POWER ADMINISTRATION REPORTS 4
LIST OF PROJECT-RELATED JOURNAL PUBLICATIONS 7
LIST OF PROJECT-RELATED CONFERENCE AND WORKSHOP PROCEEDINGS 11
RESPONSES TO ISRP PROJECT SPECIFIC QUESTIONS 17
Mountain Snake Province (ISRP2001-12A) 17
Mainstem and Systemwide Province (ISRP2002-14) 19
Literature Cited 22
INTERIM STANDARDS FOR THE USE OF CAPTIVE PROPAGATION TECHNOLOGY IN RECOVERY OF ANADROMOUS SALMONIDS LISTED UNDER THE ENDANGERED SPECIES ACT 23
Introduction 23
Table 1. Decision Standards for Using Captive Propagation Technology to Recover Listed Anadromous Salmonids 24
Table 2. Operational Standards for using Captive Propagation Technology to Recover ESA-Listed Anadromous Salmonids 33
Table 3. Outline of a Captive Propagation Operation Plan 44
Table 4. Summary of Benefits Attributed to Captive Propagation Technology 67
Table 5. Summary of Hazards Related to Captive Propagation Technology 69
Literature Cited 72
ARTIFICIAL PRODUCTION REVIEW 79
Introduction 79
Section II. Recommended Policies for the Future Role of Artificial Production in the Columbia River Basin 79
Section III. Implementing Reform in Artificial Production Policy and Practices 81
Literature Cited 110

CAPTIVE REARING PROGRAM FOR SALMON RIVER SPRING CHINOOK SALMON 116

LIST OF PROJECT-RELATED ENDANGERED SPECIES ACT SECTION 10 REPORTS 116
LIST OF PROJECT-RELATED BONNEVILLE POWER ADMINISTRATION REPORTS 116
LIST OF PROJECT-RELATED JOURNAL PUBLICATIONS 118
LIST OF PROJECT-RELATED CONFERENCE AND WORKSHOP PROCEEDINGS 121
RESPONSES TO ISRP PROJECT SPECIFIC QUESTIONS 126
Mountain Snake Province (ISRP2001-12A) 126
Mainstem and Systemwide Province (ISRP2002-14) 128
Literature Cited 131
Release of captively reared adult anadromous salmonids for population maintenance and recovery: biological tradeoffs and management considerations 133

INTERIM STANDARDS FOR THE USE OF CAPTIVE PROPAGATION TECHNOLOGY IN RECOVERY OF ANADROMOUS SALMONIDS LISTED UNDER THE ENDANGERED SPECIES ACT 153
Introduction 153
Table 1. Decision Standards for Using Captive Propagation Technology to Recover Listed Anadromous Salmonids 153
Table 2. Operational Standards for using Captive Propagation Technology to Recover ESA-Listed Anadromous Salmonids 162
Table 3. Outline of a Captive Propagation Operation Plan 177
Table 4. Summary of Benefits Attributed to Captive Propagation Technology 197
Table 5. Summary of Hazards Related to Captive Propagation Technology 199
Literature Cited 202
ARTIFICIAL PRODUCTION REVIEW 210
Introduction 210
Section II. Recommended Policies for the Future Role of Artificial Production in the Columbia River Basin 210
Section III. Implementing Reform in Artificial Production Policy and Practices 212
Literature Cited 246

GRANDE RONDE BASIN SPRING CHINOOK SALMON CAPTIVE BROODSTOCK PROGRAM 252

LIST OF PROJECT-RELATED ENDANGERED SPECIES ACT SECTION 10 REPORTS 252
LIST OF PROJECT-RELATED JOURNAL PUBLICATIONS 255
LIST OF PROJECT-RELATED CONFERENCE AND WORKSHOP PROCEEDINGS 257
RESPONSES TO ISRP PROJECT SPECIFIC QUESTIONS 261
Blue Mountain and Mountain Snake Provinces (ISRP2001-12A) 261
Literature Cited 268
INTERIM STANDARDS FOR THE USE OF CAPTIVE PROPAGATION TECHNOLOGY IN RECOVERY OF ANADROMOUS SALMONIDS LISTED UNDER THE ENDANGERED SPECIES ACT 269
Introduction 269
Table 1. Decision Standards for Using Captive Propagation Technology to Recover Listed Anadromous Salmonids 270
Table 2. Operational Standards for using Captive Propagation Technology to Recover ESA-Listed Anadromous Salmonids 278
Table 3. Outline of a Captive Propagation Operation Plan 291
Table 4. Summary of Benefits Attributed to Captive Propagation Technology 309
Table 5. Summary of Hazards Related to Captive Propagation Technology 311
Literature Cited 314
ARTIFICIAL PRODUCTION REVIEW 318
Introduction 318
Section II. Recommended Policies for the Future Role of Artificial Production in the Columbia River Basin 319
Section III. Implementing Reform in Artificial Production Policy and Practices 320
Literature Cited 343
ACKNOWLEDGEMENTS 346

PREFACE

The project sponsors associated with the Redfish Lake sockeye salmon and Snake River spring/summer chinook captive broodstock programs are pleased to provide the following set of deliverables to answer Council questions regarding program activities. Sections are provided for each program that address project-specific questions raised by the ISRP in province review processes, explain how projects are consistent with the *Interim Standards for the Use of Captive Propagation Technology in Recovery of Anadromous Salmonids Listed under the Endangered Species Act* document, and articulate how projects are consistent with the Council's *Artificial Production Review* document. Our responses also include reference lists of all project-related annual ESA reports, BPA reports, and scientific publications that provide federal authorization and reporting documentation for the programs.

The foundational approaches and decisions to implement these captive broodstock programs were developed through public processes that include the initial biological reviews and Endangered Species Act listings for the stocks, recommendations from such groups as the Snake River Salmon Recovery Team (the Bevan Team) and the Hatfield Salmon Summit, and recommendations in documents such as the NMFS proposed Recovery Plan for Snake River Salmon. These recommendations and actions were consistent with the Council's 1992 draft (A804.a) and 1994 final (7.4D) Fish and Wildlife Program identification of the need to develop captive broodstocks as perhaps "the most cost effective means of accelerating recovery of severely depleted stocks."

The Redfish Lake Sockeye Salmon Captive Broodstock Program was the first program initiated by state, federal, and tribal agreement in 1991. The Snake River spring/summer chinook captive broodstock programs were initiated in the mid 1990s through the USFWS Lower Snake River Compensation Plan (LSRCP) Conservation Oversight Group, in conjunction with state, federal, and tribal groups. Currently, the Redfish Lake Sockeye Salmon Captive Broodstock Program is overseen by the BPA-chaired Stanley Basin Sockeye Technical Oversight Committee (SBSTOC). The Captive Rearing Program for Snake River Spring Chinook Salmon and the Grand Ronde Basin Spring Chinook Salmon Captive Broodstock Program are overseen by the BPA-chaired Chinook Salmon Captive Propagation Technical Oversight Committee (CSCPTOC) and the Oregon Technical Oversight Team (TOT), respectively. All three committees contain representatives of state, federal, tribal, and private groups involved in the conservation of the ESA-listed stocks. Data indicate that the captive broodstock programs described in the attached documents have achieved rearing and release successes rarely seen in other endangered species programs and support that captive propagation is a sound conservation strategy.

In providing the attached responses, project sponsors seek to resolve the major technical issues the Council has identified regarding captive broodstock technology.

REDFISH LAKE SOCKEYE SALMON CAPTIVE BROODSTOCK PROGRAM

LIST OF PROJECT-RELATED ENDANGERED SPECIES ACT SECTION 10 REPORTS

Flagg, T. A., and W. C. McAuley. 1995. NMFS Northwest Fisheries Science Center report to NMFS Office of Protected Resources for captive broodstock rearing of Redfish Lake sockeye salmon from December 1991 through December 1994 under ESA Section 10 Propagation Permit 795, 22 p.

Flagg, T. A., and W. C. McAuley. 1996. NMFS Northwest Fisheries Science Center report to NMFS Office of Protected Resources for captive broodstock rearing of Redfish Lake sockeye salmon from December 1994 through December 1995 under ESA Section 10 Propagation Permit 795, 17 p.

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Flagg, T. A., and W. C. McAuley. 1998. NMFS Northwest Fisheries Science Center report to NMFS Office of Protected Resources for captive broodstock rearing of Redfish Lake sockeye salmon from January through December 1997 under ESA Section 10 Propagation Permit 1005, 22 p.

Flagg, T. A., W. C. McAuley, and W. T. Fairgrieve. 1999. NMFS Northwest Fisheries Science Center report to NMFS Office of Protected Resources for captive broodstock rearing of Redfish Lake sockeye salmon from January through December 1998 under ESA Section 10 Propagation Permit 1148, 27 p.

Frost, D. A., W. C. McAuley, D. J. Maynard, and T. A. Flagg. 2002. NMFS Northwest Fisheries Science Center report to NMFS Office of Protected Resources for captive broodstock rearing of Redfish Lake sockeye salmon from January through December 2001 under ESA Section 10 Propagation Permit 1148, 27 p.

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Hebdon, L., C. Willard, P. Kline, J. Castillo, and K. Johnson. 2001. Idaho Department of Fish and Game report to the National Marine Fisheries Service for the Redfish Lake Sockeye Salmon Captive Broodstock Program. January 1, 2001 through December 31, 2001. ESA Section 10 Permit No. 1120, 25 p.

Hebdon, L., C. Willard, D. Baker, P. Kline, J. Castillo, J. Gable, and K. Johnson. 2002. Idaho Department of Fish and Game report to the National Marine Fisheries Service for the Redfish Lake Sockeye Salmon Captive Broodstock Program. January 1, 2002 through December 31, 2002. ESA Section 10 Permit No. 1120, 31 p.

Johnson, K., and P. Kline. 1994. Idaho Department of Fish and Game report to the National Marine Fisheries Service for the Redfish Lake Sockeye Salmon Captive Broodstock

Program. January 1, 1994 through December 31, 1994. ESA Section 10 Permit No. 1120, 24 p.

Johnson, K., and P. Kline. 1995. Idaho Department of Fish and Game report to the National Marine Fisheries Service for the Redfish Lake Sockeye Salmon Captive Broodstock Program. January 1, 1995 through December 31, 1995. ESA Section 10 Permit No. 795, 15 p.

Johnson, K., and P. Kline. 1996. Idaho Department of Fish and Game report to the National Marine Fisheries Service for the Redfish Lake Sockeye Salmon Captive Broodstock Program. July 1993 through January 1995. ESA Section 10 Permit No. 795, 25 p.

Kline, P., and J. Pravecek. 1996. Idaho Department of Fish and Game report to the National Marine Fisheries Service for the Redfish Lake Sockeye Salmon Captive Broodstock Program. January 1, 1996 through December 31, 1996. ESA Section 10 Permit No. 795, 13 p.

Kline, P., J. Pravecek, J. Heindel, and K. Johnson. 1998. Idaho Department of Fish and Game report to the National Marine Fisheries Service for the Redfish Lake Sockeye Salmon Captive Broodstock Program. January 1, 1998 through December 31, 1998. ESA Section 10 Permit No. 1120, 19 p.

Kline, P., L. Hebdon, J. Heindel, K. Johnson, and B. Malaise. 1999. Idaho Department of Fish and Game report to the National Marine Fisheries Service for the Redfish Lake Sockeye Salmon Captive Broodstock Program. January 1, 1999 through December 31, 1999. ESA Section 10 Permit No. 1120, 21 p.

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Pravecek, J., P. Kline, and K. Johnson. 1997. Idaho Department of Fish and Game report to the National Marine Fisheries Service for the Redfish Lake Sockeye Salmon Captive Broodstock Program. January 1, 1997 through December 31, 1997. ESA Section 10 Permit No. 795, 22 p.

Taki, D. 1996. Shoshone-Bannock Tribes report to the NMFS Office of Protected Resources for Section 10 Research Permit #998 for work performed during calendar year 1996.

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Berejikian, B. A. (editor). 2001. Research on captive broodstock programs for Pacific salmon: performance period 1 June 2000 through 31 May 2001. Report to Bonneville Power Administration, Contract No. 99-AI-17859, 114 p.

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Brannon, E. L., A. L. Setter, T. L. Welsh, S. J. Rocklage, G. H. Thorgaard, and S. A. Cummings. 1992. Genetic analysis of *Oncorhynchus nerka*. Annual Progress Report. Bonneville Power Administration, Contract No DE-BI79-90BP12885, 13 p.

Brannon, E. L., T. Welsh, R. Danner, K. Collins, M. Casten, G. H. Thorgaard, K. Adams, and S. Cummings. 1994. Genetic analysis of *Oncorhynchus nerka*: Life history and genetic analysis of Redfish Lake *Oncorhynchus nerka*. Completion Report. Bonneville Power Administration, Contract No. DE-BI79-90BP12885, 48p.

Fairgrieve, W. T., C. L. Masada, W. C. McAuley, M. E. Peterson, M. S. Meyers, and M. S. Strom. 2003. Use of antibiotics and new vaccines to reduce mortality from bacterial kidney disease in chinook salmon: Evaluation of Toxic Effects of Long-term Prophylactic Use of Azithromycin and Erythromycin. Final Report for FY 1999-2002. *In* B. A. Berejikian and C. Nash (ed), Research on captive broodstock programs for Pacific salmon Research, FY2002-2003 Annual Report to Bonneville Power Administration, Contract No. 99-AI-17859.

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Flagg, T. A., and C. V. W. Mahnken (editors). 1995. An assessment of captive broodstock technology for Pacific salmon. Report to Bonneville Power Administration, Contract DE-AI79 93BP55064, 299 p.

Flagg, T. A., W. C. McAuley, M. R. Wastel, D. A. Frost, and C. V. W. Mahnken. 1996. Redfish Lake sockeye salmon captive broodstock rearing and research, 1994. Report to Bonneville Power Administration, Contract DE-AI79-92BP41841, 98 p.

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Johnson, K. A. 1993. Research and recovery of Snake River sockeye salmon, 1991-1992. Report to Bonneville Power Administration, Contract DE-BI79-91BP21065, 38 p.

Johnson, K. A., and J. J. Pravecek. 1995. Research and recovery of Snake River sockeye salmon, 1993. Report to Bonneville Power Administration, Contract DE-BI79-91BP21065, 37 p.

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RESPONSES TO ISRP PROJECT SPECIFIC QUESTIONS

Mountain Snake Province (ISRP2001-12A)

a) Project 199204000 (NOAA Fisheries)—Redfish Lake Sockeye Salmon Captive Broodstock Rearing and Research

No response required.

b) Project 199107200 (Idaho Department of Fish and Game)—Redfish Lake Sockeye Salmon Captive Broodstock Program

Point #1: The ISRP wrote, "The ISRP does not question the credentials of the technical oversight panel of experts brought in to provide input on specific aspects of the program. The ISRP does, however, remain committed to a detailed and rigorous review of this large and expensive program by a team of outsiders directed to address the performance and continuing need for each element of the program."

Sponsor Response to #1: Project sponsors have collaboratively addressed the concerns of the ISRP by satisfying the deliverables request identified in the Council's November 12, 2002 letter (Issue 12). In that letter, the Council identified the following "information and issues" that needed to be addressed in writing and provided to the Council and Bonneville:

1) Address the additional questions raised by the ISRP (ISRP 2001-12A) for each of the particular projects in their final review,

2) Explain how each project used and addressed the Interim Standards for the use of Captive Propagation Technology in Recovery of Anadromous Salmonids Listed under the Endangered Species Act (NMFS 1999), and

3) Each project should articulate how it is consistent with the Council's Artificial Production Review report (Council doc. 99-15).

It is our understanding that the collaborative products that we have generated in response to the Council's November 12, 2002 information request relate directly to the issues raised in ISRP document 2001-12A and that Council, Council Staff, the ISRP, and Bonneville understand the relatedness of these processes. Accordingly, we envision this submittal of documents as the initiation of efforts to address the ISRP's request for an independent program review in addition to satisfying the Council's "deliverables" request. Project sponsors believe it is inappropriate to initiate an independent, outside review of programs but will cooperate in such a review when initiated by the Council.

c) Project 199107100 (Shoshone-Bannock Tribes)—Snake River Sockeye Salmon Habitat and Limnological Research

Point #1: The ISRP wrote, "Fundable in part at a reduced level to develop and implement an operational plan based on what they judge can be concluded from the results obtained to date. Further research is not likely to produce substantial additional information in the near future. Results are highly variable, some suggesting a benefit and others no benefit. Stanley Lake is mentioned as a reference location, but the data for that lake are limited to limnological observations."

Sponsor Response to #1: *O. nerka* foraging conditions in the Sawtooth Valley lakes are presently diminished by losses of marine derived nutrients and grazing pressure exerted by nonnative kokanee. At the recommendation of the SBSTOC, nutrient enhancement was undertaken to increase primary and secondary production in the Sawtooth Valley lakes to improve foraging conditions for listed sockeye salmon without negatively altering plankton community structure or changing lake trophic status. During our initial prenutrification consultations with Dr. John Stockner (Canadian Department of Fisheries and Oceans, retired), we identified that maintaining high aesthetic standards (clear water) was another important consideration, as sockeye salmon nursery lakes were situated in the Sawtooth National Recreation Area—an area that receives considerable public recreation pressure.

To maintain these conditions and comply with consent orders issued by the Idaho Department of Environmental Quality, our initial fertilization prescriptions were conservative compared to past practices in British Columbia and Alaska. These "light" applications resulted in relatively subtle trophic responses—particularly in light of variable climatic conditions, *O. nerka* population abundance, and sockeye salmon stocking levels. Impacts from nutrient supplementation at lower trophic levels (light penetration, primary productivity, chlorophyll *a* concentrations, etc.) are unambiguous. However, at higher trophic levels (zooplankton and fish) responses become difficult to detect. This is especially true in the Sawtooth Valley lakes where nonendemic *O. nerka* (kokanee) have become established. Kokanee year class strength is highly variable in these lakes, causing intense intraspecific competition during periods of high abundance.

To illustrate these points, during periods of high kokanee abundance in Pettit and Alturas lakes, we documented a dramatic decline in zooplankton biomass accompanied by a species composition shift from a *Daphnia spp*. dominated community to a *Bosmina spp*. dominated community. With respect to climatic variability, we compared natural nutrient loading in Redfish Lake during drought and normal precipitation years. In 1993 (a normal precipitation year), nitrogen loading was approximately double that for 1992 (a drought year). Phosphorus loading in 1993 was approximately 250% greater than 1992 levels. These examples illustrate how density-dependent rearing conditions and natural climatic variability (beyond our control) can significantly impact lake-rearing environments.

In addition to monitoring limnological variables, *O. nerka* population abundance is monitored each year in the Sawtooth Valley lakes. These data are used to make decisions (at the SBSTOC level) regarding kokanee population control and to determine appropriate stocking rates for individual lakes (allocation between lakes). Kokanee control has been implemented in spawning tributaries at Redfish and Alturas lakes. In Pettit Lake, kokanee spawn in-lake, under ice, so limiting escapement is not a feasible alternative. Lake fertilization is an option we consider to offset potentially limiting conditions, particularly in the short term, when kokanee control efforts have been ineffective.

Considering the conflicting values and variation inherent in aquatic ecosystems (e.g., recreation demand, natural climatic variability, fluctuating *O. nerka* population dynamics, and variable juvenile sockeye salmon reintroduction numbers), the SBSTOC and the Shoshone-Bannock Tribes support the development of annual lake management plans that are based on current fisheries and limnological data (e.g., all of the abiotic and biotic variables we currently monitor). Therefore, it remains our recommendation to continue using an adaptive management approach to develop year-specific plans at the SBSTOC level and avoid the development of a structured multiyear plan. We further recommend continued use of nutrient supplementation when limnological and fisheries data suggest that forage resources are low or over-utilized.

Our data shows that nutrient applications have increased carbon flows through the pelagic ecosystems of these lakes while avoiding shifts in plankton community dynamics. We believe our results demonstrate that, managed in this fashion, the addition of nutrients to sockeye salmon nursery lakes can offset potentially limiting rearing conditions and provide a safer rearing environment for fish reintroduced from the captive broodstock program.

We believe the coordinated efforts of the Redfish Lake Sockeye Salmon Captive Broodstock Program stand as a model example of a fully integrated effort for the Northwest Power and Conservation Council's Fish and Wildlife Program. In addition to applying cutting edge conservation hatchery practices and technically sound fisheries monitoring and evaluation techniques, through our efforts, habitat conditions are being monitored and managed to facilitate the reintroduction of Snake River sockeye salmon in the Sawtooth Valley lakes of Idaho. It is safe to say that without this focus on habitat management, the program would be at risk of overstocking nursery lakes. Simply put, our efforts provide the technical foundation and justification to implement annual sockeye salmon reintroduction plans.

Mainstem and Systemwide Province (ISRP2002-14)

a) Project 199305600 (NOAA Fisheries)—Assessment of Captive Broodstock Technologies

Point #1: The ISRP wrote, "We are concerned about the idea that adults produced through the captive brood program can be released to reproduce with wild fish in natural streams (Idaho stocks only). Our concern is that as a means to reintroduce these stocks to the natural environment, the approach is far too high-risk given the value of these fish and perhaps inappropriate. Given the extent of assessments conducted to date and reported in this proposal, we would recommend an immediate stop to this activity (except on a small research scale) until it can be proven that the strategy has any merit. The only merit we can see to this approach is allowing the animals to participate in mate selection and hopefully to interbreed with other conspecifics. However, a much more responsible approach may have been to develop controlled flow environments (artificial or natural sections of streams) where the animals could be protected. Reintroduction of captive brood fish is a major issue associated with this rearing strategy, but there should be some minimum standard of care taken given the importance of these fish and the investment made by the Basin!"

Sponsor Response to #1: We (the sponsors of project #199305600) do not decide which reintroduction strategies should be implemented. Reintroduction strategies for captive broodstocks are determined by the state and tribal agencies that operate captive broodstock programs for maintenance and recovery of ESA-listed populations. IDFG (1996) has described its rationale for adult-release as part of its "cohort replacement" program for Salmon River spring chinook salmon populations (BPA Project #199700100). Adult release is one of several reintroduction strategies proposed by the Nez Perce Tribe, Confederated Tribes of the Umatilla Indian Reservation, and Washington Department of Fish and Wildlife for Tucannon River spring chinook salmon (BPA Project #200001900). The Stanley Basin sockeye salmon program also practices release of adults into Redfish Lake (BPA Project #199107200).

Research priorities (including research on adult releases) for Project 199305600 have been based on the needs of the agencies operating captive broodstock programs, so that the scientific results can be applied to improve captive broodstock technologies. In February 1999, we solicited advice from the regional state, tribal, and federal managers of captive broodstock programs through the Technical Oversight Committees for Stanley Basin sockeye salmon and Snake River spring chinook salmon. The TOC members rated research on problems associated with adult reproductive performance as one of their highest priorities. The need was re-emphasized in a workshop we recently convened on captive broodstocks for imperiled populations of Pacific salmon in June 2002.

The adult release strategy is specific to captive broodstock programs, and thus research on the topic is not being covered anywhere in the basin, except under this project. The research thus far conducted by NMFS indicates reproductive deficiencies in captively reared adults (Berejikian et al. 1997, 2000, 2001ab), but has also begun to identify mechanisms by which performance might be improved (Berejikian et al., in review). Without the research we have conducted thus far, there would be no published information on the natural reproductive capacity of captively reared Pacific salmon.

The adult release research is being conducted on a small (experimental) scale, as recommended by the ISRP.

Point #2: The ISRP wrote, "The other issue is minor and concerns the wording involved in the inbreeding study. The authors refer to "progeny of mates chosen at random–the control. However, our reading of the design would indicate that simply a random selection of returning adults (which would seem to ignore the use of the DNA pedigree data) would include some level of inbreeding accumulating in the control line. Is this correct or did the authors mean that their control would be composed of nonsibling relationships only? In these lines, these may be better described as an outbred line, which would be an appropriate basis for comparison or control.

Another area where the authors could further contribute to resolving critical uncertainties in the use of captive broodstock and supplementation technology is in the modeling of the timeframe and scale of incurring inbreeding effects via supplementation and captive broodstock programs (decrease in fitness) versus the potentially counterbalancing "cleansing" effect of natural selection on hatchery-produced fish as they become part of a naturally spawning population. Fitness impacts on populations can occur quickly in the hatchery environment (as documented in the literature); however, little information is available on how quickly the accumulated genetic load can be shed by salmon populations as they spawn naturally and local adaptation occurs. The balance between these two processes, including the magnitude of genetic (fitness) change and the timeframes over which they occur, may be the fulcrum upon which the long-term success or failure of these programs hinges. Thus, a major uncertainty is on what timescale can this "readaptation" occur? Is it compatible with our goals for recovery/rebuilding, or does the readaptation process occur so slowly that it represents a constraint on how captive brood and supplementation programs can be used?"

Sponsor Response to #2: The ISRP raise an issue that we failed to clarify adequately. It is our intent and has been our practice to compose the "control" line of individuals mated at random but excluding known full- or half-siblings. This is an appropriate basis for a comparison or control line, but we shall refer to it as an outbred line in future. Having said that, the utility of a randomly mated line with some degree of close inbreeding is not diminished so long as the degree of inbreeding is measured. It is the relationship between the rate of inbreeding and the expression of inbreeding that is important to characterize, and our analysis basically involves comparison of regression lines.

The issue of rate of readaptation is being addressed directly in an independent study, funded by the Hatchery Scientific Review Group, by Mike Ford and Jeff Hard of NMFS and Howard Fuss, Patrick Hulett, and Cameron Sharpe of WDFW on Minter Creek coho salmon (the proposal is attached). The inbreeding component of the captive broodstock project supported by BPA and reviewed here does not address this issue directly, but some of the data on inbreeding and inbreeding depression in the captive and released populations could be used to parameterize selection models during the process of readaptation (genetic data from the study are already being used to seed selection models to look at harvest selection as part of an independent inquiry).

***Point #3*:** The ISRP wrote, “The budget description is again quite limited and includes two points for clarification: what is the 19% Leave surcharge, and why are there costs under Other that again seem to be Indirect charges? The labor charges and cost sharing with NMFS needs clarification, as this issue occurs in a few proposals.”

Sponsor Response to #3: The leave surcharge covers holiday pay and vacation time. The Rents, Communications, and Utilities costs under the “Other category” include: 1) telecommunications for field stations ($12.0K), 2) electricity for seawater pumps, stream channel pumps, filter pumps, and chiller operation at Manchester Research Station ($51.7), 3) site lease for Big Beef Creek ($7.0K), and 4) printing, publication, and reprint charges ($5.0K). The NMFS “in kind” labor contribution covers labor costs for NMFS personnel working on Project 199305600 that are not included in the proposal and therefore not covered by BPA.

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INTERIM STANDARDS FOR THE USE OF CAPTIVE PROPAGATION TECHNOLOGY IN RECOVERY OF ANADROMOUS SALMONIDS LISTED UNDER THE ENDANGERED SPECIES ACT

Introduction

The following information addresses the elements of the *Interim Standards for the Use of Captive Propagation Technology in Recovery of Anadromous Salmonids Listed under the Endangered Species Act* document prepared by the National Marine Fisheries Service, Sustainable Fisheries Division–Hatchery/Inland Fisheries Branch (NMFS 1999).

This section of our composite report address the following program and projects:

Program: Redfish Lake Sockeye Salmon Captive Broodstock Program

Projects: 1990-09-300. University of Idaho. Genetic Analysis of *Oncorhynchus nerka*, Modified to Include Chinook Salmon.

1991-07-100. Shoshone-Bannock Tribes. Snake River Sockeye Salmon Habitat and Limnological Research.

1991-07-200. Idaho Department of Fish and Game. Redfish Lake Sockeye Salmon Captive Broodstock Program.

1992-04-000. NOAA Fisheries. Redfish Lake Sockeye Salmon Captive Broodstock Rearing and Research.

1993-05-600. NOAA Fisheries. Assessment of Captive Broodstock Technologies.

Our response is organized to follow language from the document:

"Managers who plan to sponsor a captive propagation program should proceed through the following steps:"

1. Consider the alternatives to captive propagation and review the guidelines presented in the following sections of this document.

2. Evaluate the status of the population targeted for captive propagation and goals of the proposed program design using the decision issues listed in Table 1.

3. Shape the program proposal using the operational standards outlined in Table 2.

4. Develop a detailed captive propagation plan following the outline in Table 3.

5. Evaluate the proposal against the hazards and benefits listed in Tables 4 and 5.

Table 1. Decision Standards for Using Captive Propagation Technology to Recover Listed Anadromous Salmonids

Table 1. Issue 1. Population Status.

Guideline 1. Population is at a high risk of extinction in the immediate future.

- **a. Population is at very low abundance (e.g., <50 fish a year) OR**
- **b. Population is at low abundance and declining OR**
- **c. Population is at moderate abundance and declining precipitously OR**
- **d. Little or no natural production predicted for at least a full generation.**

Numbers of Snake River sockeye salmon have declined dramatically in recent years. In Idaho, only the lakes of the upper Salmon River (Sawtooth Valley) remain as potential sources of production. Historically, five Sawtooth Valley lakes (Redfish, Alturas, Pettit, Stanley, and Yellow Belly) supported sockeye salmon (Bjornn et al. 1968; Chapman et al. 1990). By 1962, sockeye salmon were no longer returning to Stanley, Pettit, and Yellow Belly lakes (Chapman et al. 1990). Currently, only Redfish Lake receives a remnant anadromous run (Flagg 1993; Flagg and McAuley 1994; Kline 1994; Kline and Younk 1995; Flagg et al. 1996; Kline and Lamansky 1997; Hebdon et al. 2000, 2002, in review; Flagg et al. 2001; Frost et al. 2002; Flagg et al., in review,a).

Historical accounts of sockeye salmon abundance in the Sawtooth Valley are scarce. In the late 1800s, Evermann (1896) made observations on the distribution and abundance of sockeye salmon in Sawtooth Valley lakes. Although not quantitatively described, Evermann reported observing sockeye salmon in Alturas, Pettit, and Stanley lakes. In 1881, over 1,100 kg of sockeye salmon were harvested from Alturas Lake and sold to a nearby mining community. In 1954, an adult sockeye salmon monitoring weir was constructed on the outlet of Redfish Lake (Bjornn et al. 1968). Over a 13-year monitoring period (1954–1966), adult escapement ranged from a low of 11 fish in 1961 to a high of 4,361 fish in 1955. The adult weir was modified and reinstalled in 1985. Over a three-year monitoring period (1985–1987), 11, 29, and 14 adults, respectively, were counted at the structure. Since the inception of sockeye salmon recovery efforts in 1991, the adult weir on Redfish Lake Creek has been operated annually. Since 1990, 16 wild adult sockeye salmon have returned to Redfish Lake Creek.

Waples et al. (1991) described Snake River sockeye salmon as a prime example of a species on the threshold of extinction. In response to a petition submitted by the Shoshone-Bannock Tribes, Snake River sockeye salmon were listed as endangered under the Endangered Species Act on November 20, 1991 (56 FR 58619). The ESA recognizes that conservation of listed species may be facilitated by artificial means while factors impeding population recovery persist (Hard et al. 1992). Often, the only reasonable avenue to build populations quickly enough to avoid extinction is through captive broodstock technology (Flagg and Mahnken 1995; Flagg et al. 1995; Flagg and Nash 1999; Flagg and Mahnken 2000; Flagg et al. 2000; Flagg et al., in review,b; Pollard and Flagg in review). Based on critically low population numbers and the risk of extinction, IDFG in cooperation with NMFS, the Shoshone-Bannock Tribes, Bonneville Power Administration, and others initiated recovery efforts in 1991 (see Flagg 1993; Johnson 1993; Spaulding 1993; Flagg and McAuley 1994; Kline 1994; Johnson and Pravecek 1995, 1996; Kline and Younk 1995; Teuscher and Taki 1995, 1996; Flagg et al. 1996; Kline and Lamansky 1997; Pravecek and Johnson 1997; Taki and Mikkelsen

1997; Pravecek and Kline 1998; Kline and Heindel 1999; Taki et al. 1999; Hebdon et al. 2000, 2002, in review; Lewis et al. 2000; Griswold et al. 2000, 2003; Flagg et al. 2001; Kline and Willard 2001; Kohler et al 2001, 2002; Frost et al. 2002; Flagg et al., in review,b). Consistent with the primary artificial production strategy identified in the Northwest Power Planning Council's 2000 Fish and Wildlife Program (NPPC 2000b), the NMFS 1997 predecisional Snake River Salmon Recovery Plan (Schmitten et al. 1995), basinwide salmon recovery strategies developed by the Federal Caucus (Federal Caucus 2000), guidelines presented in the Council's Artificial Production Review (NPPC 1999), artificial production measures (Section 9.6.4) and Action 177 identified in the FCRPS Biological Opinion (NMFS 2000), and goals, objectives, and strategies presented in Section 5.2 of the Council's Salmon Subbasin Summary (NPPC 2000a), program efforts focus on using captive broodstock technology to protect and rebuild the population. The captive broodstock concept differs from that used in conventional hatcheries in that fish of wild origin are maintained in the hatchery through maturation and spawning (Flagg et al. 1995; Flagg and Nash 1999; Flagg et al., in review,a,b; Pollard and Flagg in review).

Although not without risk, captive broodstock technology is sufficiently advanced to provide the measures necessary to amplify depressed populations and reduce extinction risk (Flagg et al. 1995; Schiewe et al. 1997; Flagg and Nash 1999; Pollard and Flagg in review). Techniques used to culture and spawn sockeye salmon reflect the Region's best science. Program fish culture protocols follow accepted conservation hatchery guidelines developed by Hard (1992), Kapuscinski and Jacobson (1987), NPPC (1999), and Flagg and Nash (1999). For Snake River sockeye salmon, captive techniques may represent the only means of rebuilding population strength and maintaining genetic variability quickly enough to avoid the consequences of inbreeding and possible population extinction.

Coordination of recovery efforts is carried out under the guidance of the Stanley Basin Sockeye Technical Oversight Committee (SBSTOC), a team of technical experts representing the agencies involved in the recovery and management of Snake River sockeye salmon. Further coordination takes place at the Federal level through the ESA Section 10 permitting process.

Project sponsors are also actively involved with ongoing efforts to finalize the Council's Artificial Production Review and Evaluation process and Phase II and III steps in the NMFS/Council Hatchery and Genetic Management Plan process. In addition, project sponsors are actively contributing information to the NMFS Technical Recovery Team process.

Table 1. Issue 1. Population Status
Guideline 2. Population is of very low abundance relative to available habitat and production potential, and short-term supplementation is deemed necessary to accelerate natural recovery.

See response provided for Table 1 Issue 1 Guideline 1 above.

Table 1. Issue 2. Importance of Population
Guideline 1. The population targeted for captive propagation is important, relative to other populations because:

Snake River sockeye salmon were identified as a unique Evolutionarily Significant Unit (ESU) by NMFS in 1991 (Waples et al. 1991). These fish are considered important to the evolutionary legacy of the species, because they are the last remnants of an isolated population that return approximately 1,445 km to the headwaters of the Salmon River in Idaho.

a. Unique genetic qualities.

Sockeye salmon from Redfish Lake have been examined using allozymes (Winans et al. 1996) in context with other sockeye salmon populations of the Pacific Northwest. In that study, Redfish Lake sockeye salmon were found to contain differing allele frequencies that set them apart genetically. Allozymes were also used, in part, as the genetic basis for the listing of the anadromous and residual components of the Redfish Lake population (Waples et al. 1991). More recently, sockeye salmon have been examined using a variety of mitochondrial and nuclear DNA markers (Faler and Powell 2003). Mitochondrial evidence suggests sockeye salmon within the Columbia River Basin comprise a third glacial refugia apart from those thought to have occurred along the coast of British Columbia and the Gulf of Alaska. Sockeye salmon within the basin are further set apart by differences in haplotype frequencies among remaining sockeye salmon populations found in Redfish Lake, Lake Wenatchee, and Okanogan Lake. Within Redfish Lake itself, anadromous sockeye salmon and residual sockeye salmon have significantly different distributions among mitochondrial lineages as compared to the resident kokanee population in Fishhook Creek. Frequencies among microsatellite loci are also significantly different providing genetic evidence for the assertion of both spatial and temporal differences in spawning between sockeye salmon and kokanee in Redfish Lake (Faler and Powell 2003).

b. Unique adaptations to specific habitats (e.g., adaptations in run timing, migration distance, and behavior).

The following excerpt was taken from the 1991 status review of Snake River sockeye salmon (Waples et al. 1991).

"Redfish Lake supports the southernmost sockeye salmon population in the world. Sockeye salmon returning to Redfish Lake also travel a greater distance from the sea (almost 900 miles) and to a higher elevation (6,500 feet) than do sockeye salmon anywhere else in the world. In contrast, sockeye salmon in the Wenatchee and Okanogan river/lake systems spawn at elevations more than 4,000 feet lower. Furthermore, these upper Columbia River populations are in a different ecoregion domain (Humid Temperate Domain) than is Redfish Lake (Dry Domain) (Bailey 1980). Collectively, these data argue strongly for the ecological uniqueness (with respect to sockeye salmon) of the Snake River habitat and make it likely that the population contains unique adaptive genetic characteristics".

c. Low likelihood of successful natural recolonization from other populations in the event of extinction.

Three life history forms of *O. nerka* occur in Redfish Lake: anadromous sockeye salmon, residual sockeye salmon, and resident kokanee. Anadromous and residual sockeye salmon are reproductively isolated from the resident kokanee form. Preliminary results from otolith microchemistry studies (Kline and Lamansky 1997) suggest that anadromous and residual sockeye salmon produce progeny that conform to either anadromous or residual life history strategies. Results from genetic investigations (Brannon et al. 1994; Waples et al. 1997; Faler and Powell 2003) suggest that Redfish Lake resident kokanee (introduced) are genetically distinct from anadromous and residual sockeye salmon.

Sunbeam Dam was constructed in 1910 by the Golden Sunbeam Mining Company. Built on the Salmon River immediately upstream from the confluence of the Yankee Fork of the Salmon River with the Salmon River, the dam remained intact until it was intentionally breached in 1934 (Chapman et al. 1990). Constructed of concrete, stone, and timber, the dam was approximately 30 feet in height, 100 feet in length at the bottom and 300 feet long at the top. The rounded surface of the top crest acted as the spillway. The downstream face of the dam was sloped and acted as a splash apron. The dam diverted water for power production into a supply tunnel located on the north side of the river. The powerhouse supplied electricity to the mine and mill located on nearby Jordan Creek. Power was supplied for one year before the mine and mill property were sold in 1911.

Sunbeam Dam constituted a complete blockage for adult anadromous fish for most of the period between 1911 and 1934. The original fish ladder, operating in 1911, proved to be completely ineffective. In 1919, a redesigned fish ladder was installed. Completed in 1920, the ladder reportedly passed adult sockeye salmon during its first year of operation. Between 1921 and 1934, fish passage via the redesigned ladder was reported as doubtful. In 1931, chinook salmon reportedly began negotiating the abandoned power supply tunnel. In 1934, the rock abutment on the south side of the dam was breached with explosives.

Following the removal of Sunbeam Dam in 1934, sockeye salmon recolonized Sawtooth Valley lakes. Residual sockeye salmon were most likely responsible for refounding the population following the removal of this dam.

Recolonization from “nearest neighbor” populations of anadromous sockeye salmon is unlikely considering the distance between these populations and the Sawtooth Valley in Idaho. The closest anadromous sockeye salmon populations are located on tributaries of the upper Columbia River in Washington and British Columbia.

d. High potential productivity, or unique social, economic, or cultural value.

Relatively little information is available to characterize potential Snake River sockeye salmon productivity. Bjornn et al. (1968) measured smolt-to-adult return (SAR) rates for Redfish Lake sockeye salmon from the mid 1950s to the mid 1960s. During this period, SARs ranged from less than 1.0% to approximately 1.8% (e.g., 18 returning adults for every 1,000 emigrating smolts). Estimated commercial harvest rates on adult sockeye salmon during this period ranged from 2% to as high as 69% and may have significantly impacted reported SARs. Recent paleolimnological investigations indicate that at times as many as 30,000 adults may have spawned in Redfish Lake (Finney, 2001). Spawning and rearing habitat for sockeye salmon in all three program recovery lakes is still in good condition (IDFG and SBT; unpublished data). As such, the SBSTOC and other program cooperators are confident that the potential exists for rapid population rebuilding if SARs increase to replacement, or higher, levels (e.g., greater than approximately 1.8%).

Snake River sockeye salmon have local, regional, and perhaps national, social and cultural significance. Socially, they are a wild Idaho icon and serve as a reminder of how species presence and abundance have changed in the last 50 years. Additionally, Snake River sockeye salmon stand as a key example of what many people consider a focal species to preserve and maintain as part of their heritage. Culturally and economically, Snake River sockeye salmon were once important food source to local communities in central Idaho. Relied on in part to feed mining communities around the turn of the century (late 1800s through early 1900s), they were once abundant enough to consider building a canning industry. The Shoshone-Bannock Tribes treat Snake River sockeye salmon as a culturally important species. Tribal leaders are deeply committed to recovering this unique stock.

Table 1. Issue 3. Scale of Project
Guideline 1. Total captive production should be based on the number of fish needed to:
a. Prevent extinction.

Snake River sockeye salmon captive broodstocks are being maintained at both NOAA Fisheries and IDFG facilities. Groups of fish are reared at two or more facilities to avoid the potential of catastrophic loss of important genetic lineages. IDFG rears captive broodstock groups full term to maturity in fresh well water at its Eagle Fish Hatchery near Boise, Idaho (Johnson 1993; Johnson and Pravecek 1995, 1996; Pravecek and Johnson 1997; Pravecek and Kline 1998; Kline and Heindel 1999; Kline and Willard 2001). NOAA Fisheries rears captive broodstock groups both full term to maturity in fresh well water and from smolt to adult in seawater (Flagg 1993; Flagg and McAuley 1994; Flagg et al. 1996, 2001; Frost et al. 2002; Flagg et al., in review,a). Freshwater well sources are chosen to reduce exposure to pathogens; seawater is filtered and UV-treated for the same reason. All fish are reared in tanks inside secure enclosures, and rearing systems are monitored for security and life support functions.

At the inception of the Redfish Lake Sockeye Salmon Captive Broodstock Program in the early 1990s, the expected performance of captive broodstocks in terms of growth, survival, and reproductive performance had been noted to be variable and often low (Flagg and Mahnken 1995; Schiewe et al. 1997). These factors have been monitored as a gauge of success of the current program compared to earlier attempts with nonlisted fish (Schiewe et al. 1997). During the program, mean survival to adult has ranged from 79-88% for brood year groups of captive brood reared at IDFG facilities and 13-74% for those reared at NOAA facilities. Mean annual egg viability of captive broodstock reared at IDFG facilities has ranged from 29-60% and from 33-78% for those reared at NOAA facilities. Mean weight of spawners at both IDFG and NOAA facilities has often exceeded 2.5 kg, exceeding wild fish weight by more that 60%.

At the initiation of the project, it was recognized that the effective population size for establishment of the captive broodstock was likely to be extremely small. A total of 16 wild fish returned to Redfish Lake subsequent to the ESA listing; all were captured and spawned for the Redfish Lake Sockeye Salmon Captive Broodstock Program. In addition, about 886 smolts and 26 residual sockeye salmon were captured and incorporated in the program. The program currently has first, second, and third generation lineages of these fish in captive broodstock culture.

The captive broodstocks for Snake River sockeye salmon are achieving a high degree of population amplification. The initial sourcing of 5,450 eyed eggs from the spawning of the five wild anadromous female sockeye salmon that returned to Redfish Lake in the 1990s and a few residual juveniles and anadromous smolts has resulted in the production of over 1.15 million progeny (prespawning adults, eyed eggs, presmolts, and smolts) replanted to Sawtooth Valley habitats. To date, the program has generated in excess of 300 returning anadromous adults. It is virtually certain that without the boost provided by these captive broodstocks, Snake River sockeye salmon would have become extinct.

b. Adequately represent genetic variation for life history traits of the wild population.
c. Minimize genetic change during captivity.

The genetic characteristics of the original population are not known. However, the program has trapped all anadromous returning adults, thus making the broodstock used to expand the F_1 generation representative of the genetic variation remaining within the entire population.

Spawning protocols are primarily designed to minimize the risk of inbreeding. Using known pedigrees from captive anadromous returns and from prespawn adults held in the hatchery, males and females are sorted and favorable crosses prioritized. Additionally, genetic analyses are used to aid in the development of spawning designs. Genetic analyses are conducted in “real time” (e.g., genetic data from returning sockeye salmon are provided to hatchery managers within two weeks of capture and before spawning begins). Maternal lineages remaining in the Redfish Lake sockeye salmon population are well characterized and can be distinguished from the other two populations of anadromous sockeye salmon remaining in the Columbia Basin (Lake Wenatchee and Okanogan Lake sockeye) (Faler and Powell 2003). Individuals are crossed so as to maintain the mitochondrial lineages observed in Redfish Lake and to maintain genetic diversity as evidenced in nuclear loci.

Risks to the genetic integrity of the captive population from applied mating designs are assessed through empirical calculations of stability of heterozygosity and genetic diversity over time among spawned, captive Redfish Lake sockeye salmon. Data trends are evaluated as percentage of source (or beginning) heterozygosity and genetic diversity.

Equalization of sockeye salmon captive broodstock family lines retained in the hatchery production group also facilitates the retention of available genetic diversity and heterozygosity as discussed by Allendorf (1993).

d. Reestablish the fish in the wild.

See sponsor response to Table 1 Issue 3 Guideline 1a above and Table 3 Issue 7 Operating Protocol 1 below.

Guideline 2. Duration should be as short as possible (one to three generations).

The exact duration of the Redfish Lake Sockeye Salmon Captive Broodstock Program is unclear and may extend to the recovery date for the population. In the interim, the project is following the recovery goals established by the earlier Recovery Plan (Schmitten et al. 1995) proposed for Snake River salmon that called for multiple generations of captive broodstocks to help maintain and enhance Snake River sockeye salmon while recovery efforts are under way. The proposed plan provided the following delisting criteria for Snake River sockeye salmon:

"For sockeye salmon, the numerical escapement goal is an eight-year (approximately two generation) geometric mean of at least 1,000 natural spawners returning annually to Redfish Lake and 500 natural spawners in each of two other Snake River basin Lakes." These recovery targets were also identified in the *Interim Abundance and Productivity Targets* document produced by NOAA Fisheries in 2002.

Table 1. Issue 4. Measures of Success

Guideline 1. Successful programs will:

a. Substantially reduce risk extinction.

The Redfish Lake Sockeye Salmon Captive Broodstock Program has clearly reduced the extinction risk for this ESA-listed population. This program has made many major efforts to ensure genetic divergence from the original source population is minimized. These efforts include adopting mating protocols that maximize genetic variability and reintroducing juvenile fish to their native environment at a variety of life history stages (eyed-eggs, parr, smolts, and adults) to provide natural selection an opportunity to genetically "retune" the population to the rigors of life in the wild. This approach incorporates older life history stages (e.g., smolts) to ensure at least a portion of the reintroduced fish will survive to the next generation. The reintroduction program also releases maturing fish into Sawtooth Valley lakes to spawn naturally so sexual and natural selection have an opportunity to readapt the population to their native environment. In addition, returning adults are routinely incorporated into the Redfish Lake Sockeye Salmon Captive Broodstock Program as a means to counter the effects of unintended domestic selection that may occur in the culture environment.

For a review of reintroduction efforts (e.g., the number and life stage of reintroductions) and the number of hatchery-produced adults that have returned to the program, see sponsor responses to Table 1 Issue 3 Guideline 1a above and Table 3 Issue 7 Operating Protocol 1 below. Program reintroductions have substantially reduced the risk of extinction.

Mean in-hatchery survival to adult has ranged from 79-88% for brood year groups of captive broodstocks reared at IDFG facilities and 13-74% for those reared at NOAA facilities. Mean annual egg viability of captive broodstocks reared at IDFG facilities has ranged from 29-60% and from 33-78% for those reared at NOAA facilities.

b. Cause minimal genetic change in comparison with the original source population.

c. Reintroduce fish that are phenotypically similar to wild fish of the same age in development, morphology, physiological state, and behavior.

The Redfish Lake Sockeye Salmon Captive Broodstock Program is modeled, to the extent possible, on the population structure, mating protocol, growth, morphology, nutrient cycling, and other biological characteristics of the naturally spawning population. The number of program fish released at each life stage is based on the system's historical carrying capacity for that life history stage. Although fish within the program are mated in a manner to maximize the retention of original genotypes within the population, broodstock adults and hatchery-produced anadromous returns are also released and allowed to mate in a natural manner. Extensive efforts have been made to ensure that the natural behavior, growth, and morphological characteristics of fish taken into culture are maintained. However, the first step in this process is ensuring high in-culture survival. As such, the program relies on traditional fish culture techniques with a proven record of increasing in-culture survival. Additionally, when demonstrated to have no adverse effects on in-culture survival, the program readily adopts novel fish culture technology designed to promote the natural attributes of the fish. The program also uses a wide variety of reintroduction and acclimation strategies as tools to keep program fish close to the natural model.

Adult releases have been used as a tool to allow fish to spawn naturally and produce offspring with fitness for the natural environment. Eyed-egg plants on historic spawning beaches having been employed with this same goal in mind. Unfortunately, most natural release strategies yield very low freshwater survival making it unlikely that enough fish will survive to spawn at the replacement level. Nevertheless, project sponsors are committed to these “natural” release options.

Another approach that has been used to attain the natural model was to rear fish in net pens suspended in Redfish Lake. This provided the fish the opportunity to experience the natural lake environment (background coloration, temperatures, water chemistry, and natural feeds), while remaining protected from predation. It was hoped this experience would help shape the behavior and morphology of these fish to resemble the natural model. The fish were reared in these net pens until late summer when they were released into the lake as presmolts to overwinter and out-migrate as smolts the following spring. This program was suspended when it became clear that overwinter survival of net pen acclimated fish was lower than that of conventional tank-reared fish released in the autumn.

The incorporation of proven seminatural rearing strategies into conventional rearing practices is being considered as a means to produce a more natural product while maintaining the increased survival associated with autumn parr and smolt releases.

All fish in the present anadromous Redfish Lake sockeye salmon population have originated from the indigenous population. The captive broodstock was founded exclusively from Redfish Lake anadromous adults, anadromous smolts, and residual adults. Since the inception of the program in 1991, all wild anadromous adult sockeye salmon returning to Redfish Lake have been incorporated in the captive broodstock. As such, there is no “natural” population to mimic. Adults are released to spawn naturally now but are products of the hatchery program.

Genetic integrity of the captive population from applied mating designs is assessed through empirical calculations of stability of heterozygosity and genetic diversity over time among spawned, captive Redfish Lake sockeye salmon. Genetic monitoring is conducted using allozyme and microsatellite DNA analysis and the generation of kinship coefficients. Equalization of sockeye salmon captive broodstock family lines retained in the hatchery production group has facilitated the retention of available genetic diversity and heterozygosity (Flagg et al., in review,a).

Genetic diversity has been directly correlated with long- term success and persistence of populations (see Avise 1994 for a review). It is the intention of this program to minimize the loss of genetic variation and heterozygosity by utilizing available genetic diversity within the population and crossing available individuals in a breeding strategy to minimize other genetic risks (such as inbreeding).

d. Increase the number of fish reproducing successfully in the wild.

The Redfish Lake Sockeye Salmon Captive Broodstock Program is achieving its near-term goal of building the captive population as a safety net to maintain the gene pool and to prevent extinction. The program is now focusing on producing captive broodstock progeny that can be used in release efforts designed to restore anadromous sockeye salmon runs to the Snake River Basin. The initial sourcing of eggs from the spawning of the five wild anadromous female sockeye salmon that returned to Redfish Lake in the 1990s, several residual sockeye salmon adults, and several hundred anadromous smolts has resulted in the production of over 1.15 million progeny (prespawning adults, eyed eggs, presmolts, and smolts) replanted to Sawtooth Valley habitats (Flagg et al., in review,a).

These efforts have been responsible for the return of seven anadromous adults in 1999, 257 in 2000, 26 adults in 2001, and 22 adults in 2002 to Sawtooth Valley lakes. The majority of these adults have been allowed to spawn volitionally.

Prespawn adult sockeye salmon from the Redfish Lake Sockeye Salmon Captive Broodstock Program were first released to Sawtooth Valley waters in 1993. Since that time, adult releases have occurred in 1994, 1996, 1997, 1999, 2000, 2001, and 2002. For release years 1993, 1994, 1996, and 1997, all prespawn adults released for natural spawning were reared through release (full-term) at IDFG and NOAA Fisheries hatcheries. In 1999, 2000, 2001, and 2002, release groups consisted of full-term hatchery adults and hatchery-produced anadromous adults. Two hundred twenty-nine of the 880 adults that have been released for natural spawning were hatchery-produced anadromous adults.

Prespawn adult and eyed-egg reintroduction strategies have substantially increased unmarked smolt out-migration from Sawtooth Valley lakes. Since 1998, we estimate that in excess of 13,000 unmarked smolts, produced from these strategies, have emigrated from Redfish Lake (IDFG unpublished information).

Table 1. Issue 5. Changing or Terminating Program

Guideline 1. If risk of immediate extinction lessens because causes of decline are corrected, terminate or phase into a conventional supplementation program.

Guideline 2. If program increases numbers of successful natural spawners, increase the proportion allowed to spawn naturally.

Guideline 3. If substantial progress has not been made toward recovery at the end of the end of three complete generations and no progress has been made toward correcting the causes of decline, reevaluate program.

Guideline 4. If negative effects of captive propagation appear, the program should be altered or terminated.

The risk of immediate species extinction has lessened due to the efforts of the Redfish Lake Sockeye Salmon Captive Broodstock Program. However, the causes of decline have not been corrected (parent:progeny ratios are not at or above replacement levels). Negative effects associated with captive hatchery intervention have not been observed to date. Hatchery outcomes (e.g., growth, survival, gamete quality, and reproductive success) continue to be monitored and reviewed at the SBSTOC level.

Table 2. Operational Standards for using Captive Propagation Technology to Recover ESA-Listed Anadromous Salmonids

Table 2. Issue 1. Choice of Broodstock.

Guideline 1. If all remaining individuals of the population of wild fish targeted for recovery are not incorporated in the captive broodstock, develop a broodstock selection protocol to ensure that the genetic and life history variability of the target population is reflected in the captive broodstock.

Broodstock development using wild Redfish Lake sockeye salmon has included anadromous adults, residual adults, and out-migrating smolts. Wild sockeye salmon represent the potential infusion of new genetic diversity into the breeding program. Since 1991, all 16 wild anadromous adult sockeye salmon that returned to the Sawtooth Valley have been incorporated into the breeding program. Residual sockeye salmon adults (26) were captured and used to develop broodstocks in 1992, 1993, and 1995. Wild out-migrating smolts from Redfish Lake were captured in 1991-1993, reared through maturation at the IDFG Eagle Fish Hatchery, and selectively incorporated in the breeding program. During these collection years, 886 out-migrating smolts were captured and transferred to the Eagle Fish Hatchery (Table 1).

Table 1. Redfish Lake Sockeye Salmon Captive Broodstock Program broodstock collection history.

Collection year	Anadromous adults	Residual adults	Smolts
1991	4 (3 male, 1 female)		759
1992	1 male	5 (4 male, 1 female)	79
1993	8 (6 male, 2 females)	18 (16 males, 2 females)	48
1994	1 female		
1995		3 males	
1996	1 female		
1997			
1998	1 male		
1999			
2000			

Guideline 2. Continual infusion of wild fish into successive year classes of the broodstock may slow domestication of captive propagated fish.

Since the inception of the program in 1991, all wild anadromous adults have been incorporated in the breeding program. As mentioned above, 26 residual sockeye salmon adults and 886 wild sockeye salmon smolts have also been incorporated in the broodstock.

Fish released from the Redfish Lake Sockeye Salmon Captive Broodstock Program have produced returning adults that have been filtered through the natural environment for most of their lifecycle. The program has established the guideline that a significant proportion of these returning adults be incorporated into the broodstock to counteract the effect of any unintentional domestic selection that may be occurring.

Currently, there are no plans to incorporate additional residual sockeye salmon or out-migrating smolts in the broodstock program. All other anadromous, returning adults are trapped, genetically identified to determine relatedness, and either incorporated in a spawning matrix to maintain genetic diversity or released to spawn volitionally.

Table 2. Issue 2. Captive Broodstock Spawning.

The guidelines the program has established for captive broodstock spawning incorporate the “best practice” genetic advice for maintaining the population’s original genetic diversity. These guidelines include: 1) equal representation of all family lines in spawning, 2) retrieving all possible eggs from mature females, 3) using spawning protocols that maximize the genetic effective population size, 4) using factorial spawning designs, 5) using cryopreserved sperm, and 6) using induced spawning to maximize reproduction. The purpose of these guidelines is to maintain as much of the natural genetic variation in the population as possible.

Guideline 1. Spawn all available adults.

Every effort is made to spawn all available adults. Eggs produced at spawning are divided into three lots (by female) and fertilized with sperm from three males (factorial design) to produce three unique subfamilies. Male contribution is subsequently equalized as each male is used to fertilize eggs from three different females (on average).

Guideline 2. Retrieve all possible eggs from mature females, either by multiple live spawnings or through careful attention to ripeness and handling.

Female ripeness is assessed two to three times per week as spawning progresses. Females are anesthetized and gently handled to assess the onset of ovulation. All female sockeye salmon are euthanized at spawning. Every effort is made to remove all potentially viable eggs from the body cavity of each fish.

Guideline 3. Use spawning protocols that maximize the effective genetic population size:

a. Factorial or (with greater numbers of parents) single-pair matings.

Spawning has occurred each year since the inception of the program in 1991 (see Flagg 1993; Johnson 1993; Flagg and McAuley 1994; Johnson and Pravecek 1995, 1996; Flagg et al. 1996; Pravecek and Johnson 1997; Pravecek and Kline 1998; Kline and Heindel 1999; Flagg et al. 2001; Kline and Willard 2001; Frost et al. 2002; Flagg et al., in review,a). The IDFG is required by NMFS Permit No. 1120 to discuss proposed broodstock spawning matrices with NMFS Conservation Biology Division and Resource Enhancement and Utilization Technology Division staff prior to implementation. In addition, proposed spawning plans are reviewed at the SBSTOC level. Sockeye salmon spawning follows accepted, standard practices as described by McDaniel et al. (1994) and Erdahl (1994). Timing of spermiation and ovulation is judged during routine sorting procedures. Females judged “ready” for spawning on any spawn date are separated from the general population. The family origin (lineage) of ovulating females is identified by PIT tag code. Based on the approved spawning design, appropriate, spermiating males are located and isolated in separate holding ponds. Generally, eggs produced at spawning are divided into three lots (by female) and fertilized with sperm from three males (factorial design) to produce three unique subfamilies. Sperm motility is periodically checked. Male contribution is subsequently equalized as each male is used to fertilize eggs from three different females (on average). Eggs are incubated by subfamily to produce lineage-specific groups for reintroduction under different strategies and to produce fish to meet future broodstock needs. Hatchery outcomes from annual spawning events are summarized at the subfamily level, evaluated, and discussed at the SBSTOC level. Variables routinely evaluated include maturation rate, fecundity, gamete quality, egg size, sperm motility, egg survival to the eyed stage of development, and proportion of anomalies in resultant fry. Adaptively managed, program spawning protocols are adjusted to maximize program success.

b. Cryopreserved sperm (benefits of using cryopreserved sperm should be weighed against potential for loss of viability, especially when the number of eggs is low).

Cryopreservation of milt from male donors has been used in the Redfish Lake Sockeye Salmon Captive Broodstock Program since 1991 and follows techniques described by Cloud et al. (1990) and Wheeler and Thorgaard (1991). Beginning in 1996, cryopreserved milt was used to produce specific lineage broodstocks for use in future spawn years. “Designer broodstocks,” produced in this manner, will increase the genetic variability available in future brood years. Periodically, fertilization trials are conducted to check the efficacy of cryopreserved milt (note: fresh milt from kokanee and cryopreserved sockeye salmon milt are used to fertilize common kokanee egg lots).

c. Induced spawning.

Hormone analog implants (GnRHa) may be used by NOAA Fisheries and IDFG personnel to induce ovulation and sperm production in maturing sockeye salmon. In addition, hormone treatments may be used to synchronize ovulation and spermiation in captive adults.

Table 2. Issue 3. Rearing of Fish.

Redfish Lake sockeye salmon captive broodstocks are being maintained by both NOAA Fisheries and IDFG. Groups of fish are reared at two or more facilities to avoid the potential of catastrophic loss of important genetic lineages. IDFG rears captive broodstock groups full term to maturity in fresh well water at its Eagle Fish Hatchery near Boise, Idaho (Johnson 1993; Johnson and Pravecek 1995, 1996; Pravecek and Johnson 1997; Pravecek and Kline 1998; Kline and Heindel 1999; Kline and Willard 2001). NOAA Fisheries rears captive broodstock groups both full term to maturity in fresh well water and from smolt to adult in seawater (Flagg 1993; Flagg and McAuley 1994; Flagg et al. 1996; Flagg et al. 2001; Frost et al. 2002).

The Redfish Lake Sockeye Salmon Captive Broodstock Program’s principal guiding tenets are to maintain the population’s natural traits by maximizing in-culture and post-release survival, minimize potential negative impacts of hatchery culture, and minimize genetic divergence from the native population. Other program guidelines are modified as necessary (at the SBSTOC level) to remain consistent with the principal guidance protocols. As an example, the program initially established the guideline that reintroduced fish would be reared in net pens established in Redfish Lake so they could experience the light, cover, substrate, diet, and temperature conditions of their natural lacustrine environment (Johnson 1993; Johnson and Pravecek 1995, 1996; Pravecek and Johnson 1997; Pravecek and Kline 1998; Kline and Heindel 1999; Kline and Willard 2001). However, this guideline was amended when it was recognized that fish reared in a conventional manner in standard hatchery tanks overwintered and out-migrated significantly better than net pen reared fish.

Fish husbandry protocols follow standard fish culture practices (for a general overview of methods, see Leitritz and Lewis 1976; Piper et al. 1982; Rinne et al. 1986; Erdahl 1994; IHOT 1995; McDaniel et al. 1994; Bromage and Roberts 1995; Schreck et al. 1995; Pennell and Barton 1996; NMFS 1999; Wedemeyer 2001) and other protocols and guidelines approved by the SBSTOC to ensure high quality rearing conditions. Considerable coordination takes place between NOAA Fisheries and IDFG culture experts and at the SBSTOC level. Fish sample counts are conducted as needed to ensure that actual growth tracks with projected growth. In general, fish are handled as little as possible. Age-0 through age-2 sockeye salmon rearing densities are maintained at levels not to exceed 0.5 lbs/ft^3 (8 kg/m^3). Rearing tanks are managed for a minimum of 1½ water exchanges per hour. All water use is single pass. Shade covering (70%) and jump screens are used where appropriate. Incubation and rearing water temperature is maintained between 7.0°C and 13.5°C at the IDFG Eagle Fish Hatchery and 5.0°C and 10.0°C at the NOAA Fisheries Burley Creek Fish Hatchery. Chilled water may be used during incubation and early rearing to even out development and growth differences that may result from a protracted spawning period. In addition, chilled water may be used to manipulate development and growth to more closely follow a natural profile. Sockeye salmon greater than age-1 are generally maintained on chilled water through maturation. Rearing water temperature varies as a function of demand but is generally maintained between 7.0°C and 11.0°C at NOAA Fisheries and IDFG facilities.

Fish are fed a commercial diet produced by Bio-Oregon, Inc. (Warrenton, Oregon) or Moore-Clark (Bellingham, Washington). Rations are weighed daily and follow suggested feeding rates provided by the manufacturer(s). Bio-Oregon developed a custom broodstock diet that includes elevated levels of vitamins, minerals, and pigments. Palatability and levels of natural pigments are enhanced by the addition of natural flavors from fish and krill. Through approximately 100 g weight, fish receive a standard Bio-Oregon semimoist formulation or Moore-Clark dry diet. Beyond 100 g weight, fish receive the Moore-Clark salmon broodstock diet or the Bio-Oregon custom broodstock diet.

Guideline 1. As much as possible, mimic wild rearing conditions (light, cover, substrate, flow, temperature, densities) for fish to be released in the wild.

Sockeye salmon are generally incubated in darkness, and incubation and rearing densities do not exceed 0.5 lbs/ft^3 (8.0 kg/m^3) for most of the rearing cycle. Shade cover is always available to fish in the primary captive broodstock program. In most cases, the program does not use natural-like habitat during culture or rear fish in variable higher velocity habitat. The latter is probably not relevant to sockeye salmon that rear naturally in low velocity lake habitat. The fish are fed by hand or automated feed delivery systems, rather than demand feeders. No fish in the program are exposed to predator training. Fish-human interactions are generally minimized. Fish have been acclimated in net pens suspended in Redfish Lake prior to release in some instances. Volitional emigration has not been used to date, as most fish rearing is done at offsite locations. However, smolts produced from presmolt releases, eyed-egg plants, or from the release of prespawn adults naturally emigrate from nursery lakes.

Guideline 2. Facilities for freshwater rearing should have pathogen- and predator-free water supplies.

In order to maximize survival and reduce fish health risks, the program utilizes water supplies that are pathogen and predator free. However, this guideline may be modified so that fish scheduled for reintroduction (smolt releases) can be cultured in surface water supplies to provide prerelease acclimation, modulate growth, and potentially increase the potential for homing. Backup and system redundancy are in place for degassing, pumping, and power generation.

Guideline 3. Fish being transferred to seawater for rearing or release should be handled so as not to compromise their ability to adapt to seawater.

The Redfish Lake Sockeye Salmon Captive Broodstock Program primarily rears sockeye salmon from swim-up through maturation full-term on freshwater. However, a small seawater rearing program is maintained at the NOAA Fisheries Manchester Research Station located on Puget Sound to produce fish primarily for the prespawn adult reintroduction strategy.

Fish are handled with extreme care and kept in water to the maximum extent possible during transport and processing procedures. Transportation of smolts to seawater occurs in insulated containers and temperature is not allowed to rise more than 2°C. The transport containers are supplied with a continuous oxygen supply that maintains dissolved oxygen at full saturation. The containers are loaded at no more than 0.5 lbs/gallon (59.7 kg/m^3). Smolts are transitioned to seawater in tanks filled with pathogen-free freshwater. Full strength processed seawater is gradually added until all the freshwater has been displaced (an 8-12 h process).

Guideline 4. Seawater-based rearing facilities should minimize the effects of storms, harmful phytoplankton, predation, poaching, and disease.

Seawater rearing is being conducted at the NOAA Fisheries Manchester Research Station located on Puget Sound. A secure land-based seawater captive broodstock rearing complex houses 400 m^2 of floor space for fish rearing tanks in one building, and 1,280 m^2 in another. A major advantage of the site is the excellent seawater quality. Annual seawater temperature at the site normally ranges between 7-13°C, and salinity ranges between 26-29 ppt. A 700 m long pipeline from the end of the pier supplies about 1,250 gpm of pumped seawater to the Station's land-based facilities. The 400 m^2 seawater laboratory contains six 4.1 m, four 3.7 m, and six 1.8 m diameter circular fiberglass tanks. The 1,280 m^2 facility houses 20 6.1 m diameter circular fiberglass tanks. The seawater supplied to these tanks is processed to prevent naturally occurring pathogens from entering the rearing tanks. Incoming seawater is filtered down to a 5.0 micron particulate size and passed through UV-sterilizers to inactivate remaining organic material. Sensors monitor water flow and pressure through the seawater filtration/sterilization system. Before entering fish rearing tanks, the processed seawater is passed through packed column degassers to strip out any excess nitrogen and to boost dissolved oxygen levels. An emergency generator is automatically activated in the event of a power failure. In addition, the tanks are directly supplied with oxygen to maintain life support in the event of an interruption in water flow. Tanks where maturing fish are held are supplied with combinations of ambient and chilled water. The Station complies with Washington State Department of Fish and Wildlife quarantine certification standards by depurating all effluent from the captive broodstock rearing areas with ozone.

Guideline 5. Managers should consider equalizing the contribution of all parents to the next generation to maximize effective population size and reduce artificial selection in the captive environment.

The contribution of parents is equalized in several ways. First, males and females are crossed in a factorial design such that the contribution of any particular male or female is spread amongst several crosses. This serves to decrease the loss of contribution from an individual if there is catastrophic loss to the egg lot or if the cross is less successful (fertility is low) than others. Second, numbers of eggs and the amount of sperm is equalized for each factorial cross (each females eggs are evenly divided and fertilized with sperm from three separate males). Third, each lot of eggs or family line is tracked with a pedigree; successfully fertilized eggs are sorted, and equal numbers of offspring representing male or female components in each family line are retained for broodstock. Excess numbers of individuals are released and their genetic component tracked upon their return.

Table 2. Issue 4. Release of Fish.

Guideline 1. Release fish at a life stage and size where their probability of survival to adulthood is greatest.

Since the inception of the program in 1991, the development of egg and fish reintroduction plans has followed a “spread-the-risk” philosophy incorporating several release strategies and multiple lakes. Release strategies were developed by SBSTOC cooperators and reflect tested techniques applied in the commercial aquaculture field as well as in state, provincial, and federal agency programs. Progeny produced at Eagle Fish Hatchery and at NOAA Fisheries facilities are reintroduced to Sawtooth Valley waters at different life history stages using a variety of release options including: 1) eyed-egg releases to lake incubator boxes, 2) presmolt releases direct to lakes, 3) presmolt releases to Redfish Lake following net pen rearing, 4) smolt releases to outlet streams and to the upper Salmon River, and 5) prespawn adult releases direct to lakes. Out-migrant monitoring and evaluations are conducted annually to determine the relative success of the various release strategies employed by the program (Hebdon et al., in review). Adaptively managed, results are used to help shape the development of future release plans. The SBSTOC plays a major role in this process.

Guideline 2. Acclimate fish to locations in the watershed where they are intended to return.

Eyed-egg, prespawn adult, and presmolt release options produce juvenile sockeye salmon that experience acclimation time in Sawtooth Valley sockeye salmon nursery lakes. Acclimation time varies from approximately seven months for presmolt release groups planted in rearing lakes in October of their first year of life and out-migrating at age-1 to approximately 26 months for fish produced from eyed-egg or prespawn adult release options that out-migrate from rearing lakes at age-2.

In addition to the release strategies described above, juvenile sockeye salmon may be released to receiving waters as full-term smolts. Smolt rearing for this program currently occurs at the IDFG Sawtooth Fish Hatchery (located in the Sawtooth Valley). Age-0 sockeye salmon are transferred from inside vats supplied with well water to outside raceways supplied with upper Salmon River water approximately eight months in advance of release.

Guideline 3. Design release strategies to integrate fish from captive propagation programs with wild fish at the same life history stage, if any remain in the natural system.

Eyed-egg, prespawn adult, presmolt, and smolt release options successfully integrate hatchery-origin fish with wild fish. Progeny produced from eyed-egg and prespawn adult releases hatch in natural rearing environments and, therefore, integrate with natural fish immediately after hatch. Presmolt releases occur when fish are approximately eight months in age. Presmolts typically spend one to two winters in rearing lakes before emigrating at age-1 or age-2. Smolt releases are scheduled to coincide with the peak emigration window of fish that volitionally leave the system.

Guideline 4. When fish are likely to remain in the release area (for example presmolts or residuals), disperse the releases.

Juvenile out-migrants produced from eyed-egg, prespawn adult, and presmolt releases integrate with wild/natural fish and emigrate from nursery lakes volitionally. Smolt releases are managed to disperse out-plants between two sites (Redfish Lake Creek and the upper Salmon River). If large numbers of smolts are available to plant, releases are spread out over a period of days.

However, program data suggest that hatchery-produced, juvenile sockeye salmon do not delay their downstream migration. Generally, median travel time to Lower Granite Dam (747 km downstream) for all release strategies is less than 15 d (Kline 1994; Kline and Younk 1995; Kline and Lamansky 1997; Hebdon et al. 2000, 2002, in review).

Guideline 5. Use release protocols that minimize stress caused by handling, transportation, or new surroundings.

Every effort is made to minimize impacts to fish associated with handling, transportation, and release. Containers used to transport fish vary by task. In all cases, containers of the proper size and configuration are used for the task at hand. Fish are maintained in water of the proper quality (temperature, oxygen, chemical composition) during handling and transfer phases of transportation. Transport trucks equipped with 300 gal (1,136 L) to 2,500 gal (9,463 L) tanks are available to the program. Each transport vehicle is equipped with oxygen and fresh flow systems. Drivers are instructed to make regular stops to check fish status, oxygen and fresh flow systems, and water temperature.

Guideline 6. Minimize negative interactions with other species in the watershed.

The IDFG and NOAA Fisheries have implemented fish culture programs that emphasize the prevention and control of infectious disease. Preliberation fish health monitoring occurs to ensure that presmolts and smolts released to Sawtooth Valley waters meet accepted fish health criteria. As such, the potential impacts from disease transfer are not expected to jeopardize the continued existence of listed (and other) species present in the project area.

Competition between hatchery-reared sockeye salmon and other species is not expected to jeopardize their continued existence.

Hatchery-reared sockeye salmon have the potential to prey on other species, but the impact is expected to be minimal.

Table 2. Issue 5. Management of Returning Adults.

Guideline 1. If the program meets all other guidelines, there is no general restriction on the proportion of hatchery fish of this stock on the spawning grounds of the population targeted for recovery for the first three generations. Individual projects may limit the proportion of hatchery fish spawning naturally depending on the details specific to the project.

Since the inception of this program in 1991, all wild anadromous sockeye salmon captured at Sawtooth Valley weirs have been incorporated in the hatchery breeding program. In addition, several residual sockeye salmon were trapped between 1992 and 1995 and incorporated in the breeding program. Residual sockeye salmon spawn in the same locations and at the same time as the anadromous form. The Shoshone-Bannock Tribes and the IDFG have conducted residual sockeye salmon spawning surveys since 1993. Numbers of residual sockeye salmon observed during these surveys have ranged from zero fish to more than 50 fish. Between 1999 and 2002, less than 10 residual sockeye salmon have been observed annually. While it remains possible that a small wild residual sockeye salmon component still exists in Redfish Lake, our ability to differentiate wild from hatchery-origin residuals has been lost. Residuals should be considered the same population as anadromous sockeye and components of the Snake River ESU, which has only one extant population. To be able to differentiate between residuals and anadromous sockeye would show an emphasis on the separation of these two subsets based solely upon a decrease in random mating, which naturally occurs as a result of life history variation. From a programmatic standpoint, residual gene pools have not been incorporated into the broodstock program for anadromous adults (they have not been crossed with anadromous returns). This strategy was deemed appropriate, since there is evidence the residual life history pattern may have a genetic component to it, and the emphasis on the program is to increase the number of returning anadromous adults.

Prespawn adult sockeye salmon from the Redfish Lake Sockeye Salmon Captive Broodstock Program were first released to Sawtooth Valley waters in 1993. Since that time, adult releases have occurred in 1994, 1996, 1997, 1999, 2000, 2001, and 2002. For release years 1993, 1994, 1996, and 1997, all prespawn adults released for natural spawning were reared through release (full-term) at IDFG and NOAA Fisheries hatcheries. In 1999, 2000, 2001, and 2002, release groups consisted of full-term hatchery adults and hatchery-produced anadromous adults.

Guideline 2. Non-ESU hatchery fish from other programs should not exceed natural levels of straying between the populations in question or constitute more than approximately one percent of total abundance if natural rates of straying are not known.

No non-ESU sockeye salmon from other hatchery programs are expected to stray from the upper Columbia River to the Sawtooth Valley of Idaho. Genetic monitoring of all returning adults has not indicated any out-of-basin strays. Pedigree and kinship analysis of all returning adults eliminates the possibility of contribution by strays unless trapping is at less than 100%.

Table 2. Issue 6. Other Disposition of Fish.

Guideline 1. Monitoring and evaluation of fish in captive propagation will include (at a minimum):

a. Survival at life history stages up to adulthood.
b. Viability of gametes produced in captivity.
c. Behavior, morphology, and viability and reproductive success of offspring produced in captivity.

Hatchery outcomes from annual spawning events are summarized at the subfamily level, evaluated, and discussed at the SBSTOC level. Variables routinely evaluated include maturation rate, fecundity, general gamete quality, egg size, sperm motility, egg survival to the eyed stage of development, and proportion of anomalies in resultant fry. Adaptively managed, program spawning protocols are adjusted to maximize program success. The success of these protocols is monitored by tracking subfamilies and families using pedigree information and real-time genetic analysis of returning adults.

Mean survival to adult has ranged from 79-88% for brood year groups of captive brood reared at IDFG facilities and 13-74% for those reared at NOAA facilities. Mean annual egg viability of captive broodstock reared at IDFG facilities has ranged from 29-60% and from 33-78% for those reared at NOAA facilities. Mean weight of spawners at both IDFG and NOAA facilities has often exceeded 2.5 kg, exceeding wild fish weight by more than 60% (Flagg et al., in review,a).

Behavior and morphology of offspring produced in captivity has not been monitored. However, if atypical behavior or morphology is observed, events or situations are documented.

Guideline 2. Monitoring and evaluation of offspring released to the wild will include:

a. Survival and migration success.

Out-migrant monitoring and evaluations are conducted annually to determine the relative success of the various release strategies employed by the program (Kline 1994; Kline and Younk 1995; Kline and Lamansky 1997; Hebdon et al. 2000, 2002, in review). Adaptively managed, results are used to help shape the development of future release plans. The SBSTOC plays a major role in this process.

To estimate *O. nerka* out-migrant run size from Redfish, Alturas, and Pettit lakes, IDFG personnel (in cooperation with Shoshone-Bannock Tribe personnel) operate smolt traps on Redfish Lake Creek and on the upper Salmon River at the IDFG Sawtooth Fish Hatchery. In addition, the Shoshone-Bannock Tribes operate smolt traps on Alturas Lake and Pettit Lake creeks. Trapping activities are coordinated through the SBSTOC. Wild out-migrant sockeye salmon captured at trap sites are anesthetized in buffered MS222 (Tricaine Methane Sulfonate), measured for fork length, weighed, and injected with PIT tags. Hatchery out-migrants (identified by the absence of adipose fins) captured at trap sites are anesthetized in this same manner and scanned for PIT tags. PIT-tagged hatchery out-migrants are measured for fork length and weighed as for wild out-migrants. Non-PIT-tagged hatchery out-migrants may be PIT tagged at this time. All captured sockeye salmon out-migrants are held in flow-through, low velocity, live boxes at their respective trap sites and released approximately one-half hour after sunset.

Trapping efficiency is determined by releasing PIT-tagged wild and hatchery-produced out-migrants upstream for subsequent recapture. Total emigration or out-migration run size is estimated for specific intervals within the total period of out-migration. Intervals are defined as periods of out-migration with similar stream discharge and recapture efficiency. Seasonal out-migrant run size and 95% confidence intervals are estimated using maximum likelihood and profile likelihood estimators developed by Steinhorst et al. (in review). Estimates are generated separately for wild/natural and hatchery-produced fish.

Estimates of out-migration are developed by broodstock program release strategy at Redfish, Alturas, and Pettit lake trap sites. Out-migration estimates by release location and release strategy are also developed at Lower Granite Dam. PIT tag interrogation data for Lower Granite Dam is retrieved from the Columbia River Basin PIT Tag Information System (PTAGIS). Median travel times to Lower Granite Dam are calculated (where possible) for wild/natural and hatchery-produced sockeye salmon.

Because systems operations and fish handling potentially differ by date, arrival times to Lower Granite Dam are compared for wild/natural and hatchery-produced progeny (by release strategy) using two sample Kolmogorov-Smirnov tests (α = .05), (Sokal and Rohlf 1981). If travel times differ between evaluation groups, results of subsequent statistical tests are qualified. Multiple, chi-square goodness of fit tests (α = .05) are used to compare PIT tag interrogation data at lake outlet trapping locations and at Lower Granite Dam (Zar 1974). A priori power analysis for differences between proportions was conducted to determine PIT tag sample size (Cohen 1989).

Presmolt releases represent the primary component of the reintroduction effort accounting for more fish released than all other release options combined. Overwinter and out-migration survival comparisons between net pen and direct-lake presmolt release groups have been conducted for five years. In four of the five years of investigation, out-migrants produced from the fall direct-lake release option overwintered and out-migrated significantly better to the trapping facility on Redfish Lake Creek than fish released to Redfish Lake from a net pen rearing environment (Hebdon et al., in review). Fish produced from the fall direct-lake release also had significantly higher recapture rates at downstream dams in three of the five investigation years. Presmolts released to Pettit and Alturas lakes in the fall overwintered and out-migrated significantly better than summer-released groups (Hebdon et al., in review).

b. Ability to return to hatchery or natural spawning areas.

Two adult traps are used to capture returning anadromous sockeye salmon in the Sawtooth Valley. The first trap is located on Redfish Lake Creek approximately 1.4 km downstream from the outlet of Redfish Lake. The second trap is located on the upper Salmon River at the Sawtooth Fish Hatchery weir. Anadromous adults are transferred from trap sites to inside vats at the IDFG Sawtooth Hatchery for temporary holding. Adults may be marked with temporary tags to identify return location and timing. In addition, fin tissue may be sampled to facilitate genetic investigations. Based on recommendations from the SBSTOC, adults are transferred to lakes for natural spawning or to the Eagle Fish Hatchery to be incorporated in the captive breeding design.

The IDFG and NOAA Fisheries captive broodstock programs have produced in excess of 860,000 presmolts, 158,000 smolts, 880 adults, and 325,000 eyed-eggs for reintroduction to waters in the Sawtooth Valley . An estimated 310,000 sockeye salmon smolts have been produced through these releases. To date, 312 hatchery-produced, anadromous adults have returned from this production.

c. Ability to successfully produce offspring in the wild.

The program uses two release strategies that could successfully produce (from hatch) offspring in the wild.

In 1995, the SBSTOC recommended that IDFG incorporate an eyed-egg planting strategy (and evaluation) into the annual program release design. With subsequent NOAA Fisheries approval through the Section 10 permit process, this strategy was first implemented in 1996. Eggs destined for this release option are produced at the IDFG Eagle Fish Hatchery and the NOAA Fisheries-operated Burley Creek Hatchery in Washington State. A complete history of eyed-egg plants and estimated hatch results is presented in the following table (Table 2).

Table 2. Redfish Lake Sockeye Salmon Captive Broodstock Program eyed-egg release history and estimated hatch results.

Release year	Release location	No. of eggs planted	Estimated hatch
1996	Redfish Lake	105,000	97%
1997	Redfish Lake	85,378	98%
	Alturas Lake	20,389	72%
1999	Pettit Lake	20,311	74%
2000	Pettit Lake	65,200	79%
2002	Pettit Lake	30,924	97%
	Total	327,202	

Prespawn adult sockeye salmon from the Redfish Lake Sockeye Salmon Captive Broodstock Program were first released to Sawtooth Valley waters in 1993. Since that time, adult releases have occurred in 1994, 1996, 1997, 1999, 2000, 2001, and 2002. For release years 1993, 1994, 1996, and 1997, all prespawn adults released for natural spawning were reared through release (full-term) at IDFG and NOAA Fisheries hatcheries. In 1999, 2000, 2001, and 2002, release groups consisted of full-term hatchery adults and hatchery-produced anadromous adults. Prior to releasing adults for natural spawning, a subset of adults are fitted with ultrasonic or radio transmitters to facilitate tracking and spawning evaluations. A complete history of prespawn adult plants is presented in the following table.

Table 3. Redfish Lake Sockeye Salmon Captive Broodstock Program prespawn adult release history and estimated redd construction results.

Release	Rearing origin	Date	Number	Number of suspected redds

Lake		released	released	observed
Redfish	Full-term hatchery	1993	20	
Redfish	Full-term hatchery	1994	65	One behavioral observation
Redfish	Full-term hatchery	1996	120	30 suspected redds
Redfish	Full-term hatchery	1997	80	30 suspected redds
Pettit	Full-term hatchery	1997	20	1 suspected redd
Alturas	Full-term hatchery	1997	20	Test digs only
Redfish	Full-term hatchery	1999	18	8 suspected redds
	Hatchery-produced anadromous	1999	3	
Redfish	Full-term hatchery	2000	46	20 to 30 suspected redds
Redfish	Hatchery-produced anadromous	2000	120	
Pettit	Full-term hatchery	2000	0	Redds suspected but not visible
Pettit	Hatchery-produced anadromous	2000	28	
Alturas	Full-term hatchery	2000	25	14 to 19 suspected redds
Alturas	Hatchery-produced anadromous	2000	52	
Redfish	Full-term hatchery	2001	65	12 to 15 areas of excavation observed
Redfish	Hatchery-produced anadromous	2001	14	
Redfish	Full-term hatchery	2002	178	10 areas of excavation observed
Redfish	Hatchery-produced anadromous	2002	12	
		Total	880	

Captive propagation operation plans should follow the outline provided in Table 3.

Table 3. Outline of a Captive Propagation Operation Plan

Table 3. Issue 1. Captive Propagation Program Description.

1. **Name of Program.**

   Redfish Lake Sockeye Salmon Captive Broodstock Program.

2. **Stock and species to be propagated.**

   Snake River sockeye salmon—Redfish Lake stock.

3. Names of the accountable organization and individuals.

Virgil Moore, Bureau of Fisheries Chief
Idaho Department of Fish and Game
600 S. Walnut St., P.O. Box 25
Boise, ID 83703

Dr. Walton W. Dickhoff, Acting Division Director
National Marine Fisheries Service
Northwest Fisheries Science Center
Resource Enhancement and Utilization Technology Division
2725 Montlake Blvd East
Seattle, Washington 98112-2097

Nancy Murillo, Business Council Chairperson
Shoshone-Bannock Tribes
P.O. Box 306
Fort Hall, ID 83203

Dr. Madison S. Powell
Center for Salmonid and Freshwater Species at Risk
University of Idaho / HFCES
3059F National Fish Hatchery Road
Hagerman, ID 83332

4. Location of program and extent of target area.

Sawtooth Valley, Idaho. Redfish, Alturas, and Pettit lakes.

5. Program goals.

The ultimate goal of Redfish Lake Sockeye Salmon Captive Broodstock Program is to reestablish sockeye salmon runs to Sawtooth Basin waters and to provide for utilization of sockeye salmon resources. In the near term, the program goal is to maintain genetic resources unique to Snake River sockeye salmon and to prevent species extinction while long-term solutions in smolt-to-adult survival are sought. The IDFG and the Stanley Basin Sockeye Technical Oversight Committee (SBSTOC) have agreed to adhere to a program of prudent broodstock management to minimize inbreeding and the potential influence of domestication.

6. Expected duration of program.

The exact duration of the Redfish Lake Sockeye Salmon Captive Broodstock Program is unclear and may extend to the recovery date for the population. In the interim, the project is following the recovery goals established by the earlier Recovery Plan (Schmitten et al. 1995) proposed for Snake River salmon that called for multiple generations of captive broodstocks to help maintain and enhance Redfish Lake sockeye salmon while recovery efforts are under way. The proposed plan provided the following delisting criteria for Redfish Lake sockeye salmon:

"For sockeye salmon, the numerical escapement goal is an eight-year (approximately two generation) geometric mean of at least 1,000 natural spawners returning annually to Redfish Lake and 500 natural spawners in each of two other Snake River basin Lakes." These recovery targets were also identified in the Interim Abundance and Productivity Targets documents produced by NOAA Fisheries in 2002.

Table 3. Issue 2. Relationship of Program to Other Management Objectives.

1. Relationship to habitat protection and recovery strategies:

a. Major factors inhibiting natural production.

As discussed by Flagg et al. (1995), a dilemma facing enhancement efforts at Redfish Lake is that most of the severe barriers to survival for Snake River sockeye salmon are downstream of the spawning and rearing habitat. Both manmade (dams) and natural habitat alterations, harvest, and changes in ocean productivity probably contributed to reduction in abundance of Snake River sockeye salmon. These are outside the purview of SBSTOC actions. Current smolt-to-adult survival of sockeye salmon from Sawtooth Valley lakes is rarely greater than 0.3% (Hebdon et al., in review). Under current conditions, the adult recruit/spawner ratio for Redfish Lake sockeye salmon is about 0.15:1. Recovery to a nominal population equilibrium of 1:1 replacement would require over a 6-fold increase in survival from current conditions. Given this situation, it is probable that captive broodstocks and artificial propagation will need to remain key components in maintaining Snake River sockeye salmon for years to come.

b. Description of habitat protection and recovery efforts.

Snake River sockeye salmon freshwater rearing habitat is located in the upper Salmon River Drainage. All nursery lakes lie within the Sawtooth National Recreation Area in the Sawtooth National Forest in central Idaho.

Three Sawtooth Valley Lakes (Redfish, Pettit, and Alturas), designated as critical spawning and rearing habitat under the ESA listing (56 FR 58619), have been incorporated in the current efforts to prevent extinction of Snake River sockeye salmon. The Sawtooth Valley lakes are classified as oligotrophic and share many characteristics with sockeye salmon nursery lakes in British Columbia and Alaska. Sockeye salmon forage consists primarily of cladocerans, copepods, and littoral invertebrates. Project nursery lakes are encompassed by wilderness and considered pristine. The lakes themselves are managed for recreation, with U.S. Forest Service (USFS) campgrounds along portions of their shorelines. These uses are not believed to substantially impair sockeye rearing or spawning habitat. The USFS has restricted foot traffic at Sockeye Beach (an historical sockeye salmon spawning location in Redfish Lake) to reduce impacts to native vegetation and to reduce the quantity of fine material recruiting to the Sockeye Beach spawning habitat.

Losses of marine derived nutrients (MDN) have reduced the productivity and carrying capacities of the Sawtooth Valley lakes. Paleolimnological investigations estimate that as many as 30,000 adults may have spawned in Redfish Lake historically (Finney 2001).

Currently, annual *O. nerka* population estimates are made using hydroacoustic and trawling techniques to ensure carrying capacities are not exceeded when juvenile sockeye are released into the lakes. Lake carrying capacities, *O. nerka* standing stock and age structure, and macrozooplankton abundance/biomass data are used to determine stocking levels and allocation between the various lakes and to determine if nutrient supplementation is necessary. These data allow the SBSTOC coordinating team to identify and manage for optimal lake rearing conditions for the release of sockeye salmon from project captive broodstocks.

To stabilize rearing conditions and to provide food resources for reintroduced sockeye salmon, nutrient supplementation was conducted in Redfish Lake (1995-1998 and 2000-2001), Alturas Lake (1997-1999), and Pettit Lake (1997-1999). Liquid ammonium nitrate and ammonium phosphate (20:1 (1995-1998) and 30:1 N:P (1999-2001) ratio at an aerial loading rates of about 35 mg P/m^2/year) was surface applied weekly by boat from June-October (Spaulding 1993; Teuscher and Taki 1995, 1996; Taki and Mikkelsen 1997; Taki et al. 1999; Lewis et al. 2000; Griswold et al. 2000, 2003; Kohler et al 2001, 2002). Limnological parameters including nutrient levels, chlorophyll *a*, Secchi depth, primary productivity, heterotrophic bacteria, autotrophic picoplankton, phytoplankton, and zooplankton assemblage characteristics (species composition and densities) were monitored concomitant with fertilization activities. In general, results have indicated that: 1) negative impacts to aesthetic values and water quality were insignificant, 2) marked increases in chlorophyll *a*, primary productivity, and zooplankton biomass occurred, providing evidence that nutrient supplementation was effective, and 3) growth and survival of endangered sockeye were maintained or improved (Griswold et al. 2003).

Since the inception of this project, we have documented density-dependant trophic level responses when kokanee populations have peaked in Pettit and Alturas lakes. To address this in Redfish Lake, we limited escapement of nonlisted kokanee as another tool to improve growth and survival of sockeye salmon progeny released into the lake from the program.

At the time of ESA listing of Snake River sockeye salmon, adult passage to Alturas Lake was unlikely and adult access to Pettit Lake was impossible. During the mid 1990s, the USFS removed an irrigation diversion on Alturas Lake Creek, allowing passage of adult salmonids into Alturas Lake. In 1996, the Shoshone-Bannock Tribes removed a fish passage barrier at the outlet of Pettit Lake (Teuscher and Taki 1996). A juvenile and adult weir was constructed specifically for capturing sockeye.

c. Expected benefits of and time frame for habitat restoration efforts.

Passage benefits associated with the reconnecting of habitat by removal of passage barriers will last indefinitely and benefit all native fish species. We documented movement of bull trout *Salvelinus confluentus* and northern pikeminnow *Ptychocheilus oregonensis* into Pettit Lake within months following the removal of the lake outlet barrier.

The effect of nutrient supplementation is focused primarily on increasing forage for juvenile sockeye salmon. However, positive responses from other trophic levels indicate a healthier lake ecosystem (Griswold et al. 2003). This process is similar to what has been documented in stream nutrient enhancement projects. The duration of benefits from nutrient supplementation is dependant on several other elements including *O. nerka* densities and annual meteorological conditions.

2. Ecological interaction with other species:

a. Consideration of interactions with other wild and hatchery salmonids that will affect or be affected by releases from the proposed program.
b. Description of the interactions among the proposed program and introduced and native non-salmonid species.

The operation of hatchery facilities (weirs, water removal, and effluent discharge), hatchery production levels, disease transmission, competition for resources, predation, and negative genetic impacts are examples of ecological interactions that could affect listed species in the project area.

Hatchery facilities—The operation of the Sawtooth Fish Hatchery and the monitoring weir on Redfish Lake Creek are not expected to jeopardize the continued existence of listed species in the project area. Weirs are maintained daily and managed so as not to adversely affect listed species. Water removal from the upper Salmon River and effluent discharge are also not expected to adversely affect listed species.

Production levels—Production levels for the Redfish Lake Sockeye Salmon Captive Broodstock Program and not expected to adversely affect listed species. Snake River sockeye salmon releases are exempt from the NMFS Columbia and Snake rivers production ceiling. Program reintroduction strategies are developed to not exceed annual estimates of nursery lake carrying capacity.

Disease transmission—IDFG and NOAA Fisheries programs follow stringent disease prevention protocols and produce healthy, high quality fish. Preliberation fish health monitoring occurs to ensure that healthy fish are released to receiving nursery lakes. Fish health criteria are in place for common bacterial and viral pathogens and require fish to not exceed SBSTOC-accepted pathogen prevalence levels before they can be released.

Competition—Competition between hatchery-produced and naturally-produced sockeye salmon is expected to be minimal because all releases of eyed-eggs, juvenile sockeye salmon, and prespawn adults to nursery lakes will be based on the estimated carrying capacity of each lake. Annual release plans remain flexible to take into account the natural variability of rearing lakes. Whole lake nutrification conducted by the Shoshone-Bannock Tribes is expected to augment the rearing capability of nursery lakes.

Predation—Hatchery-reared sockeye salmon have the capability to prey on naturally-produced sockeye salmon and other species, but impact is expected to be minimal to nonexistent. Juvenile sockeye salmon are primarily planktivores and insectivores and do not typically become piscivorous.

Genetic impacts—Some genetic change associated with the management of Snake River sockeye salmon in the hatchery is most likely unavoidable. However, every opportunity is taken to minimize this change. All wild, anadromous sockeye salmon have been incorporated in program annual breeding plans. As such, no wild anadromous sockeye salmon have had access to Sawtooth Valley lakes since the inception of the program in 1991. Program managers and University of Idaho researchers develop annual spawning designs that maximize the retention of genetic diversity and heterozygosity while minimizing risk associated with inbreeding and domestication selection.

3. Relationship to fisheries and harvest objectives for other species:

a. Description of fisheries that might incidentally harvest these fish.

Mainstem Columbia River sport, commercial, and tribal harvest is cooperatively managed by federal, state, and tribal management partners. Based on run forecasts, limited harvest opportunities may be granted for sockeye salmon. The NOAA fisheries Protected Resources Division places limits on Snake River sockeye salmon (based on unique, identifiable marks). Sport and Commercial incidental take is generally limited to 1% or less of the total harvest. Adipose-fin clipped sockeye salmon are required to be returned to the river unharmed. Tribal take is less restricted but also managed.

b. Expected harvest impacts.

At the present time, ocean and lower Columbia River harvest is not expected to significantly impact the ability of the Sockeye Salmon Captive Program to achieve its goals and objectives.

c. Expected escapements.

Escapement is not significantly limited by sport, commercial, or ceremonial harvest. Based on empirical emigration and adult return information collected since the inception of this program in 1991 and on historical productivity information collected between 1954 and 1965, current adult escapement is expected to range between 0.05 and 0.6% of the number of estimated juveniles emigrating from Sawtooth Valley waters in any year (Bjornn, et al. 1968; Hebdon et al., in review).

Table 3. Issue 3. Origin and Identify of Broodstock.

1. Guidelines for using the stock in the program.

Numbers of Snake River sockeye salmon have declined dramatically in recent years. In Idaho, only the lakes of the upper Salmon River (Sawtooth Valley) remain as potential sources of production. Historically, five Sawtooth Valley lakes (Redfish, Alturas, Pettit, Stanley, and Yellow Belly) supported sockeye salmon (Bjornn et al. 1968; Chapman et al. 1990). By 1962, sockeye salmon were no longer returning to Stanley, Pettit, and Yellow Belly lakes (Chapman et al. 1990). Currently, only Redfish Lake receives a remnant anadromous run (Kline 1994; Kline and Younk 1995; Kline and Lamansky 1997; Hebdon et al. 2000, 2002, in review; Flagg et al. 2001).

2. Operating protocols to implement guidelines.

Since the inception of the Redfish Lake Sockeye Salmon Captive Broodstock Program in 1991, all wild anadromous adults have been incorporated in the breeding program. Twenty-six residual sockeye salmon adults and 886 wild sockeye salmon smolts have also been incorporated in the broodstock.

Fish released from the program have produced returning adults that have been filtered through the natural environment for most of their lifecycle. The program has established the guideline that a significant proportion of these returning adults be incorporated into the broodstock to counteract the effect of any unintentional domestic selection that may be occurring.

Currently, there are no plans to incorporate additional residual sockeye salmon or out-migrating smolts in the broodstock program. All other anadromous, returning adults are trapped, genetically identified to determine relatedness, and either incorporated in a spawning matrix to maintain genetic diversity or released to spawn volitionally.

3. Data to support protocols:

a. History of broodstock.

Broodstock development using wild, Redfish Lake sockeye salmon has included anadromous adults, residual adults, and out-migrating smolts. Wild sockeye salmon represent the potential infusion of new genetic diversity into the breeding program. Since 1991, all 16 wild anadromous adults sockeye salmon that returned to the Sawtooth Valley have been incorporated into the breeding program. Residual sockeye salmon adults (26) were captured and used to develop broodstocks in 1992, 1993, and 1995. Wild out-migrating smolts from Redfish Lake were captured in 1991–1993, reared through maturation at the IDFG Eagle Fish Hatchery, and selectively incorporated in the breeding program. During these collection years, 886 out-migrating smolts were captured and transferred to the Eagle Fish Hatchery.

b. Annual broodstock size and sex ratio.

Idaho Department of Fish and Game and NOAA Fisheries hatchery facilities each retain approximately 450 eyed-eggs annually to develop future broodstock spawning groups. Eggs are selected to fully represent all unique genetic identity and pedigree groups. Family size is equalized during this process.

The Redfish Lake Sockeye Salmon Captive Broodstock Program will also collect male and female hatchery-produced anadromous adults that return to Sawtooth Valley Lakes. While most of these adults will be released to spawn naturally, a portion will be incorporated in annual spawning designs. Only anadromous returning adults will be taken into the Redfish Lake Sockeye Salmon Captive Broodstock Program. The fish will be collected at fish traps operated throughout the complete run period, with fish taken into the broodstock program proportionally representing all periods of run timing.

c. Genetic and ecological differences between this stock and other stocks.

Maternal lineages remaining in the Redfish Lake sockeye salmon population are well characterized and can be distinguished from the other two populations of anadromous sockeye salmon remaining in the Columbia Basin (Lake Wenatchee and Okanogan Lake sockeye) (Faler and Powell 2003). Individuals are crossed so as to maintain these mitochondrial lineages observed in Redfish Lake and to maintain genetic diversity as evidenced in nuclear loci.

d. Description of special traits or other reasons for choosing this stock.

Redfish Lake sockeye salmon may be uniquely adapted to exist in the central mountains of Idaho. They travel further than any other North American sockeye salmon population to spawn in the lakes of the Sawtooth Valley (>1,450 km). In addition, they travel to the highest elevation of any North American sockeye salmon population (>1,980 m) and currently are the most southerly sockeye salmon spawning population in North America (Waples et al. 1991).

Sockeye salmon from Redfish Lake have been examined using allozymes (Winans et al. 1996) in context with other sockeye populations of the Pacific Northwest. In that study, Redfish Lake sockeye were found to contain differing allele frequencies that set them apart genetically. Allozymes were also used, in part, as the genetic basis for the listing of the anadromous and residual components of the Redfish Lake population (Waples et al. 1991). More recently, sockeye salmon have been examined using a variety of mitochondrial and nuclear DNA markers (Faler and Powell 2003). Mitochondrial evidence suggests sockeye salmon within the Columbia River Basin comprise a third glacial refugia apart from those thought to have occurred along the coast of British Columbia and the Gulf of Alaska. Sockeye salmon within the basin are further set apart by differences in haplotype frequencies among remaining sockeye salmon populations found in Redfish Lake, Lake Wenatchee, and Okanogan Lake. Within Redfish Lake itself, anadromous sockeye salmon and residual sockeye salmon have significantly different distributions among mitochondrial lineages as compared to the resident kokanee population in Fishhook Creek. Frequencies among microsatellite loci are also significantly different, providing genetic evidence for the assertion of both spatial and temporal differences in spawning between sockeye salmon and kokanee in Redfish Lake (Faler and Powell 2003).

4. Facilities available for isolating and maintaining the captive program.

Thorough facility descriptions are provided below in responses to “Mating” and “Rearing” sections of Table 3. Methods for isolating and maintaining captive broodstocks are reviewed.

5. Personnel accountable for developing the captive propagation program.

<u>NOAA Fisheries</u>

Principal Investigators:	Thomas A. Flagg	360-871-8306
	Dr. Desmond J. Maynard	360-871-8313
	Dr. Barry A. Berejikian	360-871-8301
Field Supervisors:	Dr. Lee Harrell	360-871-8307
	Carlin McAuley	360-871-8314
	Deborah A. Frost	
	Michael Wastel	360-871-8323
Field Personnel:	James Hackett	360-871-8300
	Dr. William Fairgrieve	360-871-8305
	Bryon Kluver	

<u>Idaho Department of Fish and Game</u>

Principal Investigator:	Paul Kline	208-465-8404
Hatchery Management:	Dan Baker	208-939-4114
	Jeff Heindel	

	Jeremy Redding	
Field Research:	J. Lance Hebdon Catherine Willard	208-465-8404
Fish Health Mgmt.	Dr. Keith Johnson	208-939-2413

Shoshone-Bannock Tribes

Principal Investigator:	Doug Taki	208-478-3914
Field Research:	Andy Kohler Robert Griswold (Biolines)	208-478-3759 208-774-3345

University of Idaho

Principal Investigator:	Dr. Madison Powell	208-837-9096

Table 3. Issue 4. Broodstock Collection.

6. **Operating protocols:**
   a. **Number of each sex to be collected and maintained in captive propagation.**
   b. **Kind of fish collected (life stage, special characteristics).**
   c. **Description of sampling design.**
   d. **Method of identifying target population if more than one stock exists.**

   Refer to responses provided above for Table 3 Issue 3.

7. **Data to support protocols:**
   a. **Distribution of target population over time and space.**
   b. **Biological information (fecundity, sex ratios).**

Refer to responses provided above for Table 3 Issue 3.

Table 3. Issue 5. Mating.

1. **Operating protocols:**
   a. **Number of each sex to be mated.**

   The Redfish Lake Sockeye Salmon Captive Broodstock Program collects male and female hatchery-produced anadromous adults that return to Sawtooth Valley Lakes. While most of these adults will be released to spawn naturally, a portion will be incorporated in annual spawning designs. Only anadromous returning adults will be taken into the program. The fish will be collected at fish traps operated throughout the complete run period, with fish taken into the broodstock program proportionally representing all periods of run timing.

   In addition to hatchery-produced anadromous adults, IDFG and NOAA Fisheries facilities each produce between 200 and 400 mature, hatchery adults annually. Mature hatchery adults contribute to prespawn adult releases, eyed-egg releases, and the production of juvenile sockeye salmon for reintroduction to Sawtooth Valley lakes.

Currently, program facilities (primarily the IDFG Sawtooth Fish Hatchery) have the ability to rear approximately 120,000 juveniles for presmolt releases and approximately 60,000 for smolt releases. Additionally, the program can accommodate up to approximately 100,000 eyed-eggs for planting in in-lake incubators. Program facilities can rear up to 300 adults to release directly to Sawtooth Valley lakes for volitional spawning.

b. Method for choosing spawners.

See Table 5 Issue 3c below.

c. Fertilization scheme.

Historically, maturation has been determined solely by changes in skin sheen, skin coloration, and body morphology approximately four weeks prior to spawning. As of the summer of 2002, ultrasound scanning technology was used to determine maturation status of fish. Ultrasound allows program staff to determine maturation earlier than waiting for development of physical changes by maturing fish. Earlier maturation detection allows for prespawn planning (e.g., number of mature females expected, projected egg numbers, etc.). We plan to continue using this technology in the future.

The Idaho Department of Fish and Game and NOAA Fisheries staff are required by ESA Section 10 permit language to discuss proposed broodstock spawning matrices with NOAA Fisheries Northwest Fisheries Science Center (NWFSC) genetics staff. This is accomplished by distributing and discussing a proposed spawning matrix at the Stanley Basin Sockeye Technical Oversight Committee (SBSTOC) level.

Mature captive broodstock salmon are anesthetized with MS-222 and checked for ripeness on a weekly basis during the spawning season, typically after October 1. Hormone implants (gonadotropin releasing hormone analog [GnRHa]) are injected into the dorsal sinus of some unripe fish to expedite ovulation and spermiation and to coordinate spawn timing between males and females (Swanson et al. 1995). Females that are ready to spawn, as determined by egg expression, are humanely killed and have their PIT tag code, fork length, and weight recorded. Females are then bled by cutting the caudal peduncle to the depth of the caudal artery. Bleeding is a standard procedure done to limit the amount of blood accumulating with the eggs that might clog the eggs' micropyle and reduce fertilization. Females are bled for 5-10 minutes and then abdominally incised with a sterile spawning knife. The free flowing eggs are manually stripped and collected in a plastic bag. The eggs from each female are divided into three subfamilies. Males that are used for spawning are live or dead spawned, depending on the need for their reuse on future spawning dates. In either case, milt is expressed into Whirl-Pak™ bags by compressing the ventral surface. Milt quality and motility is checked with a microscope.

Mating strategies are structured to maintain genetic diversity. These strategies include dividing the female into three subfamilies and fertilizing each subfamily with a different male, attempting representation of individual fish equally, avoidance of pairing between close siblings, fertilization between different year classes and fertilization with cryopreserved sperm from other generations as suggested by Hard et al. (1992). Specific mating protocol matrices for individual year classes and lineages are developed by geneticists in consultation with the SBSTOC.

Eggs are fertilized following “dry method” procedures. Milt from one male is poured into the plastic bag containing approximately one-third of the eggs of one female (one subfamily). The milt is gently worked into the eggs for several seconds, saline solution (85 mg/L NaCl) is added to activate the sperm, and the eggs are agitated to distribute the activated milt. The bag is left undisturbed during the initial stages of the fertilization process. After approximately five minutes, the eggs are water hardened in a 100 ppm buffered Iodophor solution for 30 minutes and placed in up-flow containers for isolated incubation. Beginning two days after fertilization, the eggs are treated with a formalin drip into the water supply (1,668 mg/L for 15 minutes three times per week) for control of *Saprolegnia* spp. The eggs are left undisturbed from the sensitive period at 48 hours after fertilization until they have reached the eyed stage. When the eggs have eyed, they are shocked. Dead or unfertilized eggs are removed and counted to determine fertilization rates.

Spawning adults are analyzed for common bacterial and viral pathogens, such as bacterial kidney disease (BKD), infectious hematopoietic necrosis virus, and viral hemorrhagic septicemia. Tissue samples are collected from the kidney, spleen, and pyloric caeca of each fish, and ovarian fluid samples are collected from each female and analyzed at program fish health laboratories. Results of fish health analysis of spawners will be used by IDFG and the SBSTOC to determine disposition of eggs and subsequent juveniles.

Fish health is checked daily by observing feeding response, external condition, and behavior of fish in each tank as initial indicators of developing problems. In particular, fish culturists look for signs of lethargy, spiral swimming, side swimming, jumping, flashing, unusual respiratory activity, body surface abnormalities, and unusual coloration. Presence of any of these behaviors or conditions is immediately reported to the program fish pathologist. A fish pathologist routinely monitors captive broodstock mortalities to try to determine cause of death. When a treatable pathogen is either detected or suspected, the program fish pathologist prescribes appropriate therapeutic drugs to control the problem. Dead fish are routinely analyzed for common bacterial and viral pathogens, e.g., bacterial kidney disease, infectious hematopoietic necrosis virus, etc. (Thoesen 1994). Select carcasses may be appropriately preserved for pathology, genetic, and other analyses. After necropsy, specimens that are not vital to further analysis are disposed according to protocols identified in ESA Section 10 permits.

2. Facilities.

NOAA Fisheries Burley Creek Hatchery

Spawning is conducted at the Station’s Burley Creek Hatchery satellite facility near Burley, Washington (approximately 21 km from Manchester). The facility is leased by NOAA from Fish Pro Farms, Inc., Port Orchard, Washington. This freshwater hatchery has been redesigned as a protective rearing facility for salmonid captive broodstocks. The facility includes a 613 m^2 building containing eleven 3.6 m and thirteen 1.5 m diameter tanks. A separate incubation room accommodates downwell incubators for isolated egg incubation.

The Burley Creek is supplied with about 2,000 L/min (500 gpm) of high-quality 10°C well water pumped from two separate wells. Well water is generally considered to be pathogen free. Before distribution to the tanks, the water is passed through packed column degassing towers that strip out any excess nitrogen and boost dissolved oxygen levels to 90%

saturation. Water flow and intruder alarms are monitored through a security system linked to pagers and home and office telephones. Effluent from the hatchery is depurated through a settling basin and UV-sterilization system. An emergency generator is automatically activated in the event of a power failure. In addition, all tanks can be supplied with emergency oxygen in the event of a water delivery system failure.

NOAA Fisheries Manchester Research Station

The Manchester Research Station is located on Clam Bay, a small bay adjoining the central basin of Puget Sound, Washington. The station is located on nine hectares of land surplused from the U.S. Navy to NOAA in the late 1960s. The main building at the Manchester Research Station contains three laboratories, nine offices, and computer and conference rooms. Adjoining the main building is a disease diagnostic laboratory containing a pathology lab, a bioassay lab, and two offices. A land-based seawater captive broodstock rearing complex houses three offices, wet and dry labs, and 400 m^2 of floor space for fish rearing tanks in one building, and 1,280 m^2 in another.

A 700 m long pipeline from the end of the pier supplies about 4,165 L/min (1,100 gpm) of pumped seawater to the Station's land-based facilities. Water is pumped via 50 hp centrifugal pumps. The system is outfitted with a backup 50 hp pump in case of primary pump failure. An alarm system monitors the pumps and electrical supply and is tied into an automatic dialer system linked to pagers and home and office telephones. Redundant emergency generators are automatically serially activated in the event of a power failure.

The 400 m^2 seawater laboratory contains six 4.1 m, four 3.7 m, and six 1.8 m diameter circular fiberglass tanks. The 1,280 m^2 facility houses 20 6.1 m diameter circular fiberglass tanks. Portions of both buildings are used for the project. A major advantage of the Manchester Research Station is the excellent seawater quality. Clam Bay is a major tidal mixing zone between Sinclair and Dyes inlets to the west and waters of central Puget Sound to the east. Annual seawater temperature at the site normally ranges between 7-15°C, and salinity ranges between 26-29 ppt. The high quality seawater environment, combined with a 250 m pier made available to the station by the EPA Region X Laboratory, make the Manchester Research Station an excellent site for experimentation and culture of a variety of finfish and shellfish.

The seawater supplied to the captive broodstock tanks at the Manchester Research Station is processed to prevent naturally occurring pathogens from entering the rearing tanks. Filtering consists of primary sand filters containing number 20-grade sand; this filters out all organic and inorganic material more than 20 microns in diameter. Water exiting the sand filters immediately enters a secondary cartridge filter system capable of filtering out all material more than 5 microns in diameter. The water then passes through a UV treatment system to inactivate remaining organic material. Sensors monitor water flow and pressure through the seawater filtration/sterilization system.

Before entering fish rearing tanks, the processed seawater is passed through packed column degassers to strip out any excess nitrogen and to boost dissolved oxygen levels. In addition, the tanks are directly supplied with oxygen to maintain life support in the event of an interruption in water flow. All 6.1 m tanks are supplied with combinations of ambient and chilled water. The Station complies with Washington State Department of Fish and Wildlife quarantine certification standards by depurating all effluent from the captive broodstock rearing areas with ozone.

IDFG Eagle Fish Hatchery

Artesian water from three wells is currently in use. Artesian flow is augmented with four separate pump/motor systems. Water temperature remains a constant 13.5°C, and total dissolved gas averages 100% after degassing. Water chilling capability was added at Eagle Fish Hatchery in 1994. Chiller capacity accommodates incubation, a portion of fry rearing, and a portion of adult holding needs. Backup and system redundancy is in place for degassing, pumping, and power generation. Nine water level alarms are in use, linked through an emergency service contractor. Additional security is provided by limiting public access and by the presence of three onsite residences occupied by IDFG hatchery personnel.

Facility layout at Eagle Fish Hatchery remains flexible to accommodate culture activities ranging from spawning and incubation through adult rearing. Egg incubation capacity at Eagle Fish Hatchery is approximately 300,000 eggs. Incubation is accomplished in small containers specifically designed for the program allowing for separation of individual subfamilies. Incubators are designed to distribute both upwelling and downwelling flow to accommodate pre- and post-hatch life stages.

Several fiberglass tank sizes are used to culture sockeye from fry to the adult stage, including: 1) 0.7 m diameter semisquare tanks (0.09 m^3); 2) 1.0 m diameter semisquare tanks (0.30 m^3); 3) 2.0 m diameter semisquare tanks (1.42 m^3); 4) 3.0 m diameter circular tanks (6.50 m^3); and 5) 4.0 m diameter semisquare tanks (8.89 m^3). Typically, 0.7 m and 1.0 m tanks are used for rearing fry from ponding to approximately 1.0 g weight. Two- and three-meter tanks are used to rear juveniles to approximately 10.0 g and to depot and group fish by lineage or release strategy prior to distribution to Sawtooth Valley waters. Three- and four-meter tanks are used to rear fish to maturity for future broodstock production (spawning). Flows to all tanks are maintained at no less than 1.5 exchanges per hour. Shade covering (70%) and jump screens are used where appropriate. Discharge standpipes are external on all tanks and assembled in two sections ("half pipe principle") to prevent tank dewatering during tank cleaning.

IDFG Sawtooth Fish Hatchery

Sawtooth Fish Hatchery was completed in 1985 as part of the U.S. Fish and Wildlife Service Lower Snake River Compensation Plan and is located on the Salmon River, 3.5 km upstream from the confluence of Redfish Lake Creek. Sawtooth Fish Hatchery personnel and facilities have been utilized continuously since 1991 for various aspects of the Redfish Lake Sockeye Salmon Captive Broodstock Program, including: 1) prespawn anadromous adult holding, 2) egg incubation, and 3) juvenile rearing for presmolt and smolt releases. In addition, hatchery personnel assist with many field activities, including: 1) net pen fish rearing; 2) fish trapping and handling; and 3) fish transportation and release.

Eyed-eggs, received at Sawtooth Fish Hatchery from Eagle Fish Hatchery or NOAA Fisheries, are incubated in vertical trays. Fry are ponded to 0.7 m fiberglass tanks. Juvenile sockeye (>1 g) are held in vats or in a series of 2.0 m fiberglass tanks installed in 1997. Typically, juvenile sockeye salmon reared at Sawtooth Fish Hatchery are released as presmolts or smolts. Prespawn anadromous adults captured at Redfish Lake Creek or Sawtooth Fish Hatchery weirs are held in vats until release for natural spawning or transfer to the Eagle Fish Hatchery for spawning. Generally, well water supplies water flow for incubation, rearing, and holding. Well water temperature varies by time of year from approximately 2.5°C in January and February to 11.1°C in August and September. When sockeye salmon are held for smolt releases, they may be moved to outside raceways that receive water from the Salmon River. Salmon River water temperature varies by time of year from approximately 2.5°C in January and February to 13.3°C in August and September. Backup and redundancy water systems are in place. Rearing protocols are established cooperatively between IDFG personnel and reviewed at the SBSTOC level.

Table 3. Issue 6. Rearing.

1. **Operating protocols:**
   a. **How will the incubation and rearing environment be different from or similar to natural rearing?**

The NOAA and IDFG have modified facilities to provide incubation and rearing environments that promote adherence to conservation hatchery principles. Incubation is carried out in small "isolation" buckets that prevent the potential spread of infectious diseases while maintaining individual family identification. Rearing occurs in circular tanks as opposed to raceways to better manage family segregation and potential fish health risks. Incubation and rearing occurs at multiple facilities to guard against loss associated with catastrophic events at any one location. Program fish are generally incubated in darkness, and incubation and rearing densities do not exceed 0.5 lbs/ft^3 (8.0 kg/m^3) for most of the rearing cycle. Shade cover is always available to fish in the primary captive broodstock program. In most cases, the program does not use natural-like habitat during culture or rear fish in variable higher velocity habitat. The latter is probably not relevant to sockeye salmon that rear naturally in low velocity lake habitat. The fish are fed by hand or automated feed delivery systems rather than demand feeders. No fish in the program are exposed to predator training. Fish-human interactions are generally minimized. Fish have been acclimated in net pens suspended in Redfish Lake prior to release in some instances. Volitional emigration has not been used to date, as most fish rearing is done at offsite locations. However, smolts produced from presmolt releases, eyed-egg plants, or from the release of prespawn adults naturally emigrate from nursery lakes.

b. **How will family groups be separated and their contributions equalized?**

At spawning, individual family lots are incubated in isolation incubators. At ponding, some consolidation occurs, but primary family lineages are reared independently. When fish reach approximately 6.0 g mean weight, broodstock groups are PIT tagged allowing for further consolidation to occur.

At maturation, broodstock adults are identified using PIT tag codes. Annual spawning events follow approved spawning designs developed at the SBSTOC level and reviewed by NOAA Fisheries and University of Idaho geneticists. The contribution of parents is equalized in several ways. First, males and females are crossed in a factorial design such that the contribution of any particular male or female is spread amongst several crosses. This serves to decrease the loss of contribution from an individual if there is catastrophic loss to the egg lot or if the cross is less successful (fertility is low) than others. Second, numbers of eggs and the amount of sperm is equalized for each factorial cross (each females eggs are evenly divided and fertilized with sperm from three separate males). Third, each lot of eggs or family line is tracked with a pedigree, successfully fertilized eggs are sorted, and equal numbers of offspring representing male or female components in each family line are retained for broodstock. Excess numbers of individuals are released and their genetic component tracked upon their return.

2. Data to support protocols.

Age-0 through age-2 sockeye salmon rearing densities are maintained at levels not to exceed 8 kg/m^3. Rearing tanks are managed for a minimum of 1½ water exchanges per hour. All water use is single pass. Shade covering (70%) and jump screens are used where appropriate. Incubation and rearing water temperature is maintained between 7.0°C and 13.5°C at the IDFG Eagle Fish Hatchery and 5.0°C and 10.0°C at the NOAA Fisheries Burley Creek Fish Hatchery. Chilled water may be used during incubation and early rearing to modulate development and growth differences that may result from a protracted spawning period. In addition, chilled water may be used to manipulate growth to more closely follow a natural profile.

Fish are fed a commercial diet produced by Bio-Oregon (Warrenton, Oregon) or Moore-Clark (Vancouver, BC). Rations are weighed daily and follow suggested feeding rates provided by the manufacturer(s). Bio-Oregon developed a custom broodstock diet that includes elevated levels of vitamins, minerals, and pigments. Palatability and levels of natural pigments are enhanced by the addition of natural flavors from fish and krill. Through approximately 100 g weight, fish receive a standard Bio-Oregon semimoist formulation or Moore-Clark dry diet. Beyond 100 g weight, fish receive the Moore-Clark salmon broodstock diet or the Bio-Oregon custom broodstock diet.

Approved chemical therapeutants are used prophylactically and for the treatment of infectious diseases. Prior to effecting treatments, the use of chemical therapeutants is discussed with NOAA Fisheries and IDFG fish health professionals. Fish necropsies are performed on all program mortalities that satisfy minimum size criteria for the various diagnostic or inspection procedures performed. Routine necropsies include investigations for viral pathogens (infectious pancreatic necrosis virus and infectious hematopoietic necrosis virus), and various bacterial pathogens (e.g., bacterial kidney disease *Renibacterium salmoninarium*, bacterial gill disease *Flavobacterium branchiophilum*, coldwater disease *Flavobacterium psychrophilum*, and motile aeromonad septicemia *Aeromonas* spp.). In addition to the above, anadromous adult sockeye salmon are screened for the causative agent of whirling disease *Myxobolus cerebralis*, furunculous *Aeromonas salmonicida*, and the North American strain of viral hemorrhagic septicemia virus. All laboratory diagnostic and inspection procedures follow protocols described by Thoesen (1994).

3. Facilities.

See response for Table 3 Issue 5 Section 2 above for a thorough description of facilities used by the program.

Table 3. Issue 7. Release.

1. Operating protocols:

a. Number, size, and life stage at release.

Through 2002, IDFG and NOAA Fisheries hatchery programs have produced in excess of 860,000 presmolts, 158,000 smolts, 880 adults, and 325,000 eyed-eggs for reintroduction to Sawtooth Valley lakes and tributary streams. From this production, approximately 290,000 hatchery-produced, juvenile sockeye salmon have emigrated from Sawtooth Valley waters.

Annual release plans are developed at the SBSTOC level. Lake limnology and carrying capacity information as well as information generated from out-migration monitoring and evaluation studies contribute to the prioritization of annual plans. Hatchery rearing space availability may also influence the development of release plans.

Release information for the program is summarized by reintroduction strategy in Tables 4-7.

Table 4. Eyed-egg reintroduction history.

Release year	Release location	No. of eggs planted	Estimated hatch
1996	Redfish Lake	105,000	97%
1997	Redfish Lake	85,378	98%
	Alturas Lake	20,389	72%
1999	Pettit Lake	20,311	74%
2000	Pettit Lake	65,200	79%
2002	Pettit Lake	30,924	97%
	Total	327,202	

Table 5. Presmolt reintroduction history.

Release Lake	Release Strategy	Release Date	Number Released	Number PIT-tagged	Mean Release Wt.
Redfish	Net pen	8/3/94	11,130	1,904	8.2 g
Redfish	Fall direct-lake	11/23/94	2,989	854	8.1 g
Redfish	Net pen	10/10/95	28,163	1,721	11.4 g
Redfish	Summer direct-lake	6/29/95	27,179	1,731	5.8 g
Redfish	Fall direct-lake	10/5,10/95	27,703	2,520	16.1 g
Pettit	Summer direct-lake	7/27/95	8,527	861	7.4 g
Redfish	Net pen	10/7/96	1,932	1,932	22.0 g
Redfish	Net pen	10/21/97	62,907	2,596	21.1 g
Redfish	Summer direct-lake	7/14/97	21,036	1,990	9.6 g
Redfish	Fall direct-lake	10/15/97	68,379	2,010	21.0 g
Pettit	Summer direct-lake	7/1/97	8,643	1,336	8.7 g
Alturas	Fall direct-lake	10/16/97	72,496	1,861	21.0 g
Alturas	Summer direct-lake	7/15/97	22,250	2,032	8.4 g
Redfish	Net pen	10/1/98	55,830	2,973	14.4 g

Redfish	Fall direct-release	10/14/98	39,418	1,206	10.6 g
Pettit	Summer direct-lake	7/15/98	7,246	1,501	9.8 g
Alturas	Fall direct-lake	10/14/98	39,377	1,246	10.3 g
Redfish	Fall direct-lake	10/6/99	23,886	1,560	9.7 g
Pettit	Fall direct-lake	10/6/99	3,430	2,009	10.4
Alturas	Fall direct-lake	10/6/99	12,955	1,559	10.8 g
Redfish	Fall direct-lake	10/11/00	48,051	-	10.8 g
Pettit	Summer direct-lake	7/31/00	6,007	-	2.9 g & 8.5 g
Pettit	Fall direct-lake	10/11/00	6,067	-	13.9 g
Alturas	Summer direct-lake	7/31/00	5,986	-	2.9 g & 8.5 g
Alturas	Fall direct-lake	10/11/00	6,003	-	12.8 g
Redfish	Fall direct-lake	10/8/01	41,529	-	10.8 g
Redfish	Net Pen	10/10/01	41,474		30.0 g
Pettit	Fall direct-lake	10/9/01	4,993	-	15.4 g
Pettit	Summer direct lake	7/27/01	3,059	-	14.4 g
Pettit	Summer direct lake	7/31/01	2,998	-	4.0 g
Alturas	Fall direct lake	10/9/01	5,990	-	14.0 g
Alturas	Summer direct lake	7/27/01	3,064	-	14.5 g
Alturas	Summer direct lake	7/31/01	3,059	-	4.0
Redfish	Summer direct-lake	8/28/02	31,000	-	11.4 g
Redfish	Summer direct-lake	8/29/02	30,500	-	11.4 g
Alturas	Summer direct-lake	8/27/02	6,123	-	10.6 g
Pettit	Summer direct-lake	8/27/02	7,805	-	11.4 g
Redfish	Fall direct-lake	10/8/02	45,001	-	15.3 g
Pettit	Fall direct-lake	10/8/02	19,981	-	14.8 g
		Total	864,166		

Table 6. Smolt reintroduction history.

Release location	Date released	Number released	Number PIT-tagged	Mean release weight
Redfish Lake Creek	4/21/95	3,794	1,371	177.5 g
Redfish Lake Creek	5/2/96	11,545	1,990	50.0 g
Redfish Lake Creek	4/28, 5/4/98	37,583	2,000	26.5 g & 63.5 g
Upper Salmon River	4/28, 5/4/98	44,032	1,999	26.5 g & 63.5 g
Redfish Lake Creek	5/5/99	4,859	400	25.4 g
Upper Salmon River	5/4/99	4,859	400	25.4 g
Redfish Lake Creek	5/9/00	148	148	258 g

Redfish Lake Creek	5/2/01	13,915	1,000	49.4 g
Redfish Lake Creek	5/7/02	38,672	995	27.6 g
	Total	159,344		

Table 7. Prespawn adult reintroduction history.

Release Lake	Rearing origin	Date released	Number released	Number of suspected redds observed
Redfish	Full-term hatchery	1993	20	
Redfish	Full-term hatchery	1994	65	One behavioral observation
Redfish	Full-term hatchery	1996	120	30 suspected redds
Redfish	Full-term hatchery	1997	80	30 suspected redds
Pettit	Full-term hatchery	1997	20	1 suspected redd
Alturas	Full-term hatchery	1997	20	Test digs only
Redfish	Full-term hatchery	1999	18	8 suspected redds
	Hatchery-produced anadromous	1999	3	
Redfish	Full-term hatchery	2000	46	20 to 30 suspected redds
Redfish	Hatchery-produced anadromous	2000	120	
Pettit	Full-term hatchery	2000	0	Redds suspected but not visible
Pettit	Hatchery-produced anadromous	2000	28	
Alturas	Full-term hatchery	2000	25	14 to 19 suspected redds
Alturas	Hatchery-produced anadromous	2000	52	
Redfish	Full-term hatchery	2001	65	12 to 15 areas of excavation observed
Redfish	Hatchery-produced anadromous	2001	14	
Redfish	Full-term hatchery	2002	178	10 areas of excavation observed
Redfish	Hatchery-produced anadromous	2002	12	
		Total	880	

b. Date, location, and number per location of release.

Refer to tables presented above for Table 3 Issue 7 Section 1a.

c. Release technique (direct, acclimation, volitional).

Refer to tables presented above for Table 3 Issue 7 Section 1a.

d. Tags and marks.

Several tagging methods are employed in this project. Juvenile sockeye salmon are passive integrated transponder (PIT) tagged prior to release from the hatchery and when captured at out-migration traps. Standard PIT tagging methodologies and protocols developed by the Pacific States Marine Fish Commission are followed, and PIT tags have been demonstrated to be safe for use in juvenile salmonids and to be reliable over the life of Pacific salmon (Prentice et al. 1990). Fish are anesthetized, tagged, and allowed to recover prior to release. Individual disinfected PIT tag needles are used for each fish. Juvenile PIT tag detections at Lower Snake and Columbia river dams are an integral part of the evaluation of juvenile releases, because they provide almost immediate feedback on the success of different strategies and valuable information on timing of migration.

In addition to PIT tagging juveniles released to the habitat, all sockeye salmon retained for broodstock are individually identified with PIT tags. These tags allow fish culturists to monitor individual fish growth and track the lineage of individual fish to ensure that only appropriate genetic crosses are made when fish are spawned. Sockeye salmon are PIT tagged as presmolts and will retain their tag for the remainder of their life.

In addition to PIT tags, coded-wire tags (CWTs) are used to evaluate homing and to identify fish to a specific release strategy. Coded-wire tags are stainless steel wires that are injected into the nose cartilage of the fish following procedures described by Jefferts et al. (1963). These tags remain with the fish throughout its life and are recovered from carcasses collected in spawning surveys or from fish spawned at the hatchery.

All juvenile sockeye salmon released as smolts or presmolts are adipose fin-clipped prior to release. This allows juveniles encountered in the lakes to be positively identified as progeny from the program during other sampling activities. In addition to adipose clipping, ventral fin clips have been used to evaluate different release timings or rearing origins.

Radio tags are used to track adult sockeye salmon that are released to the lakes for natural spawning. Radio tagging is conducted in accordance to standard methods, and only a portion of the released fish is tagged.

Floy tags (T-bar anchor type tags) are used to identify full term hatchery adults released to the lakes for natural spawning. These tags allow easy identification of adult origin when adults are encountered during redd counting.

2. Data to support protocols.

Since the inception of the program in 1991, the development of egg and fish reintroduction plans has followed a “spread-the-risk” philosophy incorporating several release strategies and multiple lakes. Release strategies were developed by SBSTOC cooperators and reflect tested techniques applied in the commercial aquaculture field as well as in State, Provincial and Federal agency programs. Progeny produced at Eagle Fish Hatchery and at NOAA Fisheries facilities are reintroduced to Sawtooth Valley waters at different life history stages using a variety of release options including: 1) eyed-egg releases to lake incubator boxes, 2) presmolt releases direct to lakes, 3) presmolt releases to Redfish Lake following net pen rearing, 4) smolt releases to outlet streams and to the upper Salmon River, and 5) prespawn adult releases direct to lakes. Out-migrant monitoring and evaluations are conducted annually to determine the relative success of the various release strategies employed by the program. Adaptively managed, results are used to help shape the development of future release plans. The SBSTOC plays a major role in this process. For a review of the release history of the program, see Kline 1994; Kline and Younk 1995; Kline and Lamansky 1997; Pravecek and Kline 1998; Hebdon et al. 2000, 2002, in review.

3. Facilities and equipment.

Eggs are shipped at the eyed stage between NOAA Fisheries and IDFG facilities using a commercial air service. Iodophor-disinfected (100 ppm) eggs are packed at a conservative density in perforated tubes, then capped and labeled. Tubes are wrapped with hatchery water-saturated cheesecloth and packed in small coolers. Ice chips are added to ensure proper temperature maintenance, and coolers are sealed with packing tape. Personnel from IDFG and NOAA Fisheries are responsible for shuttling coolers to and from air terminals.

Fry may be transferred between IDFG and NOAA Fisheries facilities. If fry transfers occur, a commercial air service is used as described above. Fish are transported in plastic fish transfer bags containing 10°C water. Oxygen is added to the bags before sealing. Bags are placed in coolers containing ice chips to ensure an appropriate temperature environment. Coolers are sealed with packing tape and accompanied by IDFG personnel on the aircraft.

Containers used to transport fish vary by task. In all cases, containers of the proper size and configuration are used. Appropriate temperature, oxygen, and chemical composition are maintained during the handling and transfer phases of transportation. Containers vary from five-gallon plastic buckets and coolers for short-term holding and inventory needs to barge-mounted holding tanks for midlake (pelagic) fish releases and net pen fish transfers. Truck-mounted tanks, used for long distance transfers, are available to the program with 300 gal (1,136 L), 1,000 gal (3,785 L), and 2,500 gal (9,463 L) capacities. Transport guidelines are in place to not exceed 89 g/L (0.75 lb/gal).

Sockeye salmon have been reintroduced to Sawtooth Valley waters as eyed-eggs, subyearlings, yearlings, and prespawn adults.

Eyed-eggs are distributed to egg boxes manufactured by IDFG personnel specifically for this program. Plastic light baffle grids and plastic mesh netting partition and prevent eggs from falling into the biofilter ring medium until after hatch. Plastic mesh netting surrounding egg boxes allows fish to volitionally emigrate following yolk absorption. Each egg box accommodates approximately 3,000 eggs. Following loading, egg boxes are lowered to the lake substrate in approximately 3 m of water over known or suspected areas of lakeshore spawning.

Sockeye salmon presmolts are distributed to Sawtooth Valley lakes in truck-mounted transportation tanks. Fish are transferred from truck-mounted tanks to 250 gal (946 L) barge-mounted tanks for pelagic releases and net pen introductions. Adequate water temperature tempering occurs before the release of fish.

Sockeye salmon smolts are distributed to Sawtooth Valley waters using truck-mounted transportation tanks. To date, sockeye salmon smolts have only been introduced to Redfish Lake Creek downstream of the juvenile out-migrant weir and to the Salmon River downstream of the Sawtooth Fish Hatchery weir. Adequate water temperature tempering occurs before the release of fish.

Prespawn adult sockeye salmon are distributed to Sawtooth Valley waters using truck-mounted transportation tanks. Adults have been introduced to Redfish Lake, Alturas Lake, and Pettit Lake. Fish are released at public access points at dusk. Adequate water temperature tempering occurs before the release of fish.

Table 3. Issue 8. Monitoring and Evaluation.

1. **Biological and propagation parameters monitored:**
    a. **Survival at different life stages.**
    b. **Age at maturity, sex ratios, fecundity, viability of gametes.**

In-hatchery survival monitoring includes the tracking of: 1) egg survival to the eyed stage of development, 2) eyed-egg to hatch, 3) hatch to ponding, and 4) ponding through maturation. Mean in-hatchery survival from ponding to adult has ranged from 79-88% for brood year groups of captive broodstocks reared at IDFG facilities and 13-74% for those reared at NOAA facilities (Flagg 1993; Johnson 1993; Flagg and McAuley 1994; Johnson and Pravecek 1995, 1996; Flagg et al. 1996; Pravecek and Johnson 1997; Pravecek and Kline 1998; Kline and Heindel 1999; Flagg et al. 2001; Kline and Willard 2001; Frost et al. 2002).

Age at maturity of hatchery broodstocks maintained at NOAA Fisheries and IDFG facilities is predominantly age-3. Age-2 maturation has ranged from 0% to over 30% (one year) and typically averages less than 10%. Age-4 maturation is typically less than 5% of the number of fish maturing in any brood year group (Flagg 1993; Johnson 1993; Flagg and McAuley 1994; Johnson and Pravecek 1995, 1996; Flagg et al. 1996; Pravecek and Johnson 1997; Pravecek and Kline 1998; Kline and Heindel 1999; Flagg et al. 2001; Kline and Willard 2001; Frost et al. 2002).

Fecundity of age-2, age-3, and age-4 females typically averages about 1,400, 1,900, and 2,200 eggs per female, respectively. Mean annual egg viability of captive broodstocks reared at IDFG facilities has ranged from 29-60% and from 33-78% for those reared at NOAA facilities (Flagg 1993; Johnson 1993; Flagg and McAuley 1994; Johnson and Pravecek 1995, 1996; Flagg et al. 1996; Pravecek and Johnson 1997; Pravecek and Kline 1998; Kline and Heindel 1999; Flagg et al. 2001; Kline and Willard 2001; Frost et al. 2002).

c. **Genetic, morphological, meristic, and behavioral similarity to donor population.**

Anadromous sockeye salmon within the Columbia River and its tributaries are characterized by several maternal lineages only observed within the Basin (Faler and Powell 2003). Moreover, sockeye salmon from Redfish Lake can be further characterized by a maternal lineage only observed within that lake. Though similarities exist with the resident kokanee population, Redfish Lake anadromous sockeye salmon are sufficiently different to eliminate from consideration any contribution of resident kokanee to Redfish Lake sockeye salmon. Morphologically, meristically, and genetically sockeye salmon within the captive program closely resemble what are inferred to be natural fish, although no wild counterparts exist to this fully captive population. Behaviorally, captive broodstock fish do not resemble resident kokanee, either.

d. Survival of progeny in wild.

Overwinter survival of groups of presmolts released to Redfish, Pettit, and Alturas lakes has ranged from a low of a few percent to over 40 percent (Kline 1994; Kline and Younk 1995; Kline and Lamansky 1997; Pravecek and Kline 1998; Hebdon et al. 2000, 2002, in review, Flagg et al., in review,a). A total of about 180,000 sockeye salmon smolts resulting from program releases have out-migrated from Sawtooth Valley lakes since the program began. Another about 160,000 hatchery-reared smolts have also been released and have out-migrated.

Presmolt releases represent the primary component of the reintroduction effort accounting for more fish released than all other release options combined. Overwinter and out-migration survival comparisons between net pen and direct-lake presmolt release groups have been conducted for five years. In four of the five years of investigation, out-migrants produced from the fall direct-lake release option overwintered and out-migrated significantly better to the trapping facility on Redfish Lake Creek than fish released to Redfish Lake from a net pen rearing environment (Hebdon et al., in review). Fish produced from the fall direct-lake release also had significantly higher recapture rates at downstream dams in three of the five investigation years. Presmolts released to Pettit and Alturas lakes in the fall overwintered and out-migrated significantly better than summer-released groups (Hebdon et al., in review).

Hebdon et al. (in review) have documented from 8-30 suspected sockeye salmon redds in each of the last four years in Redfish Lake. Redds have also been documented in Pettit and Alturas lakes subsequent to the release of prespawning adults. From these adult out-plants and from eyed-egg releases, in excess of 13,000 unmarked out-migrants have emigrated from Redfish Lake since 1998.

Between 1999 and 2002, a total of 312 adults have returned from the ocean from captive broodstock releases.

e. Contribution to natural spawning and success of progeny.

The Redfish Lake Sockeye Salmon Captive Broodstock Program is achieving its near-term goal of building the captive population as a safety net to maintain the gene pool and to prevent extinction. The program is now focusing on producing captive broodstock progeny that can be used in release efforts designed to restore anadromous sockeye salmon runs to the Snake River Basin. The initial sourcing of eggs from the spawning of the five wild anadromous female sockeye salmon that returned to Redfish Lake in the 1990s, several residual sockeye salmon adults, and several hundred anadromous smolts has resulted in the production of over 1.15 million progeny (prespawning adults, eyed eggs, presmolts, and smolts) replanted to Sawtooth Valley habitats (Flagg et al., in review,a).

These efforts have been responsible for the return of seven anadromous adults in 1999, 257 in 2000, 26 adults in 2001, and 22 adults in 2002 to Sawtooth Valley lakes. The majority of these adults have been allowed to spawn volitionally.

Prespawn adult sockeye salmon from the Redfish Lake Sockeye Salmon Captive Broodstock Program were first released to Sawtooth Valley waters in 1993. Since that time, adult releases have occurred in 1994, 1996, 1997, 1999, 2000, 2001, and 2002. For release years 1993, 1994, 1996, and 1997, all prespawn adults released for natural spawning were reared through release (full-term) at IDFG and NOAA Fisheries hatcheries. In 1999, 2000, 2001, and 2002, release groups consisted of full-term hatchery adults and hatchery-produced anadromous adults. Two hundred twenty-nine of the 880 adults that have been released for natural spawning were hatchery-produced anadromous adults.

Prespawn adult and eyed-egg reintroduction strategies have substantially increased unmarked smolt out-migration from Sawtooth Valley lakes. Since 1998, we estimate that in excess of 13,000 unmarked smolts, produced from these strategies, have emigrated from Redfish Lake (IDFG unpublished information).

f. Incidental harvest in fisheries.

At the present time, no harvest is allowed for Snake River sockeye salmon. However, intermittent sport, commercial, and tribal fisheries for sockeye salmon in the lower Columbia River have the potential for the incidental harvest of program fish. To date, eight sockeye harvested in the Columbia River have been identified through a combination of external marks and mitochondrial haplotypes as potentially originating from Redfish Lake. Lower Columbia River fisheries are monitored annually.

2. Evaluation and feedback mechanism.

Adaptively managed, the program generates hatchery-produced eggs, juveniles, and adults for supplementation to Sawtooth Valley waters. In addition, emphasis is placed on the annual development of genetically diverse broodstocks. Program captive broodstock techniques reflect the Region's best protocols for maintaining maximum genetic diversity, survival, and production success. Fish culture variables (e.g., broodstock mating designs, fish survival, maturation success, fecundity, egg survival to eye, and fish health) are continuously monitored and evaluated to ensure maximum program success. Juvenile out-migrant monitoring (using PIT tag technology), adult return monitoring, and adult sonic telemetry studies provide information critical for the evaluation of program reintroduction strategies. Program methods and results undergo constant review through the Stanley Basin Sockeye Technical Oversight Committee, a team of technical experts assembled to review program results and to guide program direction.

3. Restoring a naturally-reproducing component of the population:
a. Progress in habitat restoration.

The effect of nutrient supplementation on lake habitat is monitored intensively (Teuscher and Taki 1995, 1996; Taki and Mikkelsen 1997; Taki et al. 1999; Lewis et al. 2000; Griswold et al. 2000, 2003; Kohler et al. 2001, 2002). Parameters monitored include water temperature (°C), dissolved oxygen (mg/l), conductivity (µS/cm), Secchi depth (m), compensation depth (m), nutrient concentrations (µg/L), chlorophyll *a* concentrations (µg/l), heterotrophic bacteria and autotrophic picoplankton (APP) densities (cells/ml), phytoplankton density (cells/ml) and biovolume (mm^3/l), and zooplankton density (no./l) and biomass (µg/l). See response to Table 3 Issue 2 1b for additional information on habitat restoration efforts. In general, results of lake fertilization efforts indicate that: 1) negative impacts to aesthetic values and water quality were insignificant, 2) marked increases in chlorophyll *a*, primary productivity and zooplankton biomass occurred, providing evidence that nutrient supplementation was effective, and 3) growth and survival of endangered sockeye were maintained or improved (Griswold et al. 2003).

In-lake fish competition/predation dynamics are also monitored to evaluate interactions between resident fish and progeny released from the Redfish Lake Sockeye Salmon Captive Broodstock Program.

b. Use of habitat by fish from captive propagation program.

Weight and length data are collected for juvenile sockeye salmon at the time of their reintroduction to Sawtooth Valley nursery lakes (typically in the fall) and at out-migration (generally the following spring). Growth information indicates that sockeye salmon are foraging and utilizing appropriate lake habitats. Juvenile sockeye salmon captured in vertical gillnets in Pettit and Alturas lakes indicate they are occupying the same pelagic strata as resident *O. nerka* (Teuscher and Taki 1995, 1996; Taki and Mikkelsen 1997; Taki et al. 1999; Lewis et al. 2000; Griswold et al. 2000, 2003; Kohler et al. 2001, 2002).

Prespawn adult sockeye salmon released to Sawtooth Valley lakes select suitable spawning habit and construct successful redds (Kline and Lamansky 1997; Hebdon et al. 2000, 2002, in review).

c. Success in natural reproduction.

In 1999, the first hatchery-produced sockeye salmon returned to the Sawtooth Valley. In that year, seven age-3 adults (six males and one female) returned to spawn. In 2000, the program experienced its first significant return of hatchery-produced adults. Two hundred fifty-seven sockeye salmon returned to collection facilities on Redfish Lake Creek and the upper Salmon River at the IDFG Sawtooth Fish Hatchery. The majority of year 2000 adult returns were released to the system for natural spawning. In 2001, 26 hatchery-produced adults returned to collection facilities in Idaho (the weir on Redfish Lake Creek and the weir at the Sawtooth Hatchery on the upper Salmon River). In 2002, 22 hatchery-produced adnlt sockeye salmon returned to the Sawtooth Basin.

Prespawn adult and eyed-egg reintroduction strategies have substantially increased unmarked smolt out-migration from Sawtooth Valley lakes. Since 1998, we estimate that in excess of 13,000 unmarked smolts, produced from these strategies, have emigrated from Redfish Lake (IDFG unpublished information).

Table 4. Summary of Benefits Attributed to Captive Propagation Technology

Table 4. Benefit 1. Increase Total Abundance of the Target Population.
Evaluation Criteria. Spawner:spawner replacement ratio is higher for captive propagation program than for fish remaining in natural habitat.

Increased survival potential in protective culture provides the ability for captive broodstocks to rapidly increase effective breeding population size and markedly aid recovery efforts through production of large numbers of juveniles (Flagg and Mahnken 2000; Flagg et al., in review,b;

Pollard and Flagg in review). The current efforts to prevent extinction of Snake River sockeye salmon have provided a large measure of success. Between 1999-2002, over 312 adults returned from the ocean from captive broodstock releases–an amplification of almost 20 times the number of wild fish that returned in the 1990s.

Sockeye salmon production and productivity are monitored annually (Hebdon et al., in review). Current smolt-to-adult survival of sockeye salmon from Sawtooth Valley lakes is rarely greater than 0.3% (Hebdon et al., in review). Under current conditions, the adult recruit/spawner ratio for Redfish Lake sockeye salmon is about 0.15:1. Recovery to a nominal population equilibrium of 1:1 replacement would require over a 6-fold increase in survival from current conditions. A dilemma facing enhancement efforts at Redfish Lake is that most of the severe barriers to survival for Snake River sockeye salmon are downstream of the spawning and rearing habitat (Flagg et al. 1995). Both manmade (dams) and natural habitat alterations, harvest, and changes in ocean productivity probably contributed to reduction in abundance of Snake River sockeye salmon. These are outside the purview of SBSTOC actions.

Spawning and rearing habitat in Sawtooth Valley nursery lakes is sufficient to allow the population to increase in abundance.

Table 4. Benefit 2. Preserve the Target Population.
Evaluation Criteria. Genetic, morphological, meristic, and behavioral characteristics of fish in captive propagation reflect the natural population.

It is the intention of this program to minimize the loss of genetic variation and heterozygosity by utilizing available genetic diversity within the population and crossing available individuals in a breeding strategy to minimize other genetic risks (such as inbreeding). Using known pedigrees from captive anadromous returns and from prespawn adults held in the hatchery, males and females are sorted and favorable crosses prioritized. Additionally, genetic analyses (both maternal lineage and microsatellite loci) are used to aid in development of spawning designs. Genetic analyses are conducted in “real time” (i.e., genetic data from returning sockeye salmon are provided to hatchery managers within two weeks of capture and before spawning begins). Maternal lineages remaining in the Redfish Lake sockeye salmon population are well characterized and can be distinguished from the other two populations of anadromous sockeye salmon remaining in the Columbia Basin (Lake Wenatchee and Okanogan Lake sockeye) (Robison 1995; Faler 2002; Faler and Powell 2003). Individuals are crossed so as to maintain these mitochondrial lineages observed in Redfish Lake and to maintain genetic diversity as evidenced in nuclear loci.

Risks to the genetic integrity of the captive population from applied mating designs are assessed through empirical calculations of stability of heterozygosity and genetic diversity over time among spawned captive Redfish Lake sockeye salmon. Data trends are evaluated as percentage of source (or beginning) heterozygosity and genetic diversity. There is significant retention of both heterozygosity and genetic diversity within the first three generations of captive culture. These measures are expected to decrease as the population becomes closed, principally due to drift. Some loss of heterozygosity and genetic diversity will occur despite the most enlightened efforts to cross remaining available stock and even employing cryopreserved sperm. However, it also appears that these losses can be somewhat minimized by the careful development of prudent mating strategies.

The Redfish Lake Sockeye Salmon Captive Broodstock Program strives to ensure for the safety of the fish maintained in culture, to produce fish for release in restoration efforts, and to the extent possible improve habitat. Standard fish culture practices have a proven track record of meeting these needs. However, program managers pursue novel fish culture protocols, too, in an effort to develop fish with morphological, meristic, and behavioral characteristics that reflect the natural population. Marine rearing is one approach the program uses to ensure anadromous traits are maintained in the captive broodstock population. Net pen rearing is another approach that was employed to maintain the natural attributes of these fish. It allowed fish destined for reintroduction to experience the background coloration, natural foods, temperature profile, and water chemistry of Redfish Lake. While this approach may have encouraged the development of natural morphological, meristic, and behavioral characteristics, it resulted in a lower overwinter survival than that of conventionally reared fish released directly into the lake. Other approaches employed to encourage the development of natural morphology, meristics, and behavior include egg box releases, overwinter acclimation releases, and adult releases. As with net pen rearing, these programs increase the time reintroduced fish experience the natural environment in a manner that encourages both wild-type phenotypic development and natural selection. However, as with net pen rearing, the advantage of reintroducing fish at these life history stages must be weighted against potential reductions in freshwater survival.

Table 4. Benefit 3. Increase Number of Natural-origin Recruits.
Evaluation Criteria. The product of the spawner:spawner replacement rate in the captive program and the relative success of captive-produced fish spawning in the wild to natural fish exceeds 1.0, and there is sufficient current habitat capacity to allow the population to increase in abundance.

A total of about 180,000 sockeye salmon smolts resulting from program releases have out-migrated from Sawtooth Valley lakes since the program began (Flagg et al., in review,a). Another about 160,000 hatchery-reared smolts have also been released and have out-migrated.

Hebdon et al. (in review) have documented from 8-30 suspected sockeye salmon redds in each of the last four years in Redfish Lake. Redds have also been documented in Pettit and Alturas lakes subsequent to the release of prespawning adults. From these adult out-plants and from eyed-egg releases, in excess of 13,000 unmarked out-migrants have emigrated from Redfish Lake since 1998. These results suggest that eyed-egg and prespawn adult releases have the potential to supplement depleted populations and to increase abundance in the habitat.

In addition, see sponsor response to Table 4 Benefit 1 above.

Table 5. Summary of Hazards Related to Captive Propagation Technology

Table 5. Hazard 1. Negative Effects Associated with Small Population Size.
Risk Evaluation 1. Probability of:
a. Inbreeding depression.

Evidence of inbreeding depression has not arisen within the Redfish Lake sockeye salmon population to date. Normal conditions associated with inbreeding depression, such as high variability in fertilization between male spawners, have not been observed. However, the founders of the captive Redfish Lake population is an extremely small number, and through time, crosses among individuals within this now closed population will increase the relatedness among future generations. Current genetic population size to census population size ratios remain relatively similar to those observed among other wild populations of salmonids and significantly different from most general hatchery populations (Powell and Kline 2003).

b. Loss of within-population genetic variability.

Powell and Kline (2002, 2003) demonstrated empirically that genetic diversity and heterozygosity within the Redfish Lake population is currently at 92% of source (e.g., 92% of the genetic diversity and heterozygosity within the founders are still present among the surviving captive population). This is primarily a result of the spawning matrices developed to minimize these losses. However, the founders of the captive Redfish Lake population is an extremely small number, and through time, crosses among individuals within this now closed population will result in the loss of heterozygosity and genetic diversity through drift despite any multifactorial efforts to cross surviving adults.

c. Accumulation of deleterious mutations.

The accumulation of deleterious mutations is a concern, since an individual affected with a genetic attribute that may reduce its evolutionary fitness could pass this on. However, within extremely small populations, rare alleles are usually lost through drift, both those that are advantageous and those that reduce fitness. Thus, within many small populations deleterious mutations have already been "purged" from the surviving members (See Avise 1994 and Hedrick 2000 for reviews). Accumulation of homozygous recessive alleles that are deleterious is a function of relatedness (inbreeding). Steps are taken to minimize inbreeding by producing pedigrees and kinship coefficients for use in the design of breeding matrices for all prespawn adults.

Table 5. Hazard 2. Negative Effects of Propagation in an Artificial Environment.

Risk Evaluation 1. Domestication: Probability of adaptation to the captive propagation environment at the expense of adaptation to the natural environment.

Even the most enlightened captive broodstock programs cannot eliminate all selection pressure associated with a captive environment nor can they mimic with any great success all of the selection pressure found in the natural environment. However, several steps can be taken to minimize these selection pressures. Captive propagation of Snake River sockeye salmon follows the generally accepted genetic guidelines extensively reviewed in Miller and Kapuscinski (2003) and closely monitors potential genetic hazards as indicated by Hard et al. (1992). The maintenance of genetic diversity and heterozygosity within the captive broodstock population from 1991-2002 is reviewed by Powell and Kline (2002, 2003).

Risk Evaluation 2. Catastrophic loss due to disease outbreaks or facility failure.

The program maintains redundant populations to ensure genetic material is not lost due to disease outbreak or facility failure. Each captive broodstock family is allocated in a manner ensuring equal representation in groups maintained at IDFG and NOAA Fisheries facilities. The family groups at each facility are then subdivided again to ensure each family line is maintained in at least two separate tanks. Backup and system redundancy are in place for degassing, pumping, and power generation.

Fish health is checked daily by observing feeding response, external condition, and behavior of fish in each tank as initial indicators of developing problems. In particular, fish culturists look for signs of lethargy, spiral swimming, side swimming, jumping, flashing, unusual respiratory activity, body surface abnormalities, and unusual coloration. Presence of any of these behaviors or conditions is immediately reported to the program fish pathologist. American Fisheries Society (AFS) "Bluebook" procedures are employed to isolate bacterial or viral pathogens and to identify parasite etiology (Thoesen 1994). Dead fish are routinely analyzed for common bacterial and viral pathogens (e.g., bacterial kidney disease, infectious hematopoietic necrosis virus, etc). Genetic samples are also collected from spawning mortalities in an effort to conduct mitochondrial DNA and/or nuclear DNA evaluations for sockeye salmon broodstocks held in the program. When a treatable pathogen is either detected or suspected, the program fish pathologist prescribes appropriate therapeutic drugs to control the problem. Select carcasses may be appropriately preserved for pathology, genetic, and other analyses. After necropsy, carcasses that are not vital to further analysis are disposed of as per language contained in ESA Section 10 permits for the program.

Table 5. Hazard 3. Loss of Diversity Among Populations.

Risk Evaluation 1. Broodstock can be effectively collected from targeted population without substantial mixing with non-targeted, genetically distinct populations.

It is unlikely that any strays will return to Redfish Lake. In any case, all returning adults are genetically tested for their origin before they are released or selected to cross in the broodstock program. Real-time genetic analysis is used to determine the identity of every fish (Faler and Powell 2003). Thus, the origin of all spawners used in the captive broodstock program is known. Moreover, each animal is "pedigreed," and the relatedness of each proposed cross is evaluated. Redfish Lake kokanee and anadromous sockeye salmon are reproductively isolated. Kokanee spawn in one lake tributary stream in August, and sockeye salmon spawn over submerged beach substrate in October.

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ARTIFICIAL PRODUCTION REVIEW

Introduction

The following information addresses the elements of the *Artificial Production Review* document prepared by the Northwest Power Planning Council (NPPC 1999).

This section of our composite report address the following program and projects:

Program: Redfish Lake Sockeye Salmon Captive Broodstock Program

Projects: 1990-09-300. University of Idaho. Genetic Analysis of *Oncorhynchus nerka*, Modified to Include Chinook Salmon.

1991-07-100. Shoshone-Bannock Tribes. Snake River Sockeye Salmon Habitat and Limnological Research.

1991-07-200. Idaho Department of Fish and Game. Redfish Lake Sockeye Salmon Captive Broodstock Program.

1992-04-000. NOAA Fisheries. Redfish Lake Sockeye Salmon Captive Broodstock Rearing and Research.

1993-05-600. NOAA Fisheries. Assessment of Captive Broodstock Technologies.

Our response is organized to address the following:

- Section II through Section III C 1 of Council document 99-15 (Artificial Production Review),
- Section VIII D, the Guidelines on Hatchery Practices, Ecological Integration and Genetics from Council document 99-4 (Review of Artificial Production of Anadromous and Resident Fish in the Columbia River Basin, A Scientific Basis for Columbia River Production Programs), and
- Section III C 2, the Performance Standards and Indicators for the Use of Artificial Production for Anadromous and Resident Fish Populations in the Pacific Northwest (January 17, 2001).

Section II. Recommended Policies for the Future Role of Artificial Production in the Columbia River Basin

Section II. A. Scientific Principals Provide Basis for Policy Change

Project sponsors associated with the Redfish Lake Sockeye Salmon Captive Broodstock Program support the need to develop a coordinated policy for the operation of hatcheries in the basin. Hatchery reform recommendations or any attempt to develop policy to guide hatchery reform should be based on the best available science as well as an understanding of how this science dovetails with ecological objectives and strategies. As stated in section II A of Council document 99-15, a logical framework to guide planning efforts associated with the Council's Fish and Wildlife Program was identified as part of the Multispecies Framework Project. The primary purpose of this document was to integrate fish, wildlife, and ecological functions and to help the region develop a collective vision and approach for fish and wildlife recovery in the Columbia River Basin. The eight scientific principles listed in Section II A of Council document 99-15 were developed as part of this process. Project sponsors and the Council's Artificial Production Review Scientific Review Team agree that hatchery reform and the development of future regional hatchery policies should be consistent with the principles identified for the Multispecies Framework Project.

Section II. B. Management Principles and Legal Mandates

Project sponsors and their respective agencies and tribes recognize their obligation to ensure that the Redfish Lake Sockeye Salmon Captive Broodstock Program is consistent with the array of legal mandates described in Section II B of Council document 99-15.

Section II. C. The Five Purposes of Artificial Production

The following information addresses the need to define the purpose for artificial production programs described in Section II C of Council document 99-15. Information is organized by column heading as presented in Table 1.

1) Purpose—Preservation/conservation. The program was implemented in 1991 to address demographic and ecological risks associated with extremely low population abundance. The near-term goal for the program is to conserve the genetic resources of the population using captive broodstock technology.

2) Rationale—Biological Problem: Extremely low population abundance has the potential for causing extinction or loss of genetic diversity.

3) Rationale—Motivation: Conserve genetic resources of the population using captive broodstock technology and prevent short-term extinction.

4) Implications—Duration: Temporary (until causes of declines in the natural population are rectified).

5) Implications—Assumption or Condition: Genetic characteristics can be conserved via artificial propagation. Habitat problems will be corrected in the immediate or distant future.

Section II. D. Policies to Guide the Use of Artificial Production

Section II D of Council document 99-15 identifies 10 policies to help guide the use of artificial production in a scientifically sound manner to achieve management objectives. The scientific principles, legal mandates, and purposes discussed above provide the backdrop for the use of these policies. Our discussion of how the Redfish Lake Sockeye Salmon Captive Broodstock Program is consistent with these policies is presented below in Section III C 1 (*Applying the Policies and Performance Standards to Evaluate and Improve the Operation of Artificial Production Facilities. General recommendation—immediately implement needed improvements in artificial production programs and facilities*).

Section II. E. Performance Standards

Section II E of Council document 99-15 describes the process for the development of performance standards and indicators designed to be used to help evaluate artificial production programs. Our discussion of how the Redfish Lake Sockeye Salmon Captive Broodstock Program is consistent with these performance standards and indicators is presented below in Section III C 2 (*Applying the Policies and Performance Standards to Evaluate and Improve the Operation of Artificial Production Facilities. How to evaluate for consistency with policies and standards and identification of deficiencies; use of independent audits; independent scientific review*).

The following version of Performance Standards was used for this review:
Performance Standards and Indicators for the Use of Artificial Production for Anadromous and Resident Fish Populations in the Pacific Northwest. January 17, 2001.

Section III. Implementing Reform in Artificial Production Policy and Practices

Section III. A. Six Implementation Recommendations

Implementation recommendations 1–3 are indirectly addressed in responses provided for Sections III A 1, III B, III B 1, III B 2, III A 2, III C, and III C 2, below. Implementation recommendation 3 is not specifically referenced by section heading.

Implementation Recommendations 4-6 are not addressed as they describe issues and needs that range beyond the responsibility of project sponsors.

Section III. A. 1. (Implementation Recommendation 1). Evaluate the purposes for all artificial production facilities and programs in the basin within three years, applying the principles, policies, and statement of purposes recommended above

Implementation Recommendation 1, as addressed in Council document 99-15, is reviewed in greater detail in Section III B. As such, our response to this implementation recommendation is incorporated in Section III B text below.

Section III. B. Evaluating the Purposes for All Artificial Production Facilities and Programs in the Basin.

Section III. B. 1. Initial evaluation of purposes of artificial production facilities and programs.

Over the next three years, review and determine the purpose for every artificial production program and facility in the basin, federal and non-federal, consistent with the principles, purposes, and policies described in Part II of this report. These evaluations should be a prerequisite for seeking continued funding or approvals in whatever funding and approval reviews that the facility or program faces in the next few years.

See the discussion provided above addressing Table 1 of Section II C of Council document 99-15. The purpose of the Redfish Lake Sockeye Salmon Captive Broodstock Program is "conservation/preservation." This purpose has been consistently articulated in the following documents:

1) Project sponsor proposals submitted to the Council and ISRP as part of the provincial review process for the Fish and Wildlife Program,

2) Individual project sponsor annual progress reports submitted to the Bonneville Power Administration,

3) Draft documents completed as part of the ongoing Council's Artificial Production Review and Evaluation process, and in the

4) Draft HGMP being completed for the program.

Section III. B. 2. Evaluation of purposes of artificial production facilities and programs over time—the need for subbasin plans.

The Council expects that by sometime in 2000, the ultimate conclusion of various analytical, planning, and decision making processes in the region (e.g., the Multispecies Framework process, the Council's Fish and Wildlife Program amendment process, the federal agencies' ESA decisions, and Management Plan renegotiations in U.S. v. Oregon) will be the initiation of a comprehensive subbasin planning process, guided in part by basin and province-level goals and objectives, overarching policies for artificial production based on the policies in this report, and criteria for subbasin planning. The purpose or purposes of all artificial production facilities must be re-evaluated in that subbasin planning effort, consistent with the policies in this report.

The Council noted the need to balance increasing the numbers of fish in hatchery-supported populations with maintaining the genetic and biological diversity of natural populations in Section 4.1 of its 1994 Fish and Wildlife Program (NPPC 1994). The Council further noted that actions aimed at increasing fish numbers and conserving biological diversity are both important to maintaining a healthy ecosystem. Goals and objectives of the Redfish Lake Sockeye Salmon Captive Broodstock Program are consistent with these principles. Considerable attention and effort are placed on the importance of maintaining the genetic integrity of the Snake River sockeye salmon ESU. Reintroducing fish to the habitat is also an important component of this program.

Redfish Lake Sockeye Salmon Captive Broodstock Program goals and objectives are also consistent with guidelines and recommendations specifically addressed in the following sections of the 1994 Fish and Wildlife Program: 7.2—the need to utilize artificial propagation to aid depleted populations; 7.4C.1—the need for immediate intervention to protect badly damaged populations; 7.4D—the need to develop captive broodstocks as "the most cost effective means of accelerating recovery of severely depleted stocks," 7.4E—the use of cryopreservation to "bank" critical genetic resources and to protect future options; and 7.5A.1—the recommendation to continue captive broodstock efforts for Snake River sockeye salmon, to produce fish for reintroduction to the habitat, to develop a monitoring and evaluation program, and to develop the facility infrastructure to meet these needs.

Captive broodstock efforts are also consistent with the recovery language presented in the NMFS predecisional Snake River Salmon Recovery Plan (Schmitten et al. 1995). In addition, sockeye recovery efforts conform to recommendations developed by Columbia Basin Fish and Wildlife Authority (CBFWA) co-managers. Specifically, the use of captive broodstock technology to increase numbers of Snake River sockeye salmon is identified as one of several general strategies developed to achieve outcome-based objectives identified in the 1999 Annual Implementation Work Plan (NPPC 1999).

Salmon Subbasin Summary: The critical status of Snake River Sockeye salmon is clearly described in Section 4.1.1.a of the Salmon Subbasin Summary (NPPC 2000a). Section 4.5.1 identifies the Redfish Lake Sockeye Salmon Captive Broodstock Project as one of two artificial production programs in place in the Salmon Subbasin addressing recovery goals through the use of conservation hatchery practices. Program goals and objectives are also consistent with existing plans, policies, and guidelines presented in Section 5.1 of the Salmon Subbasin Summary as developed by Bonneville Power Administration (Section 5.1.1.a), the National Marine Fisheries Service (Section 5.1.1.b), the Nez Perce Tribe (Section 5.1.2.a), the Shoshone-Bannock Tribes (Section 5.1.2.b) and the Idaho Department of Fish and Game (Section 5.1.3.a).

Existing Federal, State, and Tribal goals, objectives, and strategies identified in the Salmon Subbasin Summary (Section 5.2) overlap with principal objectives of the Redfish Lake Sockeye Salmon Captive Broodstock Program. The “overarching” hatchery goal of the Basinwide Salmon Recovery Strategy (Federal Caucus 2000) is to reduce the genetic, ecological, and management effects of artificial production on natural populations. Specific recommendations that overlap with Objective 1 of the captive broodstock program include using safety net programs on an interim basis to avoid extinction while other recovery actions take place, preserving the genetic legacy of the most at-risk populations, limiting the adverse effects of hatchery practices on ESA-listed populations, and using genetically appropriate broodstocks to stabilize and/or bolster weak populations (Section 5.2.1).

Bonneville Power Administration (Section 5.2.1.a) presented basinwide objectives for implementing actions under the Federal Columbia River Power System Biological Opinion (NMFS 2000) and suggested that hatcheries can play a critical role in recovery of anadromous fish by: “increasing the number of biologically-appropriate naturally spawning adults, improving fish health and fitness, and improving hatchery facilities, operation, and management and reducing potential harm to listed fish.” Specific strategies developed by BPA include reducing the potentially harmful effects of hatcheries, using safety net programs on an interim basis to avoid extinction, and using hatcheries in a variety of ways to aid recovery. This language is consistent with the primary objectives of the Redfish Lake Sockeye Salmon Captive Broodstock Program.

The goal of NOAA Fisheries in the Salmon Subbasin (Section 5.2.1.b) is to achieve the recovery of Snake River spring/summer and fall chinook, sockeye, and steelhead resources. Ultimately, NOAA Fisheries’ goal is the achievement of self-sustaining, harvestable levels of salmon populations that no longer require the protection of the Endangered Species Act. Redfish Lake Sockeye Captive Broodstock Program goals and objectives are consistent with this language.

2000 Columbia River Basin Fish and Wildlife Program: The Redfish Lake Sockeye Salmon Captive Broodstock Program conforms to the general vision of the Fish and Wildlife Program (Section III.A.1) and its “overarching” objective to protect, mitigate, and enhance the fish and wildlife of the Columbia River and its tributaries (Section III.C.1, NPPC 2000b). Specifically, the Primary Artificial Production Strategy of the Fish and Wildlife Program (Section 4.) addresses the need to complement habitat improvements by supplementing native fish populations with hatchery-produced fish with similar genetics and behavior to their wild counterpart. In addition, Section 4 includes language stressing the need to minimize the negative impacts of hatcheries in the recovery process. Redfish Lake Sockeye Salmon Captive Broodstock Program goals and objectives are aligned with this philosophy. Program methods receive constant review by the Stanley Basin Technical Oversight Committee (SBSTOC), a team of program cooperators, outside experts, and invited public sector participants assembled to review program findings and to provide assistance with the development of future activities. Cooperators strive to provide hatchery practices that meet Fish and Wildlife Program standards.

FCRPS Biological Opinion: The Federal Columbia River Power System Biological Opinion includes Artificial Propagation Measures (Section 9.6.4) that address reforms to "reduce or eliminate adverse genetic, ecological, and management effects of artificial production on natural production while retaining and enhancing the potential of hatcheries to contribute to basinwide objectives for conservation and recovery" (NMFS 2000). The FCRPS Biological Opinion recognizes that artificial production measures have "proven effective in many cases at alleviating near-term extinction risks." Many of the Actions to Reform Existing Hatcheries and Artificial Production Programs (Section 9.6.4.2.) are being carried out in the Redfish Lake Sockeye Salmon Captive Broodstock Program. Specifically, Objective 1, Tasks C through N of the captive broodstock program address reform measures dealing with the management of genetic risk, the production of fish from locally adapted stocks, the use of mating protocols designed to avoid genetic divergence from the biologically appropriate population, matching production with habitat carrying capacity, and marking hatchery-produced fish to distinguish natural from hatchery fish. The FCRPS Biological Opinion also reviews the need for the development of NMFS-approved Hatchery and Genetic Management Plans (HGMP). At the time of this writing, a draft HGMP covering the sockeye salmon artificial production program is in its final stages of development.

Specific Actions in the FCRPS Biological Opinion that demonstrate logical connections with the sockeye program are contained in Section 9.6.4.3. Action 175 calls for the development of safety net populations of at-risk salmon and steelhead. The Redfish Lake Sockeye Salmon Captive Broodstock Program serves as an "intensely intrusive" example where the entire population of anadromous adults (since 1991) was taken into captivity. Action 177 calls for BPA to begin to implement and sustain NMFS-approved safety-net projects. This action includes the provision to fund modifications to existing facilities. This obligation will continue indefinitely as circumstances warrant.

The governors of the states of Idaho, Montana, Oregon, and Washington urged regional recovery planners to recognize the multipurpose aspect of hatcheries, which includes fish production for harvest, supplementation to rebuild naturally spawning populations, and captive broodstock experiments for conservation and restoration (Offices of the Governors 2000, Chapter IV, Hatchery Reforms). The governors recommended, "*all hatcheries in the Columbia River Basin be reviewed within three years to determine the facilities' specific purposes and potential future uses in support of fish recovery and harvest*." The Redfish Lake Sockeye Salmon Captive Broodstock Program is directly involved with the use of existing and emerging conservation hatchery technologies to develop captive broodstocks for conservation and restoration purposes.

Relationships described above are substantive in nature and address core guidelines, goals, objectives, and strategies identified in the various planning documents. Techniques and products developed in the Redfish Lake Sockeye Salmon Captive Broodstock Program are critical components of the overall conceptual framework being developed in the Region.

Section III. A. 2. (Implementation Recommendation 2). Applying the policies and standards in Part II, take the necessary steps to evaluate and then improve the operation of artificial production facilities that have an agreed-upon purpose.

Implementation Recommendation 2, as addressed in Council document 99-15, is reviewed in greater detail in Section III C. As such, our response to this implementation recommendation is incorporated in Section III C text below.

Section III. C. Applying the Policies and Performance Standards to Evaluate and Improve the Operation of Artificial Production Facilities.

Section III. C. 1. General recommendation—immediately implement needed improvements in artificial production programs and facilities.

All facilities must be evaluated for consistency with the policies and standards in this report relating to artificial production. Evaluating the facility, developing a work plan to meet the standards, and showing progress toward meeting the standards should be a prerequisite to obtaining continued funding (in whatever funding process the facility sits) or obtaining ESA approval for continued operations. Transition and reprogramming funds need to be available (see Part III D.) to make this transition a reality.

The following review of improvement recommendations #1 through #10 is consistent with language provided by the Council's Science Review Team (SRT) and their guidelines presented in Council Document 99-4. Note–a review of SRT guidelines is presented later in this document.

Policy Recommendation 1. The manner of use and the value of artificial production must be considered in the context of the environment in which it will be used.

- **The success of artificial production depends on the quality of the environment in which the fish are released, reared, migrate, and return.**

  Three Sawtooth Valley Lakes (Redfish, Pettit, and Alturas) designated as critical spawning and rearing habitat under the ESA listing (56 FR 58619) have been incorporated in the current efforts to prevent extinction of Snake River sockeye salmon. All three of these lakes are situated at over 2,000 m in elevation in the Sawtooth Mountains of Idaho. Redfish Lake is the largest of the three lakes at 615 ha, Alturas Lake has a surface area of 338 ha, and Pettit Lake is the smallest of the three lakes at 160 ha. Redfish Lake has about one-half of the total estimated carrying capacity of the Sawtooth Valley lakes that historically supported anadromous sockeye salmon (BPA 1995). According to Bjornn et al. (1968), the historic production of sockeye salmon smolts from Redfish Lake probably never exceeded 100,000 fish. Paleolimnological investigations estimate that at times as many as 30,000 adults may have spawned in Redfish Lake (Finney, 2001).

  The majority of the Redfish, Pettit, and Alturas lake watersheds are encompassed by wilderness and considered pristine. The lakes themselves are managed for recreation, with U.S. Forest Service (USFS) campgrounds along their shorelines. These uses are not believed to substantially impair sockeye rearing or spawning habitat. At the time of ESA-listing of Snake River sockeye salmon (1991), perhaps the greatest habitat constraint in the Sawtooth Valley lakes was the lack of anadromous access in all except Redfish Lake. During the mid 1990s, the fish barriers on Alturas and Pettit Lake creeks (an irrigation intake and concrete rough fish barrier, respectively) were modified to facilitate fish passage of anadromous salmonids into these historic habitats (Teuscher and Taki 1996).

The Sawtooth Valley lakes are classified as oligotrophic and share many characteristics with sockeye salmon nursery lakes in British Columbia and Alaska (Griswold et al. 2003). However, overall nutrient loading of marine derived nutrients (MDN) in the lake has been reduced by the decline of returning adult salmon. This has had an understandably severe consequence for *O. nerka* juvenile production. The forage dynamics of the lakes have been extensively surveyed during the project (Spaulding 1993; Teuscher and Taki 1995, 1996; Taki and Mikkelsen 1997; Taki et al. 1999; Lewis et al. 2000; Griswold et al. 2000, 2003; Kohler et al 2001, 2002.). Forage for *O. nerka* in Sawtooth Valley lakes consists primarily of cladocerans, copepods, and littoral invertebrates.

Exceeding the carrying capacity of Sawtooth Valley sockeye nursery lakes has been a concern of the SBSTOC coordinating team since the inception of the program. Exceeding the carrying capacity of the lakes could cause density-dependant impacts on zooplankton size, biomass, and species composition and could result in the reduction of sockeye salmon growth and survival. To prevent such an occurrence, carrying capacity models were developed (Teuscher and Taki 1995).

To stabilize rearing conditions and to provide food resources for reintroduced sockeye salmon, nutrient supplementation was conducted in Redfish Lake (1995-1998 and 2001-2002), Alturas Lake (1997-1999), and Pettit Lake (1997-1999). Liquid ammonium nitrate and ammonium phosphate (20:1 [1995-1998] and 30:1 N:P (1999-2002) ratio at an aerial loading rates of about 35 mg P/m^2/year) was surface applied weekly by boat from June-October (Spaulding 1993; Teuscher and Taki 1995, 1996; Taki and Mikkelsen 1997; Taki et al. 1999; Lewis et al. 2000; Griswold et al. 2000, 2003; Kohler et al 2001, 2002.). Limnological parameters including nutrient levels, chlorophyll *a*, Secchi depth, primary productivity, heterotrophic bacteria, autotrophic picoplankton, phytoplankton, and zooplankton assemblage characteristics (species composition and densities) were monitored concomitant with fertilization activities. In general, results have indicated that 1) negative impacts to aesthetic values and water quality were insignificant, 2) marked increases in chlorophyll *a*, primary productivity, and zooplankton biomass occurred, providing evidence that nutrient supplementation was effective, and 3) growth and survival of endangered sockeye were maintained or improved (Griswold et al. 2003).

Currently, annual *O. nerka* population estimates are made using hydroacoustic and trawling techniques to ensure carrying capacities are not exceeded when juvenile sockeye are released into the lakes. Lake carrying capacities, *O. nerka* standing stock and age structure, and macrozooplankton abundance/biomass data are used to determine stocking levels and allocation between the various lakes and to determine if nutrient supplementation is necessary. These data allow the SBSTOC coordinating team to identify and manage for optimal lake rearing conditions for the release of sockeye salmon from project captive broodstocks.

- **Artificial production provides protection for a limited portion of the lifecycle of fish that exist for the rest of their lives in a larger ecological system, albeit altered, that may include riverine, reservoir, lake, estuarine, and marine systems that are**

subject to environmental factors and variation that we can only partially understand.

Project sponsors understand that captive intervention should be a short-term tool used only to get past bottlenecks that jeopardize the good standing of the population (e.g., demographic, genetic, or environmental risk). The benefits of using captive technology should outweigh the risks of doing so and work should be underway to correct the problems that brought about the need to intervene.

Project sponsor activities are focused on providing the best fish culture environment, monitoring program, and evaluation effort to support the maintenance and rebuilding of the Snake River sockeye salmon ESU. At the same time, it is hoped regional efforts to decrease migratory mortality of juvenile and adult anadromous salmonids are successful. Project sponsors recognize that these efforts are largely out of their immediate sphere of influence.

- **The success of artificial production must be evaluated with regard to sustained benefits over the entire lifecycle of the produced species in the face of natural environmental conditions and not evaluated by the number of juveniles produced.**

The Redfish Lake Sockeye Salmon Captive Broodstock Program includes a comprehensive set of program elements that address: fish culture, in-hatchery monitoring and evaluation, field monitoring and evaluation, lake habitat and limnology monitoring and evaluation, and genetic monitoring and evaluation needs. The combined efforts of federal, state, university, and tribe cooperators provide the foundation to address daily management responsibilities, critical program uncertainties, and a comprehensive management and recovery vision for the ESU.

The Redfish Lake Sockeye Salmon Captive Broodstock Program's hatchery activities represent the regions most advanced fish culture practices and contribute to maintaining critical species genetic diversity and heterozygosity. In addition, hatchery protocols undergo constant revision to improve the survival and reproductive viability of fish held in culture. Field monitoring and evaluation activities track survival from release through adult return over a variety of reintroduction strategies. Adaptively managed, reintroduction plans are modified to direct effort to those strategies that offer the most potential for returning anadromous adults to the program.

- **Domestication selection is the process whereby an artificially propagated population diverges in survival traits from the natural population. This divergence is not avoidable entirely, but it can be limited by careful hatchery protocols such as those required by policies in this report.**

Domestication selection is taken into consideration within the Redfish Lake Sockeye Salmon Captive Broodstock Program. Managers employ a variety of techniques and protocols to minimize this type of selection. Foremost, fish within the broodstock program are not selected for growth or other performance measures as they would in a production hatchery setting. Animals are bred in a factorial design that minimizes the loss of genetic variability and heterozygosity with the captive population, the loss of which is a consequence of domestication selection. Animals are also kept in an environment that minimizes demographic extinction risk from disease or predation, etc., but maintains lower density, natural light levels, water temperatures, and feeding regimes designed to simulate or more closely resemble natural conditions.

- **For actions that mitigate for losses in severely altered areas, such as irrevocably blocked areas where salmon once existed, the production of nonnative species may be appropriate in situations where the altered habitat or species assemblages are inconsistent with feasible attainment of management objectives using endemic species.**

  Not applicable.

Policy Recommendation 2. Artificial production must be implemented within an experimental, adaptive management design that includes an aggressive program to evaluate benefits and address scientific uncertainties.

The Redfish Lake Sockeye Salmon Captive Broodstock Program is operated within an experimental, adaptive management design that addresses the majority of benefit and risk factors identified for operation of Conservation Hatcheries and captive broodstock programs (Flagg et al. 1995; Flagg et al., in review,a,b; Pollard and Flagg in review). Required strategies range from providing proper genetic breeding protocols, through specifics of rearing and release, and monitoring and evaluation. Investigation of scientific uncertainties has assured a feedback loop of information that has allowed the SBSTOC to adaptively manage the program.

Genetic integrity of the captive population from applied mating designs are assessed through empirical calculations of stability of heterozygosity and genetic diversity over time among spawned, captive Redfish Lake sockeye salmon (Powell and Kline 2002, 2003). Genetic monitoring is conducted using allozyme and microsatellite DNA analysis and the generation of kinship coefficients (Faler and Powell 2003). Equalization of sockeye salmon captive broodstock family lines retained in the hatchery production group has facilitated retention of available genetic diversity and heterozygosity (Flagg et al., in review,b).

New captive broodstock rearing and reintroduction technology is continuously being developed through combined efforts of the implementation programs and project 1993-056-00, Assessment of Captive Broodstock Technologies. During the program, mean survival to adult has ranged from 79-88% for brood year groups of captive brood reared at IDFG facilities (see Johnson 1993; Johnson and Pravecek 1995, 1996; Pravecek and Johnson 1997; Pravecek and Kline 1998; Kline and Heindel 1999; Kline and Willard 2001) and 13-74% for those reared at NOAA facilities (see Flagg 1993; Flagg and McAuley 1994; Flagg et al. 1996; Flagg et al. 2001; Frost et al. 2002). Mean annual egg viability of captive broodstock reared at IDFG facilities has ranged from 29-60% and from 33-78% for those reared at NOAA facilities. The captive broodstocks for Redfish Lake sockeye salmon are achieving a high degree of population amplification. Data indicates that the Redfish Lake Sockeye Salmon Captive Broodstock Program has achieved rearing and release successes rarely seen in other endangered species programs. The initial sourcing of 5,450 eyed eggs from the spawning of the five wild anadromous female sockeye salmon that returned to Redfish Lake in the 1990s and a few residual juveniles and anadromous smolts has resulted in the production of over 1.15 million progeny (prespawning adults, eyed eggs, presmolts, and smolts) replanted to Stanley Basin habitats (Flagg et al., in review,b; Hebdon et al., in review).

Effects of these releases on the carrying capacity of Sawtooth Valley sockeye nursery lakes have been investigated. Exceeding the carrying capacity of the lakes could cause density-dependent impacts on zooplankton size, biomass, and species composition and could result in the reduction of sockeye salmon growth and survival. To prevent such an occurrence, carrying capacity models were developed. To stabilize rearing conditions and to provide food resources for reintroduced sockeye salmon, nutrient supplementation was conducted in Redfish Lake (1995-1998 and 2001-2002), Alturas Lake (1997-1999), and Pettit Lake (1997-1999). Limnological parameters have been monitored, including nutrient levels, chlorophyll *a*, Secchi depth, primary productivity, heterotrophic bacteria, autotrophic picoplankton, phytoplankton, and zooplankton assemblage characteristics (species composition and densities) were monitored concomitant with fertilization activities. In general, results have indicated that 1) negative impacts to aesthetic values and water quality were insignificant, 2) marked increases in chlorophyll *a*, primary productivity and zooplankton biomass occurred, providing evidence that nutrient supplementation was effective, and 3) growth and survival of endangered sockeye were maintained or improved (Griswold et al. 2003). Currently, annual *O. nerka* population estimates are made using hydroacoustic and trawling techniques to ensure carrying capacities are not exceeded when juvenile sockeye are released into the lakes. Lake carrying capacities, *O. nerka* standing stock and age structure, and macrozooplankton abundance/biomass data are used to determine stocking levels and allocation between the various lakes and to determine if nutrient supplementation is necessary (Flagg et al., in review,b).

A cornerstone of the project is extensive monitoring and evaluation of survival of fish both while they are resident in Sawtooth Valley lakes and during smolt out-migration and subsequent adult return (Kline 1994; Kline and Younk 1995; Kline and Lamansky 1997; Hebdon et al. 2000, 2002, in review). All hatchery presmolt and smolt releases are adipose clipped and a portion coded-wire tagged and/or PIT tagged. A total of about 180,000 sockeye salmon smolts resulting from program releases have out-migrated from Sawtooth Valley lakes since the program began. Approximately 160,000 hatchery-reared smolts have also been released and have out-migrated. Between 1999 and 2002, a total of 312 adults have returned from the ocean from captive broodstock releases (Hebdon et al., in review). It is virtually certain that the Redfish Lake Sockeye Salmon Captive Broodstock Program has, at least for the short-term, prevented extinction of Snake River sockeye salmon.

One of the primary reasons for success of the project in preventing extinction of Snake River sockeye salmon is that extensive efforts have concurrently addressed 1) the needs of developing captive broodstock culture technologies for the population, 2) preservation of the genetics of the population existing at time of ESA-listing, and 3) remediation of barriers to survival in the freshwater rearing habitat, and assurance of functioning forage food webs. As noted above, the extensive monitoring and evaluation program has assured a feedback loop of information that has allowed the SBSTOC to adaptively manage the program toward success.

Policy Recommendation 3. Hatcheries must be operated in a manner that recognizes that they exist within ecological systems whose behavior is constrained by larger-scale basin, regional, and global factors.

- **Management of artificial production, and the expectations of that management, should be flexible to reflect the dynamics of the natural environment. Production and harvest managers should anticipate large variation in artificial production returns similar to that in natural production.**

  Program managers are aware of the need to incorporate flexibility into annual production plans to accommodate the inherent variability of Stanley Basin lakes to rear and support production from the program. Annually, the Shoshone-Bannock Tribes conduct limnologic investigations in program nursery lakes and develop estimates of *O. nerka* carrying capacity. In addition, the Shoshone-Bannocks and the IDFG monitor *O. nerka* abundance, biomass, and density in program nursery lakes. This information is presented and discussed at the SBSTOC level and forms the foundation for the development of annual reintroduction plans. Annual reintroduction plans remain flexible to accommodate annual nursery lake rearing conditions. In addition, the Shoshone-Bannock Tribes implemented a whole-lake artificial nutrification program in 1995 to improve growing conditions in nursery lakes and to ensure that program reintroductions do not jeopardize the food producing capabilities of receiving lakes.

In addition, the Redfish Lake Sockeye Salmon Captive Broodstock Program is managed to generate its own broodstock annually and not to solely rely on anadromous, hatchery-produced adult returns to source spawning adults. While the return of anadromous, hatchery-produced, and natural-origin adults is desirable, the program is capable of maintaining a continuum of spawning adults without relying on the environment to produce anadromous returns.

- **The management and performance of individual facilities cannot be considered in isolation but must be coordinated at watershed, subbasin, basin, and regional levels, and must be integrated with efforts to improve habitat characteristics and natural production where appropriate.**

  Project technical review, prioritization, and funding decisions are carried out at the subbasin, basin, and regional levels through cooperative processes developed by regional fish managers, the Columbia Basin Fish and Wildlife Authority, and the Northwest Power and Conservation Council. The action agencies and tribes are also providing input to the ongoing subbasin planning process.

  Individual hatchery facilities operated by the IDFG and NOAA Fisheries that produce eggs and fish for the Redfish Lake Sockeye Salmon Captive Broodstock Program are guided by outcomes of the coordinated processes described above. By no means are the actions of these individual facilities "isolated."

Policy Recommendation 4. A diversity of life history types needs to be maintained in order to sustain a system of populations in the face of environmental variation.

Genetic diversity has been directly correlated with long-term success and persistence of populations (see Avise 1994 for a review). It is the intention of this program to minimize the loss of genetic variation and heterozygosity by utilizing available genetic diversity within the population and crossing available individuals in a breeding strategy to minimize other genetic risks (such as inbreeding).

Policy Recommendation 5. Naturally selected populations should provide the model for successful artificially reared populations, in regard to population structure, mating protocol, behavior, growth, morphology, nutrient cycling, and other biological characteristics.

- **With regard to increasing the survival of the hatchery population itself, the working hypothesis is that mimicking the incubation, rearing, and release conditions of naturally spawning populations will increase survival rates after release into the natural environment. Some efforts to mimic natural rearing**

processes, such as the use of shading, are generally accepted as appropriate practices. Uncertainty lies in how far managers should go in mimicking natural rearing conditions in an effort to improve survival, especially considering the increasing cost, the difficulty of some measures, and the possibility of declining benefits. In addition, there are certain situations in which the survival of artificially produced fish appears to be enhanced by not mimicking natural release size or migration times. Decisions to deviate from the biological characteristics of the naturally spawning population should be documented through an explicitly stated biological rationale and carefully evaluated. In addition, the efficacy of programs that mimic natural populations should continue to be tested to reduce uncertainty.

- **With regard to the possibility of adverse impacts of artificial production on naturally spawning fish, much of the recent literature suggests that using local broodstocks and mimicking natural rearing conditions will reduce the impacts of artificially produced populations on naturally spawning populations and the ecosystem. There is a counter-hypothesis that, at least in some situations, it is best for artificial production managers to avoid mimicking the release times, places, and conditions of natural populations to avoid harmful competition, predation, and other adverse interactions. Again, any decisions to deviate from the biological characteristics of the naturally spawning population should be documented through an explicitly stated biological rationale and carefully evaluated.**

The Redfish Lake Sockeye Salmon Captive Broodstock Program is modeled, to the extent possible, on the population structure, mating protocol, growth, morphology, nutrient cycling, and other biological characteristics of the naturally spawning population. The number of program fish released at each life stage is based on the system's historical carrying capacity for that life history stage. Although fish within the captive broodstock program are mated in a manner to maximize the retention of original genotypes within the population, broodstock adults and hatchery-produced anadromous returns are also released and allowed to mate in a natural manner. Extensive efforts have been made to ensure that the natural behavior, growth, and morphological characteristics of fish taken into culture are maintained. However, the first step in this process is ensuring high in-culture survival. As such, the captive broodstock program relies on traditional fish culture techniques with a proven record of increasing in-culture survival. Additionally, when demonstrated to have no adverse effects on in-culture survival, the program readily adopts novel fish culture technology designed to promote the natural attributes of the fish. The program also uses a wide variety of reintroduction and acclimation strategies as tools to keep program fish close to the natural model.

Adult releases have been used as a tool to allow fish to spawn naturally, with the intent that offspring will be conditioned to the natural environment. Eyed-egg plants on historic spawning beaches have been employed with this same goal in mind. Unfortunately, these approaches often yield very low freshwater survival, making it unlikely that these strategies alone will produce enough fish to spawn at the replacement level. Nevertheless, project sponsors are committed to these "natural" release options because of potential conferred fitness advantages of full-term rearing in the habitat (Hebdon et al., in review).

Another approach that has been used to attain the natural model was to rear fish in net pens suspended in Redfish Lake. This provided the fish the opportunity to experience the natural lake environment (background coloration, temperatures, water chemistry, and natural feeds), while remaining protected from predation. It was hoped this experience would help shape the behavior and morphology of these fish to resemble the natural model. The fish were reared in these net pens until late summer when they were released into the lake to overwinter and out-migrate as smolts the following spring. This program was suspended when it became clear that overwinter survival of net pen acclimated fish was lower than that of conventional raceway reared fish released in the autumn.

The incorporation of proven seminatural rearing strategies into conventional raceway rearing practices is being considered as a means to produce a more natural product while maintaining the increased survival associated with autumn parr and smolt releases.

All fish in the present anadromous Snake River sockeye salmon population have originated from the indigenous Redfish Lake population. The captive broodstock was founded exclusively from Redfish Lake anadromous adults, anadromous smolts, and residual adults. Since the inception of the program in 1991, all wild anadromous adult sockeye salmon returning to Redfish Lake have been incorporated in the captive broodstock. As such, there is no “natural” population to mimic. Adults are released to spawn naturally now but are products of the hatchery program.

- **The final working hypothesis, which applies to artificial production for the *restoration* purpose, is that through the use of locally adapted or compatible broodstocks and natural rearing and release conditions, artificial production can benefit or assist naturally spawning populations. This is the least established hypothesis of the three, and the one most in need of experimental treatment and evaluation.**

  Not applicable.

Policy Recommendation 6. The entities authorizing or managing a artificial production facility or program should explicitly identify whether the artificial propagation product is intended for the purpose of augmentation, mitigation, restoration, preservation, research, or some combination of those purposes for each population of fish addressed.

- **A decision identifying an artificial production program as a “permanent” *mitigation* program should be accompanied, for example, by an explicit identification of the permanently lost habitat that it replaces.**

  Not applicable.

- **A decision identifying a *restoration* program should include, for example, an explicit determination that suitable restored habitat exists or will soon exist for reseeding. It should also include a statement of the expected duration of the program, by which it is expected the natural population will be rebuilt and the facility withdrawn (or continued with a different identified purpose).**

  Not applicable.

- **Similarly, a decision identifying a *preservation/conservation* program should include, for example, an explicit determination that the underlying habitat decline or other problem-threatening extirpation will be addressed and how. This decision should also include a statement of the expected duration of the program, the time by which the program will be evaluated to determine if it is a success (meaning the time by which it is expected that natural processes can once again sustain the population, and the facility withdrawn or converted to another identified purpose) or a failure (meaning that it is time to end or reorient the program).**

As noted in Pollard and Flagg (in review), captive propagation on its own will rarely, if ever, constitute a complete recovery program. Sponsors must address issues concerning factors of decline that caused the population to reach the status where captive propagation is necessary. Redfish Lake Sockeye Salmon Captive Broodstock Program sponsors have addressed a majority of factors likely affecting population abundance of sockeye salmon juveniles in their rearing habitats. At the time of ESA-listing of Snake River sockeye salmon (1991), perhaps the greatest habitat constraint in the Sawtooth Valley lakes was the lack of anadromous access in all except Redfish Lake. During the mid 1990s, the fish barriers on Alturas and Pettit lake creeks (an irrigation intake and concrete rough fish barrier, respectively) were modified to facilitate fish passage of anadromous salmonids into these historic habitats (Flagg et al., in review, b). Carrying capacity models were developed and lakes fertilized to stabilize rearing conditions and to provide food resources for reintroduced sockeye salmon (Griswold et al. 2003; Flagg et al., in review, b).

The current efforts to prevent extinction of Snake River sockeye salmon have provided a large measure of success. Between 1999-2002, over 312 adults returned from the ocean from captive broodstock releases—an amplification of almost 20 times the number of wild fish that returned in the 1990s. Important lineages of Snake River sockeye salmon are being maintained in culture as preserves for genetic variability and for numerical and demographic amplification of the extant wild population. Most importantly, it is virtually certain that the broodstock program has, at least for the short-term, prevented extinction of Snake River sockeye salmon.

As pointed out by Flagg et al. (1995; in review, b), a dilemma facing enhancement efforts at Redfish Lake is that most of the severe barriers to survival for Snake River sockeye salmon are downstream of the spawning and rearing habitat. Both manmade (dams) and natural habitat alterations, harvest, and changes in ocean productivity probably contributed to reduction in abundance of Snake River sockeye salmon. These are outside the purview of SBSTOC actions. Regional fish managers are currently involved in a Technical Recovery Team (TRT) process to determine needed recovery actions and timeframes. Redfish Lake Sockeye Salmon Captive Broodstock Program sponsors are hopeful that the TRT process will help provide necessary actions for population stability in areas outside SBSTOC authority. Current smolt-to-adult survival (SAR) of sockeye salmon from Sawtooth Valley lakes is rarely greater than 0.3% (Hebdon et al., in review). Under current conditions, the adult recruit/spawner ratio for Redfish Lake sockeye salmon is about 0.15:1. Recovery to a nominal population equilibrium of 1:1 replacement would require over a 6-fold increase in survival from current conditions. Under these current conditions, it is probable that captive broodstocks and artificial propagation will need to be key components in maintaining Snake River sockeye salmon for years to come.

Policy Recommendation 7. Decisions on the use of the artificial production tool need to be made in the context of deciding on fish and wildlife goals, objectives and strategies at the subbasin and province levels.

The critical status of Snake River Sockeye salmon is clearly described in Section 4.1.1.a of the Salmon Subbasin Summary. Section 4.5.1 identifies the Sockeye Salmon Captive Broodstock Project as one of two artificial production programs in place in the Salmon Subbasin addressing recovery goals through the use of conservation hatchery practices. Program goals and objectives are also consistent with existing plans, policies, and guidelines presented in Section 5.1 of the Salmon Subbasin Summary as developed by Bonneville Power Administration (Section 5.1.1.a), the National Marine Fisheries Service (Section 5.1.1.b), the Nez Perce Tribe (Section 5.1.2.a), the Shoshone-Bannock Tribes (Section 5.1.2.b) and the Idaho Department of Fish and Game (Section 5.1.3.a).

Existing Federal, State, and Tribal goals, objectives, and strategies identified in the Salmon Subbasin Summary (Section 5.2) overlap with the primary objectives of the Sockeye Salmon Captive Broodstock Program. The “overarching” hatchery goal of the Basinwide Salmon Recovery Strategy (Federal Caucus 2000) is to reduce the genetic, ecological, and management effects of artificial production on natural populations. Specific recommendations that overlap with objectives of the captive broodstock program include using safety net programs on an interim basis to avoid extinction while other recovery actions take place, preserving the genetic legacy of the most at-risk populations, limiting the adverse effects of hatchery practices on ESA-listed populations, and using genetically appropriate broodstocks to stabilize and/or bolster weak populations (Section 5.2.1).

Bonneville Power Administration (Section 5.2.1.a) presented basinwide objectives for implementing actions under the Federal Columbia River Power System Biological Opinion (NMFS 2000) and suggested that hatcheries can play a critical role in recovery of anadromous fish by “increasing the number of biologically-appropriate naturally spawning adults, improving fish health and fitness, and improving hatchery facilities, operation, and management and reducing potential harm to listed fish.” Specific strategies developed by BPA include reducing the potentially harmful effects of hatcheries, using safety net programs on an interim basis to avoid extinction, and using hatcheries in a variety of ways to aid recovery. This language is consistent with the primary objectives of the Sockeye Salmon Captive Broodstock Program.

The goal of NOAA Fisheries in the Salmon Subbasin (Section 5.2.1.b) is to achieve the recovery of Snake River spring/summer and fall chinook, sockeye, and steelhead resources. Ultimately, NOAA Fisheries’ goal is the achievement of self-sustaining, harvestable levels of salmon populations that no longer require the protection of the Endangered Species Act. Redfish Lake Sockeye Captive Broodstock Program goals and objectives are consistent with this language.

Salmon Subbasin goals, objectives, and strategies developed by the Nez Perce Tribe (Section 5.2.2.a) and the Shoshone-Bannock Tribes (Section 5.2.2.b) relate directly to the Sockeye Salmon Captive Broodstock Program. The principal Nez Perce Tribal goal “to restore anadromous fish in rivers and streams…” is directly compatible with the primary captive broodstock program goal. In addition, program goals and objectives are consistent with Shoshone-Bannock Tribal Objective 1, and Strategies 1 and 3. Shoshone-Bannock Tribal activities are in place to compliment captive broodstock program work performed by cooperating BPA contractors.

Representatives from the action agencies and tribes associated with the Redfish Lake Sockeye Salmon Captive Broodstock Program are currently contributing to the ongoing subbasin assessment and planning process. Snake River sockeye salmon are considered a "focal" species in the development of the subbasin plan. A draft plan for the Salmon subbasin (Mountain Snake Province) is anticipated by June of 2004.

Policy Recommendation 8. Appropriate risk management needs to be maintained in using the tool of artificial propagation.

Mortality associated with the trapping and handling of juvenile sockeye salmon is typically 1.0% or less. Mortality associated with capture, handling, and tagging of juvenile fish is minimized in several ways. Juvenile traps are checked twice daily to reduce the length of time fish are in traps, and traps are adjusted nightly based on water levels. All personnel are properly trained in fish handling methods before being allowed to operate traps. All fish are anesthetized prior to tagging and are allowed to recover prior to release.

Fish husbandry protocols follow standard fish culture practices (for a general overview of methods, see Leitritz and Lewis 1976; Piper et al. 1982; Rinne et al. 1986; Erdahl 1994; IHOT 1995; McDaniel et al. 1994; Bromage and Roberts 1995; Schreck et al. 1995; Pennell and Barton 1996; NMFS 1999; Wedemeyer 2001) and other protocols and guidelines approved by the SBSTOC to ensure high quality rearing conditions.

Genetic hazards with artificial production outlined in Hard et al. (1992) are taken into consideration. Breeding matrices developed by IDFG and the University of Idaho are reviewed by NMFS personnel and SBSTOC members before implementation.

Diseased, moribund, or nonproductive fish and gametes are removed from the captive population and disposed of following AFS Fish Health Blue Book and Pacific Northwest Fish Health Protection Committee guidelines to ensure the overall health of rearing groups. This culling is necessary to prevent the spread of contagious diseases to the general population.

Gametes, embryos, or fish may be sampled as necessary to detect diseases and to monitor fertilization and the development of embryos. This lethal sampling is necessary to improve the reproductive success of fish in the captive broodstock program.

Rearing facilities are staffed full time and have backup and redundancy systems in place to ensure an uninterrupted supply of pathogen free water. Alarm systems and generator systems are also in place.

Fish transport equipment is maintained in top working condition. All transport vehicles have onboard oxygen and fresh flow water agitation systems. Fish are inspected at regular intervals during transportation.

Policy Recommendation 9. Production for harvest is a legitimate management objective of artificial production, but to minimize adverse impacts on natural populations associated with harvest management of artificially produced populations, harvest rates and practices must be dictated by the requirements to sustain naturally spawning populations.

Production for harvest remains a long-term goal for the Redfish Lake Sockeye Salmon Captive Broodstock Program. At the present time, no harvest is allowed for Snake River sockeye salmon. However, intermittent sport, commercial, and tribal fisheries for sockeye salmon in the lower Columbia River have the potential for the incidental harvest of program fish. To date, eight sockeye harvested in the Columbia River have been identified through a combination of external marks and mitochondrial haplotypes as potentially originating from Redfish Lake.

In 2000, the Shoshone-Bannock Tribes were authorized by NOAA to conduct a limited fishery for Snake River sockeye salmon (no fishing occurred).

Policy Recommendation 10. Federal and other legal mandates and obligations for fish protection, mitigation, and enhancement must be fully addressed.

Title 36 of Idaho State Code declares fish and wildlife to be the property of the state of Idaho and mandates the Idaho Department of Fish and Game Commission (Commission) to “preserve, protect, and perpetuate such wildlife and provide for the citizens of the state and as by law permitted to others, continued supplies of such wildlife for hunting, fishing, and trapping.” Under the Commission’s guidance, the Idaho Department of Fish and Game (Department) manages the fish and wildlife of the state. The Department’s 2001-2006 Fisheries Management Plan includes policy statements that focus anadromous fisheries management on protecting and restoring fish habitat and water quality; prioritizing the management of wild, native populations of anadromous fish species, emphasizing the maintenance of self-sustaining populations, and utilizing hatchery-produced fish effectively. In addition, the Department is committed to maintaining programs such as the Sockeye Salmon Captive Broodstock Program to safeguard and perpetuate the Snake River ESU.

The Policy of the Shoshone-Bannock Tribes for management of Snake River basin resources is to pursue, promote, and where necessary, initiate efforts to restore the Snake River system and affected unoccupied lands to a natural condition. This includes the restoration of component resources to conditions that most closely represent the ecological features associated with a natural river ecosystem. In addition, the Tribes will work to ensure the protection, preservation, and where appropriate the enhancement of Rights reserved under the Fort Bridger Treaty of 1868 and any inherent aboriginal rights.

In addition to state and tribal policy, the Redfish Lake Sockeye Salmon Captive Broodstock Program complies with federal Endangered Species Act Policy. Since the inception of the program in 1991, the various entities involved with program implementation have secured all necessary Section 10 permits authorizing the take of listed Snake River sockeye salmon for research and enhancement activities. Accordingly, biological opinions generated by NOAA Fisheries have concluded that program activities are not likely to jeopardize the continued existence of listed Snake River sockeye salmon.

Section VIII. D. Guidelines on Hatchery Practices, Ecological Integration, and Genetics.

The guidelines reviewed below are from the *Review of Artificial Production of Anadromous and Resident Fish in the Columbia River Basin. A Scientific Basis for Columbia River Production Programs. Northwest Power Planning Council. Document 99-4. April 1999. Portland, Oregon.*

Guideline 1. Technology should be developed and used to more closely resemble natural incubation and rearing conditions in salmonid hatchery propagation.

The captive broodstock program fish are generally reared following guideline 1. They are incubated in darkness, and incubation and rearing densities do not exceed 0.5 lbs/ft^3 (8.0 kg/m^3)

for most of the rearing cycle. Shade cover is always available to fish in the primary captive broodstock program. In most cases, the program does not use natural-like habitat during culture or rear fish in variable higher velocity habitat. The latter is probably not relevant to sockeye salmon that rear naturally in low velocity lake habitat. The fish are fed by hand or automated feed delivery systems rather than demand feeders. No fish in the program are exposed to predator training. Fish-human interactions are generally minimized. Fish have been acclimated in net pens suspended in Redfish Lake prior to release in some instances. Volitional emigration has not been used to date, as most fish rearing is done at offsite locations. However, smolts produced from presmolt releases, eyed-egg plants, or from the release of prespawn adults naturally emigrate from nursery lakes.

Guideline 2. Hatchery facilities need to be designed and engineered to represent natural incubation and rearing habitat, simulating incubation and rearing experiences complementary with expectations of wild fish in natural habitat.

The program does not generally use facilities designed to simulate the natural incubation and rearing experience, as most proven fish culture technology does not incorporate these features. Net pen rearing within Redfish Lake was utilized as a means to accomplish this goal. This provided the fish experience with the natural temperature profile of the lake, natural foods entering the net pen, and familiarized them with the native water chemistry of the lake. While this provided fish a natural rearing experience, this rearing option has been temporarily suspended due to the fact that net pen-reared presmolts experienced relatively poor overwinter survival following release compared to conventional raceway-reared presmolts (Hebdon et al., in review).

Guideline 3. New hatchery technology for improving fish quality and performance needs to have a plan for implementation and review at all hatchery sites, where appropriate, to assure its application.

New captive broodstock technology is continuously being developed through combined efforts of the sockeye and chinook salmon captive broodstock programs (i.e., ‘implementation’ programs) and project 1993-056-00, “Assessment of Captive Broodstock Technologies” (‘assessment’). Technical Oversight Committee Meetings provide the mechanism for the assessment and implementation projects to identify critical areas for technological development. Through this process, all BPA-funded projects are reviewed. The result is a collaborative research effort to improve captive broodstock technology in five major areas:

1) Improve reintroduction success of adult and juvenile salmon;
2) Improve olfactory imprinting and homing in sockeye salmon;
3) Improve physiological development and maturation;
4) Improve in-culture survival through prevention and treatment of disease; and
5) Evaluate effects of inbreeding and inbreeding depression in captive populations.

Advancements in technology are integrated into implementation program operations, and the biological benefits of the advancements are monitored by each of the programs.

Guideline 4. To mimic natural populations, anadromous hatchery production strategy should target natural population parameters in size and timing among emigrating anadromous juveniles to synchronize with environmental selective forces shaping natural population structure.

Program smolts are released during the historic out-migration window for Redfish Lake sockeye salmon. Historically, the majority of the program smolts have been larger than naturally out-migrating fish. However, in recent years, use of chilled water during incubation and rearing of groups of fish for presmolt and smolt reintroductions at the IDFG Sawtooth Fish Hatchery has minimized this divergence.

Eyed-egg plants and prespawn adult releases produce juveniles that rear naturally in the lake environment from hatch to smolt emigration and are in the same size range of natural out-migrants.

Guideline 5. To mimic natural populations, resident hatchery production strategy should target population parameters in size and release timing of hatchery-produced resident juveniles to correspond with adequate food availability and favorable prey to maximize their post-stocking growth and survival.

Not applicable.

Guideline 6. Supplementation hatchery policy should utilize ambient natal stream habitat temperatures to reinforce genetic compatibility with local environments and provide the linkage between stock and habitat that is responsible for population structure of stocks from which hatchery fish are generated.

Program sponsors are aware of the importance of managing rearing and incubation water temperatures to ensure the linkage described in Guideline 6 is maintained. The Idaho Department of Fish and Game (IDFG) Eagle Fish Hatchery and the NOAA Fisheries Burley Creek Fish Hatchery have the ability to used chilled water during incubation and rearing phases of culture to meet this guideline.

Annually, the Redfish Lake Sockeye Salmon Captive Broodstock Program spawns adults and produces eyed-eggs to meet two different needs: 1) the production of eggs to meet reintroduction needs, and 2) the production of eggs to meet broodstock needs. Eggs produced to meet broodstock needs produce fish that remain in the hatchery through maturation and spawning. All rearing to meet this need occurs at the IDFG Eagle Fish Hatchery and the NOAA Fisheries Burley Creek Fish Hatchery. Ambient facility water temperature (13.5°C for Eagle Fish Hatchery and 10.0°C for Burley Creek Fish Hatchery) is typically chilled during all phases of broodstock culture. Through an adaptive management process and from technical discussions at the SBSTOC level, program managers have identified several benefits associated with water temperature manipulation. Chilled water has been demonstrated to positively influence the rate of precocial maturation (age-2 primarily) and to have a positive impact on gamete quality. As such, water temperature is typically chilled down to between 5.0°C and 9.0°C during the entire incubation phase of development. Early rearing through age-2 rearing water temperature typically ranges from 7.0°C to 10.0°C. Final rearing through maturation water temperature does not exceed 10.0°C at the Burley Creek Hatchery and 11.0°C at the Eagle Fish Hatchery.

Eggs produced to meet reintroduction needs are generated at the IDFG Eagle Fish Hatchery and the NOAA Fisheries Burley Creek Fish Hatchery. The majority of these eggs are transferred to the IDFG Sawtooth Fish Hatchery and reared for presmolt and smolt release options. However, eyed-eggs may be transferred from Eagle and Burley Creek facilities to Sawtooth Valley lakes for an in-lake incubation program. During incubation at IDFG and NOAA Fisheries hatcheries, temperature manipulation occurs as described above for broodstock eggs. In addition, for the egg box program, an effort is made to incubate eggs in such a manner as to accrue a similar number of temperature units as naturally deposited eggs. While it is not possible to completely synchronize hatchery and lake temperature profiles, an effort is made to minimize the departure from the natural temperature profile.

Incubation at the Sawtooth Fish Hatchery typically occurs on pathogen-free well water. The well water temperature profile at the Sawtooth Fish Hatchery fluctuates seasonally between 2.0°C to 11.5°C and is similar to the temperature profiles of Stanley Basin lakes. The one exception to this statement is that hatchery water does not reach the maximum temperatures experienced during summer months in basin lakes (~ 18.0°C).

Guideline 7. Salmonid hatchery incubation and rearing experiences should use the natal stream water source whenever possible to enhance home stream recognition.

Project sponsors agree in principle with Guideline 7 and have prioritized several release options that take advantage of acclimation time in nursery lakes. Eyed-egg, prespawn adult, and presmolt release options produce juvenile sockeye salmon that experience acclimation time in Sawtooth Valley sockeye salmon nursery lakes. Acclimation time varies from approximately seven months for presmolt release groups planted in rearing lakes in October of their first year of life and out-migrating at age-1 to approximately 26 months for fish produced from eyed-egg or prespawn adult release options that out-migrate from rearing lakes at age-2.

In addition to the release strategies described above, juvenile sockeye salmon may be released to receiving waters as full-term smolts. Smolt rearing for this program currently occurs at the IDFG Sawtooth Fish Hatchery. Even though only a limited time is spent in natal waters, based on adult returns to date, smolt releases have been successful (Hebdon et al. 2000, 2002, in review). Age-0 sockeye salmon are transferred from inside vats supplied with well water to outside raceways supplied with upper Salmon River water approximately eight months in advance of release.

The use of “raw” river or lake water during incubation and early rearing is kept to a minimum for fish health management reasons.

Guideline 8. Hatchery release strategies need to follow standards that accommodate reasonable numerical limits determined by the carrying capacity of the receiving stream to accommodate residence needs of nonmigrating members of the release population.

Residual sockeye salmon and hatchery-produced juvenile sockeye salmon that delay their out-migration until age-2 are susceptible to impacts from overstocking as well as from carrying capacity shifts that occur naturally. Annual surveys have been conducted in Redfish Lake since 1992 to identify residual sockeye salmon spawner abundance. Residual sockeye salmon are genetically identical to the anadromous form yet remain in Redfish Lake through maturation and spawning (nonmigratory). Redfish Lake residual sockeye salmon are considered part of the ESU and have not been identified in Alturas or Pettit lakes. Spawner survey data indicate that residual sockeye salmon are not abundant in Redfish Lake (typically fewer than 20 individuals counted annually with over 36 h of snorkel effort dispersed over a five-week interval).

Hatchery-produced juvenile sockeye salmon typically emigrate from nursery lakes following one or two winters of residency. The proportion of the hatchery-produced population that reside in lakes longer and emigrate at age-2 can be significant and represent the majority of the cohort in some years. Predicting the proportion of juvenile sockeye salmon age-1 and age-2 out-migration is difficult. Hydroacoustic surveys and mid-water trawl surveys are conducted annually to identify *O. nerka* biomass, density, and abundance.

Developing reliable estimates of lake carrying capacity and protecting the ability of nursery lakes to accommodate reintroductions of sockeye salmon has been a priority of the project technical management team since the inception of the program. Exceeding the carrying capacity of nursery lakes could result in density-dependent impacts on zooplankton size, biomass, and species composition (Goodlad et al. 1974) and reductions in sockeye salmon growth and survival (Hyatt and Stockner 1985; Kyle et al. 1988).

At the inception of recovery efforts, and prior to the large-scale reintroduction of hatchery-produced juvenile sockeye salmon to rearing lakes, the Shoshone-Bannock Tribes coordinated a thorough literature search to identify protocols used by Alaska and British Columbia researchers to guide past and ongoing sockeye salmon supplementation efforts. This information along with initial Sawtooth Valley nursery lake carrying capacity estimates developed by Bowles and Cochnauer (1984) provided the initial guidance for program reintroductions. In 1994, the SBSTOC organized a workshop to specifically address the development of carrying capacity estimates. Following this exchange, the Shoshone-Bannock Tribes reviewed several carrying capacity models and selected the methodology in use today (Teuscher and Taki 1995; Stockner 1997).

Limnological and meteorological data are used to develop estimates of lake carrying capacity. Stocking decisions are based on these estimates as well as on estimates of ambient kokanee/residual sockeye salmon abundance. Naturally produced progeny from listed stocks and residuals are included in these estimates. Nutrient supplementation may be used to increase carrying capacities and to accommodate juvenile sockeye salmon reintroductions from the program.

Guideline 9. Hatchery programs should dedicate significant effort in developing small facilitates designed for specific stream sites where supplementation and enhancement objectives are sought, using local stocks and ambient water in the facilities designed around engineered habitat to simulate the natural stream, whenever possible.

As mentioned above under Guideline 7 the Redfish Lake Sockeye Salmon Captive Broodstock Program has prioritized release strategies that reintroduce eggs and fish back to native rearing habitat at early life history stages. Eyed-egg, prespawn adult, and presmolt release options are consistent with the language presented in Guideline 9. Program sponsors go to considerable effort to transfer eyed-eggs, presmolts, and prespawn adults to Stanley Basin lakes to take advantage of natural spawning and rearing conditions.

Because project sponsors take every opportunity to manage the program to avoid unnecessary fish health risk, the present operating scenario is an advantage over using any surface water supply adjacent to rearing habitat for early rearing. Surface water in the Stanley Basin supports bacterial, parasite, and possibly viral pathogens that could jeopardize the success of the program.

Guideline 10. Genetic and breeding protocols consistent with local stock structure need to be developed and faithfully adhered to as a mechanism to minimize potential negative hatchery effects on wild populations and to maximize the positive benefits that hatcheries can contribute to the recovery and maintenance of salmonids in the Columbia ecosystem.

Managers employ a variety of techniques and protocols to minimize negative hatchery effects. Foremost, fish within the broodstock program are not selected for growth or other performance measures as they would in a production hatchery setting. Animals are bred in a factorial design that minimizes the loss of genetic variability and heterozygosity with the captive population (Powell and Kline 2002), the loss of which is a consequence of domestication selection. Animals are also kept in an environment that minimizes demographic extinction risk from disease or predation, etc., but maintains lower density, natural light levels, water temperatures, and feeding regimes designed to simulate or more closely resemble natural conditions. However, breeding protocols do not mimic local population structure entirely, since residual individuals are not incorporated within the breeding matrices of the anadromous adults. There is evidence there is a genetic component to residualization of *Oncorhynchus* stocks (Burgner 1991), and the program's emphasis is on anadromous returns.

Guideline 11. Hatchery propagation should use large breeding populations to minimize inbreeding effects and maintain what genetic diversity is present within the population.

The Snake River sockeye salmon population is at critically low levels of abundance with fewer than 25 fish returning in a 10-year period. The greatest risk to this population is extinction through demographic or environmental hazards. Thus, the program has trapped the entire population for its captive broodstock program. No large "parent population exists." Remaining individuals are the sole source of genetic variation and remaining heterozygosity within this population and ESU. As part of the genetics monitoring project for Snake River sockeye salmon at the University of Idaho, returning adults and captive broodstocks are continually assessed for loss in both individual and population level heterozygosity and genetic diversity. Relative frequencies of various microsatellite, nuclear and mitochondrial RFLPs are monitored over time (see Faler and Powell 2003 for a review).

Guideline 12. Hatchery supplementation programs should avoid using strays in breeding operations with returning fish.

It is unlikely that any strays will return to Redfish Lake. In any case, all returning adults are genetically tested for their origin before they are released or selected to cross in the broodstock program. Real-time genetic analysis is used to determine the identity of every fish (Faler and Powell 2003).

Guideline 13. Restoration of extirpated populations should follow genetic guidelines to maximize the potential for re-establishing self-sustaining populations. Once initiated, subsequent effort must concentrate on allowing selection to work by discontinuing introductions.

Adult, prespawning, sockeye have been released to Redfish Lake to spawn volitionally. Kinship and pedigree analysis using microsatellites are used to assess the relative success of natural spawners along with weir counts of unmarked smolts. The success of reintroduction strategies and genetic drift associated with a limited number of adult contributors is monitored over time (Faler and Powell 2003).

Guideline 14. Germ plasm repositories should be developed to preserve genetic diversity for application in future recovery and restoration projects in the basin and to maintain a gene bank to reinforce diversity among small inbred natural populations.

Cryopreservation of milt from male donors has been used in the Redfish Lake Sockeye Salmon Captive Broodstock Program since 1991 and follows techniques described by Cloud et al. (1990) and Wheeler and Thorgaard (1991). Beginning in 1996, cryopreserved milt was used to produce specific lineage broodstocks for use in future spawn years (Faler and Powell 2003). "Designer broodstocks," produced in this manner, will increase the genetic variability and diversity available in future brood years. Cryopreserved milt is employed as a means to counteract the effects of drift upon the finite captive broodstock population. Periodically, fertilization trials are conducted to check the efficacy of cryopreserved milt (note: fresh milt from kokanee and cryopreserved sockeye salmon milt are used to fertilize common kokanee egg lots).

Currently there are in excess of 4,500, 0.5 ml cryopreserved sperm samples available to the program. These samples constitute male returns from most years of the program. Samples are divided between three locations to prevent a catastrophic loss from accidents at any one location.

Guideline 15. The physical and genetic status of all natural populations of anadromous and resident fishes need to be understood and routinely reviewed as the basis of management planning for artificial production.

The physical status of the Redfish Lake sockeye population is monitored in a variety of ways at several life stages including redd counts, smolt enumeration, hydroacoustic density estimates, and enumeration of returning adults. Genetically, several life stages (those within the lake) are sampled nondestructively to assess the relative frequencies of both nuclear alleles and maternal lineages (evidenced through mitochondrial DNA) (Faler 2002; Faler and Powell 2003). Likewise, the status of the resident, nonlisted kokanee population is also monitored as well as the populations present in Pettit and Alturas Lakes.

Guideline 16. An in-hatchery fish monitoring program needs to be developed on performance of juveniles under culture, including genetic assessment to ascertain if breeding protocol is maintaining wild stock genotypic characteristics.

Future broodstock adults are selected through a stratified-random design (Powell and Kline 2003 but see Ballou and Lacy 1995 for a review). From ponding through spawning, various in-hatchery performance variables are routinely monitored. Following the reintroduction of broodstock program progeny to rearing lakes, fish are typically sampled at smolt out-migration with emphasis placed on fish health monitoring, fish quality monitoring, and genetic identity monitoring. Returning adults are genetically tested to determine the relative success of maternal lines and genetic diversity as evidenced using microsatellite analysis (Faler 2002; Faler and Powell 2003).

Guideline 17. A hatchery fish monitoring program needs to be developed on performance from release to return, including information on survival success, interception distribution, behavior, and genotypic changes experienced from selection between release and return.

Returning fish are genetically tested to determine the relative success of maternal lines and genetic diversity as evidenced using microsatellite analysis (Faler 2002; Faler and Powell 2003). Individual adults are "pedigreed" using real-time genetic analysis prior to spawning. Thus, genetic contributions of family lines are equalized; random changes to allele frequencies and loss of rare alleles (evidence of drift) are minimized. Smolts are also monitored both physically (by count) and genetically to assess relative contributions of family lines to out-migrants and to compare relative survivals of smolts to adults.

Guideline 18. A study is required to determine cost of monitoring hatchery performance and sources of funding.

Not applicable.

Guideline 19. Regular performance audits of artificial production objectives should be undertaken, and where they are not successful, research should be initiated to resolve the problem.

Not applicable.

Guideline 20. The NPPC should appoint an independent peer review panel to develop a basinwide artificial production program plan to meet the ecological framework goals for hatchery management of anadromous and resident species.

Not applicable.

Section III. C. 2. How to evaluate for consistency with policies and standards and identification of deficiencies; use of independent audits; independent scientific review.

Entities seeking funding for artificial production programs should analyze their programs and facilities against the policies and performance standards described in this report to identify deficiencies and needed improvements, making use of the existing audit information where appropriate. These entities should use a combination of self-evaluations and independent evaluations, using scientific resources to focus on critical areas of uncertainty. The end result of this self-evaluation process should be a demonstration of consistency with the policies and standards or an explanation of inconsistencies and a proposal for correction. The evaluations and conclusions should then be presented to the review bodies, including independent scientific panels, for review as part of the funding processes. And, until the decisions on use and purpose are revisited as described in Part III B above, the proposals and decisions in the funding reviews should include an explicit if interim evaluation of the more fundamental questions about purpose, which would balance the magnitude of needed operational improvements against the potential for a change in purpose, as part of a judgment on funding priorities.

Our discussion of how the Redfish Lake Sockeye Salmon Captive Broodstock Program is consistent with the Council's performance standards and indicators is presented below.

Note: Performance Standards and Indicators described in this section or our response were taken from the final January 17, 2001 version of *Performance Standards and Indicators for the Use of Artificial Production for Anadromous and Resident Fish Populations in the Pacific Northwest*. Numbers referenced below correspond to numbers used in the above document.

3.2.2 Standard: Release groups sufficiently marked in a manner consistent with information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries.

Indicator 1: Marking rate by type in each release group documented.

3.3.1 Standard: Artificial propagation program contributes to an increasing number of spawners returning to natural spawning areas.

Indicator 1: Annual number of spawners on spawning grounds estimated in specific locations.
Indicator 2: Spawner-recruit ratios are estimated in specific locations.
Indicator 3: Number of redds in natural production index areas documented.

3.3.2 Standard: Releases are sufficiently marked to allow statistically significant evaluation of program contribution.

Indicator 1: Marking rates and type of mark documented.
Indicator 2: Number of marks identified in juvenile and adult groups documented.

3.4.1 Standard: Fish collected for broodstock are taken throughout the return in proportions approximating the timing and age structure of the population.

Indicator 1: Temporal distribution of broodstock collection managed.
Indicator 2: Age composition of broodstock collection managed.

3.4.2 Standard: Broodstock collection does not significantly reduce potential juvenile production in natural areas.

Indicator 1: A portion of natural-origin, hatchery-produced spawners is collected for broodstock purposes.
Indicator 2: A portion of natural-origin, hatchery-produced spawners is released to migrate to natural spawning areas.
Indicator 3: Number of adults, eggs, or juveniles placed in natural rearing areas is managed.

3.4.3 Standard: Life history characteristics of the natural population do not change as a result of this program.

Indicator 1: Life history characteristics of natural and hatchery-produced populations are measured (e.g., juvenile dispersal timing, juvenile size at out-migration, adult return timing, adult age and sex ratio, natural and hatchery spawn timing, hatch and swim-up timing, hatchery rearing densities, growth, diet, physical characteristics, fecundity, egg size, etc).

3.4.4 Standard: Annual release numbers do not exceed estimated basinwide and local habitat capacity.

Indicator 1: Annual release numbers, life-stage, size at release, length of acclimation documented.
Indicator 2: Location of releases documented.
Indicator 3: Timing of hatchery releases documented.

3.5.1 Standard: Patterns of genetic variation within and among natural populations do not change significantly as a result of artificial production.

Indicator 1: Genetic profiles of naturally-produced and hatchery-produced adults developed.

3.5.2 Standard: Collection of broodstock does not adversely impact the genetic diversity of the naturally spawning population.

Indicator 1: Total number of natural spawners reaching collection facilities documented.
Indicator 2: Total number of natural spawners estimated passing collection facilities documented.
Indicator 3: Timing of collection compared to overall run timing considered.

3.5.3 Standard: Artificially produced adults in natural production areas do not exceed appropriate proportion.

Indicator 1: Ratio of natural to hatchery-produced adults monitored.
Indicator 2: Observed and estimated total numbers of natural and hatchery-produced adults passing counting stations.

3.5.4 Standard: Juveniles are released on-station or after sufficient acclimation to maximize homing ability to intended return locations.

Indicator 1: Location of juvenile releases documented.
Indicator 2: Length of acclimation period documented.
Indicator 3: Release type (e.g., volitional or forced) documented.
Indicator 4: Adult straying documented.

3.6.1 Standard: The artificial production program uses standard scientific procedures to evaluate various aspects of artificial production.

Indicator 1: Scientifically based experimental design with measurable objectives and hypotheses.

3.6.2. Standard: The artificial production program is monitored and evaluated on an appropriate schedule and scale to address progress toward achieving the experimental objectives.

Indicator 1: Monitoring and evaluation framework including detailed time line.
Indicator 2: Annual and final reports.

3.7.1 Standard: Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols.

Indicator 1: Annual reports indicating level of compliance with applicable standards and criteria.

3.7.2 Standard: Effluent from artificial production facility will not detrimentally affect natural populations.

Indicator 1: Discharge water quality compared to applicable water quality standards.

3.7.3 Standard: Water withdrawals and in-stream water diversion structures for artificial production facility operation will not prevent access to natural spawning areas, affect spawning, or impact juveniles.

Indicator 1: Water withdrawals documented—no impacts to listed species.
Indicator 2: Number of adult fish aggregating and/or spawning immediately below water intake point monitored.
Indicator 3: NMFS screening criteria adhered to.

3.7.4 Standard: Releases do not introduce pathogens not already existing in the local populations and do not significantly increase the levels of existing pathogens.

Indicator 1: Certification of juvenile fish health documented prior to release.
Indicator 2: Samples of natural populations for disease occurrence conducted.
Indicator 3: Juvenile densities during artificial rearing managed conservatively.

3.7.6 Standard: Adult broodstock collection operation does not significantly alter spatial and temporal distribution of natural population.

Indicator 1: Spatial and temporal spawning distribution of natural population above and below trapping facilities monitored.

3.7.7 Standard: Weir/trap operations do not result in significant stress, injury, or mortality in natural populations.

Indicator 1: Mortality rates in trap documented.
Indicator 2: Prespawning mortality rates of trapped fish in hatchery or after release documented.

3.7.8 Standard: Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of natural fish.

Indicator 1: Size and time of release of juvenile fish documented and compared to size and timing of natural fish.

Monitoring and Evaluation of Performance Standards and Indicators:

Standard 3.2.2 and associated indicators: The program is required by ESA Section 10 permit to visibly mark all reintroduced fish. As such, all presmolt, smolt, and adult sockeye salmon released back to the habitat are fin clipped. In addition, genetic tissue samples from progeny that result from natural release options (e.g., eyed-egg and prespawn adult) are taken to facilitate individual or release-option genetic assignment test analyses. Specific release groups also receive Passive Integrated Transponder (PIT) or coded-wire tags.

Standard 3.3.1 and associated indicators: To date, the program has documented the successful return of over 300 hatchery-produced, anadromous sockeye salmon. Only 16 wild sockeye salmon have returned to the Stanley Basin of Idaho since the inception of this program in 1991. Adult sockeye salmon are captured at collection weirs on Redfish Lake Creek and on the upper Salmon River at the Sawtooth Fish Hatchery.

Standard 3.3.2 and associated indicators: To estimate *O. nerka* out-migrant run size from Redfish, Alturas, and Pettit lakes, IDFG personnel (in cooperation with Shoshone-Bannock Tribe personnel) operate smolt traps on Redfish Lake Creek and on the upper Salmon River at the IDFG Sawtooth Fish Hatchery. In addition, the Shoshone-Bannock Tribes operate smolt traps on Alturas Lake and Pettit Lake creeks. Trapping activities are coordinated through the SBSTOC.

Trapping efficiency is determined by releasing PIT-tagged wild and hatchery-produced out-migrants upstream for subsequent recapture. Total emigration or out-migration run size is estimated for specific intervals within the total period of out-migration. Intervals are defined as periods of out-migration with similar stream discharge and recapture efficiency. Seasonal out-migrant run size and 95% confidence intervals are estimated using maximum likelihood and profile likelihood estimators developed by Steinhorst et al. (in review). Estimates are generated separately for wild/natural and hatchery-produced fish.

Estimates of out-migration are developed by broodstock program release strategy at Redfish, Alturas, and Pettit lake trap sites. Out-migration estimates by release location and release strategy are also developed at Lower Granite Dam. PIT tag interrogation data for Lower Granite Dam is retrieved from the Columbia River Basin PIT Tag Information System (PTAGIS). Median travel times to Lower Granite Dam are calculated (where possible) for wild/natural and hatchery-produced sockeye salmon.

Because systems operations and fish handling potentially differ by date, arrival times to Lower Granite Dam are compared for wild/natural and hatchery-produced progeny (by release strategy) using two sample Kolmogorov-Smirnov tests (α = .05), (Sokal and Rohlf 1981). If travel times differ between evaluation groups, results of subsequent statistical tests are qualified. Multiple, chi-square goodness of fit tests (α = .05) are used to compare PIT tag interrogation data at lake outlet trapping locations and at Lower Granite Dam (Zar 1974). A priori power analysis for differences between proportions was conducted to determine PIT tag sample size (Cohen 1989).

Standard 3.4.1, 3.4.2, 3.5.3, and associated indicators: All returning adult sockeye are captured at weirs located on Redfish Lake Creek and on the upper Salmon River at the Sawtooth Fish Hatchery. All captured adults are held temporarily on well water at the Sawtooth Fish Hatchery. Based on marks, tags, and "real time" genetic analyses conducted by the University of Idaho, decisions to release or hold adults for spawning are made. Decisions to hold adults for spawning are driven by "desirability" guidelines established to avoid inbreeding and to incorporate unique genetic information into the captive component.

Standard 3.4.3 and associated indicators: Life history characteristics of natural and hatchery-produced juvenile and adult sockeye salmon are monitored (e.g., adult spawning success and juvenile out-migration success). In-hatchery variables are monitored continuously (e.g., growth, survival, rearing conditions, maturation, age at maturity, spawning success, gamete quality, egg size, fecundity, egg survival to the eyed stage of development, etc.).

Standard 3.4.4, 3.5.3 and associated indicators: Annual release numbers, release strategy selected, size at release, and release location are discussed annually at the SBSTOC level. Limnologic conditions and lake carrying capacity estimates are generated by the Shoshone-Bannock Tribes. The prioritization of release strategies considers this information as well as information generated from monitoring and evaluation efforts in place to determine the relative success of the different release strategies used.

Standard 3.5.1, 3.5.2 and associated indicators: The University of Idaho provides genetic support for this program. Genetic profiles of wild and hatchery-produced sockeye salmon have been and continue to be produced. The hatchery population is constantly monitored to

determine such variables as genetic effective population size, loss of genetic variability, and loss of heterozygosity.

Standard 3.5.4 and associated indicators: Eyed-egg, prespawn adult, and presmolt release options produce juvenile sockeye salmon that experience acclimation time in Stanley Basin sockeye salmon nursery lakes. Acclimation time varies from approximately seven months for presmolt release groups planted in rearing lakes in October of their first year of life and out-migrating at age-1 to approximately 26 months for fish produced from eyed-egg or prespawn adult release options that out-migrate from rearing lakes at age-2.

In addition to the release strategies described above, juvenile sockeye salmon may be released to receiving waters as full-term smolts. Smolt rearing for this program currently occurs at the IDFG Sawtooth Fish Hatchery. Age-0 sockeye salmon are transferred from inside vats supplied with well water to outside raceways supplied with upper Salmon River water approximately eight months in advance of release.

Standard 3.6.1, 3.6.2 and associated indicators: Program goals, objectives, and tasks focus on the preservation/conservation purpose of this effort. Hatchery practices (e.g., spawning and rearing protocols) are based on current and emerging “best practices” and undergo constant review at the SBSTOC level. An experimental design has been established to guide the reintroduction of eggs and fish back to the habitat. A comprehensive monitoring and evaluation program is in place to track rearing habitat quality and the relative out-migration success of the various release strategies used.

Standard 3.7.1, 3.7.2, 3.7.3, 3.7.6, 3.7.7 and associated indicators: The artificial production component of the program adheres with all state and federal policies in place to prevent the spread of infectious pathogens, to ensure that facility discharge water quality meets all appropriate standards, and that intake and outflow screens meet appropriate standards. In addition, water removal from adjacent natural water systems is monitored and not considered to have any negative impact on native or introduced species.

Adult and juvenile weirs are monitored so as not to adversely affect target or other fish species. Anadromous sockeye salmon adult presence and distribution below weirs is carefully monitored. Every precaution is taken to ensure that trapping does not negatively impact anadromous adults.

Standard 3.7.4 and associated indicators: IDFG and NOAA fish health facilities process samples for diagnostic and inspection purposes from captive broodstock sockeye salmon, production sockeye salmon, and anadromous sockeye salmon. Routine fish necropsies include investigations for viral pathogens (infectious pancreatic necrosis virus and infectious hematopoietic necrosis virus), and various bacterial pathogens (e.g., bacterial kidney disease *Renibacterium salmoninarium*, bacterial gill disease *Flavobacterium branchiophilum*, coldwater disease *Flavobacterium psychrophilum*, and motile aeromonad septicemia *Aeromonas* spp.). In addition to the above, anadromous adult sockeye salmon are screened for the causative agent of whirling disease *Myxobolus cerebralis*, furunculous *Aeromonas salmonicida,* and the North American strain of viral hemorrhagic septicemia virus. All laboratory diagnostic and inspection procedures follow protocols described by Thoesen (1994).

Approved chemical therapeutants are used prophylactically and for the treatment of infectious diseases. Prior to effecting treatments, the use of chemical therapeutants is discussed with an

IDFG fish health professional. Fish necropsies are performed on all program mortalities that satisfy minimum size criteria for the various diagnostic or inspection procedures performed.

All appropriate state permits are secured prior to transporting eggs or fish across state boundaries. Prior to release, preliberation fish health sampling occurs for presmolt and smolt release groups.

Standard 3.7.8 and associated standards: Predation by artificially produced fish on naturally produced fish is not expected in this species. Diet analysis conducted by the Shoshone-Bannock Tribes has not confirmed the presence of salmonid bones or tissue in the samples collected to date. Juvenile sockeye salmon size at out-migration and timing of out-migration are monitored by the IDFG and the Shoshone-Bannock Tribes at three locations.

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RESPONSES TO ISRP PROJECT SPECIFIC QUESTIONS

Mountain Snake Province (ISRP2001-12A)

a. Project 199700100—IDFG Captive Rearing Project for Salmon River Chinook Salmon

Point #1: The ISRP wrote, "Sponsors provided reasonable and detailed answers to reviewers' questions and comments. Questions remain, however, about the need to alter the performance traits of the captive brood to make them similar to fish in nature. These characters are largely dependent on environment so characteristics of fish reared in hatcheries will reflect those conditions, and fish produced in nature will reflect those conditions. Detailed and careful work to produce fish with similar characteristics from either set of conditions is certain to require a continuing and long-term effort, and in the view of some reviewers, perhaps a flawed strategy. Sponsors need to reassess what they are doing in this project. It appears from the review that the project will never be complete."

Sponsor Response to #1: We appreciate the ISRP's acknowledgement that "sponsors provided reasonable and detailed answers to reviewers' questions and comments." It is our hope that remaining questions will be adequately addressed in the following response and in the main body of information presented in the collaborative documents that follow.

For the benefit of the Council, Council Staff, and the ISRP, the following brief review of the planning process that led to the initiation of the Captive Rearing Program for Salmon River Spring Chinook Salmon and the Grande Ronde Basin Chinook Salmon Captive Broodstock Program is provided.

In the early 1990s, fisheries managers representing the Idaho Department of Fish and Game, the Oregon Department of Fish and Wildlife, the Washington Department of Fish and Wildlife, the Shoshone-Bannock Tribes, the National Marine Fisheries Service, the Nez Perce Tribe, the Confederated Tribes of the Umatilla Indian Reservation, and the U.S. Fish and Wildlife Service formed technical and policy committees to discuss implementing captive intervention programs for specific Snake River spring/summer chinook salmon stocks at risk. Two approaches were identified: a conventional captive broodstock approach and a less conventional captive rearing approach. Both approaches shared the same goal of maintaining Snake River chinook salmon metapopulation structure by preventing year-class failures and local extinctions. The Oregon Department of Fish and Wildlife (and partners) prioritized three Grande Ronde River basin chinook salmon stocks to incorporate into a traditional captive broodstock program. The Idaho Department of Fish and Game (and partners) prioritized three Salmon River chinook salmon stocks to incorporate into a captive rearing program. The principal goals of both programs were to effectively manage perceived demographic, genetic, and environmental risks by preventing localized extinctions, preventing cohort collapse, and maintaining stock heterozygosity, genetic diversity, and viability.

The Idaho Department of Fish and Game selected the captive rearing approach to achieve management goals while minimizing potential negative impacts associated with more traditional captive broodstock or supplementation programs. Captive rearing has several inherent advantages over traditional captive broodstock or supplementation strategies.

The adult release strategy provides potential biological benefits that include the opportunity for natural and sexual selection to occur on the spawning grounds – selection that is relaxed during artificial spawning. Adult release and egg stocking reduces potential for straying and may minimize domestication selection of the offspring compared to programs that artificially spawn adults and release their offspring as smolts. Berejikian et al. (in review) provide a particularly relevant discussion of the biological trade-offs and management considerations associated with the selection of strategies for reintroducing anadromous salmonids. **To assist reviewers, a draft of this manuscript is attached following the Literature Cited page for this section of the document.**

Captive Rearing Program for Salmon River Spring Chinook Salmon objectives include language directed at developing hatchery-reared adult chinook salmon with "the proper behavioral, morphological, and physiological characteristics" to successfully reproduce in the wild. The project sponsors agree with the ISRP that it is most likely a "flawed strategy" to pursue the culture of adult hatchery fish that exactly match the wild template; no artificial propagation program is likely to meet that objective. Nevertheless, we maintain that fully understanding the reproductive potential of hatchery-produced adult chinook salmon is critical to the Basin's collective captive propagation efforts because of the potential genetic and ecological benefits it provides over conventional broodstock programs. Furthermore, every reasonable opportunity should be taken to minimize behavioral, morphological, and physiological divergence from wild conspecifics in order to maximize the program's potential to achieve success.

Accordingly, an <u>appropriate</u> level of monitoring and evaluation occurs in this program to:

- develop the best fish culture protocols to produce fish that meet program objectives, and
- document behavior and breeding success of adults released to streams to spawn naturally.

In addition, NOAA project 1993-056-00, (Assessment of Captive Broodstock Technologies) is conducting the following applied research that directly benefits the Captive Rearing Program for Salmon River Spring Chinook Salmon:

- Investigations of reproductive behavior and success of chinook salmon reared in experimental treatments in stream channels and natural streams are being conducted to improve reintroduction success in captive rearing programs.
- Studies of the effects of growth on incidence of early male maturity and adult quality in spring chinook salmon are being conducted to induce natural age-at-maturity for both sexes without compromising adult body size.
- Studies of the effects of rearing temperature and growth rate on maturation timing, fecundity, egg size, egg quality, and reproductive behavior in spring chinook salmon are being studied to improve the productivity of adults for artificial and natural spawning.

NOAA's Assessment project has published numerous studies in the peer-reviewed scientific literature, the findings of which have provided guidance to the implementations. They include studies on reproductive physiology (Shearer et al. 1997ab; Silverstein et al. 1998, 1999; Shearer and Swanson 2000), reproductive performance and offspring fitness of (Berejikian 2000; Berejikian et al. 1997, 1999, 2001abc, 2003), and morphology (Hard et al. 2000).

Mainstem and Systemwide Province (ISRP2002-14)

a. Project 199009300—UI Genetic analysis of *Oncorhynchus nerka* (modified to include chinook salmon)

No Response Needed—As excerpted from the 2002-14 document under project 199009300: "The project sponsors provided a thorough response that adequately addressed the ISRP's preliminary review questions, including additional description and details on the recent use of microsatellite loci analyses to develop pedigrees, identify parentage, and set up MAI (Maximal Avoidance of Inbreeding) matrices to guide captive breeding options for severely depressed Chinook populations in the East Fork of the Salmon and West Fork Yankee Fork."

b. Project 199606700—NOAA Fisheries Manchester Spring chinook broodstock project

No response was required.

c. Project 199305600—NOAA Fisheries Assessment of captive broodstock technologies

Point #1: The ISRP wrote, "We are concerned about the idea that adults produced through the captive brood program can be released to reproduce with wild fish in natural streams (Idaho stocks only). Our concern is that as a means to re-introduce these stocks to the natural environment, the approach is far too high risk given the value of these fish and perhaps inappropriate. Given the extent of assessments conducted-to-date and reported in this proposal, we would recommend an immediate stop to this activity (except on a small research scale) until it can be proven that the strategy has any merit. The only merit we can see to this approach is allowing the animals to participate in mate selection and hopefully to interbreed with other conspecifics. However, a much more responsible approach may have been to develop controlled flow environments (artificial or natural sections of streams) where the animals could be protected. Re-introduction of captive brood fish is a major issue associated with this rearing strategy but there should be some minimum standard of care taken given the importance of these fish and the investment made by the Basin!"

Sponsor Response to #1: We (the sponsors of project 199305600) do not decide which reintroduction strategies should be implemented. Reintroduction strategies for captive broodstocks are determined by the state and tribal agencies that operate captive broodstock programs for maintenance and recovery of ESA-listed populations. IDFG (1996) has described its rationale for adult-release as part of its "cohort replacement" program for Salmon River spring chinook salmon populations (BPA Project #199700100). Adult release is one of several reintroduction strategies proposed by the Nez Perce Tribe, Confederated Tribes of the Umatilla Indian Reservation, and Washington Department of Fish and Wildlife for Tucannon River spring chinook salmon (BPA Project #200001900). The Stanley Basin sockeye salmon program also practices release of adults into Redfish Lake (BPA Project #199107200).

Research priorities (including research on adult releases) for Project 199305600 have been based on the needs of the agencies operating captive broodstock programs, so that the scientific results can be applied to improve captive broodstock technologies. In February 1999, we solicited advice from the regional state, tribal, and federal managers of captive broodstock programs through the Technical Oversight Committees for Stanley Basin sockeye salmon and Snake River spring chinook salmon. The TOC members rated research on problems associated with adult reproductive performance as one of their highest priorities. The need was re-emphasized in a workshop we recently convened on captive broodstocks for imperiled populations of Pacific salmon in June 2002.

The adult release strategy is specific to captive broodstock programs, and thus research on the topic is not being covered anywhere in the basin, except under this project. The research thus far conducted by NMFS indicates reproductive deficiencies in captively-reared adults (Berejikian et al. 1997, 2000, 2001ab), but has also begun to identify mechanisms by which performance might be improved (Berejikian et al. in review). Without the research we have conducted thus far, there would be no published information on the natural reproductive capacity of captively reared Pacific salmon.

The adult release research is being conducted on a small (experimental) scale, as recommended by the ISRP.

Point #2: The ISRP wrote, "The other issue is minor and concerns the wording involved in the inbreeding study. The authors refer to 'progeny of mates chosen at random—the control.' However, our reading of the design would indicate that simply a random selection of returning adults (which would seem to ignore the use of the DNA pedigree data) would include some level of inbreeding accumulating in the control line. Is this correct or did the authors mean that their control would be composed of nonsibling relationships only? In these lines, these may be better described as an out-bred line, which would be an appropriate basis for comparison or control.

Another area where the authors could further contribute to resolving critical uncertainties in the use of captive broodstock and supplementation technology is in the modeling of the timeframe and scale of incurring inbreeding effects via supplementation and captive broodstock programs (decrease in fitness) versus the potentially counterbalancing "cleansing" effect of natural selection on hatchery-produced fish as they become part of a naturally spawning population. Fitness impacts on populations can occur quickly in the hatchery environment (as documented in the literature), however, little information is available on how quickly the accumulated genetic load can be shed by salmon populations as they spawn naturally and local adaptation occurs. The balance between these two processes, including the magnitude of genetic (fitness) change and the timeframes over which they occur, may be the fulcrum upon which the long-term success or failure of these programs hinges. Thus, a major uncertainty is on what timescale can this "readaptation" occur? Is it compatible with our goals for recovery / rebuilding or does the readaptation process occur so slowly that it represents a constraint on how captive brood and supplementation programs can be used?"

Sponsor Response to #2: The ISRP raise an issue that we failed to clarify adequately. It is our intent and has been our practice to compose the "control" line of individuals mated at random but excluding known full- or half-siblings. This is an appropriate basis for a comparison or control line, but we shall refer to it as an outbred line in future. Having said that, the utility of a randomly mated line with some degree of close inbreeding is not diminished so long as the degree of inbreeding is measured. It is the relationship between the rate of inbreeding and the expression of inbreeding that is important to characterize, and our analysis basically involves comparison of regression lines.

The issue of rate of readaptation is being addressed directly in an independent study, funded by the Hatchery Scientific Review Group, by Mike Ford and Jeff Hard of NMFS and Howard Fuss, Patrick Hulett, and Cameron Sharpe of WDFW on Minter Creek coho salmon (the proposal is attached). The inbreeding component of the captive broodstock project supported by BPA and reviewed here does not address this issue directly, but some of the data on inbreeding and inbreeding depression in the captive and released populations could be used to parameterize selection models during the process of readaptation (genetic data from the study are already being used to seed selection models to look at harvest selection, as part of an independent inquiry).

Point #3: The ISRP wrote, “The budget description is again quite limited and includes two points for clarification: what is the 19% Leave surcharge and why are there costs under Other that again seem to be Indirect charges? The labor charges and cost sharing with NMFS needs clarification as this issue occurs in a few proposals.”

Sponsor Response to #3: The leave surcharge covers holiday pay and vacation time. The Rents, Communications, and Utilities costs under the “Other category” include: 1) telecommunications for field stations ($12.0K), 2) electricity for sea-water pumps, stream channel pumps, filter pumps, and chiller operation at Manchester Research Station ($51.7), 3) site lease for Big Beef Creek ($7.0K), and 4) printing, publication, and reprint charges ($5.0K). The NMFS “in kind” labor contribution covers labor costs for NMFS personnel working on Project 199305600 that are not included in the proposal and, therefore, not covered by BPA.

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Release of captively reared adult anadromous salmonids for population maintenance and recovery: biological tradeoffs and management considerations

Barry Berejikian
National Marine Fisheries Service
Northwest Fisheries Science Center
Resource Enhancement and Utilization Technologies Division
P.O. Box 130, Manchester, Washington 98353
(360) 871-8301 (phone), (206) 842-8364 (fax)
barry.berejikian@noaa.gov

Thomas Flagg
National Marine Fisheries Service
Northwest Fisheries Science Center
Resource Enhancement and Utilization Technologies Division
P.O. Box 130, Manchester, Washington 98353
(360) 871-8306 (phone), (206) 842-8364 (fax)
tom.flagg@noaa.gov

and

Paul Kline
Idaho Department of Fish and Game
600 South Walnut Street, P.O. Box 25, Boise, Idaho 83707
(208) 939-4114 (phone), (208) 939-2415 (fax)
pkline@idfg.state.id.us

ABSTRACT

Captive broodstocks have been initiated for maintenance and recovery of imperiled anadromous salmonid populations, because they can provide a rapid demographic boost and reduce short-term extinction risk. As with captive propagation programs for other vertebrates, difficulties with reintroduction to the natural environment is a major impediment to success. Strategies for reintroduction of anadromous salmonid captive broodstocks in the U.S. and Canada include release of captively reared adults (currently 4 programs), stocking their offspring as eyed-eggs (2 programs), parr (5 programs), or smolts (8 programs). Captive broodstock programs that release adults considered the management objectives of i) evaluating different reintroduction strategies, and ii) spreading the risk of failure of any one particular strategy, to be very important. By contrast, programs that release only juveniles viewed the same two objectives to be far less important. This distinction indicates that the programs releasing adults consider the strategy to be an experimental one that may serve to offset potential risks associated with juvenile release options. However, the finding that preventing extinction was considered to be very important in adult and juvenile release programs alike indicates that programs releasing adults believe the strategy, at a minimum, will not impede that objective. Preventing extinction was considered to be a very important objective in adult and juvenile release programs alike. The adult release strategy provides potential biological benefits that include the opportunity for natural and sexual selection to occur on the spawning grounds—selection that is relaxed during artificial spawning. Adult release and egg stocking reduces potential for straying and may minimize domestication selection of the offspring compared to programs that artificially spawn adults and release their offspring as smolts. The potential benefits of adult and egg releases must be weighed against (and may be offset by) the greater F_1 production that could be achieved by releasing hatchery-reared smolts.

INTRODUCTION

In North America, artificial propagation programs for Pacific salmon and steelhead (*Oncorhynchus* spp.) and Atlantic salmon (*Salmo Salar*) that rear fish to sexual maturity in captivity (i.e., 'captive broodstock' programs) are becoming an increasingly important component of species preservation. The majority of captive broodstock efforts involve Columbia River Basin salmon stocks (Table 1). The Columbia River Basin projects began in the early 1990s with a collaborative project for restoration of Redfish Lake sockeye salmon, *O. nerka* (Flagg et al. 1995). Efforts expanded in the mid 1990s with the addition of cooperatives for six stocks of Snake River spring/summer chinook salmon (*O. tshawytscha*). By the late 1990s, captive broodstock protection had been conferred to two stocks of spring chinook salmon from the mid Columbia River region. Outside the Columbia River Basin, captive broodstock programs have been implemented for chinook salmon in Washington, coho salmon (*O. kisutch*) in California, Atlantic salmon in Maine, and steelhead in Washington and British Columbia, Canada. In addition, NMFS (2000) has identified six populations of steelhead and several salmon populations that have dropped to critically low levels and continue to decline. Following thorough risk benefit analyses, captive propagation programs for some or all of these populations may be required to reduce the risk of extinction.

Captive broodstocks are established by removing adults, eyed embryos, or juveniles from their natal habitats and culturing them to adulthood to bypass high juvenile-to-adult mortality (Waples and Do 1994; Schiewe et al. 1997; Flagg et al. 1995). When sexually mature, the adults may be used in two ways. Most typically, captive broodstock programs artificially spawn the captively reared adults to produce large numbers of offspring for further culture or release into the wild. The F_1 (or F_2 in cases where adults are collected) offspring may be released as i) eyed eggs stocked into in-stream or in-lake incubators, ii) presmolts (under yearlings), or iii) smolts. Alternatively, embryos or juveniles collected from wild adults or from natal habitats may be reared to adulthood and released to their natal streams for natural spawning. The recentness of captive broodstock recovery programs for anadromous Pacific salmonids and the consequent paucity of monitoring and evaluation data makes predicting their success in aiding recovery difficult. The apparent behavioral deficiencies in reintroduced animals from conventional hatchery programs for salmonids (Brown and Laland 2001) and captive populations of other animals (Price 1997) further the uncertainty. While the development of captive broodstock technologies has progressed over the past 15 years or so, collection, rearing, and reintroduction strategies for captive broodstocks remain largely experimental (Flagg and Mahnken 2000).

Captive broodstocks differ fundamentally from conventional hatchery programs in that full-term captive culture imparts artificial environmental influences on anadromous salmonids for the portion of their life history normally spent in the ocean. Also, strategies being implemented to reintroduce fish from captive broodstock programs to their ancestral habitats vary much more so than conventional hatchery programs. The practice of releasing smolts (rather than younger fish) has been institutionalized in conventional hatchery programs, presumably because it maximizes survival and, hence, the return of adults. In this paper, we address the question of why captive broodstock programs, which contain large portions of severely depleted populations, frequently implement nontraditional reintroduction strategies ranging from the release of captively reared adults to release of F_1 offspring as eggs, fry, parr, smolts, or adults (Table 2). We summarize the major biological tradeoffs and some potential management objectives associated with the various reintroduction strategies. We focus discussion on the release of captively reared adults, because it is the most novel of the current strategies and has the potential to provide several biological benefits not afforded by other strategies.

Biological tradeoffs associated with different reintroduction strategies

The duration of captive culture and stage at which salmon are reintroduced to the natural environment may have consequences on several important aspects of anadromous salmonid biology, including natural and sexual selection during reproduction, homing/imprinting, environmentally induced behavioral changes, domestication selection, and demographics. The consequences of each of these mechanisms may favor certain reintroduction strategies over others. Each topic covered below is complex and some have received considerable attention in the published literature. We narrowed our coverage to focus as directly as possible on what we considered to be the more important genetic, ecological, and demographic implications of different reintroduction strategies.

***Natural and sexual selection during reproduction*—**In anadromous salmonids, natural and sexual selection act on reproductive traits that directly determine the ability to produce offspring and/or on the fitness of the offspring. Sexual selection refers to intrasexual competition and mate choice either by males or females, whereas natural selection during reproduction may target other phenotypic traits, such as spawn timing and location. Larger males gain an advantage in competition for access to nesting females (Keenleyside and Dupuis 1988; Fleming and Gross 1994; Berejikian et al. 1997). The intense competition among males for access to spawning females has led to the evolution of secondary sex characteristics. For example, independent of body size effects, hooked snout length in male coho salmon (Fleming and Gross 1994), body depth in sockeye salmon (Quinn and Foote 1994), and kype length in chinook salmon (Berejikian et al. 2001c) afford greater access to nesting females. Males closest to females and first to ejaculate during oviposition have been shown to leave more offspring by fertilizing more eggs on average than males entering the nest later (e.g., Schroder 1981; Thompson et al. 1998).

Larger males stimulate females to increase their rate of spawning, which is widely interpreted as a form of intersexual selection by female mate choice (Schroder 1981; Foote 1989; De Gaudemar et al. 2000; Berejikian et al. 2000). Choosy females may derive indirect (genetic) benefits of mating with larger males to the extent that body size and associated traits are heritable and afford the offspring a fitness advantage.

Competition among females for nesting sites is generally less intense than male-male competition. Nevertheless, where females compete for nesting territories, smaller females can be forced to delay breeding (Fleming and Gross 1994), which increases the possibility of incomplete egg deposition prior to death.

Natural selection may also target body size and other phenotypic traits. For example, larger females dig deeper nests (van den Berghe and Gross 1984; Steen and Quinn 1999), providing their eggs greater protection from streambed scour or disturbance by later-spawning females (Hayes 1987). While the majority of studies indicate advantages to large body size in spawning males and females, forces such as size-selective predation against larger fish (e.g., Quinn and Kinnison 1999) may counterbalance them. Natural selection also targets female traits unrelated to body size, including egg (and consequently fry) size and spawn timing in Atlantic salmon (Einum and Fleming 2000a; Einum and Fleming 2000b).

In some current broodstock programs, elaborate breeding protocols have been established to minimize inbreeding, maximize genetic diversity, and guard against unintentional selection for particular phenotypes. Nevertheless, release of juveniles from programs that involve artificial spawning can potentially remove (relax) natural and sexual selection forces and introduce the potential for directional artificial selection on certain phenotypic characters. The extent to which removal of natural and sexual selection harms the target population depends largely on the heritability of the phenotypic characters under selection (Futuyma 1997); that is, it depends on the response to selection in the next generation. Heath et al. (2003) found a reduction in egg size (a correlated response to selection for high fecundity) in a population of chinook salmon farmed for three generations. The high heritability for egg mass and strong selection intensity indicated the strong potential for selection on reproductive characters when natural spawning was eliminated. Other studies comparing the reproductive behavior and estimated breeding success of multigeneration hatchery and wild populations indicate depressed performance of hatchery fish (Fleming and Gross 1992; Fleming and Gross 1993), but the relative environmental effects of hatchery rearing from egg to smolt versus genetic effects of multigenerational artificial spawning has not been quantified.

In short, reproductive traits targeted either directly or indirectly by selection cannot be reliably approximated by any current artificial spawning protocols, including random or factorial mating designs. Releasing captively reared adults for natural spawning in natal or ancestral habitats should minimize genetic changes associated with relaxation or changes in the direction or intensity of natural or sexual selection during reproduction. None of the other reintroduction strategies provide such a potential benefit. However, reproductive deficiencies of naturally spawning captively reared adults must also be considered, and we discuss those in detail later in the paper.

Imprinting, homing, and straying—Salmon imprint (learn) on the odors of waters they experience during smoltification (Hasler and Scholz 1983; Dittman et al. 1996), and olfactory cues guide their homing migrations to natal streams. Imprinting has been demonstrated to occur during the parr-smolt transformation in coho salmon and is associated with surges in certain hormone levels (Dittman et al. 1996). However, fine scale homing and complex juvenile migration patterns necessitate a more complex model for imprinting that includes several stages of juvenile development prior to smoltification. During the spawning migration, adult sockeye salmon often bypass lakes and rivers in which they had undergone smoltification, and home to their natal streams. Quinn (1993) suggested a plausible model that salmon first home to areas where they smolted and then seek cues that would guide finer scale migration to their natal streams. Although experimental studies have yet to demonstrate imprinting at life stages prior to smoltification, Quinn et al. (1999) found that sockeye salmon, which rear in the pelagic environment of Lake Iliamna, Alaska, exhibited the ability to home to their natal beaches. Other species including chinook salmon (Murray and Rosenau 1989) and steelhead that may migrate away from their emergence sites and reside in non-natal areas may also imprint on odors experienced during the earliest stages of their life history.

Salmon may possess inherent abilities to home to their ancestral waters. For example, chinook salmon reared and released from locations downstream from their parental river of origin migrated past their release site and entered their parental river (McIsaac and Quinn 1988), and transplanted steelhead stocks accounted for a higher number of strays than local stocks in a study along the Oregon Coast (Schroeder et al. 2001). Maintenance of local adaptation is presumably a primary objective of captive broodstock programs, because nearly all programs we surveyed reintroduce cultured fish to their natal (or parental) streams. So long as captive broodstocks are derived from local native populations, the apparent genetic component to homing should not be a concern for such programs. However, genetic control of homing may hinder attempts to restore salmon and steelhead to streams where the native populations have been extirpated and rely on the translocation of a non-native population.

Doubtless, the release of captively reared adults or eggs into target streams would result in natural imprinting processes and homing ability and, therefore, would represent a best-case scenario for a captive propagation program. Alevins and emerging juveniles would experience odors from their natal streams at the appropriate times. Information from conventional hatchery programs that release smolts suggests that juvenile salmon reared at one location and released as smolts offsite generally return to the location of their release, although fish may home to their rearing hatchery rather than their release location when the two differ (Schroeder et al. 2001; review by Quinn 1993). Releases that occur much earlier or later than the parr-smolt transformation can also increase straying (Unwin and Quinn 1993; Pascual et al. 1995). Artificially spawned and reared smolts may home at rates similar to progeny of released adults provided incubation and smolt rearing occurs on natal stream water (Hard and Heard 1999). In practice, however, many captive broodstock programs rear juveniles on pathogen free well water to minimize disease-related mortality, rear juveniles offsite because of facilities limitations, transport juveniles from rearing to release sites, or practice some combination of the above. Each of these practices may lead to increased rates of straying in programs that rear and release post-emergent juveniles.

Rearing effects on social behavior of juveniles—In recent years, much attention has focused on the ecological impacts of releasing hatchery-reared anadromous salmonids into streams. Concerns regarding ecological interactions generally focus on predation by released hatchery salmonids on wild salmonids (for more information on this topic see reviews by Fresh 1997 and Flagg et al. 2000) and competition between them. Artificially propagated anadromous salmonid populations exhibit divergence in social behaviour from wild populations after several generations of culture, indicating a genetic basis for such effects (Swain and Riddell 1990; Riddell and Swain 1991; Einum and Fleming 1997). The potential for unnatural behavioral development resulting from environmental (rearing) effects presents a more relevant concern for captive broodstock programs, which release juveniles derived from locally adapted wild broodstock. In this respect, the important question is: How does captive rearing from egg to release affect the development of social behavior, and therefore, post-release interactions with wild fish? The studies of value in addressing this question include evaluations of juvenile salmonid social behavior from a common parental population, reared in different environments, and evaluated in a common novel environment.

Independent of genetic effects, early rearing environments can affect the development of social behavior and success in agonistic contests for resources. Fenderson and Carpenter (1971) found that hatchery-reared Atlantic salmon were less aggressive when tested at low density than wild salmon, but were more aggressive when tested at high density. Hatchery rearing had no apparent effect on several agonistic behaviors of Atlantic salmon, but did affect their microhabitat use in laboratory flumes (Dickson and MacCrimmon 1982). Berejikian et al. (1996) found that rearing steelhead from wild parents under different densities and rations in hatchery environments or in natural stream channels had little affect on the development of agonistic behavior. However, environmental factors including stream rearing, low ration, and low density caused the locally derived hatchery population to exhibit increases in aggressive frequencies. Reduced ration can also cause higher frequencies of aggressive behavior in Atlantic salmon (Symons 1968), and localizing food distribution in rearing vessels can increase aggressive behavior frequencies in chum salmon (Ryer and Olla 1995).

Dominance in agonistic contests can provide individuals access to more energetically profitable stream positions (Fausch 1984; Metcalfe 1986) and presumably increase fitness. Rhodes and Quinn (1998) found that hatchery-reared coho salmon dominated hatchery-reared coho salmon for access to food in laboratory trials. Conversely, hatchery-reared steelhead parr released into tributaries of their parental river achieved social dominance in 50% of agonistic contests with smaller wild fish, but lost 90% of contests against larger wild fish, indicating a competitive disadvantage, although prior residence advantages of natural fry could not be ruled out (Berejikian 1995). Similarly, steelhead reared under conventional hatchery protocols were more often subordinate to naturally reared steelhead in laboratory trials (Berejikian et al. 2001b).

Release of captively reared adults or stocking of their eggs into targeted areas should result in juvenile offspring undergoing natural development of social behavior and minimize unnatural interactions between them and wild fish. The alternative of rearing offspring from captive broodstock in the hatchery for a period of time before release will increase the likelihood of altering agonistic behavior, competitive ability and, thereby, the nature of interactions with wild fish. Resulting impacts of released juveniles on fitness of wild juveniles with which they interact are far less clear. Thus far, all published studies we found documenting competition between released hatchery salmonids and wild conspecifics at large in natural streams involved either a non-local or domesticated hatchery stock or lacked any experimental replication (see Nielsen 1994; McMichael et al. 1997; McMichael et al. 1999; Bachman 1984)

Domestication—The 'weight of evidence' indicates that domestication selection is a real consequence of artificial propagation (Reisenbichler and Rubin 1999). Domestication selection defined as "any change in the selection regime of a cultured population relative to that experienced by the natural population" (from Waples 1999) would include artificial, intentional, and unintentional selection that can occur in an artificially propagated population. All captive broodstock programs, regardless of the release strategy, may be subject to domestication selection, to the extent that genetic changes can occur in a single generation. For our purposes, the question is whether potential for domestication selection increases as the duration in captivity increases from captively reared adult through F_1 smolt.

Several authors have argued that the dramatic differences in hatchery and natural environments and vastly different mortality schedules in hatchery and wild salmonid populations inevitably leads to domestication selection (Campton 1995; Busack and Currens 1995; Waples 1999). That is, relative to natural populations, hatchery populations experience high survival from egg to release (e.g., Flagg et al. 1995) and suffer lower survival than wild fish from release to return as mature adult (Light 1989; Lindsay et al. 1989). Mounting evidence that multigeneration artificial propagation of salmonid populations leads to phenotypic changes for traits such as agonistic behavior (Riddell and Swain 1991), antipredator behavior (Einum and Fleming 1997) and predator avoidance ability (Berejikian 1995), and growth (anadromous brown trout, *S. trutta;* Petersson and Järvi 2000) supports the domestication concern. The general conclusion from these and other ‘common garden’ experiments controlling for potential effects of the rearing environment is that phenotypic divergence of the hatchery and wild populations studied can have a genetic basis and domestication selection as defined here is a plausible mechanism.

To extend the argument that differential mortality schedules of wild and hatchery fish contributes to domestication selection, releasing fish earlier in their life (i.e., earlier than the smolt stage) may reduce the potential (also proposed by Waples 1999). For example, offspring groups from artificially spawned captive broodstock released as parr (several months prior to smoltification) will likely experience egg-to-smolt mortality rates that are intermediate between groups of eggs emerging naturally from remote site incubators or from redds constructed by captively reared adults. Any benefit of early release in terms of reduced domestication selection has yet to be demonstrated empirically. In short, juveniles produced from naturally spawning captively reared adults should experience selection pressures similar to those experienced by wild offspring of wild fish, whereas a much stronger argument can be made for domestication selection in programs that spawn captively reared adults and release their progeny as smolts.

Productivity—Captive broodstock programs must consider demographic effects on the target population when evaluating the relative effectiveness of different reintroduction strategies in increasing population abundance. The primary tenet of captive broodstock programs is that full-term captive culture will rapidly increase population abundance. In fact, in-culture survival from the point of collection to adult is generally quite high and has increased in recent years with improvements in husbandry practices (Flagg and Mahnken 2000). In predicting the relative demographic gains that might be achieved by the various reintroduction approaches, it is important to estimate the relative mortality that can occur at each major life history stage.

The greatest potential for differences in overall production of F_1 smolts from captively reared adults occurs between the adult release strategy and the alternative of artificial spawning and rearing to smolt prior to release. For the adult release strategy, losses can occur in the natural environment during gamete release (i.e., poor fertilization), incubation, emergence, age-0 rearing (spring through fall) and overwinter rearing. Using current technology, the expected reproductive performance of captively reared salmonids released as adults for natural spawning comes most directly from the following recent studies quantifying their breeding behavior and reproductive success under experimental conditions and in the natural environment.

Studies comparing reproductive performance of captive (reared from fry to adult) and wild coho salmon indicates captive males and females were competitively inferior to wild counterparts

(Berejikian et al. 1997) leading to poorer adult-to-fry reproductive success (Berejikian et al. 2001a). Chinook salmon reared in captivity from egg to adult exhibit delayed final maturation, incomplete egg deposition, and high rates of nest abandonment (Berejikian et al. 2001c, Venditti 2002; Berejikian et al. 2003). Reproductive problems in captive chinook salmon may stem more from disruption of the endocrine system than physical fitness deficiencies brought on by captive rearing, because manipulating prematuration temperatures (Venditti et al., Idaho Department of Fish and Game, unpublished data) and injection of reproductive hormones (Berejikian et al. 2003) have improved reproductive behavior. In steelhead, released captive adults contributed to a dramatic increase in the number of redds constructed in the Hamma Hamma River, Washington. The proportion of viable eggs (to the eyed stage of development) hydraulically sampled from those redds has thus far exceeded 90%, indicating high reproductive performance for this species (Berejikian et al. 2002).

Offspring of released captively reared adults and eggs stocked directly into streams or lakes will suffer greater mortality to the smolt stage than if held in culture. Although highly variable, embryos and free-swimming juveniles suffer substantial mortality in natural freshwater environments. Ward and Slaney (1993) estimated an annual average of 6.5% egg-to-fry survival for Keogh River, BC steelhead, 12.9% fry-to-smolt survival and, therefore, less than 1% egg-to-smolt survival. Bjornn et al. (1968) estimated egg-to-smolt survival rates of approximately 7% over several years for sockeye salmon in Redfish Lake, Idaho. Egg-to-fry survival of chinook salmon was categorized as less than 30% in a survey by Healy (1991), and estimated survival from summer parr to smolt for wild stream-type chinook salmon in the Snake River Basin ranged annually between 8 and 38% (Paulsen and Fisher 2001). Egg-to-smolt survival rates in the hatchery environment are not well documented in the literature but are arguably much higher than in the natural environment (e.g., >75% egg-to-smolt survival in cultured Redfish Lake sockeye salmon (Flagg et al. 1995).

As described, smolt production and consequently the number of returning adults from naturally spawning captively reared adults will be lower than for programs that artificially spawn captively reared adults and release hatchery-reared smolts. It is unclear whether greater marine survival of fish that have lived (because of their earlier release) in the natural environment for months to years before out-migrating will fully compensate for their lower survival to the smolt stage. Thus far, only one captive broodstock program has evaluated survival to adult of salmon (sockeye) released at different life history stages (Hebdon et al. this volume). It indicates that the greatest productivity is derived from F_1 smolt release, followed by F_1 age-0 parr release into Redfish Lake, Idaho, and the poorest productivity per captive adult spawner came from a combination of adult and eyed egg stocking into Redfish Lake (productivity from these two strategies could not be determined). The relative return rate of adults from various strategies must be followed by the question of how successfully they will reproduce. However, Fleming et al. (1997) quantified the relative breeding success of hatchery-reared (from egg to smolt) Atlantic salmon against that of cohorts reared in the natural environment. The effects of juvenile rearing in the hatchery included i) a roughly 50% reduction in breeding success of wild males, ii) females developing smaller eggs, and iii) delayed adult migration in both sexes. Compared to other strategies, the smolt release strategy may lead to poorer breeding success on a one-to-one basis. However, the release of smolts offers the likelihood that a greater number of adults will be produced, which may more than compensate for breeding deficiencies.

Habitat degradation, depensatory mortality, overfishing, invasive species, or various combinations of these factors can reduce population abundance and impede attempts to utilize artificial propagation recovery. The level of productivity achieved from any of the reintroduction strategies will depend on the major factors causing the population decline and relative stage-specific mortality rates. For example, adult or egg releases into poor spawning and early rearing habitat may provide little benefit. High quality spawning and early rearing habitat connected to a migration corridor that inflicts unnaturally high mortality may be a better fit for adult or egg releases to allow for as much naturalization as possible. Poor habitat quality in spawning, rearing, and migratory areas may require more intensive intervention (i.e., artificial spawning and smolt release) to overcome reduced carrying capacity in the natural environment. These and the numerous other possible scenarios should be considered in future management for release strategies from captive broodstocks.

MANAGEMENT OBJECTIVES AND ASSOCIATED REINTRODUCTION STRATEGIES

In addition to the biological considerations discussed, it is recognized that the operation of captive broodstock programs, including reintroduction strategies, may vary depending on the goals of the management framework or entities. The abundance of each population incorporated into the captive broodstock programs listed in Table 1 had declined to perilously low levels. This section of the paper describes the results of a survey sent to personnel closely involved in the management of the 13 captive broodstock programs in order to better understand the role of overall program objectives in determining reintroduction strategies. Program representatives were asked to describe past and current broodstock collection and reintroduction strategies (Table 2) and identify why certain reintroduction strategies (if any) had been discontinued. They were also asked to rank the importance on a scale of one to five of eight potential objectives (with a rank of 5 being ‘most important’) of a captive broodstock program (Table 3) with respect to all of the following considerations: the rationale for initiating the program, current management goals, and reintroduction strategies. Of the 13 identified programs, 11 responded with information on collection and reintroduction strategies, and 10 completed the management objectives portion of the survey.

Current captive broodstock programs collect and reintroduce anadromous salmonids at all major freshwater life history stages (Table 2). Three programs collect eyed eggs by hydraulic removal from redds, two programs collect subyearling fry or parr, one program collects migrating smolts, and five programs collect maturing adults.

Seven of the 12 programs currently implement more than one reintroduction strategy, and 10 of the 12 programs have implemented more than one strategy since the inception of the programs. Most commonly, programs release juveniles at smoltification and least frequently stock eyed embryos either into streamside or in-gravel incubators. Six of the programs have released captively reared adults (either of natural origin or F_1 from captive broodstock, Table 2), but three have discontinued the practice either due to ineffectiveness, loss of funding, or because only adults in excess of those needed for artificial spawning were released. All programs that release adults have at least one other reintroduction strategy. By contrast, three smolt-release programs have not released fish at any other life history stage.

Preventing imminent biological extinction of the target population(s) had the highest mean rank of any of the potential objectives for all programs combined (Table 3). Meeting interagency or legal agreements and complying with constituent desires for certain reintroduction strategies were considered least important (Table 3). Programs that release adults considered the following two objectives: 1) evaluating the relative effectiveness of different reintroduction strategies either by comparing different strategies within or between programs, and 2) spreading the risk of failure of any one particular reintroduction strategy, to be very important considerations in managing the program. By contrast, programs that do not release adults viewed these two objectives as far less important in project management (Table 3). This distinction indicates that the programs releasing adults consider the strategy to be experimental and a measure to spread risks associated with juvenile release options. However, the finding that preventing extinction was considered to be very important in adult and juvenile release programs alike indicates that programs releasing adults believe the strategy, at a minimum, will not impede that objective.

CONCLUSIONS AND RECOMMENDATIONS

The potential consequences of captive culture on homing and imprinting, natural and sexual selection, domestication selection, and rearing environment effects on social behavior differ depending on the reintroduction strategy and favor the release of captively reared adult salmon or artificially produced eggs. The arguments for proper imprinting and reducing developmental divergences have perhaps the most scientific support, although consequences are difficult to quantify. Benefits in terms of natural and sexual selection during spawning and reduced domestication selection are less well supported (i.e., more theoretical), but still indicate advantages of adult release. The release of natural origin adults or eyed-eggs probably offers the lowest initial population amplification but may minimize potential divergence of the cultured and wild source population(s)—an important consideration for restoration purposes. The greater productivity gained by growing fish for a longer period of time and to a larger (smolt) size may counterbalance the ecological and genetic concerns.

It is difficult to make broad recommendations to broodstock managers given the uniqueness and complexity of individual programs and undoubtedly different management tolerance of ecological, genetic, and demographic risks. However, the major tradeoff is between greater productivity from release of older and larger juveniles vs. presumed genetic and ecological benefits of adult or possibly egg release strategies. Each program will likely be able to monitor demographic changes but will likely have greater difficulty monitoring genetic and ecological consequences. Therefore, we recommend that programs take the least invasive approach that provides demographic gains sufficient to meet program objectives. For example, if prevention of cohort loss and maintaining a continuum of spawning in the habitat is a primary program goal and maximizing production is not, adult releases may be adequate. Following thorough monitoring and evaluation, early release strategies might be eliminated if productivity is not meeting goals, but might be relied on more if they are. Programs should be flexible enough to implement changes following analysis of data from monitoring efforts.

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Table 1. Captive broodstock programs for maintenance or recovery of imperiled anadromous salmonids in North America.

Species	River/Lake origin	Region	Number of stocks	Status of program	Strategies/ objectives[a]
Chinook salmon	Sacramento River	Central CA	1	Ongoing	Yes/yes
Chinook salmon	White River	Puget Sound, WA	1	Terminated[b]	Yes/yes
Chinook salmon	Tucannon River	Columbia River, WA	1	Ongoing	Yes/yes
Chinook salmon	Dungeness River	E. Straits of Juan de Fuca, WA	1	Ongoing	Yes/no
Chinook salmon	Mid-Columbia River	Central, WA	1	--	No/no
Chinook salmon	Grand Ronde River and tributaries	Snake River, OR	3	Ongoing	Yes/yes
Chinook salmon	Salmon River tributaries	Snake River, ID	3	Ongoing	Yes/yes
Atlantic salmon	Gulf of Maine	Gulf of ME	8	Ongoing	Yes/yes
Steelhead	Hamma Hamma River	Hood Canal, WA	1	Ongoing	Yes/yes
Steelhead	E. Vancouver Island rivers	Vancouver Island, BC	5 (3)[c]	Ongoing	Yes/yes
Sockeye	Redfish Lake	Stanley Basin, ID	1	Ongoing	Yes/yes
Coho	Scott Creek	Central CA coast	1	Pre-release[d]	Yes/yes
Coho	Dry Creek	Russian River, CA coast	1	Pre-release[d]	No/no

[a] The strategies/objectives column indicates whether ('yes') or not ('no') survey information was obtained for i) reintroduction strategies implemented (first response) and ii) importance of management objectives (second response).
[b] Fish are no longer reared to adult in captivity.
[c] The program initially included five populations but has subsequently been reduced to three.
[d] Fish have been collected for rearing to adult but have not yet matured.

Table 2. Summary of collection and reintroduction strategies implemented by 11 of 13 captive broodstock programs for recovery of imperiled salmonid populations in North America. The number of programs currently implementing a particular strategy is shown. Numbers in parentheses represent the sum of past and current programs. Several programs implement more than one strategy; therefore, the total frequency is greater than the number of programs.

	Reintroduction					
	Natural Origin		F_1 from captive broodstock[b]			
Collection[a]	Smolt	Adult	Egg	Age-0 parr[c]	Smolt	Adult
Egg	1 (1)	2 (2)	1 (1)		1 (1)	
Fry/Parr				3 (3)	2 (2)	0 (1)
Smolt		0 (1)			1 (1)	
Adult		0 (1)[d]	1 (1)	2 (2)	4 (4)	1 (1)
Total	**1 (1)**	**2 (4)**	**2 (2)**	**5 (5)**	**8 (8)**	**1 (2)**

[a] Frequency of collection strategies represents current practices (past practices not shown).
[b] F_1 from captive broodstock refers to first generation offspring of fish reared to sexual maturity in captivity. In cases where adults are collected from the wild, these fish would be released after two generations of artificial spawning.
[c] Includes release of age-0 parr where smoltification naturally occurs at age-1 or older. Release of age-0 smolts from chinook salmon populations with a predominant ocean-type life history is included under the smolt reintroduction column.
[d] Captively reared adults produced from adult collections represent the F_1 generation.

Table 3. The importance of eight potential objectives (ranked on a scale of 1 to 5 with 5 being most important) for a captive broodstock recovery program shown as the mean score from survey respondents representing 10 programs. The adult release column shows the mean response from four programs that currently (three programs) or have recently (one program) implemented adult release as a planned reintroduction strategy. Two juvenile release programs have released adults; these are not included in the adult release mean, because releases were unplanned and discontinued.

Objective	Ranking			
	Overall Range	Overall mean	Juvenile release mean	Adult release mean
1. Prevent imminent biological extinction of the target population	3-5	4.55	4.70	4.25
2. Maintain genetic integrity (genetic diversity and local adaptation) of the population until the factors for the population decline are fixed.	2-5	3.90	3.80	4.00
3. Amplify the population to a level of long-term self-sustainability after the program was terminated.	3-5	4.00	4.00	3.75
4. Rebuild the population for the purpose of supporting a sport or commercial (tribal or nontribal) fishery.	2-4	2.40	2.60	2.25
5. Meet or comply with existing inter-agency, treaty-trust, or other legal agreements	1-4	2.18	2.60	1.95
6. Respond to user group or constituent desires regarding a particular reintroduction strategy	1-3	2.60	1.60	2.14
7. Evaluate the effectiveness (i.e., research) of different reintroduction strategies either by comparing different strategies within your program or between yours and other program(s).	2-5	3.38	2.60	4.45
8. Spread the risk of failure of any one particular reintroduction strategy.	1-4	2.74	2.00	3.60

INTERIM STANDARDS FOR THE USE OF CAPTIVE PROPAGATION TECHNOLOGY IN RECOVERY OF ANADROMOUS SALMONIDS LISTED UNDER THE ENDANGERED SPECIES ACT

Introduction

The following information addresses the elements of the *Interim Standards for the Use of Captive Propagation Technology in Recovery of Anadromous Salmonids Listed under the Endangered Species Act* document prepared by the National Marine Fisheries Service, Sustainable Fisheries Division—Hatchery/Inland Fisheries Branch (NMFS 1999).

This section of our composite report address the following program and projects:

Program: Captive Rearing Program for Salmon River Spring Chinook Salmon

Projects: 1990-093-00. University of Idaho. Genetic Analysis of *Oncorhynchus nerka*, Modified to Include Chinook Salmon.

1993-05-600. NOAA Fisheries. Assessment of Captive Broodstock Technologies.

1996-067-00. NOAA Fisheries. Manchester Spring Chinook Broodstock Project.

1997-001-00. Idaho Department of Fish and Game. Captive Rearing Program for Salmon River Spring Chinook Salmon.

Our response is organized to follow language from the document:

"Managers who plan to sponsor a captive propagation program should proceed through the following steps:"

1. Consider the alternatives to captive propagation and review the guidelines presented in the following sections of this document.
2. Evaluate the status of the population targeted for captive propagation and goals of the proposed program design using the decision issues listed in Table 1.
3. Shape the program proposal using the operational standards outlined in Table 2.
4. Develop a detailed captive propagation plan following the outline in Table 3.
5. Evaluate the proposal against the hazards and benefits listed in Tables 4 and 5.

Table 1. Decision Standards for Using Captive Propagation Technology to Recover Listed Anadromous Salmonids

Table 1. Issue 1. Population Status

Guideline 1. Population is at a high risk of extinction in the immediate future.

- **a. Population is at very low abundance (e.g., <50 fish a year) OR**
- **b. Population is at low abundance and declining OR**

c. Population is at moderate abundance and declining precipitously OR
d. Little or no natural production predicted for at least a full generation.

Idaho Department of Fish and Game's (IDFG) long-term management objective for chinook salmon *Oncorhynchus tshawytscha* is to maintain Snake River salmon populations at levels that will provide sustainable harvest (IDFG 2001). Restoring currently depressed populations to historic levels is a prerequisite to this condition. Artificial propagation of spring and summer chinook salmon in the Salmon River basin, through Lower Snake River Compensation Plan (LSRCP) and Idaho Power Company hatcheries, was initiated to compensate for lost production and productivity caused by the construction and operation of private and federal hydroelectric facilities in the Snake River basin. The mitigation approach was to trap, spawn, and rear a portion of the historically productive local broodstock to produce a large number of smolts (Bowles 1993). When chinook salmon trapping began in 1981 as part of the LSRCP, it was assumed that enough chinook salmon adults would return to provide for harvest and continued hatchery production needs. It was also assumed that hatchery programs would not negatively affect the productivity or genetic viability of target or other populations and that natural populations would remain self-sustaining even with hydropower projects in place. In reality, smolt-to-adult survival in wild Snake River chinook salmon declined abruptly with completion of the federal hydroelectric system by the mid-1970s (Petrosky and Schaller 1996), and numbers of naturally produced salmon declined at various rates throughout the Snake River basin. It now appears the survival rate estimates used in the hatchery mitigation program models were substantially overestimated, which has led to hatchery programs that have been unable to mitigate for the loss of chinook salmon due to the dams or stem the decline of target populations. Spring/summer chinook salmon returns have been insufficient to meet artificial and natural smolt and adult production predictions, much less provide a consistent harvestable surplus of adults.

Development of the Snake River hydrosystem has substantially influenced the decline of local spring/summer chinook salmon stocks by reducing productivity and survival (Raymond 1979; Schaller et al. 1999), and has contributed to the listing of Snake River chinook salmon under the Endangered Species Act (ESA). A recovery strategy incorporating natural-river function is most likely to increase the smolt-to-adult return rate and provide for recovery of these populations (Marmorek et al. 1998). However, until smolt-to-adult survival is increased, the challenge for this program is to preserve the existing metapopulation structure (by preventing local or demographic extinctions) of these stocks to ensure they remain extant to benefit from future recovery actions. This project is developing technology that may be used in the recovery of the listed Snake River spring/summer chinook salmon evolutionarily significant unit (ESU), (NMFS 1995). Preserving the metapopulation structure of this ESU is consistent with the predecisional Snake River Salmon Recovery Plans (NMFS 1995; Schmitten et al. 1997), and supports the Northwest Power and Conservation Council's goal of maintaining biological diversity while doubling salmon and steelhead runs (NPPC 1994).

The populations of naturally produced Snake River salmon have declined precipitously from the relatively high levels of the 1960s (Matthews and Waples 1991; NMFS 1995). Fewer than 10,000 naturally produced, adult spring chinook salmon have returned to spawning areas upstream of Lower Granite Dam annually for the last 25 years (1979-2003) with the exception of 1992 and 2001-2003. Estimates of the number of wild/natural spring chinook salmon over Lower Granite Dam averaged 5,049 adults

(1997-2001) with recent consecutive low runs of 1,416, 745, and 1,358 fish in 1994, 1995, and 1996, respectively. During that same period (1979-2001), wild/natural summer chinook salmon returns averaged 3,021 adults. The maximum count for wild summer chinook salmon during that period was 12,475 fish in 2001, but the previous high was only about half that number, 6,458 fish in 1997. Counts of wild summer chinook salmon dropped below 1,000 individuals in 1992, 1994, and 1995.

The combined counts of returning spring and summer chinook salmon to the Snake River basin were the lowest on record in 1994 (3,915 fish) and 1995 (1,797 fish). For perspective, in each year from 1962 to 1971, an average of 148,000 adult anadromous salmonids crossed Ice Harbor Dam into the Snake River basin. The spring/summer component of the run was comprised primarily of wild fish and accounted for about 40 percent of the total number of anadromous salmonids counted, and averaged 59,900 fish annually. Most of these returnees were produced in and destined for production areas now located upstream of Lower Granite Dam.

In recent years, the number of adult spring and summer chinook salmon crossing Lower Granite Dam has fluctuated widely. The comparatively large runs in 2000-2003 are the product of a combination of relatively high flow and favorable ocean conditions. However, the vast majority of the fish in these runs are of hatchery origin.

The following excerpt was taken from NOAA Fisheries (2003) preliminary conclusions regarding the updated status of listed ESUs on West Coast salmon and steelhead:

“The 1991 ESA status review (Mathews and Waples, 1991) of the Snake River spring/summer chinook ESU concluded that the ESU was at risk based on a set of key factors. Aggregate abundance of naturally produced Snake River spring/summer chinook runs had dropped to a small fraction of historical levels. Short-term projections (including jack counts, habitat/flow conditions in the brood years producing the next generation of returns) were for a continued downward trend in abundance. Risk modeling indicated that if the historical trend in abundance continued, the ESU as a whole was at risk of extinction within 100 years. The review identified related concerns at the population level within the ESU. Given the large number of potential production areas in the Snake basin and the low levels of annual abundance, risks to individual subpopulations may be greater than the extinction risk for the ESU as a whole. The 1998 chinook status review (Myers et al. 1998) summarized and updated these concerns. Both short- and long-term abundance trends had continued downward. The report identified continuing disruption due to the impact of mainstem hydroelectric development including altered flow regimes and impacts on estuarine habitats. The 1998 review also identified regional habitat degradation and risks associated with the use of outside hatchery stocks in particular areas—specifically including major sections of the Grande Ronde River basin.”

Although not without risk, captive broodstock technology is sufficiently advanced to provide the measures needed to maintain or amplify populations and to reduce extinction risk (Flagg et al. 1995; Flagg and Mahnken 1995; Schiewe et al. 1997; Flagg and Nash 1999; Flagg et al. in review; Pollard and Flagg in review). Techniques used in this program to culture chinook salmon reflect the Region’s best science. Program fish culture protocols follow accepted conservation hatchery guidelines developed by Brannon et al. (1999), Hard et al. (1992), Kapuscinski and Jacobson (1987), NPPC (1999), and Flagg and Nash (1999).

Coordination of recovery efforts is carried out under the guidance of the Chinook Salmon Captive Propagation Technical Oversight Committee (CSCPTOC), a team of technical experts representing the agencies involved in the recovery and management of Salmon River spring chinook salmon. Further coordination takes place at the Federal level through the ESA Section 10 permitting process. The CSCPTOC was formed to convey new information between the various state, federal, and tribal entities involved in the captive culture of chinook salmon. The CSCPTOC meets approximately every two months, which allows an adaptive management approach to all phases of the program and provides a forum of peer review and discussion for all activities and culture protocols associated with this program.

Project sponsors are also actively involved with ongoing efforts to finalize the Council's Artificial Production Review and Evaluation process and Phase II and III steps in the NOAA/Council Hatchery and Genetic Management Plan process. In addition, project sponsors are actively contributing information to the NOAA Technical Recovery Team process.

Guideline 2. Population is of very low abundance relative to available habitat and production potential, and short-term supplementation is deemed necessary to accelerate natural recovery.

See response provided for Table 1 Issue 1 Guideline 1 above.

Table 1. Issue 2. Importance of Population
Guideline 1. The population targeted for captive propagation is important, relative to other populations because:

The following excerpt was taken from 1991 status review of Snake River chinook salmon (Matthews and Waples 1991).

"Phenotypic, life history, and genetic data support the conclusion that Snake River chinook salmon are distinct in an ecological/genetic sense. In a cluster analysis of environmental data (stream gradient, precipitation, elevation, vegetation type, etc.), Schreck et al. (1986) demonstrated two distinct groups of Snake River localities, with one group including those from the Imnaha and Grande Ronde Rivers and the other including those from the Salmon River. Both groups were quite distinct from other localities in the Columbia River Basin. Phenotypic data also indicate that the populations are structured geographically. The fact that juvenile migration behavior is the same for spring and summer chinook salmon in the Snake River, but different for these two forms in the upper Columbia River, strongly implies ecological/genetic differences between the regions. The precision required to migrate great distances from different natal streams and tributaries and return with high fidelity and exact timing to start the next generation 1 to 3 years later speaks of biological entities that are highly adapted to their particular environments. The differences detected by protein electrophoresis between Snake River spring/summer chinook salmon and chinook salmon in the lower and mid-Columbia River Basin may be an indication of adaptive genetic differences at parts of the genome not sampled by protein electrophoresis. By comparison, the genetic differences found between different spring and summer chinook salmon populations within the Snake River are rather modest."

a. Unique genetic qualities

The following excerpt was taken from 1991 status review of Snake River chinook salmon (Matthews and Waples 1991).

“As a group, Snake River spring and summer chinook salmon are characterized by relatively low levels of genetic variation. Winans (1989) found that heterozygosity values in Snake River spring and summer chinook salmon were about half as large as those in lower river stocks of similar run-timing. It has been suggested (Utter et al. 1989; Winans 1989) that these relatively low levels of genetic variation may reflect past bottlenecks in population size; however, other explanations cannot be ruled out. A more recent study (Waples et al. 1991) using more gene loci suggests that the difference in level of genetic variability between Snake River and lower Columbia River stocks may not be as great as previously thought.”

“Snake River spring and summer chinook salmon also have been shown to be genetically distinct from other chinook salmon populations in North America, with two exceptions. One group is spring chinook salmon from the upper Columbia River. In recent genetic studies, this group is primarily represented by samples from hatcheries using Carson stock fish. This similarity may be due to the origin of the Carson stock, which was initiated to mitigate losses to upper Columbia River populations eradicated by construction of Grand Coulee Dam. Founding broodstock was collected at Bonneville Dam (Mullan 1987) and likely included some and possibly many Snake River fish. Subsequently, Carson stock has been extensively out-planted in the Columbia and Snake River Basins (Howell et al. 1985). According to Mullan (1987), the Wenatchee, Entiat, and Methow rivers are the last remaining drainages in the upper Columbia River Basin with "wild" runs of spring chinook salmon, and over a million smolts of Carson stock hatchery fish are released annually into each of these rivers.”

b. Unique adaptations to specific habitats (e.g., adaptations in run timing, migration distance, and behavior).

The following excerpt was taken from the 1991 status review of Snake River chinook salmon (Matthews and Waples 1991).

“The habitat occupied by spring/summer chinook salmon in the Snake River appears to be unique to the biological species. In contrast to coastal mountains and the Cascade Range, the Snake River drainage is typified by older, eroded mountains with high plateaus containing many small streams meandering through long meadows. Much of the area is composed of batholithic granite that is prone to erosion, creating relatively turbid water with higher alkalinity and pH in comparison to the Columbia River (Sylvester 1959). The region is arid with warm summers, resulting in higher annual temperatures than in many other salmon production areas in the Pacific Northwest. These characteristics combine to produce a highly productive habitat for these fish. As previously mentioned, the Salmon River alone once produced nearly half of the spring and summer chinook salmon returning to the Columbia River.”

“Chapman et al. (1991) described 10 geologic provinces in the Snake River Basin. Each is unique to some degree in the type of habitat it provides for anadromous salmonids in terms of both geology and climate. Together, these areas form an aquatic ecosystem for chinook salmon that is unique in the Columbia River Basin and, probably, the world. It seems likely that the anadromous salmonid populations that inhabit this ecosystem are unique also."

c. Low likelihood of successful natural recolonization from other populations in the event of extinction.

The extent to which stocks targeted by this project might experience successful natural recolonization from other populations is unknown. In general, wild/natural spring chinook salmon abundance in the upper Salmon River of Idaho is depressed. As such, the recolonizing contribution from neighbor stocks is expected to be minimal at this time.

d. High potential productivity, or unique social, economic, or cultural value

Snake River salmon are vital to the evolutionary legacy of the species. The Snake River historically produced approximately 50% of the total spring/summer chinook salmon for the entire Columbia River basin (Bjornn 1960; Mallet 1974). As a result of habitat degradation and loss in other states, Idaho and northeast Oregon currently have over 70% of the natural production potential for these fish in the Columbia River basin (StreamNet database).

Schaller et al. (1996) concluded that spawner and recruit data of the aggregate upriver run of wild spring chinook salmon for brood years 1939-1990 provided little or no evidence of a long-term, gradual decline in productivity and survival rate. Rather, the analyses provided support for the hypothesis that the productivity and survival rate of upriver spring chinook salmon remained fairly stable from early hydropower development (1939) until the era of major hydropower development (about 1970) when major declines began.

Idaho currently has about 3,676 miles of spawning and/or rearing habitat for spring and summer chinook salmon. This represents about 62% of predevelopment condition (Hassemer et al. 1997). Thirty percent of this habitat is within boundaries of designated wilderness or wild and scenic river corridors. Sufficient habitat exists to support far greater smolt production than currently occurs from the low number of adults returning over the last 20 years.

Table 1. Issue 3. Scale of Project
Guideline 1. Total captive production should be based on the number of fish needed to:

a. Prevent extinction.
b. Adequately represent genetic variation for life history traits of the wild population.
c. Minimize genetic change during captivity.
d. Reestablish the fish in the wild.

To maintain stock structure (the within and among population variability) for specific population segments at relatively high risk of localized extinction, the IDFG Captive Rearing Project for Salmon River chinook salmon was implemented. The primary objectives of the program are to: 1) avoid demographic and environmental risks associated with cohort loss, and 2) to maintain heterozygosity and gene pool identify of the Snake River spring/summer chinook salmon ESU.

The strategy of captive rearing is to prevent cohort collapse of the specified target populations by providing captive-reared adult spawners to the natural environment, which, in turn, maintains the continuum of generation-to-generation smolt production. Each generation of smolts, then, provides the opportunity for population maintenance or increase should environmental conditions prove favorable for that cohort.

The captive rearing approach was developed primarily as a way to maximize the number of spawners in the habitat while minimizing intervention impacts. Under these guidelines, only enough juveniles or eyed-eggs from target populations would be collected to generate a minimum number of spawners to return to the natural habitat to meet the primary program objectives stated above.

Captive rearing has several inherent advantages over traditional captive broodstock or supplementation strategies. Captive rearing allows more natural selection to occur than in a conventional broodstock program. Natural selection operates in the redd prior to egg collection, and captive-reared individuals compete for mates and spawning opportunities. Additionally, domestication selection is most likely reduced as only wild individuals are brought into the program annually to initiate rearing groups. Additionally, the program is not designed as a spawning program. Limited spawning occurs to assess several reproductive questions, but the primary focus of the program is to rear wild-captured juveniles or eggs to maturation for release back to the habitat for natural spawning. The captive rearing approach should also help ensure that the unique genetic attributes of the target populations will be preserved. A final advantage of the captive rearing technique is that a larger number of populations can be reared in a given amount of facility space because the large number of juveniles produced in a broodstock program do not need to be maintained.

Survival of program fish from collection to sexual maturity has been quite high and has been improving as we refine our culture techniques. Further improvements in survival should be realized as cohorts sourced as eyed-eggs begin to make up a larger fraction of the fish in the program. These cohorts should experience higher survival to sexual maturity since they come into the program with a much lower incidence of bacterial kidney disease, they have not been exposed to whirling disease, and they are not infested with parasitic gill copepods. Despite these fish health limitations, the captive rearing program has maintained 40%-60% survival to sexual maturity in recent cohorts. Survival at these levels has resulted in over 650 fish reaching maturity in the program; the majority of which have been returned to natal streams for natural spawning. Annual field monitoring has demonstrated that these fish can and do successfully spawn with other captive-reared and wild chinook salmon. Egg collections from redds spawned by program females have been shown to contain viable eggs, and collections are being made to assess production from these redds. Genetic samples have been collected from program adults released to spawn volitionally and from parr collected the following summer near known spawning sites. Parent-progeny analysis will be conducted using microsatellite allele frequency to determine the probability that each parr collected has one or both captive-reared parents. Additionally, spawn crosses at the Eagle Fish Hatchery have made over 90,000 eyed-eggs available for planting in in-stream incubators. These incubators have been shown to have high survival and hatch rates, potentially adding to additional production from this program. Similar genetic analyses are being conducted in systems where these incubators have been used.

Guideline 2. Duration should be as short as possible (one to three generations)

The exact duration of the Captive Rearing Project for Salmon River Chinook Salmon is unclear and may extend to the recovery date for the population.

The captive rearing program for Salmon River chinook salmon began in 1995 with the collection of brood year 1994 smolts. Collections have occurred annually since that time, with the most recent collections being made during September-October 2003. Current broodstocks in culture will mature through 2008 (within the three-generation window established with the collection of brood year 1994 juveniles).

The need to collect additional cohorts for existing project populations will be assessed by program managers and through Subbasin Planning and NOAA-Fisheries Recovery Planning processes. The project will be proposed for extension through the NWPCC Fish and Wildlife Program to accommodate the maturation of additional cohorts, evaluation of adult out-planting efforts, and the association of production to these out-plant groups.

Table 1. Issue 4. Measures of Success

Guideline 1. Successful programs will:

a. **Substantially reduce risk extinction.**
b. **Cause minimal genetic change in comparison with the original source population.**
c. **Reintroduce fish that are phenotypically similar to wild fish of the same age in development, morphology, physiological state, and behavior.**
d. **Increase the number of fish reproducing successfully in the wild.**

The strategy of captive rearing is to prevent cohort collapse of the specified target populations by providing captive-reared adult spawners to the natural environment, which, in turn, maintains the continuum of generation-to-generation smolt production.

The primary implementation strategy of this program is to collect eyed-eggs from naturally-produced redds, rear fish in the hatchery through maturation, and return adults to natal streams to spawn naturally. It is reasonable to assume the release of natural origin adults or eyed-eggs probably minimizes potential divergence of the cultured and wild source population(s)—an important consideration for restoration purposes. Releasing captive-reared adults for natural spawning in natal habitats should minimize genetic changes associated with relaxation or changes in the direction or intensity of natural or sexual selection during reproduction (Berejikian et al. in review). Traditional captive broodstock or supplementation programs do not provide such a potential benefit.

Inbreeding depression and domestication selection are real consequences of artificial propagation (Reisenbichler and Rubin 1999). Domestication selection defined as “any change in the selection regime of a cultured population relative to that experienced by the natural population” (from Waples 1999) would include artificial, intentional, and unintentional selection that can occur in an artificially propagated population. Juveniles produced from naturally spawning captive-reared adults should experience selection pressures similar to those experienced by wild offspring of wild fish, whereas a much stronger argument can be made for inbreeding depression and domestication selection in programs that spawn captive-reared adults and release their progeny as smolts.

The Captive Rearing Program for Salmon River Spring Chinook Salmon is focused on developing culture techniques to raise fish to adulthood with the proper behavioral, morphological, and physiological characteristics to successfully interact with and breed with wild individuals.

Survival of program fish from collection to sexual maturity has been quite high and has been improving as we refine our culture techniques. Further improvements in survival should be realized as cohorts sourced as eyed-eggs begin to make up a larger fraction of the fish in the program. These cohorts should experience higher survival to sexual maturity since they come into the program with a much lower incidence of bacterial kidney disease, they have not been exposed to whirling disease, and they are not infested with parasitic gill copepods. Despite these fish health limitations, the captive rearing program has maintained 40%-60% survival to sexual maturity in recent cohorts. Survival at these levels has resulted in over 650 fish reaching maturity in the program; the majority of which have been returned to natal streams for natural spawning.

The Captive Rearing Program for Salmon River Spring Chinook Salmon conducts field evaluations each year to assess the behavior of and estimate production by program animals. Metrics of interest to date have included appropriateness and frequency of reproductive behaviors (including courtship, digging, and aggression), number of redds constructed by program females, and survival of eggs spawned by captive-reared females. Captive-reared chinook salmon males have been shown to display the entire range of courtship behaviors attributed to chinook salmon. Courtship behaviors in captive-reared males follow the same general patterns as observed in wild males during the 1–2 h leading up to spawning, although captive-reared males tend to court somewhat less frequently than the wild males (Venditti et al. 2003). Captive-reared females have also been shown to display reproductive behaviors similar to wild conspecifics. During the hours leading up to spawning, these fish perform approximately 2–3 nest digs every 10 min. After spawning, captive-reared females cover dig almost continuously for about 10 min and continue this elevated level of cover digging for at least 30 min (Venditti et al. 2003). This annual field monitoring has demonstrated that these fish can and do successfully spawn with other captive-reared and wild chinook salmon. Egg collections from redds spawned by program females have been shown to contain viable eggs, and collections are being made to assess production from these redds. Genetic samples have been collected from program adults released to spawn volitionally and from parr collected the following summer near known spawning sites. Parent-progeny analysis will be conducted using microsatellite allele frequency to determine the probability that each parr collected has one or both captive-reared parents.

Table 1. Issue 5. Changing or Terminating Program

Guideline 1. If risk of immediate extinction lessens because causes of decline are corrected, terminate or phase into a conventional supplementation program.

Guideline 2. If program increases numbers of successful natural spawners, increase the proportion allowed to spawn naturally.

Guideline 3. If substantial progress has not been made toward recovery at the end of the end of three complete generations and no progress has been made toward correcting the causes of decline, reevaluate program.

Guideline 4. If negative effects of captive propagation appear, the program should be altered or terminated.

In recent years, the number of adult spring and summer chinook salmon crossing Lower Granite Dam has fluctuated widely. The comparatively large runs in 2000-2003 are the product of a combination of relatively high flow and favorable ocean conditions. However, the vast majority of the fish in these runs are of hatchery origin. While the risk of immediate, localized species extinction has lessened, it is not safe to assume that productivity will remain at the elevated levels observed in the last four years. Causes of decline have not been corrected (parent:progeny ratios for wild spring/summer chinook salmon are not at or above replacement levels). Negative effects associated with captive hatchery intervention have not been observed to date. Hatchery outcomes and adult reproductive success in the wild continue to be monitored and reviewed at the CSCPTOC level.

Table 2. Operational Standards for using Captive Propagation Technology to Recover ESA-Listed Anadromous Salmonids

Table 2. Issue 1. Choice of Broodstock

Guideline 1. If all remaining individuals of the population of wild fish targeted for recovery are not incorporated in the captive broodstock, develop a broodstock selection protocol to ensure that the genetic and life history variability of the target population is reflected in the captive broodstock.

Captive populations for this project are sourced from the progeny of naturally spawning adults. Beginning with the first collection in 1995 and continuing through 1998, summer parr, fall presmolts and/or spring smolts were collected from the three source streams. Although rearing groups sourced as juveniles converted to feed and survived well, by 1999 it became apparent there were limitations associated with disease, parasite infestations, unknown family representation, and slow growth related to sourcing the populations at the juvenile stage. We assessed the risks and benefits of sourcing the captive populations by hydraulically removing eyed-eggs from natural redds. This technique has been used successfully in other programs, and we developed equipment and employed it beginning in 1999 to collect eyed-eggs from the three populations. Survival and growth of fish collected as eyed-eggs has been excellent to date (McNeil 1964).

To facilitate the evaluation of reproductive success or to balance risks associated with low wild/natural adult chinook salmon escapement to target streams, safety net culture populations have been produced periodically. While the majority of eggs produced in this fashion are returned to target streams as part of a hatch box program conducted by the Shoshone-Bannock Tribes, progeny may be retained to compliment rearing groups. The complete collection history for the program is presented in Table 1.

Table 1. Collection history for the Captive Rearing Project for Salmon River Chinook Salmon. Numbers of fish or eggs collected (or produced from in-hatchery spawning) are indicated by brood year and stock.

Stock	Brood Year								
	BY94	BY95	BY96	BY97	BY98	BY99	BY00	BY01	BY02
Lemhi NP	200	163	178	147	191				
Lemhi NE						264			
Lemhi SN									
WFYF NP	214		113	210	229				

WFYF NE							304	272	308
WFYF SN						300			
EFSR NP	201		5		185				
EFSR NE						143	503	311	328
EFSR SN					304	91			

NP and NE refer to rearing groups sourced as natural parr and eyed-eggs, respectively.
SN refers to safety net rearing groups sourced from in-hatchery spawning.
Lemhi, WFYF, and EFSR refer to the Lemhi, West Fork Yankee Fork Salmon, and the East Fork Salmon rivers.

Juvenile collections (brood years 1994 through 1998) were conducted using seines and screw traps. Collections were made over the course of summer, fall, and spring movement and emigration seasons. Eyed-egg collections (brood year 1999 through present) incorporate eggs from multiple redds and take into account spawn timing and the range of redd distribution in study streams.

Guideline 2. Continual infusion of wild fish into successive year classes of the broodstock may slow domestication of captive propagated fish

Table 2. Issue 2. Captive Broodstock Spawning

The primary implementation strategy of this program is to collect eyed-eggs from naturally-produced redds, rear fish in the hatchery through maturation, and return adults to natal streams to spawn naturally. It is reasonable to assume the release of natural origin adults or eyed eggs probably minimizes potential divergence of cultured and wild source population(s)—an important consideration for restoration purposes. Releasing captive-reared adults for natural spawning in natal habitats should minimize genetic changes associated with relaxation or changes in the direction or intensity of natural or sexual selection during reproduction (Berejikian et al. in review). Traditional captive broodstock or supplementation programs do not provide such a potential benefit.

Inbreeding depression and domestication selection are real consequences of artificial propagation (Reisenbichler and Rubin 1999). Domestication selection defined as “any change in the selection regime of a cultured population relative to that experienced by the natural population” (from Waples 1999) would include artificial, intentional, and unintentional selection that can occur in an artificially propagated population. Juveniles produced from naturally spawning captive-reared adults should experience selection pressures similar to those experienced by wild offspring of wild fish, whereas a much stronger argument can be made for inbreeding depression and domestication selection in programs that spawn captive-reared adults and release their progeny as smolts.

The Captive Rearing Program for Salmon River Spring Chinook Salmon is focused on developing culture techniques to raise fish to adulthood with the proper behavioral, morphological, and physiological characteristics to successfully interact with and breed with wild individuals. Thus, the principal underlying advantage of the program is the production of a “wild” performing individual under culture conditions, which eliminate or decrease demographic and environmental risks associated with migration and ocean residence.

While in-hatchery spawning is not a goal of this program, it is sometimes necessary from both a programmatic standpoint as well as a conservation one. Programmatically, when in-hatchery spawning occurs to investigate the reproductive success of captive animals, managers employ a variety of techniques and protocols to minimize selection and to maintain genetic diversity of the spawning population. Foremost, fish within the broodstock program are not selected for growth or other performance measures as they might be in a production hatchery setting. Animals are bred in a factorial design that minimizes the loss of genetic variability and heterozygosity with the captive population; the loss of which might be a consequence of domestication selection. Animals are also kept in an environment that minimizes demographic risk from disease, predation, etc., but maintains lower density, natural light levels, water temperatures, and feeding regimes designed to simulate or more closely resemble natural conditions.

Guideline 1. Spawn all available adults

The primary implementation strategy of this program is to collect eyed-eggs from naturally-produced redds, rear fish in the hatchery through maturation, and return adults to natal streams to spawn naturally. When in-hatchery spawning occurs, every effort is made to spawn all available adults. Eggs produced at spawning are divided into three lots (by female) and fertilized with sperm from three males (factorial design) to produce three unique subfamilies. Male contribution is subsequently equalized as each male is used to fertilize eggs from three different females (on average).

Guideline 2. Retrieve all possible eggs from mature females, either by multiple live spawnings or through careful attention to ripeness and handling.

The primary implementation strategy of this program is to collect eyed-eggs from naturally-produced redds, rear fish in the hatchery through maturation, and return adults to natal streams to spawn naturally. When in-hatchery spawning occurs, female ripeness is assessed two to three times per week as spawning progresses. Females are anesthetized and gently handled to assess the onset of ovulation. All female chinook salmon are euthanized at spawning. Every effort is made to remove all potentially viable eggs from the body cavity of each fish.

Guideline 3. Use spawning protocols that maximize the effective genetic population size:

a. Factorial or (with greater numbers of parents) single-pair matings.

The primary implementation strategy of this program is to collect eyed-eggs from naturally-produced redds, rear fish in the hatchery through maturation, and return adults to natal streams to spawn naturally.

For a review of spawning events that have occurred during the course of the program, see Hassemer et al. (1999, 2001) and Venditti et al. (2002, 2003). Proposed spawning designs are developed cooperatively between IDFG, NOAA Fisheries, and the University of Idaho (Project 1990-093-00) and are reviewed at the CSCPTOC level. Chinook salmon spawning follows accepted, standard practices as described by McDaniel et al. (1994) and Erdahl (1994). Timing of spermiation and ovulation is judged during routine sorting procedures. Females judged “ready” for spawning on any spawn date are separated from the general population. The family origin (redd number) of ovulating females is identified by PIT tag code. Based on the approved spawning design, appropriate, spermiating males are located and isolated in separate holding ponds. Generally, eggs produced at spawning are divided into three lots (by female) and fertilized with sperm from three males (factorial design) to produce three unique subfamilies. Sperm motility is checked for every male. Male contribution is subsequently equalized as each male is used to fertilize eggs from three different females (on average). Eggs are incubated by subfamily to produce specific progeny groups. Hatchery outcomes from annual spawning events are summarized at the subfamily level, evaluated, and discussed at the CSCPTOC level. Variables routinely evaluated include maturation rate, age at maturation, fecundity, gamete quality, egg size, sperm motility, and egg survival to the eyed stage of development. Adaptively managed, program spawning protocols are adjusted to maximize program success.

b. Cryopreserved sperm (benefits of using cryopreserved sperm should be weighed against potential for loss of viability, especially when the number of eggs is low).

The primary implementation strategy of this program is to collect eyed-eggs from naturally-produced redds, rear fish in the hatchery through maturation, and return adults to natal streams to spawn naturally.

Cryopreservation of milt from male donors has been used in the Captive Rearing Program for Salmon River Spring Chinook Salmon since 1997 and follows techniques described by Cloud et al. (1990) and Wheeler and Thorgaard (1991).

Cryopreserved milt was used in controlled spawning events in 1998 and 1999. Currently there are in excess of 3,000 0.5 ml cryopreserved sperm samples available to the program. These samples represent male chinook salmon from three stocks that matured between 1997 and 2002.

c. Induced spawning.

The primary implementation strategy of this program is to collect eyed-eggs from naturally-produced redds, rear fish in the hatchery through maturation, and return adults to natal streams to spawn naturally.

Hormone analog implants (GnRHa) may be used by NOAA Fisheries and IDFG personnel to induce ovulation and spermiation in maturing chinook salmon. In addition, hormone treatments may be used to synchronize ovulation and spermiation in captive adults.

Table 2. Issue 3. Rearing of Fish

The Chinook Salmon Captive Broodstock Program's principle guiding tenets are to maintain the population's natural traits by maximizing in-culture and post-release survival, minimize potential negative impacts of hatchery culture, and minimize genetic divergence from the native population. Other program guidelines are modified as necessary (at the CSCPTOC level) to remain consistent with the principal guidance protocols. For a review of annual fish culture activities associated with this program see Flagg et al. 1997, 1998; Hassemer et al. 1999, 2001; McAuley et al. 2000; Venditti et al. 2002, 2003.

Following collection, fish are reared exclusively in freshwater at the Eagle Fish Hatchery until they reach the smolt stage of development. At this time, smolts are transferred to the NOAA Fisheries Manchester Research Station in Washington State for saltwater rearing through maturation. Fish are reared using standard fish culture practices and approved therapeutics (for a general overview of methods see Leitritz and Lewis 1976; Piper et al. 1982; Rinne et al. 1986; Erdahl 1994; IHOT 1995; McDaniel et al. 1994; Bromage and Roberts 1995; Schreck et al. 1995; Pennell and Barton 1996; NMFS 1999; Wedemeyer 2001) and other protocols and guidelines approved by the CSCPTOC to ensure high quality rearing conditions. Considerable coordination takes place between IDFG and NOAA Fisheries culture experts and at the CSCPTOC level. Because captive broodstock husbandry for wild stocks is a new concept, the program implements practices that maximize fish quality and survival, rather than the number or size of fish produced as in traditional enhancement or commercial farming programs. Fish culture practices at IDFG and NOAA hatcheries conform to requirements detailed in ESA Section 10 Permit 1010.

Rearing and loading density are maintained on the lower end of the scale to provide the best rearing environment possible. Generally, juvenile-to-adult rearing density in the tanks is maintained at less than 8 kg/m^3 (0.5 lbs/ft^3) during most of the culture period; however, fish density may range to 16 kg/m^3 (1.0 lbs/ft^3) at maturity. Loading densities normally range from 0.29 kg/Lpm (2.5 lb/gpm) to 0.84 kg/Lpm (7 lbs/gpm).

Fish sample counts are conducted as needed to ensure that actual growth tracks with projected growth. In general, fish are handled as little as possible. All water use is single pass. Shade covering (70%) and jump screens are used where appropriate. Rearing water temperature is maintained between 7.0°C and 13.5°C at the IDFG and NOAA facilities.

Through smoltification, fish are fed a commercial diet produced by Bio-Oregon, Inc. From smoltification through maturation, fish are fed a commercially prepared dry brood diet produced by Moore-Clark. The daily ration ranges from 0.4 to 2.7% body weight per day depending on estimated fish size and water temperature (Iwama 1996). Pellet size is determined from a chart provided by the manufacturer that is based on current guidelines for commercial aquaculture. Fish are fed by point source automatic feeders (Allan feeders or belt feeders).

The captive chinook salmon are reared in seawater until they begin to show signs of maturation. Fish culturists conduct maturation checks on fish in all groups suspected of having ripening adults. Maturation is currently determined by changes in skin sheen, skin coloration, and body morphology. In the spring of 2002, efforts were made to determine if ultrasound scanning could be used to determine maturation status of fish earlier in the year. Preliminary results are very encouraging. All fish determined to be maturing in seawater are transferred to the IDFG Eagle Fish Hatchery. A large number of maturing adult fish from 1994 through 1999 year classes have already been returned to Idaho for use in recovery efforts.

Observable indices of fish health are checked daily by examining feeding response, external condition, and behavior of fish in each tank as initial indicators of developing problems. In particular, fish culturists look for signs of lethargy, spiral swimming, side swimming, jumping,

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Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

flashing, unusual respiratory activity, body surface abnormalities, and unusual coloration. Presence of any of these behaviors or conditions is immediately reported to the fish health staff. A fish pathologist routinely monitors fish that die to determine cause of death. When a treatable pathogen is either detected or suspected, IDFG and or NOAA Fisheries fish health program leaders prescribe appropriate therapeutic drugs to control the problem. Select mortalities are appropriately preserved for pathology, genetic, and other analyses. Specimens that are not vital to analysis are disposed of in a manner consistent with ESA permits.

Guideline 1. As much as possible, mimic wild rearing conditions (light, cover, substrate, flow, temperature, densities) for fish to be released in the wild

Captive rearing groups are maintained on natural lighting (IDFG Eagle Fish Hatchery) or on low levels of natural lighting supplemented by halogen lights that are automatically controlled to follow the natural photoperiod (NOAA Fisheries Manchester Research Station). Artificial lights used at the NOAA Fisheries facility have a 30-minute ramp up (sunrise) and ramp down (sunset) feature. This ramping process reduces additional stress on the fish by avoiding the startle response associated with lights being instantaneously turned on at full intensity.

Rearing and loading density are maintained on the low end of the scale to provide the best rearing environment possible. Generally, juvenile-to-adult rearing density in the tanks is maintained at less than 8 kg/m^3 (0.5 lbs/ft^3) during most of the culture period. Loading densities range from 0.29 kg/Lpm (2.5 lbs/gpm) to 0.84 kg/Lpm (7 lbs/gpm).

A mild current (<45 cm/sec) generated in the rearing tanks at the NOAA Fisheries facility by a subsurface water jet inlet results in mild, continuous swimming activity. Experience has shown that chinook salmon reared under these conditions have improved feeding response and growth.

Rearing water temperature is maintained between 7.0°C and 13.5°C at the IDFG and NOAA facilities.

Maturing, captive-reared chinook salmon are separated into two groups for holding under two temperature regimes during their freshwater maturation at Eagle. These temperature manipulations are an attempt to synchronize spawn timing of captive-reared and wild stocks and to improve egg survival to the eyed stage of development. Control fish are maintained on ambient well water (control; ≈13.5°C), and test fish are held on chilled water (test; range 8.9°C-12.0°C). Care is taken to ensure that the entire size range of fish present is represented in both groups. It is well established in the literature that elevated water temperature prior to spawning can reduce egg viability and delay spawn timing. Two chilled water regimes have been tested on maturing program fish at Eagle to date. The first test separated fish into two groups maintained at constant temperatures 13.5°C and 8.9°C. Spawn date and mean egg survival to the eyed stage of development was compared between the two groups, but results were inconclusive. Males from the chilled water group did begin running milt approximately 10 d earlier than those in the control group. Based on these results, we altered our use of chilled water to mimic temperatures anadromous returnees would encounter as they progressed upstream from the Columbia River estuary to our study stream. Once at Eagle the maturing fish were placed on straight chilled water. Water temperature was then increased 0.5°C approximately every 10 d to a maximum temperature of 12°C. Water temperature was then reduced following the same procedure until straight chilled water was being supplied to the tank. Fish were maintained at this temperature until released for volitional spawning or spawned at the hatchery. Results from hatchery spawning indicate that under this temperature regime test males began running milt several weeks earlier than control males, and the peak spawn date for test females was almost three weeks earlier than in control females. Egg survival for lots produced by test group females was also almost twice that of control females.

The incorporation of proven seminatural rearing strategies into conventional raceway rearing practices is not directly applicable to this program. Generally, seminatural rearing modifications are employed to improve survival of salmon during the out-migration phase of their life history (Maynard et al. 1995, 1996a, 1996b, 1996c, 1996d, 1998a, 1998b; Maynard and Flagg 2001). As juveniles are not released as part of this project's experimental design, the incorporation of rearing modifications that reflect seminatural conditions is not considered a priority.

Guideline 2. Facilities for freshwater rearing should have pathogen- and predator-free water supplies

<u>IDFG Eagle Fish Hatchery</u>

Specific pathogen-free artesian water from five wells is used, and artesian flow is augmented with four separate pump/motor systems. Flow to all tanks is maintained at no less than 1.5 exchanges per hour. Ambient water temperature remains a constant 13.5°C, and total dissolved gas averages 100% after degassing. Water chilling capability was added at the Eagle facility in 1994 and is used during incubation and rearing of chinook salmon. Through transfer to saltwater at smolt age, fish are reared on chilled water with a temperature range of 9.0°C to 11.0°C. Backup and system redundancy is in place for degassing, pumping, and power generation. Oxygen is available on site for emergency supply to all rearing tanks. Nine water level alarms are in use and linked through an emergency service operator. Additional security is provided by limiting public access and by the presence of three on-site residences occupied by IDFG hatchery personnel.

<u>NOAA Fisheries Manchester Research Station</u>

A 700 m long pipeline supplies approximately 4,165 L/min (1,100 g/min) of pumped saltwater to the land-base saltwater rearing of saltwater. Annual saltwater temperatures at the site normally range from 7.0°C to 13.0°C, and salinity ranges between about 26-29 ppt. Saltwater is processed to ensure quality. Filtering consists of six sand filters containing number 20 grade sand; this filters out all organic and inorganic material more than 20 microns in diameter. Water exiting the sand filters immediately enters a second set of four cartridge filters holding 24 filter elements, which are capable of filtering out all material more than 5 microns in diameter. The water then passes through UV sterilizers to inactivate remaining organic material. Flow and pressure sensors monitor flow through saltwater filtration/sterilization systems. Before entering fish rearing tanks, the processed saltwater is passed through 120 cm long by 20 cm diameter packed column degassers, which are located at each pool, to strip out any excess nitrogen and to boost dissolved oxygen levels. Any interruption in water flow activates an emergency oxygen supply to all rearing containers.

Guideline 3. Fish being transferred to seawater for rearing or release should be handled so as not to compromise their ability to adapt to seawater.

The IDFG transfers fish to the Manchester Research Station as smolts in the spring of their second year of life. The first transfers in any year are sentinels (10 fish from each stock) to determine the readiness of the population for seawater transition. When it is demonstrated these sentinels are surviving well and have begun to feed, the remainder of the fish are transferred. The main smolt groups are transitioned to seawater in 4 m diameter circular tanks in Building 12 at the Manchester facility. The first step in this transitioning process is to add pathogen-free freshwater to each tank. The next step is to introduce the smolts to the tanks and then gradually add full strength Puget Sound seawater until all the freshwater has been displaced (an 8-12 h process). The postsmolts are generally held in these tanks through the summer before being transferred to the 6.1 m diameter circular tanks in Building 13. The transfer of fish to Building 13 begins when tanks became available as earlier year classes mature and are moved off-station.

Guideline 4. Seawater-based rearing facilities should minimize the effects of storms, harmful phytoplankton, predation, poaching, and disease

Seawater rearing is being conducted at the NOAA Fisheries Manchester Research Station located on Puget Sound. A secure land-based seawater captive broodstock rearing complex houses 400 m^2 of floor space for fish rearing tanks in one building and 1,280 m^2 in another. A major advantage of the site is the excellent seawater quality. Annual seawater temperature at the site normally ranges between 7.0°C to 13.0°C, and salinity ranges between 26-29 ppt. A 700 m long pipeline from the end of the pier supplies about 4,165 L/min (1,100 g/min) of pumped seawater to the Station's land-based facilities. The 400 m^2 seawater laboratory contains six 4.1 m, four 3.7 m, and six 1.8 m diameter circular fiberglass tanks. The 1,280 m^2 facility houses 20 6.1 m diameter circular fiberglass tanks. The seawater supplied to these tanks is processed to prevent naturally occurring pathogens from entering the rearing tanks. Incoming seawater is filtered down to a 5.0 micron particulate size and passed through UV sterilizers to inactivate remaining organic material. Sensors monitor water flow and pressure through the seawater filtration/sterilization system. Before entering fish rearing tanks, the processed seawater is passed through packed column degassers to strip out any excess nitrogen and to boost dissolved oxygen levels. An emergency generator is automatically activated in the event of a power failure. In addition, the tanks are directly supplied with oxygen to maintain life support in the event of an interruption in water flow. Tanks where maturing fish are held are supplied with combinations of ambient and chilled water. The Station complies with Washington State Department of Fish and Wildlife quarantine certification standards by depurating all effluent from the captive broodstock rearing areas with ozone.

Guideline 5. Managers should consider equalizing the contribution of all parents to the next generation to maximize effective population size and reduce artificial selection in the captive environment.

The primary implementation strategy of this program is to collect eyed-eggs from naturally-produced redds, rear fish in the hatchery through maturation, and return adults to natal streams to spawn naturally. Between 20 and 40 pairs of captive-reared adults, representing three age-classes, are typically released to target streams in any year. Eyed-eggs are typically collected from approximately six redds in each target stream (approximately 50 eggs per redd). In low years of adult escapement, this collection design may correspond to a sampling rate of greater than 50% of the number of redds present.

When in-hatchery spawning occurs, the contribution of parents is equalized in several ways. First, males and females are crossed in a factorial design such that the contribution of any particular male or female is spread amongst several crosses. This serves to decrease the loss of contribution from an individual if there is catastrophic loss to the egg lot or if the cross is less successful than others. Second, numbers of eggs and the amount of sperm is equalized for each factorial cross (each females eggs are evenly divided and fertilized with sperm from three separate males). Third, each lot of eggs or family line is tracked by family (e.g., redd number).

Table 2. Issue 4. Release of Fish
Guideline 1. Release fish at a life stage and size where their probability of survival to adulthood is greatest.

The primary implementation strategy of this program is to collect eyed-eggs from naturally-produced redds, rear fish in the hatchery through maturation, and return adults to natal streams to spawn naturally. Between 20 and 40 pairs of captive-reared adults, representing three age-classes, are typically released to target streams in any year.

In-hatchery survival for both freshwater and saltwater rearing groups has been excellent. For rearing groups sourced as eyed-eggs, survival from collection through hatch routinely exceeds 96%. Survival from ponding through transfer to saltwater for natural egg groups typically averages 90% or better. Survival from smolt transfer through maturation for the various stocks has averaged 53% and has been higher in recent years (Table 2).

The current efforts to prevent the localized extinction of spring chinook salmon in the Lemhi, East Fork Salmon, and West Fork Yankee Fork Salmon rivers have provided a large measure of success. Between 1998-2002, over 650 maturing, adult chinook salmon have matured in the program; the majority of which have been returned natal streams to spawn naturally (Table 2). In addition, over 90,000 eyed-eggs have been planted in incubation boxes in study streams. By maintaining rearing groups in the hatchery through maturation, the program takes full advantage of the survival benefit afforded by protective culture.

Table 2. Seawater transfer and maturation (return to freshwater) history for the Captive Rearing Program for Salmon River Spring Chinook Salmon. Numbers of fish or eggs transferred are indicated by brood year and stock.

		Age at maturity			
Brood Year and Stock	Smolts (n)	Age-2 (n)	Age-3 (n)	Ages-4,5,6 (n)	% Survival
94 Lemhi NP	75	4	2	42	64.0
94 WFYF NP	87	1	17	28	52.9
94 EFSR NP	75	4	17	28	65.3
95 Lemhi NP	69	2	14	38	78.3
96 Lemhi NP	110	0	12	34	41.8
96 WFYF NP	60	8	0	2	16.7
96 EFSR NP	5	0	0	0	0.0
97 Lemhi NP	102	10	18	10	78.4

97 WFYF NP	165	18	16	33	64.2
98 Lemhi NP	158	12	25	73	70.3
98 WFYF NP	193	25	35	76	73.1
98 EFSR NP	145	11	18	23	57.9
98 EFSR SN	229	31	9	20	26.6
99 Lemhi NE	210	47	41	36	59.5
99 WFYF SN	242	15	69	60	73.1
99 EFSR NE	113	44	26	20	79.6
99 EFSR SN	65	6	10	19	64.6
00 WFYF NE	203	65	12		95.1
00 EFSR NE	379	68	21		75.1
01 EFYF NE	257	103			72.4
01 EFSR NE	285	45			85.3

NP and NE refer to rearing groups sourced as natural parr and eyed-eggs, respectively.
SN refers to safety net rearing groups sourced from in-hatchery spawning.
Lemhi, WFYF, and EFSR refer to the Lemhi, West Fork Yankee Fork Salmon, and the East Fork Salmon rivers.

Guideline 2. Acclimate fish to locations in the watershed where they are intended to return.

The maintenance of local adaptation is presumably a primary objective of captive broodstock programs because nearly all programs reintroduce cultured fish to their natal (or parental) streams. So long as captive broodstocks are derived from local native populations, the apparent genetic component to homing should not be a concern for such programs. The release of captive-reared adults or eggs into target streams is expected to result in natural imprinting processes and homing ability, and therefore represents a best-case scenario for captive propagation programs. Alevins and emerging juveniles should experience odors from their natal streams at the appropriate times.

Guideline 3. Design release strategies to integrate fish from captive propagation programs with wild fish at the same life history stage, if any remain in the natural system.

Eyed-egg and prespawn adult reintroduction options employed by this program successfully integrate hatchery-origin fish with wild fish. Progeny produced from eyed-egg and prespawn adult releases hatch in natural rearing environments and, therefore, integrate with natural fish immediately after hatch.

Guideline 4. When fish are likely to remain in the release area (for example presmolts or residuals), disperse the releases.

The Captive Rearing Program for Salmon River Spring Chinook Salmon was developed as an alternative to traditional captive broodstocking or supplementation programs and, inherently, minimizes this type of intervention impact. No juveniles are produced or reintroduced as part of this program.

The number of adults produced for reintroduction is managed to remain below the estimated carrying capacity of study streams and adequate spawning and rearing habitat is available to accommodate both prespawn adult and eyed-egg releases. Progeny that result from program releases are influenced by the same set of natural processes that act on the natural population. Juvenile out-migrants produced from eyed-egg and prespawn adult reintroduction strategies integrate with wild/natural fish and emigrate from nursery waters volitionally.

Guideline 5. Use release protocols that minimize stress caused by handling, transportation, or new surroundings.

Every effort is made to minimize impacts to fish associated with handling, transportation, and release. Containers used to transport fish vary by task. In all cases, containers of the proper size and configuration are used for the task at hand. Fish are maintained in water of the proper quality (temperature, oxygen, chemical composition) during handling and transfer phases of transportation. Transport trucks equipped with 300 gal (1,136 L) to 2,500 gal (9,463 L) tanks are available to the program. Each transport vehicle is equipped with oxygen and fresh flow systems. Drivers are instructed to make regular stops to check fish status, oxygen and fresh flow systems, and water temperature.

The IDFG transfers fish to the Manchester Research Station as smolts in the spring of their second year of life. The first transfers are sentinels (10 fish from each stock) to determine the readiness of the population for seawater transition. When it is demonstrated these sentinels survive well and begin to feed, the remainder of the fish are transferred. The main smolt groups are transitioned to seawater in 4 m diameter circular tanks in Building 12 of the Manchester facility. The smolts are introduced into tanks filled with pathogen-free freshwater, which is gradually replaced with full strength Puget Sound seawater (an 8-12 h process). Postsmolts are generally held in these tanks through the summer before being transferred to the 6.1 m diameter circular tanks in Building 13.

Guideline 6. Minimize negative interactions with other species in the watershed.

The operation of hatchery facilities (weirs, water removal, and effluent discharge), production levels, disease transmission, competition for resources, predation, and negative genetic impact are examples of ecological interactions that could affect listed species in the project area.

Project hatchery facilities do not withdraw from or discharge water into natural habitat areas occupied by the target species.

Weirs installed to confine captive adults following release for natural spawning are maintained daily and managed so as not to adversely affect listed species.

Production levels from this program are not expected to adversely affect listed species. Eggs produced from redds constructed by captive-reared adults hatch within a natural time frame and produce juvenile chinook salmon that recruit to the fish community with wild conspecifics. Natural escapement levels are such that the additional contribution of spawners from this program is not expected to adversely affect listed species.

The IDFG and NOAA Fisheries programs follow stringent disease prevention protocols and produce healthy, high quality fish. Preliberation fish health monitoring occurs to ensure that healthy fish are released to receiving waters. Fish health criteria are in place for common bacterial and viral pathogens and require fish to not exceed CSCPTOC-accepted pathogen prevalence levels before they can be released.

Competition between hatchery-produced and naturally-produced chinook salmon is expected to be minimal. Some competition between wild and hatchery-produced adults occurs during courting and spawning activities. Eggs produced from redds constructed by captive-reared adults hatch within a natural time frame and produce juvenile chinook salmon that recruit to the fish community with wild conspecifics.

Predation is not expected to occur as juvenile chinook salmon produced by captive adults hatch and recruit to the fish community along with wild conspecifics.

Some genetic change associated with the management of Snake River chinook salmon in the hatchery is most likely unavoidable. However, every opportunity is taken to minimize this change. Eggs collected to source rearing groups for this program are removed from several redds representing the full range of spawn timing. Numbers of eggs removed from redds is equalized at collection. Fish that hatch from eggs are reared by family (e.g., redd) until they are uniquely marked (e.g., PIT tagged). In-hatchery spawning events follow protocols developed by University of Idaho and NOAA Fisheries geneticists and are designed to minimize inbreeding and maximize genetic diversity.

Table 2. Issue 5. Management of Returning Adults

Guideline 1. If the program meets all other guidelines, there is no general restriction on the proportion of hatchery fish of this stock on the spawning grounds of the population targeted for recovery for the first three generations. Individual projects may limit the proportion of hatchery fish spawning naturally depending on the details specific to the project.

The Captive Rearing Program for Salmon River Spring Chinook Salmon was developed as an alternative to traditional captive broodstocking or supplementation programs and, inherently, minimizes this type of intervention impact. No juveniles are produced or reintroduced as part of this program.

The number of adults produced for reintroduction is managed to remain below the estimated carrying capacity of study streams and adequate spawning and rearing habitat is available to accommodate both prespawn adult and eyed-egg releases. Progeny that result from program releases are influenced by the same set of natural processes that act on the natural population.

Guideline 2. Non-ESU hatchery fish from other programs should not exceed natural levels of straying between the populations in question, or constitute more than approximately one percent of total abundance if natural rates of straying are not known.

The extent to which straying occurs in target streams is not well documented. Eyed-eggs collected to source rearing groups come only from redds constructed by wild/natural spring chinook salmon. Accordingly, rearing groups reflect the composition of wild/natural populations to the maximum extent possible. The release of captive-reared adults or eggs into target streams is expected to result in natural imprinting processes and homing ability, and, therefore, represents a best-case scenario for captive propagation programs. Alevins and emerging juveniles should experience odors from their natal streams at the appropriate times.

Table 2. Issue 6. Other Disposition of Fish

Guideline 1. Monitoring and evaluation of fish in captive propagation will include (at a minimum):

- **a. Survival at life history stages up to adulthood.**
- **b. Viability of gametes produced in captivity.**
- **c. Behavior, morphology, and viability and reproductive success of offspring produced in captivity.**

From incubation through maturation, various in-hatchery performance variables are routinely monitored. Coordinated through the CSCPTOC, variables routinely examined include: egg survival from the eyed-stage of development to hatch, sac fry survival to ponding, fish survival to smoltification, survival during transfer from freshwater to seawater, seawater entry survival, fish survival to maturation, fish health profiles, fish rearing densities, fish weights, feed conversion rates, survival of maturing adults during transfer from seawater to freshwater, maturation timing, age at maturation, and survival during transfer from freshwater to release for natural spawning. Variables routinely monitored following in-hatchery spawning events include: general gamete quality, fecundity, egg size, milt motility, egg survival to the eyed-stage of development, and egg survival from eye through hatch. In addition, necropsies are performed on all fish that die during culture.

Fin samples have been collected from program fish since the inception of this program to source material to be genetically analyzed. In cooperation with project 1990-093-00 (University of Idaho—Genetic analysis of *Oncorhynchus nerka*, modified to include chinook salmon), samples are analyzed to identify genetic characteristics of target populations and to develop breeding plans to guide controlled spawning events.

After the completion of spawning activities, eggs are collected from redds spawned by captive-reared females to determine the fertilization rate in these redds and to determine if this measure of gamete quality is influenced by the temperature history of the female while at Eagle. Eggs are collected using hydraulic methods. Opaque eggs or those having fungal growth are considered dead and are preserved in 95% ethanol. Clear eggs are classified as viable and are placed in Stockard's solution, which causes pre-eyed embryos to become visible. Eggs in this category are further categorized as fertilized or blank depending on the presence or absence of an embryo. The number of eggs in each category is enumerated and the percentage in each computed. Finally, the number of eyed-eggs produced by captive-reared females is estimated from the proportion of fertilized eggs observed, estimated fecundity, and the total number of redds produced by program females.

Chinook salmon parr are collected from streams that received prespawn adult chinook salmon to obtain fin clips for genetic analysis to determine if program parents produced them. Parr are collected throughout stream study sections, although particular emphasis is given to areas near known spawning locations. Once captured, the parr are transferred to tubs filled with fresh stream water located on the shore and lightly anesthetized with buffered MS-222. A small portion of the anal fin is removed and preserved in 95% ethanol. Scissors used to remove fin tissue are swabbed with isopropyl alcohol between specimens to reduce the possibility of DNA cross-contamination. The fish are also measured to the nearest 1 mm FL before being placed into a tub of fresh stream water to recover. Parr are then released back into the stream near their point of collection once sampling is completed at that site. Microsatellite markers will be utilized to conduct parentage analysis (parental exclusion analysis; Colbourne et al. 1996; Talbot et al. 1996; Estoup et al. 1998; Bernatchez and Duchesne 2000; Eldridge et al. 2002) to determine the relative reproductive success of captive-reared adults in terms of F_1 progeny.

Guideline 2. Monitoring and evaluation of offspring released to the wild will include:

a. Survival and migration success.
b. Ability to return to hatchery or natural spawning areas.
c. Ability to successfully produce offspring in the wild.

A cornerstone of the project is extensive monitoring and evaluation that occurs following the release of maturing adult spring chinook salmon to the habitat for natural spawning.

Behavioral data collection begins approximately 24 h after fish are released. Observers are assigned two to four stream reaches to scan each day, enabling the entire study section to be monitored over a two-day period. Observers walk slowly upstream watching for chinook salmon; when a fish is detected, the time is recorded, and its habitat associations and activities are observed and documented for 5 min. During this time, the observers also use binoculars and polarized sunglasses to determine if it is a wild or a study fish based on the presence or absence of a disc tag. If it is a study fish, the identification number and/or color combination of the tag is recorded. If the number can be determined (or the fish is wild), its location is recorded on a global positioning system (GPS) receiver. When multiple fish are observed simultaneously, their activity, habitat, and location information are recorded separately for each individual.

When courting or digging activity is observed between chinook salmon during the first 5 min of observation, additional time is spent recording the frequency of these behaviors to estimate how close the pair is to spawning. If, based on these frequencies, the observer determines spawning could occur within 1-2 h, they remain with the pair and record their behaviors until 30 min after spawning. Behavioral observations are recorded in 10 min blocks at this point to facilitate comparisons of courting, aggression, and digging frequencies as spawning approaches. Captive-reared chinook salmon males have been shown to display the entire range of courtship behaviors attributed to chinook salmon. Courtship behaviors in captive-reared males follow the same general patterns as observed in wild males during the 1–2 h leading up to spawning, although captive-reared males tend to court somewhat less frequently than the wild males. Captive-reared females have also been shown to display reproductive behaviors similar to wild conspecifics.

The recent development of electromyogram (EMG) tags that read and transmit electrical signals associated with muscle activity provided the opportunity to record swimming activity and energy use in fish that cannot be observed directly. Studies conducted under NOAA’s Assessment of Captive Broodstock Technologies project are underway to develop quantified relationships between signals emitted from EMG tags and spawning activity. Facilities at the NOAA Fisheries Manchester Research Station have allowed scientists the opportunity to monitor spawning behavior of captive-reared chinook salmon 24 hr/day. Signals from the EMG tags are transmitted to a radio receiver every 3 seconds, and the data are continuously recorded during periods when fish are at rest, engaged in aggressive interactions, digging (females), courting (males), and spawning. Behaviors are also continuously recorded via overhead and underwater video at the same time EMG signals are being received. Preliminary analysis of behavioral and EMG data indicates a clear EMG pattern associated with egg deposition (and subsequent covering of the eggs) by females. NOAA and IDFG scientists intend to utilize EMG tags to monitor reproductive performance of chinook salmon being released for natural spawning in Idaho streams. Doing so will provide much needed additional information on spawn timing, mating combinations, and breeding success of ESA-listed chinook salmon.

Radio telemetry is also used to collect additional information on the movements, distribution, and fate of marked individuals. This technique is used early in the season to estimate how far upstream study fish have traveled and allows us to concentrate observation effort in areas known to contain fish. Telemetry is also used to locate individuals associated with logjams and other dense cover that would otherwise not be visible to shoreline observers. Finally, radio telemetry is used to locate carcasses to assist in determining the cause of mortality and whether or not the fish has spawned.

After the completion of spawning activities, eggs are collected from redds spawned by captive-reared females to determine the fertilization rate in these redds and to determine if this measure of gamete quality is influenced by the temperature history of the female while at Eagle. Eggs are collected using hydraulic methods. Opaque eggs or those having fungal growth are considered dead and are preserved in 95% ethanol. Clear eggs are classified as viable and are placed in Stockard's solution, which causes pre-eyed embryos to become visible. Eggs in this category are further categorized as fertilized or blank depending on the presence or absence of an embryo. Fertilization rates have been essentially 100% in all redds where live eggs have been collected. The number of eggs in each category is enumerated and the percentage in each computed. The percentage of live eggs collected from redds spawned by captive-reared female chinook salmon has ranged from 0%-100% and has averaged between 35% and 55% in recent years. Finally, the number of eyed-eggs produced by captive-reared females is estimated from the proportion of fertilized eggs observed, estimated fecundity, and the total number of redds produced by program females.

Chinook salmon parr are collected from streams that received prespawn adult chinook salmon to obtain fin clips for genetic analysis to determine if program parents produced them. Parr are collected throughout stream study sections, although particular emphasis is given to areas near known spawning locations. Once captured, the parr are transferred to tubs filled with fresh stream water located on the shore and lightly anesthetized with buffered MS-222. A small portion of the anal fin is removed and preserved in 95% ethanol. Scissors used to remove fin tissue are swabbed with isopropyl alcohol between specimens to reduce the possibility of DNA cross-contamination. The fish are also measured to the nearest 1 mm FL before being placed into a tub of fresh stream water to recover. Parr are then released back into the stream near their point of collection once sampling is completed at that site. Microsatellite markers will be utilized to conduct parentage analysis (parental exclusion analysis; Colbourne et al. 1996; Talbot et al. 1996; Estoup et al. 1998; Bernatchez and Duchesne 2000; Eldridge et al. 2002) to determine the relative reproductive success of captive-reared adults in terms of F_1 progeny.

Table 3. Outline of a Captive Propagation Operation Plan

Table 3. Issue 1. Captive Propagation Program Description.

1. **Name of Program.**

   Captive Rearing Program for Salmon River Spring Chinook Salmon.

2. **Stock and species to be propagated.**

   Snake River spring chinook salmon:
   Lemhi River stock,
   East Fork Salmon River stock,
   West Fork Yankee Fork Salmon River stock.

3. **Names of the accountable organization and individuals.**

   Virgil Moore, Bureau of Fisheries Chief
   Idaho Department of Fish and Game
   600 S. Walnut St. P.O. Box 25
   Boise, ID 83703

   Dr. Walton W. Dickhoff, Acting Division Director
   National Marine Fisheries Service
   Northwest Fisheries Science Center
   Resource Enhancement and Utilization Technology Division
   2725 Montlake Blvd East
   Seattle, Washington 98112-2097

   Nancy Murillo, Business Council Chairperson
   Shoshone-Bannock Tribes
   P.O. Box 306
   Fort Hall, ID 83203

   Dr. Madison S. Powell
   Center for Salmonid and Freshwater Species at Risk
   University of Idaho / HFCES
   3059F National Fish Hatchery Road
   Hagerman, ID 83332

4. **Location of program and extent of target area.**

   Salmon River drainage, Idaho. Lemhi River, East Fork Salmon River, West Fork Yankee Fork Salmon River.

5. **Program goals.**

   Fishery managers in the Snake River basin convened in the early 1990s to discuss possible means of maintaining overall stock structure of the Snake River spring/summer chinook salmon population by protecting small populations or stocks at high risk of extinction. It was agreed that a form of captive culture might be appropriate for some stocks. However, it was not known how captive culture could best be used to ensure the continued existence of the stocks and at the same time maintain the genetic and/or biological diversity of these same stocks. Two approaches were identified: a conventional captive broodstock program and a captive rearing program. The two approaches share a similar goal—in general, to maintain Snake River chinook salmon metapopulation structure by preventing local extinctions of high risk populations. Future population rebuilding opportunities can be exercised if this goal is met.

To maintain stock structure (the within and among population variability) for specific population segments at relatively high risk of localized extinction, the IDFG Captive Rearing Project for Salmon River Chinook Salmon was implemented. The primary objectives of the program are to: 1) avoid demographic and environmental risks associated with cohort loss, and 2) to maintain heterozygosity and gene pool identify of the Snake River spring/summer chinook salmon ESU.

The strategy of captive rearing is to prevent cohort collapse of the specified target populations by providing captive-reared adult spawners to the natural environment, which, in turn, maintains the continuum of generation-to-generation smolt production. Each generation of smolts, then, provides the opportunity for population maintenance or increase should environmental conditions prove favorable for that cohort.

The captive rearing approach was developed primarily as a way to maximize the number of spawners in the habitat while minimizing intervention impacts. Under these guidelines, only enough juveniles or eyed-eggs from target populations would be collected to generate a minimum number of spawners to return to the natural habitat to meet the primary program objectives stated above.

Captive rearing has several inherent advantages over a traditional captive broodstock or supplementation strategies. Captive rearing allows more natural selection to occur than in a conventional broodstock program. Natural selection operates in the redd prior to egg collection, and captive-reared individuals compete for mates and spawning opportunities. Additionally, domestication selection is most likely reduced as only wild individuals are brought into the program annually to initiate rearing groups. Additionally, the program is not designed as a spawning program. Limited spawning occurs to assess several reproductive questions, but the primary focus of the program is to rear wild-captured juveniles or eggs to maturation for release back to the habitat for natural spawning. The captive rearing approach should also help ensure that the unique genetic attributes of the target populations will be preserved. A final advantage of the captive rearing technique is that a larger number of populations can be reared in a given amount of facility space, because the large number of juveniles produced in a broodstock program do not need to be maintained.

6. Expected duration of program.

The exact duration of the Captive Rearing Project for Salmon River Chinook Salmon is unclear and may extend to the recovery date for the population.

The captive rearing program for Salmon River chinook salmon began in 1995 with the collection of brood year 1994 smolts. Collections have occurred annually since that time, with the most recent collections being made during September-October 2003. Current broodstocks in culture will mature through 2008 (within the three-generation window established with the collection of brood year 1994 juveniles).

The need to collect additional cohorts for existing project populations will be assessed by program managers and through Subbasin Planning and NOAA-Fisheries Recovery Planning processes. The project will be proposed for extension through the NWPCC Fish and Wildlife Program to accommodate the maturation of additional cohorts, evaluation of adult out-planting efforts, and the association of production to these out-plant groups.

Table 3. Issue 2. Relationship of Program to Other Management Objectives

1. **Relationship to habitat protection and recovery strategies:**
   a. **Major factors inhibiting natural production.**
   b. **Description of habitat protection and recovery efforts.**
   c. **Expected benefits of and time frame for habitat restoration efforts.**

   The Snake River historically produced approximately 50% of the total spring/summer chinook salmon for the entire Columbia River basin (Bjornn 1960; Mallet 1974). As a result of habitat degradation and loss in other states, Idaho and northeast Oregon currently have over 70% of the natural production potential for these fish in the Columbia River basin (StreamNet database).

   Idaho currently has about 3,676 miles of spawning and/or rearing habitat for spring and summer chinook salmon. This represents about 62% of predevelopment condition (Hassemer et al. 1997). Thirty percent of this habitat is within boundaries of designated wilderness or wild and scenic river corridors. Sufficient habitat exists to support far greater smolt production than currently occurs from the low number of adults returning over the last 30 years.

   There is no question that the quality of Idaho spawning and rearing habitat has generally declined from predevelopment conditions. However, the IDFG and other scientists have noted that change in Idaho's spawning and rearing habitat quality has not occurred of a magnitude proportionate to the change in salmon populations during the last 30 years. The most significant change to the ecosystem that occurred within the last 30 years is the construction of additional dams on the lower Snake and Columbia rivers in Washington. The decline of Idaho's wild salmon and steelhead coincides directly with the completion of these dams.

   At the present time, the region is actively involved with the implementation of the Federal Columbia Power System Biological Opinion. This plan includes measures to address mainstem migration as well as spawning and rearing habitat improvements.

2. **Ecological interaction with other species:**
   a. **Consideration of interactions with other wild and hatchery salmonids that will affect or be affected by releases from the proposed program.**
   b. **Description of the interactions among the proposed program and introduced and native non-salmonid species.**

   The operation of hatchery facilities (weirs, water removal, and effluent discharge), hatchery production levels, disease transmission, competition for resources, predation, and negative genetic impacts are examples of ecological interactions that could affect listed species in the project area.

Project hatchery facilities do not withdraw from or discharge water into natural habitat areas occupied by the target species.

Weirs installed to confine captive adults following release for natural spawning are maintained daily and managed so as not to adversely affect listed species.

Production levels from this program are not expected to adversely affect listed species. Eggs produced from redds constructed by captive-reared adults hatch within a natural time frame and produce juvenile chinook salmon that recruit to the fish community with wild conspecifics. Natural escapement levels are such that the additional contribution of spawners from this program is not expected to adversely affect listed species.

The IDFG and NOAA Fisheries programs follow stringent disease prevention protocols and produce healthy, high quality fish. Preliberation fish health monitoring occurs to ensure that healthy fish are released to receiving waters. Fish health criteria are in place for common bacterial and viral pathogens and require fish to not exceed CSCPTOC-accepted pathogen prevalence levels before they can be released.

Competition between hatchery-produced and naturally-produced chinook salmon is expected to be minimal. Some competition between wild- and hatchery-produced adults occurs during courting and spawning activities. Eggs produced from redds constructed by captive-reared adults hatch within a natural time frame and produce juvenile chinook salmon that recruit to the fish community with wild conspecifics.

Predation is not expected to occur as juvenile chinook salmon produced by captive adults hatch and recruit to the fish community along with wild conspecifics.

Some genetic change associated with the management of Snake River chinook salmon in the hatchery is most likely unavoidable. However, every opportunity is taken to minimize this change. Eggs collected to source rearing groups for this program are removed from several redds representing the full range of spawn timing. Numbers of eggs removed from redds is equalized at collection. Fish that hatch from eggs are reared by family (e.g., redd) until they are uniquely marked (e.g., PIT tagged). In-hatchery spawning events follow protocols developed by University of Idaho and NOAA Fisheries geneticists and are designed to minimize inbreeding and maximize genetic diversity.

3. Relationship to fisheries and harvest objectives for other species:

a. Description of fisheries that might incidentally harvest these fish.

Mainstem Columbia River sport, commercial, and tribal harvest is cooperatively managed by federal, state, and tribal management partners. Based on run forecasts, limited harvest opportunities occur in this area. Additionally, Idaho, Washington, and Oregon manage chinook salmon sport fishing seasons. In Idaho, limited chinook salmon sport fisheries occurred in 1990, 1992, 1993, 1997, 1998, and 2000-2003 in specific Salmon River tributaries and 1992, 1997, 1998, and 2000-2003 in the Clearwater River drainage. The IDFG works with the NOAA fisheries Protected Resources Division to manage these activities.

b. Expected harvest impacts.

At the present time, ocean and lower Columbia River and state harvest is not expected to significantly impact the ability of the Captive Rearing Program for Salmon River Spring Chinook Salmon to achieve its goals and objectives.

c. Expected escapements.

Spring/summer chinook salmon escapement is not significantly limited by sport, commercial, or ceremonial harvest. Recent (1992–2000) spring/summer chinook salmon SARs from Lower Granite Dam to Lower Granite Dam averaged (geometric mean) 0.8% and ranged from 0.2% to 3.0%. Historic (1960s) SARs averaged 2.8% and ranged from 2.3% to 4.5% (IDFG file information).

Table 3. Issue 3. Origin and Identify of Broodstock.

1. **Guidelines for using the stock in the program.**
2. **Operating protocols to implement guidelines.**

The Captive Rearing Project for Salmon River Chinook Salmon focuses on three ESA-listed, wild/natural stocks. Stocks were selected based on their relative importance to the ESU, estimated demographic risk, history of hatchery intervention, and risk of exposure to experimental techniques. In addition, stock selection was based on the presence of a minimum level of adult escapement and on the availability of suitable spawning habitat in target streams. These criteria were critical to meeting post-release adult evaluation objectives related to spawning behavior, interactions between hatchery-reared and wild/natural adults, and spawning success.

The three stocks that were selected (Lemhi River, East Fork Salmon River, West Fork Yankee Fork Salmon River) satisfied the above criteria. Eyed-eggs are typically collected from approximately six redds in each target stream (approximately 50 eggs per redd). In low years of adult escapement, this collection design may correspond to a sampling rate of greater than 50% of the number of redds present.

The Captive Rearing Program for Salmon River Spring Chinook Salmon is modeled, to the extent possible, on the population structure, growth, morphology, nutrient cycling, and other biological characteristics of the naturally spawning population. Only local broodstocks are sourced to initiate captive rearing groups. Additionally, the technique of captive rearing allows a higher level of natural selection to occur than in a conventional broodstock program. Natural selection operates in the redd prior to egg collection, and captive-reared individuals, released to the habitat to spawn naturally, compete for mates and spawning opportunities. Additionally, hatchery selection is reduced by bringing only wild individuals into the program, (e.g., no subsequent filial generations are developed and maintained in the hatchery). In theory, this will also help ensure that the unique genetic attributes of the target populations will be preserved.

3. **Data to support protocols:**
   a. **History of broodstock.**
   b. **Annual broodstock size and sex ratio.**

Captive populations for this project are sourced from the progeny of naturally spawning adults. Beginning with the first collection in 1995 and continuing through 1998, summer parr, fall presmolts, and/or smolts were collected from the three source streams. Although rearing groups sourced as juveniles converted to feed and survived well, by

1999 it became apparent there were limitations associated with disease, parasite infestations, unknown family representation, and slow growth related to sourcing the populations at the juvenile stage. We assessed the risks and benefits of sourcing the captive populations by hydraulically removing eyed-eggs from natural redds. This technique has been used successfully in other programs, and we developed equipment and employed it beginning in 1999 to collect eyed-eggs from the three populations. Survival and growth of fish collected as eyed-eggs has been excellent to date.

To facilitate the evaluation of reproductive success or to balance risks associated with low wild/natural adult chinook salmon escapement to target streams, safety net culture populations have been produced periodically. While the majority of eggs produced in this fashion are returned to target streams as part of a hatch box program conducted by the Shoshone-Bannock Tribes, progeny may be retained to compliment rearing groups. The complete collection history for the program is presented in Table 1 of this document.

c. Genetic and ecological differences between this stock and other stocks.
d. Description of special traits or other reasons for choosing this stock.

The following excerpt was taken from NOAA Fisheries (2003) preliminary conclusions regarding the updated status of listed ESUs on West Coast salmon and steelhead:

"The 1991 ESA status review (Mathews and Waples, 1991) of the Snake River spring/summer chinook ESU concluded that the ESU was at risk based on a set of key factors. Aggregate abundance of naturally produced Snake River spring/summer chinook runs had dropped to a small fraction of historical levels. Short-term projections (including jack counts, habitat/flow conditions in the brood years producing the next generation of returns) were for a continued downward trend in abundance. Risk modeling indicated that if the historical trend in abundance continued, the ESU as a whole was at risk of extinction within 100 years. The review identified related concerns at the population level within the ESU. Given the large number of potential production areas in the Snake basin and the low levels of annual abundance, risks to individual subpopulations may be greater than the extinction risk for the ESU as a whole. The 1998 chinook status review (Myers et al. 1998) summarized and updated these concerns. Both short- and long-term abundance trends had continued downward. The report identified continuing disruption due to the impact of mainstem hydroelectric development including altered flow regimes and impacts on estuarine habitats. The 1998 review also identified regional habitat degradation and risks associated with the use of outside hatchery stocks in particular areas—specifically including major sections of the Grande Ronde River basin."

The following excerpts were taken from 1991 status review of Snake River chinook salmon (Matthews and Waples 1991).

"Phenotypic, life history, and genetic data support the conclusion that Snake River chinook salmon are distinct in an ecological/genetic sense. In a cluster analysis of environmental data (stream gradient, precipitation, elevation, vegetation type, etc.), Schreck et al. (1986) demonstrated two distinct groups of Snake River localities, with one group including those from the Imnaha and Grande Ronde Rivers and the other including those from the Salmon River. Both groups were quite distinct from other localities in the Columbia River Basin. Phenotypic data also indicate that the populations are structured geographically. The fact that juvenile migration behavior is the same for spring and summer chinook salmon in the Snake River, but different for these two forms in the upper Columbia River, strongly implies ecological/genetic differences between the regions. The precision required to migrate great distances from different natal streams and tributaries and return with high fidelity and exact timing to start the next generation 1 to 3 years later speaks of biological entities that are highly adapted to their particular environments. The differences detected by protein electrophoresis between Snake River spring/summer chinook salmon and chinook salmon in the lower and mid-Columbia River Basin may be an indication of adaptive genetic differences at parts of the genome not sampled by protein electrophoresis. By comparison, the genetic differences found between different spring and summer chinook salmon populations within the Snake River are rather modest."

"As a group, Snake River spring and summer chinook salmon are characterized by relatively low levels of genetic variation. Winans (1989) found that heterozygosity values in Snake River spring and summer chinook salmon were about half as large as those in lower river stocks of similar run timing. It has been suggested (Utter et al. 1989; Winans 1989) that these relatively low levels of genetic variation may reflect past bottlenecks in population size; however, other explanations cannot be ruled out. A more recent study (Waples et al. 1991) using more gene loci suggests that the difference in level of genetic variability between Snake River and lower Columbia River stocks may not be as great as previously thought."

"Snake River spring and summer chinook salmon also have been shown to be genetically distinct from other chinook salmon populations in North America, with two exceptions. One group is spring chinook salmon from the upper Columbia River. In recent genetic studies, this group is primarily represented by samples from hatcheries using Carson stock fish. This similarity may be due to the origin of the Carson stock, which was initiated to mitigate losses to upper Columbia River populations eradicated by construction of Grand Coulee Dam. Founding broodstock was collected at Bonneville Dam (Mullan 1987) and likely included some and possibly many Snake River fish. Subsequently, Carson stock has been extensively out-planted in the Columbia and Snake River Basins (Howell et al. 1985). According to Mullan (1987), the Wenatchee, Entiat, and Methow rivers are the last remaining drainages in the upper Columbia River Basin with "wild" runs of spring chinook salmon, and over a million smolts of Carson stock hatchery fish are released annually into each of these rivers."

4. Facilities available for isolating and maintaining the captive program.

Thorough facility descriptions are provided below in responses to "Mating" and "Rearing" sections of Table 3. Methods for isolating and maintaining captive rearing groups are reviewed.

5. Personnel accountable for developing the captive propagation program.

<u>NOAA Fisheries</u>

Principal Investigators:	Thomas A. Flagg	360-871-8306
	Dr. Desmond J. Maynard	360-871-8313
	Dr. Barry A. Berejikian	360-871-8301
Field Supervisors:	Dr. Lee Harrell	360-871-8307

	Carlin McAuley Michael Wastel	360-871-8314 360-871-8323
Field Personnel:	James Hackett Dr. William Fairgrieve Bryon Kluver	360-871-8300 360-871-8305

Idaho Department of Fish and Game

Principal Investigator:	Paul Kline	208-465-8404
Hatchery Management:	Dan Baker Jeff Heindel Jeremy Redding	208-939-4114
Field Research:	David Venditti Catherine Willard	208-465-8404
Fish Health Mgmt.	Dr. Keith Johnson	208-939-2413

Shoshone-Bannock Tribes

Principal Investigator:	Doug Taki	208-478-3914
Field Research:	Andy Kohler	208-478-3759

University of Idaho

Principal Investigator:	Dr. Madison Powell	208-837-9096

Table 3. Issue 4. Broodstock Collection

1. **Operating protocols:**
   a. **Number of each sex to be collected and maintained in captive propagation.**
   b. **Kind of fish collected (life stage, special characteristics).**
   c. **Description of sampling design.**
   d. **Method of identifying target population if more than one stock exists.**

   Refer to responses provided above for Table 3., Issue 3.

2. **Data to support protocols:**
   a. **Distribution of target population over time and space.**
   b. **Biological information (fecundity, sex ratios).**

   Refer to responses provided above for Table 3., Issue 3.

Table 3. Issue 5. Mating.

1. **Operating protocols:**
   a. **Number of each sex to be mated.**

The primary implementation strategy of this program is to collect eyed-eggs from naturally-produced redds, rear fish in the hatchery through maturation, and return adults to natal streams to spawn naturally. It is reasonable to assume the release of natural origin adults or eyed-eggs probably minimizes potential divergence of cultured and wild source population(s)—an important consideration for restoration purposes. Releasing captive-reared adults for natural spawning in natal habitats should minimize genetic changes associated with relaxation or changes in the direction or intensity of natural or sexual selection during reproduction (Berejikian et al. in review). Traditional captive broodstock or supplementation programs do not provide such a potential benefit.

The Captive Rearing Program for Salmon River Spring Chinook Salmon is focused on developing culture techniques to raise fish to adulthood with the proper behavioral, morphological, and physiological characteristics to successfully interact with and breed with wild individuals.

When in-hatchery spawning occurs to investigate the reproductive success of captive animals, managers employ a variety of techniques and protocols to minimize selection and to maintain genetic diversity of the spawning population. Foremost, fish within the broodstock program are not selected for growth or other performance measures as they might be in a production hatchery setting. Animals are bred in a factorial design that minimizes the loss of genetic variability and heterozygosity with the captive population, the loss of which is a consequence of domestication selection. Animals are also kept in an environment that minimizes demographic risk from disease, predation, etc., but maintains lower density, natural light levels, water temperatures, and feeding regimes designed to simulate or more closely resemble natural conditions.

b. Method for choosing spawners.

See Table 5 Issue 3c below.

c. Fertilization scheme.

For a review of spawning events that have occurred during the course of the program, see Hassemer et al. 1999, 2001 and Venditti et al. 2002, 2003. Proposed spawning designs are developed cooperatively between IDFG, NOAA Fisheries, and the University of Idaho (Project 1990-093-00) and are reviewed at the Chinook Salmon Captive Propagation Technical Oversight Committee (CSCPTOC) level. Chinook salmon spawning follows accepted, standard practices as described by McDaniel et al. (1994) and Erdahl (1994). Timing of spermiation and ovulation is judged during routine sorting procedures. Females judged “ready” for spawning on any spawn date are separated from the general population. The family origin (redd number) of ovulating females is identified by PIT tag code. Based on the approved spawning design, appropriate, spermiating males are located and isolated in separate holding ponds.

Eggs are fertilized following “dry method” procedures. Milt from one male is poured into the plastic bag containing approximately one-third of the eggs of one female (one subfamily). The milt is gently worked into the eggs for a several seconds, saline solution (85 mg/L NaCl) is added to activate the sperm, and the eggs are agitated to distribute the activated milt. The bag is left undisturbed during the initial stages of the fertilization process. After approximately 5 min, the eggs are water hardened in a 100 ppm buffered Iodophor solution for 30 min and placed in up-flow containers for isolated incubation.

Beginning two days after fertilization, the eggs are treated with a formalin drip into the water supply (1,668 mg/L for 15 min three times per week) for control of *Saprolegnia* spp. The eggs are left undisturbed from the sensitive period at 48 h after fertilization until they have reached the eyed stage. When the eggs have eyed, they are shocked. Dead or unfertilized eggs are removed and counted to determine fertilization rates.

2. Facilities.

NOAA Fisheries Manchester Research Station

The Manchester Research Station is located on Clam Bay, a small bay adjoining the central basin of Puget Sound, WA. The station is located on nine hectares of land surplused from the U.S. Navy to NOAA in the late 1960s. The main building at the Manchester Research Station contains three laboratories, nine offices, and computer and conference rooms. Adjoining the main building is a disease diagnostic laboratory containing a pathology lab, a bioassay lab, and two offices. A land-based seawater captive broodstock rearing complex houses three offices, wet and dry labs, and 400 m^2 of floor space for fish rearing tanks in one building and 1,280 m^2 in another.

Manchester Spring Chinook Broodstock Project fish are reared in circular tanks supplied with filtered and ultraviolet light (UV) treated seawater. The annual seawater temperature at the site normally ranges between 7.0°C and 14.0°C, and salinity ranges between 26 and 29 ppt. A 250 m pier, made available to the station by the Environmental Protection Agency Region X Laboratory, provides access to 50 hp centrifugal pumps that supply about 4,165 LPM (1,100 gpm) of seawater through a 700 m long pipeline to the station's land-based facilities. Backup 50 hp pumps are available in case of primary pump failure. An alarm system monitors the pumps and electrical supply and is tied to an automatic dialer system linked to pagers and home telephones. Redundant emergency generators are automatically serially activated in the event of a power failure.

Fish rearing for the Manchester Spring Chinook Broodstock Project at the Station is conducted in two buildings (12 and 13). A 400 m^2 area in Building 12 contains six 4.1 m diameter circular tan fiberglass tanks and four 3.7 m diameter circular gray fiberglass tanks. A 1,280 m^2 building (Building 13) houses 20 6.1 m diameter circular gray fiberglass tanks. Portions of both buildings are used for the project. The seawater supplied to these tanks is processed to prevent naturally occurring pathogens from entering the rearing tanks. The processing consists of filtering through primary sand filters that eliminate all organic and inorganic material larger than 20 microns in diameter and secondary cartridge filters that screen out all material larger than 5 microns in diameter. The water then passes through a UV system to inactivate remaining organic material. Sensors monitor water flow and pressure through the seawater filtration system.

Before entering fish rearing tanks, the processed seawater is passed through degassing columns to remove excess nitrogen and to boost dissolved oxygen levels. In addition, the tanks are directly supplied with oxygen to maintain life support in the event of an interruption in water flow. Rearing temperatures are maintained at or below 13.0°C with combinations of ambient and chilled water. The station complies with Washington Department Fish and Wildlife (WDFW) quarantine certification standards by depurating all effluent from the captive broodstock rearing areas with ozone.

IDFG Eagle Fish Hatchery

Artesian water from three wells is currently in use. Artesian flow is augmented with four separate pump/motor systems. Water temperature remains a constant 13.5°C, and total dissolved gas averages 100% after degassing. Water chilling capability was added at Eagle Fish Hatchery in 1994. Chiller capacity accommodates incubation, a portion of fry rearing, and a portion of adult holding needs. Backup and system redundancy is in place for degassing, pumping, and power generation. Nine water level alarms are in use, linked through an emergency service contractor. Additional security is provided by limiting public access and by the presence of three on-site residences occupied by IDFG hatchery personnel.

Facility layout at Eagle Fish Hatchery remains flexible to accommodate culture activities ranging from spawning and incubation through adult rearing. Egg incubation capacity at Eagle Fish Hatchery is approximately 300,000 eggs. Incubation is accomplished in small containers specifically designed for the program allowing for separation of individual subfamilies. Incubators are designed to distribute both upwelling and downwelling flow to accommodate pre- and post-hatch life stages.

Several fiberglass tank sizes are used to culture fish from fry to the adult stage, including: 1) 0.7 m diameter semisquare tanks (0.09 m^3); 2) 1.0 m diameter semisquare tanks (0.30 m^3); 3) 2.0 m diameter semisquare tanks (1.42 m^3); 4) 3.0 m diameter circular tanks (6.50 m^3); and 5) 4.0 m diameter semisquare tanks (8.89 m^3). Flows to all tanks are maintained at no less than 1.5 exchanges per hour. Shade covering (70%) and jump screens are used where appropriate. Discharge standpipes are external on all tanks and assembled in two sections ("half pipe principle") to prevent tank dewatering during tank cleaning.

Table 3. Issue 6. Rearing.

1. **Operating protocols:**
   a. **How will the incubation and rearing environment be different from or similar to natural rearing?**

The NOAA and IDFG have modified facilities to provide incubation and rearing environments that promote adherence to conservation hatchery principles. Incubation is carried out in small "isolation" buckets that prevent the potential spread of infectious diseases while maintaining individual family identification. Rearing occurs in circular tanks as opposed to raceways to better manage family segregation and potential fish health risks. Incubation and rearing occurs at multiple facilities to guard against loss associated with catastrophic events at any one location.

   b. **How will family groups be separated and their contributions equalized?**

Following the collection of eyed-eggs, individual family lots (redds) are incubated in isolation incubators. When fish reach approximately 6.0 g mean weight, rearing groups are PIT tagged allowing further consolidation to occur.

At maturation, broodstock adults are identified using PIT tag codes. When in-hatchery spawning occurs, annual spawning events follow approved spawning designs developed at the CSCPTOC level and reviewed by NOAA Fisheries and University of Idaho geneticists. The contribution of parents is equalized several ways. First, males and females are crossed in a factorial design such that the contribution of any particular male or female is spread amongst several crosses. This serves to decrease the loss of contribution from an individual if there is catastrophic loss to the egg lot or if the cross is less successful than others. Second, numbers of eggs and the amount of sperm is equalized for each factorial cross (each females eggs are evenly divided and fertilized with sperm from three separate males). Third, each lot of eggs or family line is tracked by family (e.g., redd number).

2. Data to support protocols.

Following collection, fish are reared exclusively in freshwater at the Eagle Fish Hatchery until they reach the smolt stage of development. At this time, smolts are transferred to the NOAA Fisheries Manchester Research Station in Washington State for saltwater rearing through maturation. Fish are reared using standard fish culture practices and approved therapeutics (for a general overview of methods see Leitritz and Lewis 1976; Piper et al. 1982; Rinne et al. 1986; Erdahl 1994; IHOT 1995; McDaniel et al. 1994; Bromage and Roberts 1995; Schreck et al. 1995; Pennell and Barton 1996; NMFS 1999; Wedemeyer 2001) and other protocols and guidelines approved by the CSCPTOC to ensure high quality rearing conditions. Considerable coordination takes place between IDFG and NOAA Fisheries culture experts and at the CSCPTOC level. Because captive broodstock husbandry for wild stocks is a new concept, the program implements practices that maximize fish quality and survival, rather than the number or size of fish produced as in traditional enhancement or commercial farming programs. Fish culture practices at IDFG and NOAA hatcheries conform to requirements detailed in ESA Section 10 Permit 1010.

Rearing and loading densities are maintained on the lower end of the scale to provide the best rearing environment possible. Generally, juvenile-to-adult rearing density in the tanks is maintained at under 8 kg/m^3 (0.5 lbs/ft^3) during most of the culture period; however, fish density may range to 16 kg/m^3 (1.0 lbs/ft^3) at maturity. Loading densities normally range from 0.29 kg/Lpm (2.5 lb/gpm) to 0.84 kg/Lpm (7 lbs/gpm).

Fish sample counts are conducted as needed to ensure that actual growth tracks with projected growth. In general, fish are handled as little as possible. All water use is single pass. Shade covering (70%) and jump screens are used where appropriate. Rearing water temperature is maintained between 7.0°C and 13.5°C at the IDFG and NOAA facilities.

Through smoltification, fish are fed a commercial diet produced by Bio-Oregon, Inc. From smoltification through maturation, fish are fed a commercially prepared dry brood diet produced by Moore-Clark. The daily ration ranges from 0.4 to 2.7% body weight per day depending on estimated fish size and water temperature (Iwama 1996). Pellet size is determined from a chart provided by the manufacturer that is based on current guidelines for commercial aquaculture. Fish are fed by point source automatic feeders (Allan feeders or belt feeders).

Approved chemical therapeutants are used prophylactically and for the treatment of infectious diseases. Prior to effecting treatments, the use of chemical therapeutants is discussed with NOAA Fisheries and IDFG fish health professionals. Fish necropsies are

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Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

performed on all program mortalities that satisfy minimum size criteria for the various diagnostic or inspection procedures performed. Routine necropsies include investigations for viral pathogens (infectious pancreatic necrosis virus and infectious hematopoietic necrosis virus) and various bacterial pathogens (e.g., bacterial kidney disease *Renibacterium salmoninarium*, bacterial gill disease *Flavobacterium branchiophilum*, coldwater disease *Flavobacterium psychrophilum*, and motile aeromonad septicemia *Aeromonas* spp.). All laboratory diagnostic and inspection procedures follow protocols described by Thoesen (1994).

3. Facilities.

See response for Table 3 Issue 5 Section 2 above for a thorough description of facilities used by the program.

Table 3. Issue 7. Release.

1. Operating protocols:

a. Number, size, and life stage at release.

Between 1998 and 2002, over 650 adult chinook salmon have matured in the program, the majority of which have been returned to natal streams for natural spawning. In addition, over 90,000 eyed-eggs have been planted in incubation boxes in study streams (Table 3).

Between 20 and 40 pairs of captive-reared adults, representing three age-classes, are typically released to target streams in any year. Eyed-eggs are typically collected from approximately six redds in each target stream (approximately 50 eggs per redd) to source rearing groups. In low years of adult escapement, this collection design may correspond to a sampling rate of greater than 50% of the number of redds present.

Annual reintroduction plans and discussed and finalized at the CSCPTOC level. To examine specific reproductive variables, a portion of maturing adults may be retained for in-hatchery spawning.

b. Date, location, and number per location of release.

Refer to tables presented below for Table 3 Issue 7 Section 2.

c. Release technique (direct, acclimation, volitional).

Refer to tables presented below for Table 3 Issue 7 Section 2.

d. Tags and marks.

Several tagging methods are employed in this project, including Passive Integrated Transponder (PIT), elastomer, Peterson disc, Floy, and radio transmitters. Captive reared juvenile chinook are PIT tagged when they reach appropriate size. Those collected as parr or smolts are PIT tagged upon capture. PIT tags are injected into the peritoneal cavity using standard PIT tagging methodologies and protocols (Prentice et al. 1990). PIT tags are used to track individual fish through the captive rearing project along with genetic information to construct spawning matrices. Latex elastomer tags are used as a secondary marking system to indicate rearing location and source stream. Fish are marked with elastomer tags by using a hypodermic needle to inject a thin stripe of pigment into the clear tissue adjacent to the eye. Disc tags having unique color/numeric combinations may be attached to the dorsal surface of released fish, allowing field identification of individual fish. Floy tags may also be inserted near the dorsal fin to serve a function similar to disc tags. Radio tags are used to facilitate tracking of adult chinook salmon released in various drainages for volitional spawning. Techniques developed by Burger et al. (1985) are utilized to implant radio tags in the stomach via the esophagus. Radio tags have a lifespan sufficient to ensure transmitter operation beyond the time of postspawning mortality. Radio tagging permits individual fish to be easily identified and located and may allow us to evaluate the spawning behavior of captive-reared individuals over larger stream sections while interacting with wild conspecifics.

2. Data to support protocols.

Data to support the release history of the program are presented below. The majority of maturing fish presented in Table 3 have been returned to natal streams for natural spawning.

Table 3. Summary of maturing chinook salmon produced in the program. Stock designations are: Lemhi River, West Fork Yankee Fork Salmon River (WFYF), and East Fork Salmon River (EFSR).

Out-plant year and Stock	Age-2 (n)		Age-3 (n)		Ages-4,5,6 (n)	
	males	females	males	females	males	females
97 Lemhi			1			
97 WFYF			4			
97 EFSR			4			
98 Lemhi			19			49
98 WFYF			9			35
99 Lemhi	12		16		1	33
99 EFSR					1	6
00 Lemhi			20		4	48
01 WFYF			43			46
02 WFYF	56		76		23	61
02 EFSR	40		45		16	30
TOTALS	108		237		45	308

Table 4. Summary of captive chinook salmon eyed-egg transfers and hatching rates for in-stream and streamside incubators at Lemhi River (LR), West Fork Yankee Fork Salmon River (WFYF), and East Fork Salmon River (EFSR) sites.

Year planted and	No. of eyed-	Dates transferred	No. of eyed-	Estimated

incubation location	eggs transferred		eggs planted	hatching rate
1998, WFYF	3,451	11/2/98	3,393	92.1%
1998, LR–Hayden Creek site	9,324	11/2/98	9,320	75.0%
1998, EFSR	15,240	11/2, 7/98	15,240	91.04%
1998, EFSR–Big Boulder Creek site	2,039	11/2, 7/98	2,039	62.3%
1999, WFYF	2,297	10/13/99	2,297	86.0%
1999, EFSR	1,038	11/2/99	1,038	No data, hatch box vandalized
2000, WFYF	1,266	11/8/00	1,266	82.7%
2001, LR-Bear Valley Creek site	8,130	10/18, 11/1/01	8,130	78.7%
2002, LR–Hayden Creek site	47,997	10/16, 23, 31/02	47,997	55.2%
TOTALS	90,782		90,720	

3. Facilities and equipment.

Eyed-eggs may be transferred from collection locations to the Eagle Fish Hatchery and from Eagle Fish Hatchery to remote field locations for incubation in streamside or in-stream incubation systems. After collection, eyed-eggs are packed at a conservative density in perforated shipping tubes, capped, and labeled to identify target stream and the number of eyed-eggs collected. Tubes are wrapped with hatchery water-saturated cheesecloth and packed in small, insulated coolers. Ice chips are added to ensure proper temperature maintenance and coolers are sealed with packing tape. Once the eggs arrive at the Eagle Fish Hatchery, they are immediately disinfected in a 100 ppm iodine solution for 30 min. Packaging for eggs transferred to remote field locations for incubation in streamside or in-stream incubation systems is the same as described above. Eggs are monitored hourly during transportation.

Fish are transported to and from collection locations and rearing locations in truck mounted, insulated tanks (typically 1,136 L capacity) with alarm and backup oxygen systems on board. For longer duration trips (e.g., from NOAA Washington facilities to Idaho), truck-mounted tanks are available to the program with 1,136 L (300 gal), 3,785 L (1000 gal), and 9,463 L (2,500 gal) capacities. Transport guidelines are in place to not exceed 89 g/L (0.75 lb/gal). Fish are monitored hourly during transportation.

Project leaders ensure that fish transport is conducted to provide the best possible conditions for safe transfer of fish between destinations. Pathology and fish culture experts provide guidance on all fish transportation events.

Tanks on transport trucks are disinfected and filled with clean well water prior to transportation. All vehicles are equipped to provide the appropriate conditions (temperature, oxygen, capacity) to ensure the safe transport of fish to and from specified locations. Water temperature in transport tanks is maintained at levels necessitating minimal tempering between source and destination temperatures. In addition, all vehicles are equipped with two-way radios or cellular phones to provide routine or emergency communication capability. Prior to releasing transported fish at hatchery or remote release locations, transport and receiving water temperatures are tempered to within 2.0°C of each other.

Table 3. Issue 8. Monitoring and Evaluation.

1. **Biological and propagation parameters monitored:**
   a. **Survival at different life stages.**
   b. **Age at maturity, sex ratios, fecundity, viability of gametes.**

From incubation through maturation, various in-hatchery performance variables are routinely monitored. Coordinated through the CSCPTOC, variables routinely examined include egg survival from the eyed-stage of development to hatch, sac fry survival to ponding, fish survival to smoltification, survival during transfer freshwater to seawater, seawater entry survival, fish survival to maturation, fish health profiles, fish rearing densities, fish weights, feed conversion rates, survival of maturing adults during transfer from seawater to freshwater, maturation timing, age at maturation, and survival during transfer from freshwater to release for natural spawning. Variables routinely monitored following in-hatchery spawning events include general gamete quality, fecundity, egg size, milt motility, egg survival to the eyed-stage of development, and egg survival from eye through hatch. In addition, necropsies are performed on all fish that die during culture (Flagg et al. 1997, 1998; Hassemer et al. 1999, 2001; McAuley et al. 2000; Venditti et al. 2002, 2003.

Fin samples have been collected from program fish since the inception of this program to source material to be genetically analyzed. In cooperation with project 1990-093-00 (University of Idaho—Genetic analysis of *Oncorhynchus nerka*, modified to include chinook salmon), samples are analyzed to identify genetic characteristics of target populations and to develop breeding plans to guide controlled spawning events.

New captive broodstock technology is continuously being developed through combined efforts of the sockeye and chinook salmon captive propagation programs (i.e., ‘implementation’ programs) and project 1993-056-00, “Assessment of Captive Broodstock Technologies.” Technical Oversight Committee Meetings provide the mechanism for the assessment and implementation projects to identify critical areas for technological development. Collaborative research efforts to improve captive broodstock technology occur in five major areas:

1) Improve reintroduction success of adult and juvenile chinook salmon,
2) Improve olfactory imprinting and homing,
3) Improve physiological development and maturation of chinook salmon,
4) Improve in-culture survival through prevention and treatment of disease in chinook salmon, and
5) Evaluate effects of inbreeding and inbreeding depression in captive chinook salmon populations.

These five objectives are being achieved by coordinated studies on nutrition, physiology, microbiology, genetics, behavior, and ecology. Researchers combine experimental studies on surrogate captive populations with direct sampling of ESA-listed captive populations. The reproductive behavior and success of chinook salmon reared in experimental treatments in stream channels and natural streams are being quantified to improve reintroduction success in captive rearing programs. Critical imprinting periods for salmon are being determined to improve imprinting and homing. Studies of the effects of growth on incidence of early male maturity and adult quality in spring chinook salmon are being conducted to induce natural age-at-maturity for both sexes without compromising adult body size. The effects of rearing temperature and growth rate on maturation timing, fecundity, egg size, egg quality, and reproductive behavior in spring chinook salmon are being studied to improve the productivity of adults for artificial and natural spawning. To reduce in-culture mortality related to bacterial kidney disease, drug resistance development, pharmacokinetics, efficacy, and toxicity of azithromycin will be determined in studies on juvenile chinook salmon. Genetic studies are continuing to assess the effect of controlled inbreeding on survival, development, age structure, and other aspects of the life history of chinook salmon. The scientific results of this research program will continue to be conveyed by all the research scientists involved through the primary (peer-reviewed) literature, technical reports, regional Technical Oversight Committee meetings, and workshops/symposia. Advancements in technology are integrated into implementation program operations, and the biological benefits of the advancements are monitored by each of the programs.

NOAA's Assessment project has published numerous studies in the peer-reviewed scientific literature, the findings of which have provided guidance to the implementations. They include studies on reproductive physiology (Shearer et al. 1997ab; Silverstein et al. 1998, 1999; Shearer and Swanson 2000), pathology (Alcorn and Pascho 2000, 2002; Alcorn et al. 2003), reproductive performance and offspring fitness (Berejikian et al. 1997, 1999, 2001ab, 2003), morphology (Hard et al. 2000a) and genetic effects of inbreeding (Hard et al. 2000b)

c. Genetic, morphological, meristic, and behavioral similarity to donor population.

This project was implemented to maintain stock structure (within and among population variability) for specific population segments at relatively high risk of localized extinction. The primary objectives of the program are to: 1) avoid demographic and environmental risks associated with cohort loss, and 2) to maintain heterozygosity and gene pool identify of the Snake River spring/summer chinook salmon ESU.

The strategy of captive rearing is to prevent cohort collapse of the specified target populations by providing captive-reared adult spawners to the natural environment, which, in turn, maintains the continuum of generation-to-generation smolt production. Each generation of smolts, then, provides the opportunity for population maintenance or increase should environmental conditions prove favorable for that cohort.

The captive rearing approach was developed primarily as a way to maximize the number of spawners in the habitat while minimizing intervention impacts. Under these guidelines, only enough juveniles or eyed-eggs from target populations would be collected to generate a minimum number of spawners to return to the natural habitat to meet the primary program objectives stated above.

Captive rearing has several inherent advantages over traditional captive broodstock or supplementation strategies. Captive rearing allows more natural selection to occur than in a conventional broodstock program. Natural selection operates in the redd prior to egg collection, and captive-reared individuals compete for mates and spawning opportunities. Additionally, domestication selection is most likely reduced as only wild individuals are brought into the program annually to initiate rearing groups. The release of natural origin adults or eyed-eggs probably minimizes potential divergence of cultured and wild source population(s)–-an important consideration for restoration purposes. Releasing captive-reared adults for natural spawning in natal habitats should minimize genetic changes associated with relaxation or changes in the direction or intensity of natural or sexual selection during reproduction (Berejikian et al. in review). Traditional captive broodstock or supplementation programs do not provide such a potential benefit.

Some genetic change associated with the management of Snake River chinook salmon in the hatchery is most likely unavoidable. However, every opportunity is taken to minimize this change. Eggs collected to source rearing groups for this program are removed from several redds representing the full range of spawn timing. Numbers of eggs removed from redds is equalized at collection. Fish that hatch from eggs are reared by family (e.g., redd) until they are uniquely marked (e.g., PIT tagged). In-hatchery spawning events follow protocols developed by University of Idaho and NOAA Fisheries geneticists and are designed to minimize inbreeding and maximize genetic diversity.

d. Survival of progeny in wild.
e. Contribution to natural spawning and success of progeny.

The current efforts to prevent the localized extinction of spring chinook salmon in the Lemhi, East Fork Salmon, and West Fork Yankee Fork Salmon rivers have provided a large measure of success. Between 1998-2002, over 650 maturing, adult chinook salmon have matured in the program; the majority of which have been returned to natal streams to spawn naturally. In addition, over 90,000 eyed-eggs have been planted in incubation boxes in study streams.

Eyed-egg and prespawn adult reintroduction options employed by this program successfully integrate hatchery-origin fish with wild fish. Progeny produced from eyed-egg and prespawn adult releases hatch in natural rearing environments and, therefore, integrate with natural fish immediately after hatch.

A cornerstone of the project is extensive monitoring and evaluation that occurs following the release of maturing adult spring chinook salmon to the habitat for natural spawning. Field staff identify the number (and identify when possible) of adults that contributed in spawning events. The number of estimated redds produced by hatchery adults is also estimated (Table 5).

When eggs have reached the eyed stage of development, a portion of the redds spawned by captive-reared females are sampled to determine fertilization success and survival to the eyed stage of egg development. Based on this information, the number of eyed-eggs produced by captive-reared females is estimated from the proportion of fertilized eggs observed, estimated fecundity, and the total number of redds produced by program females.

Following hatch, chinook salmon parr are collected from streams that received prespawn adult chinook salmon to obtain fin clips for genetic analysis to determine if program parents produced them. Parr are collected throughout stream study sections, although particular emphasis is given to areas near known spawning locations. Microsatellite markers will be utilized to conduct parentage analysis (parental exclusion analysis; Colbourne et al. 1996; Talbot et al. 1996; Estoup et al. 1998; Bernatchez and Duchesne

2000; Eldridge et al. 2002) to determine the relative reproductive success of captive-reared adults in terms of F_1 progeny.

The IDFG also works cooperatively with the Shoshone-Bannock Tribes to receive fin tissue samples from smolts collected at a downstream monitoring screw trap on the one project stream.

Finally, all carcasses from wild/natural chinook spawners observed in study areas are tissue sampled to facilitate similar genetic analyses.

Table 5. The number of estimated redds constructed by prespawn adult spring chinook salmon released by the captive rearing program.

Out-plant year	Lemhi system	East Fork Salmon River	West Fork Yankee Fork Salmon River
1998	25		4
1999	31	1	
2000	15		
2001			18
2002			33

Note: For information presented in Table 5., field observations focused primarily on the Lemhi River system in 1998-2000 and on the West Fork Yankee Fork Salmon River in 2000-2003.

f. Incidental harvest in fisheries.

Mainstem Columbia River sport, commercial, and tribal harvest is cooperatively managed by federal, state, and tribal management partners. Based on run forecasts, limited harvest opportunities occur in this area. Additionally, Idaho, Washington, and Oregon manage chinook salmon sport fishing seasons. In Idaho, limited chinook salmon sport fisheries occurred in 1990, 1992, 1993, 1997, 1998, and 2000-2003 in specific Salmon River tributaries and 1992, 1997, 1998, and 2000-2003 in the Clearwater River drainage. The IDFG works with the NOAA Fisheries Protected Resources Division to manage these activities.

Chinook salmon sport fisheries in Idaho target fish produced by Lower Snake River Compensation Plan and Idaho Power Company mitigation programs. Fish produced for mitigation purposes are adipose fin clipped. Adults produced in the Captive Rearing Program for Salmon River Spring Chinook Salmon are out-planted directly into spawning habitats that are closed to all fisheries. Progeny of these adults (either from volitional spawning or egg-boxes) that return as adults have adipose fins intact and are not directly targeted.

2. Evaluation and feedback mechanism.

In addition to individual agency efforts, considerable coordination and feedback occurs under the guidance of the Chinook Salmon Captive Propagation Technical Oversight Committee (CSCPTOC), a team of technical experts representing the agencies involved in the recovery and management of Salmon River spring chinook salmon. The CSCPTOC meets approximately every two months, which allows an adaptive management approach to all phases of the program and provides a forum of peer review and discussion for all activities and culture protocols associated with this program. Participants in the CSCPTOC include Idaho Department of Fish and Game, Bonneville Power Administration, National Marine Fisheries Service, Oregon Department of Fish and Wildlife, Shoshone-Bannock Tribes, University of Idaho, U.S. Fish and Wildlife Service, and Washington Department of Fish and Wildlife.

3. Restoring a naturally-reproducing component of the population:

a. Progress in habitat restoration.

The NOAA Fisheries, the U.S. Fish and Wildlife Service, and various Idaho parties have been working to agree on and implement long-term conservation actions needed to minimize the risk of “take” of ESA-listed salmon, bull trout, and steelhead in the Lemhi River drainage. The parties have settled on interim flows and other actions that demonstrate both commitment and good faith progress toward reaching long-term objectives. The details of this agreement are outlined in the *2002-2003 Conservation Agreement in the Lemhi River Basin*.

Landowners and water users of the upper Salmon River drainage have been working with the State of Idaho, the U.S. Fish and Wildlife Service, NOAA Fisheries, and the Shoshone-Bannock tribes to address land and water needs in the basins of the Salmon River drainage. The intent of this process is to negotiate and participate in a long-term program for the conservation of fish and fish habitat. The details of this agreement are outlined in the *Upper Salmon River Basin Conservation Memorandum of Understanding 2003*.

b. Use of habitat by fish from captive propagation program.

Behavioral and habitat utilization data collection begins approximately 24 h after adults produced by the captive rearing program are released into their natal streams for volitional spawning. Dominant behaviors and habitat associations in captive-reared chinook salmon follow a pattern consistent with increasing maturation and desire to spawn. In the weeks immediately after release, program fish are generally observed holding or milling in pools or in close association with large woody debris. Moving is another frequently observed activity in these fish at this time and demonstrates their propensity to distribute themselves throughout the available habitat. Then as the season progresses, courtship, aggression, and redd construction and maintenance become more prevalent, and more fish are observed in pool tailouts. Then as the spawning period ends, aggression, redd holding, and redd maintenance are the dominant activities, with fish generally associated with tailouts.

See response to Table 3 Issue 8-1 (above) for additional information.

c. Success in natural reproduction.

After the completion of spawning activities, eggs are collected from redds spawned by captive-reared females to determine the fertilization rate in these redds and to determine if this measure of gamete quality is influenced by the temperature history of the female while at Eagle. Eggs are collected using hydraulic methods described above. Opaque eggs or those having fungal growth are considered dead and are preserved in 95%

ethanol. Clear eggs are classified as viable and are placed in Stockard's solution, which causes embryos to become visible. Eggs in this category are further categorized as fertilized or blank depending on the presence or absence of an embryo. Fertilization rates have been essentially 100% in all redds where live eggs have been collected. The number of eggs in each category is enumerated and the percentage in each computed. The percentage of live eggs collected from redds spawned by captive-reared female chinook salmon has ranged from 0%-100% and has averaged between 35% and 55% in recent years. Finally, the number of eyed-eggs produced by captive-reared females is estimated from the proportion of fertilized eggs observed, estimated fecundity, and the total number of redds produced by program females.

Chinook salmon parr are collected from streams that received prespawn adult chinook salmon to obtain fin clips for genetic analysis to determine if program parents produced them. Parr are collected throughout stream study sections, although particular emphasis is given to areas near known spawning locations. Once captured, the parr are transferred to tubs filled with fresh stream water located on the shore and lightly anesthetized with buffered MS-222. A small portion of the anal fin is removed and preserved in 95% ethanol. Scissors used to remove fin tissue are swabbed with isopropyl alcohol between specimens to reduce the possibility of DNA cross-contamination. The fish are also measured to the nearest 1 mm FL before being placed into a tub of fresh stream water to recover. Parr are then released back into the stream near their point of collection once sampling is completed at that site. Microsatellite markers will be utilized to conduct parentage analysis (parental exclusion analysis; Colbourne et al. 1996; Talbot et al. 1996; Estoup et al. 1998; Bernatchez and Duchesne 2000; Eldridge et al. 2002) to determine the relative reproductive success of captive-reared adults (adults released for volitional spawning in 2001) in terms of F_1 progeny (parr collected in 2002).

See response to Table 3 Issue 8-1 (above) for additional information.

Table 4. Summary of Benefits Attributed to Captive Propagation Technology

Table 4. Benefit 1. Increase Total Abundance of the Target Population.
Evaluation Criteria. Spawner:spawner replacement ratio is higher for captive propagation program than for fish remaining in natural habitat.

The strategy of captive rearing is to prevent cohort collapse of specified target populations by providing captive-reared adult spawners to the natural environment, which, in turn, maintains the continuum of generation-to-generation smolt production. Each generation of smolts, then, provides the opportunity for population maintenance or increase should environmental conditions prove favorable for that cohort. The captive rearing approach was developed primarily as a way to maximize the number of breeding units that could be addressed while minimizing intervention impacts. Under these guidelines, only enough juvenile chinook salmon or eyed-eggs would be collected to ensure that the minimum target number of spawners (e.g., 20 pairs of adults) would be produced to meet program goals.

The appropriate number of juveniles or eyed-eggs to collect to meet spawner goals was not known at the outset of the program. In-hatchery survival and maturation at age modeling conducted prior to implementation identified that approximately 250 juveniles or eyed-eggs would need to be collected to meet adult goals. This number has been adequate to meet our adult goal of generating a minimum of 20 pairs of adults to return to target streams annually for natural spawning.

When compared to the number of adults that might have been produced from 250 juveniles or eyed-eggs left in the natural environment, the captive rearing approach clearly offers a several-fold survival advantage. Even at smolt-to-adult return rates (SAR) considered necessary for population replacement (e.g., 2.0% SAR) approximately five adults would be expected to return to spawn from 250 successful smolts. The spawner:spawner replacement level is considerably higher for the captive propagation program than for fish remaining in the wild.

Table 4. Benefit 2. Preserve the Target Population.
Evaluation Criteria. Genetic, morphological, meristic, and behavioral characteristics of fish in captive propagation reflect the natural population.

The Captive Rearing Program for Salmon River Spring Chinook Salmon is focused on developing culture techniques to raise fish to adulthood with the proper behavioral, morphological, and physiological characteristics to successfully interact with and breed with wild individuals. It is reasonable to assume the release of natural origin adults or eyed-eggs probably minimizes potential divergence of cultured and wild source population(s)–-an important consideration for restoration purposes. Releasing captive-reared adults for natural spawning in natal habitats should minimize genetic changes associated with relaxation or changes in the direction or intensity of natural or sexual selection during reproduction. Adult release and egg stocking reduces potential for straying and may minimize domestication selection of the offspring compared to programs that artificially spawn adults and release their offspring as smolts (Berejikian et al. in review). Traditional captive broodstock or supplementation programs do not provide such a potential benefit.

The Captive Rearing Program for Salmon River Spring Chinook Salmon is focused on developing culture techniques to raise fish to adulthood with the proper behavioral, morphological, and physiological characteristics to successfully interact with and breed with wild individuals. Thus, the principal underlying advantage of the program is the production of a “wild” performing individual under culture conditions, which eliminate or decrease demographic and environmental risks associated with migration and ocean residence.

Program managers employ a variety of techniques and protocols to minimize negative hatchery effects. Foremost, fish within the broodstock program are not selected for growth or other performance measures as they might be in a production hatchery setting. When in-hatchery spawning occurs, animals are bred in a factorial design that minimizes the loss of genetic variability and heterozygosity with the captive population, the loss of which might be a consequence of domestication selection. Animals are also kept in an environment that minimizes demographic risk from disease, predation, etc., but maintains lower density, natural light levels, water temperatures, and feeding regimes designed to simulate or more closely resemble natural conditions.

Table 4. Benefit 3. Increase Number of Natural-origin Recruits.
Evaluation Criteria. The product of the spawner:spawner replacement rate in the captive program and the relative success of captive-produced fish spawning in the wild to natural fish exceeds 1.0, and there is sufficient current habitat capacity to allow the population to increase in abundance.

See sponsor response to Table 4 Benefit 1 above.

Table 5. Summary of Hazards Related to Captive Propagation Technology

Table 5. Hazard 1. Negative Effects Associated with Small Population Size.
Risk Evaluation 1. Probability of:
a. Inbreeding depression.

Inbreeding can be simply characterized as the increased occurrence of related individuals mating, which can take place in both the wild and under captive conditions. The consequences of inbreeding include a loss of heterozygosity and an increase in homozygosity relative to expectations under random mating (Tave 1993, Hallerman 2003 and references therein). Within captive propagation programs, this hazard may arise in two principal ways—through overrepresentation of related individuals in the population and through assortative mating.

Overrepresentation of related individuals can arise when a small portion of the wild population is sampled and becomes "amplified" under culture conditions where survival to prespawning adult is significantly higher (higher survival is a goal of the program). These individuals are in turn released to spawn with a small, finite wild population, thus increasing the opportunity for greater representation of particular genes and family groups within that population. Thus, the methods used to sample or "mine" the wild population for young or gametes to use in captive propagation or captive rearing becomes an important concern.

Within the captive rearing program, wild populations have been sampled in two ways (as described elsewhere in this document) through the collection of parr and the collection of fertilized eggs. Parr are no longer collected for captive rearing primarily for concerns over the environmental hazard of vertically transmitted disease (eggs can be disinfected, whereas parr cannot). It may also be true that given the limited number of sampling times and the conditions under which parr were collected, they may represent a substantially higher proportion of related individuals than other collection methods, though this has not been specifically tested genetically as of yet. It can be shown, however, that the current method of wild population sampling (e.g., hydraulic sampling of eyed-eggs) is effective in reducing the occurrence of vertically transmitted disease. Generally speaking, allele frequencies of adults from different year-classes, which are examined within the captive rearing program as part of project number 199009300, have not been shown to differ significantly regardless of apparent sampling regimes (Powell and Faler unpublished data).

Assortative mating also represents a potential contributor to inbreeding hazards in a finite population. This occurs when individuals spawn volitionally based upon appearance (phenotype) and/or behavior. Assortative mating, in this case, lowers the effective population size (Ne) by subdividing the population. Indeed the goal of the captive rearing program is to culture prespawn adults that act and appear just as their wild counterparts. Assortative mating is perhaps the greatest potential contributor to inbreeding hazards within captive rearing. However, as described elsewhere, every effort is taken to minimize differences between wild and cultured counterparts. However, until detailed genetic analyses (kinship and sibship analyses) of spawning success (initiated in 2001) are complete, the extent of assortative mating and the relative success of cultured prespawn adults remain unknown other than through behavioral observations.

b. Loss of within-population genetic variability.

Loss of within-population genetic variation is the primary risk associated with poor decision making in hatchery programs (Miller and Kapuscinski 2003). This phenomenon arises when gametes or individuals are sampled from a finite population resulting in genetic drift. The rate of loss has been shown to be roughly proportional to the inverse of twice the effective population size (Wright 1977). Within the captive rearing program, this would have the greatest potential to occur when redds are sampled for fertilized eggs, and the resulting cultured adults do not represent the entire breadth of genetic diversity observed in the remaining wild population. Thus far, genetic analysis of allele frequencies among and between year-classes of chinook salmon from the study streams do not differ significantly from year to year (Powell and Faler, unpublished data). These data suggest loss of within-population genetic variability has not been a significant risk to the program to date. Moreover, available genetic evidence suggests that matrix spawning protocols used when captive-reared adults are retained for in-hatchery spawning (such as was done for the East Fork Salmon River in 1998) are effective in retaining the highest percentage of genetic diversity when compared to theoretical estimates based upon other commonly employed spawning strategies such as 1:1 pairing (Powell and Faler, unpublished data).

c. Accumulation of deleterious mutations.

The accumulation of deleterious mutations which effect fitness can arise in small population as a consequence of either and/or both hazards listed above. Inbreeding generally results in an increase of homozygous alleles for any particular locus. This includes alleles that are deleterious but would not otherwise be expressed under heterozygous conditions. Likewise, the loss of genetic diversity within a population can similarly result in an increase in the expression of deleterious recessives through the resulting increase in homozygotes. Within the current captive rearing program, every effort is made to minimize the loss of within-population genetic variation and avoid inbreeding in these finite chinook populations by employing previously stated rearing strategies (and spawning strategies when necessary). However, it should also be noted that a loss of genetic diversity within a population is not limited to advantageous genes or alleles. The loss of genetic variation is indiscriminant, effecting “good” and “bad” alleles alike. Thus, small populations that have gone through genetic bottlenecks will often be purged of deleterious alleles (as well as many advantageous ones for fitness). The extent to which each of the chinook populations under study within this program carries a “genetic load” is undetermined.

Moreover, selection against individuals with deleterious alleles during spawning cannot be accomplished in the hatchery, since no genetic markers exist which show potentially disadvantageous alleles. The reduction of genetic load or the elimination of deleterious mutations can only be accomplished through two factors—drift (primarily) and selection (when sufficiently strong enough).

Table 5. Hazard 2. Negative Effects of Propagation in an Artificial Environment.
Risk Evaluation 1. Domestication: Probability of adaptation to the captive propagation environment at the expense of adaptation to the natural environment.

It is reasonable to assume the release of natural origin adults or eyed eggs probably minimizes potential divergence of cultured and wild source population(s)—an important consideration for restoration purposes. Releasing captive-reared adults for natural spawning in natal habitats should minimize genetic changes associated with relaxation or changes in the direction or intensity of natural or sexual selection during reproduction (Berejikian et al. in review). Traditional captive broodstock or supplementation programs do not provide such a potential benefit. Domestication selection defined as “any change in the selection regime of a cultured population relative to that experienced by the natural population” (from Waples 1999) would include artificial, intentional, and unintentional selection that can occur in an artificially propagated population. Juveniles produced from naturally spawning captive-reared adults should experience selection pressures similar to those experienced by wild offspring of wild fish, whereas a much stronger argument can be made for inbreeding depression and domestication selection in programs that spawn captive-reared adults and release their progeny as smolts.

Risk Evaluation 2. Catastrophic loss due to disease outbreaks or facility failure.

The program maintains redundant populations to ensure genetic material is not lost due to disease outbreak or facility failure. Each captive broodstock family is allocated in a manner ensuring equal representation in groups maintained at IDFG and NOAA Fisheries facilities. The family groups at each facility are then subdivided again to ensure each family line is maintained in at least two separate tanks. Backup and system redundancy is in place for degassing, pumping, and power generation.

Fish health is checked daily by observing feeding response, external condition, and behavior of fish in each tank as initial indicators of developing problems. In particular, fish culturists look for signs of lethargy, spiral swimming, side swimming, jumping, flashing, unusual respiratory activity, body surface abnormalities, and unusual coloration. Presence of any of these behaviors or conditions is immediately reported to the program fish pathologist. American Fisheries Society (AFS) “Bluebook” procedures are employed to isolate bacterial or viral pathogens and to identify parasite etiology (Thoesen 1994). Dead fish are routinely analyzed for common bacterial and viral pathogens (e.g., bacterial kidney disease, infectious hematopoietic necrosis virus, etc). Genetic samples are also collected from all captive fish to conduct mitochondrial DNA and/or nuclear DNA analyses. When a treatable pathogen is either detected or suspected, the program fish pathologist prescribes appropriate therapeutic drugs to control the problem. Select carcasses may be appropriately preserved for pathology, genetic, and other analyses. After necropsy, carcasses that are not vital to further analysis are disposed of as per language contained in ESA Section 10 permits for the program.

Table 5. Hazard 3. Loss of Diversity Among Populations.

Risk Evaluation 1. Broodstock can be effectively collected from targeted population without substantial mixing with non-targeted, genetically distinct populations.

The current strategy for collection of individuals for culture involves the hydraulic sampling of redds from known spawning areas of natal streams. This strategy virtually eliminates risks associated with the unwanted collection of stray juveniles or adults from other distinct populations. The extent to which prespawn adults home or alternatively emigrate out of the study stream and the extent to which they potentially contribute to the genetic constitution of other populations is unknown but presumed to be not unlike the rates found in wild counterparts.

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ARTIFICIAL PRODUCTION REVIEW

Introduction

The following information addresses the elements of the *Artificial Production Review* document prepared by the Northwest Power Planning Council (NPPC 1999).

This section of our composite report address the following program and projects:

Program: Captive Rearing Program for Salmon River Spring Chinook Salmon

Projects: 1990-093-00. University of Idaho. Genetic analysis of *Oncorhynchus nerka*, modified to include chinook salmon.

1993-056-00. NOAA Fisheries. Assessment of captive broodstock technologies.

1996-067-00. NOAA Fisheries. Manchester spring chinook broodstock project.

1997-001-00. Idaho Department of Fish and Game. Captive rearing program for Salmon River spring chinook salmon.

Our response is organized to address the following:

- Section II through Section III C-1 of Council document 99-15 (Artificial Production Review),

- Section VIII D, the Guidelines on Hatchery Practices, Ecological Integration and Genetics from Council document 99-4 (Review of Artificial Production of Anadromous and Resident Fish in the Columbia River Basin, A Scientific Basis for Columbia River Production Programs), and

- Section III C-2, the Performance Standards and Indicators for the Use of Artificial Production for Anadromous and Resident Fish Populations in the Pacific Northwest (January 17, 2001).

Section II. Recommended Policies for the Future Role of Artificial Production in the Columbia River Basin

Section II. A. Scientific Principles Provide Basis for Policy Change

Project sponsors associated with the Captive Rearing Program for Salmon River Spring Chinook Salmon support the need to develop a coordinated policy for the operation of hatcheries in the basin. Hatchery reform recommendations or any attempt to develop policy to guide hatchery reform should be based on the best available science as well as an understanding of how this science dovetails with ecological objectives and strategies. As stated in Section II A of Council document 99-15, a logical framework to guide planning efforts associated with the Council's Fish and Wildlife Program was identified as part of the Multispecies Framework Project. The primary purpose of this document was to integrate fish, wildlife, and ecological functions and to help the region develop a collective vision and approach for fish and wildlife recovery in the Columbia River Basin. The eight scientific principles listed in Section II A of Council document 99-15 were developed as part of this process. Project sponsors and the Council's Artificial Production Review Scientific Review Team agree that hatchery reform and the development of future regional hatchery policies should be consistent with the principles identified for the Multispecies Framework Project.

Section II. B. Management Principles and Legal Mandates

Project sponsors and their respective agencies and tribes recognize their obligation to ensure that the Captive Rearing Program for Salmon River Spring Chinook Salmon is consistent with the array of legal mandates described in Section II B of Council document 99-15.

Section II. C. The Five Purposes of Artificial Production

The following information addresses the need to define the purpose for artificial production programs described in Section II C of Council document 99-15. Information is organized by column heading as presented in Table 1.

1) Purpose—Preservation/conservation: The IDFG Captive Rearing Program for Salmon River Spring Chinook Salmon was initiated in 1995 with the collection of brood year 1994 chinook salmon parr from three study streams. Since then, naturally spawned chinook salmon progeny from brood years 1995-2002 have been represented in captivity to continue the project. Hassemer et al. (1999, 2001) and Venditti et al. (2002, 2003) summarize project activities from inception through 2001. The strategy of captive rearing was selected (over captive broodstocking) to maximize the number of spawners while minimizing intervention impacts of the program. The primary objectives of the program are to avoid demographic and environmental risks associated with cohort loss and to maintain heterozygosity and genetic diversity of the Snake River spring/summer chinook salmon ESU.

2) Rationale–-Biological Problem: Extremely low population abundance has the potential for causing extinction or loss of genetic diversity. Spring chinook salmon stocks selected for this program had recent annual escapements of less than 20 fish, adequate habitat for successful spawning and rearing, and demonstrated poor resiliency from the last major documented bottleneck (1979-1984).

3) Rationale–-Motivation: Conserve genetic resources of the population using captive rearing technology and prevent short-term extinction.

4) Implications–-Duration: Temporary (until causes of declines in the natural population are rectified).

5) Implications–-Assumption or Condition: Genetic characteristics can be conserved via artificial propagation. Habitat problems will be corrected in the immediate or distant future.

Section II. D. Policies to Guide the Use of Artificial Production

Section II D of Council document 99-15 identifies 10 policies to help guide the use of artificial production in a scientifically sound manner to achieve management objectives. The scientific principles, legal mandates, and purposes discussed above provide the backdrop for the use of these policies. Our discussion of how the Captive Rearing Program for Salmon River Spring Chinook Salmon is consistent with these policies is presented below in Section III C 1 (*Applying the Policies and Performance Standards to Evaluate and Improve the Operation of Artificial Production Facilities. General recommendation–-immediately implement needed improvements in artificial production programs and facilities*).

Section II. E. Performance Standards

Section II E of Council document 99-15 describes the process for the development of performance standards and indicators designed to be used to help evaluate artificial production programs. Our discussion of how the Captive Rearing Program for Salmon River Spring Chinook Salmon is consistent with these performance standards and indicators is presented below in Section III C 2 (*Applying the Policies and Performance Standards to Evaluate and Improve the Operation of Artificial Production Facilities. How to evaluate for consistency with policies and standards and identification of deficiencies; use of independent audits; independent scientific review*).

The following version of Performance Standards was used for this review:
Performance Standards and Indicators for the Use of Artificial Production for Anadromous and Resident Fish Populations in the Pacific Northwest. January 17, 2001.

Section III. Implementing Reform in Artificial Production Policy and Practices

Section III. A. Six Implementation Recommendations

Implementation recommendations 1–3 are indirectly addressed in responses provided for Sections III A 1, III B, III B 1, III B 2, III A 2, III C, and III C 2, below. Implementation recommendation 3 is not specifically referenced by section heading.

Implementation Recommendations 4-6 are not addressed, as they describe issues and needs that range beyond the responsibility of project sponsors.

Section III. A. 1. (Implementation Recommendation 1). Evaluate the purposes for all artificial production facilities and programs in the basin within three years, applying the principles, policies, and statement of purposes recommended above.

Implementation Recommendation 1, as addressed in Council document 99-15, is reviewed in greater detail in Section III B. As such, our response to this implementation recommendation is incorporated in Section III B text below.

Section III. B. Evaluating the Purposes for All Artificial Production Facilities and Programs in the Basin.

Section III. B. 1. Initial evaluation of purposes of artificial production facilities and programs.

Over the next three years, review and determine the purpose for every artificial production program and facility in the basin, federal and nonfederal, consistent with the principles, purposes and policies described in Part II of this report. These evaluations

should be a prerequisite for seeking continued funding or approvals in whatever funding and approval reviews that the facility or program faces in the next few years.

See the discussion provided above addressing Table 1 of Section II C of Council document 99-15. The purpose of the Captive Rearing Program for Salmon River Spring Chinook Salmon is "conservation/preservation." This purpose has been consistently articulated in the following documents:

1) Project sponsor proposals submitted to the Council and ISRP as part of the provincial review process for the Fish and Wildlife Program,

2) Individual project sponsor annual progress reports submitted to the Bonneville Power Administration,

3) Draft documents completed as part of the ongoing Council's Artificial Production Review and Evaluation process, and in the

4) Draft HGMP being completed for the program (Phase II and III).

Section III. B. 2. Evaluation of purposes of artificial production facilities and programs over time–the need for subbasin plans.

The Council expects that by sometime in 2000, the ultimate conclusion of various analytical, planning and decision making processes in the region (e.g., the Multispecies Framework process, the Council's Fish and Wildlife Program amendment process, the federal agencies' ESA decisions, and Management Plan renegotiations in U.S. v. Oregon) will be the initiation of a comprehensive subbasin planning process, guided in part by basin and province-level goals and objectives, overarching policies for artificial production based on the policies in this report, and criteria for subbasin planning. The purpose or purposes of all artificial production facilities must be reevaluated in that subbasin planning effort, consistent with the policies in this report.

Endangered Species Act: The Snake River spring/summer chinook salmon ESU was listed as threatened under the Endangered Species Act on April 22, 1992 (correction printed on June 3, 1992). The ESU includes all natural populations of spring/summer chinook salmon in the mainstem Snake River and any of the following subbasins: Tucannon River, Grande Ronde River, Imnaha River, and Salmon River. The ESA requires that recovery plans be generated to guide efforts focused on recovering and delisting of species.

Salmon Subbasin Summary: The depressed status of Snake River spring/summer chinook salmon is clearly described in Section 4.1.1.a. of the Northwest Power and Conservation Council's Salmon Subbasin Summary (NPPC 2000a). Section 4.5.1 identifies the Captive Rearing Program for Salmon River Spring Chinook Salmon as one of two artificial production programs in place in the Salmon Subbasin addressing recovery goals through the use of conservation hatchery practices. Program goals and objectives are also consistent with existing plans, policies, and guidelines presented in Section 5.1 of the Subbasin Summary as developed by Bonneville Power Administration (Section 5.1.1.a), the National Marine Fisheries Service (Section 5.1.1.b), the Nez Perce Tribe (Section 5.1.2.a), the Shoshone-Bannock Tribes (Section 5.1.2.b) and the Idaho Department of Fish and Game (Section 5.1.3.a).

Existing federal goals, objectives and strategies identified in the Subbasin Summary (Section 5.2) overlap significantly with the primary objectives of the Captive Rearing Program for Salmon River Spring Chinook Salmon. The “overarching” hatchery goal of the Basinwide Salmon Recovery Strategy (Federal Caucus 2000) is to reduce genetic, ecological, and management effects of artificial production on natural populations. By selecting the captive rearing approach to hatchery intervention, this program is designed to minimize negative hatchery effects on natural populations. Specific Federal Caucus recommendations that overlap with objectives of this program include using safety net programs on an interim basis to avoid extinction while other recovery actions take place; preserving the genetic legacy of the most at-risk populations; limiting the adverse effects of hatchery practices on ESA-listed populations; and using genetically appropriate broodstock to stabilize and/or bolster weak populations (Section 5.2.1).

Bonneville Power Administration (Section 5.2.1.a) presented basinwide objectives for implementing actions under the FCRPS Biological Opinion and suggested that hatcheries can play a critical role in recovery of anadromous fish by “increasing the number of biologically-appropriate naturally spawning adults; improving fish health and fitness; and improving hatchery facilities, operation, and management and reducing potential harm to listed fish.” Specific strategies developed by BPA include reducing the potentially harmful effects of hatcheries, using safety net programs on an interim basis to avoid extinction, and using hatcheries in a variety of ways to aid recovery. Captive Rearing Program for Salmon River Spring Chinook Salmon goals and objectives overlap significantly with the goals, objectives, and strategies developed by BPA. Chinook captive rearing program objectives and tasks specifically address the development of genetically prudent broodstocks and the use of cryopreservation to archive key genetic resources and to keep unique identities available to preserve future options. Program objectives and tasks specifically address the production of adult chinook salmon for reintroduction to the habitat. Hatchery practices reflect the region’s best protocols and undergo constant review and modification through the Chinook Salmon Captive Propagation Technical Oversight Committee (CSCPTOC) process.

The goal of NOAA in the Salmon Subbasin (Section 5.2.1.b.) is to achieve the recovery of Snake River spring/summer and fall chinook, sockeye, and steelhead resources. Ultimately, NOAA’s goal is the achievement of self-sustaining, harvestable levels of salmon populations that no longer require the protection of the Endangered Species Act. Chinook captive rearing program goals and objectives are consistent with this language.

2000 Columbia River Basin Fish and Wildlife Program: The Captive Rearing Program for Salmon River Spring Chinook Salmon conforms to the general vision of the Fish and Wildlife Program (Section III A 1) and its “overarching" objective to protect, mitigate and enhance the fish and wildlife of the Columbia River and its tributaries (Section III C 1; NPPC 2000b). Specifically, the Primary Artificial Production Strategy of the Fish and Wildlife Program (Section 4.) addresses the need to complement habitat improvements by supplementing native fish populations with hatchery-produced fish with similar genetics and behavior to their wild counterpart. In addition, Section 4 includes language stressing the need to minimize the negative impacts of hatcheries in the recovery process. Chinook captive rearing program goals and objectives are aligned with this philosophy. Program methods receive constant review at CSCPTOC level and constantly strive to provide hatchery practices that meet Fish and Wildlife Program standards.

2000 FCRPS Biological Opinion: The Federal Columbia River Power System Biological Opinion (NMFS 2000) includes Artificial Propagation Measures (Section 9.6.4) that address reforms to “reduce or eliminate adverse genetic, ecological, and management effects of artificial production on natural production while retaining and enhancing the potential of hatcheries to contribute to basinwide objectives for conservation and recovery." The Biological Opinion recognizes that artificial production measures have "proven effective in many cases at alleviating near-term extinction risks." Many of the Actions to Reform Existing Hatcheries and Artificial Production Programs (Section 9.6.4.2) are being carried out in the Captive Rearing Program for Salmon River Spring Chinook Salmon. Specifically, the chinook captive rearing program objectives address reform measures dealing with: the management of genetic risk, the production of fish from locally adapted stocks, the use of mating protocols designed to avoid genetic divergence from the biologically appropriate population, matching production with habitat carrying capacity, and marking hatchery-produced fish to distinguish natural from hatchery fish. The Biological Opinion also reviews the need for the development of NOAA-approved Hatchery and Genetic Management Plans (HGMP). At the time of this writing, a draft is in its final stages of development.

Specific Actions in the Biological Opinion that demonstrate logical connections with the chinook captive rearing program are identified in Section 9.6.4.3. Actions 170, 173, 174, 175, 177, 182, and 184 are all addressed by objectives identified in the Captive Rearing Program for Salmon River Spring Chinook Salmon. Actions 170 and 173 call for the design and funding of capital modifications to implement reforms identified in HGMPs. Action 174 identifies the need for "additional sampling efforts and specific experiments to determine relative distribution and timing of hatchery and natural spawners." This need is addressed in research conducted by the Captive Rearing Program for Salmon River Spring Chinook Salmon. Actions 175 and 177 call for the development and funding of safety net populations of at-risk salmon and steelhead. Target populations specifically addressed by the IDFG Captive Rearing Program for Salmon River Spring Chinook Salmon are specifically referenced in the Biological Opinion.

Recommendations made in Action 182 are to fund studies "to determine the reproductive success of hatchery fish relative to wild fish," and concerns over the genetic implications are expressed. The Captive Rearing Program for Salmon River Spring Chinook Salmon is actively involved with research designed to address this question. The captive rearing project includes research directed at determining the reproductive success of prespawn adults released for natural spawning and of captive-reared adults retained in the hatchery. In addition, the IDFG and NOAA Fisheries have initiated maturation physiology research to address questions related to reproductive timing and success. Action 184 states the need to provide funding for a "hatchery research, monitoring, and evaluation program consisting of studies to determine whether hatchery reforms reduce the risk of extinction for Columbia River basin salmonids and whether conservation hatcheries contribute to recovery." The Captive Rearing Program for Salmon River Spring Chinook Salmon is making a clear attempt to provide the needed monitoring and evaluation of conservation hatchery techniques and of behavioral patterns and spawning success in prespawn adults produced by the program.

Offices of the Governors. 2000: Recommendations of the governors of Idaho, Montana, Oregon, and Washington for the protection and restoration of fish in the Columbia River Basin. The Governors of the states of Idaho, Montana, Oregon, and Washington urged regional recovery planners to recognize the multipurpose aspect of hatcheries, which includes fish production for harvest, supplementation to rebuild naturally spawning populations, and captive broodstock experiments for conservation and restoration (Offices of the Governors 2000, Chapter IV, Hatchery Reforms). The governors recommended, "*all hatcheries in the Columbia River Basin be reviewed within three years to determine the facilities' specific purposes and potential future uses in support of fish recovery and harvest*." They further recommended that the supplementation plan recognize the tribal, state, and federal roles in implementation of the plan. Lastly, the governors supported the concept of wild fish refuges and the use of these refuges as controls for evaluating conservation hatchery efforts.

Section III. A. 2. (Implementation Recommendation 2). Applying the policies and standards in Part II, take the necessary steps to evaluate and then improve the operation of artificial production facilities that have an agreed-upon purpose.

Implementation Recommendation 2, as addressed in Council document 99-15, is reviewed in greater detail in Section III C. As such, our response to this implementation recommendation is incorporated in Section III C text below.

Section III. C. Applying the Policies and Performance Standards to Evaluate and Improve the Operation of Artificial Production Facilities.

Section III. C. 1. General recommendation—immediately implement needed improvements in artificial production programs and facilities.

All facilities must be evaluated for consistency with the policies and standards in this report relating to artificial production. Evaluating the facility, developing a work plan to meet the standards, and showing progress toward meeting the standards should be a prerequisite to obtaining continued funding (in whatever funding process the facility sits) or obtaining ESA approval for continued operations. Transition and reprogramming funds need to be available (see Part III D) to make this transition a reality.

The following review of improvement recommendations #1 through #10 is consistent with language provided by the Council's Science Review Team (SRT) and their guidelines presented in Council Document 99-4. Note–a review of SRT guidelines is presented later in this document.

Policy Recommendation 1. The manner of use and the value of artificial production must be considered in the context of the environment in which it will be used.

- **The success of artificial production depends on the quality of the environment in which the fish are released, reared, migrate, and return.**

  The Captive Rearing Program for Salmon River Spring Chinook Salmon focuses on three ESA-listed wild/natural stocks. Stocks were selected based on their relative importance to the ESU, estimated demographic risk, history of hatchery intervention, and risk of exposure to experimental techniques. In addition, stock selection was based on the presence of a minimum level of adult escapement and on the availability of suitable spawning habitat in target streams. These criteria were critical to meeting post-release adult evaluation objectives related to spawning behavior, interactions between hatchery-reared and wild/natural adults, and spawning success. The three stocks that were selected (Lemhi River, East Fork Salmon River, West Fork Yankee Fork Salmon River) satisfied the above criteria.

  Water quality is high in all three streams, and water temperatures are ideal for chinook salmon rearing. Habitat quality ranges from relatively pristine to areas of riparian degradation caused by sedimentation, grazing, mining, logging, road building, and irrigation diversion. The Lemhi River drains productive basaltic parent material, resulting in rapid fish growth. The lower section of this river flows through private land developed extensively for agriculture and grazing and typically reflects C channel conditions

(Rosgen 1985). Adequate spawning and rearing habitat occurs in reaches of the river near Leadore, Idaho and in specific tributary streams where releases of captive-reared adults has occurred (e.g., Big Spring Creek and Bear Valley Creek). The East Fork Salmon River drains a relatively sterile watershed of granitic parent material associated with the Idaho batholith. The lower 30 km of the EFSR runs through ranch and grazing property developed during the last century, but the upper reaches reflect near pristine conditions with little historical disturbance from logging, mining, or agriculture. Stream habitat in the East Fork Salmon River typically reflects B and C conditions (Rosgen 1985). Adequate spawning and rearing habitat occurs in the upper reaches of the river where program adults are released for natural spawning. The West Fork Yankee Fork Salmon River, which drains a sterile watershed similar to the EFSR, remains primarily roadless and has remained nonimpacted by land use practices for nearly half a century. Stream habitat typically reflects B and C conditions (Rosgen 1985). High quality spawning and rearing habitat is distributed throughout the river system.

- **Artificial production provides protection for a limited portion of the lifecycle of fish that exist for the rest of their lives in a larger ecological system, albeit altered, that may include riverine, reservoir, lake, estuarine, and marine systems that are subject to environmental factors and variation that we can only partially understand.**

  Project sponsors understand that captive intervention should be a short-term tool used only to get past bottlenecks that jeopardize the good standing of the population (e.g., demographic, genetic, or environmental risk). The benefits of using captive technology should outweigh the risks of doing so, and work should be underway to correct the problems that brought about the need to intervene.

  Project sponsor activities are focused on providing the best fish culture environment, monitoring program, and evaluation effort to support the maintenance and rebuilding of the Snake River spring/summer chinook salmon ESU. At the same time, it is hoped regional efforts to decrease migratory mortality of juvenile and adult anadromous salmonids are successful. Project sponsors recognize that these efforts are largely out of their immediate sphere of influence.

  Activities implemented by this program are discussed and reviewed by the CSCPTOC, a team of biologists and scientists representing the various agencies and tribes associated with the project. This body also coordinates research on specific issues and makes recommendations for future activities. Specific fish culture protocols (e.g., fish rearing density, rearing container size, water temperature, diet, etc.) have been reviewed by the CSCPTOC. In addition, specific fish transportation protocols (e.g., temperature tempering, transport density, tank configuration, safety contingency plans, etc.) have undergone similar review.

- **The success of artificial production must be evaluated with regard to sustained benefits over the entire lifecycle of the produced species in the face of natural environmental conditions, and not evaluated by the number of juveniles produced.**

  The Captive Rearing Program for Salmon River Spring Chinook Salmon includes a comprehensive set of program elements that address: fish culture, in-hatchery monitoring and evaluation, field monitoring and evaluation, post release adult behavior monitoring and evaluation, and genetic monitoring and evaluation needs. The combined efforts of federal, state, university, and tribe cooperators provide the foundation to address daily management responsibilities, critical program uncertainties, and a comprehensive management and recovery vision for the ESU.

The Captive Rearing Program for Salmon River Spring Chinook Salmon employs hatchery activities that represent the regions most advanced fish culture practices and contribute to maintaining critical species genetic diversity and heterozygosity. In addition, hatchery protocols undergo constant revision to improve the survival and reproductive viability of fish held in culture. Field monitoring and evaluation activities track the behavior of adults released to spawn naturally. The program's field monitoring and evaluation efforts include tasks directed at assessing the reproductive success of adults released to the habitat to spawn naturally. Adaptively managed, reintroduction plans may be modified to include in-hatchery evaluations of adult reproductive success.

The Captive Rearing Program for Salmon River Spring Chinook Salmon conducts field evaluations each year to assess the behavior of and to estimate production by program animals. Metrics of interest to date have included appropriateness and frequency of reproductive behaviors (including courtship, digging, and aggression), number of redds constructed by program females, and survival of eggs spawned by captive-reared females. Captive-reared chinook salmon males have been shown to display the entire range of courtship behaviors attributed to chinook salmon. Courtship behaviors in captive-reared males follow the same general patterns as observed in wild males during the 1–2 h leading up to spawning, although captive-reared males tend to court somewhat less frequently than the wild males (Venditti et al. 2003). Captive-reared females have also been shown to display reproductive behaviors similar to wild conspecifics. During the hours leading up to spawning, these fish perform approximately 2–3 nest digs every 10 min. After spawning, the captive-reared female cover digs almost continuously for about 10 min and continues this elevated level of cover digging for at least 30 min (Venditti et al. 2003). After the cessation of spawning activity, eggs are collected from a portion of redds spawned by captive-reared females to estimate embryo survival to late epiboly. Eggs are removed from the gravel using the hydraulic method of McNeil (1964) and the proportion of live eggs in each redd is computed. These values are then combined with estimated fecundity and the number of redds constructed to estimate the number of viable eggs program fish have contributed to the system. Following up on this estimate, the program has collected DNA samples from program adults prior to release for volitional spawning and from parr collected the following summer in order to document juvenile production. Parental exclusion analysis will be conducted using microsatellite allele frequencies to determine the probability of each parr being the product of one or more captive-reared parents.

- **Domestication selection is the process whereby an artificially propagated population diverges in survival traits from the natural population. This divergence is not avoidable entirely, but it can be limited by careful hatchery protocols such as those required by policies in this report.**

The captive rearing approach has several inherent advantages over a traditional captive broodstock strategy. Captive rearing allows a higher level of natural selection to occur than in a conventional broodstock program. Natural selection operates in the redd prior to egg collection, and captive-reared individuals released to the habitat to spawn naturally compete for mates and spawning opportunities. Additionally, hatchery selection is reduced by bringing only wild individuals into the program, (e.g., no subsequent filial generations are developed and maintained in the hatchery). In theory, this will also help ensure that the unique genetic attributes of the target populations will be preserved. A final advantage of the captive rearing technique is that a larger number of populations can be reared in a given amount of facility space, because the large number of juveniles produced in a broodstock program do not need to be maintained.

Breeding protocols have been established in all of the broodstock programs (regionally) to minimize inbreeding, maximize genetic diversity, and guard against unintentional selection for particular phenotypes. Nevertheless, rearing and release of juveniles from programs that involve artificial spawning can potentially remove (relax) natural and sexual selection forces and introduce the potential for directional artificial selection on certain phenotypic characters. The extent to which removal of natural and sexual selection harms the target population depends largely on the heritability of the phenotypic characters under selection (Futuyma 1997); that is, it depends on the response to selection in the next generation. Heath et al. (2003) found a reduction in egg size (a correlated response to selection for high fecundity) in a population of chinook salmon farmed for three generations. The high heritability for egg mass and strong selection intensity indicated the strong potential for selection on reproductive characters when natural spawning was eliminated. Reproductive traits targeted either directly or indirectly by selection cannot be reliably approximated by any current artificial spawning protocols, including random or factorial mating designs. Although deficiencies in overall reproductive performance have been noted, releasing captive-reared adults for natural spawning in natal or ancestral habitats should minimize genetic changes associated with relaxation or changes in the direction or intensity of natural or sexual selection during reproduction. None of the other reintroduction strategies provide such a potential benefit.

All captive broodstock programs regardless of the release strategy may be subject to domestication selection, to the extent that genetic changes can occur in a single generation. The potential for domestication selection increases as the duration in captivity increases from captive-reared adult through F_1 smolt. Differential mortality schedules of wild and hatchery fish may contribute to domestication selection; therefore, releasing fish earlier in their life may reduce the potential (also proposed by Waples 1999; Reisenbichler et al. 2003). For example, offspring groups from artificially spawned captive broodstock released as parr (several months prior to smoltification) will likely experience egg-to-smolt mortality rates that are intermediate between groups of eggs emerging naturally from remote site incubators or from redds constructed by captive-reared adults. In short, juveniles produced from naturally spawning captive-reared adults should experience selection pressures similar to those experienced by wild offspring of wild fish, whereas a much stronger argument can be made for domestication selection in programs that spawn captive-reared adults and release their progeny as smolts. However, releasing fish prior to smoltification will very likely result in reduced numbers of returning adults.

When in-hatchery spawning occurs to investigate the reproductive success of captive animals, managers employ a variety of techniques and protocols to minimize selection. Foremost, fish within the broodstock program are not selected for growth or other performance measures as they would in a production hatchery setting. Animals are bred in a factorial design that minimizes the loss of genetic variability and heterozygosity with the captive population; the loss of which is a consequence of domestication selection. Animals are also kept in an environment that minimizes demographic extinction risk from disease, predation, etc., but maintains lower density, natural light levels, water temperatures, and feeding regimes designed to simulate or more closely resemble natural conditions.

- **For actions that mitigate for losses in severely altered areas, such as irrevocably blocked areas where salmon once existed, the production of nonnative species may be appropriate in situations where the altered habitat or species assemblages are inconsistent with feasible attainment of management objectives using endemic species.**

  Not applicable.

Policy Recommendation 2. Artificial production must be implemented within an experimental, adaptive management design that includes an aggressive program to evaluate benefits and address scientific uncertainties.

Although not without risk, captive rearing technology is sufficiently advanced to provide the measures necessary to amplify depressed populations and reduce extinction risk (Flagg et al. 1995; Schiewe et al. 1997). Techniques used to collect and rear chinook salmon reflect the region's best science. Program fish culture protocols follow accepted conservation hatchery guidelines developed by Brannon et al. (1999), Flagg and Nash (1999), Hard et al. (1992), Kapuscinski and Jacobson (1987), NMFS (1999), and NPPC (1999). For some Salmon River chinook salmon populations, captive techniques may represent the best method of rebuilding population strength and genetic variability quickly enough to avoid the consequences of genetic bottlenecks, drift, inbreeding, and possible population extinction.

Little scientific information regarding captive culture techniques for Pacific salmonids was available at the inception of this program, but a substantial amount of new literature has been published in the ensuing years. The CSCPTOC was formed to convey this new information between the various state, federal, and tribal entities involved in the captive culture of chinook salmon. The CSCPTOC meets approximately every two months, which allows an adaptive management approach to all phases of the program and provides a forum of peer review and discussion for all activities and culture protocols associated with this program. Flagg and Mahnken (1995) provided an initial literature review of captive rearing and captive broodstock technology, which provided the knowledge base the program was designed upon. Using this work, the IDFG Captive Rearing Program for Salmon River Spring Chinook Salmon was initiated to further the development of this technology by monitoring and evaluating captive-reared fish during rearing and post-release spawning phases. Ryman and Laikre (1991) and Ryman et al. (1995) published works on the effects of supplementation with captive-reared individuals on the genetic effective population size of the target population. Additionally, Fleming and Gross (1992, 1993) investigated the reproductive behavior and success of hatchery and wild coho salmon.

Since the program's inception, studies documenting the spawning behavior of captive-reared chinook salmon (Berejikian et al. 2001b), coho salmon *O. kisutch* (Berejikian et al. 1997), and Atlantic salmon *Salmo salar* (Fleming et al. 1996) have been published. Other studies have also compared the competitive behavior of male captive-reared and wild coho salmon during spawning (Berejikian et al. 2001a) and the competitive differences between newly emerged fry produced by captive-reared and wild coho salmon (Berejikian et al. 1999). Finally, Hendry et al. (2000) report on the reproductive development of sockeye salmon *O. nerka* reared in captivity.

Eyed-eggs to establish captive cohorts are collected from redds spawned by wild chinook salmon in the WFYF and the EFSR using hydraulic sampling methods described by McNeil (1964). This system consists of two main components. The first is a gas-powered pump attached to a 3.8 cm diameter aluminum probe via flexible tubing. Holes drilled near the top of the probe infuse air into the water stream through venturi action. The second component is the collection net frame, which consists of a "D" shaped aluminum frame with expanded plastic mesh along its curved portion and netting around the bottom and sides of its straight portion. When the pump is on, water is forced through the probe, which is worked into the substrate. The air/water stream then lifts eggs out of the substrate, where they are swept downstream into the net. The expanded plastic screen confines eggs lifted out near the periphery and channels them into the net. In order to minimize disturbance to the redd, sampling is generally started slightly downstream of estimated nest pocket locations and progresses upstream. This prevents the fine materials lifted out of the substrate from settling back into the redd and possibly smothering the eggs. Care is also taken to keep personnel behind or to the side of the net frame to minimize redd disturbance.

To facilitate eyed-egg collections, redd locations are marked, construction and completion dates are determined, and stream temperatures are monitored with recording thermographs. When the redd is completed and the female no longer present, rocks are wrapped with orange flagging and placed in the stream bed just upstream of the pit and downstream of the pillow along the central axis of the redd. This arrangement helps locate the redd and identifies the most productive sampling locations even if algal growth has obscured it. Thermographs deployed in the study streams record water temperature at 2 h intervals, and daily average water temperature is computed to track the number of Celsius temperature units (CTUs) received by the developing embryos in each stream. Eyed-eggs are collected when they have received 300-400 CTUs. At this point eye pigmentation makes developing embryos readily identifiable and eggs are capable of withstanding collection.

Eyed-eggs are transferred from collection locations to Eagle where they are incubated, and the resulting fry are reared through smoltification. At the collection site, eyed-eggs are packed at a conservative density in perforated shipping tubes, capped, and labeled to identify them to stream and redd. Tubes are wrapped in paper towels saturated with river water and packed in small, insulated coolers. Ice chips are added to maintain proper temperature and a moist environment during transport. Eggs are taken to Eagle as soon as possible after collection, and are generally on site 4–6 h after being extracted from the gravel. Survival to hatch has been excellent to date, with most brood groups averaging well over 90%. Survival to smoltification has also been excellent to date, with survival in recent brood groups again remaining above 90%.

Fish husbandry practices employed by the program range from traditional to experimental. Fish health issues are handled using only approved therapeutants, and standard fish culture practices are employed whenever possible (for an overview of standard methods see Leitritz and Lewis 1976; Piper et al. 1982; Rinne et al. 1986; Erdahl 1994; IHOT 1995; McDaniel et al. 1994; Bromage and Roberts 1995; Schreck et al. 1995; Pennell and Barton 1996; NMFS 1999; Wedemeyer 2001). However, due to the experimental nature of the work, some aspects of the incubation, rearing, and feeding protocols vary from those used at production hatcheries. When in-hatchery spawning occurs, eggs are hatched in specially designed incubators that allow siblings from individual spawn crosses or redds to be maintained separately, and this separation is maintained until after Passive Integrated Transponder (PIT) tagging (Prentice et al. 1990) to permit future familial identification. Rearing tank size, density, and food ration vary with fish age and are managed to promote optimum growth and for attainment of program objectives.

Inventories are conducted periodically where fish are anesthetized, weighed to the nearest 0.1 g, and measured to the nearest 1 mm fork length (FL) to track growth and to ensure that projected weights track closely with actual weights. Fish are fed a standard commercial diet produced by Bio-Oregon, Inc. or Moore-Clark.

Project 1993-056-00 (NOAA Fisheries Assessment of Captive Broodstock Technologies) in collaboration with the other projects is addressing the effects of rearing temperature and growth on a variety of reproductive fitness characters, such as age of maturity, egg size, fecundity, and gamete quality. Experimental captive broodstock populations have been created, allocated to experimental treatments, and intensively studied. Understanding the mechanism whereby environmental factors that affect growth alter important reproductive characters is aiding in the development of more predictive husbandry protocols for chinook salmon captive broodstocks.

Saltwater rearing is provided for the majority of study animals from smoltification to sexual maturity at the NOAA Fisheries Manchester Research Station. This facility is located on Puget Sound near Seattle, Washington and is supplied with approximately 4,165 L/min (1,100 g/min) of saltwater that averages $29^{o}/_{oo}$ salinity and temperature from 7.0°C to 14.0°C. Raw saltwater is passed through sand and cartridge filters to remove particles >5 μ, sanitized with ultraviolet light, and degassed prior to entering fish rearing tanks. Effluent from the rearing tanks is sanitized with ozone treatment prior to being returned to Puget Sound (Frost et al. 2002). Immature chinook salmon are held in 4.1 or 6.0 m diameter tanks until maturity, which has been high (compared to natural systems) and has been improving. Approximately 40%-50% of captive-reared chinook salmon collected as parr or smolts have survived to maturity and have been released to spawn volitionally or spawned at Eagle for various reasons. Survival in brood groups collected as eyed-eggs should improve as these groups are displaying much lower incidences of bacterial kidney disease and parasite infestation.

The captive broodstock rearing program utilizes disinfectants, antibiotics, vaccinations, and antifungal treatments to control pathogens. Dosage, purpose of use, and method of application for currently used drugs are as follows: 1) Antibiotic therapies: Erythromycin is administered orally, feeding medicated feed obtained from Bio-Oregon, Inc. to produce a dose of 100 mg/kg of body-weight. Fish are fed medicated feed for up to a 28 day period to control bacterial kidney disease. When oral administration is not feasible, an intraperitoneal injection of erythromycin is given to fish at a dose of 20 mg/kg of body weight. Fingerlings are fed Oxytetracycline or oxolinic acid medicated feed at a dose of 75 mg/kg of body weight for 10 days to control outbreaks of pathogenic aeromonads, pseudomonads, and myxobacteria, etc., bacteria as these cases arise. 2) Vaccinations: smolt-sized chinook salmon are vaccinated prior to shipment to saltwater with intraperitoneal injections of Vibrogen (Aqua Health, Ltd., Charlottetown, P.E.I., Canada) to control *Vibrio spp.* and Renogen (Aqua Health Ltd.) to control bacterial kidney disease. 3) Egg disinfection: newly fertilized eggs are water hardened in 100 mg/l solution of Iodophor for 30 min to inactivate viral and bacterial pathogens on the egg surface and in the perivitelline space.

In addition to implementing the aforementioned protocols for treatment and prevention of disease, NOAA's Assessment of Captive Broodstock Technologies project is testing whether an integrated approach for treatment of *R. salmoninarum* infection with a combination of antimicrobial therapy and vaccination can reduce or eliminate subsequent expression of bacterial kidney disease. The study is testing the following specific hypotheses: (i) residual azithromycin remaining in fry from female broodstock injected with azithromycin 14 days prior to spawning will protect against acute challenge with *R. salmoninarum*; (ii) azithromycin treatment of broodstock followed by freshwater vaccination with the combinatorial Renogen/MT239 vaccine will result in protection against acute *R. salmoninarum*; and (iii) azithromycin treatment of broodstock followed by saltwater vaccination with the combinatorial Renogen/MT239 vaccine will result in protection against acute *R. salmoninarum*. The focus of these experiments is on azithromycin efficacy and whether treatment of broodstock with the azithromycin alone or in combination with a dual cellular vaccination (Renogen plus killed *R. salmoninarum* MT239) can protect juvenile chinook salmon from acute *R. salmoninarum* challenge.

Tissue samples are collected from all fish that die while in culture to monitor the presence of common bacterial and viral pathogens. American Fisheries Society (AFS) “Bluebook” procedures are employed to isolate bacterial or viral pathogens and to identify parasite etiology (Thoesen 1994). All examinations are conducted under the direction of the program fish pathologist. Genetic samples are also collected from mortalities in an effort to conduct mitochondrial DNA and/or nuclear DNA evaluations for chinook salmon populations held in the program.

Spawning adults are analyzed for common bacterial and viral pathogens, such as bacterial kidney disease, infectious hematopoietic necrosis virus, and viral hemorrhagic septicemia. Tissue samples are collected from the kidney, spleen, and pyloric caeca of each fish and ovarian fluid samples are collected from each female and analyzed at the IDFG Eagle Fish Health Laboratory. Results of fish health analyses of spawners will be used by IDFG and the CSCPTOC to determine disposition of eggs and subsequent juveniles.

Fish health is checked daily by observing feeding response, external condition, and behavior of fish in each tank as initial indicators of developing problems. In particular, fish culturists look for signs of lethargy, spiral swimming, side swimming, jumping, flashing, unusual respiratory activity, body surface abnormalities, and unusual coloration. Presence of any of these behaviors or conditions is immediately reported to the program fish pathologist. A fish pathologist routinely monitors captive rearing mortalities to try to determine cause of death. When a treatable pathogen is either detected or suspected, the program fish pathologist prescribes appropriate therapeutic drugs to control the problem. Dead fish are routinely analyzed for common bacterial and viral pathogens (e.g., bacterial kidney disease, infectious hematopoietic necrosis virus, etc). Select carcasses may be appropriately preserved for pathology, genetic, and other analyses. After necropsy, carcasses that are not vital to further analysis are disposed of as per language contained in the ESA Section 10 permit for the program.

A cornerstone of the project is extensive monitoring and evaluation that occurs following the release of maturing adult spring chinook salmon to the habitat for natural spawning.

Behavioral and habitat utilization data collection begins approximately 24 h after fish are released. Observers are assigned two to four stream reaches to scan each day, enabling the entire study section to be monitored over a two-day period. Observers walk slowly upstream watching for chinook salmon; when a fish is detected, the time is recorded, and its habitat associations and activities are observed and documented for 5 min. During this time, the observers also use binoculars and polarized sunglasses to determine if it is a wild or a study fish based on the presence or absence of a disc tag. If it is a study fish the identification number and/or color combination of the tag is recorded. If the number can be determined (or the fish is wild), its location is recorded on a global positioning system (GPS) receiver. When multiple fish are observed simultaneously, their activity, habitat, and location information are recorded separately for each individual. Dominant behaviors and habitat associations in captive-reared chinook salmon follow a pattern consistent with increasing maturation and desire to spawn. In the weeks immediately after release, program fish are generally observed holding or milling in pools or in close association with large woody debris. Moving is another frequently observed activity in these fish at this time and demonstrates their propensity to distribute themselves throughout the study section. Then as the season progresses, courtship, aggression, and redd construction and maintenance become more prevalent, and more fish are observed in pool tailouts. Then as the spawning period ends, aggression, redd holding, and redd maintenance are the dominant activities, with fish generally associated with tailouts.

When courting or digging activity is observed between chinook salmon during the first 5 min of observation, additional time is spent recording the frequency of these behaviors to estimate how close the pair is to spawning. If, based on these frequencies, the observer determines spawning could occur within 1-2 h, they remain with the pair and record their behaviors until 30 min after spawning. Behavioral observations are recorded in 10 min blocks at this point to facilitate comparisons of courting, aggression, and digging frequencies as spawning approaches.

The recent development of electromyogram (EMG) tags that read and transmit electrical signals associated with muscle activity provided the opportunity to record swimming activity and energy use in fish that cannot be observed directly. Studies conducted under NOAA's Assessment of Captive Broodstock Technologies project are underway to develop quantified relationships between signals emitted from EMG tags and spawning activity. Facilities at the NOAA Fisheries Manchester Research Station have allowed scientists the opportunity to monitor spawning behavior of captive-reared chinook salmon 24 hr/day. Signals from the EMG tags are transmitted to a radio receiver every 3 seconds, and the data are continuously recorded during periods when fish are at rest, engaged in aggressive interactions, digging (females), courting (males), and spawning. Behaviors are also continuously recorded via overhead and underwater video at the same time EMG signals are being received. Preliminary analysis of behavioral and EMG data indicates a clear EMG pattern associated with egg deposition (and subsequent covering of the eggs) by females. NOAA and IDFG scientists intend to utilize EMG tags to monitor reproductive performance of chinook salmon being released for natural spawning in Idaho streams. Doing so will provide much needed additional information on spawn timing, mating combinations, and breeding success of ESA-listed chinook salmon.

Radio telemetry is also used to collect additional information on the movements, distribution, and fate of marked individuals. This technique is used early in the season to determine how far upstream study fish have traveled and allows investigators to concentrate observation effort in areas known to contain fish. Telemetry is also used to locate individuals associated with logjams and other dense cover that would otherwise not be visible to shoreline observers. Finally, radio telemetry is used to locate carcasses to assist in determining the cause of mortality and whether or not the fish has spawned.

At the end of the study period, eyed-eggs are collected from redds spawned by captive-reared females to determine fertilization rates and survival to the eyed stage of egg development. Eyed-eggs are collected using the methods described above, with the exception that sampling begins near the center of redds to minimize sampling time. Opaque eggs or those having fungal growth are considered dead and are preserved in 95% ethanol. Clear eggs are classified as viable and are placed in Stockard's solution. Eggs in this category are further categorized as fertilized or blank depending on the presence or absence of an embryo. The number of eggs in each category is enumerated and the percentage in each computed.

After the completion of spawning activities, eggs are collected from redds spawned by captive-reared females to determine the fertilization rate in these redds and to determine if this measure of gamete quality is influenced by the temperature history of the female while at Eagle. Eggs are collected using hydraulic methods described above. Opaque eggs or those having fungal growth are considered dead and are preserved in 95% ethanol. Clear eggs are classified as viable and are placed in Stockard's solution, which causes pre-eyed embryos to become visible. Eggs in this category are further categorized as fertilized or blank depending on the presence or absence of an embryo. Fertilization rates have been essentially 100% in all redds where live eggs have been collected. The number of eggs in each category is enumerated and the percentage in each computed. The percentage of live eggs collected from redds spawned by captive-reared female chinook salmon has ranged from 0%-100% and has averaged between 35% and 55% in recent years. Finally, the number of eyed-eggs produced by captive-reared females is estimated from the proportion of fertilized eggs observed, estimated fecundity, and the total number of redds produced by program females.

Chinook salmon parr are collected from streams that received prespawn adult chinook salmon to obtain fin clips for genetic analysis to determine if program parents produced them. Parr are collected throughout stream study sections, although particular emphasis is given to areas near known spawning locations. Once captured, the parr are transferred to tubs filled with fresh stream water located on the shore and lightly anesthetized with buffered MS-222. A small portion of the anal fin is removed and preserved in 95% ethanol. Scissors used to remove fin tissue are swabbed with isopropyl alcohol between specimens to reduce the possibility of DNA cross-contamination. The fish are also measured to the nearest 1 mm FL before being placed into a tub of fresh stream water to recover. Parr are then released back into the stream near their point of collection once sampling is completed at that site. Microsatellite markers will be utilized to conduct parentage analysis (parental exclusion analysis; Colbourne et al. 1996; Talbot et al. 1996; Estoup et al. 1998; Bernatchez and Duchesne 2000; Eldridge et al. 2002) to determine the relative reproductive success of captive-reared adults (adults released for volitional spawning in 2001) in terms of F_1 progeny (parr collected in 2002).

Policy Recommendation 3. Hatcheries must be operated in a manner that recognizes that they exist within ecological systems whose behavior is constrained by larger-scale basin, regional and global factors.

- **Management of artificial production, and the expectations of that management, should be flexible to reflect the dynamics of the natural environment. Production and harvest managers should anticipate large variation in artificial production returns similar to that in natural production.**

  Program managers are aware of the need to incorporate flexibility into annual production plans to accommodate the inherent variability and dynamics of the natural environment. The Captive Rearing Program for Salmon River Spring Chinook Salmon is managed to source annual rearing groups from progeny of natural spawning events that occur in study streams. If low adult escapement is predicted in any year, the program has the ability to generate safety net broodstocks by conducting in-hatchery spawning to prevent the loss of year-specific cohorts. Managed properly, this approach can ensure a continuum of spawners while minimizing risks associated with traditional breeding programs.

- **The management and performance of individual facilities cannot be considered in isolation but must be coordinated at watershed, subbasin, basin, and regional levels, and must be integrated with efforts to improve habitat characteristics and natural production where appropriate.**

Project technical review, prioritization, and funding decisions are carried out at the subbasin, basin, and regional levels through cooperative processes developed by regional fish managers, the Columbia Basin Fish and Wildlife Authority, and the Northwest Power and Conservation Council. The action agencies and tribes are also providing input to ongoing subbasin planning, hatchery and genetic management planning, and artificial production review and evaluation processes.

Individual hatchery facilities operated by the IDFG and NOAA Fisheries that produce eggs and fish for the Captive Rearing Program for Salmon River Spring Chinook Salmon are guided by outcomes of the coordinated processes described above. By no means are the actions of these individual facilities "isolated."

Policy Recommendation 4. A diversity of life history types needs to be maintained in order to sustain a system of populations in the face of environmental variation.

Genetic diversity has been directly correlated with long-term success and persistence of populations (Avise 1994). It is the intention of this program to minimize the loss of genetic variation and heterozygosity by utilizing available genetic diversity within the population and crossing available individuals in a breeding strategy to minimize other genetic risks (such as inbreeding). Once again, the primary focus of this program is to rear wild-sourced eggs and not to generate progeny in the hatchery. As such, the program is expected to have minimal impact on natural populations.

Policy Recommendation 5. Naturally selected populations should provide the model for successful artificially reared populations, in regard to population structure, mating protocol, behavior, growth, morphology, nutrient cycling, and other biological characteristics.

- **With regard to increasing the survival of the hatchery population itself, the working hypothesis is that mimicking the incubation, rearing, and release conditions of naturally spawning populations will increase survival rates after release into the natural environment. Some efforts to mimic natural rearing processes, such as the use of shading, are generally accepted as appropriate practices. Uncertainty lies in how far managers should go in mimicking natural rearing conditions in an effort to improve survival, especially considering the increasing cost, the difficulty of some measures, and the possibility of declining benefits. In addition, there are certain situations in which the survival of artificially produced fish appears to be enhanced by not mimicking natural release size or migration times. Decisions to deviate from the biological characteristics of the naturally spawning population should be documented through an explicitly stated biological rationale and carefully evaluated. In addition, the efficacy of programs that mimic natural populations should continue to be tested to reduce uncertainty.**

- **With regard to the possibility of adverse impacts of artificial production on naturally spawning fish, much of the recent literature suggests that using local broodstocks and mimicking natural rearing conditions will reduce the impacts of artificially produced populations on naturally spawning populations and the ecosystem. There is a counter-hypothesis that, at least in some situations, it is best for artificial production managers to avoid mimicking the release times, places, and conditions of natural populations to avoid harmful competition, predation, and other adverse interactions. Again, any decisions to deviate from**

the biological characteristics of the naturally spawning population should be documented through an explicitly stated biological rationale and carefully evaluated.

The Captive Rearing Program for Salmon River Spring Chinook Salmon is modeled, to the extent possible, on the population structure, growth, morphology, nutrient cycling, and other biological characteristics of the naturally spawning population. Only local broodstocks are sourced to initiate captive rearing groups. Additionally, the technique of captive rearing allows a higher level of natural selection to occur than in a conventional broodstock program. Natural selection operates in the redd prior to egg collection, and captive-reared individuals released to the habitat to spawn naturally compete for mates and spawning opportunities. Additionally, hatchery selection is reduced by bringing only wild individuals into the program, (e.g., no subsequent filial generations are developed and maintained in the hatchery). In theory, this will also help ensure that the unique genetic attributes of the target populations will be preserved.

Maturing adults produced in the program are released to the habitat during a time window when natural adults are present. The number of adults released to study stream to spawn naturally is managed by controlling the number of eggs collected to source rearing groups. Typically, between 20 and 40 pair of adults are released to study streams annually. Eyed-eggs produced from in-hatchery spawning events (periodically conducted to examine various aspects of the reproductive success of captive chinook salmon) may be planted in study streams. Eyed-eggs are planted in study streams during a time window that reflects natural incubation timing.

Extensive efforts have been made to ensure that the natural behavior, growth, and morphological characteristics of fish taken into culture are maintained. The first step in this process is ensuring high in-culture survival. As such, the captive rearing program relies on traditional fish culture techniques with a proven record of increasing in-culture survival. Additionally, when demonstrated to have no adverse effects on in-culture survival, the program readily adopts novel fish culture technology designed to promote the natural attributes of the fish. As an example, a smolt-to-adult seawater rearing phase has been incorporated into the program. Maintaining Pacific salmon in seawater from smoltification until initiation of maturation associated with freshwater reentry is a preferred captive propagation strategy for anadromous salmonids. This provides the fish with the natural environmental condition they are physiologically adapted to.

The incorporation of proven seminatural rearing strategies into conventional raceway rearing practices is not directly applicable to this program. Generally, seminatural rearing modifications are employed to improve survival of salmon during the out-migration phase of their life history (Maynard et al. 1995, 1996a, 1996b, 1996c, 1996d, 1998a, 1998b; Maynard and Flagg 2001). As juveniles are not released as part of this project's experimental design, the incorporation of rearing modifications that reflect seminatural conditions is not considered a priority. However, IDFG and NOAA rearing facilities incorporate shade covering on all rearing containers, rear fish under natural lighting conditions, and minimize handling and disturbance to captive animals.

- **The final working hypothesis, which applies to artificial production for the *restoration* purpose, is that through the use of locally adapted or compatible broodstocks and natural rearing and release conditions, artificial production can benefit or assist naturally spawning populations. This is the least established**

hypothesis of the three, and the one most in need of experimental treatment and evaluation.

Not applicable.

Policy Recommendation 6. The entities authorizing or managing a artificial production facility or program should explicitly identify whether the artificial propagation product is intended for the purpose of augmentation, mitigation, restoration, preservation, research, or some combination of those purposes for each population of fish addressed.

- **A decision identifying an artificial production program, as a "permanent" mitigation program should be accompanied, for example, by an explicit identification of the permanently lost habitat that it replaces.**

  Not applicable.

- **A decision identifying a *restoration* program should include, for example, an explicit determination that suitable restored habitat exists or will soon exist for reseeding. It should also include a statement of the expected duration of the program, by which it is expected the natural population will be rebuilt and the facility withdrawn (or continued with a different identified purpose).**

  Not applicable.

- **Similarly, a decision identifying a *preservation/conservation* program should include, for example, an explicit determination that the underlying habitat decline or other problem-threatening extirpation will be addressed and how. This decision should also include a statement of the expected duration of the program, the time by which the program will be evaluated to determine if it is a success (meaning the time by which it is expected that natural processes can once again sustain the population, and the facility withdrawn or converted to another identified purpose) or a failure (meaning that it is time to end or reorient the program).**

  As noted in Pollard and Flagg (in review), captive propagation on its own will rarely, if ever, constitute a complete recovery program. Managers must address issues concerning factors of decline that caused the population to reach the status where captive propagation is necessary. Captive Rearing Program for Salmon River Spring Chinook Salmon sponsors have addressed a majority of factors likely affecting population abundance of the target species in their rearing habitats. At the time of ESA-listing of Snake River spring/summer chinook salmon (1992), perhaps the greatest habitat constraint in the upper Salmon River was the lack of adult escapement.

  The current efforts to prevent the localized extinction of spring chinook salmon in the Lemhi, East Fork Salmon, and West Fork Yankee Fork Salmon rivers have provided a large measure of success. Between 1998-2002, over 650 adult chinook salmon have matured in the program, the majority of which have been returned to natal streams to spawn naturally. In addition, over 90,000 eyed-eggs have been planted in incubation boxes in study streams.

  As pointed out by Flagg et al. (1995; in review), a dilemma facing enhancement efforts for salmon is that most of the severe barriers to survival are downstream of the spawning and rearing habitat. Both manmade (dams) and natural habitat alterations, harvest, and changes in ocean productivity probably contributed to reduction in abundance of Snake River salmon. These are outside the purview of CSCPTOC actions. Regional fish managers are currently involved in a Technical Recovery Team (TRT) process to determine needed recovery actions and timeframes. Captive Rearing Program for Salmon River Spring Chinook Salmon sponsors are hopeful that the TRT process will help provide necessary actions for population stability in areas outside CSCPTOC authority. Under current conditions, it is probable that captive propagation (particularly for preservation/conservation purposes) will need to remain a key component of management efforts for years to come.

Policy Recommendation 7. Decisions on the use of the artificial production tool need to be made in the context of deciding on fish and wildlife goals, objectives, and strategies at the subbasin and province levels.

The depressed status of Snake River spring/summer chinook salmon is clearly described in Section 4.1.1.a of the Northwest Power and Conservation Council's Salmon Subbasin Summary (NPPC 2000a). Section 4.5.1 identifies the Captive Rearing Program for Salmon River Spring Chinook Salmon as one of two artificial production programs in place in the Salmon Subbasin addressing recovery goals through the use of conservation hatchery practices. Program goals and objectives are also consistent with existing plans, policies, and guidelines presented in Section 5.1 of the Subbasin Summary as developed by Bonneville Power Administration (Section 5.1.1.a), the National Marine Fisheries Service (Section 5.1.1.b), the Nez Perce Tribe (Section 5.1.2.a), the Shoshone-Bannock Tribes (Section 5.1.2.b) and the Idaho Department of Fish and Game (Section 5.1.3.a).

Existing federal goals, objectives and strategies identified in the Subbasin Summary (Section 5.2) overlap significantly with the primary objectives of the Captive Rearing Program for Salmon River Spring Chinook Salmon. The "overarching" hatchery goal of the Basinwide Salmon Recovery Strategy (Federal Caucus 2000) is to reduce genetic, ecological, and management effects of artificial production on natural populations. By selecting the captive rearing approach to hatchery intervention, this program is designed to minimize negative hatchery effects on natural populations. Specific Federal Caucus recommendations that overlap with objectives of this program include using safety net programs on an interim basis to avoid extinction while other recovery actions take place, preserving the genetic legacy of the most at-risk populations, limiting the adverse effects of hatchery practices on ESA-listed populations, and using genetically appropriate broodstock to stabilize and/or bolster weak populations (Section 5.2.1).

Bonneville Power Administration (Section 5.2.1.a) presented basinwide objectives for implementing actions under the FCRPS Biological Opinion and suggested that hatcheries can play a critical role in recovery of anadromous fish by "increasing the number of biologically-appropriate naturally spawning adults; improving fish health and fitness; and improving hatchery facilities, operation, and management and reducing potential harm to listed fish." Specific strategies developed by BPA include reducing the potentially harmful effects of hatcheries, using safety net programs on an interim basis to avoid extinction, and using hatcheries in a variety of ways to aid recovery. Captive Rearing Program for Salmon River Spring Chinook Salmon goals and objectives overlap significantly with the goals, objectives, and strategies developed by BPA. Chinook captive rearing program objectives and tasks specifically address the development of genetically prudent broodstocks and the use of cryopreservation to archive key genetic resources and to keep unique identities available to preserve future options. Program objectives and tasks specifically address the production of adult chinook salmon for reintroduction to the habitat. Hatchery practices reflect the region's best protocols and undergo constant review and modification through the CSCPTOC process.

The goal of NOAA in the Salmon Subbasin (Section 5.2.1.b) is to achieve the recovery of Snake River spring/summer and fall chinook, sockeye, and steelhead resources. Ultimately, NOAA's goal is the achievement of self-sustaining, harvestable levels of salmon populations that no longer require the protection of the Endangered Species Act. Chinook captive rearing program goals and objectives are consistent with this language.

Representatives from the action agencies and tribes associated with the program are currently contributing to the ongoing subbasin assessment and planning process. Snake River spring/summer chinook salmon are considered a "focal" species in the development of the subbasin plan. A draft plan for the Salmon subbasin (Mountain Snake Province) is anticipated by June of 2004.

Policy Recommendation 8. Appropriate risk management needs to be maintained in using the tool of artificial propagation.

Mortality associated with the trapping and handling of juvenile chinook salmon is avoided as only eyed-eggs are now collected to initiate rearing groups. Collecting eyed-eggs from the field is designed to have minimum impact on listed fish. Redds are approached from downstream, and care is taken to avoid trampling redds. Information from field observations and thermographs is used to ensure eggs are collected during their most tolerant stage. Eggs are immediately transferred to small coolers saturated with chilled river water for transfer to the hatchery. The hydraulic sampling system used to collect eggs appears to have little effect on the developing embryos. Generally, less than 2% of the collected eggs do not hatch. Eyed-eggs are transferred from collection locations to the Eagle Fish Hatchery and from Eagle Fish Hatchery to remote field locations for incubation in streamside or in-stream incubation systems. After collection, eyed-eggs are packed at a conservative density in perforated shipping tubes, capped, and labeled to identify target stream and the number of eyed-eggs collected. Tubes are wrapped with hatchery water-saturated cheesecloth and packed in small, insulated coolers. Ice chips are added to ensure proper temperature maintenance and coolers are sealed with packing tape. Once the eggs arrive at the Eagle Fish Hatchery, they are immediately disinfected in a 100 ppm iodine solution for 30 min. Collection of eyed-eggs also reduces the possibility of disease occurrence in culture. Fish collected as eggs have lower incidence of bacterial kidney disease than those collected as parr or fry. In addition, the egg stage is not susceptible to *Myxobolus cerebralis*, the organism that causes whirling disease (Markiw 1991). Juvenile collection at this stage results in healthier fish, minimizes the risk of contaminating culture facilities, and increases survival of captive individuals. Packaging for eggs transferred to remote field locations for incubation in streamside or in-stream incubation systems is the same as described above. Eggs are monitored hourly during transportation.

Fish husbandry protocols follow standard fish culture practices (for a general overview of methods, see Leitritz and Lewis 1976; Piper et al. 1982; Rinne et al. 1986; Erdahl 1994; IHOT 1995; McDaniel et al. 1994; Bromage and Roberts 1995; Schreck et al. 1995; Pennell and Barton 1996; NMFS 1999; Wedemeyer 2001) and other protocols and guidelines approved by the CSCPTOC to ensure high quality rearing conditions.

Genetic hazards with artificial production outlined in Hard et al. (1992) are taken into consideration. Breeding matrices developed by IDFG and the University of Idaho are reviewed by NOAA Fisheries personnel and CSCPTOC members before implementation.

Diseased, moribund, or nonproductive fish and gametes are removed from the captive population and disposed of following AFS Fish Health Blue Book and Pacific Northwest Fish Health Protection Committee guidelines to ensure the overall health of rearing groups (Thoesen 1994). This culling is necessary to prevent the spread of contagious diseases to the general population.

Gametes, embryos, or fish may be sampled as necessary to detect diseases and to monitor fertilization and the development of embryos. This lethal sampling is necessary to improve the reproductive success of fish in the captive broodstock program.

Rearing facilities are staffed fulltime and have backup and redundancy systems in place to ensure an uninterrupted supply of pathogen free water. Alarm systems and generator systems are also in place.

Fish transport equipment is maintained in top working condition. All transport vehicles have onboard oxygen and fresh flow water agitation systems. Fish are inspected at regular intervals during transportation.

Policy Recommendation 9. Production for harvest is a legitimate management objective of artificial production, but to minimize adverse impacts on natural populations associated with harvest management of artificially produced populations, harvest rates and practices must be dictated by the requirements to sustain naturally spawning populations.

There is currently no directed harvest of wild/natural spring/summer chinook salmon in Idaho. While harvest remains a long-term goal of managers, no changes in current policies are expected in the near term.

Policy Recommendation 10. Federal and other legal mandates and obligations for fish protection, mitigation, and enhancement must be fully addressed.

Title 36 of Idaho State Code declares fish and wildlife to be the property of the State of Idaho and mandates the Idaho Department of Fish and Game Commission (Commission) to "preserve, protect, and perpetuate such wildlife and provide for the citizens of the state and as by law permitted to others continued supplies of such wildlife for hunting, fishing, and trapping." Under the Commission's guidance, the Idaho Department of Fish and Game (Department) manages the fish and wildlife of the state. The Department's 2001-2006 Fisheries Management Plan includes policy statements that focus anadromous fisheries management on protecting and restoring fish habitat and water quality, prioritizing the management of wild native populations of anadromous fish species, emphasizing the maintenance of self-sustaining populations, and utilizing hatchery-produced fish effectively. In addition, the Department is committed to maintaining programs such as the Captive Rearing Program for Salmon River Spring Chinook Salmon to safeguard and perpetuate the Snake River ESU.

The Policy of the Shoshone-Bannock Tribes for management of Snake River basin resources is to pursue, promote, and where necessary, initiate efforts to restore the Snake River system and affected unoccupied lands to a natural condition. This includes the restoration of component resources to conditions that most closely represent the ecological features associated with a natural river ecosystem. In addition, the Tribes will work to ensure the protection, preservation, and where appropriate the enhancement of Rights reserved under the Fort Bridger Treaty of 1868 and any inherent aboriginal rights.

In addition to state and tribal policy, the Captive Rearing Program for Salmon River Spring Chinook Salmon complies with federal Endangered Species Act Policy. Since the inception of the program in 1995, the various entities involved with program implementation have secured all necessary Section 10 permits authorizing the take of listed Snake River spring chinook salmon for research and enhancement activities. Accordingly, biological opinions generated by NOAA Fisheries have concluded that program activities are not likely to jeopardize the continued existence of listed Snake River spring/chinook salmon.

Section VIII. D. Guidelines on Hatchery Practices, Ecological Integration, and Genetics.

The guidelines reviewed below are from the *Review of Artificial Production of Anadromous and Resident Fish in the Columbia River Basin. A Scientific Basis for Columbia River Production Programs. Northwest Power Planning Council. Document 99-4. April 1999. Portland OR.*

Guideline 1. Technology should be developed and used to more closely resemble natural incubation and rearing conditions in salmonid hatchery propagation.

Program fish are generally reared following guideline 1. They are incubated in darkness and incubation and rearing densities do not exceed 0.5 lbs/ft^3 (8.0 kg/m^3) for most of the rearing cycle. Shade cover is always available to fish in the primary captive rearing program. The fish are fed by hand or automated feed delivery systems rather than demand feeders. No fish in the program are exposed to predator training. Fish-human interactions are generally minimized.

The IDFG Eagle Fish Hatchery is supplied with specific pathogen-free artesian water from five wells, and flow is augmented with four separate pump/motor systems. Flow to all tanks is maintained at no less than 1.5 exchanges per hour. Ambient water temperature remains a constant 13.5°C, and total dissolved gas averages 100% after degassing. Through transfer to saltwater at smolt age, fish are reared on chilled water at the IDFG Eagle Fish Hatchery. Using a water chilling system, ambient water temperature is reduced to between 9.0°C and 11.0°C. Backup and system redundancy is in place for degassing, pumping, and power generation. Oxygen is available on site for emergency supply to all rearing tanks. Nine water level alarms are in use and linked through an emergency service operator. Additional security is provided by limiting public access and by the presence of three on-site residences occupied by IDFG hatchery personnel.

The NOAA Manchester Spring Chinook Broodstock Project (1996-067-00) provides the marine rearing component for ongoing captive broodstock safety-net efforts for ESA-listed stocks of spring/summer chinook salmon from the Grande Ronde River Basin in Oregon and the Salmon River Basin in Idaho. Continuation of the marine rearing component at Manchester Research Station is vital to the overall success of the cooperative projects. Maintaining Pacific salmon in seawater from smoltification until initiation of maturation associated with freshwater reentry is a preferred captive broodstocking strategy for anadromous salmonids. This provides the fish with the natural environmental condition they are physiologically adapted to and minimizes the opportunity for unintentional domestic selection to work against their anadromous traits (Hard et al. 1992). The Manchester Research Station's captive broodstock facility provides seawater that is filtered and UV disinfected to minimize the risk of pathogens being introduced to the captive broodstock populations from Puget Sound. Stocks are cultured in large circular tanks inside a secure building. This combination of onshore tanks and seawater treatment eliminates most of the mortality associated with conventional net pen rearing of Pacific salmon. High velocity current, seawater temperature control, shade cover, and ambient and low level artificial light (programmed to follow the natural photoperiod) are used to simulate natural rearing as much as possible. Ultrasound technology is employed to provide early identification of maturing adults in time to transfer them back to freshwater to emulate the freshwater reentry timing of ocean returning adults.

NOAA's Assessment of Captive Broodstock Technologies project is conducting experiments designed to examine the premise that egg size and fecundity are determined during specific seasonal windows during the lifecycle of female salmon. One or more physiological aspects of growth (e.g., body size, growth rate, and lipid reserves) are determined during specific developmental windows in naturally rearing salmon, and these in turn affect ooctye development and reproductive investment. The studies are testing the following specific hypotheses: i) Growth during rearing of juveniles in freshwater (smolt size) influences subsequent egg size and fecundity; ii) Growth during the fall of the second year (first summer and fall in seawater) influences both the decision to mature the following year and egg size and fecundity; and iii) Growth during the spring of the third year (age 3 spawners) and the fourth year (age 4 spawners) influences egg size and fecundity. Understanding these mechanisms should result in guidelines for setting growth schedules during critical life history periods to narrow the gap in reproductive success between natural and captive chinook salmon.

Maturing, captive-reared chinook salmon are separated into two groups for holding under two temperature regimes during their freshwater maturation at Eagle. These temperature manipulations are an attempt to synchronize spawn timing of captive-reared and wild stocks and to improve egg survival to the eyed stage of development. Control fish are maintained on ambient well water (control; ≈13.5°C), and test fish are held on chilled water (test; range 8.9°C-12.0°C). Care is taken to ensure that the entire size range of fish present is represented in both groups. It is well established in the literature that elevated water temperature prior to spawning can reduce egg viability and delay spawn timing. Two chilled water regimes have been tested on maturing program fish at Eagle to date. The first test separated fish into two groups maintained at constant temperatures 13.5°C and 8.9°C. Spawn date and mean egg survival to the eyed stage of development was compared between the two groups, but results were inconclusive. Males from the chilled water group did begin running milt approximately 10 d earlier than those in the control group. Based on these results, we altered our use of chilled water to mimic temperatures anadromous returnees would encounter as they progressed upstream from the Columbia River estuary to our study stream. Once at Eagle the maturing fish were placed on straight chilled water. Water temperature was then increased 0.5°C approximately every 10 d to a maximum temperature of 12°C. Water temperature was then reduced following the same procedure until straight chilled water was being supplied to the tank. Fish were maintained at this temperature until released for volitional spawning or spawned at the hatchery. Results from hatchery spawning indicate that under this temperature regime test males began running milt several weeks earlier than control males, and the peak spawn date for test females was almost three weeks earlier than in control females. Egg survival for lots produced by test group females was also almost twice that of control females.

Guideline 2. Hatchery facilities need to be designed and engineered to represent natural incubation and rearing habitat, simulating incubation and rearing experiences complementary with expectations of wild fish in natural habitat.

The program does not generally use facilities designed to simulate the natural incubation and rearing experience as most proven fish culture technology does not incorporate these features.

The primary focus of this program is to return maturing chinook salmon to natal streams for natural spawning. As such, eggs and juveniles produced from captive-reared adults experience natural incubation and rearing conditions.

Guideline 3. New hatchery technology for improving fish quality and performance needs to have a plan for implementation and review at all hatchery sites, where appropriate, to assure its application.

New captive broodstock technology is continuously being developed through combined efforts of the sockeye and chinook salmon captive propagation programs (i.e., 'implementation' programs) and project 1993-056-00, "Assessment of Captive Broodstock Technologies." Technical Oversight Committee Meetings provide the mechanism for the assessment and implementation projects to identify critical areas for technological development. Collaborative research efforts to improve captive broodstock technology occur in five major areas:

1) Improve reintroduction success of adult and juvenile chinook salmon,
2) Improve olfactory imprinting and homing,
3) Improve physiological development and maturation of chinook salmon,
4) Improve in-culture survival through prevention and treatment of disease in chinook salmon, and
5) Evaluate effects of inbreeding and inbreeding depression in captive chinook salmon populations.

These five objectives are being achieved by coordinated studies on nutrition, physiology, microbiology, genetics, behavior, and ecology. Researchers combine experimental studies on surrogate captive populations with direct sampling of ESA-listed captive populations. The reproductive behavior and success of chinook salmon reared in experimental treatments in stream channels and natural streams are being quantified to improve reintroduction success in captive rearing programs. Critical imprinting periods for salmon are being determined to improve imprinting and homing. Studies of the effects of growth on incidence of early male maturity and adult quality in spring chinook salmon are being conducted to induce natural age-at-maturity for both sexes without compromising adult body size. The effects of rearing temperature and growth rate on maturation timing, fecundity, egg size, egg quality, and reproductive behavior in spring chinook salmon are being studied to improve the productivity of adults for artificial and natural spawning. To reduce in-culture mortality related to bacterial kidney disease, drug resistance development, pharmacokinetics, efficacy, and toxicity of azithromycin will be determined in studies on juvenile chinook salmon. Genetic studies are continuing to assess the effect of controlled inbreeding on survival, development, age structure, and other aspects of the life history of chinook salmon. The scientific results of this research program will continue to be conveyed by all the research scientists involved through the primary (peer-reviewed) literature, technical reports, regional Technical Oversight Committee meetings, and workshops/symposia. Advancements in technology are integrated into implementation program operations, and the biological benefits of the advancements are monitored by each of the programs.

NOAA's Assessment project has published numerous studies in the peer-reviewed scientific literature, the findings of which have provided guidance to the implementations. They include studies on reproductive physiology (Shearer et al. 1997ab; Silverstein et al. 1998, 1999; Shearer and Swanson 2000), pathology (Alcorn and Pascho 2000, 2002; Alcorn et al. 2003), reproductive performance and offspring fitness (Berejikian et al. 1997, 1999, 2001ab, 2003), morphology (Hard et al. 2000), and genetic effects of inbreeding (Hard et al. 2000).

Guideline 4. To mimic natural populations, anadromous hatchery production strategy should target natural population parameters in size and timing among emigrating anadromous juveniles to synchronize with environmental selective forces shaping natural population structure.

The Captive Rearing Program for Salmon River Spring Chinook Salmon primarily produces prespawn adults for natural spawning in target streams. The program is focused on developing culture techniques to produce fish with the proper behavioral, morphological, and physiological characteristics to successfully interact with and breed with wild individuals.

To assess the reproductive potential of captive-reared adult chinook salmon, (e.g., maturation timing, gamete quality, egg survival to eyed stage of development), in-hatchery spawning occurs in this program. Molecular markers, screened by University of Idaho geneticists, have been used to distinguish populations and to construct breeding matrices. Information developed from in-hatchery spawning is used to compliment behavioral observations and reproductive success data collected in the field following the release of maturing adult chinook salmon. Eggs produced from in-hatchery spawning events are out-planted to hatch boxes in target streams.

Eggs and progeny produced from prespawn adult and eyed-egg reintroduction strategies are integrated in the natural population. Ecological processes affect natural and program-produced eggs and fish similarly. As such, little to no deviation from natural population parameters (e.g., size of emigrants and timing of emigration) is expected.

Guideline 5. To mimic natural populations, resident hatchery production strategy should target population parameters in size and release timing of hatchery-produced resident juveniles to correspond with adequate food availability and favorable prey to maximize their post-stocking growth and survival.

Not applicable.

Guideline 6. Supplementation hatchery policy should utilize ambient natal stream habitat temperatures to reinforce genetic compatibility with local environments and provide the linkage between stock and habitat that is responsible for population structure of stocks from which hatchery fish are generated.

Program sponsors are aware of the importance of managing rearing and incubation water temperatures to ensure the linkage described in Guideline 6 is maintained. The Idaho Department of Fish and Game Eagle Fish Hatchery and the NOAA Fisheries Manchester Research Station have the ability to used chilled water during incubation and rearing phases of culture to meet this guideline.

Annually, the Captive Rearing Program for Salmon River Spring Chinook Salmon collects eyed-eggs from natural redds to source rearing groups. Incubation and early rearing (through smoltification) occurs at the IDFG Eagle Fish Hatchery on specific pathogen-free water. Incubation and rearing water temperature is maintained between 9.0°C and 11.0°C. Manchester Research Station supplies ambient temperature seawater that is filtered and UV treated. Throughout the marine rearing cycle, from smolt to adult, captive-reared chinook salmon are exposed to naturally fluctuating ambient seawater temperatures (7.0°C-13.0°C), well within the range they would experience in the ocean environment. Seawater temperatures range up to 15.0°C during the summer months, so chillers are employed to keep the upper temperature limit at 13.0°C. Discussions at the CSCPTOC level identified 13.0°C as the upper limit for chinook salmon reproductive success. Increased incidence of disease has also been associated with higher water temperatures.

Guideline 7. Salmonid hatchery incubation and rearing experiences should use the natal stream water source whenever possible to enhance home stream recognition.

Project sponsors agree in principle with Guideline 7. A primary advantage of captive rearing over conventional captive broodstock programs that produce presmolts or smolts for reintroduction is that prespawn adult and eyed-egg reintroduction strategies produce juveniles that experience natural stream conditions from hatch. As such, acclimation time is maximized and mirrors the natural experience.

The use of “raw” river water during incubation and early rearing is not logistically possible for this program nor is it recommended considering the small size of annual rearing groups and risks associated contracting infectious diseases.

Guideline 8. Hatchery release strategies need to follow standards that accommodate reasonable numerical limits determined by the carrying capacity of the receiving stream to accommodate residence needs of nonmigrating members of the release population.

The intent of this question is to address potential adverse ecological interactions that might arise as a result of the release of large numbers of <u>juvenile</u> fish. The Captive Rearing Program for Salmon River Spring Chinook Salmon was developed as an alternative to traditional captive broodstocking or supplementation programs and, inherently, minimizes this type of intervention impact. No juveniles are produced or reintroduced as part of this program.

The number of adults produced for reintroduction is managed to remain well below the estimated carrying capacity of study streams and adequate spawning and rearing habitat is available to accommodate both prespawn adult and eyed-egg releases. Progeny that result from program releases are influenced by the same set of natural processes that act on the natural population.

Guideline 9. Hatchery programs should dedicate significant effort in developing small facilitates designed for specific stream sites where supplementation and enhancement objectives are sought, using local stocks and ambient water in the facilities designed around engineered habitat to simulate the natural stream, whenever possible.

As mentioned above under Guideline 7, the Captive Rearing Program for Salmon River Spring Chinook Salmon employs release strategies that reintroduce prespawn adults or eyed-eggs (developed from local stocks) back to native habitat. As progeny from both release strategies hatch in native waters and experience natural environmental conditions, concerns related to Guideline 9 are eliminated.

Because project sponsors take every opportunity to avoid subjecting program fish to unnecessary fish health risk, the present operating scenario is advantageous over using any surface water supply adjacent to natal streams. Surface water in the project area supports pathogenic bacteria, parasites, and possibly viral agents that could jeopardize the success of the program.

Guideline 10. Genetic and breeding protocols consistent with local stock structure need to be developed and faithfully adhered to as a mechanism to minimize potential negative

hatchery effects on wild populations and to maximize the positive benefits that hatcheries can contribute to the recovery and maintenance of salmonids in the Columbia ecosystem.

Managers employ a variety of techniques and protocols to minimize negative hatchery effects. Foremost, fish within the broodstock program are not selected for growth or other performance measures as they would in a production hatchery setting. When in-hatchery spawning occurs, animals are bred in a factorial design that minimizes the loss of genetic variability and heterozygosity with the captive population, the loss of which may also be a consequence of domestication selection. Animals are also kept in an environment that minimizes demographic risks from disease, predation, etc., but maintains lower density, natural light levels, water temperatures, and feeding regimes designed to simulate or more closely resemble natural conditions.

Current genetic data from individuals in the captive rearing program indicate the majority of starting genetic diversity and heterozygosity have been maintained thus far among cultured adults (Powell and Faler, unpublished data). Moreover, the release of captive-reared adults to spawn volitionally with wild counterparts minimizes negative hatchery influences (artificial selective pressures and the relaxation of natural selective pressures) as compared to programs in which adults are spawned *ex situ* and their progeny are raised to smolts.

Guideline 11. Hatchery propagation should use large breeding populations to minimize inbreeding effects and maintain what genetic diversity is present within the population.

The focus of this program is to collect eyed-eggs from naturally-produced redds, rear fish in the hatchery through maturation, and return adults to natal streams to spawn naturally. The release of natural origin adults or eyed eggs probably minimizes potential divergence of the cultured and wild source population(s)—an important consideration for restoration purposes. Releasing captive-reared adults for natural spawning in natal habitats should minimize genetic changes associated with relaxation or changes in the direction or intensity of natural or sexual selection during reproduction (Berejikian et al. in review). Traditional captive broodstock or supplementation programs do not provide such a potential benefit.

Inbreeding depression and domestication selection are real consequences of artificial propagation (Reisenbichler and Rubin 1999). Domestication selection defined as “any change in the selection regime of a cultured population relative to that experienced by the natural population” (from Waples 1999) would include artificial, intentional, and unintentional selection that can occur in an artificially propagated population. Juveniles produced from naturally spawning captive-reared adults should experience selection pressures similar to those experienced by wild offspring of wild fish, whereas a much stronger argument can be made for inbreeding depression and domestication selection in programs that spawn captive-reared adults and release their progeny as smolts.

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It should be noted the populations used to evaluate the captive rearing program were declining and had reached a minimal number of spawners as evidenced by redd counts. The guideline above then presents a conundrum (why employ captive propagation when breeding populations are sufficiently large?). It would be more accurate to indicate that logistically, a maximal number of breeders are used (e.g., spawn as many breeders as possible to maximize effective population size) when spawning is necessary. Additionally, those breeders used should reflect, to the extent possible, the breadth of genetic variation remaining in wild counterparts, and they should also reflect a random sample not significantly different from the level of relatedness observed in the wild population. Available genetic evidence from Project 199009300 fails to show significant differences between wild and cultured samples of adults in this program thus far.

Guideline 12. Hatchery supplementation programs should avoid using strays in breeding operations with returning fish.

The extent to which straying occurs in target streams is not well documented. Eyed-eggs collected to source rearing groups come only from redds constructed by wild/natural spring chinook salmon. Accordingly, rearing groups reflect the composition of wild/natural populations to the maximum extent possible.

Guideline 13. Restoration of extirpated populations should follow genetic guidelines to maximize the potential for re-establishing self-sustaining populations. Once initiated, subsequent effort must concentrate on allowing selection to work by discontinuing introductions.

Not applicable—populations incorporated in this program have not been extirpated.

Guideline 14. Germ plasm repositories should be developed to preserve genetic diversity for application in future recovery and restoration projects in the basin and to maintain a gene bank to reinforce diversity among small inbred natural populations.

Cryopreservation of milt from male donors has been used in the Captive Rearing Program for Salmon River Spring Chinook Salmon since 1997 and follows techniques described by Cloud et al. (1990) and Wheeler and Thorgaard (1991).

Cryopreserved milt was used in controlled spawning events in 1998 and 1999. Currently there are in excess of 3,000 0.5 ml cryopreserved sperm samples available to the program. These samples represent male chinook salmon from three stocks that matured between 1997 and 2002.

Guideline 15. The physical and genetic status of all natural populations of anadromous and resident fishes needs to be understood and routinely reviewed as the basis of management planning for artificial production.

The physical status of Snake River spring/chinook salmon in the project area is monitored annually by a variety of techniques at several life stages including spawner surveys, redd counts, and the enumeration of migrating juveniles. These data primarily reside in annual project reports produced by the IDFG and the Shoshone-Bannock Tribes. For a review of Snake River spring/summer chinook salmon genetic investigations, see Matthews and Waples (1991) and NOAA (2003). Evaluation of spawning success from out-planted adults using genetic methods was begun in 2001. Sampling from two year-classes is now complete and will be turned over to Project 199009300 for subsequent analysis.

Guideline 16. An in-hatchery fish monitoring program needs to be developed on performance of juveniles under culture, including genetic assessment to ascertain if breeding protocol is maintaining wild stock genotypic characteristics.

From incubation through maturation, various in-hatchery performance variables are routinely monitored. Coordinated through the CSCPTOC, variables routinely examined include egg survival from the eyed-stage of development to hatch, sac fry survival to ponding, fish survival to smoltification, survival during transfer from freshwater to seawater, seawater entry survival, fish survival to maturation, fish health profiles, fish rearing densities, fish weights, feed conversion rates, survival of maturing adults during transfer from seawater to freshwater, maturation timing, age at maturation, and survival during transfer from freshwater to release for natural spawning. Variables routinely monitored following in-hatchery spawning events include general gamete quality, fecundity, egg size, milt motility, egg survival to the eyed-stage of development, and egg survival from eye through hatch. In addition, necropsies are performed on all fish that die during culture.

Fin samples have been collected from program fish since the inception of this program to source material to be genetically analyzed. In cooperation with project 1990-093-00 (University of Idaho—Genetic analysis of *Oncorhynchus nerka*, modified to include chinook salmon), samples are analyzed to identify genetic characteristics of target populations and to develop breeding plans to guide controlled spawning events. Available genetic data has shown a high level of retention of starting genetic variation and heterozygosity. Spawning protocols utilizing a dissimilarity matrix, developed cooperatively, have been shown to offer advantages in retaining heterozygosity long term over theoretical estimates calculated with other methods (e.g., 1:1 spawning and random spawning). Genetic data are also used to conduct parental exclusion analysis using microsatellite loci to associate juvenile production with out-planted adults.

Guideline 17. A hatchery fish monitoring program needs to be developed on performance from release to return, including information on survival success, interception distribution, behavior, and genotypic changes experienced from selection between release and return.

Survival within the program is routinely monitored during all stages of captive-rearing process. Survival to hatch in eyed-eggs collected to establish each new brood group has been excellent to date, with most brood groups averaging well over 90%. Survival to smoltification has also been excellent to date, with survival in recent brood groups again remaining above 90%. Most mortality observed in the program occurs between smoltification and maturation, but compared to natural systems, program survival has been extraordinarily high and has been improving. Approximately 40%-50% of captive-reared chinook salmon collected as parr or smolts have survived to maturity and have been released to spawn volitionally or spawned at Eagle. Survival in brood groups collected as eyed-eggs should be even higher as these groups are displaying much lower incidences of bacterial kidney disease and parasite infestation than those collected as parr or smolts.

The Captive Rearing Program for Salmon River Spring Chinook Salmon conducts field evaluations each year to assess the performance of program animals. Metrics of interest to date have included appropriateness and frequency of reproductive behaviors (including courtship, digging, and aggression), number of redds constructed by program females, and survival of eggs spawned by captive-reared females. Captive-reared chinook salmon males have been shown to display the entire range of courtship behaviors attributed to chinook salmon. Courtship behaviors in captive-reared males follow the same general patterns as observed in wild males during the 1–2 h leading up to spawning, although captive-reared males tend to court somewhat less frequently than the wild males (Venditti et al. 2003). Captive-reared females have also been shown to display reproductive behaviors similar to wild conspecifics. During the hours leading up to spawning, these fish perform approximately 2-3 nest digs every 10 min. After spawning, the captive-reared female cover digs almost continuously for about 10 min and continues this elevated level of cover digging for at least 30 min (Venditti et al. 2003).

In addition to spawning observations, program investigators assess the general behavior patters and habitat associations of program fish, post release, to assess the appropriateness of these criteria as well. Dominant behaviors and habitat associations in captive-reared chinook salmon follow a pattern consistent with increasing maturation and desire to spawn. In the weeks immediately after release, program fish are generally observed holding or milling in pools or in close association with large woody debris. Moving is another frequently observed activity in these fish at this time and demonstrates their propensity to distribute themselves throughout the study section. Then as the season progresses, courtship, aggression, and redd construction and maintenance become more prevalent, and more fish are observed in pool tailouts. Then as the spawning period ends, aggression, redd holding, and redd maintenance are the dominant activities, with fish generally associated with tailouts.

After the completion of spawning by captive-reared fish, eggs are collected from redds spawned by captive-reared females to determine the fertilization rate in these redds and to determine if this measure of gamete quality is influenced by the temperature history of the female while at Eagle. Eggs are collected using hydraulic methods. Opaque eggs or those having fungal growth are considered dead and are preserved in 95% ethanol. Clear eggs are classified as viable and are placed in Stockard's solution, which causes pre-eyed embryos to become visible. Eggs in this category are further categorized as fertilized or blank depending on the presence or absence of an embryo. The number of eggs in each category is enumerated and the percentage in each computed. Finally, the number of eyed-eggs produced by captive-reared females is estimated from the proportion of fertilized eggs observed, estimated fecundity, and the total number of redds produced by program females.

Chinook salmon parr are collected from streams that received prespawn adult chinook salmon to obtain fin clips for genetic analysis to determine if program parents produced them. Parr are collected throughout stream study sections, although particular emphasis is given to areas near known spawning locations. Once captured, the parr are transferred to tubs filled with fresh stream water located on the shore and lightly anesthetized with buffered MS-222. A small portion of the anal fin is removed and preserved in 95% ethanol. Scissors used to remove fin tissue are swabbed with isopropyl alcohol between specimens to reduce the possibility of DNA cross-contamination. The fish are also measured to the nearest 1 mm FL before being placed into a tub of fresh stream water to recover. Parr are then released back into the stream near their point of collection once sampling is completed at that site. Microsatellite markers are being utilized to conduct parentage analysis (parental exclusion analysis; Colbourne et al. 1996; Talbot et al. 1996; Estoup et al. 1998; Bernatchez and Duchesne 2000; Eldridge et al. 2002) to determine the relative reproductive success of captive-reared adults (adults released for volitional spawning in 2001) in terms of F_1 progeny (parr collected in 2002). This genetic evaluation is ongoing for all year-classes.

Guideline 18. A study is required to determine cost of monitoring hatchery performance and sources of funding.

Not applicable.

Guideline 19. Regular performance audits of artificial production objectives should be undertaken, and where they are not successful, research should be initiated to resolve the problem.

Not applicable.

Guideline 20. The NPPC should appoint an independent peer review panel to develop a basinwide artificial production program plan to meet the ecological framework goals for hatchery management of anadromous and resident species.

Not applicable.

Section III. C. 2. How to evaluate for consistency with policies and standards and identification of deficiencies; use of independent audits; independent scientific review.

Entities seeking funding for artificial production programs should analyze their programs and facilities against the policies and performance standards described in this report to identify deficiencies and needed improvements, making use of the existing audit information where appropriate. These entities should use a combination of self-evaluations and independent evaluations, using scientific resources to focus on critical areas of uncertainty. The end result of this self-evaluation process should be a demonstration of consistency with the policies and standards or an explanation of inconsistencies and a proposal for correction. The evaluations and conclusions should then be presented to the review bodies, including independent scientific panels, for review as part of the funding processes. And, until the decisions on use and purpose are revisited as described in Part III B above, the proposals and decisions in the funding reviews should include an explicit if interim evaluation of the more fundamental questions about purpose, which would balance the magnitude of needed operational improvements against the potential for a change in purpose, as part of a judgment on funding priorities.

Our discussion of how the Captive Rearing Program for Salmon River Spring Chinook Salmon is consistent with the Council's performance standards and indicators is presented below.

Note: Performance Standards and Indicators described in this section or our response were taken from the final January 17, 2001 version of *Performance Standards and Indicators for the Use of Artificial Production for Anadromous and Resident Fish Populations in the Pacific Northwest*. Numbers referenced below correspond to numbers used in the above document.

3.2.2 Standard: Release groups sufficiently marked in a manner consistent with information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries.

Indicator 1: Marking rate by type in each release group documented.

3.3.1 Standard: Artificial propagation program contributes to an increasing number of spawners returning to natural spawning areas.

Indicator 1: Annual number of spawners on spawning grounds estimated in specific locations.
Indicator 2: Spawner-recruit ratios are estimated in specific locations.
Indicator 3: Number of redds in natural production index areas documented.

3.3.2 Standard: Releases are sufficiently marked to allow statistically significant evaluation of program contribution.

Indicator 1: Marking rates and type of mark documented.
Indicator 2: Number of marks identified in adult groups documented.

3.4.1 Standard: Fish collected for broodstock are taken throughout the return in proportions approximating the timing and age structure of the population.

Indicator 1: Temporal distribution of broodstock collection managed.
Indicator 2: Age composition of broodstock collection managed.

3.4.2 Standard: Broodstock collection does not significantly reduce potential juvenile production in natural areas.

Indicator 1: Eyed-eggs are collected from a subset of wild redds to source broodstocks.
Indicator 2: Hatchery-produced spawners are released to migrate to natural spawning areas.
Indicator 3: Number of adults, eggs, or juveniles placed in natural rearing areas is managed.

3.4.3 Standard: Life history characteristics of the natural population do not change as a result of this program.

Indicator 1: Life history characteristics of natural and hatchery-produced populations are measured (e.g., juvenile dispersal timing, juvenile size at out-migration, adult return timing, adult age and sex ratio, natural and hatchery spawn timing, hatch and swim-up timing, hatchery rearing densities, growth, diet, physical characteristics, fecundity, egg size, etc).

3.4.4 Standard: Annual release numbers do not exceed estimated basinwide and local habitat capacity.

Indicator 1: Annual release numbers, life stage, size at release, documented.
Indicator 2: Location of releases documented.
Indicator 3: Timing of hatchery releases documented.

3.5.1 Standard: Patterns of genetic variation within and among natural populations do not change significantly as a result of artificial production.

Indicator 1: Genetic profiles of naturally-produced and hatchery-produced adults developed.

3.5.2 Standard: Collection of broodstock does not adversely impact the genetic diversity of the naturally spawning population.

Indicator 1: Eyed-eggs are collected from a subset of wild redds to source broodstocks.

Indicator 2: Timing of collection compared to overall run timing considered.

3.5.3 Standard: Artificially produced adults in natural production areas do not exceed appropriate proportion.

Indicator 1: Ratio of natural to hatchery-produced adults monitored.

3.6.1 Standard: The artificial production program uses standard scientific procedures to evaluate various aspects of artificial production.

Indicator 1: Scientifically based experimental design with measurable objectives and hypotheses.

3.6.2. Standard: The artificial production program is monitored and evaluated on an appropriate schedule and scale to address progress toward achieving the experimental objectives.

Indicator 1: Monitoring and evaluation framework including detailed timeline.
Indicator 2: Annual and final reports.

3.7.1 Standard: Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols.

Indicator 1: Annual reports indicating level of compliance with applicable standards and criteria.

3.7.2 Standard: Effluent from artificial production facility will not detrimentally affect natural populations.

Indicator 1: Discharge water quality compared to applicable water quality standards.

3.7.3 Standard: Water withdrawals and in stream water diversion structures for artificial production facility operation will not prevent access to natural spawning areas, affect spawning, or impact juveniles.

Indicator 1: Water withdrawals documented—no impacts to listed species.
Indicator 2: Number of adult fish aggregating and/or spawning immediately below water intake point monitored.
Indicator 3: NMFS screening criteria adhered to.

3.7.4 Standard: Releases do not introduce pathogens not already existing in the local populations and do not significantly increase the levels of existing pathogens.

Indicator 1: Certification of juvenile fish health documented prior to release.
Indicator 2: Samples of natural populations for disease occurrence conducted.
Indicator 3: Juvenile densities during artificial rearing managed conservatively.

3.7.6 Standard: Adult broodstock collection operation does not significantly alter spatial and temporal distribution of natural population.

Indicator 1: Spatial and temporal spawning distribution of natural population above and below trapping facilities monitored.

3.7.7 Standard: Weir/trap operations do not result in significant stress, injury, or mortality in natural populations.

Indicator 1: Mortality rates in trap documented.
Indicator 2: Prespawning mortality rates of trapped fish in hatchery or after release documented.

3.7.8 Standard: Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of natural fish.

Indicator 1: Juveniles are not released. Production occurs from captive-reared adults released to spawn naturally.

Monitoring and Evaluation of Performance Standards and Indicators:

Standard 3.2.2 and associated indicators: All adult chinook salmon released back to the habitat are PIT tagged, elastomer tagged, and Petersen disk tagged. Genetic tissue samples from progeny that result from natural spawning events are taken to facilitate individual assignment test analyses. Hatchery groups are PIT tagged and elastomer tagged.

Standard 3.3.1 and associated indicators: The primary objective of this program is to reintroduce hatchery-produced adults for natural spawning. Adults are sourced from eyed-eggs collected from redds constructed by wild adult chinook salmon.

Standard 3.3.2 and associated indicators: Adults released for natural spawning are 100% marked with PIT tags, elastomer tags, and Petersen disk tags. Intensive post-release behavioral monitoring occurs to document spawning-related behavior and spawning success.

Standard 3.4.1, 3.4.2, 3.5.3, and associated indicators: Chinook salmon rearing groups are sourced as eyed-eggs from redds constructed by wild adults. Approximately 50 eyed-eggs are removed, using hydraulic sampling gear, from six redds each. Redds are selected to represent the range of spawn timing. Care is taken to not negatively impact eggs remaining in redds sampled by program personnel.

Standard 3.4.3 and associated indicators: Life history characteristics of natural and hatchery-produced adult chinook salmon are monitored (e.g., adult spawning success). In-hatchery variables are monitored continuously (e.g., growth, survival, rearing conditions, maturation, age at maturity, spawning success, gamete quality, egg size, fecundity, egg survival to the eyed stage of development, etc.).

Standard 3.4.4, 3.5.3 and associated indicators: Annual adult release numbers, size at release, and release location are discussed annually at the CSCPTOC level. Release levels do not exceed habitat spawning and rearing capacities.

Standard 3.5.1, 3.5.2 and associated indicators: The University of Idaho provides genetic support for this program. Genetic profiles of wild and hatchery-produced chinook salmon have been and continue to be produced. The hatchery population is constantly monitored to

determine such variables as genetic effective population size, loss of genetic variability, and loss of heterozygosity.

Standard 3.6.1, 3.6.2 and associated indicators: Program goals, objectives, and tasks focus on the preservation/conservation purpose of this effort. Hatchery practices (e.g., spawning and rearing protocols) are based on current and emerging "best practices" and undergo constant review at the CSCPTOC level. An experimental design has been established to guide the reintroduction of adults back to the habitat. A comprehensive monitoring and evaluation program is in place to track post-release adult spawning success.

Standard 3.7.1, 3.7.2, 3.7.3, 3.7.6, 3.7.7 and associated indicators: The artificial production component of the program adheres with all state and federal policies in place to prevent the spread of infectious pathogens, to ensure that facility discharge water quality meets all appropriate standards, and that intake and outflow screens meet appropriate standards.

Adult and juvenile weirs are monitored to not adversely affect target or other fish species. Anadromous chinook salmon adult presence and distribution below weirs is carefully monitored. Every precaution is taken to ensure that trapping does not negatively impact anadromous adults.

Standard 3.7.4 and associated indicators: IDFG and NOAA fish health facilities process samples for diagnostic and inspection purposes from captive broodstock chinook salmon. Routine fish necropsies include investigations for viral pathogens (infectious pancreatic necrosis virus and infectious hematopoietic necrosis virus), and various bacterial pathogens (e.g., bacterial kidney disease *Renibacterium salmoninarium*, bacterial gill disease *Flavobacterium branchiophilum*, coldwater disease *Flavobacterium psychrophilum*, and motile aeromonad septicemia *Aeromonas* spp.). In addition to the above, captive fish are screened for the causative agent of whirling disease *Myxobolus cerebralis*, furunculous *Aeromonas salmonicida*, and the North American strain of viral hemorrhagic septicemia virus.

Approved chemical therapeutants are used prophylactically and for the treatment of infectious diseases. Prior to effecting treatments, the use of chemical therapeutants is discussed with an IDFG fish health professional. Fish necropsies are performed on all program mortalities that satisfy minimum size criteria for the various diagnostic or inspection procedures performed.

All appropriate state permits are secured prior to transporting eggs or fish across state boundaries. Prior to release, preliberation fish health sampling occurs for presmolt and smolt release groups.

Standard 3.7.8 and associated standards: Predation by artificially produced fish on naturally produced fish is not expected to occur as no juvenile releases occur. Juveniles produced by this program hatch from redds constructed in the habitat.

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RESPONSES TO ISRP PROJECT SPECIFIC QUESTIONS

Blue Mountain and Mountain Snake Provinces (ISRP2001-12A)

a) Project ID 199801001 (Oregon Department of Fish and Wildlife)—Grande Ronde Basin Spring Chinook Salmon Captive Broodstock Program

ISRP Preliminary Review Comments: "Fundable. No response required."

b) Project ID 199800703 (Confederated Tribes of the Umatilla Indian Reservation)—Facility O&M and Program M&E for Grande Ronde Spring Chinook Salmon and Summer Steelhead

ISRP Preliminary Review Comments: "Response required."

ISRP Final Review Comments: "Fundable, adequate response and, as requested, the proposal has been substantially improved through reorganization and the provision of greater detail...This proposal initially lacked the detailed information and tasks that were presented in proposal #199800702, but the revisions adequately addressed this concern."

c) Project ID 199801006 (Nez Perce Tribe)—Captive Broodstock Artificial Propagation

ISRP Preliminary Review Comments (presented here from the sponsor's response provided on 10 October 2001):

ISRP General Comments: "This proposal is for monitoring and evaluation of progeny of the captive brood stock collected and reared under project #199801001. The proposal involves coordination with state and federal agencies, assistance in the monitoring and evaluation of juveniles and brood adults reared at Bonneville Hatchery and Manchester Marine Laboratory, monitoring and evaluation of the F_1 generation juveniles and returning adults, and reporting. Like proposal #199801001, this is a well-written proposal that focuses on research and evaluation of alternative approaches to supplementation through captive broodstock. The proposal presents a thorough technical background that puts the project in context, the rationale and significance to regional programs is detailed and clear, and project history section includes results to date, with some comparisons between stocks and/or rearing treatments."

Sponsor Response to General Comments: We thank the ISRP for their review and comment on this project proposal and commend their efforts. We agree with the ISRP that Project 199801006 is a strong proposal with a focused research and evaluation approach to captive broodstock supplementation. Furthermore, we believe that although the captive broodstock method is largely unproven and uncertainty exists in terms of its application to preserve threatened populations, captive broodstock programs may be the most effective means of accelerating their recovery. Thus, this proposed project will address the uncertainty specific to captive broodstock technology and add to our knowledge regarding supplementation in general.

Response to Specific Comments:

ISRP Comment No. 1: "A response is requested concerning the PIT tagging of the F_1 juveniles. Section 8 of this proposal indicates that 8,000 PIT tags are included (Objective 3.1). It is not evident from the text, however, if this is the total number of PIT tags allocated to all three populations (are other PIT tags provided by other sources, etc.), and how are these tags allocated between stocks, treatments, and families? This concern needs to be clarified in this proposal. A statistical basis to the tagging program would clearly strengthen this proposal."

Sponsor Response to Comment No. 1: The 8,000 PIT tags mentioned on page 20 of the narrative are allocated for the Lostine River captive brood progeny only. The Confederated Tribes of the Umatilla Reservation (CTUIR) and Oregon Department of Fish and Wildlife (ODFW) are responsible for the captive brood progeny from the Upper Grande Ronde and Catherine Creek. PIT tags are used to evaluate the captive progeny as a single group per stock compared against the standards set by their wild counterparts, which are tagged under BPA Project No. 199202604. Size limitations preclude PIT tagging discrete treatment groups prior to final ponding when all groups are brought together and mixed. However, coded-wire tags (CWT) and an adipose fin clip (mark) are applied to all progeny prior to mixing. Thus, the CWTs allow for the comparative evaluation of treatment groups from the recovered tags at the adult stage.

As stated in the proposal, PIT tags detections give managers the ability to monitor and evaluate the downstream performance of captive, wild and conventional smolts. Once in river, smolt survival is determined with Program SURPH.2. The model is a statistical survival analysis package used in fish and wildlife tagging studies. It was designed to analyze release-recapture data for survival estimates (Skalski et al. 1994). For the purpose of this study, SURPH methodology is combined with PIT-tag technology to help quantify survival relationships through the Columbia River Basin. Wild and/or hatchery juveniles from the Lostine River are PIT-tagged, released and potentially detected at multiple dams as they migrate to the ocean. PIT-tag interrogation data is retrieved from the PTAGIS database and processed for SURPH through the program called CAPHIST. CAPHIST was designed by the University of Washington to arrange "comma separated values" (CSV) lists obtained from PTAGIS into SURPH data files. The result is the collection of capture data that can be analyzed to estimate survival <u>and</u> covariates that might influence survival (Skalski et al. 1994).

Sample size requirements for determining survival to Lower Granite and McNary dams are estimated using the SURPH SAMPLE-SIZE program. Using observed survival and detection probability rates from recent hatchery releases, estimated minimum release groups of 800 (Lower Granite Dam) to 7,500 (McNary Dam) PIT tagged smolts are required. Thus, 8,000 PIT tagged smolts from the captive progeny and other groups are adequate for determining migration timing, median arrival dates, and survival through the hydrosystem.

ISRP Comment No. 2: "There is an important question associated with these marking programs. The comparison of natural, conventional, and captive brood production will obviously be based on the extensive use of PIT tags in many of the proposals reviewed. Have the comanagers considered the adequacy of marking rates to compare these three types of spring chinook production, and if so, what level of difference in performance may be detectable?"

Response to Comment No. 2: The adequacy of PIT tag marking rates for juvenile monitoring and evaluation is addressed in the above response. Comparison of juvenile performance regarding the three types of spring chinook production (natural, conventional and captive brood) is ongoing. Survival rates to Lower Granite Dam of Lostine River 1997 brood year conventional hatchery and wild smolts were 62.7% (0.13 SE) and 79.7% (0.062 SE), respectively. Survival rates to Lower Granite Dam of Lostine River 1998 brood year captive brood F_1s and wild smolts were 61.2% (0.13 SE) and 60.5% (0.066 SE), respectively. The survival rate to Lower Granite Dam of Lostine River 1999 brood year captive brood F_1s was 47.6% (0.006 SE). Wild 1999 brood year survival is yet to be calculated. Next spring will be the first time that both conventional and captive brood F_1 smolts are released in the same year. Therefore, simultaneous comparison of wild, conventional, and captive brood F_1 juvenile performance will be possible.

For adult performance comparison, we desire a minimum return of 30 adults per cohort according to treatment (wild, conventional and captive brood F_1). Based on Lichatowich and Cramer (1979), a return of 30 adults will provide an 80% chance to detect a 4% to 53% change in a measured parameter with a 5% to 50% coefficient of variation over 8 to 10 years. All captive brood F_1s and conventional smolts are given an adipose fin clip to distinguish them from wild fish when returning as adults. All conventional smolts are also given a VIE tag to distinguish them from the captive brood F_1s. Hence, the marking rate is essentially 100% for all three groups and comparisons can be made accordingly with a high chance of detecting performance differences as long as at least 30 adults return per group.

In terms of smolt-to-adult return (SAR), the Lostine weir affords us the opportunity to determine SARs for wild, conventional, and captive brood F_1 to the mouth of the river. SARs are calculated as the number of adults per brood year group observed at the weir divided by the number of smolts per brood year group. Marmorek et al. (1998) define smolt-to-adult survival rates as the rate of survival from the time a fish passes the uppermost dam (Lower Granite Dam) as smolts to the time they return to that dam as adults. If this SAR definition is desirable for performance comparison, then a minimum of 30 PIT tagged adults per group must be detected at Lower Granite Dam. From 1977 to 1994 Snake River chinook SARs ranged from 0.2% to 2.6% with a median of 1% (Marmorek et al 1998). To detect 30 PIT tagged adults at Lower Granite Dam with a 1.0% SAR, at least 3,000 PIT tagged smolts need to survive to and be detected at the dam. Thus far, the lowest survival to Lower Granite Dam of Lostine smolts is 47.6% (2001 migration year). At that rate 3,808 of the 8,000 PIT tagged smolts would have passed the dam. Therefore, the 8,000 PIT tag marking rate per group seems adequate to determine SARs to Lower Granite Dam with a significant chance of detecting differences.

ISRP Final Review Comments: “Fundable. The response comprehensively addresses the review comments. This proposal is for monitoring and evaluation of progeny of the captive broodstock collected and reared under project #199801001. The proposal involves coordination with state and federal agencies, assistance in the monitoring and evaluation of juveniles and brood adults reared at Bonneville Hatchery and Manchester Marine Laboratory, monitoring and evaluation of the F_1 generation juveniles and returning adults, and reporting. Like proposal #199801001, this is a well-written proposal that focuses on research and evaluation of alternative approaches to supplementation through captive broodstock. The proposal presents a thorough technical background that puts the project in context, rationale and significance to regional programs is detailed and clear, and project history section includes results to date, with some comparisons between stocks and/or rearing treatments. Objectives are again stated as tasks, and not measurable comparisons or tests, but the intentions in the context are clear. In a past review, there was a question concerning overlap between this program and M&E associated with the conventional hatchery production activities. Our understanding is that these M&E tasks are discrete. However, there is an important question associated with these marking programs. The comparison of natural, conventional, and captive brood production will obviously be based on the extensive use of PIT tags in many of the proposals reviewed. Have comanagers considered the adequacy of marking rates to compare these three types of spring chinook production, and if so, what level of difference in performance may be detectable? This latter issue is not only relevant to this one proposal, but other NPT proposals have noted methods for estimating the numbers of PIT tags required for comparisons. A statistical basis to the tagging program would clearly strengthen this, and related, proposals.”

Sponsor Response: Comparison of relative survival between natural, conventional and captive broodstock production occurs at multiple life history points and utilizes several marking approaches to distinguish each group. PIT tags are specifically used to quantify survival to Lower Granite and McNary dams. A more rigorous description of statistical designs for marking rates and comparative analysis will be provided in future Nez Perce Tribe proposals. In addition, description of required precision and analysis methods for comparative tests across all Grande Ronde River subbasin production groups is being provided in the northeast Oregon Comprehensive Monitoring and Evaluation Plan for Imnaha and Grande Ronde Subbasin Spring Chinook Salmon.

d) Project ID 199800702 (Nez Perce Tribe)—Grande Ronde Supplementation: Lostine River O&M and M&E

ISRP Preliminary Review Comments: "Fundable, without response."

e) Project ID 199703800 (Nez Perce Tribe)—Preserve Salmonid Gametes and Establish a Regional Salmonid Germplasm Repository

ISRP Preliminary Review Comments (presented here from the sponsor's response provided on 10 October 2001):

ISRP General Comment: "Response is needed. To date, the project has cryopreserved male gametes from over 2,700 chinook salmon and steelhead. The proposal would continue and expand that program roughly four-fold after construction of a new building, evaluating additional basins for gamete collections from salmonids (resident and anadromous), other fishes such as lamprey and burbot, and amphibians."

ISRP Issue Number 1: "Sponsors need to provide a convincing argument that the use of cryopreservation as a tool of conservation for Columbia river salmonids is logical,…."

Response to Issue Number 1: Cryopreservation is the simplest, most inexpensive method to preserve genomes that can be used to maintain future conservation options. Sperm that is properly cryopreserved and stored can be easily used to produce animals that contain conserved genetic information. Gene banking efforts are not new to the conservation biology field. Gene banks are commonplace for plants, mammals, birds, and livestock. The plant germplasm repository has been in place for over 100 years as a success story for the botanical world. As more aquatic species become threatened or endangered, it is reasonable to establish a regional aquatic germplasm repository to preserve the vanishing genetic material. "More subpopulations are likely to become extirpated" (Serveen et al. 2001).

ISRP Issue Number 2: Measures such as cryopreservation are taken in an attempt to protect a species for a very short time while emergency actions are taken to restore lost habitat.

Response to Issue Number 2: The maintenance of the genetic biodiversity of native animals is currently a challenge and is a goal that may require decades to accomplish. In the pursuit of this goal, some native populations may be completely lost until conservation actions that address factors limiting survival are implemented. In order to buy time for this social and political process to occur and in order to have the genetic resources available to complete this objective, the preservation of the biodiversity that is currently available is essential.

Cryopreservation has the ability to protect genetic diversity in the short and long term. In the short term, it can protect against demographic instability in hatchery scenarios. It can be used to augment low return years, particularly when females return in larger numbers than males or when females ripen before the males are ready to spawn. The addition of male gametes into hatchery populations could deter the effects of inbreeding due to small population size. Small populations are at risk due to demographic and environmental stochasticity, and random catastrophes.

Restoration of lost habitat, improvements to hydropower passage, or changes in hatchery operations may require twenty plus years to realize the direct benefits to fish. Storing imperiled species' germplasm buys recovery efforts some time. It should not be thought that this cryopreservation effort in any way compromises ongoing habitat restoration, improvements to hydropower passage, or changes to conservation hatchery program. Rather it complements other recovery efforts by preserving existing diversity for future use. Cryopreservation serves as a tool to conserve and maintain genetic diversity without substantial risks to natural production.

The overall objective is to preserve existing genetic diversity for short and long-term options. A comprehensive program has been developed and should be expanded to cover the needs of declining species in the Columbia River basin where aquatic species are imperiled. We agree that a germplasm repository will not increase biodiversity of the present populations; and it will not increase the number of fish in the river systems. A germplasm repository will provide salmon managers (for example) in the year 2100 with the genetics of animals that are spawning in our rivers presently.

ISRP Issue Number 3: A concern is that the gametes retained do not represent the population, and their contribution to a breeding program may not be random.

Response to Issue Number 3: Chinook salmon samples were collected from adult broodstock collection facilities in the Imnaha River, South Fork Salmon River, Lostine River, upper Salmon River, and Pahsimeroi River that were representative of the spectrum of the run. Representative sampling from natural production areas has been more challenging. We have attempted to representatively sample selected subpopulations across an area as geographically immense as the Snake River basin. Gametes are collected from all year classes of males, including jacks, ensuring that all life histories available are sampled. Every subpopulation could not be sampled due to funding and manpower constraints. The ability to cryopreserve eggs or embryos is not currently available to fisheries science.

It is true that only the male genetic material is being cryopreserved, but entire populations can be rebuilt from backcrossing or using females from adjacent spawning aggregates. It is clear that in order to use this germplasm repository correctly, the genetic information of the males that contributed the sperm and the expertise of qualified geneticists or rare animal breeding specialists must be employed. Mating protocol designs are not part of the current project.

ISRP Issue Number 4: The population is already in a population genetic bottleneck before the original samples are taken and repeated sampling only exacerbates that problem.

Response to Issue Number 4: Gamete collections from chinook salmon are sampled over the spectrum of the spawning run to ensure representative sampling of the existing genetic material. Repeated sampling over a number of years allows collection of unrelated individuals from different brood years. The gene banks represent the best attempt to characterize the subpopulation as possible.

A goal of the project is to collect 100 individuals per year over five years from each population to preserve as diverse a founder population as possible. The objective is to conserve genetic diversity within and between the subpopulations, the principle being preservation of a large sample size provides future management options. The larger the founder population size the better. Nothing can be done about the loss that has occurred in the past. However, future loss of genetic diversity can be slowed if not prevented by cryopreservation of gametes.

ISRP Issue Number 5: Trials generally show relatively low viability of cryopreserved sperm; is a random sample of the genetic material passed to subsequent generation?

Response to Issue Number 5: The fertility of cryopreserved and thawed sperm will be no greater than the fresh sperm and is of slightly lower quality. The fertility trials on chinook salmon in 2000 show a 60% fertilization rate (range of 27-76) of cryopreserved sperm. This is decent viability in comparison to some hatcheries, which are getting 81-93% fertilization (McCall Hatchery 1989-1998 records). The viability may be considered lower compared to conventional hatchery programs, but is acceptable for endangered species given the alternative, which is zero. With respect to random sampling of genetic material being passed on to subsequent generations; for endangered species management, 60% fertilization ability means 60% more fish produced than 0% not using cryopreserved sperm. We have no reason to suspect genetic material would not be representatively incorporated into subsequent production.

ISRP Issue Number 6: Why do the sponsors feel that it is "…logical that BPA fund this proposal because of its past investment…?"

Response to Issue Number 6: The Bonneville Power Administration has spent large amounts of money towards mitigation and now recovery efforts of Columbia River salmonids. Funding to support this project may be possible from other sources associated with endangered species fish management; however, a goal of the Bonneville Power Administration should be to provide adequate support for a fish germplasm repository to insure the availability of all salmonid populations in the Northwest. This insurance policy, the establishment of a long-term germplasm repository that contains the representative genomes of all native fish populations in the Columbia River Basin, will require less than 1% of the overall research budget, and it will provide a tangible genetic legacy of the present biodiversity. The decline of anadromous fish is mostly from passage issues in the mainstem Snake and Columbia Rivers.

ISRP Issue Number 7: Shouldn't a Regional Center be a collaborative effort?

Response to Issue Number 7: A Regional Germplasm Repository should definitely be a collaborative effort. Ongoing cooperation between the states of Idaho, Oregon and Washington, two universities, regulatory agencies and Tribes facilitates this tool for archiving existing genetic material. For example, Idaho Department of Fish and Game stores endangered sockeye salmon gametes in the Snake River germplasm repository. The Grande Ronde spring chinook captive broodstock program and endangered Kootenai River white sturgeon gametes are stored in the germplasm repository. The Washington Department of Fish and Wildlife has recently requested storage space for Yakima River spring chinook gametes.

The Regional Germplasm Repository as a proposal is a collaborative efforts in terms of cooperation with the University of Idaho and Washington State University. Academic, management and regulatory agencies have conferred and discussed the merits of a regional program. As the program expands, it will rely on other agencies with expertise in a particular area to prioritize and samples species for gene banking. The Nez Perce Tribe is simply providing leadership and management of the repository because of its past involvement in the establishment of the Snake River germplasm repository.

ISRP Issue Number 8: Why is a new (versus renovated) building needed?

Response to Issue Number 8: A new building is proposed because of the lack of space available at the universities currently.

ISRP Issue Number 9: Why build on the opposite side of Moscow from the university? Why isn't it better to place this in very close proximity to either UI or WSU to maximize interaction and (presumably) minimize costs?

Response to Issue Number 9: The Alturas location was chosen for its close proximity to the universities (five minute drive to the University of Idaho), state-of-the-art facilities, and because it is a technology transfer partner with the University of Idaho. Moscow and Pullman are both very small communities. We proposed this as a stand-alone, independent facility to avoid university overhead costs and so the germplasm stored within is under the control of the salmon managers of the Columbia River basin.

ISRP Issue Number 10: The reviewers questioned why gametes would be collected from cutthroat trout for the repository when their population status has been judged healthy enough to preclude ESA listing.

Response to Issue Number 10: The reason cutthroat trout and other aquatic species' gamete collections are mentioned in the proposal is to collect gametes while the species is relatively healthy and abundant. Proactive collections, before the species is listed under the Endangered Species Act, are necessary to collect gametes before genetic bottleneck occur.

ISRP Issue Number 11: Please clarify the relationship of the proposed regional repository in this proposal and that proposed for Hagerman.

Response to Issue Number 11: There is no relationship between the proposed regional germplasm repository and the research experiment station in Hagerman. There are no competing interests for cryopreserving sperm in the Hagerman proposal.

ISRP Final Review Comments: "Fundable in part, continuing sperm preservation at a level similar to current efforts, but not to expand and elevate this to a Regional Center. This needs a high level scientific review such as by the ISAB that focuses on the state of the science of this strategy and its application in the FWP."

Sponsor Response: We are not currently pursuing funding for development of the Regional Germplasm Repository through NPCC/BPA at this time. However, a formal cryopreservation plan is being formulated and will be published in a peer-reviewed journal for scientific review and critique.

Literature Cited

Lichatowich, J., and S. Cramer. 1979. Parameter Selection and Sample Sizes in Studies of Anadromous Salmonids. Oregon Department of Fish and Wildlife Fish Division. Information Report Series Number 80-1. Portland, Oregon.

Marmorek, D. R., C. N. Peters, and I. Parnell (eds.) and thirty-two contributors. 1998. PATH final report for fiscal year 1998. Prepared by ESSA Technologies Ltd., Vancouver, British Columbia. 263 pages.

Skalski, J.R. et al. 1994. Statistical Survival Analysis of Fish and Wildlife Tagging Studies (SURPH.1). BPA project # 89-107. Bonneville Power Administration. Portland, Oregon.

INTERIM STANDARDS FOR THE USE OF CAPTIVE PROPAGATION TECHNOLOGY IN RECOVERY OF ANADROMOUS SALMONIDS LISTED UNDER THE ENDANGERED SPECIES ACT

Introduction

The following information addresses the elements of the *Interim Standards for the Use of Captive Propagation Technology in Recovery of Anadromous Salmonids Listed under the Endangered Species Act* document prepared by the National Marine Fisheries Service, Sustainable Fisheries Division–Hatchery/Inland Fisheries Branch (NMFS 1999).

This section of our composite report address the following program and projects:

Program: Grande Ronde Basin Chinook Salmon Captive Broodstock Program

Projects: 1998-01-001. Oregon Department of Fish and Wildlife. Grande Ronde Basin Spring Chinook Salmon Captive Broodstock Program.

1998-01-006. Nez Perce Tribe. Captive Broodstock Artificial Propagation.

1993-05-600. NOAA Fisheries. Assessment of Captive Broodstock Technologies.

1998-05-301. Nez Perce Tribe. Northeast Oregon Hatchery Management Plan.

1998-05-305. Oregon Department of Fish and Wildlife. Northeast Oregon Hatcheries Planning.

1998-00-704. Oregon Department of Fish and Wildlife. Northeast Oregon Hatcheries Implementation.

1998-00-702. Nez Perce Tribe. Grande Ronde Supplementation: Lostine River O&M and M&E.

1998-00-703. Confederated Tribes of the Umatilla Indian Reservation. Facility O&M and Program M&E for Grande Ronde Spring Chinook Salmon and Summer Steelhead.

1997-03-800. Nez Perce Tribe. Preserve Salmonid Gametes and Establish a Regional Salmonid Germplasm Repository

1998-05-305. Oregon Department of Fish and Wildlife. Northeast Oregon Hatcheries Planning.

Our response is organized to follow language from the document:

“Managers who plan to sponsor a captive propagation program should proceed through the following steps:”

1. Consider the alternatives to captive propagation and review the guidelines presented in the following sections of this document.

2. Evaluate the status of the population targeted for captive propagation and goals of the proposed program design using the decision issues listed in Table 1.

3. Shape the program proposal using the operational standards outlined in Table 2.

4. Develop a detailed captive propagation plan following the outline in Table 3.

5. Evaluate the proposal against the hazards and benefits listed in Tables 4 and 5.

Table 1. Decision Standards for Using Captive Propagation Technology to Recover Listed Anadromous Salmonids

Table 1. Issue 1. Population Status.

Guideline 1. Population is at a high risk of extinction in the immediate future.

- **d. Population is at very low abundance (e.g., <50 fish a year) OR**
- **e. Population is at low abundance and declining OR**
- **f. Population is at moderate abundance and declining precipitously OR**
- **g. Little or no natural production predicted for at least a full generation.**

The Grande Ronde spring chinook salmon *Oncorhynchus tshawytscha* population is part of the Snake River spring- and summer-run ESU, which once numbered approximately 1.5 million. Myers et al. (1998) listed the population size at 2,500 in 1997. The Grande Ronde Basin once supported large runs of chinook salmon, and estimated peak escapements in excess of 10,000 occurred as recently as the late 1950s (U.S. Army Corps of Engineers 1975). Natural escapement declines in the Grande Ronde Basin have been severe and parallel those of other Snake River populations. Reduced productivity has primarily been attributed to increased mortality associated with downstream and upstream migration past eight dams and reservoirs in the Snake and Columbia rivers. Reduced spawner numbers, combined with human manipulation of previously important spawning habitat, have resulted in decreased spawning distribution and population fragmentation of chinook salmon in the Grande Ronde Basin.

Escapement of spring/summer chinook salmon in the Snake River basin included 1799 adults in 1995, less than half of the previous record low of 3,913 adults in 1994. Catherine Creek, Grande Ronde River, and Lostine River were historically three of the most productive populations in the Grande Ronde Basin (Carmichael and Boyce 1986). However, productivity of these populations has been poor for recent brood years. Escapement (based on total redd counts) in Catherine Creek and Grande Ronde and Lostine rivers dropped to alarmingly low levels in 1994 and 1995. A total of 11, 3, and 16 redds were observed in 1994 in Catherine Creek, upper Grande Ronde River, and Lostine River, respectively, and 14, 6, and 11 redds were observed in those same streams in 1995. In contrast, the maximum number of redds observed in the past was 505 in Catherine Creek (1971), 304 in the Grande Ronde River (1968), and 261 in 1956 in the Lostine River (Tranquilli et al. 2003). Redd counts for index count areas (a standardized portion of the total stream) have also decreased dramatically for most Grande Ronde Basin streams from 1964-2002, dropping to as low as 37 redds in the 119.5 km in the index survey areas in 1995 from as high as 1205 redds in the same area in 1969. All streams reached drastically low escapement levels (0-6 redds in the index areas) in the 1990s except those in which no redds were found for several years and surveys were discontinued, such as Spring, Sheep, and Indian creeks, which had a total of 109 redds in 1969.

Number of redds in index areas of Catherine Creek, upper Grande Ronde River, Lostine River, and the entire Grande Ronde Basin, 1964-2002.

Year	Catherine Creek	Upper Grande Ronde River	Lostine River	Grande Ronde Basin Total
1964	41	172	114	916
1965	47	128	65	647
1966	15	143	107	932
1967	75	216	99	781
1968	73	304	106	915
1969	147	194	99	1205
1970	73	51	76	990
1971	235	129	76	996
1972	144	110	125	840
1973	222	52	138	912
1974	106	61	114	489
1975	42	42	33	296
1976	112	75	77	426
1977	10	92	25	247
1978	80	42	120	546
1979	41	7	21	100
1980	69	32	18	199
1981	22	38	8	122
1982	63	29	58	265
1983	58	49	39	220
1984	28	26	57	187
1985	32	70	68	393
1986	76	37	48	325
1987	152	106	49	526
1988	176	99	107	641
1989	38	0	20	122
1990	32	31	16	183
1991	19	10	11	119
1992	41	97	14	256
1993	63	88	66	483
1994	4	1	7	54
1995	7	5	6	37
1996	9	13	13	151
1997	21	10	27	157
1998	9	12	9	91
1999	17	0	40	99
2000	7	4	34	175
2001	33	2	41	282
2002	86	6	85	403

The ESA recognizes that conservation of listed species may be facilitated by artificial means while factors impeding population recovery persist (Hard et al. 1992). Often, the only reasonable avenue to build populations quickly enough to avoid extinction is through captive broodstock technology (Flagg and Mahnken 1995; Flagg et al. 1995; Flagg and Nash 1999; Flagg and Mahnken 2000; Flagg et al. 2000; Flagg et al. in review; Pollard and Flagg in review). The captive broodstock concept differs from that used in conventional hatcheries in that fish of wild origin are maintained in the hatchery through maturation and spawning (Flagg et al. 1995; Flagg and Nash 1999; Flagg et al. in review; Pollard and Flagg in review). Although not without risk, captive broodstock technology is sufficiently advanced to provide the measures necessary to amplify depressed populations and reduce extinction risk and reflect the Region's best science (Flagg et al. 1995; Schiewe et al. 1997; Flagg and Nash 1999; Pollard and Flagg in review). Program fish culture protocols follow accepted conservation hatchery guidelines developed by Hard et al. (1992), Kapuscinski and Jacobson (1987), NPPC (1999), and Flagg and Nash (1999). For Grande Ronde River chinook salmon, captive propagation techniques represent a viable and effective means of rebuilding populations strength and maintaining genetic variability quickly enough to avoid the consequences of inbreeding and possible populations extinction.

Guideline 2. Population is of very low abundance relative to available habitat and production potential, and short-term supplementation is deemed necessary to accelerate natural recovery.

See response provided for Table 1 Issue 1 Guideline 1 above.

Table 1. Issue 2. Importance of Population

Guideline 1. The population targeted for captive propagation is important, relative to other populations because:

The chinook salmon stocks cultured for this captive broodstock program are genetically and/or ecologically distinct. The Interior Columbia Basin Technical Recovery Team (ICBTRT) considered the Grande Ronde and Imnaha rivers to be a grouping separate from others in the Snake or Columbia River basins (ICBTRT 2003). The Independent Scientific Panel for the U.S. v Oregon dispute concluded "that a substantial component of the native spring chinook salmon populations in the Grande Ronde Basin still exists" and found "real biological differences" between Catherine Creek and upper Grande Ronde River populations (Currens et al. 1996). Within the Grande Ronde Basin, the ICBTRT found genetic and/or ecological differentiation between Wenaha River, Minam River, Lostine River, Catherine Creek and upper Grande Ronde River spring chinook salmon populations.

The following excerpt was taken from the 1991 status review of Snake River chinook salmon (Matthews and Waples 1991):

"Phenotypic, life history, and genetic data support the conclusion that Snake River chinook salmon are distinct in an ecological/genetic sense. In a cluster analysis of environmental data (stream gradient, precipitation, elevation, vegetation type, etc.), Schreck et al. (1986) demonstrated two distinct groups of Snake River localities, with one group including those from the Imnaha and Grande Ronde rivers and the other including those from the Salmon River. Both groups were quite distinct from other localities in the Columbia River Basin. Phenotypic data also indicate that the populations are structured geographically. Phenotypic data also indicate that the populations are structured geographically. The fact that juvenile migration behavior is the same for spring and summer chinook salmon in the Snake River, but different for these two forms in the upper Columbia River, strongly implies ecological/genetic differences between the regions. The precision required to migrate great distances from different natal streams and tributaries and return with high fidelity and exact timing to start the next generation 1 to 3 years later speaks of biological entities that are highly adapted to their particular environments. The differences detected by protein electrophoresis between Snake River spring/summer chinook salmon and chinook salmon in the lower and mid Columbia River Basin may be an indication of adaptive genetic differences at parts of the genome not sampled by protein electrophoresis. By comparison, the genetic differences found between different spring and summer chinook salmon populations within the Snake River are rather modest."

a. Unique genetic qualities.

The chinook salmon stocks cultured for this captive broodstock program are genetically and/or ecologically distinct. The Snake River spring/summer chinook salmon populations show "modest genetic differences but substantial ecological differences, in comparison with Columbia River stream-type populations" (Myers et al. 1998). Further, the data concerning Snake River chinook salmon populations, "suggest that Snake River spring/summer chinook salmon from individual streams exist as coherent populations" (Waples et al. 1993). They found distinct genetic differences among Minam River, Catherine Creek, Lostine River, and Lookingglass Hatchery (Rapid River) chinook salmon stocks. The Independent Scientific Panel for the U.S. v Oregon dispute concluded "that a substantial component of the native spring chinook salmon populations in the Grande Ronde Basin still exists" and found "real biological differences" between Catherine Creek and upper Grande Ronde River populations (Currens et al. 1996). The Interior Columbia Basin Technical Recovery Team (ICBTRT) considered the Grande Ronde and Imnaha rivers to be a grouping separate from others in the Snake or Columbia River basins (ICBTRT 2003). Within the Grande Ronde Basin, the ICBTRT found genetic and/or ecological differentiation between Wenaha River, Minam River, Lostine River, Catherine Creek, and upper Grande Ronde River spring chinook salmon populations.

b. Unique adaptations to specific habitats (e.g., adaptations in run timing, migration distance, and behavior).

The chinook salmon stocks cultured for this captive broodstock program are ecologically distinct. The ICBTRT found differentiation in smolt migration timing in spring chinook salmon stocks from the Wenaha River, Minam River, and Catherine Creek. The Independent Scientific Panel for the U.S. v Oregon dispute found "real biological differences" between Catherine Creek and upper Grande Ronde River populations (Currens et al. 1996).

The following excerpt was taken from the 1991 status review of Snake River chinook salmon (Matthews and Waples 1991):

"The habitat occupied by spring/summer chinook salmon in the Snake River appears to be unique to the biological species. In contrast to coastal mountains and the Cascade Range, the Snake River drainage is typified by older, eroded mountains with high plateaus containing many small streams meandering through long meadows. Much of the area is composed of batholithic granite that is prone to erosion, creating relatively turbid eater with higher alkalinity and pH in comparison to the Columbia River (Sylvester 1959). The region is arid, with warm summers, resulting in higher annual temperatures than in many other salmon production areas in the Pacific Northwest. These characteristics combine to produce a highly productive habitat for these fish. As previously mentioned, the Snake River alone once produced nearly half of the spring and summer chinook salmon returning to the Columbia River."

c. Low likelihood of successful natural recolonization from other populations in the event of extinction.

The likelihood of successful natural colonization from nearby populations is unknown. However, it would seem unlikely that a sufficient number of strays could find and colonize these streams, since all nearby chinook salmon populations are also declining, even those in wilderness areas. Further, reestablishing a self-sustaining population from strays would seem extremely unlikely.

d. High potential productivity, or unique social, economic, or cultural value.

Myers et al. (1998) reported that the Snake River once supported 1.5 million adult chinook salmon but in 1997 was approximately 2,500. The Grande Ronde Basin once supported large runs of chinook salmon *Oncorhynchus tshawytscha* and estimated peak escapements in excess of 10,000 occurred as recently as the late 1950s (U.S. Army Corps of Engineers 1975). In the Grande Ronde Basin, human alteration of spawning habitat has resulted in population fragmentation and reduced spawning distribution. Reduction in quantity and quality of rearing habitat has reduced the capacity of some streams in the Grande Ronde River subbasin to support juvenile spring chinook salmon. Juvenile production capacity has been reduced by approximately 30% in the upper Grande Ronde River and Sheep Creek, 20% in the Lostine River and Bear Creek, and 70% in the Wallowa River and Hurricane Creek (Carmichael and Boyce 1986). However, much spawning and rearing habitat still exists but is underutilized, given the recent drastic decrease in population size with little change in available habitat.

The Grande Ronde River subbasin once supported fisheries that were an important part of tribal cultures and economies (ODFW 2001). These fisheries included both anadromous and resident populations and a variety of species. As European settlement came to the area, the fisheries were woven into the culture of these new inhabitants as well. An objective of the Lower Snake River Compensation Plan is to reestablish historic tribal and recreational fisheries.

Table 1. Issue 3. Scale of Project

Guideline 1. Total captive production should be based on the number of fish needed to:

a. Prevent extinction.
b. Adequately represent genetic variation for life history traits of the wild population.
c. Minimize genetic change during captivity.
d. Reestablish the fish in the wild.

The goal of the Grande Ronde Basin Chinook Salmon Captive Broodstock Program is to prevent extinction of the three program populations. Escapement to the upper Grande Ronde River, Catherine Creek, and Lostine River dropped to alarmingly low levels in

1994 and 1995. A total of 11, 3, and 16 redds were observed in 1994 in Catherine Creek, upper Grande Ronde River, and Lostine River, respectively, and 14, 6, and 11 redds were observed in those same streams in 1995. In contrast, the maximum number of redds observed in the past was 505 in Catherine Creek (1971), 304 in the Grande Ronde River (1968), and 261 in 1956 in the Lostine River (Tranquilli et al. 2003). Escapement for Lostine River, Catherine Creek, and upper Grande Ronde River chinook salmon exceeded 150 adults (threshold) nearly 100% of the time during 1964-1974. However, from 1975-1994 escapement in each of these streams exceeded this threshold only 54-61% of the time, and escapement has exceeded 150 fish 0-56% of the years since 1994. Reduction of spawning escapements below this threshold indicates a high and unacceptable risk to the persistence of these populations; thus, we developed the captive and conventional broodstock programs to attempt to alleviate this risk.

The Biological Requirements Work Group (1994) developed “threshold” escapement levels for use in their analyses, based on considerations of demographic and genetic risk. These threshold levels represent escapement levels at which qualitative changes in processes are likely to occur and below which uncertainties about processes or population enumerations are likely to become significant. For spring chinook salmon populations, they decided on a level of 150 naturally spawning adults annually for small populations, such as Lostine River, Catherine Creek, and upper Grande Ronde River. Our take of 500 parr each year from each stream is based on producing 150,000 F_1 generation smolts to reach an annual threshold population goal of 150 spawning adults returning to each stream. These figures are based on a series of survival and production assumptions based on a literature review and ODFW hatchery experience (ODFW 1996).

Genetic change during captivity and the possible influence that stray captive broodstock progeny may have on unsupplemented chinook salmon populations are also concerns for this program. We address these concerns in four ways. First, our collection target of 500 fish per stream per year and our protocol for collecting parr from the entirety of their distribution in each stream are designed to result in a captive population that is representative of the entire wild population. Second, we do all we can to maximize captive broodstock survival to maturation. This insures that the maximum amount of genetic diversity within the captive broodstock program is passed on to the F_1 generation and released back to nature in the streams from which their parents were collected. Third, we spawn the fish within a matrix in which eggs from each female are fertilized by 2-4 males, and each male may fertilize up to four females (see Table 2, Issue 2, Guideline 3.a). The matrices are developed semi-randomly, with an avoidance for spawning males and females of the same cohort, to avoid possible sibling crosses. Fourth, all captive broodstock offspring are marked so that they can be visually identified at the weir and released above it to insure that any fish collected for the captive broodstock program is the result of at least one lifecycle in nature.

Guideline 2. Duration should be as short as possible (one to three generations).

The Grande Ronde Basin Chinook Salmon Captive Broodstock Program was developed to achieve a sustained annual return of at least 150 wild chinook salmon to each program stream. Captive broodstock fish are reared from collection as parr through maturation, spawned and their progeny reared to the smolt stage and released into the stream from which their parents were collected. These progeny return and spawn naturally, hopefully with wild fish, and their offspring complete a natural cycle. This cycle typically requires 1-5 years of captive rearing to reach maturity and spawn, 1.5 years of F_1 juvenile rearing to smolt and release, 1-3 years for F_1 adult returns, and 1.5 years for natural F_2 smolt production, and 1-3 years for F_2 adult returns. Hence, to completely evaluate a cycle of three generations requires up to 14 years. The program also has an experimental component, the design of which requires a minimum of five cycles, thus requiring 19 years for completion.

The captive broodstock program began in 1995 with the collection of the 1994 cohort. We first released captive broodstock offspring in 2000 (1998 cohort), and we have completed two full generations as of the 2003 spawn. We are seeing increasing populations of the program stocks. However, counts of chinook salmon passing Lower Granite Dam and our redd counts and population estimates in the Grande Ronde Basin fluctuate dramatically with changes in environmental conditions. For example, the 1998 cohort was strong, while the 1999 cohort may be a near failure, probably due to poor downstream migration conditions caused by drought in the region. Achieving the target of a sustained return of 150 wild chinook salmon in each stream will determine the longevity of the program.

Table 1. Issue 4. Measures of Success

Guideline 1. Successful programs will:

a. **Substantially reduce risk extinction.**
b. **Cause minimal genetic change in comparison with the original source population.**
c. **Reintroduce fish that are phenotypically similar to wild fish of the same age in development, morphology, physiological state, and behavior.**
d. **Increase the number of fish reproducing successfully in the wild.**

The goal of the Grande Ronde Basin Chinook Salmon Captive Broodstock Program is to “prevent extinction of the three populations and provide a future basis to reverse the decline in stock abundance of Grande Ronde River chinook salmon and ensure a high probability of population persistence well into the future once the causes of basin wide population declines have been addressed” (ODFW 1996). We have made progress towards this goal in that we have been successful in releasing captive broodstock offspring and those offspring have returned to spawn in the wild—the first full cohort to return has done so at a rate exceeding expectation. However, we recognize that the final measure of success will be the production and return of an F_2 generation. We have a program designed to monitor and evaluate this based on genetics and comparisons of population sizes between years when these streams were unsupplemented and between streams with no supplementation (Minam and Wenaha rivers).

Two associated objectives for this program are to maintain the genetic diversity of indigenous artificially propagated chinook salmon populations and that of wild chinook salmon populations. This program strives to develop fish culture methods that can be used to prevent extinction in other similar populations while maintaining the physiological, developmental, morphological, and behavioral traits of those populations.

To prevent genetic changes caused by human intervention, we spawn the fish within spawning matrices that ensure that eggs from each female are fertilized by sperm from 2-4 males, and that each male fertilizes eggs of up to four females. These matrices are developed to avoid crosses within cohorts, (to prevent sibling crosses), but crosses are otherwise randomly selected from within the available ripe fish for each spawn. We also mark all captive broodstock offspring and do not allow their collection at weirs for conventional hatchery broodstock. This ensures that a lifecycle is spent in nature to prevent domestication. To monitor for potential genetic changes we are collecting tissue samples from all captive broodstock fish and from all fish captured at weirs and carcasses found during spawning ground surveys. These tissues will be analyzed for genetic changes.

Table 1. Issue 5. Changing or Terminating Program

Guideline 1. If risk of immediate extinction lessens because causes of decline are corrected, terminate or phase into a conventional supplementation program.

Myers et al. (1998) reviewed the causes of declines in Snake River spring chinook salmon runs: “Mainstem Columbia and Snake River hydroelectric development has resulted in a major disruption of migration corridors and affected flow regimes and estuarine habitat. There is habitat degradation in many areas related to forest, mining and grazing practices, with significant factors being lack of pools, high temperatures, low flows, poor overwintering conditions, and high sediment loads.” It would seem highly unlikely that the causes of decline will be corrected quickly. A conventional hatchery supplementation program (funded by LSRCP) is now in place in each of the program streams and a plan has been developed to eventually replace the captive broodstock program with the conventional program (CTUIR et al 2002).

Guideline 2. If program increases numbers of successful natural spawners, increase the proportion allowed to spawn naturally.

The Biological Requirements Work Group (1994) developed “threshold” escapement levels for use in their analyses, based on considerations of demographic and genetic risk. Our take of 500 parr each year from each stream is based on producing 150,000 F_1 generation smolts to reach an annual threshold population goal of 150 spawning adults returning to each stream. These figures are based on a series of survival and production assumptions based on a literature review and ODFW hatchery experience (ODFW 1996). This program and the associated Lower Snake River Compensation Plan conventional hatchery program were also developed with a sliding scale for collection of adults at weirs for conventional hatchery production. As escapement increases, a lower percentage of the run may be collected (up to the number needed for production). At escapement levels below 250 fish, 40% of the wild and hatchery (non-captive broodstock fish) may be collected. At escapement of 251-500 fish, no more than 20% of the wild and hatchery (non-captive broodstock fish) may be collected. At escapement of >500 fish, no hatchery-reared fish, and no more than 20% of the wild run may be collected.

Guideline 3. If substantial progress has not been made toward recovery at the end of the end of three complete generations and no progress has been made toward correcting the causes of decline, reevaluate program.

We have completed two full generations as of the 2003 spawning season, and we are seeing increasing populations of the program stocks. However, counts of chinook salmon passing Lower Granite Dam and our redd counts and population estimates in the Grande Ronde Basin fluctuate dramatically with changes in environmental conditions. For example, the 1998 cohort was strong, while the 1999 cohort may be a near failure, probably due to poor downstream migration conditions caused by drought in the region. The Grande Ronde Basin Chinook Salmon Captive Broodstock Program is constantly being evaluated for improving protocols and the necessity of continuing the program. Evaluations are done at the level of the Technical Oversight Team (TOT; comprised of research, fish culture and management biologists from each of the comanagement agencies for Grande Ronde Basin Chinook Salmon Captive Broodstock Program) and the level of the Chinook Salmon Captive Propagation Technical Oversight Committee (TOC; BPA-facilitated group comprised of biologists from agencies conducting captive broodstock programs within the Snake River Basin and permitting agencies).

Guideline 4. If negative effects of captive propagation appear, the program should be altered or terminated.

The Grande Ronde Basin Chinook Salmon Captive Broodstock Program is constantly being monitored and evaluated for negative effects at the TOT and TOC levels. No negative effects associated with captive rearing that would threaten these stocks have been observed. We modify protocols as needed to improve our success at rearing the captive broodstock and producing offspring for release.

Table 2. Operational Standards for using Captive Propagation Technology to Recover ESA-Listed Anadromous Salmonids

Table 2. Issue 1. Choice of Broodstock.

Guideline 1. If all remaining individuals of the population of wild fish targeted for recovery are not incorporated in the captive broodstock, develop a broodstock selection protocol to ensure that the genetic and life history variability of the target population is reflected in the captive broodstock.

All salmon used for this program are collected as parr in August and September. We attempt to collect 500 spring chinook salmon parr from each of Catherine Creek, Grande Ronde River, and Lostine River. Fifty fish is the minimum number that will be acceptable for a stock within a year. If fewer than 50 fish are collected, they are returned to the river. Collections are made from throughout the drainage to ensure that the captive broodstock is representative of the population. Information from the ODFW Early Life History crew and reconnaissance surveys is used to determine fish distribution within each stream and from where to collect fish. We also use data of the number of redds from the previous year's spawning ground survey. No bias is made for fish size during collections, but precociously maturing males are not collected if captured.

Number of spring chinook salmon parr collected from the 1994-2001 cohorts in Catherine Creek, upper Grande Ronde River, and Lostine River from 1995-2002.

	Stream		
Cohort	Catherine Creek	Grande Ronde River	Lostine River
1994	498	110	499
1995	500	2	481
1996	500	500	501
1997	500	500	500
1998	500	500	498
1999	503	0	500
2000	503	502	503

2001	500	461	500

Guideline 2. Continual infusion of wild fish into successive year classes of the broodstock may slow domestication of captive propagated fish.

Each cohort collected has been composed entirely of fish spawned in the wild. Beginning with the collection of the 2001 cohort (in August 2002), there is the possibility of collecting captive broodstock F_2 generation fish—offspring of captive broodstock F_1 generation, which were released as smolts and allowed to complete their lifecycle in nature. There will be no efficient means for us to determine the parentage of the fish that we collect. However, the fish that we will collect will be the result of one entire lifecycle in the wild and can be considered to be wild.

Table 2. Issue 2. Captive Broodstock Spawning.

The guidelines established for captive broodstock spawning incorporate the "best practice" genetic advice for maintaining the population's original genetic diversity. These guidelines include: 1) equal representation of all family lines in spawning, 2) retrieving all possible eggs from mature females, 3) using spawning protocols that maximize the effective population genetic size, 4) using factorial spawning designs, 5) using cryopreserved sperm, and 6) using induced spawning to maximize reproduction. The purpose of these guidelines is to maintain as much of the natural genetic variation in the population as possible.

Guideline 1. Spawn all available adults.

Every effort is made to spawn all available adults. Eggs from each female are divided into approximately equal cells and fertilized with sperm from at least two and as many as four males—males fertilize eggs from up to four different females.

Guideline 2. Retrieve all possible eggs from mature females, either by multiple live spawnings or through careful attention to ripeness and handling.

Female ripeness is assessed once per week as spawning progresses. Females are anesthetized and gently handled to assess the onset of ovulation. All female chinook salmon are euthanized at spawning, and every effort is made to remove all potentially viable eggs from the body cavity of each fish.

Guideline 3. Use spawning protocols that maximize the effective genetic population size:

a. Factorial or (with greater numbers of parents) single-pair matings.

Spawning has occurred each year since 1998. Our objective is an equitable contribution to the next generation by all mature fish, within disease and survival constraints but without resorting to culling healthy eggs to equalize family contributions. We have focused on equalizing each parent's contribution to the next generation by maximizing the number of family groups (individual male x female combinations used in spawning) in each matrix, ensuring female fertilization by more than one male, preferring that males fertilize eggs from more than one female and maximizing family group numbers in each matrix for a given number of spawners (i.e., a 2 x 2 matrix is preferred over a 1 x 3 matrix). The spawning matrix ratio and age distribution of the spawners is used to assign fish of a specific age, sex, and treatment to each matrix. Our goal is to emphasize crosses between different age classes to reduce the likelihood of sibling crossing (this has been facilitated by our result that most males mature at ages 2 and 3 while nearly all females mature at age-4 or older). Sperm motility is checked for each male and if it is non-motile, the male is returned to the holding tank for possible use later (if motile sperm are eventually produced). Program spawning protocols are adjusted, as necessary, to maximize program success.

We begin by assigning females, then males to matrices. When we have to use more than one fish from a given age class, we initially target mates from a different age class and then target mates from the age class with the greatest number of fish. For example, if we were using a matrix that called for three males, our preference would be one male from each age class (e.g., two, three or four years). Our second choice in this example would be to have two males from the age class with the greatest number of fish and one male from a second age class. Our last choice would be to have three males from one age class, especially the same age class as the female.

Based on genetic and logistic considerations, we prefer equal numbers of males and females in each matrix, e.g., 4 x 4, 3 x 3, or 2 x 2 matrices (in that order). One-by-one (1 x 1) matrices and any matrix with only one male are not used. The female:male ratio (X) will fall into one of 11 categories and each category is associated with a particular spawning matrix (see table).

Spawning categories with associated sex ratios (X) for development of spawning matrices.

Spawn category	Spawning population sex ratios (female/male)	Spawning matrix ratio	Spawning criteria and comments
A	X > 77.5/22.5	4 : 1	4 x 4; 1 fresh and 12 cryo (1 fresh with 3 cryo males/female); 50% eggs with fresh
B	77.5/22.5 > X > 69.5/30.5	3 : 1	3 x 4; 1 fresh and 9 cryo (1 fresh with 3 cryo males/female); 50% eggs with fresh
C	69.5/30.5 > X > 63.0/37.0	2 : 1	Matrix matches spawning matrix ratio; if cryo is used, 2 x 4; 1 fresh and 6 cryo (1 fresh with 3 cryo males/female); 50% eggs with fresh
D	63.0/37.0 > X > 58.5/41.5	3 : 2	Matrix matches spawning matrix ratio
E	58.5/41.5 > X > 55.0/45.0	4 : 3	Matrix matches spawning matrix ratio
F	55.0/45.0 > x > 45.0/55.0	1 : 1	Matrix matches spawning matrix ratio
G	45.0/55.0 > X > 41.5/58.5	3 : 4	Matrix matches spawning matrix ratio
H	41.5/58.5 > X > 37.0/63.0	2 : 3	Matrix matches spawning matrix ratio
I	37.0/63.0 > X > 27.0/73.0	1 : 2	Matrix matches spawning matrix ratio
J	27.0/73.0 > X > 22.5/77.5	1 : 3	Matrix matches spawning matrix ratio
K	22.5/77.5 > X	1 : 4	Matrix matches spawning matrix ratio

If accurate estimates of sex ratios for a population (i.e., the stock and treatment within which spawning will be conducted, e.g., Catherine Creek freshwater) are available, the 'preferred matrix development protocol' is employed throughout the spawning season. Population sex ratios should be made prior to the first spawn (we hope to improve this by using ultrasound or near infrared spectroscopy). Ripeness sorts are conducted on a weekly basis throughout the spawning season, which provide information on fish available for spawning each week by cohort, population, treatment, and sex; these are not populations sex ratios and are not used to determine sex ratios for matrix development purposes. If accurate sex ratio estimates are not available, a backup protocol is used.

The sex ratios for each population and treatment, as determined prior to the first spawn, are the target sex ratios used to develop spawning matrices throughout the spawning season. During each week of spawning these sex ratios are used for developing successive matrices until there are too few fish of either sex available to meet the target sex ratio for the respective population/ treatment combination. At this time, the criteria for the 'Backup matrix development protocol' is employed. For example, if the target sex ratio is 3:2 (female:male) and there are 19 fish to spawn (11 females and 8 males), then the first three matrices would fall into category 'D' (3 x 2 matrices), which would leave 2 females and 2 males which would fall into category 'F' and would be spawned in a 2 x 2 matrix.

The preferred ratio is one that falls in Category F (e.g., 1:1 sex ratio). Under Category F, we will spawn fish in either a 4 x 4, 3 x 3, or 2 x 2 (female x male) matrix. Since 1 x 1 matrices will not be used, we may have to use one of the two smaller matrix configurations to avoid the possibility of 1 x 1 matrices. For example, when the sex ratio calls for use of Category F and ten fish are available (e.g., 5 females and 5 males), we will use one 3 x 3 matrix and one 2 x 2 matrix rather than one 4 x 4 and one 1 x 1 matrix.

The backup protocol is employed when too few fish of either sex are available to meet the target sex ratio under the 'preferred matrix development protocol' or the population sex ratio is unknown. Ripeness sorting is conducted throughout the spawning season to provide information on cohort, population, treatment, and sex of fish available for spawning. Each week, when this process is completed, we determine the female:male ratio by population and treatment of fish that are ready to spawn. For each population and treatment, we assign a spawning category (A-K) and develop the first matrix based on the spawning matrix ratio associated with that spawning category (generally we expect to be in categories E, F, or G). After the first matrix is assigned, we recalculate the female:male ratio of the remaining spawners for that population and treatment and use the appropriate matrix to spawn. This is an iterative process that occurs after each successive matrix assignment.

b. Cryopreserved sperm (benefits of using cryopreserved sperm should be weighed against potential for loss of viability, especially when the number of eggs is low).

Cryopreserved semen is used whenever there are fewer than two fresh males available for a spawning matrix—except in rare circumstances, at least one fresh male is used with every female. Whenever cryopreserved semen is used, each female is spawned with as many males as possible—up to four males (e.g., one fresh male and three cryopreserved semen samples). For example, if there is only one female and one fresh male from a given population and treatment for a matrix, then three cryopreserved semen samples of the same population and treatment are used to make a 1 x 4 matrix. If there is more than one female, but only one fresh male for a matrix, then the fresh male is used with each female, and cryopreserved semen from three separate males is used for each female in the matrix in order to make a series of 1 x 4 matrices. This results in the use of one fresh male and as many as 12 cryopreserved semen samples to fertilize the eggs from a maximum of four females. If sufficient cryopreserved semen is not available to develop a four-male matrix, then cryopreserved semen may be used to fertilize the eggs from more than one female. When one fresh male is used in a matrix with cryopreserved semen, the eggs from each female in the matrix are divided as follows: 50% of the eggs are fertilized by the fresh male and 50% are fertilized by cryopreserved semen. For example, if one fresh male and three cryopreserved samples are used, then 50% of the eggs will be fertilized by the fresh male and 16.7% of the eggs will be fertilized by each of the three cryopreserved semen samples. This is done because of low mean fertilization rate of cryopreserved semen (34%) vs. fresh semen (80%) (Hoffnagle et al. 2003).

Due to large differences in the fertilization rates between fresh and cryopreserved semen (Hoffnagle et al. 2003), we are examining this allocation of eggs between fresh and cryopreserved males. The present allocation system gives priority to female contribution to the F_1 generation and, hence, to smolt production, at the expense of cryopreserved male contribution. However, increasing the contribution of cryopreserved males will decrease the female contribution (and production). We are hoping to develop a strategy that will be more equitable to cryopreserved males while not seriously reducing female contribution.

Selection of cryopreserved semen to be used for spawning is done as follows. First, determine the population, treatment, and cohort needed for the matrix. Second, randomly select a cryopreserved semen sample from all available samples for the appropriate population, treatment, and cohort. Lastly, activate part of the semen sample and check it for motility (present or absent). If motility is present, this sample will be used in the matrix. If motility is absent, this sample will not be used in the matrix and another sample will be randomly selected.

c. Induced spawning.

Hormone analog implants (GnRHa) are used only in a few maturing male chinook salmon. This is done just prior to the expected begin of spawning to insure that ripe males are available for any females that ripen.

Table 2. Issue 3. Rearing of Fish.

Fish husbandry protocols follow standard fish culture practices (for a general overview of methods, see Leitritz and Lewis 1976; Piper et al. 1982; Rinne et al. 1986; Erdahl 1994; IHOT 1995; McDaniel et al. 1994; Bromage and Roberts 1995; Schreck et al. 1995; Pennell and Barton 1996; NMFS 1999; Wedemeyer 2001). Other protocols and guidelines are approved by the TOT and discussed by the TOC.

Chinook salmon are reared in ODFW and NMFS facilities during two distinct phases of their lifecycle: captive juvenile phase and captive adult phase. During each of these phases, the fish are reared and under one of two rearing regimes: natural vs. accelerated growth (captive juvenile phase) and saltwater vs. freshwater (captive adult phase).

Captive Juvenile Phase

After collection, the fish are transported to Lookingglass Fish Hatchery (1994-2001 cohorts) or Wallowa Fish Hatchery (2002 and future cohorts) where they are measured for length and weight, checked for external parasites, and randomly assigned to one of two presmolt treatment groups: accelerated or natural growth. Beginning with the 2000 cohort, one half of the fish were reared under each presmolt growth regime. Previous cohorts were divided into thirds, with one-third of the fish being reared under the accelerated growth regime (destined to be Freshwater Accelerated group) and two-thirds reared under the natural growth regime (Freshwater Natural and Saltwater Natural groups).

Treatment of natural and accelerated groups differs based on water temperature and food ration (which is based on the ability of fish to metabolize food at a given temperature). The "natural" growth treatment group is raised under a simulated natural growth regime that is designed to produce smolts that are of a size similar to that seen in wild salmon from the Grande Ronde Basin (approximately 23 g). Temperature for natural growth groups decreases to approximately 5°C (the lowest that we are able to chill water), simulating a natural decrease in winter water temperature. The accelerated growth treatment maintains the fish at approximately 14°C throughout the winter, and the fish are fed to satiation to encourage maximum growth. All treatments are reared under a simulated natural photoperiod that is adjusted every two weeks. The captive broodstock fish fed Moore-Clarke Nutra Plus food of an appropriate size for the size of the fish. In November, three months after capture, the parr are implanted with a Passive Integrated Transponder (PIT) tag to individually identify them.

Photoperiod and temperature regimes for captive broodstock parr (2000-2001 example dates).

	Photoperiod			Temperature (°C)	
Beginning date of treatment	Time on	Time off	Total hours of light	Natural treatment	Accelerated treatment
17 Aug	423	1928	15.1	12.2	12.2
31 Aug	442	1903	14.3	12.2	12.2
14 Sep	500	1835	13.6	12.1	12.2
28 Sep	517	1808	12.8	11.6	12.2
12 Oct	535	1742	12.1	10.0	12.2
26 Oct	553	1720	11.4	6.0	12.2
09 Nov	611	1701	10.8	5.0	12.2
23 Nov	629	1649	10.3	5.0	12.2
07 Dec	644	1643	10	5.0	12.2
21 Dec	654	1646	9.9	5.0	12.2
04 Jan	658	1657	10	5.0	12.2
18 Jan	654	1712	10.3	5.0	12.2
01 Feb	642	1731	10.8	5.0	12.2
15 Feb	624	1750	11.4	5.0	12.2
01 Mar	601	1809	12.1	5.0	12.2
15 Mar	536	1827	12.8	5.0	12.2
29 Mar	509	1846	13.6	6.8	12.2
12 Apr	443	1905	14.4	7.6	12.2
26 Apr	417	1924	15.1	9.4	12.2
10 May	355	1943	15.8	11.0	12.2

We have employed a set of protocols to prevent diseases that are known threats to the program. First, a subsample of the incoming parr is visually checked for the presence of parasitic copepods. Second, parr receive a prophylactic treatment for bacterial kidney disease (BKD) by either a 10 day azithromycin medicated feeding as soon as possible after collection and adjustment to feeding or an intraperitoneal injection of erythromycin or azithromycin on the day of capture. Two or three additional prophylactic treatments (the number has varied) with erythromycin are given to the fish through the year. The 1998, 1999, and 2000 cohorts were given an injection of a BKD vaccine (Renogen). However, this was discontinued with the 2001 cohort because it has not appeared to be sufficiently effective in our program to warrant the additional handling and stress. Also, to prevent vibriosis, a vibrio inoculation is given to all fish at least two weeks prior to transfer to saltwater. Although vibriosis is a disease of saltwater-reared fish only, the inoculation is given to all fish to maintain consistency of treatment between experimental groups.

Captive Adult Phase

Rearing from smolt to adult is accomplished in either freshwater (Bonneville Fish Hatchery; BOH) or saltwater (Manchester Marine Laboratory; MML). Beginning with the 2000 cohort, one half of the fish (50% of the natural growth group and 50% of the accelerated growth group) were/will be transferred to each of BOH and MML. In previous years, one third (one half of the natural growth group) of the fish were reared in saltwater and two thirds (one half of the natural growth group and all of the accelerated growth group) were reared in freshwater.

At smoltification, (early May), the fish are transported to either BOH or MML. Transfer of the majority of the saltwater fish is preceded by the transfer of ten sentinel fish, in early May, to ensure that they have smolted and will thrive in saltwater. Sentinels are transferred to MML and placed in 278 L tanks filled with freshwater. After they have been placed in the tank, saltwater is added to the tank at a rate of 7.6 L/min to replace the freshwater. The fish are fed after two days and are observed closely for feeding behavior and signs of acclimation. If the sentinel fish survive and are actively feeding within seven days, then the remainder of the saltwater fish is transferred. If not, an additional ten sentinels are transferred and the process is repeated until the sentinels adapt well to saltwater. This method has worked very well to insure successful transfer to saltwater.

Fish at both BOH and MML are reared in separate tanks for each stock and cohort, except for remaining five- and six-year old fish, which are combined within each stock. All fish are reared on a simulated natural photoperiod. At age 2, a Visual Implant (VI) tag is inserted in each fish for use as a secondary tag in case of loss of the PIT tag. The fish are fed according to their size and observed for general health.

The fish are also administered erythromycin as a prophylactic treatment for BKD at least twice each year (approximately December and June). The dose of erythromycin is 100 mg/kg fish weight/day with fish pills comprising about 30% of the feed for 28 days with a seven day withdrawal period before further handling or other stress. Other diseases are treated as needed.

The fish are sampled for growth (length and weight) and general condition during quarterly sampling in which 25 fish or 25% (whichever is greater) of each population, cohort, and treatment are examined. Once each year (April/May, in conjunction with maturity sorting), all fish are examined, weighed, and measured. For handling, all fish are anesthetized using MS-222 and are sometimes treated with hydrogen peroxide (1:3500 for one hour) after handling if fungal infection is a concern.

Bonneville Fish Hatchery

At BOH, captive broodstock fish are reared in pathogen-free, well water that ranges in temperature from 8.9-11.1°C. Water flows into the tanks at a rate of 270-795 L/min, depending on the density of fish in the tanks, which has ranged from 0.28-9 kg/m^3. The highest densities occur when a cohort reaches four years of age and has not suffered much mortality. The fish are fed Moore Clarke 2-8.5 mm pellets at rates ranging from 2% of body weight for small fish to 0.37% for the largest fish.

Manchester Marine Laboratory

At MML, the fish are reared in filtered seawater from Puget Sound. Temperature ranges from 7-13°C (chillers maintain temperature at or below 13°C). Flow into the tanks ranges from 95-284 L/min, depending on the number and size of fish in the tank. Rearing density is kept below 8 kg/m^3. The fish are fed Moore-Clarke 2.5-8.5 mm pellets and at a rate of 0.5-2% of body weight/day. Automatic feeders feed the fish approximately eight times each day.

Guideline 1. As much as possible, mimic wild rearing conditions (light, cover, substrate, flow, temperature, densities) for fish to be released in the wild.

No captive broodstock fish are released into the wild. Progeny of captive broodstock fish are reared until smoltification and released into the stream from which their parents were collected.

Guideline 2. Facilities for freshwater rearing should have pathogen- and predator-free water supplies.

All freshwater rearing is done in pathogen-free well or spring water. At Lookingglass Fish Hatchery and Bonneville Fish Hatchery, well water was pumped for captive broodstock rearing. At Wallowa Fish Hatchery, well water is used for rearing under the accelerated growth regime and spring water for the natural growth regime. The spring was capped with large gravel to prevent colonization by fish and use by birds that may introduce diseases or parasites.

Guideline 3. Fish being transferred to seawater for rearing or release should be handled so as not to compromise their ability to adapt to seawater.

One half of the captive broodstock chinook salmon is reared in saltwater at the NOAA Fisheries Manchester Research Station located on Puget Sound. Transfer of the majority of the saltwater fish is preceded by the transfer of ten sentinel fish to ensure that they have smolted and will thrive in saltwater. Sentinels are transferred to MML and placed in 278 L tanks filled with freshwater. After they have been placed in the tank, saltwater is added to the tank at a rate of 7.6 L/min to replace the freshwater. The fish are fed after two days and are observed closely for feeding behavior and signs of acclimation. If the sentinel fish survive and are actively feeding within seven days, then the remainder of the saltwater fish is transferred. If not, an additional ten sentinels are transferred and the process is repeated until the sentinels adapt well to saltwater. Fish are handled with extreme care and kept in water to the maximum extent possible during transport and processing procedures. Transportation of smolts to seawater occurs in insulated containers, and temperature is not allowed to rise more than 2°C. Transport containers are continuously supplied with oxygen supply to maintain dissolved oxygen at full saturation. The containers are loaded at no more than 59.7 kg/m^3 (0.5 pounds/gallon).

Guideline 4. Seawater-based rearing facilities should minimize the effects of storms, harmful phytoplankton, predation, poaching, and disease.

Seawater rearing is conducted at the NOAA Fisheries Manchester Research Station located on Puget Sound. An advantage of the site is the excellent seawater quality: annual seawater temperature at the site ranges between 7-13°C and salinity ranges between 26-29 ppt. A 700 m pipeline supplies about 4,730 Lpm of seawater into the station. A 400 m^2 seawater laboratory contains six 4.1 m, four 3.7 m, and six 1.8 m diameter circular fiberglass tanks. A 1,280 m^2 facility houses twenty 6.1 m diameter circular fiberglass tanks. Incoming seawater is filtered down to a 5.0 F particulate size and passed through UV-sterilizers to prevent pathogens from entering rearing tanks. Sensors monitor water flow and pressure through the seawater filtration/sterilization system. Before entering fish rearing tanks, the processed seawater is passed through packed column degassers to remove excess nitrogen and boost dissolved oxygen levels. An emergency generator is automatically activated in the event of a power failure. In addition, the tanks are directly supplied with oxygen to maintain life support in the event of an interruption in water flow. Tanks where maturing fish are held are supplied with combinations of ambient and chilled water. The MML complies with Washington State Department of Fish and Wildlife quarantine certification standards by depurating all effluent from the captive broodstock rearing areas with ozone.

Guideline 5. Managers should consider equalizing the contribution of all parents to the next generation to maximize effective population size and reduce artificial selection in the captive environment.

Contribution of parents is equalized in two ways. First, males and females are crossed in a matrix design such that the contribution of any particular male or female is spread amongst several crosses (see Table 2, Issue 2, Guideline 3.a). This serves to decrease the loss of contribution from an individual in case of complete loss of an egg lot (cell within a matrix) or if the cross is less successful than others (male or female fertility is low). Second, numbers of eggs and the amount of sperm is equalized for each matrix cross (each female's eggs are evenly divided and fertilized with sperm from 2-4 males).

The TOT has decided that no viable embryos will be destroyed for the purpose of equalizing parental contribution. However, when more offspring are produced than can be reared to smolt at Lookingglass Fish Hatchery, the excess fish have been released as parr into previously selected outlet streams. In this instance, the fish to be released as parr have come from a portion of the eggs of many females.

Table 2. Issue 4. Release of Fish.

Guideline 1. Release fish at a life stage and size where their probability of survival to adulthood is greatest.

Smolts have been chosen as the preferred life stage to release fish because they have proven to provide a substantial egg-to-adult survival advantage over presmolt releases in the Grande Ronde Basin (Carmichael 1998). However, we have contingencies for release of other life stages when captive broodstock production exceeds that required for program needs and/or the ability of Lookingglass Fish Hatchery to rear the fish to smolt at the program density. In these instances, we have predesignated outlet streams in the basin of each program stream into which we release the fish as parr. These are streams with historic chinook salmon runs and suitable habitat remains, but there are currently few or no chinook salmon in them. Also, excess Catherine Creek progeny have been designated to be used to restore the chinook salmon population in Lookingglass Creek.

Guideline 2. Acclimate fish to locations in the watershed where they are intended to return.

All fish released as smolts are acclimated prior to release. Presmolt releases of fish in excess of that capable of being reared at Lookingglass Fish Hatchery are released directly into the streams. Acclimation sites are located on each of the program streams within areas of known spawning activity, suitable rearing habitat and are supplied with unfiltered stream water. Acclimation time has varied from two to four weeks.

Guideline 3. Design release strategies to integrate fish from captive propagation programs with wild fish at the same life history stage, if any remain in the natural system.

The Grande Ronde Basin Chinook Salmon Captive Broodstock Program is designed to release fish as smolts in order that the fish will imprint on the home stream but to minimize interaction with wild juveniles. The fish are released at the approximate time during which wild fish are smolting and beginning their downstream migration. Presmolt releases are preferred in areas in which natural production is low or nonexistent in order to minimize hatchery:wild interaction.

Guideline 4. When fish are likely to remain in the release area (for example presmolts or residuals), disperse the releases.

When parr are released, they are dispersed evenly within the release area. When smolts are released, they are given a period in which they can leave the acclimation ponds volitionally (7-14 days) before being forced out.

Guideline 5. Use release protocols that minimize stress caused by handling, transportation, or new surroundings.

Every effort is made to minimize impacts to fish associated with handling, transportation, and release. Containers used to transport fish vary by task. In all cases, containers of the proper size and configuration are used. Fish are maintained in water of the proper quality (temperature, oxygen, chemical composition) at all times. Each transport vehicle is equipped with oxygen and fresh flow systems. Drivers are instructed to make regular stops to check fish status, oxygen and fresh flow systems, and water temperature.

Guideline 6. Minimize negative interactions with other species in the watershed.

Preliberation fish health monitoring is conducted to insure that all fish released meet accepted fish health criteria. As such, potential impacts from disease transfer are not expected to jeopardize the continued existence of listed (and other) species present in the project area. Competition between hatchery-reared chinook salmon and other species is not expected. Hatchery-reared chinook salmon have the potential to prey on other species, but the impact is expected to be minimal because of their release timing. Recoveries of PIT-tagged fish show that they quickly migrate from the streams, in association with wild chinook salmon.

Table 2. Issue 5. Management of Returning Adults.

Guideline 1. If the program meets all other guidelines, there is no general restriction on the proportion of hatchery fish of this stock on the spawning grounds of the population targeted for recovery for the first three generations. Individual projects may limit the proportion of hatchery fish spawning naturally depending on the details specific to the project.

The Grande Ronde Basin Chinook Salmon Captive Broodstock Program and the associated Lower Snake River Compensation Plan conventional hatchery program were developed with a sliding scale for collection of adults at weirs for conventional hatchery production. As escapement increased, a lower percentage of the run may be collected (up to the number needed for production). At escapement levels below 250 fish, 40% of the wild and hatchery (non-captive broodstock fish) may be collected. At escapement of 251-500 fish, no more than 20% of the wild and hatchery (non-captive broodstock fish) may be collected. At escapement of >500 fish, no hatchery-reared fish and no more than 20% of the wild run may be collected.

Guideline 2. Non-ESU hatchery fish from other programs should not exceed natural levels of straying between the populations in question, or constitute more than approximately one percent of total abundance if natural rates of straying are not known.

All hatchery-reared fish released into the Grand Ronde Basin are marked with coded-wire tags, PIT tags, and/or adipose fin clip. We look for marks on fish returning to weirs and on carcasses recovered during spawning ground surveys. We are particularly concerned with straying of hatchery salmon into the Minam and Wenaha rivers, which have not been supplemented with hatchery fish. Our results show that straying of hatchery-reared fish has been minimal. Since 1996, annual stray rates into the Minam River have ranged from 0-13% (mean = 4%) and in the Wenaha River, stray rates have been 0-15% (5%).

Straying of fish into the Grande Ronde Basin has also been minimal, though the number of marked carcasses recovered has been low. In 2002, seven wild chinook salmon from the John Day River (PIT-tagged) passed Lower Granite Dam and one of those was recovered in Catherine Creek. In 2003, two more tagged wild John Day River salmon passed Lower Granite Dam.

Table 2. Issue 6. Other Disposition of Fish.

Guideline 1. Monitoring and evaluation of fish in captive propagation will include (at a minimum):

a. Survival at life history stages up to adulthood.
b. Viability of gametes produced in captivity.
c. Behavior, morphology, and viability and reproductive success of offspring produced in captivity.

We assess the program at key life history phases in the production cycle: the Captive Juvenile Phase, the Captive Adult Phase, the F_1 Generation Phase and the F_2 Generation Phase. Each phase is further subdivided into discrete periods. Data collected during each period and phase are critical for evaluating treatment and overall program performance. Critical variables measured during each period/phase are described below.

The Captive Juvenile Phase begins at collection and ends once fish have been transferred to BOH or MML. It is composed of two periods: presmolt growth and smoltification. The primary measures of performance for this period of the cycle are growth, survival, condition, size distribution, smoltification, and disease profile. Sampling occurs throughout the period to gather the necessary data. We have had problems with hatchery chillers, and our growth profiles were not met until the 2000 cohort. Since that time, we have achieved distinct accelerated and natural growth groups. At inception of the program, we anticipated that parr-to-smolt survival would be 95% and has been 97%, ranging from 87-99%.

The Captive Adult Phase begins at transfer to either BOH or MML and ends when the fish die—either before or at spawning. It is composed of three shorter periods: post-smolt growth, maturation, and spawning. Performance during the post-smolt period is assessed primarily by growth, condition, survival, fertility (both sexes), fecundity, and disease profile. A broad array of variables is measured during the maturation period, including external morphology characteristics, date of mature recognition, degree of ripeness, ultrasound characteristics, age, time of maturation, survival, and sex ratios. The key performance measures for the spawning period include age and size at maturity and spawning, spawn timing, egg size, fecundity, sperm viability, fertility, and disease profile. Post-smolt growth has been slower than anticipated, and captive broodstock adults are approximately two-thirds the size of mature wild fish. Fecundity follows body size and is also lower than that of wild fish. Smolt-to-adult survival rate was expected to be 55% and has been 63% (26-83%). We expected mean embryo viability to be 75% and it has been 78%, ranging from 56-86%.

The F_1 Generation Phase begins at fertilization of eggs from captive broodstock fish and ends when the resulting fish die. This phase is composed of the incubation, juvenile rearing, smolt release, post-smolt growth, maturation, and spawning periods. Many of the standard hatchery evaluation variables are used to assess performance. Important variables include egg survival, hatching time, fry survival, growth rates, condition, size distribution, fry-smolt survival, smolt out-migration performance, smolt-to-adult survival, catch distribution, run timing, age structure at return, size-at-age, sex ratio, prespawn survival in nature, spawning distribution in nature, spawning success, and straying. Egg-to-smolt survival has been 75%, lower than the anticipated rate of 80%. The number of fish released has also varied dramatically from 1,500 to 180,000. We have had only two years of adult returns, so no conclusions can yet be drawn. We anticipated a smolt-to-adult return rate of 0.1%, but we have exceeded the expected rate for the 1998 cohort, even without the age 5 returns: mean return rate is 0.45% and ranges from 0.2% in the Grande Ronde River to 0.8% in the Lostine River.

The F_2 Generation Phase begins once embryos resulting from F_1 Generation fish are formed and ends when fish from these embryos die. This phase is composed of the presmolt, smolt, post-smolt growth, adult return, and spawning periods. During this period, we measure variables in the natural environment to assess the natural production performance of captive fish reproducing in nature. Variables include egg-to-fry survival, egg-to-smolt survival, juvenile tributary migration patterns, growth rates, parr and smolt production, smolt migration patterns, smolt-to-adult survival, catch distribution, run timing, age structure at return, size and age at maturation, sex ratios, prespawn survival in nature, spawning distribution in nature, spawning success, straying, and productivity (progeny-to-parent ratios).

We measure an array of variables in each phase/period of the cycle. The information we collect and analyze will allow us to compare our experimental treatments (FN, FA, SN, and SA), to develop relationships between treatments and performance, to monitor the basic progress in fish culture, to detect areas of concern that may need our immediate attention, and to judge the adequacy of the benchmarks we have used to design the overall captive broodstock program. We measure fork length of each fish and weight of a sample of fish at collection and at specific sampling periods to assess the growth profile and condition of the captive fish. We implant PIT tags in November (approximately 15 months after fertilization) and VI tags the following summer (approximately 23 months following fertilization) to allow us to track individual fish.

Guideline 2. Monitoring and evaluation of offspring released to the wild will include:

a. Survival and migration success.

We monitor out-migration success by implanting PIT tags in smolts from each raceway at Lookingglass Fish Hatchery. Five hundred tags are placed in each Grande Ronde River raceway while the Catherine Creek and Lostine River fish are being used as part of a fish passage study and 21,000 and 16,000 PIT tags, respectively, are implanted. Tag detection rate has been approximately 35%, which is sufficient for an accurate estimate of smolt survival to the dams. These rates can be compared with wild fish, which are caught in smolt traps and PIT-tagged by the ODFW Early Life History Project.

b. Ability to return to hatchery or natural spawning areas.

Weirs are located on each of the program streams, and we attempt to capture 100% of the fish reaching that point. However, stream conditions dictate when the weir can be installed and contribute to its efficiency. In addition, spawning ground surveys are conducted on all program streams and snouts from marked carcasses are collected for recovery of coded-wire tags. We have had only two years of adult returns so far.

c. Ability to successfully produce offspring in the wild.

The program collects tissue samples from all fish released above the weirs (and from unsampled carcasses during spawning ground surveys). These tissue samples will be used to estimate reproductive success of the captive broodstock offspring when juveniles are captured (smolts) and adults of the F_2 generation return to spawn.

In addition, we will be using changes (hopefully, increases) in the number of fish returning to program streams relative to adult return rates in the Minam and Wenaha rivers, which are unsupplemented. In this way, we can estimate the effectiveness of the captive broodstock program to increase numbers of spawning adults in the program streams.

Captive propagation operation plans should follow the outline provided in Table 3.

Table 3. Outline of a Captive Propagation Operation Plan

Table 3. Issue 1. Captive Propagation Program Description.

1. **Name of Program.**

   Grande Ronde Basin Spring Chinook Salmon Captive Broodstock Program.

2. **Stock and species to be propagated.**

   Snake River spring chinook salmon—Grande Ronde Basin stock (Catherine Creek, Lostine River and upper Grande Ronde River).

3. **Names of the accountable organization and individuals.**

   Richard Carmichael
   Northeast Region Fish Research
   Oregon Department of Fish and Wildlife
   211 Inlow Hall
   Eastern Oregon University
   La Grande, Oregon 97850

   Dr. Walton W. Dickhoff
   Acting Division Director
   National Marine Fisheries Service
   Northwest Fisheries Science Center
   Resource Enhancement and Utilization Technology Division
   2725 Montlake Blvd East
   Seattle, Washington 98112-2097

   Paul Kucera
   Director of Biological Services
   Nez Perce Tribe Department of Fisheries Resources Management
   PO Box 365
   Lapwai, Idaho 83540

   Gary James
   Fisheries Program Manager
   Department of Natural Resources
   Confederated Tribes of the Umatilla Indian Reservation
   P. O. Box 638
   Pendleton, Oregon 97801

4. **Location of program and extent of target area.**

   Grande Ronde River Basin, Oregon-Catherine Creek, Lostine River, and upper Grande Ronde River.

5. **Program goals.**

This program was initiated as a conservation measure in response to severely declining runs of chinook salmon in the Grande Ronde Basin. Our management goals are four-fold:

1) Prevent extinction of the Catherine Creek, Lostine River, and upper Grande Ronde River chinook salmon populations.

2) Maintain the genetic diversity and identity of the stocks in the program streams and those of unsupplemented wild stocks in nearby streams, such as the Minam and Wenaha rivers.

3) Ensure a high probability of population persistence well into the future once the causes of basin wide population declines have been addressed.

4) Provide a future basis to reverse the decline in abundance of endemic Grande Ronde Basin chinook salmon populations.

6. Expected duration of program.

The Grande Ronde Basin Chinook Salmon Captive Broodstock Program was developed to achieve a sustained annual return of at least 150 wild chinook salmon to each program stream. Captive broodstock fish are reared from collection as parr through maturation, spawned and their progeny are reared to the smolt stage and released into the stream from which their parents were collected. These progeny return and spawn naturally and their offspring complete a natural cycle. This captive broodstock cycle typically requires 1-5 years of captive rearing to reach maturity and spawn, 1.5 years of F_1 juvenile rearing to smolt and release, 1-3 years for F_1 adult returns, and 1.5 years for natural F_2 smolt production, and 1-3 years for F_2 adult returns. Hence, to completely evaluate a cycle of three generations requires up to 14 years. The program also has an experimental component, the design of which requires a minimum of five cycles, thus requiring 19 years for completion.

The program began in 1995 with the collection of the 1994 cohort. We first released captive broodstock offspring in 2000 (1998 cohort) and have completed two full generations as of the 2003 spawn. We are seeing increasing populations of the program stocks; however, counts of chinook salmon passing Lower Granite Dam and our redd counts and population estimates in the Grande Ronde Basin fluctuate dramatically with changes in environmental conditions. For example, the 1998 cohort was strong, while the 1999 cohort may be a near failure, probably due to poor downstream migration conditions caused by drought in the region. Therefore, achieving a sustained annual adult return of 150 wild chinook salmon in each stream will determine the duration of the program.

Table 3. Issue 2. Relationship of Program to Other Management Objectives.

1. Relationship to habitat protection and recovery strategies:

a. Major factors inhibiting natural production.

b. Description of habitat protection and recovery efforts.

c. Expected benefits of and time frame for habitat restoration efforts.

Myers et al. (1998) reviewed the causes of declines in Snake River spring chinook salmon runs: “Mainstem Columbia and Snake River hydroelectric development has resulted in a major disruption of migration corridors and affected flow regimes and estuarine habitat. There is habitat degradation in many areas related to forest, mining and grazing practices, with significant factors being lack of pools, high temperatures, low flows, poor overwintering conditions, and high sediment loads."

Within the Grande Ronde River subbasin, riparian and in-stream habitat degradation has severely affected spring chinook salmon production potential. Livestock overgrazing, mining, mountain pine beetle damage, limited quality rearing habitat, low stream flows, poor water quality, logging activity and road construction are major problems affecting salmon production (ODFW 2001). Many of these impacts have been reduced in recent years with management practices becoming more sensitive to fish and aquatic habitats, but the effects of some past management activities will remain for years to come. Reduction in quantity and quality of rearing habitat have reduced the capacity of some streams in the Grande Ronde Basin to support juvenile chinook salmon by approximately 30 percent in the upper Grande Ronde River and Sheep Creek, 20 percent in the Lostine River and Bear Creek, and 70 percent in the Wallowa River and Hurricane Creek (Carmichael and Boyce 1986).

A number of habitat protection and recovery efforts are underway in the Grande Ronde Basin (ODFW 2001). The U.S. Forest Service, Wallowa-Whitman National Forest is conducting watershed analyses to describe the physical, biological, and human dimension features of the watersheds. The Oregon Water Resources Department and ODFW have established priorities for restoration of stream flow from consumptive uses as part of the Oregon Plan for Salmon and Watersheds. The Grande Ronde Model Watershed Program coordinates watershed and habitat restoration by government and tribal agencies and private individuals and groups in the basin. Bonneville Power Administration funds projects for habitat protection and restoration. The U.S. Bureau of Reclamation conducts research and restoration/enhancement projects in the Grande Ronde Basin and as part of its Water Conservation Field Services Program, Reclamation provides annual cost-share grants to the Union and Wallowa Soil and Water Conservation Districts. We have seen habitat improvements from these programs, and we expect that to provide benefits for Grande Ronde Basin chinook salmon.

2. **Ecological interaction with other species:**
   a. **Consideration of interactions with other wild and hatchery salmonids that will affect or be affected by releases from the proposed program.**
   b. **Description of the interactions among the proposed program and introduced and native non-salmonid species.**

Disease transmission, competition for resources, predation (by and upon program fish), and negative genetic impacts are examples of ecological interactions that could affect salmonid and non-salmonid fishes in the project area. ODFW follows stringent disease prevention protocols in order to produce healthy, high quality fish. Preliberation fish health monitoring occurs to insure that healthy fish are released. Bacterial kidney disease is the most prominent disease in the captive broodstock program. We cull eggs of females with gross symptoms of BKD at spawning and those with high BKD ELISA optical density values in an effort to reduce this disease in the population but without compromising the primary gene conservation goal of the program. Competition between hatchery- and naturally-produced chinook salmon is expected to be minimal, because fish are released as smolts and do not remain long in the streams. When parr are released, it is in streams with few or no remaining chinook salmon. Interaction with other fishes is expected to be minimal. Hatchery-reared chinook salmon are unlikely to prey upon wild conspecifics, but behavioral interactions are possible, resulting in potential negative impacts on wild chinook salmon. However, releasing program fish as smolts reduces the opportunity for these interactions. Hatchery chinook salmon are also consumed by a variety of native and non-native aquatic, terrestrial, and avian predators.

3. Relationship to fisheries and harvest objectives for other species:

a. Description of fisheries that might incidentally harvest these fish.

Mainstem Columbia River sport, commercial, and tribal harvest is cooperatively managed by federal, state, and tribal management partners. The ODFW works with NOAA Fisheries Protected Resources Division to manage these fisheries.

b. Expected harvest impacts.

Ocean and lower Columbia River harvest is not expected to significantly impact these populations. No harvest of Grande Ronde Basin chinook salmon in the Columbia River estuary has been reported since 1977 (StreamNet data).

c. Expected escapements.

Escapement is not expected to be limited by sport, commercial, or tribal harvest.

Table 3. Issue 3. Origin and Identify of Broodstock.

1. Guidelines for using the stock in the program.

The Grande Ronde Basin once supported large runs of chinook salmon and estimated peak escapements in excess of 10,000 occurred as recently as the late 1950s (U.S. Army Corps of Engineers 1975). Natural escapement declines in the Grande Ronde Basin have been severe and parallel those of other Snake River populations. Catherine Creek, upper Grande Ronde River, and Lostine River were historically three of the most productive populations in the Grande Ronde Basin with redd numbers as high as 505 in Catherine Creek (1971), 304 in the Grande Ronde River (1968), and 261 in the Lostine River (1956). However, productivity of these populations has been poor for recent brood years, with redd numbers dropping to 30 and 31 redds combined in these streams in 1994 and 1995, respectively. These chinook salmon populations had reached critical levels where dramatic and unprecedented efforts were needed to prevent extinction and preserve any future options for use of endemic fish for artificial propagation programs in recovery and mitigation efforts.

2. Operating protocols to implement guidelines.

The captive broodstock program began in 1995 with collection of the 1994 cohort. We attempt to collect 500 spring chinook salmon parr from each of the program streams in August/September. The collection number is based on reaching a sustained threshold population goal of 150 spawning adults returning to each stream annually. Progeny of captive broodstock fish are released as smolts and allowed to complete their lifecycle in the wild.

3. Data to support protocols:

a. History of broodstock.

The captive broodstock program began in 1995, with collection of the 1994 cohort and continues with collection of the 2002 cohort in August 2003. All fish collected have been age 1 parr that were spawned in nature. We have collected eight cohorts (1994-2001) of spring chinook salmon juveniles from Catherine Creek and Lostine River in 1995-2002 and six cohorts from the upper Grande Ronde River. Each year, we collected 500 (or nearly) fish from Catherine Creek and the Lostine River. Only 110 fish were collected from the Grande Ronde River in 1995 (1994 cohort), and no fish were collected from the 1995 and 1999 Grande Ronde River cohorts.

b. Annual broodstock size and sex ratio.

We attempt to collect 500 spring chinook salmon annually from each of the program streams. Each year, we collected 500 (or nearly) fish from Catherine Creek and the Lostine River. Only 110 fish were collected from the Grande Ronde River in 1995 (1994 cohort), and no fish were collected from the 1995 and 1999 Grande Ronde River cohorts. Although we cannot externally determine sex of captured parr, the sex ratio of the captive broodstock (based on post-mortem examination) has not significantly varied from 1:1 (Hoffnagle et al. 2003).

c. Genetic and ecological differences between this stock and other stocks.
d. Description of special traits or other reasons for choosing this stock.

The chinook salmon stocks cultured for this captive broodstock program are genetically and/or ecologically distinct. The Snake River spring/summer chinook salmon populations show "modest genetic differences but substantial ecological differences, in comparison with Columbia River stream-type populations" (Myers et al. 1998). Further, the data concerning Snake River chinook salmon populations, "suggest that Snake River spring/summer chinook salmon from individual streams exist as coherent populations" (Waples et al. (1993). They found distinct genetic differences among Minam River, Catherine Creek, Lostine River, and Lookingglass Hatchery (Rapid River) chinook salmon stocks. The Independent Scientific Panel for the U.S. v Oregon dispute concluded "that a substantial component of the native spring chinook salmon populations in the Grande Ronde Basin still exists" and found "real biological differences" between Catherine Creek and upper Grande Ronde River populations (Currens et al. 1996). The Interior Columbia Basin Technical Recovery Team (ICBTRT) considered the Grande Ronde and Imnaha rivers to be a grouping separate from others in the Snake or Columbia River basins (ICBTRT 2003). Within the Grande Ronde Basin, the ICBTRT found genetic and/or ecological differentiation (smolt migration timing) between Wenaha River, Minam River, Lostine River, Catherine Creek, and upper Grande Ronde River spring chinook salmon populations. Differences in adult migration timing are being seen as well (ODFW, CTUIR, and NPT unpublished data).

The following excerpts were taken from the 1991 status review of Snake River chinook salmon (Matthews and Waples 1991):

"Phenotypic, life history, and genetic data support the conclusion that Snake River chinook salmon are distinct in an ecological/genetic sense. In a cluster analysis of environmental data (stream gradient, precipitation, elevation, vegetation type, etc.), Schreck et al. (1986) demonstrated two distinct groups of Snake River localities, with one group including those from the Imnaha and Grande Ronde rivers and the other including those from the Salmon River. Both groups were quite distinct from other localities in the Columbia River Basin. Phenotypic data also indicate that the populations are structured geographically. The fact that juvenile migration behavior is the same for spring and summer chinook salmon in the Snake River, but different for these two forms in the upper Columbia River, strongly implies ecological/genetic differences between the regions. The precision required to migrate great distances from different natal streams and tributaries and return with high fidelity and exact timing to start the next generation 1 to 3 years later speaks of biological entities that are highly adapted to their particular environments. The differences detected by protein electrophoresis between Snake River spring/summer chinook salmon and chinook salmon in the lower and mid Columbia River Basin may be an indication of adaptive genetic differences at parts of the genome not sampled by protein electrophoresis. By comparison, the genetic differences found between different spring and summer chinook salmon populations within the Snake River are rather modest."

"The habitat occupied by spring/summer chinook salmon in the Snake River appears to be unique to the biological species. In contrast to coastal mountains and the Cascade Range, the Snake River drainage is typified by older, eroded mountains with high plateaus containing many small streams meandering through long meadows. Much of the area is composed of batholithic granite that is prone to erosion, creating relatively turbid eater with higher alkalinity and pH in comparison to the Columbia River (Sylvester 1959). The region is arid, with warm summers, resulting in higher annual temperatures than in many other salmon production areas in the Pacific Northwest. These characteristics combine to produce a highly productive habitat for these fish. As previously mentioned, the Snake River alone once produced nearly half of the spring and summer chinook salmon returning to the Columbia River."

4. Facilities available for isolating and maintaining the captive program.

Thorough facility descriptions are provided below in Table 3, Issue 5, Section 2. All stocks and cohorts are maintained in strict isolation except for maturing fish (when mixing of fish is desirable so that pheromones can be exchanged), and ages 5 and 6 fish, which are combined for a given stock due to limited tank availability and low numbers of fish surviving to those ages.

5. Personnel accountable for developing the captive propagation program.

NOAA Fisheries

Principal Investigators:	Thomas A. Flagg	360-871-8306
	Dr. Desmond J. Maynard	360-871-8313
	Dr. Barry A. Berejikian	360-871-8301
Field Supervisors:	Dr. Lee Harrell	360-871-8307
	Carlin McAuley	360-871-8314
	Michael Wastel	360-871-8323
Field Personnel:	Dr. William Fairgrieve	360-871-8305
	James Hackett	360-871-8300
	Bryon Kluver	

Oregon Department of Fish and Wildlife

Principal Investigator:	Richard Carmichael	541-962-3777
Research:	Dr. Timothy Hoffnagle	541-962-3777
	Don Hair	541-962-3777
	Matt Snook	541-962-3777
Hatchery Management:	Scott Patterson	541-962-2138
Lookingglass Fish Hatchery:	Bob Lund	541-437-9723
Wallowa Fish Hatchery:	Greg Davis	541-426-4467
Bonneville Fish Hatchery:	Marla Chaney	541-374-2555
	Mike Miller	541-374-2555
Fish Health Management:	Sam Onjukka	541-962-3823
Fish Management:	Jeff Zakel	541-962-2138
	Brad Smith	541-426-3279
	Bill Knox	541-426-3279

Nez Perce Tribe

Principal Investigator:	Paul Kucera	208-843-7145
Field Research:	Jim Harbeck	541-426-3198
	Mary Edwards	541-426-6223

Confederated Tribes of the Umatilla Indian Reservation:

Principal Investigator:	Gary James	541-966-2371
Field Research:	Craig Contor	541-966-2377
	Steve Boe	541-962-3777
Hatchery Management:	Brian Zimmerman	541-966-2376
	Mike McLean	541-663-1794

Table 3. Issue 4. Broodstock Collection.

1. **Operating protocols:**
   a. **Number of each sex to be collected and maintained in captive propagation.**

   We attempt to collect 500 age 1 parr annually for each program stream. There is no nonlethal method to determine sex of parr. However, sex is determined for all fish at time of death, and the sex ratio for the program (based on post-mortem examination) has not significantly deviated from 1:1.

   b. **Kind of fish collected (life stage, special characteristics).**

Captive broodstock are collected as age 1 parr in August/September. Contingencies are available for collection of migrating smolts in fall and/or spring if parr collections are unsuccessful but these contingencies have not been used.

c. Description of sampling design.

Information from surveillance surveys conducted in late summer and from the ODFW Early Life History project is used to determine the extent of stream colonization by parr each year. Parr are collected from the entirety of their distribution in each program stream.

d. Method of identifying target population if more than one stock exists.

No other stocks of chinook salmon exist in the collection areas of the program streams. Fall chinook salmon are present in the lowest reaches of the Grande Ronde River, but these are found over 160 river kilometers downstream from the areas of interest to this program.

2. Data to support protocols:

a. Distribution of target population over time and space.

Spring chinook salmon spawn and rear in approximately 83 km of stream in the upper Grande Ronde River, Lostine River, and Catherine Creek. Parr are collected across the entire distribution of fish in each stream. Information from the ODFW Early Life History crew and reconnaissance surveys is used to determine fish distribution and estimate abundance in each section of the stream for each year. In Catherine Creek, spawning and rearing habitat begins at approximately river kilometer (RK) 29, above the town of Union, Oregon, and continues 22.3 km upstream to the forks, where Catherine Creek splits into the North and South forks. Chinook salmon also spawn and rear in the lower 4.8 km of the North Fork and 4.2 km of the South Fork of Catherine Creek. In the upper Grande Ronde River, chinook salmon spawn and rear in the reach approximately 23 km upstream from RK 188. Lostine River spawning and rearing occurs for approximately 29 km upstream from RK 11.

b. Biological information (fecundity, sex ratios).

Hoffnagle et al. (2003) provides biological information on the fish in the captive broodstock program. Post-smolt growth has been slower than anticipated. At spawning, captive broodstock females have been approximately 70% as large and males are only half as large for each age class as fish reared in nature. There is little difference in mean length of females or males maturing at ages 4, 5, and 6. Males matured at a younger age and females matured at a slightly older age than anticipated. There were fewer mature age 3 females and more age 6 females than expected. Males matured at a substantially younger age than expected, and there were fewer mature age 5 males than expected. Captive broodstock salmon spawned an average of four weeks later than wild salmon. Mean fecundities for ages 3, 4, 5, and 6 females were 1421, 1865, 1769, and 1369 eggs/female. Mature females of ages 3 and 6 are rare in this program. Captive broodstock females also had fewer eggs/kg body weight than conventional broodstock females. Mean fertility (percent of total eggs reaching the eyed stage) was 78.4%. Use of fresh semen resulted in a mean fertilization rate of 79.4%, while using cryopreserved semen resulted in only 34.0% fertilization. Mean eyed egg-to-smolt survival for captive broodstock progeny has been 75% for the 1998, 1999, and 2000 cohorts and stocks. To date, only two years of captive broodstock F_1s have returned as adults. We have exceeded 0.1% smolt-to-adult survival (expected) for the 1998 cohort (0.2%-0.79%), even without the age 5 returns.

Table 3. Issue 5. Mating.

1. **Operating protocols:**

   a. **Number of each sex to be mated.**

Gametes are collected from all fish that survive to maturity. Eggs from each female are fertilized by sperm from 2-4 males. If excess males are available, then some sperm will be cryopreserved to be used when fresh males are unavailable.

   b. **Method for choosing spawners.**

Gametes are collected from all fish that reach maturity and ripen.

   c. **Fertilization scheme.**

Historically, segregation of maturing fish and sex determination was done by visual examination of coloring, body morphology, and secondary sexual characters. These 'maturity sorts' were conducted monthly from May-August. In 2001, we began using ultrasound for early determination of maturation and sex. In 2002, we began testing the use of near infrared spectroscopy for this purpose, as well. We are hoping to be able to reliably determine maturation status and sex as early as April, in order to allow us to transfer saltwater-reared fish to freshwater at the time that wild Grande Ronde Basin chinook salmon enter the Columbia River.

See Table 2 Issue 2 Guideline 3a and b for discussion of spawning matrix development and use of cryopreserved semen.

<u>**Spawning procedures**</u>

Maturing fish are given an injection of erythromycin and placed in separate tanks at BOH designated for maturing fish, based on population and age. Maturing fish from MML are transferred to BOH (transported in 3:1 freshwater:saltwater) to finish maturing in freshwater, as wild fish would do. At BOH, the fish are held in unfiltered Tanner Creek water (4.4-11.1°C) to expose them to chemical cues for maturation and a more natural seasonal and diel temperature regime. Mature fish are treated with formalin or hydrogen peroxide to combat fungal infection three times each week from the first mature sort through the first spawn. In the past, formalin was used at a concentration of 1:6,000 for one hour. In 2001 and 2002, hydrogen peroxide (1:3,500 for one hour) was, and will likely continue to be, used instead of formalin.

Spawning has occurred from early September through mid-October—approximately four weeks later than wild fish. Ripeness sorts are conducted each Monday, beginning on the last week of August, to separate ripe from green fish—based on the ability to expel milt from males and softness of the abdomen of females. Fish are identified using PIT and VI tags and an additional tag (jaw tag) is applied for quick and accurate visual identification during spawning and to ensure identification in case both the PIT and VI tags are lost. Ripe males are placed in labeled nets, and ripe females are placed in fish tubes (PVC, approximately 15 cm diameter and 1 m long) to prevent them from spawning in the tanks and allow easy retrieval of specific females for spawning. Fish are spawned only within populations and treatments and not usually within cohorts, to prevent sibling crosses (see matrix development sections above).

Males are spawned first. Each male is anesthetized and confirmed as being ripe before being taken from the tank, then scanned for its jaw tag and PIT tag or VI tag to obtain corresponding information from the database. Fork length and weight are measured. The male is then placed on the spawning rack, quickly rinsed with an iodophor solution (200 ppm), wiped dry and semen is collected in a paper cup. Once semen is collected, the male is killed with a sharp blow to the head, unless it is to be recycled. All semen samples are tested for motility prior to combining semen with eggs; motility is evaluated as present or absent based on microscopic observation of sperm cells. The semen is divided into two, three, or four labeled cups, depending on the number of females in the matrix. This process continues for each male until semen has been collected from all males for a specific matrix.

Following semen collection, females are removed from the spawning tubes, anesthetized, given a final check for ripeness and, if ripe, are killed by a blow to the head. They are scanned for their jaw tag and PIT tag or VI tag, weighed, length measured and placed on the spawning rack according to the mating order of the matrix. Their tails are cut to bleed the fish (to prevent blood from being mixed with the eggs and interfering with fertilization) and the fish are rinsed with an iodophor solution and then dried. The female's abdomen is cut open and the eggs fall into a colander and the eggs are divided into pre-weighed, labeled buckets. Buckets containing eggs are weighed, and a sample of 20 eggs is collected from each female to calculate mean egg weight for fecundity estimation. If, after the eggs have been collected, the female displays gross signs of BKD (kidney is swollen and pus-filled), then the eggs from that female are culled (after being weighed) as a disease control measure. Cups of sperm are removed from the refrigerator and placed next to the appropriate bucket of eggs along with a cup of fresh well water. Sperm is poured on the eggs and well water added to activate the sperm. After 30 seconds, excess sperm and water are decanted from the eggs. A 75 ppm iodophor solution is used to rinse the eggs, and the buckets are filled with the solution, lids placed on the bucket and put aside to water harden for 40 minutes, undisturbed. The rest of the females on the spawning rack are spawned in the same manner to complete the matrix. After 40 minutes of water hardening, the eggs are transported to Oxbow Fish Hatchery (OFH), where they are placed in incubators. When the eggs have eyed, they are shocked and dead or unfertilized eggs removed and counted to determine fertilization rate.

Tissue samples from spawned adults are collected from each fish, and ovarian fluid samples are collected from each female and analyzed at program fish health laboratories for common bacterial and viral pathogens, such as BKD, infectious hematopoietic necrosis virus, and viral hemorrhagic septicemia. Results of fish health analysis of spawners will be used to determine disposition of eggs and rearing segregation of subsequent juveniles.

2. Facilities.

<u>Lookingglass Fish Hatchery</u>

Lookingglass Fish Hatchery is located 4 km upstream from the mouth of Lookingglass Creek, a tributary of Grande Ronde River (RK 136). The captive broodstock program used 12 Canadian troughs for juvenile rearing and chillers (323 L/min total capacity) for temperature control. Water temperature was monitored automatically in all tanks with an integrated System Control and Data Acquisition system. It has pathogen-free well water and unfiltered (not pathogen-free) stream water which can be used in case of emergency. It also has a diesel powered emergency electrical backup system. Lookingglass Fish Hatchery reared the 1994-2001 cohorts of captive broodstock fish to smolt and will continue to rear the captive broodstock F_1 generation from fry to smolt.

Wallowa Fish Hatchery

The captive broodstock program will use Wallowa Fish Hatchery for captive broodstock presmolt rearing instead of LFH beginning with collection of the 2002 cohort in August 2003. Wallowa Hatchery is located one mile west of Enterprise, Oregon, on Spring Creek (RK 1), a tributary to the Wallowa River (RK 66.8), which is a tributary of Grande Ronde River (RK 132). The captive broodstock program will use 12 circular tanks to rear the fish. Water sources include gravity flow spring water (296 Lpm), and two wells (296 Lpm, each). Well temperature is 13°C, and water temperature in the spring fluctuates seasonally between 5-11°C and water sources can be blended to provide temperature control. The wells are equipped with alarms and a backup generator. The well is pathogen-free and the artesian spring has been filled with rock to prevent fish colonization. We reared sentinel chinook salmon in the spring water for a full year without discovering any reportable pathogens in the fish.

Bonneville Fish Hatchery

Bonneville Fish Hatchery is located below Bonneville Dam on Columbia River (RK 234). The Captive Broodstock Facility includes a 972 m^2 building with rearing and spawning facilities, office and storage. There are fifteen 6.1 m diameter rearing tanks and four 3.05 m diameter rearing tanks. Water comes from either a well or Tanner Creek and temperature ranges from 8.9-11.1°C. Dissolved oxygen is maintained between 7-10.7 ppm, and there is an alarm system for drops in dissolved oxygen and low or high water levels. Effluent is filtered, to meet standards for effluent, first by a rotary filter that collects all particles >21 :m and then by an ultraviolet water purification system.

We also house equipment and storage facilities (liquid nitrogen) for cryopreserved semen at the Bonneville Captive Broodstock Facility. The 1.5 m^3 stainless steel container holds 860 L of liquid nitrogen and 102,300 0.5 mL straws. We currently have over 500 semen samples cryopreserved.

Manchester Marine Laboratory

Manchester Marine Laboratory is a National Marine Fisheries Service lab located on Puget Sound near Port Orchard, Washington. In addition to other facilities, this lab accommodates the Oregon and Idaho Snake River chinook and sockeye salmon captive broodstock program's saltwater rearing facilities. A 400 m^2 building houses six 4.1 m circular tanks, and a 1280 m^2 building houses twenty 6.1 m diameter rearing tanks. Portable tanks (0.8-2.3 m^2) are also available for use. Salmon here are raised in 7-13°C saltwater that is filtered through sand and ultraviolet filters. Dissolved oxygen is maintained between 9-10 ppm and oxygen is continuously bubbled into the tanks to insure adequate dissolved oxygen levels in case of water system failure.

Table 3. Issue 6. Rearing.

1. **1. Operating protocols:**
   a. **How will the incubation and rearing environment be different from or similar to natural rearing?**

   Captive broodstock chinook salmon are reared in an ODFW facility (Lookingglass Fish Hatchery for 1994-2001 cohorts; Wallowa Fish Hatchery for 2002 and future cohorts) for presmolt rearing and at either Bonneville Fish Hatchery (ODFW) or Manchester Marine Laboratory (NOAA Fisheries) post-smolt rearing. Since these fish will not be released into the wild and the primary fish culture goal is to maximize survival to maturity, we have made little effort to make the rearing environment similar to the natural environment. Fish are reared in troughs (LFH) or circular tanks (WFH, BOH, MML). All rearing is done indoors and under a simulated natural photoperiod with a section of each tank covered and human interactions are minimized. The program does not use natural-like habitat during culture or rear fish in variable higher velocity habitat. The fish are fed by hand or automated feed delivery systems, rather than demand feeders. No fish in the program are exposed to predator training.

   Captive broodstock progeny are incubated in Heath trays at OFH and Irrigon Fish Hatchery (IFH), and at swim-up they are transferred to circular tanks for early rearing at IFH. In the spring, they are transferred to outdoor raceways at Lookingglass Fish Hatchery and reared in filtered stream water at low density (approximately one half, or less, of maximum design density for the raceways). No substrate, cover, or specific predator training is provided, and the fish are fed by hand or automatic surface feeders. At smolt, the fish are transferred to acclimation sites on their parents' natal stream supplied with unfiltered stream water and fed low rations (water temperature is usually very low). Fish are released by allowing volitional departure for 7-14 days followed by the remaining fish being forced out. The remainder of their lifecycle will be spent in the wild—no captive broodstock fish will be collected for conventional hatchery spawning.

   b. **How will family groups be separated and their contributions equalized?**

   At maturation, broodstock adults are identified using PIT tag codes. Annual spawning events follow approved spawning designs developed at the Technical Oversight Team level and have been reviewed by NOAA Fisheries and geneticists. The contribution of parents is equalized several ways. First, males and females are crossed in a matrix design such that the contribution of any particular male or female is spread amongst several crosses (see Table 2, Issue 2, Guideline 3.a.). This serves to decrease the loss of contribution from an individual if there is catastrophic loss to the egg lot or if the cross is less successful (fertility is low) than others. Second, numbers of eggs and the amount of sperm is equalized for each factorial cross (each female's eggs are evenly divided and fertilized with sperm from up to four separate males, and each male may fertilized eggs from up to four females).

2. **Data to support protocols.**

Captive broodstock fish are initially reared at Lookingglass Fish Hatchery (1994-2001 cohorts) or Wallowa fish hatchery (2002 and future cohorts) until smoltification, at which time one half of each stock is transported to each of Bonneville Fish Hatchery (freshwater) or Manchester Marine Laboratory (saltwater) for post-smolt rearing. Standard fish culture techniques and protocols are used (Leitritz and Lewis 1976; Piper et al. 1982; Rinne et al. 1986; Erdahl 1994; McDaniel et al. 1994; Bromage and Roberts 1995; IHOT 1995; Schreck et al. 1995; Pennell and Barton 1996; NMFS 1999; Wedemeyer 2001) with specific additions and modifications approved by the TOT and documented in each year's Annual Operating Plan.

Rearing and loading densities are maintained as low as possible. At BOH, captive broodstock fish are reared in pathogen-free, well water that ranges in temperature from 8.9-11.1°C. Water flows into the tanks at a rate of 270-795 L/min, depending on the density of fish in the tanks, which has ranged from 0.28-9 kg/m^3. At MML, the fish are reared in filtered seawater from Puget Sound. Temperature ranges from 7-13°C (chillers maintain temperature at or below 13°C). Flow into the tanks ranges from 95-284 L/min, depending on the number and size of fish in the tank. Rearing density is kept below 8 kg/m^3. The highest densities occur when a cohort reaches four years of age and has not suffered much mortality.

We handle the fish as little as possible but with sufficient frequency to monitor growth and condition of the fish. Multiple tasks are conducted at each handling (e.g., inoculation and growth measurements or growth and sorting for maturing fish) in order to further reduce handling. All water used is single pass and temperature ranges from 4-13°C. Saltwater used is filtered to remove suspended particles and pathogens. All freshwater used is pathogen-free well or spring water, except that used for ripening fish, which are held in filtered Tanner Creek water at Bonneville Fish Hatchery in order to provide temperature and pheromone spawning cues. Shade covering and jump screens are provided to each tank.

Presmolts are fed Moore-Clarke Nutra Plus food of an appropriate size for the size of the fish—sizes 1-3 crumbles and 1.5 mm pellets. Daily ration is 2.6% of body weight at 12°C and decreasing to 1.1% of body weight every second day at 6°C. Post-smolts are fed Moore-Clarke 2-8.5 mm pellets at rates ranging from 0.37-2% of body weight for small fish to 0.37% for the largest fish. Automatic feeders feed the fish approximately eight times each day.

Fish are given prophylactic and therapeutic treatments with approved chemicals on the prescription of ODFW and NOAA Fisheries fish health personnel and veterinarians. Necropsies are performed on all mortalities to determine cause of death. Routine inspections include viral (e.g., infectious hematopoietic necrosis virus) and bacterial (e.g., bacterial kidney disease, erythrocytic inclusion body syndrome, bacterial gill disease, bacterial cold water disease, columnaris, enteric redmouth disease, aeromonad-pseudomonad septicemia and furunculosis) pathogens. All laboratory inspection and diagnostic procedures follow protocols in Thoesen et al. (1994).

3. Facilities.

See response for Table 3, Issue 5, Section 2 above for a thorough description of facilities used by the program.

Table 3. Issue 7. Release.

1. **Operating protocols:**
    a. **Number, size, and life stage at release.**

The Grande Ronde Basin Captive Broodstock Program releases offspring as age 1 smolts (ODFW 1996). Smolts are transported to acclimation facilities on the parental streams and held there for 10-30 days. They are allowed to leave the site volitionally after 7-14 days and the remaining fish are forced out at the end of the acclimation period. Fish in excess of those needed for the program or above that capable of being reared to smolt at Lookingglass Fish Hatchery are released as parr into pre-designated outlet streams.

Release date, location, mean weight and life stage, and number of fish released for each cohort and stock.

Stock	Release date	Release location	Mean weight (g)	Life stage	Number
1998 cohort					
Catherine Creek	Apr 2000	Catherine Creek	20.2	Smolt	37,980
Grande Ronde River	Mar 2000	Grande Ronde River	23.3	Smolt	1,508
Lostine River	Apr 2000	Lostine River	21.6	Smolt	34,986
					74,474
1999 cohort					
Catherine Creek	Apr 2001	Catherine Creek	23.1	Smolt	136,833
Grande Ronde River	Mar 2001	Grande Ronde River	32.7	Smolt	2,560
Lostine River	Mar 2001	Lostine River	23.1	Smolt	133,883
					273,276
2000 cohort					
Catherine Creek	Sep 2001	Lookingglass Creek	18.5	Parr	51,864
Catherine Creek	Apr 2001	Catherine Creek	24.5	Smolt	180,343
Grande Ronde River	Oct 2001	Grande Ronde River	18.9	Parr	76,941
	Apr 2001	Grande Ronde River	25.3	Smolt	151,444
Lostine River	Apr 2001	Lostine River	26.8	Smolt	77,551
					538,413
2001 cohort					
Catherine Creek	May 2002	Lookingglass Creek	8.1	Parr	17,880
	Mar 2003	Catherine Creek	35.6	Smolt	105,292
Grande Ronde River	May 2002	Sheep Creek	7.4	Parr	32,800
	Mar 2003	Grande Ronde River	31.9	Smolt	110,049
	Apr 2003	Grande Ronde River	32.9	Smolt	100,064
Lostine River	May 2002	Bear Creek	7.6	Parr	4,660
	Mar 2003	Bear Creek	38.5	Smolt	66
	Mar 2003	Lostine River	29.6	Smolt	57,986
	Apr 2003	Lostine River	29.3	Smolt	83,881
					512,678
					2,284,464

b. Date, location, and number per location of release.

Refer to tables presented above for Table 3, Issue 7, Section 1 a.

c. Release technique (direct, acclimation, volitional).

Refer to tables presented above for Table 3, Issue 7, Section 1 a.

d. Tags and marks.

All captive broodstock progeny released into the wild are marked with coded-wire tags and an adipose fin clip. Some (at least 500/raceway) are also implanted with a PIT tag to monitor downstream migration past the Snake and Columbia river dams.

2. Data to support protocols.

Refer to tables presented above for Table 3, Issue 7, Section 1 a and Hoffnagle (2003).

3. Facilities and equipment.

Nearly all captive broodstock progeny released are acclimated at a facility on the parental stream. Acclimation facilities are located within the known spawning distribution of chinook salmon. Acclimation facilities on the upper Grande Ronde River and Catherine Creek are operated by Confederated Tribes of the Umatilla Indian Reservation and the Lostine River facility is operated by the Nez Perce Tribe.

Fish are transported from Lookingglass Fish Hatchery to the acclimation sites in fish hauling trucks operated by ODFW. These trucks have 1400-5,000 gallon semitractor tankers equipped with 12v fresh-flo aerators, oxygen diffusers, liquid oxygen, and oxygen metering systems, and some have limited refrigeration capabilities.

The Grande Ronde and Catherine Creek acclimation facilities are operated by CTUIR, and the Lostine River acclimation facility is run by NPT. The Catherine Creek facility is located at RK 47.2, the Grande Ronde facility at RK 317.6, and the Lostine River facility at RK 20.1. Each of these facilities consists of four portable aluminum raceways lined with vinyl fabric. Each raceway is 26 m long x 2.4 m with a water depth of approximately 1 m (62.4 m3) and was designed to hold 31,250 fish (22.7 g; 11.4 kg/m3) at a maximum flow of 2,366 Lpm. Each facility uses unfiltered stream water. A trailer is located at each site, permitting 24-hour supervision of the site.

Table 3. Issue 8. Monitoring and Evaluation.

1. Biological and propagation parameters monitored:

a. Survival at different life stages.

b. Age at maturity, sex ratios, fecundity, viability of gametes.

There are numerous uncertainties associated with captive broodstock programs. Therefore, we assess the program at key life history phases in the production cycle. We have divided the cycle into four phases: the Captive Juvenile Phase, the Captive Adult Phase, the F_1 Generation Phase, and the F_2 Generation Phase. Each phase is further subdivided into discrete periods. Data collected during each phase and period are critical for evaluating treatment and overall program performance. Critical variables measured during each phase/period are described below.

The *Captive Juvenile Phase* begins at collection and ends once fish have been transferred to BOH or MML. It is composed of two periods: presmolt growth and smoltification. The primary measures of performance for this period of the cycle are growth, survival, condition, size distribution, smoltification, and disease profile. Sampling occurs throughout the period to gather the necessary data.

The *Captive Adult Phase* begins at transfer to either BOH or MML and ends when the fish die—either before or at spawning. It is composed of three shorter periods: post-smolt growth, maturation, and spawning. Performance during the post-smolt period is assessed primarily by growth, condition, survival, fertility (both sexes), fecundity, and disease profile. A broad array of variables are measured during the maturation period including: external morphology characteristics, date of mature recognition, degree of ripeness, ultrasound characteristics, age, time of maturation, survival, and sex ratios. The key performance measures for the spawning period include age and size at maturity and spawning, spawn timing, egg size, fecundity, egg and sperm viability, fertility, and disease profile.

The *F_1 Generation Phase* begins at fertilization of eggs from captive broodstock fish and ends when the resulting fish die. This phase is composed of the incubation, juvenile rearing, smolt release, post-smolt growth, maturation, and spawning periods. Many of the standard hatchery evaluation variables are used to assess performance. Important variables include egg survival, hatching time, fry survival, growth rate, condition, size distribution, fry-smolt survival, smolt out-migration performance, smolt-to-adult survival, catch distribution, run timing, age structure at return, size-at-age, sex ratio, prespawn survival in nature, spawning distribution in nature, spawning success, and straying.

The *F_2 Generation Phase* begins once embryos resulting from F_1 Generation fish are formed and ends when fish from these embryos die. This phase is composed of the presmolt, smolt, post-smolt growth, adult return, and spawning periods. During this period, we measure variables in the natural environment to assess the natural production performance of captive fish reproducing in nature. Variables include egg-to-fry survival, egg-to-smolt survival, juvenile tributary migration patterns, growth rates, parr and smolt production, smolt migration patterns, smolt-to-adult survival, catch distribution, run timing, age structure at return, size and age at maturation, sex ratios, prespawn survival in nature, spawning distribution in nature, spawning success, straying, and productivity (progeny-to-parent ratios).

At inception of the program, we assumed 50% survival from parr to spawn, and we have exceeded this goal for each of the first four cohorts. Mean survival to spawn has been 63% and ranged from 52%-74%. Bacterial kidney disease was the largest source of prespawn mortality, causing at least 30-52% of the prespawn mortalities. Mean parr-to-smolt survival (97%) was higher than the expected rate of 95%. The expected smolt-to-adult survival rate is 55% and the mean (62.6%) did not differ from the expected rate. Mean smolt-to-adult survival for the Freshwater Natural group (70%) was higher than the expected rate, while survival rates for the Freshwater Accelerated (61%) and Saltwater Natural (57%) did not differ from expected.

Males matured at a younger age and females matured at a slightly older age than anticipated. We predicted a mean age of maturation of 4.1 years but there were fewer mature age 3 females and more age 6 females than expected. Females from the Freshwater Accelerated group matured at a younger mean age (4.1 years) than those of the Saltwater Natural (4.2 years), which was younger than the Freshwater Natural treatment group (4.3 years). For males, we expected a mean age of maturation of 3.8 years but they matured at a substantially younger age with fewer mature age 5 males.

Males from the Freshwater Accelerated and Freshwater Natural groups matured at a younger mean age (3.0 years) than those of the Saltwater Natural treatment group (3.2 years). Captive broodstock salmon spawned an average of four weeks later than wild salmon. Sex ratio did not differ from 1:1.

We expected fecundities to be approximately 1,200, 3,000 and 4,000 eggs for females at ages 3, 4, and 5, respectively, approximating that of wild fish. Growth of captive broodstock fish has been slower than expected and, subsequently, fecundity was also lower. Mean fecundities for ages 3, 4, 5, and 6 females were 1421, 1865, 1770, and 1369 eggs/female, respectively. Mature females of ages 3 and 6 are rare in this program. Mean fecundity was higher in the Freshwater Natural and Freshwater Accelerated groups than the Saltwater Natural treatment group. Captive broodstock females also had fewer eggs/kg body weight than conventional broodstock (naturally-reared) females.

We assumed 75% egg fertility (percent of total eggs reaching the eyed stage) and mean fertility rate (78.4%) did not vary from expected. Use of fresh semen resulted in a mean fertilization rate of 79.4%, while using cryopreserved semen resulted in only 34.0% fertilization. Mean eyed egg-to-smolt survival has been 75% for the 1998, 1999, and 2000 cohorts and stocks, lower than our expected value of 80%. To date, only three years of captive broodstock F_1s have returned as adults. We have exceeded the expected 0.1% smolt-to-adult survival rate for the 1998 cohort (0.2%-1.7%).

c. Genetic, morphological, meristic, and behavioral similarity to donor population.

We collect tissue samples (fin clips) from all fish brought into the captive broodstock program. These tissues will be used to determine the amount of relatedness of parr brought into the captive broodstock program. A preliminary analysis was conducted by Dr. Paul Moran (NOAA Fisheries, personal communication) on a cohort of Grande Ronde River fish that was produced by a small number of adults. His analysis showed a shared allele metric in these fish that was very similar to that of larger chinook salmon populations, indicating that the captive broodstock populations are representative of the populations from which they were collected.

We also collect tissue samples (opercle punches) from all fish (hatchery and wild) captured at weirs and from carcasses recovered during spawning ground surveys. These tissues will be used for two purposes. First, samples from hatchery fish will be compared to tissues collected from their parents as parr to identify their origin. Second, these tissues will be compared with tissues collected from parr, smolts, and returning adults in order to determine the effectiveness of the captive broodstock offspring to spawn in nature and produce an F_2 generation.

d. Survival of progeny in wild.

Three cohorts of captive broodstock progeny have had the opportunity to return to their home streams; for only one (1998 cohort) has the complete cohort (all age classes) returned. At inception of the program, we assumed 0.1% return of these fish. For each stock, the 1998 F_1 cohort has returned at rates exceeding 0.1%, with Catherine Creek returns nearing 1% and Lostine River reaching 1.7%. The 1999 cohort has also exceeded 0.1% return rate in all stocks, even without age 5 returns and the Lostine River 200 cohort age 3 fish have already returned at a rate of 0.13%.

Estimated number (based on recovery of marked carcasses during spawning ground surveys) of captive broodstock progeny returning as adults for each population and cohort, as of 1 October 2003.

	Males			Females				
Stock	Age 3	Age 4	Age 5	Age 4	Age 5	Total return	Number released	Return rate
1998 cohort								
Catherine Creek	85	96	36	106	21	344	37,980	0.91%
Grande Ronde River	0	0	0	3	0	3	1,508	0.20%
Lostine River	34	159	110	189	99	591	34,987	1.69%
1999 cohort								
Catherine Creek	16	74		117		207	136,833	0.15%
Grande Ronde River	0	5		5		10	2,560	0.39%
Lostine River	21	89		71		181	133,883	0.14%
2000 cohort								
Catherine Creek	74					74	183,343	0.04%
Grande Ronde River	83					83	151,444	0.05%
Lostine River	99					99	77,551	0.13%

e. Contribution to natural spawning and success of progeny.

We collect tissue samples (opercle punches) from all fish (hatchery and wild) captured at weirs and from unpunched carcasses recovered during spawning ground surveys. These tissues will be compared with tissues collected from parr, smolts, and returning adults in order to determine the effectiveness of the captive broodstock offspring to spawn in nature and produce the F_2 generation.

In addition, we can compare chinook salmon populations in these streams before and after supplementation with captive broodstock offspring and compare population trends between these supplemented streams and the unsupplemented Minam and Wenaha rivers, which are used as reference streams for this program.

f. Incidental harvest in fisheries.

At present, no sport or tribal harvest targets Grand Ronde Basin chinook salmon. However, sport, commercial and tribal fisheries for chinook salmon in the lower Columbia River may incidentally harvest program fish. All released fish are marked with coded-wire tags for monitoring of ocean and freshwater harvest. Based on coded-wire tag recoveries, Imnaha River chinook salmon have suffered an annual mean of 4.2% ocean and Columbia River harvest (0-22%). We would expect Grande Ronde Basin fish to suffer similar mortality rates.

2. Evaluation and feedback mechanism.

The Grande Ronde Basin Chinook Salmon Captive Broodstock Program is constantly being evaluated from within and outside the program. Within the program, the Technical Oversight Team (TOT; comprised of the comanagement agencies for Grande Ronde Basin Chinook Salmon Captive Broodstock Program) meets approximately eight times each year to discuss and adjust operating protocols. An Annual Operating Plan is prepared each year. The Chinook Salmon Captive Propagation Technical Oversight Committee is a BPA-facilitated group comprised of biologists from agencies conducting captive broodstock programs within the Snake River Basin and permitting agencies. The TOC meets approximate five times each year to provide updates on each program and discuss the successes and problems that each program may have.

3. Restoring a naturally-reproducing component of the population:

a. Progress in habitat restoration.

As noted in Pollard and Flagg (in review), captive propagation on its own will rarely, if ever, constitute a complete recovery program. For any recovery to be successful, the factors that caused the population to decline to the status where captive propagation is necessary must be addressed. To this end, many habitat restoration efforts are currently underway in the Grande Ronde Basin (Ashe et al. 2000; ODFW 2001) by federal, state, and tribal agencies and other groups and address issues such as stream channelization, sedimentation, stream bank stabilization, riparian vegetation, organic and inorganic pollution, and stream discharge. However, the dilemma facing enhancement efforts for Grande Ronde Basin chinook salmon is that most of the severe barriers to survival are downstream of the spawning and rearing habitat. Manmade alterations (dams), harvest, and changes in ocean productivity contributed to reduction in abundance of Grande Ronde Basin chinook salmon. It is hoped that regional efforts to improve downstream habitat and reduce migratory mortality of juvenile and adult anadromous fishes will be successful. Regional fish managers are currently involved in a Technical Recovery Team (TRT) process to determine needed recovery actions and time frames for these efforts. Project sponsors recognize that these habitat perturbations and efforts to remedy them are outside the purview of this program.

b. Use of habitat by fish from captive propagation program.

Captive broodstock progeny are released as smolts and spend little time in freshwater habitats. Returning adults are expected to spawn with naturally-produced adult spawners. We are collecting data from spawning ground surveys that will allow us to compare habitat use and spawning distribution of captive broodstock progeny in relation to that of wild fish.

c. Success in natural reproduction.

Refer to tables presented above for Table 3, Issue 8, Section 1 d.

<u>Table 4. Summary of Benefits Attributed to Captive Propagation Technology</u>

Table 4. Benefit 1. Increase Total Abundance of the Target Population.
Evaluation Criteria. Spawner:spawner replacement ratio is higher for captive propagation program than for fish remaining in natural habitat.

Increased survival potential in protective culture provides the ability for captive broodstocks to rapidly increase effective breeding population size and markedly aid recovery efforts through production of large numbers of juveniles (Flagg and Mahnken 2000, Flagg et al. in review; Pollard and Flagg in review). A mean of 63% of the parr collected survive to spawn. We have released a mean of 349,643 captive broodstock progeny per year into the program streams. At inception of this program, we assumed a 0.1% smolt-to-adult survival rate. For the 1998 cohort, we have exceeded this rate in all three stocks (0.2-1.7%) and have exceeded 0.1% return for all stocks of the 1999 cohort (ages 3 and 4 returns, only) and in the Lostine River 2000 cohort (only age 3 returns, so far).

A dilemma facing enhancement efforts for all Snake River anadromous salmonids is that Snake and Columbia river dams create severe barriers to survival (Flagg et al. 1995). Spawning and rearing habitat in the Grande Ronde Basin is sufficient to allow the population to increase in abundance. Both manmade (dams) and natural habitat alterations, harvest and changes in ocean productivity probably contributed to reduction in abundance of Grande Ronde Basin chinook salmon. However, these are outside the purview of this program.

Table 4. Benefit 2. Preserve the Target Population.
Evaluation Criteria. Genetic, morphological, meristic, and behavioral characteristics of fish in captive propagation reflect the natural population.

It is the intention of this program to minimize the loss of genetic variation and heterozygosity by utilizing available genetic diversity within the population and crossing available individuals in a breeding strategy to minimize other genetic risks (e.g., inbreeding or domestication). Our protocol for pairing allows us to avoid mating fish from the same cohort (the fact that most males mature at ages 2 and 3 and females mature at ages 4 and 5 make this easier) and matrix spawning allows us to maintain as much genetic diversity as possible (see Table 2, Issue 2, Guideline 3.a). Genetic analyses have shown that a large amount of genetic variation remains in these stocks and that the captive broodstock reflects the diversity of the wild population (Dr. Paul Moran, NOAA Fisheries, personal communication). Tissue samples collected from captive broodstock fish and from hatchery and wild fish returning to the program streams will also allow us to test for changes in genetic diversity over time.

Risks to the genetic integrity of the captive population from applied mating designs can be assessed through empirical calculations of stability of heterozygosity and genetic diversity over time within each program population. Data trends can be evaluated as the percentage of source (or beginning) heterozygosity and genetic diversity. These measures are expected to decrease as the population becomes closed, principally due to genetic drift. Some loss of heterozygosity and genetic diversity will occur despite the most enlightened efforts to cross remaining available stock and even employing cryopreserved sperm. However, it also appears that these losses can be somewhat minimized by the careful development of prudent mating strategies. Also, ensuring that these fish complete at least one full lifecycle in nature will help prevent domestication.

The Grande Ronde Basin Chinook Salmon Captive Broodstock Program strives to ensure the safety of the fish maintained in culture and to produce fish for release in restoration efforts. Standard fish culture practices have a proven track record of meeting these needs. However, program managers pursue novel fish culture protocols in an effort to develop fish with morphological, meristic, and behavioral characteristics that reflect the natural populations. Marine rearing is one approach the program uses to ensure anadromous traits are maintained in the captive broodstock population. As the program advances, we are exploring other options to encourage the development of natural morphology, meristics, and behavior, including adult releases, egg box releases, and fry or parr releases. These strategies would increase the time reintroduced fish experience in the natural environment in a manner that encourages both wild-type phenotypic development and natural selection. However, the advantage of reintroducing fish at these life history stages must be weighted against potential reductions in freshwater survival of severely depleted populations.

Table 4. Benefit 3. Increase Number of Natural-origin Recruits.
Evaluation Criteria. The product of the spawner:spawner replacement rate in the captive program and the relative success of captive-produced fish spawning in the wild to natural fish exceeds 1.0 and there is sufficient current habitat capacity to allow the population to increase in abundance.

See sponsor response to Table 4, Benefit 1 above.

Table 5 summarizes the hazards of applying captive propagation technology to recovering listed anadromous salmonids.

Table 5. Summary of Hazards Related to Captive Propagation Technology

Table 5. Hazard 1. Negative Effects Associated with Small Population Size.
Risk Evaluation 1. Probability of:
a. Inbreeding depression.

Inbreeding can be simply characterized as the increased occurrence of related individuals mating, which can take place in both the wild and under captive conditions. Consequences of inbreeding include a loss of heterozygosity and an increase in homozygosity relative to expectations under random mating (Tave 1993, Hallerman 2003 and references therein). Within captive propagation programs, this hazard may arise in two principal ways—through overrepresentation of related individuals in the population and through assortative mating.

Overrepresentation of related individuals can arise when a small portion of the wild population is sampled and becomes “amplified” under culture conditions where survival to prespawning adult is significantly higher (higher survival is a goal of the program). These individuals are in turn released to spawn with a small, finite wild population thus increasing the opportunity for greater representation of particular genes and family groups within that population. Thus, the methods used to sample or “mine” the wild population for young or gametes to use in captive propagation or captive rearing becomes an important concern.

Within the captive broodstock program, wild populations have been sampled through the collection of parr. It is possible that given the limited number of sampling times and conditions under which parr were collected, they may represent a substantially higher proportion of related individuals than other collection methods. We attempt to ensure that we collect fish from as many different parents as possible by collecting from within the entire distribution of spring chinook salmon in each program stream. Based on redd counts from spawning ground surveys, the 2000 cohort of Grande Ronde salmon may be the captive broodstock cohort with the smallest number of parents. An investigative analysis of tissue samples collected from this cohort showed them to have low relatedness - similar to that of the Rapid River stock of chinook salmon (Dr. Paul Moran, NOAA Fisheries, personal communication).

b. Loss of within-population genetic variability.

Loss of within-population genetic variation is the primary risk associated with poor decision making in hatchery programs (Miller and Kapuscinski 2003). This phenomenon arises when gametes or individuals are sampled from a finite population, resulting in genetic drift. The rate of loss has been shown to be roughly proportional to the inverse of twice the effective population size (Wright 1977). Within the captive broodstock program, this would have the greatest potential to occur when parr collected and the resulting cultured adults do not represent the entire breadth of genetic diversity observed in the remaining wild population. As stated above, the little evidence that we have shows that these populations maintain wide genetic variability suggesting that loss of within-population genetic variability has not been a significant risk to the program to date. Moreover, available genetic evidence suggests that matrix spawning protocols are effective in retaining the highest percentage of genetic diversity when compared to theoretical estimates based upon other commonly employed spawning strategies such as 1:1 pairing (Powell and Faler, unpublished data).

c. Accumulation of deleterious mutations.

Accumulation of deleterious mutations which effect fitness can arise in small population as a consequence of either and/or both hazards listed above. Inbreeding generally results in an increase of homozygous alleles for any particular locus. This includes alleles that are deleterious but would not otherwise be expressed under heterozygous conditions. Likewise, the loss of genetic diversity within a population can similarly result in an increase in the expression of deleterious recessives through the resulting increase in homozygotes. Within the captive broodstock program, every effort is made to minimize the loss of within-population genetic variation and avoid inbreeding in these finite chinook populations by employing previously stated rearing and spawning strategies. However, it should also be noted that a loss of genetic diversity within a population is not limited to advantageous genes or alleles. The loss of genetic variation is indiscriminant, affecting “good” and “bad” alleles alike. Thus, small populations that have gone through genetic bottlenecks will often be purged of deleterious alleles, as well. The extent to which each of the chinook populations under study within this program carry a “genetic load” of deleterious alleles is undetermined.

Moreover, selection against individuals with deleterious alleles during spawning cannot be accomplished in the hatchery since no genetic markers exist which show potentially disadvantageous alleles. The reduction of genetic load or elimination of deleterious mutations can only be accomplished through two factors—drift (primarily) and selection (when sufficiently strong enough).

Table 5. Hazard 2. Negative Effects of Propagation in an Artificial Environment.
Risk Evaluation 1. Domestication: Probability of adaptation to the captive propagation environment at the expense of adaptation to the natural environment.

This is an issue addressed at inception of this captive broodstock program. In order to reduce the potential for domestication in these stocks, we ensure that each captive broodstock cohort is collected as wild parr - the result of naturally-spawned fish that have completed at least one lifecycle in nature. . Additionally, all captive broodstock offspring are differentially marked and, upon return as adults, all are allowed to spawn in nature—none may be collected for inclusion in conventional hatchery spawning programs.

Risk Evaluation 2. Catastrophic loss due to disease outbreaks or facility failure.

The captive broodstock program maintains equal and redundant populations (Bonneville Fish Hatchery and Manchester Marine Laboratory) to ensure genetic material is not lost due to disease outbreak or facility failure. At Wallowa Fish Hatchery (presmolt rearing), redundant tanks are maintained for each stock and treatment. Backup and system redundancy is in place for degassing, pumping and power generation, where needed (much of our program relies on gravity-fed water supplies).

Also, strict sanitation guidelines have been developed for this program and are adhered to at each facility. Fish are given prophylactic treatments for BKD and inoculations against Vibrio sp. Fish health is checked daily by observing feeding response, external condition and behavior of fish in each tank as initial indicators of developing problems. In particular, fish culturists look for signs of lethargy, spiral swimming, side swimming, jumping, flashing, unusual respiratory activity, body surface abnormalities and unusual coloration. Presence of any of these behaviors or conditions is immediately reported to the program fish pathologist. American Fisheries Society (AFS) “Bluebook” procedures are employed to isolate bacterial or viral pathogens and to identify parasite etiology (Thoesen 1994). All mortalities are analyzed for common bacterial and viral pathogens (e.g., BKD, infectious hematopoietic necrosis virus). When a treatable pathogen is either detected or suspected, the fish pathologist prescribes appropriate prophylactic or therapeutic drugs to control the problem. After necropsy, carcasses that are not vital to further analysis are disposed of as per language contained in ESA Section 10 permits for the program.

Table 5. Hazard 3. Loss of Diversity Among Populations.

Risk Evaluation 1. Broodstock can be effectively collected from targeted population without substantial mixing with non-targeted, genetically distinct populations.

No other stocks of chinook salmon exist in the collection areas of the program streams. Fall chinook salmon are present in the lowest reaches of the Grande Ronde River but these are found over 160 river kilometers downstream from the areas of interest to this program.

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ARTIFICIAL PRODUCTION REVIEW

Introduction

The following information addresses the elements of the *Artificial Production Review* document prepared by the Northwest Power Planning Council (NPPC 1999).

This section of our composite report address the following program and projects:

Program: Grande Ronde Basin Chinook Salmon Captive Broodstock Program

Projects: 1998-01-001. Oregon Department of Fish and Wildlife. Grande Ronde Basin Spring Chinook Salmon Captive Broodstock Program.

1998-01-006. Nez Perce Tribe. Captive Broodstock Artificial Propagation.

1993-05-600. NOAA Fisheries. Assessment of Captive Broodstock Technologies.

1998-05-301. Nez Perce Tribe. Northeast Oregon Hatchery Management Plan.

1998-05-305. Oregon Department of Fish and Wildlife. Northeast Oregon Hatcheries Planning.

1998-00-704. Oregon Department of Fish and Wildlife. Northeast Oregon Hatcheries Implementation.

1998-00-702. Nez Perce Tribe. Grande Ronde Supplementation: Lostine River O&M and M&E.

1998-00-703. Confederated Tribes of the Umatilla Indian Reservation. Facility O&M and Program M&E for Grande Ronde Spring Chinook Salmon and Summer Steelhead.

1997-03-800. Nez Perce Tribe. Preserve Salmonid Gametes and Establish a Regional Salmonid Germplasm Repository

1998-05-305. Oregon Department of Fish and Wildlife. Northeast Oregon Hatcheries Planning.

Our response is organized to address the following:

- Sections II and III of Council document 99-15 (Artificial Production Review),
- The Guidelines on Hatchery Practices, Ecological Integration and Genetics from Council document 99-4 (Review of Artificial Production of Anadromous and Resident Fish in the Columbia River Basin, A Scientific Basis for Columbia River Production Programs), and
- The Performance Standards and Indicators for the Use of Artificial Production for Anadromous and Resident Fish Populations in the Pacific Northwest (17 January 2001).

Section II. Recommended Policies for the Future Role of Artificial Production in the Columbia River Basin

Section II. A. Scientific Principles Provide Basis for Policy Change.

Comanagers of the Grande Ronde Basin Chinook Salmon Captive Broodstock Program and associated projects agree that scientific principles and the best available science should guide hatchery reform and the use of hatcheries for restoration of salmon populations. Use of hatcheries should also conform to the ecological framework developed by the Multi-Species Framework Process with the intent of developing a coordinated approach to recovering fish and wildlife populations. We are part of a coordinated policy for the operation of hatcheries in the basin and will continue forward in this regard.

Section II. B. Management Principles and Legal Mandates.

Project sponsors and their respective agencies and tribes recognize their obligation to ensure that the Grande Ronde Basin Chinook Salmon Captive Broodstock Program is consistent with the array of legal mandates described in Section II B of Council document 99-15.

Section II. C. The Five Purposes of Artificial Production.

The following information addresses the need to define the purpose for artificial production programs described in Section II C of Council document 99-15. The primary purpose of the Grande Ronde Basin Chinook Salmon Captive Broodstock Program is Preservation / Conservation but comprises aspects of all five purposes for artificial production. Information is organized by column heading as presented in Table 1.

1) Purpose—Preservation/conservation: The program was implemented in 1995 to address demographic and ecological risks associated with extremely low population abundance of spring chinook salmon in the Grande Ronde Basin. The program goals are to prevent extinction of the program stocks, to maintain the genetic diversity and identity of program stocks and those in nearby streams and ensure population persistence.

2) Rationale—Biological Problem: Extremely low population abundance has the potential for causing extinction or loss of genetic diversity.

3) Rationale—Motivation: Prevent extinction and conserve genetic resources of the populations using captive propagation and cryopreservation.

4) Implications—Duration: The program has a threshold population goal of 150 spawning adults returning to each of Catherine Creek, upper Grande Ronde River and Lostine River annually. The program is expected to be temporary until we have reached a sustained threshold population and/or the causes of declines in the natural population have been rectified.

5) Implications—Assumption or Condition: Genetic characteristics can be conserved via careful artificial propagation. Habitat problems will be corrected in the immediate or distant future.

Section II. D. Policies to Guide the Use of Artificial Production.

Section II D of Council document 99-15 identifies 10 policies to help guide the use of artificial production in a scientifically sound manner to achieve management objectives. The scientific principles, legal mandates and purposes discussed above, provide the basis for use of these policies. Our discussion of how the Grande Ronde Basin Chinook Salmon Captive Broodstock Program is consistent with these policies is presented below (See Implementation Recommendation review in Section III C 1).

Section II. E. Performance Standards.

Section II E of Council document 99-15 describes the process for development of performance standards and indicators designed to be used to help evaluate artificial production programs. Our discussion of how the Grande Ronde Basin Chinook Salmon Captive Broodstock Program is consistent with these performance standards and indicators is presented below in Section III C 2 (*Applying the Policies and Performance Standards to Evaluate and Improve the Operation of Artificial Production Facilities. How to evaluate for consistency with policies and standards and identification of deficiencies; use of independent audits; independent scientific review*).

The following version of Performance Standards was used for this review:
Performance Standards and Indicators for the Use of Artificial Production for Anadromous and Resident Fish Populations in the Pacific Northwest. January 17, 2001.

Section III. Implementing Reform in Artificial Production Policy and Practices

Section III. A. Six Implementation Recommendations.

Implementation recommendations 1–3 are indirectly addressed in responses provided for Sections III A 1, III B, III B 1, III B 2, III A 2, III C, and III C 2, below. Implementation recommendation 3 is not specifically referenced by section heading.

Implementation Recommendations 4-6 are not addressed, as they describe issues and needs that range beyond the responsibility of project sponsors.

Section III. A. 1. (Implementation Recommendation 1). Evaluate the purposes for all artificial production facilities and programs in the basin within three years, applying the principles, policies, and statement of purposes recommended above.

Implementation Recommendation 1, as addressed in Council document 99-15, is reviewed in greater detail in Section III B. As such, our response to this implementation recommendation is incorporated in Section III B text below.

Section III. B. Evaluating the Purposes for All Artificial Production Facilities and Programs in the Basin.

Section III. B. 1. Initial evaluation of purposes of artificial production facilities and programs.

Over the next three years, review and determine the purpose for every artificial production program and facility in the basin, federal and non-federal, consistent with the principles, purposes and policies described in Part II of this report. These evaluations

should be a prerequisite for seeking continued funding or approvals in whatever funding and approval reviews that the facility or program faces in the next few years.

See the discussion provided above addressing Table 1 of Section II C of Council document 99-15. The purpose of the Grande Ronde Basin Chinook Salmon Captive Broodstock Program is "conservation/preservation." This purpose has been consistently articulated in the following documents:

1) Project sponsor proposals submitted to the Council and ISRP as part of the provincial review process for the Fish and Wildlife Program,

2) Individual project sponsor annual progress reports submitted to the Bonneville Power Administration and permitting agencies,

3) Draft documents completed as part of the ongoing Council's Artificial Production Review and Evaluation process, and in the

4) Draft HGMP being completed for the program.

Section III. B. 2. Evaluation of purposes of artificial production facilities and programs over time—the need for subbasin plans.

The Council expects that by sometime in 2000, the ultimate conclusion of various analytical, planning and decision making processes in the region (e.g., the Multispecies Framework process, the Council's Fish and Wildlife Program amendment process, the federal agencies' ESA decisions, and Management Plan renegotiations in U.S. v. Oregon) will be the initiation of a comprehensive subbasin planning process, guided in part by basin and province-level goals and objectives, overarching policies for artificial production based on the policies in this report, and criteria for subbasin planning. The purpose or purposes of all artificial production facilities must be re-evaluated in that subbasin planning effort, consistent with the policies in this report.

Endangered Species Act: The Snake River spring/summer chinook salmon ESU was listed as threatened under the Endangered Species Act on 22 April 1992 (correction printed on 3 June 1992). The ESU includes all natural populations of spring/summer chinook salmon in the mainstem Snake River and any of the following subbasins: Tucannon, Grande Ronde, Imnaha, and Salmon rivers. The ESA requires that recovery plans be generated to guide efforts focused on recovering and delisting of species.

Salmon Subbasin Summary: The depressed status of Grande Ronde Basin spring chinook salmon populations is clearly described in Draft Grande Ronde Subbasin Summary (ODFW 2001). Program goals and objectives of the Grande Ronde Basin Chinook Salmon Captive Broodstock Program are also consistent with existing policies and goals of state, federal and tribal agencies, including: minimizing negative hatchery effects on natural populations, especially ESA-listed populations; using hatcheries in a variety of ways to aid recovery; using safety net programs on an interim basis to avoid extinction while other recovery actions take place; preserving the genetic legacy of the most at-risk populations by using genetically appropriate broodstock; and using cryopreservation to archive key genetic resources to preserve future options. Program objectives and tasks specifically address the production of adult chinook salmon for reintroduction to nature. Hatchery practices reflect the region's best protocols and undergo constant review and modification through the Grande Ronde Basin

Chinook Salmon Captive Broodstock Program Technical Oversight Team (TOT) process. The ultimate goal is to develop self-sustaining, harvestable levels of chinook salmon populations that no longer require protection of the Endangered Species Act. Grande Ronde Basin Chinook Salmon Captive Broodstock Program goals and objectives are consistent with this language.

2000 Columbia River Basin Fish and Wildlife Program: The Grande Ronde Basin Chinook Salmon Captive Broodstock Program conforms with the general vision of the Fish and Wildlife Program (Section III A 1) and its "overarching" objective to protect, mitigate and enhance the fish and wildlife of the Columbia River and its tributaries (Section III C 1; NPPC 2000). Specifically, the Primary Artificial Production Strategy of the Fish and Wildlife Program (Section 4) addresses the need to complement habitat improvements by supplementing native fish populations with hatchery-produced fish with similar genetics and behavior to their wild counterparts. In addition, Section 4 stresses the need to minimize negative impacts of hatcheries in the recovery process. Captive broodstock program goals and objectives are aligned with this philosophy. Program methods receive constant review at TOT level and constantly strive to provide hatchery practices that meet Fish and Wildlife Program standards.

2000 FCRPS Biological Opinion: The Federal Columbia River Power System Biological Opinion (NMFS 2000) includes Artificial Propagation Measures (Section 9.6.4) that address reforms to "reduce or eliminate adverse genetic, ecological, and management effects of artificial production on natural production while retaining and enhancing the potential of hatcheries to contribute to basinwide objectives for conservation and recovery." The Biological Opinion recognizes that artificial production measures have "proven effective in many cases at alleviating near-term extinction risks." Many of the Actions to Reform Existing Hatcheries and Artificial Production Programs (Section 9.6.4.2) are being carried out in the Grande Ronde Basin Chinook Salmon Captive Broodstock Program. Specifically, this captive broodstock program's objectives address reform measures dealing with: management of genetic risk, production of fish from locally adapted stocks, use of mating protocols designed to avoid genetic divergence from the biologically appropriate population, matching production with habitat carrying capacity and marking hatchery-produced fish to distinguish them from natural fish. The Biological Opinion also reviews the need for the development of NOAA-approved Hatchery and Genetic Management Plans (HGMP). At the time of this writing, a draft is in its final stages of development.

Specific Actions in the Biological Opinion that demonstrate logical connections with the chinook salmon captive broodstock program are identified in Section 9.6.4.3. Actions 169, 170, 173, 174, 176, 177, 182, 184, and 185 are all addressed by objectives identified in the Grande Ronde Basin Chinook Salmon Captive Broodstock Program.

Much of the data needed for the Grande Ronde chinook salmon HGMP (Action 169) are provided by the captive broodstock program. Actions 170 and 173 call for the design and funding of capital modifications to implement reforms identified in HGMP's. Action 174 identifies the need for "additional sampling efforts and specific experiments to determine relative distribution and timing of hatchery and natural spawners." This need is addressed in research conducted by the Grande Ronde Basin Chinook Salmon Captive Broodstock Program. Actions 176 and 177 call for development and funding of safety net populations of at-risk salmon and steelhead. Target populations specifically addressed by the Grande Ronde Basin Chinook Salmon Captive Broodstock Program are specifically referenced in the Biological Opinion.

Recommendations made in Action 182 are to fund studies "to determine the reproductive success of hatchery fish relative to wild fish," and concerns over the genetic implications are expressed. The Grande Ronde Basin Chinook Salmon Captive Broodstock Program and ODFW LSRCP studies are actively involved with research designed to address this question. Action 184 states the need to provide funding for a "hatchery research, monitoring, and evaluation program consisting of studies to determine whether hatchery reforms reduce the risk of extinction for Columbia River basin salmonids and whether conservation hatcheries contribute to recovery." The Grande Ronde Basin Chinook Salmon Captive Broodstock Program and ODFW, NPT and CTUIR LSRCP projects are monitoring and evaluating conservation hatchery techniques and behavioral patterns and spawning success in adults produced by the program. Action 185 refers to juvenile migration studies and adult returns of these fish. Progeny from the Grande Ronde Basin Chinook Salmon Captive Broodstock Program are used for these studies.

Offices of the Governors 2000: The governors of the states of Idaho, Montana, Oregon, and Washington developed recommendations for the protection and restoration of fish in the Columbia River Basin and urged regional recovery planners to recognize the multi-purpose aspect of hatcheries, which includes fish production for harvest, supplementation to rebuild naturally spawning populations and captive broodstock experiments for conservation and restoration (Offices of the Governors 2000, Chapter IV, Hatchery Reforms). The Governors recommended, "all hatcheries in the Columbia River Basin be reviewed within three years to determine the facilities' specific purposes and potential future uses in support of fish recovery and harvest." They further recommended that the supplementation plan recognize the tribal, state, and federal roles in implementation of the plan. Lastly, the Governors supported the concept of wild fish refugia and the use of these as controls for evaluating conservation hatchery efforts. This is a component of the Grande Ronde Basin Chinook Salmon Captive Broodstock Program and Lower Snake River Compensation Plan (LSRCP) hatchery evaluation efforts.

Section III. A. 2. (Implementation Recommendation 2). Applying the policies and standards in Part II, take the necessary steps to evaluate and then improve the operation of artificial production facilities that have an agreed-upon purpose.

Implementation Recommendation 2, as addressed in Council document 99-15, is reviewed in greater detail in Section III C. As such, our response to this implementation recommendation is incorporated in Section III C text below.

Section III. C. Applying the Policies and Performance Standards to Evaluate and Improve the Operation of Artificial Production Facilities.

Section III. C. 1. General recommendation—immediately implement needed improvements in artificial production programs and facilities.

All facilities must be evaluated for consistency with the policies and standards in this report relating to artificial production. Evaluating the facility, developing a work plan to meet the standards, and showing progress toward meeting the standards should be a prerequisite to obtaining continued funding (in whatever funding process the facility sits) or obtaining ESA approval for continued operations. Transition and re-programming funds needs to be available (see Part III D) to make this transition a reality.

The following review of improvement recommendations #1 through #10 is consistent with language provided by the Council's Science Review Team (SRT) and their guidelines presented in Council Document 99-4. Note—a review of SRT guidelines is presented later in this document.

Policy Recommendation 1. The manner of use and the value of artificial production must be considered in the context of the environment in which it will be used.

- **The success of artificial production depends on the quality of the environment in which the fish are released, reared, migrate, and return.**

  The Grande Ronde Basin once supported large runs of chinook salmon and peak escapements in excess of 10,000 occurred as recently as the late 1950s (U.S. Army Corps of Engineers 1975). There have been anthropogenic habitat alterations in the Grande Ronde Basin—sometimes extensive—but habitat quality and availability has not changed substantially since the late 1950s when large runs of chinook salmon were present in the basin (Currens et al. 1996; ODFW 2001). Spawning and rearing habitat in the streams from which fish are collected for the captive broodstock program have been subjected to human alteration, primarily in the lower reaches of the streams but good habitat remains upstream of these perturbations. Access to this habitat is either unlimited (upper Grande Ronde River and Catherine Creek) or seasonally limited and the fish are assisted by being trapped and transported around dewatered sections (Lostine River).

- **Artificial production provides protection for a limited portion of the lifecycle of fish that exist for the rest of their lives in a larger ecological system, albeit altered, that may include riverine, reservoir, lake, estuarine and marine systems that are subject to environmental factors and variation that we can only partially understand.**

  Project sponsors understand that captive intervention should be considered as a short-term tool and used only to get past bottlenecks that jeopardize populations (e.g., demographic, genetic or environmental risk). The benefits of using captive technology should outweigh the risks of not doing so and work should be underway to correct the problems that brought about population declines.

  Project sponsor activities are focused on providing the best fish culture environment, fish management and monitoring and evaluation programs to support the maintenance and rebuilding of Grande Ronde Basin chinook salmon populations. At the same time, it is hoped that regional efforts to decrease migratory mortality of juvenile and adult anadromous salmonids are successful. Project sponsors recognize that these efforts are largely out of their immediate sphere of influence.

- **The success of artificial production must be evaluated with regard to sustained benefits over the entire lifecycle of the produced species in the face of natural environmental conditions, and not evaluated by the number of juveniles produced.**

  The Grande Ronde Basin Chinook Salmon Captive Broodstock Program includes programmatic elements that address fish culture, fisheries management and in-hatchery, field and genetic monitoring and evaluation. The comanagement agencies (ODFW, NPT, CTUIR and NOAA Fisheries) collaborate to address daily management responsibilities, critical program uncertainties and a comprehensive management and recovery goals. Each aspect of the program is continually being monitored and evaluated and changes are made as necessary to improve safety for the captive broodstock fish and to better achieve the goals of the program: to prevent extinction of these stocks, maintain the genetic diversity and identity of the stocks in the program and those in nearby streams, ensure population persistence and provide methodologies to be used in other captive broodstock programs.

- **Domestication selection is the process whereby an artificially propagated population diverges in survival traits from the natural population. This divergence is not avoidable entirely, but it can be limited by careful hatchery protocols such as those required by policies in this report.**

  A primary goal of this program is to maintain the genetic diversity and identity of these stocks and those of unsupplemented stocks in nearby streams. The threat of domestication selection was considered at the inception of the Grande Ronde Basin Chinook Salmon Captive Broodstock Program. We take steps to prevent domestication and potential loss of genetic diversity, by insuring that eggs from all females are fertilized by 2-4 males and that all males fertilize eggs from up to four females. We have also made a policy that all captive broodstock offspring will be allowed to spawn in nature and none will be incorporated into any conventional hatchery spawning program to insure that at least one full life cycle is completed in nature before any fish is brought into captivity.

- **For actions that mitigate for losses in severely altered areas, such as irrevocably blocked areas where salmon once existed, the production of non-native species may be appropriate in situations where the altered habitat or species assemblages are inconsistent with feasible attainment of management objectives using endemic species.**

  Not applicable.

Policy Recommendation 2. Artificial production must be implemented within an experimental, adaptive management design that includes an aggressive program to evaluate benefits and address scientific uncertainties.

The Grande Ronde Basin Chinook Salmon Captive Broodstock Program has an experimental component that is operated within an adaptive management design to address benefit and risk factors identified for operation of Conservation Hatcheries and captive broodstock programs (Flagg et al. 1995; Flagg et al. in review a, b; Pollard and Flagg in review). Required strategies include providing proper rearing environments for high survival and evaluation of experimental objectives, proper genetic breeding protocols, specific protocols for rearing and release of offspring and monitoring and evaluation of the entire program. The TOT (comprised of research, culture and management biologists from each of the comanagement agencies) adaptively manages the program and addresses issues that arise. We look for opportunities to improve the program through our own research efforts and those of others from the scientific literature, as well as discussions and presentations at professional meetings (see Hoffnagle et al. 2003 for further description).

The experimental component of the Grande Ronde Basin Chinook Salmon Captive Broodstock Program examines the effects of accelerated vs. natural presmolt rearing and saltwater vs. freshwater post-smolt rearing. We also segregate rearing of captive broodstock offspring based on the BKD status (based on ELISA) of the maternal parent and look for other means to reduce the amount of culling for bacterial kidney disease (BKD) control.

Mean parr-to-smolt survival has been 97% and mean annual egg viability has been 78%. It is too early to speculate on success or failure of the captive broodstock program. The goal is to produce a sustained annual return of 150 wild adults. We cannot determine success or failure until we see a record of returns of the F_2 generation. This is still several years into our future, as we have had only one full cohort of captive broodstock progeny return from post-smolt rearing in nature (preliminary results are promising, as we have had returns as high as 1.7%, exceeding the expected return rate of 0.1%). Returning F_1 generation fish are allowed to spawn in nature to produce the F_2 generation. We monitor returns of F_1 and F_2 generation fish by counts at weirs and on spawning ground surveys and by collection of tissue samples for comparison with tissues collected from previously returning adults.

New captive broodstock rearing and reintroduction technology is continuously being developed for this program. We have been using ultrasound and are testing near infrared spectroscopy for early determination of maturation and sex in the captive broodstock to allow us to transfer saltwater reared fish to freshwater at the appropriate time for improved health and survival to spawning. We are also testing the use of azithromycin for prophylaxis against BKD in the captured parr and for preventing vertical transmission of BKD.

We are extensively monitoring and evaluating survival of captive broodstock offspring in nature. All progeny of captive broodstock released into nature are adipose clipped and coded-wire tagged. A portion is also PIT-tagged for examination of downstream migration survival. Approximately 1.2 million smolts and 55,000 parr have been released from the 1998-2001 cohorts. Between 2001 and 2003, a total of 1,592 adults have returned from the ocean from captive broodstock releases (Hoffnagle et al. 2003). It is too early to make conclusions about return rates but the early data are promising.

Policy Recommendation 3. Hatcheries must be operated in a manner that recognizes that they exist within ecological systems whose behavior is constrained by larger-scale basin, regional and global factors.

- **Management of artificial production, and the expectations of that management, should be flexible to reflect the dynamics of the natural environment. Production and harvest managers should anticipate large variation in artificial production returns similar to that in natural production.**

  Program managers recognize the variable nature of the natural environment and the effects that the environment has on fish populations. We also recognize the concern of overstocking the available habitat, although this is unlikely to occur at present wild chinook salmon populations and stocking rates and times. We stock smolts which vacate the freshwater habitat soon after release, so their impact on wild chinook salmon in these streams is minimal. We are only beginning to see returns from the fish produced by the captive broodstock program but it is highly unlikely that adult numbers will exceed the carrying capacity of these streams in the near future. No harvest of chinook salmon is anticipated for Grande Ronde Basin streams in the near future.

  We also recognize that return rates will vary dramatically. Indeed, preliminary results from our first three cohorts released show excellent returns for the 1998 cohort, with smolt-to-adult return rates exceeding the expected rate of 1% and reaching 1.7% for Lostine River fish. The 1999 cohort appears to be suffering poor return rates, probably due to poor out-migration conditions observed throughout the Snake River Basin in

2001, but still has exceeded 0.1% for all three stocks, even without age 5 returns and the Lostine River 2000 cohort has reached 0.13% with only age 3 fish having returned.

- **The management and performance of individual facilities cannot be considered in isolation but must be coordinated at watershed, subbasin, basin, and regional levels, and must be integrated with efforts to improve habitat characteristics and natural production where appropriate.**

  The comanagers of the Grande Ronde Basin Chinook Salmon Captive Broodstock Program (ODFW, NPT, CTUIR and NOAA Fisheries) and the LSRCP (ODFW, NPT, CTUIR and USFWS) coordinate Grande Ronde Basin hatchery activities and management through the TOT and LSRCP annual operating plan process. Project technical review, prioritization and funding decisions are carried out at the subbasin, basin and regional levels through cooperative processes developed by regional fish managers, the Columbia Basin Fish and Wildlife Authority and the Northwest Power and Conservation Council.

Policy Recommendation 4. A diversity of life history types needs to be maintained in order to sustain a system of populations in the face of environmental variation.

Genetic diversity has been directly correlated with long-term success and persistence of populations (see Avise 1994). The primary goal of this captive broodstock program is to conserve the genetic diversity of the program streams and nearby unsupplemented streams by utilizing available genetic diversity within the population and crossing all available individuals using spawning matrices to minimize other genetic risks (such as inbreeding and domestication). As such, ensuring that as many fish as possible survive to spawn is an objective of the program. We have achieved a mean parr-to-adult survival rate of 63%, exceeding our goal of 50% parr-to-adult survival.

Policy Recommendation 5. Naturally selected populations should provide the model for successful artificially reared populations, in regard to population structure, mating protocol, behavior, growth, morphology, nutrient cycling, and other biological characteristics.

- **With regard to increasing the survival of the hatchery population itself, the working hypothesis is that mimicking the incubation, rearing and release conditions of naturally spawning populations will increase survival rates after release into the natural environment. Some efforts to mimic natural rearing processes, such as the use of shading, are generally accepted as appropriate practices. Uncertainty lies in how far managers should go in mimicking natural rearing conditions in an effort to improve survival, especially considering the increasing cost, the difficulty of some measures, and the possibility of declining benefits. In addition, there are certain situations in which the survival of artificially produced fish appears to be enhanced by not mimicking natural release size or migration times. Decisions to deviate from the biological characteristics of the naturally spawning population should be documented through an explicitly stated biological rationale and carefully evaluated. In addition, the efficacy of programs that mimic natural populations should continue to be tested to reduce uncertainty.**

  For the captive broodstock program, achieving the highest possible survival to maturation is the primary objective. As such, we conform to standard hatchery practices, modified as necessary to further improve survival. Other than rearing the fish under a simulated natural photoperiod, we do not attempt to mimic natural conditions for these fish, except as the fish ripen. At that time, they are exposed to natural stream water to provide them with a natural temperature regime.

We do all that we can to mimic natural conditions for rearing the F_1 generation, given the limitations of our facilities. Eggs are incubated in darkness and soon after swim-up the fish are transported to Lookingglass Fish Hatchery, where they are reared outdoors in unfiltered stream water, exposing them to a natural photoperiod and temperature regime. Our protocol is to rear them to a size at smoltification similar to that of wild fish (approximately 20 g). However, due to early hatching and opportunity for growth, the fish are usually larger, which may improve their survival (Carmichael 1998). We are making program changes to further reduce smolt size to that closer to natural smolts. At smoltification, we acclimate the fish at outdoor acclimation facilities located within the known spawning distribution of chinook salmon in each program stream. Unfiltered stream water flows through each raceway and raceways have overhead shading, in-water structures (trees), flow manipulation (to simulate a rising hydrograph) and feed is supplemented with natural aquatic and terrestrial invertebrates. The fish are allowed the opportunity to leave the acclimation ponds volitionally for 7-14 days before being forced out. Further modification of facilities to better simulate natural conditions is not feasible at this time, given the uncertainties that remain regarding natural rearing and the threatened status of these stocks.

- **With regard to the possibility of adverse impacts of artificial production on naturally spawning fish, much of the recent literature suggests that using local broodstocks and mimicking natural rearing conditions will reduce the impacts of artificially produced populations on naturally spawning populations and the ecosystem. There is a counter-hypothesis that, at least in some situations, it is best for artificial production managers to avoid mimicking the release times, places, and conditions of natural populations to avoid harmful competition, predation and other adverse interactions. Again, any decisions to deviate from the biological characteristics of the naturally spawning population should be documented through an explicitly stated biological rationale and carefully evaluated.**

The Grande Ronde Basin Chinook Salmon Captive Broodstock Program strives, to the extent possible, to maintain population structure, mating protocol, growth, morphology and other biological characteristics of the naturally spawning population. However, the first step in this process is ensuring high in-culture survival. As such, the captive broodstock program relies on traditional fish culture techniques with a proven record of increasing in-culture survival. Additionally, when demonstrated to have no adverse effects on in-culture survival, the program readily adopts novel fish culture technology designed to promote the natural attributes of the fish. Fish within the captive broodstock program are mated in a manner to maximize the retention of original genotypes within the population and all returning F_1 adults are allowed to mate in nature, hopefully with wild fish. The program also uses reintroduction and acclimation strategies to keep program fish close to the natural model.

In the future, adult releases will be considered as a tool to allow fish to spawn naturally and planting of eggs may also be considered. The intent of these strategies is that offspring will be better conditioned to the natural environment. Unfortunately, these approaches often yield very low freshwater survival, making it unlikely that these strategies alone will produce enough fish to spawn at the replacement level and attain our threshold of a sustained annual return of 150 naturally-produced adults. Therefore, they will not be employed until stock numbers have increased sufficiently.

Incorporation of proven seminatural rearing strategies into conventional raceway rearing practices is also being considered as a means to produce more natural smolts and parr, while maintaining the increased survival associated with smolt releases.

- **The final working hypothesis, which applies to artificial production for the restoration purpose, is that through the use of locally adapted or compatible broodstocks and natural rearing and release conditions, artificial production can benefit or assist naturally spawning populations. This is the least established hypothesis of the three, and the one most in need of experimental treatment and evaluation.**

  The Grande Ronde Basin Chinook Salmon Captive Broodstock Program is not primarily a restoration program. However, we have anticipated the possibility that program fish may be used to restore populations to basin streams in which chinook salmon populations have been extirpated. We agree that locally adapted stocks are the preferred option and we have designated outlet streams within or nearby each program stream into which excess captive broodstock production have been and will be stocked.

Policy Recommendation 6. The entities authorizing or managing a artificial production facility or program should explicitly identify whether the artificial propagation product is intended for the purpose of augmentation, mitigation, restoration, preservation, research, or some combination of those purposes for each population of fish addressed.

- **A decision identifying an artificial production program as a “permanent” mitigation program should be accompanied, for example, by an explicit identification of the permanently lost habitat that it replaces.**

  Not applicable.

- **A decision identifying a restoration program should include, for example, an explicit determination that suitable restored habitat exists or will soon exist for re-seeding. It should also include a statement of the expected duration of the program, by which it is expected the natural population will be rebuilt and the facility withdrawn (or continued with a different identified purpose).**

  Not applicable.

- **Similarly, a decision identifying a preservation/conservation program should include, for example, an explicit determination that the underlying habitat decline or other problem-threatening extirpation will be addressed and how. This decision should also include a statement of the expected duration of the program, the time by which the program will be evaluated to determine if it is a success (meaning the time by which it is expected that natural processes can once again sustain the population, and the facility withdrawn or converted to another identified purpose) or a failure (meaning that it is time to end or reorient the program).**

As noted in Pollard and Flagg (in review), captive propagation on its own will rarely, if ever, constitute a complete recovery program. For any recovery to be successful, the factors that caused the population to decline to the status where captive propagation is necessary must be addressed. Many habitat restoration efforts are currently underway in the Grande Ronde Basin (Ashe et al. 2000; ODFW 2001). The projects are being conducted by federal, state, and tribal agencies and other groups and address issues such as stream channelization, sedimentation, stream bank stabilization, riparian vegetation, organic and inorganic pollution, and stream discharge. However, the dilemma facing enhancement efforts for Grande Ronde Basin chinook salmon is that most of the severe barriers to survival are downstream of the spawning and rearing habitat. Manmade alterations (dams), harvest, and changes in ocean productivity probably contributed to reduction in abundance of Grande Ronde Basin chinook salmon. These are outside the purview of this program. Regional fish managers are currently involved in a Technical Recovery Team (TRT) process to determine needed recovery actions and time frames. Under these current conditions, it is probable that artificial propagation will be a key component in maintaining Grande Ronde Basin chinook salmon for years to come. However, the captive broodstock program has a goal of attaining a sustained annual return of 150 wild adults. When that is reached, the captive broodstock program will transfer propagation to a conventional hatchery supplementation program.

Policy Recommendation 7. Decisions on the use of the artificial production tool need to be made in the context of deciding on fish and wildlife goals, objectives and strategies at the subbasin and province levels.

The Grande Ronde Basin spring chinook salmon population is depressed well below levels explained by habitat alterations in the basin (Ashe 2000; ODFW 2001). The Grande Ronde Basin Chinook Salmon Captive Broodstock Program addresses recovery goals through the use of conservation hatchery practices and are consistent with existing policies and goals of state, federal and tribal agencies, including: minimizing negative hatchery effects on natural populations, especially ESA-listed populations; using hatcheries in a variety of ways to aid recovery; using safety net programs on an interim basis to avoid extinction while other recovery actions take place; preserving the genetic legacy of the most at-risk populations by using genetically appropriate broodstock; and using cryopreservation to archive key genetic resources to preserve future options. Program objectives and tasks specifically address the production of adult chinook salmon for reintroduction to nature. Hatchery practices reflect the region’s best protocols and undergo constant review and modification through the Grande Ronde Basin Chinook Salmon Captive Broodstock Program Technical Oversight Team process. The ultimate goal is to develop self-sustaining, harvestable levels of chinook salmon populations that no longer require protection under the Endangered Species Act. Grande Ronde Basin Chinook Salmon Captive Broodstock Program goals and objectives are consistent with this language. Representatives from the co-management agencies are currently contributing to the ongoing subbasin assessment and planning process.

Policy Recommendation 8. Appropriate risk management needs to be maintained in using the tool of artificial propagation.

Mortality associated with collection of chinook salmon parr is very low. We have never killed a parr during collection and mortality after collection is largely due to failure to feed, jumping out of tanks, handling or adverse reaction to the BKD vaccine. Parr-to-smolt survival has been 97%, exceeding our goal of 95%. We have further minimized mortality associated with captive propagation in several ways. All personnel are properly trained in fish handling methods and all fish are anesthetized prior to handling. We have learned to completely cover all tanks and have ceased vaccinating the fish for BKD.

Fish husbandry protocols follow standard fish culture practices (for a general overview of methods see Leitritz and Lewis 1976; Piper et al. 1982; Rinne et al. 1986; Erdahl 1994; IHOT 1995; McDaniel et al. 1994; Bromage and Roberts 1995; Schreck et al. 1995; Pennell and Barton 1996; NMFS 1999; Wedemeyer 2001). Other protocols and guidelines approved by the TOT further ensure high quality rearing conditions.

Genetic hazards with artificial production outlined in Hard et al. (1992) are taken into consideration. Spawning matrices are employed to insure that all eggs from all females are fertilized by 2-4 males and all males fertilize eggs from up to four females.

Diseased, moribund or non-productive fish and gametes are removed from the captive population and disposed of following AFS Fish Health Blue Book and Pacific Northwest Fish Health Protection Committee guidelines to ensure the overall health of rearing groups. Our standard protocol is to cull eggs, prior to fertilization, from all females displaying gross symptoms of BKD. In addition, we normally cull eggs from all females with and ELISA OD <0.8 to prevent the spread of contagious diseases to the general population. Gametes, embryos, or fish are sampled regularly to detect diseases and to monitor fertilization and the development of embryos. This lethal sampling is necessary to treat for diseases as soon as possible and to improve the reproductive success of fish in the captive broodstock program.

Rearing facilities are staffed full-time and have backup and redundancy systems in place to ensure an uninterrupted supply of pathogen free water. Alarm systems and generator systems are also in place. Fish transport equipment is maintained in top working condition. All transport vehicles have on-board oxygen and fresh flow water agitation systems. Fish are inspected at regular intervals during transportation.

Policy Recommendation 9. Production for harvest is a legitimate management objective of artificial production, but to minimize adverse impacts on natural populations associated with harvest management of artificially produced populations, harvest rates and practices must be dictated by the requirements to sustain naturally spawning populations.

Production for harvest is a goal for the Grande Ronde Basin Chinook Salmon Captive Broodstock Program. At the present time, no harvest is allowed for these fish. However, intermittent sport, commercial and tribal fisheries for chinook salmon in the lower Columbia River have the potential for incidental harvest of program fish but expected harvest will be extremely low, based on harvest of Imnaha River fish (StreamNet web site).

Policy Recommendation 10. Federal and other legal mandates and obligations for fish protection, mitigation, and enhancement must be fully addressed.

Oregon Revised Statute (ORS) 498.002 declares that “Wildlife is the property of the state” and ORS 496.012 states that, “It is the policy of the State of Oregon that wildlife shall be managed to prevent serious depletion of any indigenous species and to provide the optimum recreational and aesthetic benefits for present and future generations of the citizens of this state.” Oregon Revised Statute 496.080 creates the State Department of Fish and Wildlife, whose mission is “to protect and enhance Oregon’s fish and wildlife and their habitats for use and enjoyment by present and future generations.” The ODFW has developed a Native Fish Conservation Policy to “ensure the conservation of native fish in Oregon” focusing on “naturally produced native fish.” The ODFW has also developed a Fish Hatchery Management Policy which “describes best management practices that are intended to help ensure the conservation of both naturally produced native fish and hatchery produced fish in Oregon through the responsible use of hatcheries.” Oregon Department of Fish and Wildlife is committed to developing and maintaining innovative programs such as the Grande Ronde Basin Chinook Salmon Captive Broodstock Program to safeguard the fisheries resources of the State of Oregon.

In Nez Perce Tribal Code § 3-1-2 Purpose and Declaration of Policy, The Nez Perce Tribal Executive Committee finds that: (a) all wildlife now or in the future within the Nez Perce Reservation, not held by private ownership legally acquired...are hereby declared subject to the jurisdiction of the Nez Perce Tribe; and (b) such wildlife shall be preserved, protected and perpetuated in accordance with this chapter and for use of members of the Nez Perce Tribe and their immediate families; and (c) such wildlife resources may also be utilized for the sport and recreation of persons who are not members of the Nez Perce Tribe pursuant to rules, regulations and conditions established in accordance with this chapter.” Goals of the Nez Perce Department of Natural Resources include to “promote, protect, and perpetuate the utilization and sustainability of the tribe’s invaluable treaty rights and resources and to protect the health of the Tribal public through sound land management practices and protection of all environmental resources.”

The Confederated Tribes of the Umatilla Indian Reservation Department of Natural Resources “is responsible for co-managing wildlife on Reservation and Ceded Lands” and its Fisheries Program “is responsible for co-managing with state and federal agencies fisheries resources on the mainstem Columbia and Snake Rivers and tributaries for use by Tribal members.”

In addition to state and tribal policy, the Grande Ronde Basin Chinook Salmon Captive Broodstock Program complies with federal Endangered Species Act Policy. Since inception of the program in 1995, the co-management agencies have secured all necessary Section 10 permits authorizing the take of listed Snake River chinook salmon for research and enhancement activities. Accordingly, biological opinions generated by NOAA Fisheries have concluded that program activities are not likely to jeopardize the continued existence of listed Snake River chinook salmon.

Section VIII. D. Guidelines on Hatchery Practices, Ecological Integration, and Genetics.

Review of Artificial Production of Anadromous and Resident Fish in the Columbia River Basin. A Scientific Basis for Columbia River Production Programs. Northwest Power Planning Council. Document 99-4. April 1999. Portland OR.

Guideline 1. Technology should be developed and used to more closely resemble natural incubation and rearing conditions in salmonid hatchery propagation.

Captive broodstock fish will never see the wild and simulating natural conditions is less important than insuring a high rate of survival to maturation. Captive broodstock offspring are incubated in darkness and incubation and rearing densities do not exceed 8.0 kg/m3 for most of the rearing cycle. They are reared from soon after swim-up to smolt in outdoor raceways with unfiltered stream water that provides natural photoperiod and temperature regimes. The fish are fed by hand or automated feed delivery systems, rather than demand feeders. No fish in the program are exposed to predator training and fish-human interactions are generally minimized. Smolts are acclimated in unfiltered natural stream water at the release stream prior to release. A period of volitional emigration from the acclimation ponds is employed, after which the remaining fish are forced out.

Guideline 2. Hatchery facilities need to be designed and engineered to represent natural incubation and rearing habitat, simulating incubation and rearing experiences complementary with expectations of wild fish in natural habitat.

The captive broodstock program does not use facilities designed to simulate the natural incubation and rearing experience as most proven fish culture technology does not incorporate these features. Survival to maturation is the priority of this program.

Guideline 3. New hatchery technology for improving fish quality and performance needs to have a plan for implementation and review at all hatchery sites, where appropriate, to assure its application.

New captive broodstock technology is continuously being developed through this and other captive broodstock programs. Development, use, and evaluation of new and existing technologies are discussed at TOT meetings. New technologies in use or being tested by the Grande Ronde Basin Chinook Salmon Captive Broodstock Program include: vaccinations for BKD (discontinued), the use of ultrasound and near infrared spectroscopy for early determination of maturation and sex and the use of azithromycin for treatment and prevention of BKD and vertical transmission of BKD. We continue to examine new technologies for prevention and treatment of BKD, improved post-smolt growth, synchronizing maturation timing with that of wild chinook salmon in the Grande Ronde Basin and achieving a natural smolt size for the F_1 generation.

Guideline 4. To mimic natural populations, anadromous hatchery production strategy should target natural population parameters in size and timing among emigrating anadromous juveniles to synchronize with environmental selective forces shaping natural population structure.

Program smolts are released during the historic out-migration window for naturally-produced chinook salmon smolts in each stream. We target F_1 smolts to be the size of natural smolts (approximately 20 g) at the time of release. However, it is difficult to keep the fish this small and maintain their health. As a result, the majority of the program smolts have been larger than naturally out-migrating fish. We are examining options for achieving this target smolt size.

Guideline 5. To mimic natural populations, resident hatchery production strategy should target population parameters in size and release timing of hatchery-produced resident juveniles to correspond with adequate food availability and favorable prey to maximize their post-stocking growth and survival.

Not applicable. F_1 generation is targeted for release as smolts. When parr are released, we do so at times when food is plentiful (late spring-summer).

Guideline 6. Supplementation hatchery policy should utilize ambient natal stream habitat temperatures to reinforce genetic compatibility with local environments and provide the linkage between stock and habitat that is responsible for population structure of stocks from which hatchery fish are generated.

Program sponsors are aware of the importance of managing rearing and incubation water temperatures to insure that the linkage described in Guideline 6 is maintained. At Lookingglass Fish Hatchery, the F_1 generation is reared on unfiltered stream water with natural temperature fluctuations. Also, F_1 smolts are acclimated at release streams in unfiltered stream water.

Guideline 7. Salmonid hatchery incubation and rearing experiences should use the natal stream water source whenever possible to enhance home stream recognition.

Project sponsors agree in principle with Guideline 7 but find that this is not feasible, given our present facilities. However, a new facility on Lostine River is part of the Northeast Oregon Hatchery Project (NEOH) currently in the planning process (Ashe et al 2000). This facility, if developed, would use filtered surface water for incubation and rearing. Similar facilities for upper Grande Ronde River and Catherine Creek are being discussed. We are considering the option of releasing captive broodstock offspring as eyed eggs into the program streams once the populations have reached a sufficient size. The use of “raw” stream water during incubation and early rearing is not done at present for fish health management reasons – whirling disease is present in the Grande Ronde Basin.

Guideline 8. Hatchery release strategies need to follow standards that accommodate reasonable numerical limits determined by the carrying capacity of the receiving stream to accommodate residence needs of non-migrating members of the release population.

Myers et al. (1998) reported that the Snake River once supported 1.5 million adult chinook salmon but population size in 1997 was approximately 2,5000. The Grande Ronde Basin once supported large runs of chinook salmon and estimated peak escapements in excess of 10,000 occurred as recently as the late 1950’s (U.S. Army Corps of Engineers 1975). The maximum number of redds observed in Catherine Creek was 505 (1971), 304 in the Grande Ronde River (1968) and 261 in 1956 in the Lostine River (Tranquilli et al. 2003). We have not yet reached this number of redds in these streams. Also, we release program fish as smolts, which do not take up residence in these streams.

Guideline 9. Hatchery programs should dedicate significant effort in developing small facilitates designed for specific stream sites where supplementation and enhancement objectives are sought, using local stocks and ambient water in the facilities designed around engineered habitat to simulate the natural stream, whenever possible.

The Grande Ronde Basin Chinook Salmon Captive Broodstock Program uses only fish captured from the program streams. Project sponsors agree with and understand the need for and advantages of developing small facilities on the program streams. Indeed, discussions and plans for this are underway through NEOH (Ashe et al 2000) and other avenues. However, any use of surface water for early rearing would have to be filtered and sterilized. Surface water in the Grande Ronde Basin supports bacterial, parasite (including whirling disease) and viral pathogens that could jeopardize the success of the program.

Guideline 10. Genetic and breeding protocols consistent with local stock structure need to be developed and faithfully adhered to as a mechanism to minimize potential negative hatchery effects on wild populations and to maximize the positive benefits that hatcheries can contribute to the recovery and maintenance of salmonids in the Columbia ecosystem.

Since captive rearing allows for quicker presmolt growth, most males mature at the ages of 2 and 3 years. It is impossible for us to follow local stock age structure under these conditions. Therefore, within the captive broodstock program, all fish are given the opportunity to contribute gametes to the F_1 generation. The fish are spawned in a matrix design in which eggs from all females are fertilized by 2-4 males and all males fertilize eggs from up to four females.

For the F_1 generation, all returning captive broodstock offspring are permitted to spawn in nature. This is the best that we can do to minimize potential negative hatchery effects on wild populations.

Guideline 11. Hatchery propagation should use large breeding populations to minimize inbreeding effects and maintain what genetic diversity is present within the population.

We attempt to collect 500 parr from each program stream. Parr-to-adult survival has been increasing and the mean is 63%, resulting in approximately 315 spawners for each stock and cohort. In addition, we try to avoid crossing within cohorts, to avoid the possibility of sibling crosses and the fish are spawned in a matrix design in which eggs from all females are fertilized by 2-4 males and all males fertilize eggs of up to four females.

Guideline 12. Hatchery supplementation programs should avoid using strays in breeding operations with returning fish.

Since the captive broodstock program collects fish as parr, this is not applicable.

Guideline 13. Restoration of extirpated populations should follow genetic guidelines to maximize the potential for re-establishing self-sustaining populations. Once initiated, subsequent effort must concentrate on allowing selection to work by discontinuing introductions.

This is not a restoration program.

Guideline 14. Germ plasm repositories should be developed to preserve genetic diversity for application in future recovery and restoration projects in the basin, and to maintain a gene bank to reinforce diversity among small inbred natural populations.

Milt from male donors has been cryopreserved in the Grande Ronde Basin Chinook Salmon Captive Broodstock Program since 1997 and follows techniques described by Cloud et al. (1990) and Wheeler and Thorgaard (1991). Milt is cryopreserved from males in excess of those needed for spawning each year. Cryopreserved milt is used only when fresh milt is unavailable due to reduced fertility (34% vs. 80%).

Currently, we are storing cryopreserved sperm samples from males from each program stock and each is available for use, when needed. Samples are divided between two locations (Bonneville Fish Hatchery and the University of Idaho) to prevent a catastrophic loss from accidents at any one location.

Guideline 15. The physical and genetic status of all natural populations of anadromous and resident fishes need to be understood and routinely reviewed as the basis of management planning for artificial production.

The physical status of the Grande Ronde Basin chinook salmon population is monitored in a variety of ways at several life stages including redd counts and fry, smolt and adult enumeration. Tissue samples are collected from all captive broodstock fish and from as many returning adults (hatchery and wild) as possible - captured at weirs or carcasses found on spawning ground surveys.

Guideline 16. An in-hatchery fish monitoring program needs to be developed on performance of juveniles under culture, including genetic assessment to ascertain if breeding protocol is maintaining wild stock genotypic characteristics.

Tissue samples are collected from all captive broodstock fish and from all returning adults that are captured at weirs or recovered (as carcasses) on spawning ground surveys. These will be genetically tested to determine the relative success of hatchery vs. wild adults and for the F_2 generation to determine spawning success of hatchery-reared fish (captive broodstock F_1s) in comparison to wild fish. These tissue samples can also be analyzed for genotypic changes over time.

Guideline 17. A hatchery fish monitoring program needs to be developed on performance from release to return, including information on survival success, interception distribution, behavior, and genotypic changes experienced from selection between release and return.

Tissue samples from captive broodstock fish, returning F_1 generation and associated wild adults and the F_2 generation to document F_1 spawning success. Numbers of fish collected at weirs and on spawning grounds allow determination of smolt-to-adult survival. All hatchery fish are implanted with coded-wire tags to obtain information on straying and capture in ocean and Columbia River fisheries.

Guideline 18. A study is required to determine cost of monitoring hatchery performance and sources of funding.

Not applicable.

Guideline 19. Regular performance audits of artificial production objectives should be undertaken, and where they are not successful, research should be initiated to resolve the problem.

Not applicable.

Guideline 20. The NPPC should appoint an independent peer review panel to develop a basinwide artificial production program plan to meet the ecological framework goals for hatchery management of anadromous and resident species.

Outside the purview of this program.

Section III. C. 2. How to evaluate for consistency with policies and standards and identification of deficiencies; use of independent audits; independent scientific review.

Entities seeking funding for artificial production programs should analyze their programs and facilities against the policies and performance standards described in this report to identify deficiencies and needed improvements, making use of the existing audit

information where appropriate. These entities should use a combination of self-evaluations and independent evaluations, using scientific resources to focus on critical areas of uncertainty. The end result of this self-evaluation process should be a demonstration of consistency with the policies and standards or an explanation of inconsistencies and a proposal for correction. The evaluations and conclusions should then be presented to the review bodies, including independent scientific panels, for review as part of the funding processes. And, until the decisions on use and purpose are revisited as described in Part III B above, the proposals and decisions in the funding reviews should include an explicit if interim evaluation of the more fundamental questions about purpose, which would balance the magnitude of needed operational improvements against the potential for a change in purpose, as part of a judgment on funding priorities.

Our discussion of how the Grande Ronde Basin Chinook Salmon Captive Broodstock Program is consistent with the Council's performance standards and indicators is presented below. The following version of this document was used:

Performance Standards and Indicators for the Use of Artificial Production for Anadromous and Resident Fish Populations in the Pacific Northwest. 17 January 2001.

3.2.2 Standard: Release groups sufficiently marked in a manner consistent with information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries.

Indicator 1: Marking rate by type in each release group documented.

3.3.1 Standard: Artificial propagation program contributes to an increasing number of spawners returning to natural spawning areas.

Indicator 1: Annual number of spawners on spawning grounds estimated in specific locations.
Indicator 2: Spawner-recruit ratios are estimated in specific locations.
Indicator 3: Number of redds in natural production index areas documented.

3.3.2 Standard: Releases are sufficiently marked to allow statistically significant evaluation of program contribution.

Indicator 1: Marking rates and type of mark documented.
Indicator 2: Number of marks identified in juvenile and adult groups documented.

3.4.1 Standard: Fish collected for broodstock are taken throughout the return in proportions approximating the timing and age structure of the population.

Indicator 1: Temporal distribution of broodstock collection managed.
Indicator 2: Age composition of broodstock collection managed.

3.4.2 Standard: Broodstock collection does not significantly reduce potential juvenile production in natural areas.

Indicator 1: A portion of natural-origin, hatchery-produced spawners are collected for broodstock purposes.

Indicator 2: *A portion of natural-origin, hatchery-produced spawners are released to migrate to natural spawning areas.*
Indicator 3: *Number of adults, eggs or juveniles placed in natural rearing areas is managed.*

3.4.3 Standard: Life history characteristics of the natural population do not change as a result of this program.

Indicator 1: *Life history characteristics of natural and hatchery-produced populations are measured (e.g., juvenile dispersal timing, juvenile size at out-migration, adult return timing, adult age and sex ratio, natural and hatchery spawn timing, hatch and swim-up timing, hatchery rearing densities, growth, diet, physical characteristics, fecundity, egg size, etc).*

3.4.4 Standard: Annual release numbers do not exceed estimated basinwide and local habitat capacity.

Indicator 1: *Annual release numbers, life-stage, size at release, length of acclimation documented.*
Indicator 2: *Location of releases documented.*
Indicator 3: *Timing of hatchery releases documented.*

3.5.1 Standard: Patterns of genetic variation within and among natural populations do not change significantly as a result of artificial production.

Indicator 1: *Genetic profiles of naturally-produced and hatchery-produced adults developed.*

3.5.2 Standard: Collection of broodstock does not adversely impact the genetic diversity of the naturally spawning population.

Indicator 1: *Total number of natural spawners reaching collection facilities documented.*
Indicator 2: *Total number of natural spawners estimated passing collection facilities documented.*
Indicator 3: *Timing of collection compared to overall run timing considered.*

3.5.3 Standard: Artificially produced adults in natural production areas do not exceed appropriate proportion.

Indicator 1: *Ratio of natural to hatchery-produced adults monitored.*
Indicator 2: *Observed and estimated total numbers of natural and hatchery-produced adults passing counting stations.*

3.5.4 Standard: Juveniles are released on-station, or after sufficient acclimation to maximize homing ability to intended return locations.

Indicator 1: *Location of juvenile releases documented.*
Indicator 2: *Length of acclimation period documented.*
Indicator 3: *Release type (e.g., volitional or forced) documented.*
Indicator 4: *Adult straying documented.*

3.6.1 Standard: The artificial production program uses standard scientific procedures to evaluate various aspects of artificial production.

Indicator 1: Scientifically based experimental design with measurable objectives and hypotheses.

3.6.2. Standard: The artificial production program is monitored and evaluated on an appropriate schedule and scale to address progress toward achieving the experimental objectives.

Indicator 1: Monitoring and evaluation framework including detailed time line.
Indicator 2: Annual and final reports.

3.7.1 Standard: Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols.

Indicator 1: Annual reports indicating level of compliance with applicable standards and criteria.

3.7.2 Standard: Effluent from artificial production facility will not detrimentally affect natural populations.

Indicator 1: Discharge water quality compared to applicable water quality standards.

3.7.3 Standard: Water withdrawals and in stream water diversion structures for artificial production facility operation will not prevent access to natural spawning areas, affect spawning, or impact juveniles.

Indicator 1: Water withdrawals documented—no impacts to listed species.
Indicator 2: Number of adult fish aggregating and/or spawning immediately below water intake point monitored.
Indicator 3: NMFS screening criteria adhered to.

3.7.4 Standard: Releases do not introduce pathogens not already existing in the local populations and do not significantly increase the levels of existing pathogens.

Indicator 1: Certification of juvenile fish health documented prior to release.
Indicator 2: Samples of natural populations for disease occurrence conducted.
Indicator 3: Juvenile densities during artificial rearing managed conservatively.

3.7.6 Standard: Adult broodstock collection operation does not significantly alter spatial and temporal distribution of natural population.

Indicator 1: Spatial and temporal spawning distribution of natural population above and below trapping facilities monitored.

3.7.7 Standard: Weir/trap operations do not result in significant stress, injury, or mortality in natural populations.

Indicator 1: Mortality rates in trap documented.
Indicator 2: Prespawning mortality rates of trapped fish in hatchery or after release documented.

3.7.8 Standard: Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of natural fish.

Indicator 1: Size and time of release of juvenile fish documented and compared to size and timing of natural fish.

Monitoring and Evaluation of Performance Standards and Indicators:

Standard 3.2.2 and associated indicators: The program is required by our ESA Section 10 permit to visibly mark all reintroduced fish. As such, all presmolt and smolt chinook salmon released back to nature are fin clipped and coded-wire tagged. In addition, genetic tissue samples are collected from all captive broodstock fish and all returning progeny to identify the parents of the returning adults. Specific release groups also receive Passive Integrated Transponder (PIT) tags.

Standard 3.3.1 and associated indicators: We conduct spawning ground surveys on streams in the Grande Ronde Basin each year. In the more populated streams, we conduct at least three surveys, including index surveys, which we use for year-to-year comparisons. We use mark/recapture estimates (on streams with weirs) and/or number of redds (using an estimate of adults/redd) to estimate adult numbers annually. Spawning ground surveys, in association with ODFW Early Life History studies, allow us to estimate spawner-recruit and parent-progeny ratios.

Standard 3.3.2 and associated indicators: All chinook salmon released from hatcheries in the Grande Ronde Basin are marked to identify them as being part of a specific program (i.e., captive broodstock or conventional hatchery programs) and treatment within that program (e.g., captive broodstock parental treatment or maternal BKD category).

Standard 3.4.1, 3.4.2, 3.5.3, 3.7.6 and associated indicators: For the captive broodstock program, fish are collected as parr from the entire rearing distribution of chinook salmon for each year. For the conventional hatchery program, returning adult chinook salmon are taken from across the entire run captured to insure temporal and age class distribution within each cohort.

We also have a plan for the number of hatchery fish that can be released into each program stream. Co-manager agreement was reached in late 2002, when management strategies for each stream were finalized (CTUIR et al. 2002). The three different strategies adopted represent a continuum from aggressive hatchery intervention in the upper Grande Ronde River to more conservative intervention in Catherine Creek with the Lostine River program falling between the two. The management strategies define smolt production levels by source (captive and conventional), proportion of natural and hatchery returns that can be retained for conventional broodstock, proportion of broodstock that should be comprised of natural origin fish and the proportion of adults released above the weir to spawn naturally that can be of hatchery origin. The upper Grande Ronde River has the lowest number of returning adult chinook salmon and will be managed to achieve an annual smolt production goal and maximize the rate of increasing numbers of natural spawning fish, regardless of origin. Up to 250,000 smolts, combined from both captive and conventional broodstock programs will be released annually. Adult collections for the conventional program in Grande Ronde River will also be more aggressive, with the purpose of collecting enough adults (within our Endangered Species Act permit) to maximize smolt production at the permitted level of 250,000. Also, this stream will be managed to increase the number of adults spawning in the wild by not limiting the percentage of hatchery fish released above the weir. Adult collections for both the Catherine Creek and Lostine River conventional broodstock programs will be more conservative and follow the original adult sliding scale developed in 1998 in which no more than 40% of the estimated hatchery and wild escapement may be collected for broodstock and no more than 70% of the fish released above the weirs may be of hatchery origin (NPT 1998; ODFW 1998). Captive broodstock offspring will be used to supplement conventional broodstock production. Production of captive broodstock progeny in excess of those needed for each program stream will be released into Grande Ronde Basin tributaries previously identified and agreed upon by the co-managers. We will also maintain the Minam and Wenaha rivers as wild salmon streams (i.e., no hatchery supplementation) and will continue to monitor for straying of hatchery fish into these systems.

Sliding scale for collection of adults for conventional broodstock spawning in Catherine Creek, Grande Ronde River and Lostine River. Note: Hatchery collections may not include any captive broodstock progeny.

Estimated adult escape-ment	Catherine Creek			Grande Ronde River			Lostine River		
	Percent retained for broodstock		Percent hatchery above weir	Percent retained for broodstock		Percent hatchery above weir	Percent retained for broodstock		Percent hatchery above weir
	Wild	Hatchery		Wild	Hatchery		Wild	Hatchery	
≤250	≤40%	≤40%	–	≤50%	Number needed for collection goal)	No restriction	≤40%	≤40%	–
251-500	≤20%	≤20%	≤70%	≤50%			≤20%	≤20%	≤70%
>500	≤20%	0	≤50%	≤50%			≤20%	0	50%

<u>Standard 3.4.3 and associated indicators:</u> Life history characteristics of natural and hatchery-produced juvenile and adult chinook salmon are monitored (e.g., adult spawning success and juvenile out-migration success). In-hatchery variables are monitored continuously (e.g., growth, survival, rearing conditions, maturation, age at maturity, spawning success, gamete quality, egg size, fecundity, egg survival to the eyed stage of development, etc.).

<u>Standard 3.4.4, 3.5.3 and associated indicators:</u> Annual release numbers, release strategy selected, size at release, and release location are discussed annually at the TOT level. Given recent historic numbers of adults returning to the basin, we are far from approaching or exceeding habitat capacity.

<u>Standard 3.5.1, 3.5.2 and associated indicators:</u> Tissue samples for genetic analyses are collected from captive broodstock fish and all adults captured at weirs and carcasses recovered on spawning ground surveys. These tissues will be analyzed for changes in genetic variation. In addition, spawning ground surveys and weir captures allow us to monitor changes (if any) in run timing, spawn timing, and spawn distribution.

<u>Standard 3.5.4 and associated indicators:</u> All smolts are released from acclimation sites on the program streams. Smolts are held in ponds at the acclimation sites, containing stream water, for at least one week, after which they are allowed to leave volitionally with a forced departure a week are more later. When parr are released, they are released in late spring directly into the stream, as it is unlikely that they will migrate out of the stream at this time of year. All hatchery fish are marked and all returning adults are examined for these marks to quantify straying.

Standard 3.6.1, 3.6.2 and associated indicators: Program goals, objectives, and tasks focus on the preservation/conservation purpose of this effort. Hatchery practices (e.g., spawning, rearing and release protocols) are based on current and emerging "best practices" and undergo constant review at the TOT level. An experimental design has been established to guide these efforts and a comprehensive monitoring and evaluation program is in place.

Standard 3.7.1, 3.7.2, 3.7.3, 3.7.7 and associated indicators: The artificial production component of the program adheres to all state and federal policies in place to prevent the spread of infectious pathogens, to ensure that facility discharge water quality meets all appropriate standards and that intake and outflow screens meet appropriate standards.

Adult and juvenile weirs are monitored to not adversely affect target or other fish species. Anadromous chinook salmon adult presence and distribution below weirs is carefully monitored. Every precaution is taken to insure that trapping does not negatively impact returning adults.

Standard 3.7.4 and associated indicators: ODFW and NOAA Fisheries fish health facilities process samples for diagnostic and inspection purposes from captive broodstock chinook salmon. Routine fish necropsies include investigations for viral pathogens (infectious pancreatic necrosis virus and infectious hematopoietic necrosis virus), and various bacterial pathogens (e.g., bacterial kidney disease *Renibacterium salmoninarium*, bacterial gill disease *Flavobacterium branchiophilum*, coldwater disease *Flavobacterium psychrophilum*, and motile aeromonad septicemia *Aeromonas* spp.). In addition to the above, captive fish are screened for the causative agent of whirling disease *Myxobolus cerebralis*, furunculosis *Aeromonas salmonicida* and the North American strain of viral hemorrhagic septicemia virus.

Approved chemical therapeutants are used prophylactically and for the treatment of infectious diseases and we are exploring the uses of other therapeutants. Prior to administering treatments, the use of chemical therapeutants is discussed with fish health professionals. Fish necropsies are performed on all program mortalities that satisfy minimum size criteria for the various diagnostic or inspection procedures performed. Lastly, the program routinely culls females from spawning that display symptoms of gross BKD infection, as well as eggs from females with high BKD titers (based on ELISA).

Standard 3.7.8 and associated standards: Predation by artificially produced fish on naturally produced fish is not expected to occur. We target release of fish at sizes similar to that of naturally produced fish. We have seen no evidence of this occurring.

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A complete list of contributors and their contact information is presented below.

Paul Kline
Idaho Department of Fish and Game, 600 South Walnut Street, P.O. Box 25, Boise, Idaho 83707, (208) 939-4114 (phone), (208) 939-2415 (fax), pkline@idfg.state.id.us

David Venditti
Idaho Department of Fish and Game, 600 South Walnut Street, P.O. Box 25, Boise, Idaho 83707, (208) 465-8404 (phone), (208) 465-8434 (fax), dvenditti@idfg.state.id.us

J. Lance Hebdon
Idaho Department of Fish and Game, 600 South Walnut Street, P.O. Box 25, Boise, Idaho 83707, (208) 465-8404 (phone), (208) 465-8434 (fax), lhebdon@idfg.state.id.us

Danny Baker
Idaho Department of Fish and Game, 600 South Walnut Street, P.O. Box 25, Boise, Idaho 83707, (208) 939-4114 (phone), (208) 939-2415 (fax), dbaker@idfg.state.id.us

Timothy Hoffnagle
Oregon Department of Fish and Wildlife, 211 Inlow Hall, Eastern Oregon University, La Grande, Oregon 97850, (541) 962-3777 (phone), (541) 962-3067 (fax), thoffnag@eou.edu

Richard Carmichael
Oregon Department of Fish and Wildlife, 211 Inlow Hall, Eastern Oregon University, La Grande, Oregon 97850, (541) 962-3777 (phone), (541) 962-3067 (fax), rcarmich@eou.edu

Thomas Flagg
NOAA Fisheries, Northwest Fisheries Science Center, Resource Enhancement and Utilization Technologies Division, P.O. Box 130, Manchester, Washington 98353, (360) 871-8306 (phone), (206) 842-8364 (fax), tom.flagg@noaa.gov

Barry Berejikian
NOAA Fisheries, Northwest Fisheries Science Center, Resource Enhancement and Utilization Technologies Division, P.O. Box 130, Manchester, Washington 98353, (360) 871-8301 (phone), (206) 842-8364 (fax), barry.berejikian@noaa.gov

Desmond Maynard
NOAA Fisheries, Northwest Fisheries Science Center, Resource Enhancement and Utilization Technologies Division, P.O. Box 130, Manchester, Washington 98353, (360) 871-8313 (phone), (206) 842-8364 (fax),
des.Maynard@noaa.gov

Carlin McAuley
NOAA Fisheries, Northwest Fisheries Science Center, Resource Enhancement and Utilization Technologies Division, P.O. Box 130, Manchester, Washington 98353, (360) 871-8314 (phone), (206) 842-8364 (fax),
carlin.mcauley@noaa.gov

William Fairgrieve
NOAA Fisheries, Northwest Fisheries Science Center, Resource Enhancement and Utilization Technologies Division, P.O. Box 130, Manchester, Washington 98353, (360) 871-8305 (phone), (206) 842-8364 (fax),
William.farigrieve@noaa.gov

Herbert Pollard
NOAA Fisheries, Salmon Recovery Division, Idaho State Office, 10215 W. Emerald St., Suite 180, Boise, Idaho, (208) 378-5614 (phone), (208) 378-5699 (fax), herbert.pollard@noaa.gov

Madison Powell
University of Idaho, Hagerman Fish Culture Experiment Station, 3059F National Fish Hatchery Rd., Hagerman, Idaho 83203, (208) 837-9096 (phone), (208) 837-6047 (fax), mpowell@uidaho.edu

Doug Taki
Shoshone-Bannock Tribes, Fisheries Department, P.O. Box 306, Fort Hall, Idaho 83203, (208) 238-9397(phone), (208) 478-3986 (fax), dtaki@shoshonebannocktribes.com

Andy Kohler
Shoshone-Bannock Tribes, Fisheries Department, P.O. Box 306, Fort Hall, Idaho 83203, (208) 238-9397 (phone), (208) 478-3986 (fax), akohler@shoshonebannocktribes.com

Robert Griswold
Biolines Environmental Consulting
HC-64, Box 9965, Stanley, Idaho 83278, (208) 774-3345 (phone), (208) 774-3345 (fax), biolines@direcway.com

Jay Hesse
Nez Perce Tribe, Fisheries Department, P.O. Box 365, Lapwai, Idaho 83540, (208) 843-7145 (phone), (208) 843-9184 (fax), jayh@nezperce.org

Jim Harbeck
Nez Perce Tribe, Fisheries Department, 612 S.W. 2nd St., Enterprise, Oregon 97828, (541) 426-3198 (phone), (541) 426-2096 (fax), jimh@nezperce.org

Stephen Boe
Confederated Tribes of the Umatilla Indian Reservation, Fisheries Program, 211 Inlow Hall, Eastern Oregon University, La Grande, Oregon 97850, (541) 962-3777 (phone), (541) 962-3067 (fax), sboe@eou.edu

Michael McLean
Confederated Tribes of the Umatilla Indian Reservation, Fisheries Program, 62415A Highway 82, La Grande, Oregon 97850, (541) 663-1794 (phone), mmclean@uci.net

APPENDIX 2-18—RAINBOW TROUT HATCHERY AND GENETIC MANAGEMENT PLAN

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Rainbow Trout Stocking
Species or Hatchery Stock:	Rainbow Trout *Oncorhynchus mykiss.*
Agency/Operator:	Idaho Department of Fish and Game
Watershed and Region:	Lower Clearwater and Salmon Rivers, Idaho.
Date Submitted:	September 30, 2002
Date Last Updated:	September 30, 2002

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Hatchery: Washington Department of Fish and Wildlife Lyons Ferry Fish Hatchery.
Program: Rainbow Trout.

1.2) Species and population (or stock) under propagation, and ESA status.

Rainbow Trout *Oncorhynchus mykiss*.
Not ESA-listed.

1.3) Responsible organization and individuals

Lead Contact
Name (and title): Sharon W. Kiefer, Anadromous Fish Manager.
Agency or Tribe: Idaho Department of Fish and Game.
Address: 600 S. Walnut, P.O. Box 25, Boise, ID 83707.
Telephone: (208) 334-3791.
Fax: (208) 334-2114.
Email: skiefer@idfg.state.id.us

On-site Operations Lead
Name (and title): Tom Frew, Resident Hatchery Program Manager
Agency or Tribe: Idaho Department of Fish and Game.
Address: 600 S. Walnut, P.O. Box 25, Boise, ID 83707.
Telephone: (208) 334-3791
Fax: (208) 334-2114.
Email: tfrew@idfg.state.id.us

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

U.S. Fish and Wildlife Service – Lower Snake River Compensation Plan Office: Administers the Lower Snake River Compensation Plan as authorized by the Water Resources Development Act of 1976.

Washington Department of Fish and Wildlife – Lyons Ferry Fish Hatchery incubates rainbow trout eggs and rears fish through release size.

1.4) Funding source, staffing level, and annual hatchery program operational costs.

U.S. Fish and Wildlife Service – Lower Snake River Compensation Plan funded.
Staffing level: 0.25 FTE
Annual budget: $40,000.

1.5) Location(s) of hatchery and associated facilities.

Lyons Ferry Fish Hatchery – Along the Snake River in Franklin Co. Washington (River mile 58). Post Office Box 278, Starbuck Washington, 99359.

1.6) Type of program.

The LSRCP rainbow trout program is mitigation for the loss of angler days brought about by the fact that the four lower Snake River dams inundated about 140 miles of spawning habitat.

1.7) Purpose (Goal) of program.

Define as either: Augmentation, Mitigation, Restoration, Preservation/Conservation, or Research (for Columbia Basin programs, use NPPC document 99-15 for guidance in providing these definitions of "Purpose"). Provide a one sentence statement of the goal of the program, consistent with the term selected and the response to Section 1.6. Example: "The goal of this program is the restoration of spring chinook salmon in the White River using the indigenous stock".

<u>Mitigation</u> - The mitigation goal for this program is to produce approximately 50,000 fingerling rainbow trout (approximately 3,333 pounds or 1,512 kg) for planting in the lower 100 miles (161 km) of the Salmon River and the lower 70 miles (113 km) of the Clearwater River in Idaho.

1.8) Justification for the program.

Congress authorized the LSRCP as part of the Water Resources Development Act of 1976 (Public Law 94-587). The LSRCP is funded by the USFWS through a direct funding agreement with the BPA. The IDFG administers and implements the Idaho component of the program.

The rainbow trout program provides recreational harvest fisheries in the lower portions of the Salmon and Clearwater rivers in Idaho. Fish for this program are reared at the Washington Department of Fish and Wildlife's Lyons Ferry Fish Hatchery to release size (approximately 16 fish per pound). The IDFG is responsible for the transportation and release of fish. Measures taken to minimize adverse effects on listed species include

1) Reducing the annual total release of LSRCP fingerling rainbow trout by 12 percent from the 1990 – 1993 average.

2) Moving a portion of the release to the lower Salmon River to contribute to a fishery in the lower Salmon River and to reduce the number of fingerlings released in fall chinook salmon spawning and rearing areas of the lower Clearwater River.

3) Spreading out releases over a number of miles to reduce single site densities of rainbow trout.

4) Continuing to only stock fingerling rainbow trout from Lyons Ferry Fish Hatchery that have been certified to be free of major bacterial and viral pathogens.

5) Continuing to collect fish from the lower Clearwater and Salmon rivers for growth and diet analysis.

6) Continuing to uniquely mark fingerlings (ventral fin clip) to facilitate identification.

1.9) List of program "Performance Standards".

3.1 Legal Mandates.
3.2 Harvest.
3.3 Conservation of natural spawning populations.
3.4 Life History Characteristics.
3.5 Genetic Characteristics.
3.6 Research Activities.
3.7 Operation of Artificial Production Facilities.

1.10) List of program "Performance Indicators", designated by "benefits" and "risks."

Note: Performance Standards and Indicators used to develop Sections 1.10.1 and 1.10.2 were taken from the final January 17, 2001 version of Performance Standards and Indicators for the Use of Artificial Production for Anadromous and Resident Fish Populations in the Pacific Northwest. Numbers referenced below correspond to numbers used in the above document.

3.1.2 Standard: Program contributes to mitigation requirements.

Indicator 1: Number of fish released by program as applicable to mitigation requirements documented.

3.1.3 Standard: Program addresses ESA responsibilities.

Indicator 1: ESA Section 7 Consultation completed. ESA Section 10 permit reapplication submitted September, 1998.

3.2.1 Standard: Fish are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while avoiding over harvest of not-target species.

Indicator 1: Fishery sampled annually to determine presence/absence of target species .

3.2.2 Standard: Release groups sufficiently marked in a manner consistent with information needs and protocols to enable determination of impacts to natural-and hatchery-origin fish in fisheries.

Indicator 1: Marking rate by type in each release group documented. All fish released are uniquely marked (ventral fin clip).
Indicator 2: Sampling rate by mark type for each fishery estimated.
Indicator 3: Number of marks by type observed in fishery documented.

1.10.2) "Performance Indicators" addressing risks.

3.4.4 Standard: Annual release numbers do not exceed estimated basin-wide and local habitat capacity.

Indicator 1: Annual release numbers, life-stage, and size at release documented.
Indicator 2: Location of releases documented.
Indicator 3: Timing of hatchery releases documented.

3.5.1 Standard: Patterns of genetic variation within and among natural populations do not change significantly as a result of artificial production.

Indicator 1: Genetic profiles of naturally-produced and hatchery-produced adults developed.

3.5.2 Standard: Collection of broodstock does not adversely impact the genetic diversity of the naturally spawning population.

Indicator 1: Broodstock are not collected from natural trout populations.

3.6.2. Standard: The artificial production program is monitored and evaluated on an appropriate schedule and scale to address progress toward achieving the experimental objectives.

Indicator 1: Monitoring and evaluation framework including detailed time line.
Indicator 2: Annual and final reports.

3.7.4 Standard: Releases do not introduce pathogens not already existing in the local populations and do not significantly increase the levels of existing pathogens.

Indicator 1: Certification of juvenile fish health documented prior to release.

3.7.8 Standard: Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of natural fish.

Indicator 1: Size and time of release of juvenile fish documented.
Indicator 2: Stomach content analysis conducted annually from fish harvested in release sections of both rivers..

1.11) Expected size of program.

1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).

Not applicable. See the rainbow trout (Lyons Ferry Complex) HGMP prepared by the Washington Department of Fish and Wildlife

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location.

Life Stage	Release Location	Annual Release Level
Eyed Eggs		
Unfed Fry		
Fry		
Fingerling	Lower Salmon River Lower Clearwater River	25,000 25,000
Yearling		

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

Not applicable for rainbow trout.

1.13) Date program started (years in operation), or is expected to start.

Releases of Lyons Ferry Hatchery rainbow trout to the lower Salmon and Clearwater rivers was initiated in 1989.

1.14) Expected duration of program.

This program is expected to continue indefinitely to provide mitigation under the Lower Snake River Compensation Plan.

1.15) Watersheds targeted by program.

Listed by hydrologic unit code –

Salmon River: 1706020303400

Clearwater River 1706030608200

1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

The Idaho Department of Fish and Game has not considered alternative actions for obtaining program goals.

<u>SECTION 2. PROGRAM EFFECTS ON NMFS ESA-LISTED SALMONID POPULATIONS</u>. (USFWS ESA-Listed Salmonid Species and Non-Salmonid Species are addressed in Addendum A)

2.1) List all ESA permits or authorizations in hand for the hatchery program.

Section 7 Consultation with U.S. Fish and Wildlife Service (April 2, 1999) resulting in NMFS Biological Opinion for the Lower Snake River Compensation Program.

Section 10 Permit Number 1188 for IDFG trout stocking (reapplied for 9/98).

2.2) Provide descriptions, status, and projected take actions and levels for NMFS ESA-listed natural populations in the target area.

2.2.1) <u>Description of NMFS ESA-listed salmonid population(s) affected by the program.</u>

Four ESA-listed species: sockeye salmon - *Oncorhynchus nerka*, chinook salmon - *Oncorhynchus tshawytscha*, steelhead trout - *Oncorhynchus mykiss*, and bull trout *Oncorhynchus confluentus* occur or migrate through areas where fingerling rainbow trout are released in conjunction with this program. The IDFG believes that the release of 50,000 fingerling rainbow trout will not jeopardize the existence or recovery of these listed species.

- Identify the NMFS ESA-listed population(s) that will be <u>directly</u> affected by the program

The program is expected to have no direct effect on ESA-listed species.

- Identify the NMFS ESA-listed population(s) that may be <u>incidentally</u> affected by the program.

Snake River Fall-run chinook salmon ESU (T – 4/92)

Snake River Spring/Summer-run chinook salmon ESU (T – 4/92)

Snake River Basin steelhead ESU (T – 8/97)

Bull trout (T – 6/98)

2.2.2) <u>Status of NMFS ESA-listed salmonid population(s) affected by the program.</u>

- **Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds.**

For status reviews of listed Snake River steelhead and spring/summer chinook salmon, readers are referred to IDFG HGMPs prepared for Clearwater River B-run steelhead, Salmon River A-run steelhead, Clearwater River spring chinook salmon, and Salmon River spring and summer chinook salmon.

- Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.

Not applicable for rainbow trout.

- Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

Not applicable for rainbow trout.

- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

Not applicable for rainbow trout.

2.2.3) <u>Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of NMFS listed fish in the target area, and provide estimated annual levels of take.</u>

See below.

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

Annual hook-and-line monitoring is conducted in the lower Clearwater and Salmon rivers to determine the relative contribution of program fish to the creel and to collect stomachs for subsequent diet analysis. Sampling generally occurs during the month of August. Juvenile steelhead could be incidentally collected during this sampling.

- Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for

listed fish

Past take levels are not available.

- Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).

Projected take estimates are not available. The IDFG believes that the release of 50,000 fingerling rainbow trout will not jeopardize the existence or recovery of listed species.

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

Contingency plans to address situations where take levels are exceeded have not been developed as the IDFG feels that the release of fingerling trout from this program will not jeopardize the existence or recovery of listed species. However, the IDFG recognizes that any contingency plan should include a provision to consult with NMFS Sustainable Fisheries Division or Protected Resource Division staff and agree to an action plan.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.

This program conforms with the plans and policies of the Lower Snake River Compensation Program administered by the U.S. Fish and Wildlife Service and conforms to Section 10(a)(1b) permit language for this activity. This program has had ESA authorization since the 1992 chinook salmon listing.

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.

Cooperative Agreement between the U.S. Fish and Wildlife Service and the Idaho Department of Fish and Game, USFWS Agreement No.: 141102J010 (for Lower Snake River Compensation Plan monitoring and evaluation studies).

Cooperative Agreement between the U.S. Fish and Wildlife Service and the Idaho Department of Fish and Game, USFWS Agreement No.: 141102J009 (for Lower Snake River Compensation Plan hatchery operations).

3.3) Relationship to harvest objectives.

This program satisfies mitigation goals as outlined under the LSRCP.

3.3.1) Describe fisheries benefiting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

Sport fishery information specific to this activity is not available. Annually, the lower Salmon and Clearwater rivers are sampled to determine presence/absence of program fish and to determine the relative proportion of program fish in the sample. Creel information collected during a 1991 survey on the lower Clearwater River indicated that anglers fished an estimated 203.75 hours to catch an estimated 44 rainbow trout for a catch rate of 0.216 fish per hour. Of the 34 rainbow trout kept, nine originated from the fall fingerling plant program.

The number of fish released from this program and subsequently sampled during summer surveys designed to examine presence/absence and to determine the relative proportion of program fish in the sample is presented in the following table.

Release Year	*# of Fish Released to Clearwater R.*	*# of Fish Released to Salmon R.*	*Sample Year*	*# of Program Fish Caught in Clearwater R.*	*# of Program Fish Caught in Salmon R.*
1989	*28,290*	*34,890*	*1991*	*3*	*not sampled*
1990	*36,490*	*35,033*	*1992*	*not sampled*	*1*
1991	*48,200*	*0*	*1993*	*not sampled*	*0*
1992	*57,280*	*0*	*1994*	*0*	*not sampled*
1993	*28,000*	*29,400*	*1995*	*1*	*not sampled*
1994	*30,536*	*30,536*	*1996*	*not sampled*	*4*
1995	*25,945*	*25,945*	*1997*	*0*	*0*
1996	*0*	*0*	*1998*	*0*	*0*

1997	*0*	*0*	*1999*	*not sampled*	*not sampled*
1998	*23,450*	*23,450*	*2000*	*0*	*14*
1999	*27,000*	*26,990*	*2001*	*not sampled*	*0*
2000	*25,245*	*25,245*	*2002*	*n/a*	*n/a*

Stomach contents from 23 rainbow trout associated with this program have been examined to date. No fish or bony fish parts have been identified.

3.4) Relationship to habitat protection and recovery strategies.

Hatchery production for harvest mitigation is influenced but not linked to habitat protection strategies in the Salmon and Clearwater subbasins and other areas. The LSRCP rainbow trout program is operated consistent with existing Biological Opinions.

3.5) Ecological interactions. [Please review Addendum A before completing this section. If it is necessary to complete Addendum A, then limit this section to NMFS jurisdictional species. Otherwise complete this section as is.]

Disease Transmission- Fish for this program are produced at Washington Department of Fish and Wildlife's Lyons Ferry Fish Hatchery. Prior to release, fish undergo screening for typical bacterial and viral pathogens. Pathogens can be transmitted from resident to anadromous fish. However, in a review of the literature, Steward and Bjornn (1990) stated that there was little evidence to suggest that horizontal transmission from hatchery smolts to naturally-produced fish is widespread in production areas or in the free-flowing migration corridor. The IDFG does not have information that suggest that horizontal transmission occurs or has an adverse effect on listed species.

Fish for this program are not released if they do not conform with guidelines established by the IDFG and others (e.g., IHOT). The release of fish to Idaho waters (via IDFG transport vehicles) complies with all interstate transport permit requirements established by both states.

Predation- The IDFG has no reason to believe predation of listed, anadromous salmonid fry or fingerlings by hatchery rainbow trout will occur at any appreciable or meaningful level that would jeopardize the existence or recovery potential of listed species. Marrin and Erman (1982) found that stocked rainbow trout do not switch to a fish diet until they reach 30 cm. Ersbak and Haase (1983) suggested that hatchery-reared trout have difficulty switching to alternate food items as they become available. Hatchery rainbow trout have also failed to eat forage fish even when they are present and utilized by other salmonids (Jeppson 1975). Predation on other game fish is not common for hatchery-reared fish in general (Marnell 1986). Viola and Schuck (1991) examined stomachs of hatchery rainbow trout stocked in a chinook salmon rearing stream in Washington. Two unidentified salmonids were found in 15 stomachs collect in August and one in nine stomachs collected in October.

The IDFG has collected stomachs from Spokane-strain rainbow trout stocked to the lower Clearwater and Salmon rivers as part of this program since the inception of stocking in 1990. To date, of the 23 fish stomachs examined, no fish or fish parts have been identified (Barrett, 1991 – 2001). Fish for this program are typically stocked at approximately 13 to 18 cm in size. Fish sampled during subsequent monitoring investigations are typically 35 to 50 cm. Studies conducted by the IDFG in response to chinook and sockeye salmon listings revealed minimal predation on chinook and sockeye fry by hatchery rainbow or steelhead trout in the upper Salmon River (Cannamela 1992, IDFG 1993b, IDFG1996b) and Stanley Basin Lakes (IDFG 1998); no steelhead fry were retrieved from stomachs of hatchery steelhead smolts sampled from the Salmon River (IDFG 1993b, 1996b) and no sockeye were found in stomachs of rainbow trout sampled from Redfish Lake. Monitoring requirements of ESA Section 10 Permit #1188 (formerly #908) for the upper Salmon River were discontinued because impacts of the resident fish stocking program (on listed chinook salmon) were deemed negligible and not worthy of further evaluation. Although steelhead fry emerge later than chinook fry in the Salmon River, and could be present at the time rainbow trout are stocked, most steelhead production and early rearing occurs in tributaries, while rainbow trout are stocked in the main Salmon River; the situation is similar in the lower Salmon and Clearwater river drainages.

Fall chinook salmon fry generally emerge in the lower Clearwater River in May (IFRO 1993). Juvenile fall chinook salmon rear in shallow areas of the main river and begin their emigration to the ocean in June and July. Few if any fall chinook salmon would remain in the lower Clearwater River into October (when fish from this program are stocked). As such, there is no overlap of fingerling rainbow trout stocked for this program and fall chinook salmon fry at the time of stocking. However, there could be spatial and temporal overlap the following year. There could also be overlap of chinook salmon parr and rainbow trout in the lower Salmon River. However, even with sampling efforts directed at holdover rainbow trout, few are encountered during summer monitoring events (see below). Wiley et al. (1993) suggest high post-stocking mortality for hatchery trout following planting events.

The threat of predation from rainbow trout may have an effect on habitat use and abundance of fall chinook and spring/summer salmon juveniles (Bugert and Bjornn 1991). Emigration to areas less than optimum for growth may occur. Growth depression due to intimidation or displacement may reduce fitness, survival, and ultimately prey stock. However, the IDFG does not believe that this response occurs in the lower Clearwater and Salmon rivers because of the extremely low density of both ESA-listed salmon and hatchery-produced rainbow trout. Likely, differences in habitat selection would further minimize this type of behavioral interaction between rainbow trout and salmon juveniles.

Annually, the IDFG conducts hook-and-line sampling on resident fish populations in the lower Salmon and Clearwater rivers where fish from this program are released. A summary of the number of fish sampled to date by location and year is presented in Section 3.3.1 above. Fish collected during these surveys are sacrificed and stomachs removed for diet analysis. Of the 23 fish sampled to date, not fish parts or whole fish have been identified in stomachs.

Competition- Competition is most likely to occur between juveniles of the same size in the same immediate location when fish densities are high. The IDFG believes that rearing habitat and food are not limiting factors in the main Salmon and Clearwater river sections where fingerling rainbow trout are released in conjunction with this program. Densities of stocked rainbow trout and ESA-listed, anadromous salmonids are typically low in main river sections relative to the amount of available habitat. However, at the time of planting, limited dispersal of hatchery rainbow trout could result in temporarily high densities. The IDFG does not have specific information on habitat utilization by hatchery-produced rainbow trout in the lower Salmon and Clearwater rivers. Arnsberg et al. (1992) described the preferred habitat of chinook salmon fry in the Clearwater River as having depths ranging from 12 to 60 cm, water velocity of < 1.0 cm/s, and a substrate consisting of small cobble and smaller sediment size classes. The IDFG believes that rainbow trout would require habitat with substantially higher water velocity.

Competition between stocked rainbow trout and ESA-listed salmonid smolts is unlikely because the majority of migratory salmon and steelhead have migrated out of the system prior to the fall when rainbow trout associated with this program are stocked.

SECTION 4. WATER SOURCE

4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

See the rainbow trout (Lyons Ferry Complex) HGMP prepared by the Washington Department of Fish and Wildlife.

4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

See the rainbow trout (Lyons Ferry Complex) HGMP prepared by the Washington Department of Fish and Wildlife.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

See the rainbow trout (Lyons Ferry Complex) HGMP prepared by the Washington Department of Fish and Wildlife.

5.2) Fish transportation equipment (description of pen, tank truck, or container used).

Rainbow trout for this program are transferred from the Lyons Ferry Fish Hatchery to lower Salmon and Clearwater river plant sites in IDFG transport vehicles operated by IDFG drivers. Trucks are typically equipped with 2,300 to 2,500 gallon transport tanks. All vehicles are equipped with oxygen systems and fresh flow agitators.

5.3) Broodstock holding and spawning facilities.

See the rainbow trout (Lyons Ferry Complex) HGMP prepared by the Washington Department of Fish and Wildlife.

5.4) Incubation facilities.

See the rainbow trout (Lyons Ferry Complex) HGMP prepared by the Washington Department of Fish and Wildlife.

5.5) Rearing facilities.

See the rainbow trout (Lyons Ferry Complex) HGMP prepared by the Washington Department of Fish and Wildlife.

5.6) Acclimation/release facilities.

Fingerling rainbow trout are released directly into the Salmon and Clearwater rivers. If water temperature tempering is required, it is carried out on the transport vehicle prior to releasing fish.

5.7) Describe operational difficulties or disasters that led to significant fish mortality.

No significant mortality associated with this program has occurred.

5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

See the rainbow trout (Lyons Ferry Complex) HGMP prepared by the Washington Department of Fish and Wildlife.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.

Spokane rainbow trout stock – not ESA-listed.

6.2) Supporting information.

6.2.1) History.

The Spokane Rainbow Stock steelhead was originally started by receiving eggs from Cape Cod Hatchery in Massachusetts. The Cape Cod Stock was itself originally derived from the McCloud River in northern California in the late 1800’s. Genetic characterization has verified that the Spokane Stock is similar or identical to West Coast rainbow populations of current day.

6.2.2) Annual size.

See the rainbow trout (Lyons Ferry Complex) HGMP prepared by the Washington Department of Fish and Wildlife.

6.2.3) Past and proposed level of natural fish in broodstock.

Not applicable.

6.2.4) Genetic or ecological differences.

Not applicable.

6.2.5) Reasons for choosing.

The Spokane Stock rainbow trout have been successfully reared for many generations at WDFW facilities. The Stock performance indicates that it is highly successful in producing harvestable fish for the program.

6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

Not applicable.

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Not applicable.

7.2) Collection or sampling design.

Not applicable.

7.3) Identity.

Not applicable.

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults):

Not applicable.

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

Not applicable.

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.

Not applicable.

7.6) Fish transportation and holding methods.

Not applicable.

7.7) Describe fish health maintenance and sanitation procedures applied.

See the rainbow trout (Lyons Ferry Complex) HGMP prepared by the Washington Department of Fish and Wildlife.

7.8) Disposition of carcasses.

Not applicable.

7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

Not applicable.

SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

See the Washington Department of Fish and Wildlife's Spokane Hatchery HGMP for Section 8 (Mating) information.

8.1) Selection method.

8.2) Males.

8.3) Fertilization.

8.4) Cryopreserved gametes.

8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

SECTION 9. INCUBATION AND REARING -

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

See the rainbow trout (Lyons Ferry Complex) HGMP prepared by the Washington Department of Fish and Wildlife for information related to Section 9. Incubation and Rearing.

9.1) Incubation:

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.

9.1.2) Cause for, and disposition of surplus egg takes.

9.1.3) Loading densities applied during incubation.

9.1.4) Incubation conditions.

9.1.5) Ponding.

9.1.6) Fish health maintenance and monitoring.

9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

9.2) Rearing:

9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available.

9.2.2) Density and loading criteria (goals and actual levels).

9.2.3) Fish rearing conditions

9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.

9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.

9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.

9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.

10.1) Proposed fish release levels.

The following release levels are proposed for release year 2003.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry				
Fingerling	25,000 25,000	30 30	October October	Salmon River Clearwater River
Yearling				

10.2) Specific location(s) of proposed release(s).
Stream, river, or watercourse:

Release point: (*river kilometer location, or latitude/longitude*)
Major watershed: (e.g. "Skagit River")
Basin or Region: *(e.g. "Puget Sound")*

Stream: Salmon River
Release Point (EPA Number): 1706020303400
Major Watershed: Salmon River
Basin or Region: Snake River

Stream: Clearwater River
Release Point (EPA Number): 1706030608200
Major Watershed: Clearwater River
Basin or Region: Snake River

10.3) Actual numbers and sizes of fish released by age class through the program.

Salmon River planting history.

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1989					34,890	n/a		
1990					35,033	17.8		
1991					0			
1992					0			

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1993					29,400	10.5		
1994					30,536	19.6		
1995					25,945	14.7		
1996					0			
1997					0			
1998					23,450	13.4		
1999					26,990	10.0		
2000					25,245	18.7		
Average					19,290	14.9		

Clearwater River planting history.

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1989					28,290	n/a		
1990					36,490	n/a		
1991					48,200	16.6		
1992					57,280	15.3		
1993					28,000	10.5		
1994					30,536	19.6		
1995					25,945	14.7		
1996					0			
1997					0			
1998					23,450	13.4		
1999					27,000	10.0		
2000					25,245	18.7		
Average					27,536	14.9		

10.4) Actual dates of release and description of release protocols.

Release data information is presented for the most recent three-year period in the following table.

Release Year	Receiving Water	Release Dates
1998	Salmon River	10/8/98
1998	Clearwater	10/7/98
1999	Salmon River	10/7/99
1999	Clearwater	10/6/99
2000	Salmon River	10/3/00
2000	Clearwater	10/3/00

10.5) Fish transportation procedures, if applicable.

Fish are loaded into transport trucks using dip nets or hydraulic pumps. The loading density guideline for transport vehicles is ½ pound per gallon of water. The transport tanks are insulated to maintain good temperature control. Each tank is fitted with an oxygen system and fresh flow agitators.

10.6) Acclimation procedures (*methods applied and length of time*).

Fingerling rainbow trout are released directly to the river. Transport vehicles have the ability to temper transport tank water temperature if conditions warrant it.

10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

Fingerling rainbow trout released for this program receive a ventral fin clip.

10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

Not applicable.

10.9) Fish health certification procedures applied pre-release.

Washington Department of Fish and Wildlife fish health professionals provide the IDFG with the results of a pre-release sample taken for common bacterial and viral pathogens.

10.10) Emergency release procedures in response to flooding or water system failure.

See the rainbow trout (Lyons Ferry Complex) HGMP prepared by the Washington Department of Fish and Wildlife.

10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

Actions taken to minimize adverse effects on listed fish include:

1) Reducing the annual total release of LSRCP fingerling rainbow trout by 12 percent from the 1990 – 1993 average.

2) Moving a portion of the release to the lower Salmon River to contribute to a fishery in the lower Salmon River and to reduce the number of fingerlings released in fall chinook salmon spawning and rearing areas of the lower Clearwater River.

3) Spreading out releases over a number of miles to reduce single site densities of rainbow trout.

4) Continuing to only stock fingerling rainbow trout from Lyons Ferry Fish Hatchery that have been certified to be free of major bacterial and viral pathogens.

5) Continuing to collect fish from the lower Clearwater and Salmon rivers for growth and diet analysis.

6) Continuing to uniquely mark fingerlings (ventral fin clip) to facilitate identification.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1) Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

11.1.1) Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

Document the number, size at release, and marks applied for fish released annually into receiving waters.

Performance Standards and Indicators: 3.1.2, 3.1.3, 3.2.1, 3.2.2.

Monitor population through hook-and-line sampling to determine presence/absence and proportion in sample. Conduct stomach content analysis on all program fish collected during sampling to determine presence/absence of fish and fish parts. Continuously monitor fish health information supplied by rearing hatchery.

Performance Standards and Indicators: 3.4.4, 3.5.1, 3.5.2, 3.6.2, 3.7.4, 3.7.8.

Identify factors that are potentially limiting program success and recommend operational modifications, based on the outcome applied studies, to improve overall performance and success.

No factors identified.

11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

Yes, funding, staffing and support logistics are dedicated to the existing monitoring and evaluation program through the LSRCP program.

11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

Monitoring and evaluation activities are restricted to summer hook-and-line sampling of fish in release sections of the Salmon and Clearwater rivers. All program fish are uniquely marked (ventral fin clip) to facilitate identification. Unmarked, wild/natural salmonids collected during sampling are released unharmed.

SECTION 12. RESEARCH

12.1) Objective or purpose.

The ongoing LSRCP program research is designed to:

1) Determine presence/absence of program fish collected during summer sampling events. Compare and contrast annual information.

2) Determine the proportion of program fish collected during summer sampling events. Compare and contrast annual information.

3) Conduct diet analysis to determine whether program fish are preying on other fish species. Determine, using key bone structures, whether salmonid bony material is present in stomach samples.

12.2) Cooperating and funding agencies.

U.S. Fish and Wildlife Service – Lower Snake River Compensation Plan Office.

12.3) Principle investigator or project supervisor and staff.

Chip Corsi – Resident Fisheries Manager, Idaho Department of Fish and Game.

12.4) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

Not applicable.

12.5) Techniques: include capture methods, drugs, samples collected, tags applied.

Currently, only hook-and-line sampling is used to collect salmonids in the lower Salmon and Clearwater rivers. If wild/natural fish are collected, they are released unharmed. All hatchery-origin fish collected for subsequent stomach content analysis are sacrificed.

12.6) Dates or time period in which research activity occurs.

Hook-and-line sampling is typically conducted on the Salmon and Clearwater rivers over a one-week period in August.

12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.

Not applicable.

12.8) Expected type and effects of take and potential for injury or mortality.

Direct and/or delayed mortality from catching and releasing wild/natural salmonids (primarily steelhead) is possible though unlikely.

12.9) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1).

See Table 1.

12.10) Alternative methods to achieve project objectives.

Research methods have been modified to emphasize the use of hook-and-line sampling equipment instead of electrofishing equipment. Other alternative methods to achieve research objectives have not been explored.

12.11) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

Not applicable.

12.12) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.

See Section 11.2 above.

SECTION 13. ATTACHMENTS AND CITATIONS

Literature Cited:

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by_____________________________ Date:_____________

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: _Steelhead________________ ESU/Population:___________________________________ Activity:____________________				
Location of hatchery activity:______________________ Dates of activity:____________________ Hatchery program operator:_________________				
Type of Take	**Annual Take of Listed Fish By Life Stage (*Number of Fish*)**			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)		100		
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)				
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

Instructions:

1. *An entry for a fish to be taken should be in the take category that describes the greatest impact.*
2. *Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).*
3. *If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.*

APPENDIX 2-19—FOCAL HABITAT DESCRIPTIONS

1 Riparian/Herbaceous Wetlands

Geographic Distribution—Riparian and wetland habitats dominated by woody plants are found throughout the Columbia Basin. Lowland willow and other riparian shrublands are the major riparian types throughout the Salmon subbasin at lower elevations. Common shrub associates include sandbar willow (*Salix exigua*), water birch (*Betula occidentalis*), yellow willow (*Salix lutea*), and Woods' rose (*Rosa woodsii*) (Tuhy and Jensen 1982, Hall and Hansen 1997, Jankovsky-Jones *et al*. 1999). Black cottonwood riparian habitats occur at low to middle elevations and develop best along large rivers, but these habitats are also present in narrow bands along small streams in the subalpine zone (Hall and Hansen 1997). Subdominant members of the overstory include narrowleaf cottonwood (*Populus angustifolia*), lanceleaf cottonwood (*P. acuminata*), and peachleaf willow (*Salix amygdaloides* var. *wrightii*).

White alder riparian habitats are restricted to perennial streams at low elevations, in drier climatic zones in Hells Canyon at the border of Oregon, Washington, and Idaho, in the Malheur River drainage, and in western Klickitat and south-central Yakima counties, Washington. Quaking aspen wetlands and riparian habitats are widespread but rarely a major component throughout the basin. Ponderosa pine–Douglas-fir riparian habitat occurs only around the periphery of the Columbia Basin in Washington and up into lower montane forests.

Physical Setting—Riparian habitats appear along perennial and intermittent rivers and streams. This habitat also appears in impounded wetlands and along lakes and ponds. Their associated streams flow along low to high gradients. The riparian and wetland forests are usually in fairly narrow bands along the moving water that follows a corridor along montane or valley streams. The most typical stand is limited to 100 to 200 ft (31–61 m) from streams. Riparian forests also appear on sites subject to temporary flooding during spring runoff. Irrigation of streamsides and toeslopes provides more water than precipitation and is important in the development of this habitat, particularly in drier climatic regions. Hydrogeomorphic surfaces along streams supporting this habitat have seasonally to temporarily flooded hydrologic regimes. Riparian and wetland habitats are found at elevations from 100 to 9,500 ft (31–2,896 m).

Landscape Setting—Riparian habitats occur along streams, seeps, and lakes within the mixed conifer forest, ponderosa pine forest and woodland, western juniper and mountain mahogany woodlands, and (part of the) shrub-steppe habitats. The riparian/herbaceous wetland habitat may be described as occupying warm montane and adjacent valley and plain riparian environments.

Structure—This habitat contains shrubland, woodland, and forest communities. Stands are closed to open canopies and often multilayered. A typical riparian habitat would be a mosaic of forest, woodland, and shrubland patches along a stream course. The tree layer can be dominated by broadleaf, conifer, or mixed canopies. Tall shrub layers, with and without trees, are deciduous and often nearly completely closed thickets. These woody riparian habitats have undergrowth of low shrubs or dense patches of grasses, sedges, or forbs. Tall shrub communities (20–98 ft [6–30 m], occasionally tall enough to be considered woodlands or forests), can be interspersed with sedge meadows or moist, forb-rich grasslands. Intermittently flooded riparian habitat has ground cover composed of steppe grasses and forbs. Rocks and boulders may be a prominent feature in this habitat.

Composition—Black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), quaking aspen (*P. tremuloides*), white alder (*Alnus rhombifolia*), peachleaf willow, and, in northeast Washington, paper birch (*Betula papyrifera*) are dominant and characteristic tall deciduous trees. Water birch (*B. occidentalis*), shining willow (*Salix lucida* ssp. *caudata*), and, rarely, mountain alder (*Alnus incana*) are codominant to dominant mid-size deciduous trees. Each can be the sole dominant in stands. Conifers can occur in this habitat, though rarely in abundance, more often as individual trees. The exception is ponderosa pine (*Pinus ponderosa*) or Douglas-fir (*Pseudotsuga menziesii*) that characterizes a conifer-riparian habitat in portions of the shrub-steppe zones.

A wide variety of shrubs are found in association with forest/woodland versions of this habitat. Redosier dogwood (*Cornus sericea*), mountain alder, gooseberry (*Ribes* spp.), rose (*Rosa* spp.), common snowberry (*Symphoricarpos albus*), and Drummond's willow (*Salix drummondii*) are important shrubs in this habitat. Bog birch (*B. nana*) and Douglas spiraea (*Spiraea douglasii*) can occur in wetter stands. Redosier dogwood and common snowberry are shade tolerant and dominate stand interiors, while these shrubs and others occur along forest or woodland edges and openings. Mountain alder is frequently a prominent shrub, especially at middle elevations. Tall shrubs (or small trees) often growing under or with white alder include chokecherry (*Prunus virginiana*), water birch, shining willow, and netleaf hackberry (*Celtis reticulata*).

Shrub-dominated communities contain most of the species associated with tree communities. Willow species (*Salix bebbiana*, *S. boothii*, *S. exigua*, *S. geyeriana*, or *S. emmonii*) dominate many sites. Mountain alder can be dominant and is at least codominant at many sites. Chokecherry, water birch, Saskatoon serviceberry (*Amelanchier alnifolia*), black hawthorn (*Crataegus douglasii*), and redosier dogwood can also be codominant to dominant. Shorter shrubs, such as Woods' rose, spiraea, snowberry, and gooseberry, are usually present in the undergrowth.

The herb layer is highly variable and composed of an assortment of graminoids and broadleaf herbs. Native grasses (*Calamagrostis canadensis*, *Elymus glaucus*, *Glyceria* spp., and *Agrostis* spp.) and sedges (*Carex aquatilis*, *C. angustata*, *C. lanuginosa*, *C. lasiocarpa*, *C. nebrascensis*, *C. microptera*, and *C. utriculata*) are significant in many habitats. Kentucky bluegrass (*Poa pratensis*) can be abundant in areas that were heavily grazed in the past. Other weedy grasses, such as orchard grass (*Dactylis glomerata*), reed canarygrass (*Phalaris arundinacea*), timothy (*Phleum pratense*), bluegrass (*Poa bulbosa* and *P. compressa*), and tall fescue (*Festuca arundinacea*), often dominate disturbed areas. A short list of the great variety of forbs that grow in this habitat includes Columbian monkshood (*Aconitum columbianum*), alpine leafybract aster (*Aster foliaceus*), ladyfern (*Athyrium filix-femina*), field horsetail (*Equisetum arvense*), cow parsnip (*Heracleum maximum*), skunkcabbage (*Lysichiton americanus*), arrowleaf groundsel (*Senecio triangularis*), stinging nettle (*Urtica dioica*), California false hellebore (*Veratrum californicum*), American speedwell (*Veronica americana*), and pioneer violet (*Viola glabella*).

Other Classifications and Key References— Cowardin *et al*. (1979) called this habitat palustrine scrub-shrub and forest. Other references that describe this habitat are Daubenmire 1970, Miller 1976, Manning and Padgett 1992, Kovalchik 1993, Christy and Titus 1996, and Crowe and Clausnitzer 1997. This habitat occurs in both lotic and lentic systems and is represented as riparian and wetland areas in the Idaho gap analysis (Scott *et al*. 2002) and as palustrine forest, palustrine shrubland, and palustrine emergent in the National Wetland Inventory (NWI).

Natural Disturbance Regime—This habitat is tightly associated with stream dynamics and hydrology. Flood cycles occur within 20 to 30 years in most riparian shrublands, although flood regimes vary among stream types. Fires recur typically every 25 to 50 years, but fire can be nearly absent in colder regions or on topographically protected streams. Rafted ice and logs in freshets may cause considerable damage to tree boles in mountain habitats. Beavers crop younger cottonwood and willows and frequently dam side channels in these stands. These forests and woodlands require various flooding regimes and specific substrate conditions for reestablishment. Grazing and trampling is a major influence in altering structure, composition, and function of this habitat; some portions are very sensitive to heavy grazing.

Succession and Stand Dynamics—Riparian vegetation undergoes "typical" stand development that is strongly controlled by a site's conditions immediately following flooding and shifts in hydrology, or its "initial condition." The initial condition of any hydrogeomorphic surface is made up of the plants that survived the disturbance, the plants that can get to the site, and the amount of unoccupied habitat that is available for plant invasions. These factors select the species that can survive or grow at the site. Subsequent or repeated floods, or other influences on the initial condition, also affect that selection of species. A typical woody riparian habitat dynamic is the invasion of woody and herbaceous plants onto a new alluvial bar away from the main channel. If the bar is not scoured in 20 years, a tall shrub and small deciduous tree stand will develop. Approximately 30 years without disturbance or change in hydrology allows trees to overtop shrubs and form woodland. Another 50 years without disturbance allows conifers to invade, and in another 50 years, a mixed hardwood-conifer stand will develop. Many deciduous tall shrubs and trees cannot be invaded by conifers. Each stage can be reinitiated, held in place, or shunted into different vegetation by changes in stream or wetland hydrology, fire, grazing, or an interaction of those factors.

Effects of Management and Anthropogenic Impacts—Management effects on woody riparian vegetation can be obvious (e.g., removal of vegetation by dam construction, roads, or logging), or they can be subtle (e.g., removing beavers from a watershed, removing large woody debris, or constructing a weir dam for fish habitat). In general, excessive livestock or native ungulate use leads to less woody cover and an increase in sod-forming grasses, particularly on fine-textured soils. Undesirable forb species, such as stinging nettle and horsetail, increase with livestock use.

Status and Trends—Quigley and Arbelbide (1997) concluded that the cottonwood-willow cover type covers significantly less area now than it did before 1900 in the Inland Pacific Northwest. The authors also concluded that, although riparian shrubland had been a minor part of the landscape, occupying 2%, it had since declined to 0.5% of the landscape. Before 1900, approximately 40% of riparian shrublands occurred above 3,280 ft (1,000 m); now, nearly 80% is found above that elevation. This change reflects losses to agricultural development, roads, and dams and other flood-control activities. The current riparian shrublands contain many exotic plant species and generally are less productive than they were historically. Quigley and Arbelbide (1997) found that riparian woodland was always rare and that the change in extent from the past is substantial.

2 Shrub-Steppe

Geographic Distribution—Shrub-steppe habitats are common across the Columbia Plateau of Washington, Oregon, Idaho, as well as adjacent Wyoming, Utah, and Nevada. It extends up into the cold, dry environments of surrounding mountains.

Basin big sagebrush shrub-steppe occurs along stream channels and in valley bottoms and flats throughout Idaho. Wyoming sagebrush shrub-steppe is the most widespread habitat, occurring throughout the Columbia Plateau and the northern Great Basin. Mountain big sagebrush shrub-steppe habitat occurs throughout the mountains of Idaho. Bitterbrush shrub-steppe habitat appears primarily in the southern portion of Idaho. Interior shrub dunes and sandy steppe and shrub-steppe habitat is concentrated at low elevations in isolated pockets in the Owyhee Uplands.

Physical Setting—Generally, this habitat is associated with dry, hot environments in the Pacific Northwest, although variants appear in cool, moist areas with some snow accumulation in climatically dry mountains. Elevation range is wide (300–9,000 ft [91–2,743 m]), with most habitat occurring between 2,000 and 6,000 ft (610–1,830 m). Habitat occurs on deep alluvial, loess, silty, or sandy-silty soils on stony flats, ridges, mountain slopes, or slopes of lakebeds with ash or pumice soils.

Landscape Setting—Shrub-steppe habitat defines a biogeographic region and is the major vegetation on average sites in the Columbia Plateau, usually below ponderosa pine forest and woodland and below western juniper and mountain mahogany woodlands habitats. It forms mosaic landscapes with these woodland habitats and grasslands, dwarf shrub-steppe, and desert playa and salt scrub habitats. Mountain sagebrush shrub-steppe occurs at high elevations, occasionally within the dry mixed conifer forest and montane mixed conifer forest habitats. Shrub-steppe habitat can appear in large landscape patches. Livestock grazing is the primary land use in the shrub-steppe, although much has been converted to irrigation or dry land agriculture. Large areas occur in military training areas and wildlife refuges.

Structure—This habitat is a shrub savanna or shrubland with shrub coverage of 10 to 60%. In an undisturbed condition, shrub cover varies between 10 and 30%. Shrubs are generally evergreen, although deciduous shrubs are prominent in many habitats. Shrub height is typically medium tall (1.6–3.3 ft [0.5–1.0 m]), although some sites support shrubs approaching 9 ft (2.7 m). Vegetation structure in this habitat is characteristically an open shrub layer over a moderately open to closed bunchgrass layer. The more northern or productive sites generally have a denser grass layer and sparser shrub layer than southern or more xeric sites do. In fact, the rare good-condition site is better characterized as grassland with shrubs than as shrubland. The bunchgrass layer may contain a variety of forbs. Good-condition habitat has very little exposed bare ground and has mosses and lichens carpeting the area between taller plants. However, heavily grazed sites have dense shrubs making up greater than 40% cover, with introduced annual grasses and little or no moss or lichen cover. Moist sites may support tall bunchgrasses (> 3.3 ft [1 m]) or rhizomatous grasses. More southern shrub-steppe may have native low shrubs dominating with bunchgrasses.

Composition—Characteristic and dominant mid-tall shrubs in the shrub-steppe habitat include all three subspecies of big sagebrush (basin [*Artemisia tridentata* ssp. *tridentata*], Wyoming [*A. t.* ssp. *wyomingensis*] or mountain [*A. t.* ssp. *vaseyana*]), antelope bitterbrush (*Purshia tridentata*), and two shorter sagebrushes (silver [*A. cana*] and three-tip [*A. tripartite*]). Each of these species can be the only shrub or appear in complex seral conditions with other shrubs. Common shrub complexes are bitterbrush and Wyoming big sagebrush, bitterbrush and three-tip sagebrush, Wyoming big sagebrush and three-tip sagebrush, and mountain big sagebrush and silver sagebrush. Wyoming and mountain big sagebrush can codominate areas with tobacco brush (*Ceanothus velutinus*). Rabbitbrush (*Chrysothamnus viscidiflorus*) and short-spine horsebrush (*Tetradymia spinosa*) are common associates and often dominate sites after disturbance. Big sagebrush occurs with the shorter stiff sagebrush (*A. rigida*) or low sagebrush (*A. arbuscula*) on shallow soils or high-elevation sites. Many sandy areas are shrub-free or are open to patchy shrublands of bitterbrush and/or rabbitbrush. Silver sagebrush is the dominant and characteristic shrub along the edges of stream courses, moist meadows, and ponds. Silver sagebrush and rabbitbrush are associates in disturbed areas.

When this habitat is in good or better ecological condition, a bunchgrass-steppe layer is characteristic. Diagnostic native bunchgrasses that often dominate different shrub-steppe habitats are 1) mid-grasses: bluebunch wheatgrass (*Pseudoroegneria spicata*), Idaho fescue (*Festuca idahoensis*), bottlebrush squirreltail (*Elymus elymoides*), and Thurber needlegrass (*Stipa thurberiana)*; 2) short grasses: threadleaf sedge (*Carex filifolia*) and Sandberg bluegrass (*Poa sandbergii*); and 3) the tall grass: basin wildrye (*Leymus cinereus*). Idaho fescue is characteristic of the most productive shrub-steppe vegetation. Bluebunch wheatgrass is codominant at xeric locations, whereas western needlegrass (*Stipa occidentalis*), long-stolon sedge (*Carex inops*), or Geyer's sedge (*C. geyeri*) increase in abundance in higher-elevation shrub-steppe habitats. Needle and thread (*Hesperostipa comata*) is the characteristic native bunchgrass on stabilized, sandy soils. Indian ricegrass (*Achnatherum hymenoides*) characterizes dunes. Grass layers on montane sites contain slender wheatgrass (*Elymus trachycaulus*), mountain fescue (*F. brachyphylla*), green fescue (*F. viridula*), Geyer's sedge, or tall bluegrasses (*Poa* spp.). Bottlebrush squirreltail can be locally important in the Columbia Basin, sand dropseed (*Sporobolus cryptandrus*) is important in the Basin and Range, and basin wildrye is common in the more alkaline areas. Nevada bluegrass (*Poa secunda*), Richardson muhly (*Muhlenbergia richardsonis*), or alkali grass (*Puccinella* spp.) can dominate silver sagebrush flats. Many sites support nonnative plants, primarily cheatgrass (*Bromus tectorum*) or crested wheatgrass (*Agropyron cristatum*) with or without native grasses. Shrub-steppe habitat, depending on site potential and disturbance history, can be rich in forbs or have little forb cover. Trees may be present in some shrub-steppe habitats, usually as isolated individuals from adjacent forest or woodland habitats.

Other Classifications and Key References—Kuchler (1964) called this habitat sagebrush steppe and Great Basin sagebrush. This habitat has also been called xeric shrublands (Scott *et al*. 2002). Other references describing this habitat include Daubenmire 1970, Winward 1970, Winward 1980, Hironaka *et al*. 1983, Volland 1985, Johnson and Clausnitzer 1992, and Johnson and Simon 1987.

Natural Disturbance Regime—Barrett *et al*. (1997) concluded that the fire-return interval for this habitat is 25 years. The native shrub-steppe habitat apparently lacked extensive herds of large grazing and browsing animals until the late 1800s. Burrowing animals and their predators likely played important roles in creating small-scale patch patterns.

Succession and Stand Dynamics—With disturbance, mature stands of big sagebrush are reinvaded through soil-stored or windborne seeds. Invasion can be slow because sagebrush is not disseminated over long distances. Site dominance by big sagebrush usually takes a decade or more depending on fire severity and season, seed rain, post-fire moisture, and plant competition. Three-tip sagebrush is a climax species that reestablishes (from seeds or commonly from sprouts) within 5 to 10 years following a disturbance. Certain disturbance regimes promote three-tip sagebrush, which can out-compete herbaceous species. Bitterbrush is a climax species that plays a seral role, colonizing by seed onto rocky and/or pumice soils. Bitterbrush may be declining, replaced by woodlands in the absence of fire. Silver sagebrush is a climax species that establishes during early seral stages and coexists with later-arriving species. Big sagebrush, rabbitbrush, and short-spine horsebrush invade and can form dense stands after fire or livestock grazing. Frequent or high-intensity fire can create a patchy shrub cover or can eliminate shrub cover and create grasslands habitat.

Effects of Management and Anthropogenic Impacts—Shrub density and annual cover increase with livestock use, whereas bunchgrass density decreases. Repeated or intense disturbance, particularly on drier sites, leads to cheatgrass dominance and replacement of native bunchgrasses. Dry and sandy soils are sensitive to grazing, with needle and thread replaced by cheatgrass at most sites. These disturbed sites can be converted to modified grasslands in the agriculture habitats.

Status and Trends—Shrub-steppe habitat still dominates most of southeastern Oregon, although half of its original distribution in the Columbia Basin has been converted to agriculture. Alteration of fire regimes, fragmentation, livestock grazing, and the addition of over 800 exotic plant species have changed the character of shrub-steppe habitat. Quigley and Arbelbide (1997) concluded that big sagebrush and mountain sagebrush cover types are significantly smaller in area than they were before 1900 and that the bitterbrush/bluebunch wheatgrass cover type is similar to the pre-1900 extent. They also concluded that basin big sagebrush and big sagebrush-warm potential vegetation types' successional pathways are altered, that some pathways of antelope bitterbrush are altered, and that most pathways for big sagebrush-cool are unaltered. Overall, this habitat has seen an increase in exotic plant importance and a decrease in native bunchgrasses. More than half of the Pacific Northwest shrub-steppe habitat community types listed in the National Vegetation Classification are considered imperiled or critically imperiled (Anderson *et al*. 1998).

3 Pine/Fir Forest

Forested lands in the subbasin are commonly distinguished by the types of trees they support, with differences in dominant tree species among sites generally reflecting geographic differences in temperature and moisture available for plant growth (Pfister *et al*. 1977, Arno 1979, Cooper *et al*. 1991). Due to the influence of moist maritime air flowing in from the Pacific Coast to the Continental Divide, the climate of the subbasin is generally mild for this region. (Arno 1979). At a local scale, moisture levels tend to be high at middle elevations, on north-facing slopes, and in sheltered valleys (Barnes *et al*. 1998). In contrast, low south-facing sites and high-elevation windy ridges are relatively dry. Lands at high elevations and shaded north-facing slopes at lower elevations are generally cold, whereas sites at low elevations and on south-facing slopes are much warmer (Cilimburg and Short 2002).

Different tree species tend to thrive under different environmental conditions. For example, ponderosa pine thrives on sites that are relatively hot and dry during summer months (Foiles and Curtis 1973). In contrast, trees like western red cedar and western hemlock (*Tsuga heterophylla*) prosper in relatively mild and moist environments, like those found within the maritime-influenced climatic zones of northern Idaho and northwestern Montana (Pfister *et al*. 1977, Arno 1979, Cooper *et al*. 1991). Lodgepole pine (*Pinus contorta*) and subalpine fir (*Abies lasiocarpa*) grow relatively well in very cold locations within the region (Pfister *et al*. 1977, Cooper *et al*. 1991).

Such environmental affinities explain, in large part, the pattern of tree species distribution and forest development in the northern Rockies. They also help explain why forests dominated by different types of trees tend to have different fire histories. For example, the warm, dry environments in which the ponderosa pine thrives also happen to be extremely fire prone, while the cold, moist environments that favor subalpine fir growth may seldom carry fire (Fischer and Bradley 1987, Smith and Fischer 1997). To emphasize the interconnectedness of environmental factors (moisture and temperature), tree species distribution, and fire, this discussion of fire in the northern Rockies is framed in terms of four, broad forest types: dry montane forests, moist montane forests, lower subalpine forests, and upper subalpine forests. Each of these forest types experiences a unique moisture/temperature regime, roughly corresponding to 1) warm, dry; 2) warm, moist, 3) cool, moist; and 4) cold, moist environmental conditions.

For the purposes of this assessment, the discussion of focal habitats will incorporate an age component (seral stage) of forest structure.

3.1 Xeric, Old Forest

Geographic Distribution—Ponderosa pine is the most widely distributed pine species in North America, ranging north to south from southern British Columbia to central Mexico and east to west from central Nebraska to the west coast (Little 1979). Ponderosa pine ecosystems occupy about 15.4 million hectares across 14 states (Garrison *et al*. 1977). Pacific ponderosa pine ranges from latitude 52 degrees N in the Fraser River drainage of southern British Columbia south through the mountains of Washington, Oregon, and California to latitude 33 degrees N near San Diego. In the northeastern part of its range, it extends east of the Continental Divide to longitude 110 degrees W in Montana and south to the Snake River Plain in Idaho (Oliver and Russell 1990).

Physical Setting—This habitat generally occurs on the driest sites supporting conifers in the Pacific Northwest. Tree species that thrive on sites that are relatively warm and dry tend to dominate. These species include ponderosa pine, Douglas-fir, and western larch (*Larix occidentalis*). This habitat is widespread and variable, appearing on moderate to steep slopes in canyons and foothills and on plateaus or plains near mountains. In Idaho, this habitat can be maintained by the dry pumice soils. Average annual precipitation ranges from about 36 to 76 cm on ponderosa pine sites, often as snow.

Both the mildest and coldest of these dry montane forests can support pure stands of Douglas-fir. On the warmest and driest sites, ponderosa pine tends to grow in pure stands. These stands become increasingly open with decreasing elevation or increasingly dry soils until they are so sparse that they are no longer considered forests. Ponderosa pine "woodlands," in which trees are so few and widely spaced that none of their crowns touch, are common at lower timberline and typically mark the transition from forest to grassland or shrubland. This transition generally occurs within 300 m of the valley base elevation (Arno 1979).

Landscape Setting—This woodland habitat typifies the lower tree-line zone forming transitions with mixed conifer forest and western juniper and mountain mahogany woodlands, shrub-steppe, grassland, or agriculture habitats. Douglas-fir-ponderosa pine woodlands are found near or within the mixed conifer forest habitat. Ponderosa pine woodland is the vegetation type that Americans most commonly associate with western mountains (Peet 1988). However, the warm, dry conditions that naturally favor development and persistence of these open, park-like stands are characteristic of only a small fraction of the forested area within the northern Rockies. Douglas-fir often predominates at lower elevations, where valley base elevations are high and winter temperatures are too low for ponderosa pine. Western larch, the only deciduous conifer in the region, is an often conspicuous component of low-elevation forests.

Structure—This habitat is typically a woodland or savanna with tree canopy coverage of 10 to 60%, although closed-canopy stands are possible. The tree layer is usually composed of widely spaced, large conifer trees. Many stands tend toward a multilayered condition, with encroaching conifer regeneration. Isolated, taller conifers above broadleaf deciduous trees characterize part of this habitat. Deciduous woodlands or forests are an important part of the structural variety of this habitat. Clonal deciduous trees can create dense patches across a grassy landscape rather than scattered individual trees. The undergrowth may include dense stands of shrubs or, more often, be dominated by grasses, sedges, or forbs. Shrub-steppe shrubs may be prominent in some stands and create a distinct tree-shrub-sparse grassland habitat.

Composition—Ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*) are the most common evergreen trees in this habitat. The deciduous conifer western larch (*Larix occidentalis*) can be a codominant with the evergreen conifers, but seldom as a canopy dominant. Grand fir (*Abies grandis*) may be frequent in the undergrowth on more productive sites, giving stands a multilayered structure. In rare instances, grand fir can be codominant in the upper canopy.

The understories of xeric, old forests are usually sparse due to the lack of moisture. Common native grasses and grass-like plants include Idaho fescue, rough fescue, bluebunch wheatgrass, pinegrass (*Calamagrostis rubescens*), and elk sedge (*Carex garberi*). Forbs include arrowleaf balsamroot (*Balsamorhiza sagittata*), lupines (*Lupinus* spp.), heartleaf arnica (*Arnica cordifolia*), and western meadow-rue (*Thalictrum occidentale*). Common snowberry, mountain snowberry (*Symphoricarpos oreophilus*), antelope bitterbrush, white spirea (*Spiraea betulifolia*), Oregon grape (*Mahonia aquifolium*, formerly *Berberis aquifolium*), Saskatoon serviceberry (*Amelanchier alnifolia*), ninebark (*Physocarpus* spp.), russet buffaloberry (*Shepherdia canadensis*), common juniper (*Juniperus communis*), and chokecherry are important woody species (Pfister *et al*. 1977, Cooper *et al*. 1991).

Other Classifications and Key References—The Society of American Foresters refers to this habitat as Pacific ponderosa pine-Douglas-fir. Scott *et al*. (2002) called this habitat needleleaf forest-ponderosa pine. Other references describing elements of this habitat include Johnson and Clausnitzer 1992, Volland 1985, and Lillybridge *et al*. 1995.

Natural Disturbance Regime—Fire plays an important role in creating vegetation structure and composition in this habitat. Most of the habitat has experienced frequent low-severity fires that maintained woodland or savanna conditions. A mean fire interval of 20 years for ponderosa pine is the shortest interval for the vegetation types listed by Barrett *et al*. (1997). Soil drought plays a role in maintaining an open tree canopy in part of this dry woodland habitat.

Succession and Stand Dynamics—This habitat is climax on sites near the dry limits of each of the dominant conifer species and more seral as the environment becomes more favorable for tree growth. Open seral stands are gradually replaced by more closed shade-tolerant climax stands.

Effects of Management and Anthropogenic Impacts—Before 1900, this habitat was mostly open and park-like with relatively few undergrowth trees. Currently, much of this habitat has a younger tree cohort of more shade-tolerant species that gives the habitat a more closed, multilayered canopy. For example, this habitat includes previously natural fire-maintained stands in which grand fir can eventually become the canopy dominant. Fire suppression has lead to a buildup of fuels that increase the likelihood of stand-replacing fires. Heavy grazing, in contrast to fire, removes the grass cover and tends to favor shrub and conifer species. Fire suppression, combined with grazing, creates conditions that support invasion by conifers. Large, late-seral ponderosa pine and Douglas-fir are harvested in much of this habitat. Under most management regimes, typical tree size decreases and tree density increases in this habitat. In some areas, patchy tree establishment at the forest-steppe boundary has created new woodlands.

Status and Trends—Quigley and Arbelbide (1987) concluded that the Interior ponderosa pine cover type is significantly less in extent than it was before 1900. They included much of this habitat in their dry forest potential vegetation group 181, which they concluded has departed from natural succession and disturbance conditions. The greatest structural change in this habitat is the reduced extent of the late-seral, single-layer condition. This habitat is generally degraded because of increased exotic plants and decreased native bunchgrasses. One-third of ponderosa pine and dry Douglas-fir or grand fir community types listed in the National Vegetation Classification are considered imperiled or critically imperiled (Anderson *et al*. 1998).

3.2 Mesic, Old Forest

Geographic Distribution—The mid-elevation forests of the northern Rockies are relatively moist, receiving at least 20 inches (50 cm) of mean annual precipitation. The wetter conditions allow drought-tolerant tree species such as ponderosa pine, Douglas-fir, western larch, western white pine (*Pinus monticola*), and lodgepole pine to grow alongside less drought-tolerant species like grand fir, western red cedar (*Thuja plicata*), western hemlock, Engelmann spruce (*Picea engelmannii*), and subalpine fir. These species co-occur in various combinations at elevations between 2,999 and 6,998 ft (914 and 2,133 m) throughout Idaho. These assemblages are generally referred to as "mixed conifer" forests. The mixed conifer forest habitat appears primarily in the Blue Mountains, East Cascades, and Okanogan

Highland ecoregions of Oregon, Washington, adjacent Idaho, and western Montana.

Physical Setting—This habitat receives some of the greatest amounts of precipitation in the inland northwest, 30 to 80 inches (76–203 cm) per year. Elevation of this habitat varies geographically, with generally higher elevations to the east. Douglas-fir is common throughout the entire spectrum of these forests but is most abundant on sites receiving 20 to 25 inches (50–63 cm) of rain per year—the driest of the mesic montane forests. Some of these relatively warm, dry stands may also support ponderosa pine and appear similar to low-elevation, dry forests. Grand fir is also common at low to middle elevations, but typically predominates on sites receiving more than 25 inches (63 cm) of precipitation per year (Arno 1980, Peet 1988).

On even wetter (> 32 inches [81 cm] of annual rainfall) yet still relatively warm sites, luxuriant forests of western red cedar and western hemlock can be found. These highly productive forests, which can contain representatives of the other eight tree species listed above, tend to occur at moderately low elevations (below 4,920 ft [1,500 m]) within the balmy, maritime-influenced climatic zone of the northern Rocky Mountains (Arno 1979, Cooper *et al*. 1991). This zone generally extends from northern Idaho eastward in Montana to Glacier National Park and to the Swan, Clearwater, lower Blackfoot, and Bitterroot river valleys (Arno 1979).

On cooler sites, mixtures of western larch, lodgepole pine, subalpine fir, and Engelmann spruce are common.

Landscape Setting—This habitat makes up most of the continuous montane forests of the inland Pacific Northwest. It is located between the subalpine portions of the montane mixed conifer forest habitat and lower tree-line ponderosa pine forests.

Structure—Mesic, old forest habitats are montane forests and woodlands. Stand canopy structure is generally diverse, although single-layer forest canopies are currently more common than multilayered forests with snags and large woody debris. The tree layer varies from closed forests to more open-canopy forests or woodlands. This habitat may include very open stands. The undergrowth is complex and diverse. Tall shrubs, low shrubs, forbs, or any combination may dominate stands. Deciduous shrubs typify shrub layers. Prolonged canopy closure may lead to development of sparsely vegetated undergrowth.

Composition—This habitat contains a wide array of tree species (9) and stand dominance patterns. Douglas-fir (*Pseudotsuga menziesii*) is the most common tree in this habitat. It is almost always present and dominates or codominates most overstories. Lower elevations or drier sites may have ponderosa pine (*Pinus ponderosa*) as a codominant with Douglas-fir in the overstory and often have other shade-tolerant tree species growing in the undergrowth. On moist sites, grand fir, western red cedar, and/or western hemlock (*Tsuga heterophylla*) are dominant or codominant with Douglas-fir. Other conifers include western larch (*Larix occidentalis*) and western white pine on mesic sites and Engelmann spruce, lodgepole pine, and subalpine fir (*Abies lasiocarpa*) on colder sites. Rarely, Pacific yew (*Taxus brevifolia*) may be an abundant undergrowth tree or tall shrub. Spruce-dominated forests can be found on benches and gentle north slopes, and the cedar-hemlock forest type is most common along moist canyon bottom sites or seepages (Cilimburg and Short 2002).

The often luxuriant understories of moist montane forests tend to consist of diverse mixtures of shrubs and moist-site forbs. Common woody species include ninebark, common snowberry, white spirea, oceanspray

(*Holodiscus discolor*), dwarf huckleberry (*Gaylussacia dumosa*), grouse whortleberry (*Vaccinium scoparium*), bearberry, twinflower (*Linnaea borealis*), Sitka alder (*Alnus viridis* ssp. *sinuata*), redosier dogwood, Utah honeysuckle (*Lonicera utahensis*), menziesia (*Menziesia ferruginea*), thimbleberry (*Rubus parviflorus*), common juniper, bunchberry (*Cornus canadensis*), russet buffaloberry, Saskatoon serviceberry, and devilsclub (*Oplopanax horridus*). Forbs include starry Solomon's seal, western meadow-rue, broadleaf arnica, heartleaf arnica (*Arnica latifolia*), mountain arnica (*A. montana*), red baneberry (*Actaea rubra*), queencup beadlily, sweetscented bedstraw (*Galium odoratum*), Richardson's geranium, arrowleaf groundsel (*Senecio triangularis*), wild ginger (*Asarum caudatum*), twistedstalk (*Streptopus amplexifolini*), darkwoods violet (*Viola orbiculata*), wild sarsaparilla (*Aralia nudicaulis*), and western rattlesnake plantain (*Goodyera oblongifolia*). Other understory associates include bluejoint reedgrass (*Calamagrostis canadensis*), pinegrass, Columbia brome (*Bromus vulgaris*), field horsetail, ladyfern (*Athyrium filix-femina*), common beargrass (*Xerophyllum tenax*), and elk sedge.

Other Classifications and Key References— Kuchler (1964) called this habitat Douglas-fir (No. 12), cedar-hemlock-pine (No. 13), and grand fir-douglas-fir (No. 14) forests. Scott *et al*. (2002) classified this habitat as needleleaf forest-mixed xeric forest. Cover types that would represent this type are the Douglas-fir-dominant-mixed conifer forest and ponderosa pine-dominant-mixed conifer forest. Other references detailing forest associations for this habitat include Daniels 1969, Hopkins 1979ab, Johnson and Simon 1987, Volland 1985, Johnson and Clausnitzer 1992, Zack and Morgan 1994, and Lillybridge *et al*. 1995.

Natural Disturbance Regime—Fires were probably of moderate frequency (30–100 years) in presettlement times. Inland Pacific Northwest Douglas-fir and western larch forests have a mean fire interval of 52 years (Barrett *et al.* 1997). Typically, stand-replacement fire-return intervals are 150 to 500 years, with moderate severity-fire intervals of 50 to 100 years. Specific fire influences vary with site characteristics. Generally, wetter sites burn less frequently than drier sites, and stands are older, with more western hemlock and western red cedar, than in drier sites. Many sites dominated by Douglas-fir and ponderosa pine, which were formerly maintained by wildfire, may now be dominated by grand fir (a fire-sensitive, shade-tolerant species).

Succession and Stand Dynamics— Successional relationships of this type reflect complex interrelationships among site potential, plant species characteristics, and disturbance regime (Zack and Morgan 1994). Generally, early seral forests of shade-intolerant trees (western larch, western white pine, ponderosa pine, Douglas-fir) or shade-tolerant trees (grand fir, western red cedar, western hemlock) develop some 50 years following disturbance. Forb- or shrub-dominated communities precede this stage. These early stage mosaics are maintained on ridges and drier topographic positions by frequent fires. Early seral forest develops into mid-seral habitat of large trees during the next 50 to 100 years. Stand-replacing fires recycle this stage back to early seral stages over most of the landscape. Without high-severity fires, a late-seral condition develops either a single-layer or multilayered structure during the next 100 to 200 years. These structures are typical of cool bottomlands that usually experience only low-intensity fires.

Effects of Management and Anthropogenic Impacts—This habitat has been most affected by timber harvesting and fire suppression.

Timber harvesting has focused on large shade-intolerant species in mid- and late-seral forests, leaving shade-tolerant species. Fire suppression enforces those logging priorities by promoting less fire-resistant, shade-intolerant trees. The resultant stands at all seral stages tend to lack snags, have high tree density, and are composed of smaller and more shade-tolerant trees. Mid-seral forest structure is currently 70% more abundant than it was in historical, native systems (Quinn 1997). Late-seral forests of shade-intolerant species are now essentially absent. Early seral forest abundance is similar to that found historically but lacks snags and other legacy features.

Status and Trends—Quigley and Arbelbide (1997) concluded that the Interior Douglas-fir, grand fir, and western red cedar/western hemlock cover types are more abundant now than they were before 1900, whereas the western larch and western white pine types are significantly less abundant. Twenty percent of Pacific Northwest Douglas-fir, grand fir, western red cedar, western hemlock, and western white pine associations listed in the National Vegetation Classification are considered imperiled or critically imperiled (Anderson *et al*. 1998). Roads, timber harvest, periodic grazing, and altered fire regimes have compromised these forests. Even though this habitat is more extensive than it was before 1900, natural processes and functions have been modified enough to alter its natural status as functional habitat for many species.

3.3 Mesic, Young Forest

Mesic, young forest refers to the early seral components of forest habitats associated with the more moist (mesic) environments in the landscape. The early successional stages of forest habitats are often characterized by species different from climax forest species and typically represent disturbance and/or the environmental response to that disturbance (Pfister *et al*. 1977, Cooper *et al*. 1991). For assessment purposes in the salmon subbasin, the Rocky Mountain lodgepole pine has been identified as a useful proxy for identifying key habitat components on the landscape and important fish and wildlife species associated with those forest successional stages.

Geographic Distribution—Rocky Mountain lodgepole pine grows from the central Yukon Territory south throughout British Columbia and western Alberta east of the Coast Range. In the United States, lodgepole pine grows throughout the Rocky Mountain states, from Idaho and Montana to southern Colorado, and in the Cascades as far south as the Washington–Oregon border. Outlying eastern populations occur in the Caribou Mountains of northern Alberta, in the Cypress Hills of southeastern Alberta and southwestern Saskatchewan, in central Montana, and in the Black Hills of South Dakota (Little 1979, Critchfield 1980, Havstad *et al*. 1986).

Physical Setting—This habitat is located mostly at middle to higher elevations (2,999–8,999 ft [914–2,743 m]). These environments can be cold and relatively dry, usually with persistent winter snowpack. A few of these forests occur in low-lying frost pockets, in wet areas, or under edaphic control (usually pumice) and are relatively long-lasting features of the landscape. Average July temperature in this forest type typically falls between 60 and 64 °F. Mean annual precipitation ranges from 50 to 63 cm, with much of it falling as snow (Pfister *et al*. 1977, Arno 1979, Cooper *et al*. 1991).

Landscape Setting—This habitat appears within montane mixed conifer forest east of the Cascade Range crest and with cooler mixed conifer forest habitats. Most pumice-soil lodgepole pine habitat is intermixed with ponderosa pine forest and woodland habitats and located between mixed conifer forest habitat and either western juniper woodland or shrub-steppe habitat.

Structure—This habitat is composed of open to closed evergreen conifer tree canopies. Vertical structure is typically a singletree layer. Reproduction of other more shade-tolerant conifers can be abundant in the undergrowth. Several distinct undergrowth types develop under the tree layer: evergreen or deciduous medium-tall shrubs, evergreen low shrub, or graminoids with few shrubs. On pumice soils, sparsely developed shrub and graminoid undergrowth appears with open to closed tree canopies.

Composition—Subalpine fir (*Abies lasiocarpa*), Englemann spruce (*Picea engelmannii*), and lodgepole pine dominate many stands of this forest type. Mountain hemlock (*Tsuga mertensiana*), which is relatively restricted to the martime-influenced climatic zone west of the Continental Divide, is another key component of this habitat type. Douglas-fir, western larch, western white pine, and whitebark pine (*Pinus albicaulis*) may also be present at various stages of stand development within this forest type (Arno 1979, Pfister *et al*. 1977, Cooper *et al*. 1991). Subalpine fir, Engelmann spruce, and whitebark pine are indicators of subalpine environments and present in colder or higher sites. Quaking aspen (*Populus tremuloides*) sometimes occurs in small numbers.

The undergrowth typical of the habitat type varies from grassy (in open, park-like sites) to densely shrubby. Wet sites can support luxuriant herbaceous vegetation, while dry sites usually support few forbs. Common woody species include antelope bitterbrush, dwarf huckleberry, grouse whortleberry, common juniper, devilsclub, menziesia, and Oregon grape. Common forbs include twinflower, sweetscented bedstraw, twisted stalk, queencup beadlily, wild sarsaparilla, western meadow-rue, and heartleaf arnica. Other understory associates are common beargrass, smooth woodrush (*Luzula glabrata*), elk sedge, bluejoint reedgrass, and pinegrass (Pfister *et al*. 1977, Arno 1979, Cooper *et al*. 1991).

Other Classifications and Key References—Quigley and Arbelbide (1997) referred to this habitat as lodgepole pine cover type and as a part of the dry forest potential vegetation group. It is classified as needleleaf forest-lodgepole pine. Other references detailing forest associations with this habitat include Hopkins 1979ab, Volland 1985, Johnson and Clausnitzer 1992, and Lillybridge *et al*. 1995.

Natural Disturbance Regime—This habitat typically reflects early successional forest vegetation that originated with fires. Inland Pacific Northwest lodgepole pine has a mean fire interval of 112 years (Barrett *et al*. 1997). Summer drought areas generally have low- to medium-intensity ground fires occurring at intervals of 25 to 50 years, whereas areas with more moisture have a sparse undergrowth and slow fuel build-up that result in less frequent, more intense fire. With time, lodgepole pine stands increase in fuel loads. Woody fuels accumulate on the forest floor from insect (mountain pine beetle) and disease outbreaks and residual wood from past fires. Mountain pine beetle outbreaks thin stands, adding fuel and creating a drier environment for fire, or they open canopies and create gaps for other conifer regeneration. High-severity crown fires are likely when stands are young and tree crowns are near dead wood on the ground. After a stand opens up, shade-tolerant trees increase in number.

Succession and Stand Dynamics—Most lodgepole pine forest and woodlands are early to mid-seral stages initiated by fire. Typically, lodgepole pine establishes within 10 to 20 years after fire. This process can be a gap phase process when seed sources are scarce.

Lodgepole stands break up after 100 to 200 years. Without fires and insects, stands create more closed-canopy forest with sparse undergrowth. Because lodgepole pine cannot reproduce under its own canopy, old unburned stands are replaced by shade-tolerant conifers. Lodgepole pine on pumice soils is not seral to other tree species; these extensive stands, if not burned, thin naturally, with lodgepole pine regenerating in patches. On poorly drained pumice soil, quaking aspen sometimes plays a mid-seral role and is displaced by lodgepole when aspen clones die.

Effects of Management and Anthropogenic Impacts—Fire suppression has left many single-canopy lodgepole pine habitats unburned to develop into more multilayered stands. Thinning of serotinous lodgepole pine forests with fire intervals of less than 20 years can reduce their importance over time. In pumice-soil lodgepole stands, lack of natural regeneration in harvest units has lead to creation of "pumice deserts" within otherwise forested habitats (Cochran 1985).

Status and Trends—Quigley and Arbelbide (1997) concluded that the extent of the lodgepole pine cover type in the Pacific Northwest is the same as it was before 1900 and in some regions may exceed its historical extent. Five percent of Pacific Northwest lodgepole pine associations listed in the National Vegetation Classification are considered imperiled (Anderson *et al*. 1998). At a finer scale, these forests have been fragmented by roads and timber harvest and influenced by periodic livestock grazing and altered fire regimes.

4 Native Grasslands

Geographic Distribution—This habitat is found primarily in the Columbia Basin of Idaho, Oregon, and Washington, at middle to low elevations and on plateaus in the Blue Mountains, usually within the ponderosa pine zone in Oregon.

Idaho fescue grassland habitats were formerly widespread in the Palouse region of southeastern Washington and adjacent Idaho; most of this habitat has been converted to agriculture. Idaho fescue grasslands still occur in isolated, moist sites near lower tree line in the foothills of the Blue Mountains, northern Rocky Mountains, and east Cascade Range near the Columbia River Gorge. Bluebunch wheatgrass grassland habitats are common throughout the Columbia Basin, both as modified native grasslands in deep canyons and the dry Palouse and as fire-induced representatives in the shrub-steppe. Similar grasslands appear on the High Lava Plains Ecoregion, where they occur in a matrix with big sagebrush or juniper woodlands. In Oregon, these grasslands are also found in burned shrub-steppe and canyons in the Basin and Range and Owyhee Uplands provinces. Sand dropseed and three-awn needlegrass (or Fendler threeawn, *Aristida longiseta*) grassland habitats are restricted to river terraces in the Columbia Basin, Blue Mountains, and Owyhee Uplands of Oregon and Washington. The primary location of this habitat extends along the Snake River from Lewiston south to the Owyhee River.

Physical Setting—This habitat develops in hot, dry climates in the Pacific Northwest. Annual precipitation totals 8 to 20 inches (20–51 cm); only 10% falls in the hottest months, July through September. Snow accumulation is low (1–6 inches [3–15 cm]) and occurs only in January and February in eastern portions of the habitat's range and November through March in the west. More snow accumulates in grasslands within the forest matrix. Soils are variable: 1) highly productive loess soils up to 51 inches (130 cm) deep, 2) rocky flats, 3) steep slopes, and 4) sandy, gravel, or cobble soils. An important variant of this habitat occurs on sandy, gravelly, or silty river terraces or seasonally exposed river gravel or Spokane flood deposits. The grassland habitat is typically upland vegetation, but it may also include riparian bottomlands dominated by nonnative grasses. This habitat is found on elevations from 500 to 6,000 ft (152–1,830 m).

Landscape Setting—Grassland habitats appear well below and in a matrix with lower tree-line ponderosa pine forest and woodland or western juniper and mountain mahogany woodlands. Grassland can also be part of the lower-elevation forest matrix. Most grassland habitat occurs in two distinct large landscapes: plateau and canyon grasslands. Several rivers flow through narrow basalt canyons below plateaus supporting prairies or shrub-steppe. The canyons can be some 2,132 ft (650 m) deep below the plateau. The plateau above is composed of gentle slopes with deep, silty loess soils in an expansive, rolling dune-like landscape. Grasslands may occur in a patchwork with shallow soil scablands or occur within biscuit scablands or mounded topography. Naturally occurring grasslands are beyond the range of bitterbrush and sagebrush species. This habitat exists today in the shrub-steppe landscape where grasslands are created by brush removal, chaining or spraying, or fire. Agricultural uses and introduced perennial plants on abandoned or planted fields are common throughout the current distribution of eastside grassland habitats.

Structure—This habitat is dominated by short to medium-tall grasses (< 3.3 ft [1 m]). Total herbaceous cover can be closed to only sparsely vegetated. In general, this habitat is an open and irregular arrangement of grass clumps rather than a continuous sod cover. These medium-tall grasslands often have scattered and diverse patches of low shrubs, but few or no medium-tall shrubs (< 10% of shrub cover is taller than the grass layer). Native forbs may contribute significant cover, or they may be absent. Grasslands in canyons are dominated by bunchgrasses growing in lower densities than they do on deep-soil prairie sites. The soil surface between perennial plants can be covered with a diverse cryptogamic or microbiotic layer of mosses, lichens, and various soil bacteria and algae. Moister environments can support a dense sod of rhizomatous perennial grasses. Annual plants are a common spring and early summer feature of this habitat.

Composition—Bluebunch wheatgrass (*Pseudoroegneria spicata*) and Idaho fescue (*Festuca idahoensis*) are the characteristic native bunchgrasses of this habitat, and either or both can be dominant. Idaho fescue is common in more moist areas, and bluebunch wheatgrass is more abundant in drier areas. Rough fescue (*F. campestris*) is a characteristic dominant on moist sites in northeastern Washington. Sand dropseed (*Sporobolus cryptandrus*) or three-awn needlegrass (*Aristida longiseta*) is a native dominant grass on hot, dry sites in deep canyons. Sandberg bluegrass (*Poa sandbergii*) is usually present and occasionally codominant in drier areas. Bottlebrush squirreltail (*Elymus elymoides*) and Thurber needlegrass (*Stipa thurberiana*) can be locally dominant. Annual grasses are usually present; cheatgrass (*Bromus tectorum*) is the most widespread. In addition, medusahead (*Taeniatherum caput-medusae*) and other annual bromes (*Bromus commutatus*, *B. mollis*, *B. japonicus*) may be present to codominant. Moist environments, including riparian bottomlands, are often codominated by Kentucky bluegrass (*Poa pratensis*).

A dense and diverse forb layer can be present or entirely absent; more than 40 species of native forbs can grow in this habitat, including balsamroots (*Balsamorhiza* spp.), biscuitroots (*Lomatium* spp.), buckwheat

(*Eriogonum* spp.), fleabane (*Erigeron* spp.), lupines (*Lupinus* spp.), and milkvetches (*Astragalus* spp.). Common exotic forbs that can grow in this habitat are knapweeds (*Centaurea solstitialis, C. diffusa, C. maculosa*), tall tumblemustard (*Sisymbrium altissimum*), and Russian thistle (*Salsola kali*).

Smooth sumac (*Rhus glabra*) is a deciduous shrub found locally in combination with these grassland species. Rabbitbrushes (*Chrysothamnus nauseosus*, *C. viscidiflorus*) can occur in small amounts in this habitat, especially where grazed by livestock. In moist Palouse regions, common snowberry (*Symphoricarpos albus*) or Nootka rose (*Rosa nutkana*) may be present, but these plants are shorter than the bunchgrasses. Dry sites contain low, succulent pricklypear (*Opuntia polyacantha*). Big sagebrush (*Artemisia tridentata*) is occasional and may be increasing in grasslands on former shrub-steppe sites. Black hawthorn (*Crataegus douglasii*) and other tall shrubs can form dense thickets near Idaho fescue grasslands. Rarely, ponderosa pine (*Pinus ponderosa*) or western juniper (*Juniperus occidentalis*) can occur as isolated trees.

Other Classifications and Key References—This habitat is called Palouse prairie, Pacific Northwest grassland, steppe vegetation, or bunchgrass prairie in general ecological literature. Quigley and Arbelbide (1997) called this habitat fescue-bunchgrass and wheatgrass bunchgrass and the dry grass cover type. Scott *et al*. (2002) classified this habitat as non-forested lands-grasslands. The Oregon Gap II Project (Kiilsgaard 1999) and Oregon vegetation landscape-level (Kiilsgaard and Barrett 1998) cover types that would represent this habitat are northeast Oregon canyon grassland, forest-grassland mosaic, and modified grassland. Kuchler (1964) includes this within fescue-wheatgrass and wheatgrass-bluegrass. Franklin and Dyrness (1973) include this habitat in steppe zones of Washington and Oregon. Other references describing this habitat include Daubenmire 1970; Tisdale 1983, 1986; Noss *et al*. 1995; Morgan *et al*. 1996; and Black *et al*. 1998.

Natural Disturbance Regime—The fire-return interval for sagebrush and bunchgrass is estimated at 25 years (Barrett *et al*. 1997). The native bunchgrass habitat apparently lacked extensive herds of large grazing and browsing animals until the late 1800s. Burrowing animals and their predators likely played important roles in creating small-scale patch patterns.

Succession and Stand Dynamics— Currently, fires burn less frequently in the Palouse grasslands than they did historically because of fire suppression, roads, and conversions to cropland (Morgan *et al*. 1996). Without fire, black hawthorn shrubland patches expand on slopes, along with common snowberry and rose. Fires covering large areas of shrub-steppe habitat can eliminate shrubs and their seed sources and create eastside grassland habitat. Repeated early season fires or fires that follow heavy grazing can result in annual grasslands of cheatgrass, medusahead, knapweed, or yellow starthistle (*Centaurea solstitialis*). Annual exotic grasslands are common in dry grasslands and included in modified grasslands as part of the agriculture habitat.

Effects of Management and Anthropogenic Impacts—Large expanses of grasslands are currently used for livestock ranching. Deep-soil Palouse sites are mostly converted to agriculture. Drier grasslands and canyon grasslands—those areas with shallower soils, steeper topography, or hotter, drier environments—were more intensively grazed and for longer periods than deep-soil grasslands were (Tisdale 1986). Evidently, these drier native bunchgrass grasslands changed irreversibly to persistent annual grass and forblands. Some annual grassland, native bunchgrass, and shrub-steppe habitats were converted to intermediate wheatgrass, or more commonly, crested wheatgrass-dominated areas. Apparently, these form persistent grasslands and are included as modified grasslands in the agriculture habitat. With intense livestock use, some riparian bottomlands became dominated by nonnative grasses. Many native dropseed grasslands have been submerged by dam reservoirs.

Status and Trends—Most of the Palouse prairie of southeastern Washington and adjacent Idaho and Oregon has been converted to agriculture. Since 1900, 94% of the Palouse grasslands have been converted to crop, hay, or pasture lands. Remnants of Palouse prairie still occur in the foothills of the Blue Mountains and in isolated, moist Columbia Basin sites. The Palouse is one of the most endangered ecosystems in the United States (Noss *et al*. 1995), with only 1% of the original habitat remaining; it is highly fragmented, with most remaining habitat sites less than 10 acres. All these sites are subject to weed invasions and drift of aerial biocides. Quigley and Arbelbide (1997) concluded that fescue-bunchgrass and wheatgrass bunchgrass cover types have significantly decreased in area since before 1900, while exotic forbs and annual grasses have significantly increased during that time. Fifty percent of the plant associations recognized as components of eastside grassland habitat listed in the National Vegetation Classification are considered imperiled or critically imperiled (Anderson *et al.* 1998).

5 Aspen

Geographic Distribution—Quaking aspen (*Populus tremuloides*) is the most widely distributed tree in North America, but the habitat type is a minor one throughout eastern Washington, Oregon, and Idaho. It occurs from Newfoundland west to Alaska and south to Virginia, Missouri, Nebraska, and northern Mexico. A few scattered populations occur further south in Mexico to Guanajuato (Little 1979). Distribution is patchy in the West, with trees confined to suitable sites. Aspen stands are much more common in the Rocky Mountain states. Density is greatest in Minnesota, Wisconsin, Michigan, Colorado, and Alaska; each of these states contains at least two million acres of commercial quaking aspen forest. Maine, Utah, and central Canada also have large acreages of quaking aspen (Jones *et al*. 1985, Perala and Carpenter 1985).

Physical Setting—This habitat generally occurs on well-drained mountain slopes or canyon walls that have some moisture. Rockfalls, talus, or stony north slopes are often typical sites. This habitat may occur in steppe on moist microsites. It is not associated with streams, ponds, or wetlands. This habitat is found at elevations from 2,000 to 9,500 ft (610–2,896 m).

Landscape Setting—Aspen forms a "subalpine belt" above the western juniper and mountain mahogany woodlands habitats and below montane shrub-steppe habitat. It can occur in seral stands in the lower mixed conifer forest and the ponderosa pine forest and woodland habitats. Primary land use is livestock grazing.

Structure—Deciduous trees, usually less than 48 ft (15 m) tall, dominate this woodland or forest habitat. The tree layer grows over a forb-, grass-, or low shrub-dominated undergrowth. Relatively simple two-tiered stands characterize the typical vertical structure of woody plants in this habitat. This habitat is composed of one to many clones of trees, with larger trees toward the center of each clone. Conifers invade and create mixed evergreen-deciduous woodland or forest habitats.

Composition—Quaking aspen is the characteristic and dominant tree in this habitat. It is the sole dominant in many stands, although scattered ponderosa pine (*Pinus ponderosa*) or Douglas-fir (*Pseudotsuga menziesii*) may be present. Snowberry (*Symphoricarpos oreophilus* and, less frequently, *S. albus*) is the most common dominant shrub. Tall shrubs such as Scouler's willow (*Salix scouleriana*) and Saskatoon serviceberry (*Amelanchier alnifolia*) may be abundant. On mountain or canyon slopes, antelope bitterbrush (*Purshia tridentata*), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), low sagebrush (*A. arbuscula*), and curl-leaf mountain mahogany (*Cercocarpus ledifolius*) often occur in and adjacent to this woodland habitat.

In some stands, pinegrass (*Calamagrostis rubescens*) may dominate the ground cover without shrubs. Other common grasses are Idaho fescue (*Festuca idahoensis*), California brome (*Bromus carinatus*), or blue wildrye (*Elymus glaucus*). Characteristic tall forbs include horsemint (*Agastache* spp.), aster (*Aster* spp.), senecio (*Senecio* spp.), and coneflower (*Rudbeckia* spp.). Low forbs include meadow-rue (*Thalictrum* spp.), bedstraw (*Galium* spp.), sweetcicely (*Osmorhiza* spp.), and valerian (*Valeriana* spp.).

Other Classifications and Key References—This habitat is called aspen by the Society of American Foresters and aspen woodland by the Society of Range Management. The Oregon Gap II Project (Kiilsgaard 1999) cover types that would represent this type as aspen groves. Other references describing this habitat include Franklin and Dyrness 1973, Williams and Lillybridge 1983, Agee 1994, Howard 1996, and Mueggler 1988. (Ritter 2000).

Natural Disturbance Regime—Fire plays an important role in maintenance of this habitat. Quaking aspen will colonize sites after fire or other stand disturbances through root sprouting. Research on fire scars in aspen stands in central Utah (Howard 1996) indicated that most fires occurred before 1885 and concluded that the natural fire-return interval was 7 to 10 years. Ungulate browsing plays a variable role in aspen habitat: ungulates may slow tree regeneration by consuming aspen sprouts on some sites and may have little influence in other stands.

Succession and Stand Dynamics—There is no generalized successional pattern across the range of this habitat. Aspen sprouts after fire and spreads vegetatively into large clonal or multiclonal stands. Because aspen is shade intolerant and cannot reproduce under its own canopy, conifers can invade most aspen habitat. In central Utah, quaking aspen was invaded by conifers in 75 to 140 years. Apparently, some aspen habitat is not invaded by conifers, but eventually clones deteriorate and shrubs, grasses, and/or forbs grow in. This transition to grasses and forbs is more likely on dry sites.

Effects of Management and Anthropogenic Impacts—Domestic sheep reportedly consume four times more aspen sprouts than cattle do. Heavy livestock browsing can adversely impact aspen growth and regeneration. With fire suppression and alteration of fine fuels, fire rejuvenation of aspen habitat has been greatly reduced since about 1900. Conifers now dominate many seral aspen stands, and extensive stands of young aspen are uncommon.

Status and Trends—With fire suppression and change in fire regimes, the aspen forest habitat is less common than it was before 1900. None of the five Pacific Northwest upland quaking aspen community types in the National Vegetation Classification is considered imperiled (Anderson *et al.* 1998).

6 Juniper/Mountain Mahogany

Geographic Distribution—Western juniper occurs from southeastern Washington and Oregon southward to the upper slopes of the Sierra Nevada and San Bernardino mountains of southern California (Sowder *et al*. 1965). The species occurs along the western edge of the Great Basin in southwestern Idaho and northwestern Nevada (Meeuwig and Murray 1978). Western juniper woodlands with shrub-steppe species appear throughout the range of the juniper/mountain mahogany habitat. Many isolated mahogany communities occur throughout canyons and mountains across the range of this habitat.

During the past 150 years, western juniper has extended its range and now occupies approximately 42 million acres (17 million hectares) in the Intermountain West (Bunting 1990, Ferry *et al*. 1995). It grows over approximately four million acres (1.6 million hectares) in the Pacific Northwest (Eddleman *et al*. 1994).

Physical Setting—This habitat is widespread and variable, occurring in basins and canyons and on slopes and valley margins in the southern Columbia Plateau, as well as on fire-protected sites in the northern Basin and Range Province. It may be found on benches and foothills. Western juniper and/or mountain mahogany woodlands are often found on shallow soils on flats at middle to high elevations, usually on basalts. Other sites range from deep, loess soils and sandy slopes to very stony canyon slopes. At lower elevations, or in areas outside of shrub-steppe, this habitat occurs on slopes and in areas with shallow soils. Mountain mahogany can occur on steep rimrock slopes, usually in areas of shallow soils or protected slopes. This habitat can be found at elevations of 1,500 to 8,000 ft (457–2,438 m), mostly between 4,000 to 6,000 ft (1,220–1,830 m). Average annual precipitation ranges from approximately 10 to 13 inches (25–33 cm), with most occurring as winter snow.

Landscape Setting—This habitat reflects a transition between ponderosa pine forest and woodland and shrub-steppe, grasslands, and rarely desert playa and salt desert scrub habitats. Western juniper generally occurs on higher topography, whereas the shrub communities are more common in depressions or steep slopes with bunchgrass undergrowth. In the Great Basin, mountain mahogany may form a distinct belt on mountain slopes and ridgetops above pinyon-juniper woodland. Mountain-mahogany can occur in isolated, pure patches that are often very dense. The primary land use is livestock grazing.

Structure—This habitat is made up of savannas, woodlands, or open forests with 10 to 60% canopy cover. The tallest layer is composed of short (6.6–40 ft [2–12 m] tall) evergreen trees. Dominant plants may assume a tall-shrub growth form on some sites. The short trees appear in a mosaic pattern with areas of low or medium-tall (usually evergreen) shrubs, alternating with areas of tree layers and widely spaced low or medium-tall shrubs. The herbaceous layer is usually composed of short or medium-tall bunchgrass or, rarely, rhizomatous grass-forb undergrowth. These vegetated areas can be interspersed with rimrock or scree. A well-developed cryptogam layer often covers the ground, although bare rock can make up much of the ground cover.

Composition—Western juniper and/or mountain mahogany dominate these woodlands with either bunchgrass or shrub-steppe undergrowth. Western juniper (*Juniperus occidentalis*) is the most common dominant tree in these woodlands. Part of this habitat has curl-leaf mountain mahogany

(*Cercocarpus ledifolius*) as the only dominant tall shrub or small tree. Mahogany may be codominant with western juniper. Ponderosa pine (*Pinus ponderosa*) can grow in this habitat and, in some rare instances, may be an important part of the canopy.

The most common shrubs in this habitat are basin, Wyoming, or mountain big sagebrush (*Artemisia tridentata* ssp. *tridentata*, *A. t.* ssp. *wyomingensis*, and *A. t.* ssp. *vaseyana*) and/or bitterbrush (*Purshia tridentata*). These shrubs usually provide significant cover in juniper stands. Low or stiff sagebrush (*Artemisia arbuscula* or *A. rigida*) is a dominant dwarf shrub in some juniper stands. Mountain big sagebrush appears most commonly with mountain mahogany and mountain mahogany mixed with juniper. Snowbank shrubland patches in mountain mahogany woodlands are composed of mountain big sagebrush with bitter cherry (*Prunus emarginata*), quaking aspen (*Populus tremuloides*), and Saskatoon serviceberry (*Amelanchier alnifolia*). Shorter shrubs such as mountain snowberry or creeping Oregon grape (*Mahonia repens*) can be dominant in the undergrowth. Rabbitbrush (*Chrysothamnus nauseosus* and *C. viscidiflorus*) increase with grazing.

Part of this woodland habitat lacks a shrub layer. Various native bunchgrasses dominate different aspects of this habitat. Sandberg bluegrass (*Poa sandbergii*), a short bunchgrass, is the dominant and most common grass throughout many juniper sites. Medium-tall bunchgrasses such as Idaho fescue (*Festuca idahoensis*), bluebunch wheatgrass (*Pseudoroegneria spicata*), needlegrasses (*Stipa occidentalis*, *S thurberiana*, *S. lemmonii*), and bottlebrush squirreltail (*Elymus elymoides*) can dominate undergrowth. Threadleaf sedge (*Carex filifolia*) and basin wildrye (*Leymus cinereus*) are found in lowlands, and Geyer's and Ross' sedges (*Carex geyeri*, *C. rossii*), pinegrass (*Calamagrostis rubescens*), and blue wildrye (*E. glaucus*) appear on mountain foothills. Sandy sites typically have needle and thread (*Hesperostipa comata*) and Indian ricegrass (*Oryzopsis hymenoides*). Cheatgrass (*Bromus tectorum*) or bulbous bluegrass (*Poa bulbosa*) often dominates overgrazed or disturbed sites. In good condition, this habitat may have mosses growing under the trees.

Other Classifications and Key References—This habitat is also called juniper steppe woodland (Kuchler 1964) and western juniper, Utah juniper, and pinyon pine/juniper (Scott *et al*. 2002). Other references describing this habitat include Dealy 1971, Downing 1983, Johnson and Clausnitzer 1992, and Tisdale 1986.

Natural Disturbance Regime—Both mountain mahogany and western juniper are fire intolerant. Under natural high-frequency fire regimes, both species formed savannas or occurred as isolated patches on fire-resistant sites in shrub-steppe or steppe habitat. Western juniper is considered a topoedaphic climax tree in a number of sagebrush-grassland, shrub-steppe, and drier conifer sites. The species is an increaser in many earlier seral communities in these zones and invades without fires. Most trees taller than 13 ft (4 m) can survive low-intensity fires. The historic fire regime of mountain mahogany communities varies with community type and structure. The fire-return interval for mountain mahogany (along the Salmon River in Idaho) was 13 to 22 years until the early 1900s and has increased ever since. Mountain mahogany can live to 1,350 years in western and central Nevada. Some old growth mountain mahogany stands avoid fire by growing on extremely rocky sites.

Succession and Stand Dynamics—Juniper invades shrub-steppe and steppe habitats and reduces undergrowth productivity. Although slow seed dispersal delays recovery time, western juniper can regain dominance in 30 to 50 years following fire. A fire-return interval of 30 to 50 years typically arrests juniper invasion. The successional role of curl-leaf mountain mahogany varies with community type. Mountain brush communities where curl-leaf mountain mahogany is either dominant or codominant are generally stable and successional rates are slow.

Effects of Management and Anthropogenic Impacts—Over the past 150 years, with fire suppression, overgrazing, and changing climatic factors, western juniper has increased its range into adjacent shrub-steppe, grassland, and savanna habitats. Increased density of juniper and reduced fine fuels from an interaction of grazing and shading result in high-severity fires that eliminate woody plants and promote herbaceous cover, primarily annual grasses. Diverse mosses and lichens occur on the ground in this type if it has not been too disturbed by grazing. Excessive grazing will decrease bunchgrasses and increase exotic annual grasses, as well as various native and exotic forbs. Animals seeking shade under trees decrease or eliminate bunchgrasses and contribute to increasing cheatgrass cover.

Status and Trends—This habitat is dominated by fire-sensitive species, and therefore the range of western juniper and mountain mahogany has expanded because of an interaction of livestock grazing and fire suppression. Quigley and Arbelbide (1997) concluded that in the Inland Pacific Northwest, juniper/sagebrush, juniper woodland, and mountain mahogany cover types are now significantly greater in extent than they were before 1900. Although this habitat type covers more area, its condition is generally degraded because of increased exotic plants and decreased native bunchgrasses. One-third of Pacific Northwest juniper and mountain mahogany community types listed in the National Vegetation Classification are considered imperiled or critically imperiled (Anderson *et al.* 1998).

7 Whitebark Pine

Geographic Distribution—Whitebark pine is a picturesque tree of the subalpine forest and tree line. Its distribution is split into two broad sections. Western populations of whitebark pine extend from about 55 degrees N in western British Columbia, along the lower part of the Fraser River, south into Washington and along the Cascade Range, southward through the high mountains of Washington and Oregon into California. In northern California, whitebark pine is scattered in isolated populations, but farther south in the Sierra Nevada of central California, it is more continuous to its southern limit near Mount Whitney at about 37 degrees N (Hitchcock *et al.* 1969, Cronquist *et al*. 1972, Bailey 1975). Eastern populations occur from about 55 degrees N in central Alberta, Canada, and follow the northern Rocky Mountains southward into western Montana and central Idaho. Stands are extensive in northwestern Wyoming. Except for disjunct populations in northeastern Nevada (about 41 degrees N), the southern and eastern limits of whitebark pine are the Wind River Mountains of Wyoming (Hitchcock *et al.* 1969, Cronquist *et al*. 1972, Bailey 1975). Whitebark pine does not occur south of the Wyoming basin. The distribution of whitebark pine is strongly influenced by the Clark's nutcracker (*Nucifraga columbiana*), a bird that is important for seed dispersal and seedling establishment (Lanner 1980, Steele *et al*. 1983).

Physical Setting—Slow-growing and long-lived, the whitebark pine is typically more than 100 years old before it produces cones. Whitebark pine's growth form ranges from a krummholz mat to a moderately tall, upright tree, but the tree is often short and heavily branched, with multiple stems. Whitebark pine typically grows with other high-mountain conifers but can form nearly pure stands in relatively dry mountain ranges (Arno and Hoff 1989). Where associated trees are capable of forming closed stands, whitebark pine can be a long-lived, dominant, seral species if periodic disturbance, such as fire, removes its shade-tolerant competitors. On a broad range of dry, windy sites, however, whitebark pine is a climax tree because it is hardier and more durable than subalpine fir and other tree species (Arno and Hoff 1989). The sites where whitebark pine is seral tend to be moister and more productive than sites where the tree is climax (Arno 1986).

Landscape Setting—Whitebark pine grows on dry, rocky subalpine slopes and exposed ridges on high mountains between 5,900 and 9,950 ft (1,800 and 3,030 m). It is characteristic of tree line where it forms dense krummholz thickets. In Banff and Jasper National Parks at tree line (about 6,560 to 7,550 ft [2,000–2,300 m]), whitebark pines are dwarfed and isolated on dry, exposed sites. At the northern end of its range, the tree is a minor component of tree line. Whitebark pine is an important component of high-elevation forests in Idaho, Montana, and Wyoming between 5,900 and 10,500 ft (1,800 and 3,200 m). In high-elevation forests in the Cascade Range of southern Oregon and northern California between 8,000 and 9,500 ft (2,440 and 2,900 m), whitebark pine is a major component of tree line (Arno 1986, Arno and Hoff 1990). Whitebark pine occurs at elevations as low as 4,820 ft (1,470 m) in British Columbia and the Cascades of Washington. The lowest reported natural occurrence of whitebark pine is 3,600 ft (1,100 m) on Mt. Hood in Oregon. In the southern Sierra Nevada, it commonly occurs at elevations up to 11,500 ft (3,500 m) (Arno 1986).

Sites where whitebark pine occurs as a climax are drier than those where it is seral. Whitebark pine is important in areas where the mean annual precipitation is 24 to 70 inches (600–1,800 mm) (Arno and Hoff 1990). The climate is characterized by cool summers and cold winters with deep snowpack. Trees have high frost resistance and low shade tolerance. They occur predominately on acidic substrates, although they have also been reported on calcareous ones. Most soils under whitebark pine stands are Inceptisols. The growth of whitebark pine in Montana and Wyoming is reported as good on sandy-loam and loam, fair on gravels and clay loams, and poor on clay (Forcella and Weaver 1977, Steele *et al*. 1983, Eggers 1986, Arno and Hoff 1990).

The whitebark pine habitat lies above the mixed montane conifer forest or lodgepole pine forest habitats and below the alpine grassland and shrubland habitats. Associated wetlands in subalpine parklands extend upward a short distance into the alpine zone. Primary land use is recreation, watershed protection, and grazing.

Structure—Whitebark pine habitat has a tree layer with typically between 10 and 30% canopy cover. Openings among trees are highly variable. The habitat appears either as parkland, that is, a mosaic of treeless openings and small patches of trees, often with closed canopies, or as woodlands or savanna-like stands of scattered trees. The ground layer can be composed of 1) low to matted dwarf-shrubs 1 ft (0.3 m) tall that are evergreen or deciduous and often small-leaved; 2) sod grasses, bunchgrasses, or sedges; 3) forbs; or 4) moss- or lichen-covered soils. Herb- or shrub-dominated wetlands appear within the parkland areas and are considered part of this habitat; wetlands can occur as deciduous shrub thickets up to 6.5 ft (2 m) tall, scattered tall shrubs, dwarf shrub thickets, or herbaceous plants shorter than 1.6 ft (0.5 m). In general, eastern Cascade Range and Rocky Mountain areas are parklands and woodlands typically dominated by grasses or sedges, with fewer heathers.

Composition—In western North America, whitebark pine is a dominant or codominant species in many high-elevation forests. In the Rocky Mountains, eastern Cascade Range, and Blue Mountains, it is a minor component in mixed stands of Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*). It is found with mountain hemlock (*Tsuga mertensiana*) in the Cascade and British Columbia Coast ranges. In the upper subalpine forests of California, it is associated with subalpine fir, lodgepole pine (*Pinus contorta*), western white pine (*P. monticola*), foxtail pine (*P. balfouriana*), and limber pine (*P. flexilis*) (Arno 1980, Arno and Hoff 1990).

Drier areas are more woodland or savanna-like, often with low shrubs such as common juniper (*Juniperus communis*), kinnikinnick (*Arctostaphylos uva-ursi*), low whortleberries or grouseberries (*Vaccinium myrtillus* or *V. scoparium*), or common beargrass dominating the undergrowth. Wetland shrubs in the subalpine parkland habitat include bog-laurel (*Kalmia microphylla*), Booth's willow (*Salix boothii*), undergreen willow (*S. commutata*), Sierran willow (*S. eastwoodiae*), and blueberries (*Vaccinium uliginosum* or *V. deliciosum*).

Undergrowth in drier areas may be dominated by pinegrass (*Calamagrostis rubescens*), Geyer's sedge (*Carex geyeri*), Ross' sedge (*C. rossii*), smooth woodrush (*Luzula glabrata* var. *hitchcockii*), Drummond's rush (*Juncus drummondii*), or short fescues (*Festuca viridula*, *F. brachyphylla*, *F. saximontana*).

The remaining flora of this habitat is diverse and complex. The following herbaceous broadleaf plants are important indicators of differences in the habitat: American bistort (*Polygonum bistortoides*), American false hellebore (*Veratrum viride*), fringe leaf cinquefoil (*Potentilla flabellifolia*), marsh marigolds (*Caltha leptosepala*), avalanche lily (*Erythronium montanum*), partridgefoot (*Luetkea pectinata*), Sitka valerian (*Valeriana sitchensis*), subalpine lupine (*Lupinus arcticus* ssp. *subalpinus*), and alpine aster (*Aster alpigenus*). Showy sedge (*Carex spectabilis*) is also locally abundant (Cronquist *et al*. 1972, Dittberner and Olson 1983, Arno 1986).

Other Classifications and Key References—Quigley and Arbelbide (1997) called this habitat whitebark pine and whitebark pine-subalpine larch cover types. Kuchler (1964) included this habitat within the subalpine fir-mountain hemlock forest. Scott *et al*. (2002) classified the habitat as subalpine pine, subalpine fir/whitebark pine, and mixed whitebark pine forests (Arno 1979, Kuramoto and Bliss 1970, Douglas and Bliss 1977, Lillybridge *et al*. 1995).

Natural Disturbance Regime—Although fire is rare to infrequent in this habitat, it plays an important role, particularly in drier environments. Before 1900, whitebark pine woodland fire intervals varied from 50 to 300 years. Wind blasting by ice and snow crystals is a critical factor in these woodlands and establishes the higher limits of the habitat. Periodic shifts in climatic factors, such as drought, snowpack depth, or snow duration, either allow tree invasions into meadows and shrublands or eliminate or retard tree growth.

Succession and Stand Dynamics—In upper-elevation subalpine forests, whitebark pine is generally seral and competes with and is replaced by more shade-tolerant trees. Subalpine fir, a very shade-tolerant species, is the most abundant associate and most serious competitor of whitebark pine. Although whitebark pine is more shade tolerant than lodgepole pine and subalpine larch (*Larix lyallii*), it is less shade tolerant than Engelmann spruce and mountain hemlock (*Tsuga mertensiana*). Whitebark pine is the potential climax species on high, exposed tree-line sites and exceptionally dry sites (Arno 1986, Eggers 1986, Tomback 1986, Arno and Hoff 1990). It sometimes acts as a pioneer species in the invasion of meadows and burned areas (Forcella and Weaver 1977, Fischer and Bruce 1983). On dry, wind-exposed sites, the regeneration of whitebark pine may require several decades, even though it is often the first tree to become established (Weaver and Dale 1974, Fischer and Clayton 1983, Arno and Hoff 1990). The fact that the Clark's nutcracker disperses seed allows whitebark pine to be more widespread as a seral species. The bird's dispersal of seeds throughout subalpine habitats is partly responsible for the status of whitebark pine as a pioneer and post-fire invader (Steele *et al*. 1983).

Effects of Management and Anthropogenic Impacts—Fire suppression has contributed to change in habitat structure and functions. For example, the current "average" whitebark pine stand will burn every 3,000 years or longer because of fire suppression. Blister rust, an introduced pathogen, is increasing whitebark pine mortality in these woodlands (Ahlenslager 1987). Even limited logging can have prolonged effects because of slow invasion rates of trees. This is particularly important on drier sites and in subalpine larch stands. During wet cycles, fire suppression can lead to tree islands coalescing and parklands converting to a more closed forest habitat. Parkland conditions can displace alpine conditions through tree invasions. Livestock use and heavy horse or foot traffic can trample and compact soil. Slow growth in this habitat prevents rapid recovery.

Status and Trends—Whitebark pine might be declining because of the effects of blister rust or fire suppression leading to conversion of parklands to more closed forest. Global climate warming will likely have an amplified effect throughout this habitat. Less than 10% of Pacific Northwest subalpine parkland community types listed in the National Vegetation Classification are considered imperiled (Anderson *et al*. 1998).

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APPENDIX 2-20—TERRESTRIAL FOCAL SPECIES DESCRIPTIONS

1 Riparian/Herbaceous Wetlands

1.1 Willow (*Salix* spp.)

Four species of willow are commonly found in the Salmon subbasin but occupy different elevations. One species occupies the lower elevations: peachleaf willow (*Salix amygdaloides*). Three species occupy the higher elevations: Geyer's willow (*S. geyeriana*), Booth's willow (*S. boothii*), and Drummond's willow (*S. drummondiana*). Overall, the ecological role of the willows is to provide cover, food, bank stability, shading, nutrient cycling, filtering, and nesting substrate. Both the ecosystem and the wildlife utilizing the shrub layer depend on the health of the willows.

1.1.1 Peachleaf Willow (*Salix amygdaloides*)

Peachleaf willow is a rapidly growing, short-lived, small to medium-sized deciduous tree with one to several trunks that are typically from 6 to 12 m (20-39 ft) high (Van Dersal 1938, Weaver 1960, Hitchcock and Cronquist 1964, Dorn 1977) but that occasionally reach 20 to 24 m (66-79 ft) (Stephens 1973). Trunk diameters are typically 20 to 50 cm (8-20 inches) (Weaver 1960). The bark is thick, yellowish brown to dark brown, irregular, and fissured and has broad flat ridges (Stephens 1973). The leaves are alternate, simple, pinnately veined, and lanceolate to ovate-lanceolate, with finely serrated margins that have six to seven teeth per centimeter (Hitchcock and Cronquist 1964, Stephens 1973, Dorn 1977). Leaves are 2.5 to 10 cm (1-4 inches) long and 1 to 3 cm (0.4-1.2 inches) wide (Hitchcock and Cronquist 1964, Rowe and Scotter 1973). Male and female flowers occur on separate trees as catkins. Pistillate catkins are 3 to 8 cm (1.2-3.1 inches) long, and staminate catkins are 3 to 5 cm (1.2-2.0 inches) long (GPFA 1986).

Peachleaf willow is found along streambanks and riverbanks, pond and lake borders, moist ravines and ditches, oxbows, roadside gullies, and prairie sloughs (Stephens 1973, Dorn 1977, GPFA 1986, Hansen *et al.* 1988). It is shade intolerant and requires canopy openings to survive (Van Dersal 1938, Weaver 1960). It is tolerant of poor drainage and prolonged flooding (Hansen *et al.* 1988), but extended immersion in water for a year or longer will cause most plants to die (Green 1947).

Peachleaf willow regenerates primarily through the dispersal of thousands of small seeds. It is unable to produce suckers from lateral roots but will resprout from its root crown or stem base following fire or cutting (Argus 1973, Hansen *et al.* 1988). Peachleaf willow relies heavily on insect pollination, especially from bees (Mozingo 1987).

Willows (*Salix* spp.) in general are a preferred food of moose and beaver; peachleaf willow occurs in riparian and floodplain habitats, which these animals frequent (Van Dersal 1938, Boyd *et al*. 1986). Overuse by livestock can decrease vigor and eventually kill individuals; however, degraded stands recover rapidly after they are fenced to exclude livestock (Rickard and Cushing 1982). Because of its soil-binding properties, peachleaf willow helps stabilize streambanks and protect them from erosion; stands should therefore be maintained (Uchytil 1989).

All willows produce salicin, which chemically is closely related to acetylsalicylic acid, commonly known as aspirin. Native Americans used various preparations from willows to treat toothache, stomachache, diarrhea, dysentery, and dandruff (Mozingo

1987). Native Americans also used the stems for basketry and bow making and used the bark for tea and fabric making (Lanner 1983).

Most fires kill only aboveground plant parts (Uchytil 1989). However, severe fires can completely remove soil organic layers, leaving willow roots exposed and charred and thus eliminating basal sprouting (Rowe and Scotter 1973, Zasada 1986). Generally, peachleaf willow will resprout from its roots following fire (Hansen *et al.* 1988). Peachleaf willow is a prolific seeder, and off-site plants are important seed sources for revegetating burned areas (Zasada 1986).

1.1.2 Geyer's Willow (*Salix geyeriana*)

Geyer's willow is found in scattered mountain ranges in southern Idaho (Little 1979). Larger than many associated shrub willows, Geyer's willow grows as a large deciduous shrub or small tree, sometimes up to 6 m (20 ft) tall. It is usually found in somewhat open stands, occurring as well-spaced individuals with numerous, straight, nearly erect stems arising from a tight basal cluster (Brunsfeld and Johnson 1985). It produces an abundance of small, lightweight seeds. Male and female flowers occur on separate plants in erect catkins (Brunsfeld and Johnson 1985). The fruit is a two-valved capsule.

Geyer's willow sprouts from the root crown or stem base if aboveground stems are broken or destroyed by cutting, flooding, or fire (Haeussler and Coates 1986). Detached stem fragments form adventitious roots if they remain moist. Thus, portions of stems will root if buried in moist soil. Rooting can occur when stem fragments are transported by floodwaters and deposited on fresh alluvium (Haeussler and Coates 1986).

The Geyer's willow is found in mountains at moderately low to upper elevations, from 1,219 to 2,438 m (4,000-8,000 ft), in east-central Idaho (Brunsfeld and Johnson 1985). Geyer's willow grows in wet meadows and marshes, next to seeps and springs, and along the borders of low-gradient streams and beaver ponds (Uchytil 1991a). It is often somewhat removed from a stream's edge, occurring in broad, low-gradient valley bottoms. It is also frequently associated with abandoned and sediment-filled beaver ponds (Youngblood *et al.* 1985a). Geyer's willow will not grow and reproduce in shade. Riparian sites where Geyer's willow grows usually occur in broad montane and subalpine valleys. Adjacent uplands are dominated by Engelmann spruce (*Picea engelmannii*), blue spruce (*P. pungens*), subalpine fir (*Abies lasiocarpa*), lodgepole pine (*Pinus contorta*), ponderosa pine (*P. ponderosa*), Douglas-fir (*Pseudotsuga menziesii*), aspen (*Populus tremuloides*), or big sagebrush (*Artemisia tridentata*) (Youngblood *et al.* 1985a, Hansen *et al*. 1989).

Elk and moose eat Geyer's willow, especially in winter. Over a three-year period near Jackson Hole, Wyoming, the amount of Geyer's willow leaders removed by moose browsing was 39, 47, and 25%, respectively (Houston 1968). Willows, in general, are a preferred food and building material of beaver (Allen 1983). Willow shoots, catkins, buds, and leaves are eaten by ducks and grouse, other birds, and small mammals (Haeussler and Coates 1986).

Many Geyer's willow communities have a long history of being overgrazed, a situation that has resulted in native grasses and sedges being replaced with bluegrasses (Kovalchik 1987). Overuse also results in soil compaction, streambank sloughing, and damage to willows and other vegetation (Hansen *et al*. 1989). Prolonged overbrowsing of Geyer's willow results in poor vigor and decadence, indicated by uneven stem age distribution, a hedged or clubbed appearance, and dead plants (Kovalchik 1987). Decadent plants will recover from overbrowsing with five to six years of rest from being browsed (Kovalchik 1987).

Top-killed Geyer's willow plants sprout following fire (Uchytil 1991a). Quick, hot fires generally result in numerous sprouts per plant. Slow-burning fires result in fewer sprouts because these fires often burn down into the roots, reducing the willow's sprouting ability (Boggs *et al.* 1990). There is no specific documentation of Geyer's willow seedling establishment following fire. However, seedling establishment by other willows has been observed following fire on moist, mineral soils (Viereck 1982). Geyer's willow seeds are dispersed in summer, remain viable for only about one week, and require moist mineral soil for germination (Uchytil 1991a). Therefore, the degree of seedling establishment following fire depends on the season of burn, the weather, and the amount of mineral soil exposed (Viereck and Schandelmeier 1980).

1.1.3 Booth's Willow (*Salix boothii*)

Booth's willow is a native, multibranched, rounded shrub that is typically between 3 and 6 m (10-20 ft) tall (Brunsfeld and Johnson 1985, Youngblood *et al*. 1985b). Booth's willow is dioecious. On well-drained soils, this willow is broadly rounded and has many stems, but in bogs, it is dwarfed and has few stems (Kovalchik 1992). At 10 years of age, Booth's willow reaches a height of approximately 2.5 m (8 ft). Stems reach senescence between the ages of 15 and 20 years (Kovalchik 1992). Male and female flowers occur on separate plants in 1.0- to 1.5-cm-long (0.4-0.6 inches), erect catkins (Hansen *et al*. 1988).

Booth's willow sprouts readily from the root crown or basal stem. It will sprout vigorously following cutting regardless of cutting season (Haeussler *et al*. 1990). Booth's willow is highly tolerant of frost and flooding (Esser 1992). One adaptation under these conditions is the formation of a soft, spongy tissue called aerenchyma. This tissue enlarges the lenticels in the stems and permits more efficient gas exchange and regeneration of roots. Growth is severely limited when water levels are maintained at or above the root crown. Adventitious rooting will occur above flooded soil (Kovalchik 1992).

High moisture requirements limit Booth's willow to riparian and lacustrine areas and to bottomlands with a high water table, such as wet meadows, fens, bogs, and swamps (Brunsfeld and Johnson 1985). Booth's willow is best represented in riparian communities within the Douglas-fir (*Pseudotsuga menziesii*) zone and sagebrush-grass valley habitats. It is also found in Engelmann spruce-dominated stream bottoms in the upper Douglas-fir zone (Brunsfeld and Johnson 1985, Youngblood *et al*. 1985b). Booth's willow is a transitional species between low-middle and middle elevations and between middle and middle-high elevations (Brunsfeld and Johnson 1985). In Idaho, the elevational range for Booth's willow is between 2,255 and 2,685 m (4,000-8,800 ft). It can be found intermittently in the lower subalpine zone (Young 1980, Manning and Padgett 1989). Booth's willow is shade intolerant and grows best in full sunlight (Brunsfeld and Johnson 1985, Haeussler *et al*. 1990).

Booth's willow is found in early to mid seral plant communities (Esser 1992). It is a pioneer species on recent alluvial deposits and on recently disturbed sites (Youngblood *et al*. 1985b). The successional trend on former beaver ponds or stream channels is from open water to beaked sedge or water sedge communities to eventual codominance by Booth's willow and other willow species. If the stand dries out, Booth's willow will be replaced by species better adapted to more xeric conditions (Hansen *et al*. 1988). Booth's willow has low shade tolerance and, therefore, loses dominance on sites that are heavily forested or succeeded by more shade-tolerant species (Haeussler *et al*. 1990).

Booth's willow is an important source of browse for deer, elk, moose, and small mammals (Young 1980, Brunsfeld and Johnson 1985). Moose utilize Booth's willow stands extensively in Wyoming, Montana, and Idaho (Young 1980, Youngblood *et al*. 1985b). Many avian species nest and feed in Booth's willow stands (Young 1980, Youngblood *et al*. 1985b).

Booth's willow is a fire-tolerant shrub (Esser 1992). It sprouts readily from the root and root crown following top-kill by fire, especially in wetter stands (Lutz 1956, Hansen *et al*. 1989). It produces numerous, minute seeds that are dispersed by wind and important in colonizing recently burned areas (Haeussler *et al*. 1990). Slow-moving fires are more damaging to the roots and root crown of Booth's willow than quick, hot fires are; therefore, the latter result in more sprouts (Hansen *et al*. 1989).

Booth's willow is useful in stabilizing streambanks and providing erosion control on severely disturbed sites (Brunsfeld and Johnson 1985, Manning and Padgett 1989, Haeussler *et al*. 1990). Overgrazing by livestock can threaten riparian ecosystems unless management practices favor their protection (Manning and Padgett 1989). Livestock may churn soil surfaces when moist, resulting in soil compaction, streambank sloughing, and damage to vegetation (Hansen *et al*. 1989). However, Booth's willow is valuable in revegetating disturbed riparian sites with high water tables and at low elevations (Manning and Padgett 1989). Booth's willow is capable of colonizing a wide range of riparian sites such as rocky or gravelly sites near the water table to drier benches with deep fine-textured soils (Brunsfeld and Johnson 1985). Planting willow stem cuttings has been recognized as a valuable tool for restoring riparian habitats (McCluskey *et al*. 1983). The use of willow in rehabilitation should be emphasized (Hansen *et al*. 1989).

1.1.4 Drummond's Willow (*Salix drummondiana*)

Drummond's willow is a deciduous shrub that is generally between 2 and 4 m (6-13 ft) tall but that occasionally reaches 6 m (20 ft) (Dorn 1977, Brunsfeld and Johnson 1985). Male and female flowers occur on separate plants in erect, nearly sessile catkins (Brunsfeld and Johnson 1985). The fruit is a two-valved capsule. This willow's primary mode of reproduction is sexual. It produces an abundance of small, lightweight seeds. Drummond's willow sprouts from the root crown or stem base if aboveground stems are broken or destroyed by cutting, flooding, or fire (Haeussler and Coates 1986). Detached stem fragments will root if they are buried in moist soil (Haeussler and Coates 1986).

Drummond's willow occurs along the borders of streams, rivers, beaver ponds, and lakes and in wet meadows and marshes (Brunsfeld and Johnson 1985, Boggs *et al*. 1990). It grows at moderate elevations from lower forested and unforested foothills to subalpine habitats. It is generally most abundant in subalpine fir (*Abies lasiocarpa*)-Engelmann spruce (*Picea engelmannii*) habitat types (Brunsfeld and Johnson 1985, Boggs *et al*. 1990). In these cool habitats, it is not restricted to steamsides but occupies moist, well-aerated soils of meadows, broad valley bottoms, side-slope seeps, and stream and pond margins (Brunsfeld and Johnson 1985, Boggs *et al*. 1990). At lower elevations, it is uncommon and usually confined to the edges of streams in sagebrush (*Artemisia* spp.), Douglas-fir (*Pseudotsuga menziesii*), or ponderosa pine (*Pinus ponderosa*) vegetation zones (Brunsfeld and Johnson 1985, Boggs *et al*. 1990). Drummond's willow frequently mixes with the ecologically similar Booth's willow (*S. boothii*).

Moose consume large amounts of Drummond's willow during winter, but use by other ungulates is generally moderate to light (Uchytil 1991b). Willows are a preferred food and building material of beaver (Allen 1983). Willow shoots, catkins, buds, and leaves are eaten by ducks and grouse, other birds, and small mammals (Haeussler and Coates 1986). Drummond's willow often forms 2- to 4-m (6-13 ft) tall thickets that provide good cover for a variety of wildlife species, especially moose, and excellent nesting and foraging habitat for ducks, shorebirds, vireos, warblers, and sparrows (Douglas and Ratti 1984). Dense, overhanging branches provide shade for salmonids (Argus 1957, Hansen *et al*. 1988).

Drummond's willow provides important streambank protection by effectively stabilizing soils and is recommended for use in revegetating disturbed riparian areas (Uchytil 1991b). It is especially useful for streambank stabilization. The willow is usually planted as rooted or unrooted stem cuttings (Platts *et al*. 1987).

Drummond's willow sprouts from the root crown following top-kill by fire (Kovalchik *et al*. 1988, Boggs *et al*. 1990). However, its abundant wind-dispersed seed may be important in colonizing burned areas. Drummond's willow seeds are dispersed in summer, remain viable for only about one week, and require moist mineral soil for germination. Therefore, the degree of seedling establishment following fire depends on the season of burn, the weather, and the amount of mineral soil exposed (Viereck and Schandelmeier 1980).

Drummond's willow tends to form relatively stable, long-lived seral communities that are maintained by seasonal flooding or high water tables (Uchytil 1991b). However, these sites experience successional shifts if water tables change. If sites become wetter, sedges may replace Drummond's willow; if they become drier, upland shrubs or conifers may replace this willow (Youngblood *et al*. 1985b).

1.2 Black Cottonwood (*Populus balsamifera* ssp. *trichocarpa*)

Black cottonwood typically has a straight, branch-free trunk for more than half its length and a broad, open crown (Arno and Hammerly 1977). In closed stands, the crown tends to be narrow, with few branches growing into the lower trunk. Black cottonwood is a fast-growing, native deciduous tree, growing to 30 m (98 ft) high, though occasionally to 50 m (164 ft) (Zasada *et al*. 1978). Basal diameter is commonly between 1 and 1.5 m (3-5 ft) (Zasada *et al*. 1978). The flowers grow in catkins bearing seeds that are long and white, with cotton-like fibers that aid in dispersal via wind and/or water. Black cottonwood commonly lives 100 to 200 (or occasionally more) years (Braatne *et al*.1996).

In eastern and southern Idaho, black cottonwood-redosier dogwood (*Cornus sericea*) is a common community type; it develops best along large rivers but is also present in narrow bands along small streams in the subalpine zone (Hall and Hansen 1997). Subdominant members of the overstory include narrowleaf cottonwood (*Populus angustifolia*), lanceleaf cottonwood (*P. acuminata*), and peachleaf willow (*Salix amygdaloides*). Common shrub associates include sandbar willow (*Salix exigua*), water birch (*Betula occidentalis*), yellow willow (*Salix lutea*), and Woods' rose (*Rosa woodsii*) (Hall and Hansen 1997). Establishment by seed is episodic, often creating stands of several well-defined age groups (Malanson and Butler 1991).

Black cottonwood is a pioneer and early seral species (Hall and Hansen 1997). It and other members of the *Populus* genus are some of the fastest-growing temperate trees, an adaptation useful for pioneering disturbed sites (Eckenwalder 1996). Any activity that exposes moist, mineral soil in full sunlight creates a favorable habitat for black cottonwood seedlings, particularly when seed trees are nearby (Hall and Hansen 1997). Black cottonwood is very shade intolerant (Agee 1988). The species can tolerate flooding and sediment deposition; when young stems are covered by sediment during floods, sprouts grow from the stem toward the current (Agee 1988).

In black cottonwood habitat types of southern and eastern Idaho, black cottonwood establishes on recent gravel bars and remains dominant if there is continual flooding and sediment deposition (Tesky 1992). Without this disturbance, the community is gradually replaced by Douglas-fir, Engelmann spruce, subalpine fir, or Rocky Mountain juniper (*Juniperus scopulorum*), but occasionally yellow willow or Geyer's willow (*Salix geyeriana*) becomes dominant (Hall and Hansen 1997).

Black cottonwood is frequently damaged by fire, with even low-severity burns often causing considerable injury (Agee 1991). Young black cottonwood trees and seedlings are usually killed by fire regardless of severity (Brown 1996). Severe fire kills or top-kills even older trees (Tesky 1992). In low- and moderate-severity fires, older trees with thick bark may not be top-killed (Hall and Hansen 1997). In members of the *Populus* genus, stem bark remains thin for longer than in other trees (Eckenwalder 1996). Though old trees have increased fire resistance due to thicker, furrowed bark, they have higher fuel loading and more heartrot, both of which can increase fire severity (Gom and Rood 1999). Fire can improve seedling establishment by both exposing mineral soil and increasing light penetration so that seedlings can germinate and grow if moisture is available (Agee 1991, Brown 1996). Fire is infrequent on recently formed gravel bars, but when it does occur, damage to cottonwoods is greatest because their root systems have not developed (Hall and Hansen 1997).

1.3 Columbia Spotted Frog (*Rana luteiventris*)

The Columbia spotted frog occurs in four genetically distinguishable populations in northwestern North America (Green *et al*. 1996, 1997). These disjunct populations are highly fragmented, occurring on isolated mountains and in arid-land springs. Two of these genetically distinguishable populations occur in Idaho: a main population north of the Snake River in central Idaho and portions of the Great Basin population in the Owyhee Mountains of southwestern Idaho. While the main population of spotted frogs appears to be widespread and abundant (Clark *et al*. 1993, Gomez 1994), the Great Basin population appears to be suffering from local extinctions and declines.

The Columbia spotted frog is a medium-sized frog, reaching lengths of up to 9 cm (3.5 inches). Its dorsal ground color ranges from olive green to brown and is marked by spots having irregular borders and light-colored centers. Pigmentation on the frog's abdomen varies from yellow to red, and a light-colored stripe runs along the upper lip. As a tadpole, the spotted frog is generally brownish-green dorsally, with gold flecks. Ventrally, these tadpoles have a silvery color, and their intestines are visible.

Rangewide, spotted frogs use a variety of habitat types, including coldwater ponds, streams, lakes, and springs adjacent to mixed coniferous and subalpine forest, grassland, and brush land (Morris and Tanner 1969, Stebbins 1985). Spotted frogs are generally found in or near permanent bodies of water. Habitat usually consists of a small spring, pond, or slough with a variety of herbaceous emergent, floating, and submergent vegetation. During summer, these frogs can be found some distance from their aquatic breeding sites but are still associated with moist vegetation (Gomez 1994, Bull and Hayes 2001). Engle and Munger (2000) studied spotted frog movements in the Owyhee Mountains in Idaho and reported that, while five adults moved distances greater than 1,000 m (3,281ft), most movements were under 500 m (1,640 ft). Morris and Tanner (1969) suggest that deep silt or muck bottoms are required for winter hibernation and torpor.

Columbia spotted frog populations begin breeding in early March and continue through late April. Breeding usually begins with a male vocalizing, stimulating the other males to call simultaneously. The vocalization is described as a "clicking" noise or a soft "bubbling" sound (Morris and Tanner 1969, Stebbins 1985). Egg masses are deposited in open, shallow areas near the shoreline. It has been reported that the frogs deposit eggs in the same area annually (Morris and Tanner 1969, Nussbaum *et al*. 1983). The egg masses are not attached to vegetation and float freely in the water (Ross *et al*. 1993, 1994). Depending on water temperature, the eggs will hatch tadpoles in 10 to 21 days. The Columbia spotted frog remains in the tadpole stage for two to three months before undergoing metamorphosis into an adult frog. Preliminary skeletochronological work indicates that Columbia spotted frogs can live at least 9 years in southwestern Idaho (Engle and Munger 1998).

The spotted frog is an opportunistic forager that eats a wide variety of insects as well as different mollusks, crustaceans, and arachnids (Miller 1978, Whitaker *et al*. 1982, Licht 1986). Larvae eat algae, organic debris, plant tissue, and minute water-borne organisms.

Nonindigenous bullfrogs and fish are probably a primary cause of declining populations of spotted frogs (Storm 1966, Nussbaum *et al*. 1983, McAllister *et al*. 1993). Introduced fishes, particularly warmwater species such as largemouth bass (*Micropterus salmoides*), sunfish (*Lepomis* spp.), bullhead and catfish (*Ictalurus* spp.), and perch (*Perca* spp.) prey on both spotted frog tadpoles and adults (Hayes and Jennings 1986). In addition, residential developments have altered or eliminated wetlands and introduced a wide array of contaminants to many aquatic systems. Habitat loss and alteration have also resulted in increased isolation of remaining spotted frog populations and habitats.

1.4 Willow Flycatcher (*Empidonax traillii adastus*)

The willow flycatcher is a common migratory bird that breeds in a variety of riparian habitats. Willow flycatchers overwinter in southern Mexico and northern South America in habitats similar to those occupied on the breeding grounds. There are five subspecies of E. *traillii*, but only *E. traillii adastus* is found in the Salmon subbasin.

A small bird, the willow flycatcher is between 13 and 17 cm (5-7 ft) long (Godfrey 1986) and weighs, on average, 16 g (0.6 ounces) (Dunning 1984). The bird has a grayish-green back and wings, whitish throat, light gray-olive breast, and pale yellowish belly. It has a distinctive eye ring and white wing bars. The bill is dull yellow-orange or pinkish on the lower mandible and blackish on the maxilla. The sexes are similar in appearance, except during the breeding season when females develop a brood patch.

The willow flycatcher breeds between early May and late July. The female selects a nesting site and builds the nest while the male perches nearby (Gorski 1969). Generally, the nest is built low in the crotch of a bush or small tree near water (Hoffmann 1927). Female willow flycatchers lay between three and four eggs, occasionally five (Holcomb 1974). Eggs are incubated for about 14 days (McCabe 1991), and the female generally performs all incubation duties (McCabe 1963, 1991). Both adults feed the young, but the female plays a major role (Holcomb 1972, McCabe 1991). The chicks fledge at about 14 to 15 days from hatch. The first few days after fledging, fledglings often huddle together on the same perch and remain near the nest for 3 or 4 days; they then follow the adults until 24 to 25 days old (Walkinshaw 1966). Willow flycatchers begin breeding their first year and may live for up to 11 years (Sedgwick 2000).

Predators of the willow flycatcher include the Cooper's hawk (*Accipiter cooperii*), great horned owl (*Bubo virginianus*), red squirrel (*Tamiasciurus hudsonicus*), striped skunk (*Mephitis mephitis*), and fox (*Vulpes* spp.). Most nest predation is believed to be mammalian, including the long-tailed weasel (*Mustela frenata*), the mink (*M. vison*), and voles (*Microtus* spp.) (Paxton *et al*. 1997, Stoleson and Finch 1999). Mule deer may trample some nests, or, when grazing in riparian vegetation, cattle may knock over nests (King 1955, Valentine *et al*. 1988).

Because the willow flycatcher is restricted to streams and river corridors, it is vulnerable to human activities that may alter or change such habitats, including river dewatering, canalization, overgrazing, dam construction, and urbanization. Willow flycatchers will not even attempt nesting in the absence of water (Johnson *et al*. 1999).

1.5 Northern River Otter (*Lutra canadensis*)

In Idaho, the river otter is a protected nongame species that is found on stream boarders and in lakes, swamps, marshes, and beaver flowages. The inclusion of the taxa Lutrinae in the 1977 Appendix II of the Convention on International Trade in Endangered Species requires that the river otter be managed to ensure that stable or increasing populations persist. States must provide the U.S. Endangered Species

Scientific Authority with information that justifies current river otter management.

River otters breed in late winter or early spring; the breeding season is spread over a period of three months or longer (Banfield 1974, Chapman and Feldhamer 1982). In Idaho, breeding begins in late April. Implantation is delayed 10 to 11 months, and gestation lasts 11 months. The extreme length of gestation is due to a process called delayed implantation, in which development of the blastocyst is arrested for a period of time before it implants into the uterine wall (Tesky 1993a). Litters are generally born from March through May and range in size from one to six pups, with two to four young being most common (Chapman and Feldhamer 1982). The otter pups are born helpless. They begin to open their eyes by age 21 to 35 days; by 25 to 42 days, pups begin playing. They are introduced to water by age 48 days and may venture out of the den on their own by age 59 to 70 days. Weaning occurs at about 91 days (Chapman and Feldhamer 1982).

Female river otters normally become sexually mature when they are about 2 years old but may or may not breed at that time and may not breed every year (Melquist and Hornocker 1983). Although male river otters also become sexually mature at about 2 years old, they may not become successful breeders until they reach 5 to 7 years (Chapman and Feldhamer 1982). River otters have lived at least 16 years in captivity (Banfield 1974).

River otters are primarily nocturnal but may be active in the early morning and late afternoon in remote areas (Tesky 1993a). They are active all winter, except during the most severe periods, when they take shelter for a few days (Banfield 1974).

Melquist and Hornocker (1983) found that in west-central Idaho, river otters prefer valley habitats to mountain habitats and stream-associated habitats to lake, reservoir, and pond habitats. Mountain lakes and streams were used most often during fall. Most river otters lived entirely in the valleys, and no otters lived solely in the mountains. Use of lakes, reservoirs, and ponds was greatest during winter. Mudflats and associated open marshes, swamps, and backwater sloughs were used most often in summer (Melquist and Hornocker 1983).

River otter habitat is generally limited to open water during the winter months (Tesky 1993a). Outflows from lakes are favored habitat at this time. In late winter, water levels usually drop below ice levels in rivers and lakes, leaving a layer of air that allows river otters to travel and hunt under the ice (Spowart and Samson 1986).

River otters inhabit a variety of riparian plant communities, which are often dominated by willows (*Salix* spp.), cottonwoods (*Populus* spp.), birches (*Betula* spp.), and spruce (*Picea* spp.). Other vegetation common in river otter habitats includes cattails (*Typha* spp.), redosier dogwood (*Cornus sericea*), black hawthorn (*Crataegus douglasii*), common snowberry (*Symphoricarpos albus*), grasses, horsetails (*Equisetum* spp.), bulrushes

(*Scirpus* spp.), and sedges (*Carex* spp.) (Dronkert-Egnew 1991).

River otter habitat must provide adequate escape cover, rest sites, and den sites (Tesky 1993a). Rather than excavate their own dens, river otters use dens dug by other animals or natural shelters. They commonly use hollow trunks of large trees, beaver (*Castor canadensis*) or nutria (*Myocastor coypus*) dens, hollow logs, logjams, drift piles, jumbles of loose rocks, abandoned or unused boathouses, and duck blinds (Chapman and Feldhamer 1982). Occasionally, river otters occupy large, bulky, open nests of grasses in marshes or riverbank thickets (Banfield 1974). Understory bank cover is also important to river otters. Stream habitats generally provide more adequate escape cover and shelter and less disturbance from people than pond, lake, and reservoir habitats do (Spowart and Samson 1986).

The typical diet of river otters consists primarily of fish but also includes amphibians, insects, birds, mammals, and plants (Chapman and Feldhamer 1982). Fishes often eaten by river otters include suckers (*Catostomus* spp.), redhorses (*Moxostoma* spp.), carp (*Cyprinus* spp.), chubs (*Semotilus* spp.), daces (*Phinichthys* spp.), shiners (*Notropis* spp.), squawfish (*Ptychocheilus* spp.), bullheads and catfish (*Ictalurus* spp.), sunfish (*Lepomis* spp.), darters (*Etheostoma* spp.), and perch (*Perca* spp.). Waterfowl, freshwater mussels (*Anodonta californiensia*), periwinkles (*Oxytrema silicula*), and unidentified snails have been reported in the river otter's diet but are not important food items (Chapman and Feldhamer 1982). River otters may kill young beavers found alone in a lodge (Banfield 1974).

River otters have often been blamed for serious depredation of game fish, particularly trout (Tesky 1993a). Food habit studies, however, have all indicated that the bulk of the river otter diet consists of nongame fish species (Tesky 1993a). In many circumstances, river otters are beneficial to game fish populations because they remove nongame fish that would otherwise compete with game fish for food (Chapman and Feldhamer 1982). River otters, however, may occasionally cause severe depredation in fish hatcheries (Banfield 1974, Chapman and Feldhamer 1982).

River otters have been extirpated or reduced in many areas due to human encroachment, habitat destruction, and overharvest (Finch 1992). The most readily apparent human impact on river otters results from trappers harvesting otters for their fur. The river otter has been an economically important furbearing species since Europeans first arrived in North America (Chapman and Feldhamer 1982). Habitat destruction has also resulted in a decline in river otter populations. Some causes of river otter habitat destruction include the development of waterways for economic or recreational purposes, destruction of riparian habitat for home sites or farmland, and a decline in water quality because of increased siltation and/or pesticide residues in runoff (Chapman and Feldhamer 1982, Dronkert-Egnew 1991). Pesticide residues including mercury, DDT and its metabolites, and Mirex have been reported in river otter tissues (Chapman and Feldhamer 1982).

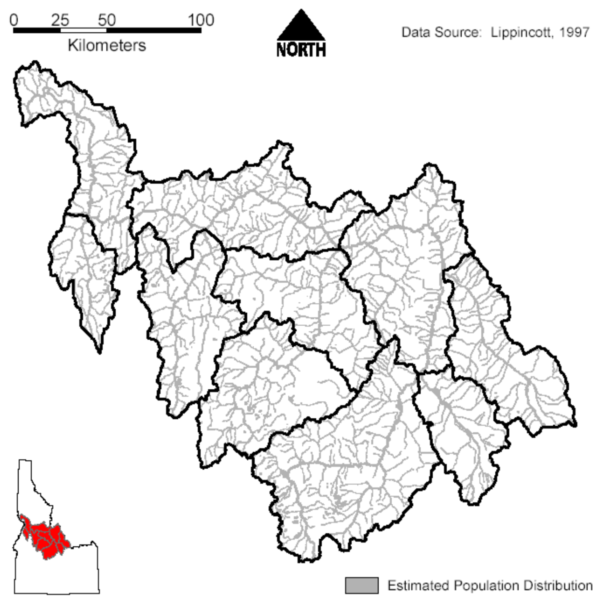
A variety of internal parasites affect river otters. Of these parasites, two roundworms (*Stronguloides lutrae* and *Gnathostoma miyazakii*) may cause serious pathological damage. River otters are also susceptible to canine distemper, jaundice, hepatitis, and feline panleucopenia (Chapman and Feldhamer 1982). The short-term effects of a riparian fire may affect the river otter's food supply. Removal of streamside vegetation increases the risk of streambank erosion and raises stream temperatures, both of which can potentially reduce fish populations in the stream. However, the long-term effect of fire on fish populations can be beneficial. Fire thins and removes conifers along streams and stimulates growth of deciduous vegetation. Such a change provides cover and shading and fosters development of terrestrial insects important in the diet of fishes (Wright and Bailey 1982).

Additionally, fire occurring in riparian areas indirectly benefits river otters by benefiting beavers (Kelleyhouse 1979). Beaver activities help create suitable habitat for river otters.

1.6 American Beaver (*Castor canadensis*)

The beaver is found throughout the Salmon subbasin, inhabiting riparian areas of mixed coniferous-deciduous forests and deciduous forests containing abundant beaver foods and lodge-building material such as quaking aspen (*Populus tremuloides*), willows (*Salix* spp.), alders (*Alnus* spp.), redosier dogwood (*Cornus sericea*), and cottonwoods (*Populus* spp.) (Patric and Webb 1953, Allen 1983). Suitable habitat for beavers must contain all of the following: stable aquatic habitat providing adequate water; a channel gradient of less than 15%; and quality food species in sufficient quantity (Allen 1983). Through tree-harvesting activity, beavers can usually control water depth and stability on small streams, ponds, and lakes and can also have an effect on natural succession.

Large lakes or reservoirs (8 hectares or 20 acres in surface area) with irregular shorelines provide optimum habitat for beavers. Lakes and reservoirs that have extreme annual or seasonal fluctuations in the water level are generally unsuitable habitat for beavers (Allen 1983, Smith and Peterson 1991). Intermittent streams or streams that have major fluctuations in discharge have little year-round value as beaver habitat (Allen 1983). Food availability is another factor determining suitable habitat for beavers (Harris 1991). Beavers often occupy marshes, ponds, and lakes when an adequate supply of food is available. They generally forage no more than about 90 m (295 ft) from water, though foraging distances of up to 200 m (656 ft) have been reported (Allen 1983).



In Idaho, beavers breed between mid-January and early June (Lippincott 1997). Beavers are generally monogamous, although males will mate with other females (Van Gelden 1982, Merritt 1987). Only the dominant female of a beaver colony breeds, producing one litter a year (Van Deelen 1991). The gestation period is four months, with the average litter size varying between two and three kits (Rue 1967, Van Gelden 1982, Zeveloff 1988, Van Deelen 1991). Kits are weaned at two to three months and can swim by one week of age (Van Gelden 1982, Zeveloff 1988). Beavers become sexually mature between ages two and three (Lawrence 1954, Wilkinson 1962). They live up to 11 years in the wild and between 15 and 21 years in captivity (Rue 1967, Merritt 1987).

Beavers are active throughout the year and usually nocturnal. They live in colonies (average five beavers per colony) that consist of three age classes: adults, kits, and yearlings that were born the previous spring (Lawrence 1954). After young beavers reach their second or third year, they are forced to leave the family group (Lawrence 1954, Merritt 1987, Zeveloff 1988). Dispersal may be delayed in areas with high beaver densities. Subadults generally leave the natal colony in late winter or early spring (Van Deelen 1991). Subadult beavers have been reported to migrate as far as 236 km (147 miles), although average migration distances range from 8 to 16 km (5-10 miles) (Allen 1983). Adult beavers are nonmigratory (Allen 1983).

Beavers are herbivores. During late spring and summer, their diet consists mainly of fresh herbaceous matter (Allen 1983, Lawrence 1954). Beavers appear to prefer herbaceous vegetation to woody vegetation during all seasons if it is available. Woody vegetation may be consumed during any season, although its highest utilization occurs from late fall through early spring when herbaceous vegetation is not available. The majority of the branches and stems of woody vegetation are cached for later use during winter (Allen 1983). Trees and shrubs closest to the water's edge are generally used first (Allen 1983).

Winter is a critical period, especially for colonies on streams because they must subsist solely on their winter food caches. In contrast with stream colonies, those on lakes are not solely dependent on their stores of woody vegetation; they can augment their winter diet of bark with aquatic plants (Lawrence 1954).

Aquatic vegetation such as duck-potato (*Sagittaria* spp.), duckweed (*Lemma* spp.), pondweed (*Potamogeton* spp.), and waterweed (*Elodea* spp.) are preferred foods when available (Allen 1983). The thick, fleshy rhizomes of water lilies (*Nymphaea* spp. and *Nuphar* spp.) may be used as a food source throughout the year. If present in sufficient amounts, water lily rhizomes may provide an adequate winter food source, resulting in little or no tree cutting or food caching of woody materials (Allen 1983, Lawrence 1954). Other important winter foods of beavers living on lakes include the rhizomes of sedges and the rootstocks of mat-forming shrubs (Lawrence 1954).

Aspen and willows are considered preferred beaver foods; however, these species are generally riparian species and so may be more available for beaver foraging but not necessarily preferred over all other deciduous tree species. Beavers have been reported to subsist in some areas by feeding on conifer trees, but these trees are a poor-quality food source (Allen 1983).

The lodge is the major source of escape, resting, thermal, and reproductive cover for beavers. Beavers usually construct lodges so that the structure is surrounded by water or located against a bank. Water protects the lodge from predators and provides concealment for beavers when traveling to and from food-gathering areas and caches (Allen 1983). On lakes and ponds, lodges are frequently situated in areas that provide shelter from wind, waves, and ice (Allen 1983). Damming large streams that have swift, turbulent waters creates calm pools for feeding and resting (Harris 1991).

Beavers have few natural predators; however, in certain areas, they may face predation pressure from wolves (*Canis lupus*), coyotes (*Canis latrans*), lynx (*Lynx canadensis*), fishers (*Martes pennanti*), wolverines (*Gulo gulo*), and occasionally bears (*Ursus* spp.). Minks (*Mustela vison*), otters (*Lutra canadensis*), hawks, and owls periodically prey on kits (Rue 1967, Lowery 1974, Merritt 1987). Humans kill beavers for their fur (Lawrence 1954, Merritt 1987).

However, beavers will live near people if all habitat requirements are met (Rue 1967). Railways, roads, and land clearing adjacent to waterways may affect beaver habitat suitability. Transplants of beaver may be successful on strip-mined land or in new impoundments where water conditions are relatively stable. Highly acidic waters, which often occur in strip-mined areas, are acceptable for beaver if suitable foods are present (Allen 1983).

Beaver activity can have a significant influence on stream and riparian habitats (Munther 1981, Barnes and Dibble 1988, Johnston and Naiman 1990, Van Deelen 1991). Through tree-harvesting activity, beavers can affect natural succession. Other than humans, beavers are the only mammals in North America that can fell mature trees; therefore, their ability to decrease forest biomass is much greater than that of other herbivores (Allen 1983). In addition, beaver ponds conserve spring runoff, thus ensuring more constant stream flow, diminishing floods, conserving soil, and helping maintain the water table (Hazard 1982).

Beaver activity can be beneficial to some wildlife species (Johnson 1989, Van Deelen 1991). Waterfowl often benefit from the increased edge, diversity, and invertebrate communities created by beaver activity (Van Deelen 1991). Occupied beaver-influenced sites produce more waterfowl because of improved water stability and increased brood-rearing cover; waterfowl production declines when beavers leave an area. Great blue herons (*Ardea herodias*), ospreys (*Pandion halietus*), bald eagles (*Haliaeetus leucocephalus*), kingfishers (*Ceryle alcyon*), and many species of songbirds also benefit from beaver activity. Otters, raccoons (*Procyon lotor*), mink, and muskrat (*Ondatra zibithica*) thrive on the increased foraging areas produced by beaver activity. Berry-producing shrubs and brush in areas cut by beavers attract white-tailed deer (*Odocoileus virginianus*) and black bear (*Ursus americanus*) (Van Deelen 1991).

Beaver activity can also improve fish habitat. Production of three trout species (*Salmo* spp. and *Salvelinus fontinalis*) in a stream in the Sierra Nevada increased due to a higher standing crop of invertebrates in beaver ponds (Gard 1961). Smallmouth bass (*Micropterus dolomieuis*) and northern pike (*Esok lucius*) also benefit from beaver impoundments (Van Deelen 1991). In some instances, beaver ponds have provided up to six times more salmonids (by total weight) per acre than adjacent stream habitat without beaver ponds has provided (Munther 1981). In areas of marginal trout habitat, however, beaver activity can reduce trout production. Beaver-caused loss of streamside shade and diminished water velocity can result in lethal water temperatures (Van Deelen 1991).

The amount of influence that cattle have on riparian environment can be reduced by beaver activity in many valley bottoms. If beavers are thoroughly established in willow habitats of wide valleys prior to cattle being introduced, the immediate effect of cattle on the stream is often minor (Munther 1981).

Beaver activity can also have detrimental effects. Beaver-caused flooding often kills valuable lowland timber (Van Deelen 1991). Human–beaver conflicts occur when beavers flood roadways and agricultural lands or dam culverts and irrigation systems. Also, beavers have potential to increase waterborne pathogens (including *Giardia lamblia*) downstream of their activity (Van Deelen 1991).

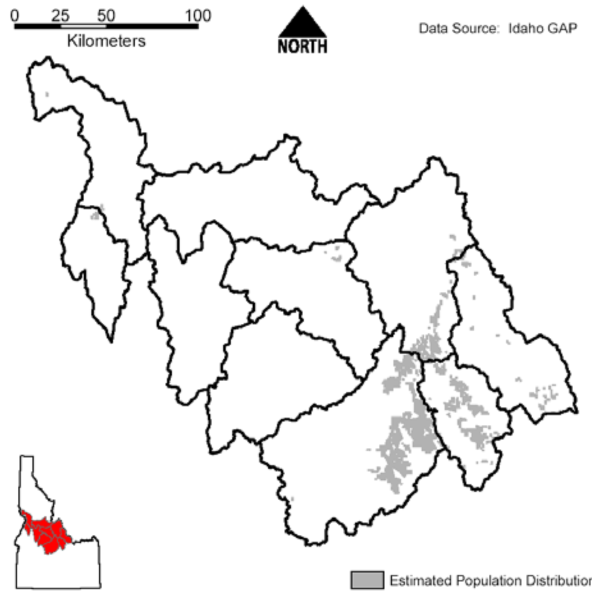
Information on the direct effects that fire has on beavers was not found in the literature; however, beavers can probably easily escape fire (Tesky 1993c). Since lodges are typically built over water, they are probably at little risk of being destroyed by fire. Fire occurring in riparian areas often benefits beaver populations (Kelleyhouse 1979). Beavers are adapted to the early stages of forest succession. Quaking aspen, willows, alders, and redosier dogwood—prime beaver food trees—all sprout vigorously after fire. As succession progresses, these trees become too large for beavers to use or are replaced by climax trees (Wright and Bailey 1982). Recurring fires within parts of boreal forests have allowed aspen and willow to replace coniferous forests. This change favors beaver populations since willow and aspen are important food sources.

2 Shrub-Steppe

2.1 Sagebrush (*Artemisia* spp.)

2.1.1 Wyoming Big Sagebrush (*Artemisia tridentata* ssp. *wyomingensis*)

Wyoming big sagebrush-steppe communities are prevalent in the West (Howard 1999). Besides Wyoming big sagebrush, there are two other widely distributed subspecies of big sagebrush: basin (*A. tridentata* ssp. *tridentata*) and mountain big sagebrush (*A. tridentata* ssp. *vaseyana*) (Beetle and Young 1965, Hickman 1993, Kartesz 1994). It is impossible to distinguish Wyoming big sagebrush from basin or mountain big sagebrush without molecular analysis (Beetle and Young 1965, Weber 1987).



Wyoming big sagebrush is a native shrub (Balliette *et al*. 1986, Dorn 1988, Hickman 1993, Cronquist *et al*. 1994). It is the most drought tolerant of the three major big sagebrush subspecies (Meyer and Monsen 1993). Plants are generally 46 to 76 cm tall, with rounded, uneven crowns. The main stem is usually branched at or near ground level into two or more substems (Schlatterer 1973, Beetle and Johnson 1982). Wyoming big sagebrush is technically an evergreen but is semideciduous in habit. It develops two types of leaves: large ephemeral leaves and smaller, perennial leaves produced from ephemeral leaf axes (Miller and Shultz 1987). The inflorescence is an open, many-flowered spike (Beetle and Johnson 1982). The fruit is a small, easily shattered achene (Shaw and Monsen 1990).

The root system is deep and well developed, with many laterals and one or more taproots. The majority of roots (about 35% of the total root system) are in the upper first foot (30.5 cm) of soil. Some roots may penetrate as far as 1.8 m (Fernandez and Caldwell 1975, Leaf 1975, Sturges 1977). Roots are infected with the vesicular-arbuscular mycorrhizae (or VAM, *Glomus microcarpus* and *Gigaspora* spp.) (Doerr *et al*. 1971, Bethlenfalvay and Dakessian 1984, Hurley and Wicklow-Howard 1986).

Wyoming big sagebrush reproduces from seed; it does not sprout or layer (Beetle and Young 1965, Schlatterer 1973, McArthur *et al*. 1977). Pollination is mostly by outcrossing, but plants can also self-pollinate (Freeman *et al*. 1991). Wyoming big sagebrush is also a long-lived species. Maximum life span may exceed 150 years (Ferguson 1964).

Wyoming big sagebrush is most common on foothills, undulating terraces, slopes, and plateaus but also occurs in basins and valley bottoms (Francis 1983, Tiedeman *et al*. 1987, Hodgkinson 1989, Dorn 1988, Cronquist *et al*. 1994). Aspect varies, but shrubs are most common on south- to west-facing slopes (Tweit and Houston 1980, Tiedeman *et al*. 1987, Burke *et al*. 1989). The plant occurs on frigid, mesic, and xeric soils of silty, clayey, skeletal, and mixed textures (Passey *et al*. 1982, Francis 1983, Winward 1983, Holland 1986, Hodgkinson 1989). In the Snake River Plain of southern Idaho, Wyoming big sagebrush communities occur on sites that have more than 20 cm of annual precipitation. Where the ranges of Wyoming and mountain big sagebrush overlap, Wyoming big sagebrush generally occurs where precipitation is less than 30 cm, whereas mountain big sagebrush occurs on wetter sites (Hironaka *et al*. 1983, Hironaka 1986, Bunting *et al*. 1993). In the southern Rocky Mountains, Wyoming big sagebrush occurs on low- to mid-elevation sites that receive precipitation mainly as rain, whereas mountain big sagebrush occurs above 2,100 m where most precipitation is snow (Leaf 1975).

Wyoming big sagebrush communities are common in southern Idaho (Kaltenecker and Wicklow-Howard 1994). The sagebrush occurs in pinyon-juniper woodlands and ponderosa pine (*P. ponderosa*) forests, often as a dominant shrub (Tausch and Tueller 1990, Eddleman *et al*. 1994, Rose and Eddleman 1994, West *et al*. 1998). On the Snake River Plain, community associates include budsage (*Artemisia spinescens*), shadscale (*Atriplex confertifolia*), littleleaf horsebrush (*Tetradymia glabrata*), green rabbitbrush, winterfat (*Krascheninnikovia lanata*), Indian ricegrass (*Achnatherum hymenoides*), bottlebrush squirreltail (*Elymus elymoides* spp.), Sandberg bluegrass (*Poa secunda*), and cheatgrass (*Bromus tectorum*) (Bunting *et al*. 1993). Soil crusts of cyanobacteria, lichens, and mosses including twisted moss (*Tortula ruralis*), fire moss (*Ceratodaon purpureus*), silvergreen bryum moss (*Bryum argenteum*), and funaria moss (*Funaria hygrometrica*) may be well represented.

Wyoming big sagebrush is preferred browse for wild ungulates (Peek *et al*. 1979, Welch and McArthur 1986, Shaw and Monsen 1990, Bray *et al*. 1991), and Wyoming big sagebrush communities are important winter ranges for big game (McArthur *et al*. 1977, Tweit and Houston 1980, Mueggler and Stewart 1981, Hironaka *et al*. 1983). Pronghorn usually browse Wyoming big sagebrush heavily (Allen *et al*. 1984). On the Idaho National Engineering and Environmental Laboratory, for example, the shrub comprised 90% of the diet of pronghorn from fall through spring. Lagomorphs may browse Wyoming big sagebrush heavily in winter (Gates and Eng 1984). Wyoming big sagebrush is a crucial food item for the sage grouse and part of the bird's critical habitat (Tweit and Houston 1980, Clifton 1981, Autenrieth *et al*. 1982, Welch *et al.* 1991, Fischer *et al*. 1993, Fischer *et al.* 1996).

Wyoming big sagebrush is a mid to late seral species (Eddleman and Doescher 1978, Francis 1983). It may take a decade or longer for Wyoming big sagebrush reestablishment after a stand-replacing event such as fire

(Sturges 1994). Prior to re-establishment of Wyoming big sagebrush, disturbed Wyoming big sagebrush communities are mostly populated with associated grasses. For instance, cheatgrass dominates many Wyoming big sagebrush stands in southern Idaho, northern Nevada, and eastern Oregon.

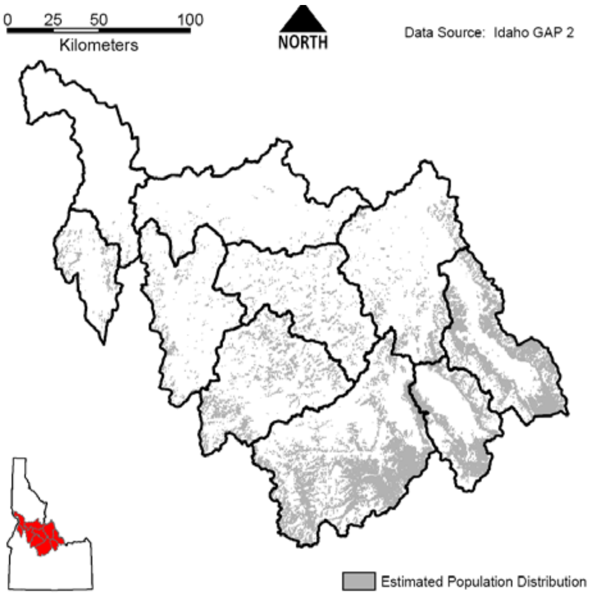
Fire is the principal means of renewal for decadent stands of Wyoming big sagebrush (Blank *et al.* 1994). After fire, Wyoming big sagebrush establishes from the seedbank (Beetle and Young 1965, Schlatterer 1973, McArthur *et al.* 1977), from seed produced by remnant plants that escaped fire (Bushey 1987), and from plants adjacent to the burn that seed in (Clifton 1981, Bushey 1987). Fires in Wyoming big sagebrush are usually not continuous, and remnant plants are the principal means of post-fire reproduction (Bushey 1987). Fire does not stimulate germination of soil-stored Wyoming big sagebrush seed, but neither does fire inhibit its germination (Chaplin and Winward 1982).

Interestingly, Native Americans made tea from big sagebrush leaves. They used the tea as a tonic and an antiseptic for treating colds, diarrhea, and sore eyes and as a rinse to ward off ticks. Big sagebrush seeds were eaten raw or made into meal (Mozingo 1987). The wood is extremely aromatic when burned, and the wood smoke was used to mask the effects of an encounter with a skunk (Elmore 1976).

2.1.2 Mountain Big Sagebrush (*Artemisia tridentata* var. *vaseyana*)

Mountain big sagebrush is a long-lived (50+ years), woody, aromatic, native, evergreen shrub (Beetle and Johnson 1982, Blank *et al.* 1994). Shrubs often appear flat topped from a distance because of the nearly equal height of flowering stalks (Lackschewitz 1991). The fruit is a small, easily shattered achene that falls or is blown near the parent plant (Young and Evans 1989, Shaw and Monsen 1990). Root length of mature plants is about 2 m (7 ft) (Richards and Caldwell 1987). Mountain big sagebrush roots are colonized by fungi that form symbiotic vesicular-arbuscular mycorrhizae (Caldwell *et al.* 1985, Trent *et al.* 1994). Aboveground, the plant is host to an unidentified, pathogenic snow-mold fungus that decreases shrub cover and productivity (Hess *et al*. 1985, Nelson and Sturges 1986).

Mountain big sagebrush usually flowers in late summer and fall, but some strains may flower as early as July (Johnson 2000). Seed matures from September through October (McArthur *et al*. 1979). Mature seeds fall or are blown from inflorescences during autumn and winter, and emergence occurs in winter or spring (McDonough and Harniss 1974, Young and Evans 1989, Meyer and Monsen 1991). Seeds are short-lived (less that five years in warehouse), and probably do not form a persistent seed bank (Young and Evans 1989, Meyer *et al*. 1990). Mountain big sagebrush can reproduce vegetatively by layering (Beetle and Young 1965, McArthur *et al*. 1979, Harvey 1981, Beetle and Johnson 1982). It does not resprout when aboveground tissues are killed by fire or other means (Blaisdell 1953, Blaisdell *et al*. 1982).



In the Intermountain West, mountain big sagebrush usually occurs in the upper elevational range of the big sagebrush zone in montane valleys and on foothills, slopes, and high ridges (Beetle 1960, Beetle 1961, McArthur *et al*. 1979, Winward 1980, Blaisdell *et al*. 1982). In northerly parts of its range, this species occurs in mountain valleys and on mountain slopes and ridges as high as 3,000 m (9,843 ft) (McArthur *et al*. 1979). In Idaho, it has been reported as low as 780 m (2,559 ft). Soils are moderately deep, well drained, slightly acidic to slightly alkaline and characterized by late-melting winter snow cover and summer moisture (Beetle 1961, West *et al.* 1978, McArthur *et al*. 1979, Blaisdell *et al*. 1982, Tueller and Eckert 1987, Burke 1989, Burke *et al*. 1989). This shrub grows in full sun but tolerates shade, often occurring in association with mature conifers (West *et al*. 1978, Noste and Bushey 1987).

Mountain big sagebrush occurs over a range of habitats from montane parklands to warm desert fringes in western North America, often as a dominant in shrublands or codominant in savannah (Johnson 2000). This species is a common component of shrub patches in arid grasslands (Mueggler and Campbell 1982, Marlow *et al*. 1987, Vaitkus and Eddleman 1991, Johnson *et al*. 1994, Rose and Eddleman 1994). It occurs widely throughout Great Basin pinyon-juniper woodlands dominated by true pinyon (*Pinus edulis*), singleleaf pinyon (*P. monophylla*), and Utah juniper (*Juniperus osteosperma*) (Tueller *et al*. 1979). Mountain big sagebrush has been reported in association with numerous other tree species, including quaking aspen (*Populus tremuloides*) (Mueggler and Campbell 1982, Mueggler 1985, Burke *et al*. 1989, Chambers 1989), ponderosa pine (*P. ponderosa*) (Peek *et al*. 1979, Harvey 1981, Johnson *et al*. 1994, Rose and Eddleman 1994), lodgepole pine (*P. contorta*) (Beetle 1961, Chambers 1989), Douglas-fir (*Pseudotsuga menziesii*) (Pfister *et al*. 1977, Harvey 1981), limber pine (*P. flexilis*) (Beetle 1961, Plummer 1976, Pfister *et al*. 1977, Harvey 1981), subalpine fir (*Abies lasiocarpa*) (McLean 1970), and whitebark pine (*P. albicaulis*) (Beetle 1961, Mumma 1990). Mountain big sagebrush may also occur in association with white fir (*A. concolor*) and Engelmann spruce (*Picea engelmannii*).

Common plant associates in Idaho and Montana include Woods' rose (*Rosa woodsii*), mountain snowberry (*Symphoricarpos oreophilus*), antelope bitterbrush (*Purshia tridentata*), and Rocky Mountain juniper. Associated grasses and forbs include Kentucky bluegrass (*Poa pratensis*), bluebunch wheatgrass (*Pseudoroegneria spicata*), Idaho fescue (*Festuca idahoensis*), cheatgrass (*Bromus tectorum*), prairie Junegrass (*Koeleria macrantha*), green needlegrass (*Nassella viridula)*, needle and thread (*Hesperostipa comata*), Sandberg bluegrass (*Poa secunda*), and bottlebrush squirreltail (*Elymus elymoides*) (Winward 1970, Marlow *et al*. 1987, Kaltenecker and Wicklow-Howard 1994, Monsen and Anderson 1995).

Publications listing mountain big sagebrush as a dominant, codominant, or indicator species include the following: *Sagebrush-Grass Habitat Types of Southern Idaho* (Hironaka *et al*. 1983), *Aspen Community Types on the Caribou and Targhee National Forests in Southeastern Idaho* (Mueggler and Campbell 1982), *Grassland and Shrubland Habitat Types of the Shoshone National Forest* (Tweit and Houston 1980), *Taxonomic and Ecological Relationships of the Big Sagebrush Complex in Idaho* (Winward 1970), and *Sagebrush Steppe* (Young *et al*. 1977).

The ecology of mountain big sagebrush in the West has been altered by postsettlement increases or decreases in historical fire intervals, livestock grazing, widespread invasion by exotic annuals, and perhaps climate change (Burkhardt and Tisdale 1976, Blaisdell *et al*. 1982, West 1988, Miller and Rose 1998). Historical abundance of big sagebrush has been disputed. According to reviews (Beetle and Johnson 1982, West 1988) and a comparative examination of 20 historical photos from three states (Kuchler 1964), big sagebrush was abundant and codominant with perennial bunchgrasses in presettlement times. Sagebrush species do not appear to have increased their range on a large scale, but reviewers agree that big sagebrush has increased in density in many places in response to excessive grazing and altered fire regimes. Mountain big sagebrush is readily killed by fire and requires at least 15 years to recover after fire (Bunting *et al*. 1987).

In the juniper woodlands of southern Idaho, western juniper has invaded large areas of mountain big sagebrush shrubland. Burkhardt and Tisdale (1969, 1976) reviewed possible causes, including destruction of grassland via livestock grazing, increased seed dispersal by sheep, climate change, and a reduction of the historic fire-return interval. In field sites, they examined seed dispersal mechanisms, fire history, and juniper seedling establishment and concluded that succession of sagebrush-grass shrublands to juniper woodlands is directly related to cessation of periodic fires. In the same region, Hironoka *et al*. (1983) identified 10 climax habitat types dominated by mountain big sagebrush.

There has been extensive documentation that many wild animals rely on the big sagebrush ecosystem by for both food and cover (McGee 1979, Nagy 1979, Peek *et al*. 1979, Blaisdell *et al*. 1982, Hironaka *et al*. 1983, Noste and Bushey 1987, Shaw and Monsen 1990, ambolt *et al*. 1994, Welch *et al*. 1996). Wildlife researchers have argued that the importance of sagebrush as forage and the effects of foraging on sagebrush are not fully appreciated (Wambolt 1995, 1996; Welch and Wagstaff 1992).

Historically, Native Americans used big sagebrush leaves and branches for medicinal teas and used the leaves as a fumigant. Bark was woven into mats, bags, and clothing (Parish *et al*. 1996).

2.1.3 Black Sagebrush (*Artemisia nova*)

A native evergreen shrub, black sagebrush is small, spreading, and aromatic. Heights usually range from 15 to 45 cm but occasionally reach up to 76 cm on productive sites (McArthur and Stevens 1986). Although plants may have an upright habit, the branches are typically decumbent and arise from a spreading base. Black sagebrush has a shallower, more fibrous root system than big sagebrush (Kleinman 1976). As a result, annual growth depends largely on soil moisture content near the ground surface.

Growth is initiated in April, with new leaves being produced from May throughout most of the summer (Beetle 1960). Flower heads first appear in July, but blooming does not occur until September; flowers may be numerous one year and particularly sparse in another (McMurray 1986). Seed dispersal takes place in October (McMurray 1986). Late spring leaves and summer leaves persist through the winter (McMurray 1986).

Black sagebrush is a significant browse species within the Intermountain region (McMurray 1986). It is especially important on low-elevation winter ranges in the southern Great Basin where extended snow-free periods allow animals to access plants throughout most of the winter (Johnson 1978). In these areas, black sagebrush is heavily utilized by pronghorn and mule deer (Beale and Smith 1970, McAdoo and Klebenow 1979, Clary and Beale 1983) and highly preferred by domestic sheep (Clary 1986). Stands are often contiguous with salt desert communities in the southern Great Basin. Relative to the surrounding vegetation, good-condition winter ranges are productive and also offer a good selection of associated species. Many of these ranges have been seriously depleted by past overgrazing (McMurray 1986).

Black sagebrush is highly nutritious winter forage. Although not as productive as many other forage species, black sagebrush has winter nutritive quality that is second only to that of big sagebrush (Cook and Stoddart 1953, Behan and Welch 1986). However, black sagebrush may be lethal to domestic sheep if it comprises the bulk of their diet for even a short time (McMurray 1986). This situation is most likely to occur when animals are concentrated on winter ranges (Johnson 1978). On spring and transitional ranges, black sagebrush is thought to cause abortion in sheep. Recent studies have shown that it is a preconditioning plant responsible for horsebrush-related photosensitization in sheep (Johnson 1978).

Black sagebrush regenerates almost exclusively from seed (Beetle 1960), spreading aggressively on favorable sites, and is a good conservation plant for dry, shallow, stony soils and mine spoils. Mature, self-perpetuating stands of black sagebrush are considered to be indicators of climax conditions. Seedlings are present during early seral stages, and plants coexist with later-arriving species (McMurray 1986). Long-established black sagebrush stands in Nevada have recently undergone invasion by both Utah juniper (*Juniperus osteosperma*) and singleleaf pinyon (*Pinus monophylla*). This invasion, which accelerated around 1921, has been attributed to the combined effects of overgrazing, fire suppression, and climatic change (Blackburn and Tueller 1970).

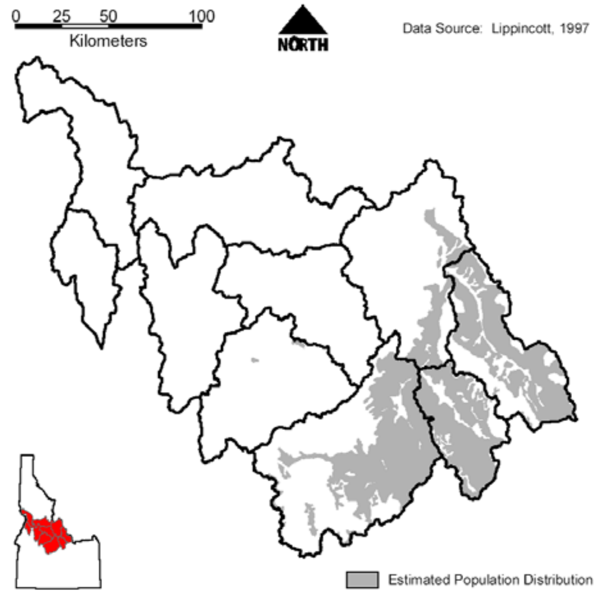
Black sagebrush is considered a climax species and has been used as an indicator in a number of habitat-typing systems within the sagebrush-grass region (McMurray 1986). It also occurs as an understory dominant within forested communities. Forested habitat types using black sagebrush as an indicator have been identified within ponderosa pine and juniper series and pinyon-juniper (*Pinus-Juniperus* spp.) series (Alexander 1985).

Historically, fire has had little or no influence in communities dominated by black sagebrush (Winward 1985). When exposed to fire, plants are easily killed and do not sprout (Wright *et al*. 1979, Volland and Dell 1981). Use of prescribed burning is not usually feasible where black sagebrush forms dense stands. Since plants are nonsprouters, fire is not recommended on winter ranges where this species constitutes an important forage plant (McMurray 1986).

2.2 Greater Sage Grouse (*Centrocercus urophasianus*)

The greater sage grouse historically inhabited much of the sagebrush-dominated regions of

North America (McClanahan 1940, Aldrich 1963, Connelly and Braun 1997). The species is renowned for its spectacular breeding displays, during which large numbers of males congregate to perform a strutting display (Johnsgard 1973). Today, sage grouse populations are declining throughout most of their range, mostly due to habitat loss and degradation (Hays *et al*. 1998).



Sage grouse are relatively large, with the males being larger than the females. Males weigh about 1.7 to 2.9 kg (4-6 lbs) and are 65 to 75 cm (26-30 inches) long; females weigh about 1.0 to 1.8 kg (2-4 lbs) and are 50 to 60 cm (20-24 inches) long (Schroeder *et al.* 1999). Both sexes have narrow, pointed tails; feathering to the base of the toes; a variegated pattern of grayish brown, buffy, and black on the upper parts of the body; and a black belly (Johnsgard 1973). Males are more colorful than females and have a black throat and bib; scaly, white foreneck plumage; and a large white ruff on the breast (Dunn *et al*. 1987). Males also exhibit two large, frontally directed air sacs of olive-green skin and yellow superciliary combs that enlarge during breeding display (Johnsgard 1973, Udvardy 1977). Sage grouse are thought to live up to 10 years in the wild, but in one study, the average life span of sage grouse in both hunted and protected populations was 1 to 1.5 years (Elman 1974); in another study, sage grouse 3 to 4 years of age were considered old (Wallestad 1975).

Female sage grouse are sexually mature their first fall and nest the following spring (Patterson 1952). Males are sexually mature the spring following their first winter. Yearling males engage in display and breeding but devote less time and energy to courtship activities than adults do (Wiley 1974).

In early April, male and female sage grouse gather for displaying and mating at specific locations, called leks. At the beginning of the breeding season, male sage grouse establish small territories on the lek. The males occupying territories near the center of the lek may be more successful at mating (Davis 1978). After mating, sage grouse hens leave the lek to nest. Most hens build nests under shrubs (Jarvis 1974, Wallestad and Pyrah 1974, Roberson 1984), specifically in areas with medium-high shrub cover and residual grass (i.e., dry grass from the previous growing season) (Schoenberg 1982, Gregg 1991, Sime 1991). Hens incubate 7 to 15 eggs for about 25 to 27 days (Connelly *et al*. 1991). After hatching, chicks wait until they are dry before they leave the nest. Sage grouse hens attempt to raise one brood in a season (Girard 1937). The chicks feed themselves, but hens spend considerable time keeping chicks warm and guarding them for the first four to five weeks (Patterson 1952).

Sage grouse usually roost on the ground from evening until early morning, feed and rest during the afternoon, and return to their roosting site at night (Johnsgard 1973). Sage grouse use shrub stands with medium to very high shrub cover primarily for foraging and loafing (Autenrieth 1981, Emmons and Braun 1984, Roberson 1984).

Sagebrush, grasses, forbs, and insects comprise the annual diet of sage grouse. Sagebrush comprises 60 to 80% of the yearly diet of adult sage grouse (Patterson 1952, Wallestad *et al*. 1975, Remington and Braun 1985), and as much as 95 to 100% of the winter diet (Roberson 1984). Forbs may constitute 50% of the diet of juveniles up to 11 weeks of age (Klebenow and Gray 1968, Peterson 1970). Forbs also appear to be important to nesting hens in the pre-laying period (Barnett and Crawford 1993). Insects make up 50% of the diet during the first and second week of life (Patterson 1952, Klebenow and Gray 1968, Peterson 1970). Johnson and Boyce (1990) found that chicks less than three weeks old required insects for survival and chicks greater than three weeks old had reduced growth rates when insects were removed from the diet.

Some researchers consider water a key component of sage grouse habitat (Carr 1967, Savage 1969, Call and Maser 1985). Others have found no evidence that sage grouse prefer sites close to water (Wallestad 1975, Autenrieth 1981, Cadwell *et al*. 1994). Sage grouse need to consume water, but they typically obtain enough water by consuming vegetation that stores water, such as succulent forbs. Sage grouse may concentrate in late summer and fall where water or succulent forbs are available. Water sources include streams, springs, water holes, and cattle troughs. Where water is available, sage grouse normally visit water sites in the morning and evening. Sage grouse that occupy areas with little precipitation may migrate to areas containing water during summer and fall. Chicks require water soon after hatching (Girard 1937), so hens with broods often migrate to areas containing water. Petersen (1980) found that hens with broods remained in upland habitat until succulent forbs disappeared; then they moved to wet meadows in late summer.

Sources of mortality of sage grouse include predation, weather, accidents, disease and parasitism, and environmental hazards such as pesticides. These natural and man-influenced factors become more important management issues with small populations. Blus *et al*. (1989), for instance, found organophosphorus insecticides (dimethoate or methamidophos) directly responsible for the death of sage grouse that occupied or were near sprayed alfalfa or potato fields in southeastern Idaho. Predation is a limiting factor throughout the annual sage grouse cycle, but its severity depends on habitat quality. Raptors and crows are the primary predators of sage grouse (Patterson 1952, Lumsden 1968, Wiley 1973), while coyotes (*Canis latrans*), bobcats (*Lynx rufus*), minks (*Mustela vison*), badgers (*Taxidea taxus*), and ground squirrels (*Spermophilus* spp.) are the most important ground predators. Weather can influence nesting success and survival of young chicks Dalke *et al*. 1963, Autenreith 1981). Diseases and parasites do not appear to be a significant source of mortality (Girard 1937, Batterson and Morse 1948).

2.3 Mule Deer (*Odocoileus hemionus*)

The mule deer is a popular game species in Idaho. Prior to the settlement of the West in the late 1800s and early 1900s, mule deer were not as abundant as they are currently (IDFG 1990a). Intense grazing by domestic animals, as well as fire suppression, changed plant communities once dominated by grasses to ranges dominated by shrubs. This habitat change to shrub-dominated ranges in combination with reduced livestock grazing, reduced competition from other wild ungulates due to hunting, and regulated deer harvest tended to promoted the growth of mule deer populations (IDFG 1990a).

The mule deer mating season usually begins in mid-November and continues through mid-December (Snyder 1991a). The gestation period lasts 203 days, with most young born between May and June (Lippincott 1997). Some July and August births also occur in some areas. Mature females commonly have twins, while yearlings have only single fawns. Weaning begins at about five weeks and is usually completed by the sixteenth week. Female mule deer usually breed at 2 years of age, while males may not mate until they are at least 3 or 4 years old due to competition with older males. The life span of a female mule deer can be as long as 22 years, while males may live as long as 16 years. Males begin to shed their antlers in December, though shedding can continue into March; mature and less healthy males might shed their antlers earlier.

Mule deer are most likely to be found in open forested regions or on the plains and prairies (Snyder 1991a). In the mountainous regions of the West, they prefer rocky or broken terrain at elevations near or at the subalpine zone (Carpenter and Wallmo 1981). They are also found in alpine, montane, and foothill zones. Mule deer seek shelter at lower elevations when snows become deep. In the mountains of the Southwest, mule deer are found in lower-elevation shrublands, while white-tailed deer occupy the higher-elevation montane areas. In open prairie regions, mule deer tend to concentrate in river breaks and brushy stream bottoms (Mackie *et al*. 1987). In the high ranges of the Rocky Mountains, mule deer migrate during winter, sometimes moving 80 to 160 km (50-100 miles) (Mackie *et al*. 1987).

Mule deer are better adapted to open areas than white-tailed deer are, although cover becomes important in winter (Snyder 1991a). Areas where cover can prevent snow from accumulating beyond 30 cm (12 inches) are most beneficial (Hanley 1984, Nyberg 1987). Wallmo and Schoen (1980) reported that mule deer could cope with snow up to 60 cm if not dense or crusty. Leckenby *et al*. (1982) and Black *et al.* (1976) listed optimal cover attributes for the Great Basin shrub-steppe region, including estimates of tree heights and canopy closure for thermal, hiding, fawning, and foraging cover. They estimated the proportions of cover and forage at 55% forage, 20% hiding cover, 10% thermal cover, 10% fawn-rearing cover, and 5% fawn habitat.

Mule deer are primarily browsers, feeding on several thousand different plant species across their range (Snyder 1991a). They are capable of altering or severely damaging plant communities through overbrowsing (Reed 1981). Mule deer consume leaves, stems, and shoots of woody plants most often during summer and fall, while grasses and forbs compose the bulk of spring diets. However, feeding behavior is quite variable in any given location. Some of the most common foods are rabbitbrush (*Chrysothamnus* spp.), mountain mahogany (*Cercocarpus* spp.), snowberry (*Symphoricarpos* spp.), buffaloberry (*Shepherdia* spp.), ceanothus (*Ceanothus* spp.), rose (*Rosa* spp.), serviceberry (*Amelanchier* spp.), sagebrush (*Artemisia* spp.), sumac (*Rhus* spp.), common chokecherry (*Prunus virginiana*), willow (*Salix* spp.), Gambel oak (*Quercus gambellii*), mockorange (*Philadelphus lewisii*), ninebark (*Physocarpus* spp.), antelope bitterbrush (*Purshia tridentata*), mariposa (*Calochortus elegans*), juniper (*Juniperus* spp.), yucca (*Yucca* spp.), euphorbia (*Euphorbia* spp.), manzanita (*Arctostaphylos* spp.), lechuguilla (*Agave lechuguilla*), western yarrow (*Achillea millefolium*), red huckleberry (*Vaccinium parvifolium*), swordfern (*Polystichum munitum*), milkvetch (*Astragalus* spp.), and dandelion (*Taraxacum officinale*). Grasses include bluegrasses (*Poa* spp.), wheatgrasses (*Agropyron* spp.), and bromes (*Bromus* spp.)

(Wallmo and Regelin 1981, Gruell 1986, Mackie *et al.* 1987, Happe *et al*. 1990).

Mule deer predators include people, domestic dogs (*Canis familiaris*), coyotes (*Canis latrans*), wolves (*Canis lupus*), black bears (*Ursus americanus*), grizzly bears (*U. arctos horribilis*), mountain lions (*Felis concolor*), lynx (*Lynx canadensis*), bobcats (*F. rufus*), and golden eagles (*Aquilla chrysaetos*) (Mackie *et al.* 1987).

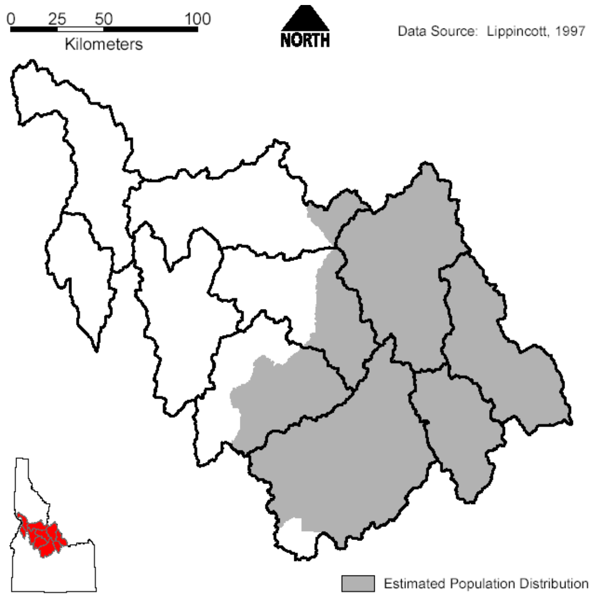
The effects of logging on mule deer populations vary between and within regions; therefore, it is difficult to generalize conclusions (Lyon and Jensen 1980). Site-specific studies are required to determine logging effects, although many studies confirm that slash depth is a major factor limiting mule deer use of harvested areas (Lyon and Jensen 1980, Hanley 1984). Studies in Alaska have shown that black-tailed deer avoid second growth forests after 20 to 30 years and instead turn to “over-mature” forests (older than 300 years) because these forests provide more browse than younger stands (Wallmo and Schoen 1980, Hanley 1984). Happe *et al*. (1990) have shown that, in coastal forests, forage in old growth has higher crude protein values than forage in clear-cuts. Tannin astringency of browse, which reduces digestive protein, is higher in clear-cuts than in old growth forests. Hanley (1984) recommended scattering clear-cuts in old growth in irregular shapes and spreading them over a wide elevational range.

A study in Colorado showed that, following a treatment in lodgepole pine-spruce-fir forests of alternating clear-cuts with uncut strips, mule deer increased after ten years. Strips 30 m (98 ft) wide produced the best results (Wallmo 1969). Wallmo and Schoen (1980) listed management guidelines for timber harvesting that benefit deer in the western United States. However, they stated that some of these guidelines are based on speculation and all contradict claims that large clear-cuts are better for mule deer.

Mule deer are vulnerable to a variety of viral, fungal, and bacterial diseases (Hibler 1981). Epizootic hemorrhagic disease (EHD) resides in a small portion of the deer population and is spread from deer to deer by Culicoides gnats. The areas most affected include lower elevations along the Salmon River near White Bird and Riggins. Mule deer tend to inflict heavy crop damage, as well as damage to hayfields, stackyards, orchards, and reforestation projects (Snyder 1991a). Mule deer are often attacked and killed by domestic dogs, and several hundred thousand deer are killed by vehicles each year (Reed 1981). Mule deer are not as tolerant of human activity and not as adaptable to disturbances as white-tailed deer are (Reed 1981).

2.4 Pygmy Rabbit (*Brachylagus idahoensis*)

The range of the pygmy rabbit includes most of the Great Basin and some of the adjacent intermountain areas of the western United States (Green and Flinders 1980a). Pygmy rabbits are typically found in areas of tall, dense sagebrush (*Artemisia* spp.) cover and are highly dependent on sagebrush to provide both food and shelter throughout the year. The species is highly vulnerable to rapid population declines because of its close association with specific components of the sagebrush ecosystem. Currently, only populations of pygmy rabbits in the Washington Columbia Basin area are listed as endangered (November 30, 2001, 68 FR 10388) under the Endangered Species Act (ESA).



Pygmy rabbits are capable of breeding when they are about one year old (Wilde and Keller 1978, Green and Flinders 1980a). The breeding season of pygmy rabbits is very short. In Idaho, it lasts from March through May. The gestation period of pygmy rabbits is unknown; it is between 27 and 30 days in various species of cottontails (*Sylvilagus* spp.). An average of six young are born per litter, and a maximum of three litters are produced per year (Green and Flinders 1980a). In Idaho, the third litter is generally produced in June (Wilde and Keller 1978). It is unlikely that litters are produced in the fall (Green and Flinders 1980a).

The growth rates of juveniles are dependent on the date of birth. Young from early litters grow larger due to a longer developmental period prior to their first winter (Green and Flinders 1980a). The mortality of adults is highest in late winter and early spring. Green and Flinders (1980a) reported a maximum estimated annual adult mortality of 88% in Idaho. Juvenile mortality was highest from birth to five weeks of age (Green and Flinders 1980a).

Pygmy rabbits may be active at any time of day, but they are generally most active at dusk and dawn (Tesky 1994). They usually rest near or inside their burrows during midday (Green and Flinders 1980b). Pygmy rabbits are generally limited to areas on deep soils with tall, dense sagebrush that they use for cover and food (Green and Flinders 1980b, Flath 1994). Individual sagebrush plants in areas inhabited by pygmy rabbits are often 1.8 (or more) m tall (6 ft) (Flath 1994). Extensive, well-used runways interlace the sage thickets and provide travel and escape routes (Green and Flinders 1980a). Dense stands of big sagebrush along streams, roads, and fencerows provide dispersal corridors for pygmy rabbits (Weiss and Verts 1984).

The pygmy rabbit is the only native leporid that digs burrows (Tesky 1994). Juveniles use burrows more than other age groups. Early reproductive activities of adults may be concentrated at burrows (Green and Flinders 1980a). When pygmy rabbits can utilize sagebrush cover, burrow use is decreased. Pygmy rabbits use burrows more in winter for thermal cover than at other times of the year (Wilde and Keller 1978).

Burrows are usually located on slopes at the base of sagebrush plants and face north to east (Tesky 1994). Tunnels widen below the surface, forming chambers, and extend to a maximum depth of about 1 m (3 ft). Burrows typically have 4 or 5 entrances but may have as few as 2 or as many as 10 (Green and Flinders 1980a). Site selection is probably related to ease of excavating burrows (Weiss and Verts 1984). In areas where soil is shallow, pygmy rabbits live in holes among volcanic rocks, in stonewalls, around abandoned buildings, and in burrows made by badgers (*Taxidea taxus*) or marmots (*Marmota flaviventris*) (Bradfield 1975, Green and Flinders 1980a). Some researchers have found that pygmy rabbits never venture further than 21.3 m from their burrows (Bradfield 1975). However, Bradfield (1975) observed pygmy rabbits range up to 100 m (328 ft) from their burrows.

Some areas inhabited by pygmy rabbits are covered with several feet of snow for up to two or more months during winter. During periods when the snow has covered most of the sagebrush, pygmy rabbits tunnel beneath the snow to find food (Tesky 1994). Snow tunnels are approximately the same height and width as underground burrows and are quite extensive, extending from one sagebrush plant to another (Bradfield 1975, Green and Flinders 1980a). Aboveground movement during winter months is restricted to these tunnel systems (Bradfield 1975). Pygmy rabbits are restricted to areas with heavy shrub cover (Green and Flinders 1980a, Flath 1994). Pygmy rabbits are seldom found in areas of sparse vegetative cover and seem reluctant to cross open space (Bradfield 1975). In southeastern Idaho, woody cover and shrub heights were significantly ($P < 0.01$) greater on sites occupied by pygmy rabbits than on other sites in the same area (Green and Flinders 1980a).

The primary food of pygmy rabbits is big sagebrush, which may comprise up to 99% of the food eaten in winter. Grasses and forbs are also eaten from mid- to late summer (Bradfield 1975, Green and Flinders 1980b, Gates and Eng 1984). In Idaho, Gates and Eng (1984) found that shrubs were 85.2% (unweighted mean) of the pygmy rabbit diet from July to December. Shrub use was lowest in August (73.1%) and highest in December (97.9%). From July to December, big sagebrush was the most important shrub in the diet (54.2%), followed by rubber rabbitbrush (*Chrysothamnus nauseosus*) (25.8%) and winterfat (*Krascheninnikovia lananta*) (4.6%). Grasses made up 10% of the diet during those months, though they were consumed mostly during July and August. Indian ricegrass and needlegrass (*Stipa* spp.) were the most important grasses consumed. Grass and forb consumption was relatively constant throughout the summer (39 and 10% of diet, respectively) and decreased to a trace amount through fall and winter. Thickspike wheatgrass, bluebunch wheatgrass (*Pseudoroegneria spicata*), and Sandberg bluegrass were preferred foods in summer (Green and Flinders 1980b).

Weasels (*Mustela* spp.) are the principal predators of pygmy rabbits (Tesky 1994). The coyote (*Canis latrans*), red fox (*Vulpes vulpes*), badger, bobcat (*Felis rufus*), great horned owl (*Bubo virginianus*), and northern harrier (*Circus cyaneus*) also prey on pygmy rabbits (Bradfield 1975, Wilde and Keller 1978, Green and Flinders 1980a).

Some populations of pygmy rabbits are susceptible to rapid declines and possibly local extirpation. Some studies suggest that pygmy rabbits are a “high inertia” species with low capacity for rapid increase in density (Weiss and Verts 1984). The loss of habitat is probably the most significant factor contributing to pygmy rabbit population declines. Sagebrush cover is critical to pygmy rabbits and sagebrush eradication is detrimental (Holechek 1981). Protection of sagebrush, particularly on floodplains and where high water tables allow growth of tall, dense stands, is vital to the survival of pygmy rabbits (Flath 1994). Fragmentation of sagebrush communities also poses a threat to populations of pygmy rabbits (Weiss and Verts 1984) because dispersal potential is limited.

Therefore, fires that eliminate much of the big sagebrush have an adverse effect on pygmy rabbit populations. The loss of big sagebrush cover from pygmy rabbit home ranges reduces food availability and increases the rabbits’ vulnerability to predation. Pygmy rabbits are probably capable of escaping slow-moving fires, but they may be burned or die of asphyxiation in some fires. During a prescribed burn of a big sagebrush-grassland community in Idaho, several pygmy rabbits died in an area where the fire advanced rapidly (Tesky 1994). Although pygmy rabbits use burrows, the burrows evidently do not always provide them with effective protection from fire (Gates and Eng 1984). Furthermore, big sagebrush is often completely killed by fire and is slow to reestablish on burned sites. For instance, on the upper Snake River Plain in Idaho, big sagebrush did not recover to prefire densities until 30 years after an August fire (Harniss and Murray 1973), and some big sagebrush was eliminated from some areas due to repeated fire (Rosentreter and Jorgensen 1986).

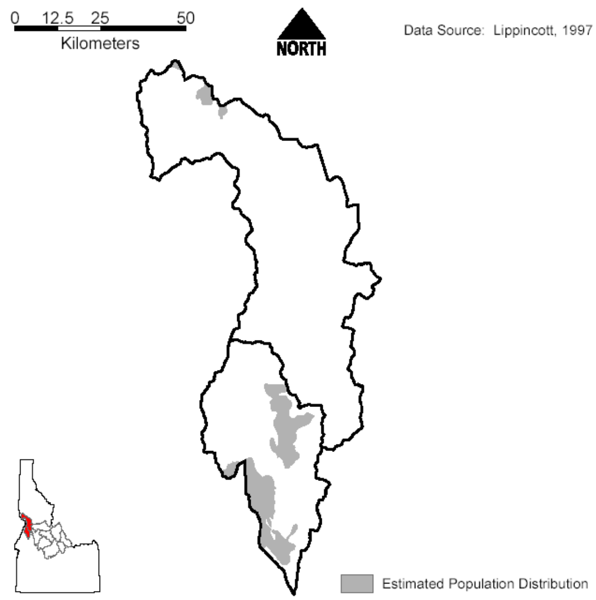
3 Pine/Fir Forest

3.1 Xeric, Old Forest

3.1.1 White-Headed Woodpecker (*Picoides albolarvatus*)

The white-headed woodpecker populations In Washington, Oregon, and Idaho have become more fragmented and reduced because of forestry practices (Marshall *et al*. 1992, Gilligan *et al*. 1994). It is listed as a species of special concern in Idaho, and a Level I Partners in Flight priority species. A medium-sized woodpecker, it is about 21 to 23 cm (8-9 inches) long. It has a black body with a white head and white patches on its wings. The male woodpecker has a red spot on its nape. The plumage of juvenile woodpeckers is similar to that of adult woodpeckers, but the black is duller (Garrett *et al*. 1996).

The white-headed woodpecker lives in montane, coniferous forests from British Columbia to California and seems to prefer forest with a relatively open canopy (50–70% cover) and an availability of snags (partially collapsed, dead trees) and stumps for nesting. The birds prefer to build nests in trees of large diameters, with preference increasing with diameter. The understory vegetation within the preferred habitat is usually very sparse. Local populations are abundant in burned or cut forest where residual live and dead trees of large diameter are present.



White-headed woodpeckers are monogamous and may remain associated with their mate throughout the year (Robinson 1957). A pair builds its nest in an old tree, snag, or fallen log, always in dead wood. Every year, the pair constructs a new nest, a task that may take three to four weeks. The nests are, on average 3 m (10 ft) aboveground. The old nests are sometimes used for overnight roosting by the birds.

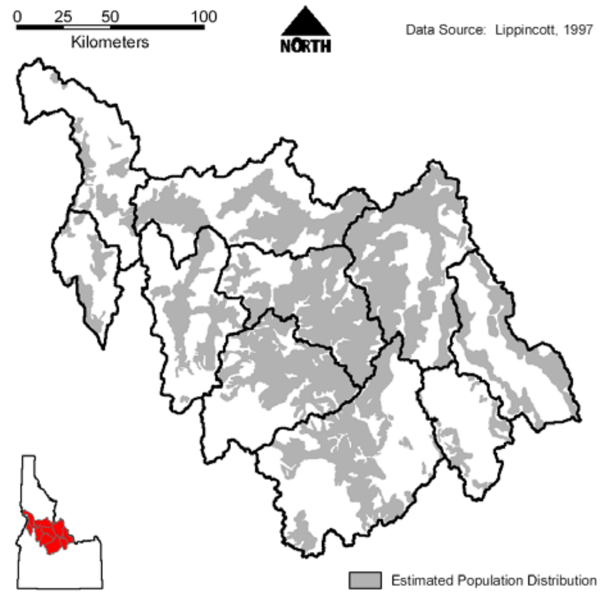
The breeding season is between May and July. The incubation period usually lasts for 14 days (Milne and Hejl 1989). The male roosts in the cavity with the young until they are fledged (Milne and Hejl 1989). The young leave the nest after about 26 days (Yom-Tov and Ar 1993). White-headed woodpeckers fledge about three to five young every year (Milne and Hejl 1989). They have one brood per breeding season, and there is no replacement brood if the first brood is lost.

The woodpeckers are not very territorial, except during the breeding season, and are essentially nonmigratory (Garrett *et al*. 1996). They are not especially social birds outside of family groups and pair bonds and generally do not have very dense populations (about one pair bond per 8 hectares) (Garrett *et al*. 1996). The territory protected is not as large as this home range, however.

Unlike other members of its genus, the white-headed woodpecker appears to subsist largely on vegetable matter, with about 50 to 90% of the diet comprised of ponderosa pine seeds; the remainder is made up of ants, beetles, other insects, and spiders (Beal 1911, Ligon 1973). When foraging for insects on conifer trunks or branches, the woodpeckers flake and chip away bark with angled strokes, using the bill as a pry, rather than by drilling the wood directly (Ligon 1973). In summer, they feed by gleaning plant foliage in needle clusters, rather than by drilling and excavating.

There are a few threats to white-headed woodpeckers, such as predation and the destruction of their habitat. Chipmunks are known to prey on the eggs and nestlings of white-headed woodpeckers (Garrett et al. 1996). Great horned owls are known to prey on adult white-headed woodpeckers. The major threat to this species, however, is the loss of its habitat and nesting sites (Cannings 1992). Logging removes the larger trees that the birds prefer to use for nesting. Fire suppression favors the replacement of pines by firs, and so the birds lose their source of food as well as their nesting sites (Raphael 1983). Population declines have been noted for white-headed woodpeckers in Idaho due to forest fragmentation and modification (Blair and Servheen 1993).

3.1.2 Flammulated Owl (*Otus flammeolus*)



The flammulated owl is the only small owl with dark blackish-brown eyes (all other small owls have a yellow iris), making it very distinctive. The owl is about 17 cm long and weighs between 45 and 63 g (1.6-2.2 lbs) (McCallum 1994). The facial disk is pale gray with rusty brown around the eyes, boldest between the eye and white eyebrows, which start at the bill and wrap around into the forehead. The chest is light gray with deep-brown or black streaks, a splash of crossbarring, and dark mottling with intermittent rust. The back has darker grays and browns, mottled with grayish-horn to gray-brown. Although the sexes are alike in appearance, the male and female can be distinguished by call (the female has a higher-pitched whining call) (McCallum 1994).

The flammulated owl is also an insectivore and one of the most migratory owls in North America. It breeds in Idaho and then leaves the state to overwinter somewhere between Central Mexico and Guatemala each year. Most owls migrate southward at the beginning of October and return to the breeding areas in late April or early May. The owl migrates primarily at night, and its migratory patterns are believed to be influenced by insect abundance (Balda *et al*. 1975).

Even though the flammulated owl has a lengthy migration, its breeding site fidelity is high, and nests are often used for multiple years. Most nest sites are in woodpecker holes or natural tree cavities, but nest boxes are also used (Bull and Anderson 1978, Smith 1981). The owl also seems to be somewhat colonial, congregating in breeding populations limited to one area while adjacent areas of optimum habitat have no birds present (McCallum 1994). The laying of eggs occurs from about mid-April through the end of May. Generally, two to four eggs are laid. The female incubates them for 21 to 22 days, and the male feeds her during this time (Cannings and Cannings 1982, Goggans 1986). The young fledge at 21 to 25 days. For the first week afterward, they stay within about 100 m (328 ft) of the nest and are fed by the adults (Linkhart and Reynolds 1987, McCallum 1994). During the second week, the young begin to learn to forage but are still supplemented by the adults (Richmond *et al*. 1980). The young become independent about 25 to 32 days after fledging (Linkhart and Reynolds 1987). Although the maximum-age recorded for a wild owl is only about eight years, the life span is probably longer than this recorded age (Reynolds and Linkhart 1990).

The flammulated owl is generally associated with dry, montane forest habitats, often with thick brush understory or sapling thickets (McCallum 1994). Its favored areas are open aspen or ponderosa pine forest where the summers are dry and warm, the insect abundance or diversity is high, and nesting cavities are available (McCallum *et al*. 1994). The owl may also occur in forests with mixes of oak, Douglas-fir, white fir, incense cedar, or sugar pine. A major factor determining habitat selection may also be related to temperatures, with upper elevation limits set by low nocturnal temperatures and lower elevation limits set by high daytime temperatures (or humidity) (McCallum *et al*. 1994).

The diet of the flammulated owl includes nocturnal arthropods like owlet moths, beetles, crickets, grasshoppers, caterpillars, centipedes, millipedes, spiders, and scorpions (McCallum 1994). The owl's prey may be taken at the ground, among foliage, and often in the air (Reynolds and Linkhart 1987, 1992). A few records exist of flammulated owls consuming prey other than insects (i.e., small mammals, birds, or lizards), but these records are suspect as some are unsubstantiated or the birds were possibly misidentified (McCallum 1994).

Predators such as red squirrels, cats, and bear raid flammulated owl nests (Richmond *et al*. 1980). Adults are also subject to predation by the Cooper's hawk (*Accipiter cooperii*) and great horned owl (*Bubo virginianus*). To date, no diseases have been found in the flammulated owl population (McCallum 1994).

The flammulated owl is considered to be one of the most abundant owls of the western pine forests, and surveys in Idaho report densities of up to 1.25 males per 40 hectares (Moore and Frederick 1991). However, anthropogenic modifications of their preferred habitat in the past century may have caused undetected increases or decreases in numbers (McCallum and Gehlbach 1988). Changes in forest structure may also change insect abundance and, therefore, impact flammulated owl populations. Reynolds and Linkhart (1992) suggested that flammulated owls have higher individual fitness in old forest habitats.

3.2 Mesic Forest

3.2.1 Pileated Woodpecker (*Dryocopus pileatus*)

The pileated woodpecker is the largest woodpecker found in Idaho and a permanent resident of deciduous or coniferous forest. The pileated woodpecker is best recognized by its large, dull-black body and brilliant-red crest. A white line extends from the bill across the cheek and down the neck. Because of its size and chisel-shaped bill (Short 1982), this woodpecker is particularly adept at excavating, and it uses this ability to construct nests and roost cavities and find food. The pileated woodpecker prefers to nest in mesic areas that are close to streams; it selects stands with the greatest basal area, greatest density of stems, and highest crown canopy.

Courtship begins in February to March, and a mated pair will share a territory all year. A clutch size of four is most common with this woodpecker. The incubation period is approximately 15 to 18 days (Kilham 1979, Harris 1982). The male and female incubate eggs alternately during the day; the male incubates at night (Bull and Jackson 1995). This woodpecker will breed after its first year and for each year thereafter (Bull and Meslow 1988). This woodpecker is known to live for at least nine years in the wild (Hoyt and Hoyt 1951, Hoyt 1952), but its life span is thought to be greater than this observed amount (Bull and Jackson 1995).

The pileated woodpecker feeds on insects, primarily carpenter ants and wood-boring beetle larvae; it also eats wild fruits and nuts (Hoyt 1957). It pries off long slivers of wood to expose ant galleries. The pileated woodpecker uses its long, extensible, pointed tongue with barbs and sticky saliva to catch and extract ants from tunnels (Hoyt 1950).

This woodpecker is adapted primarily for climbing on vertical surfaces, although it occasionally hops on the ground. It is awkward on small branches and vines when reaching for fruit. The bird is a strong flier, with slightly undulating strong flight; flight is rather slow but vigorous and direct (Sutton 1930, Short 1982). At night, the pileated woodpecker sleeps or roosts in a tree cavity, usually with multiple entrances (Bull *et al*. 1992). During conspecies conflict, there is much chasing, calling, striking with wings, and jabbing with bills (Bull and Jackson 1995). Drumming is used to proclaim a territory; it increases in frequency during early spring as courtship activities begin, and it is most frequent in the morning but can occur throughout the day (Mellen *et al*. 1992).

Known predators of the pileated woodpecker include the northern goshawk (*Accipiter gentilis*), Cooper's hawk (*A. cooperii*), red-tailed hawk (*Buteo jamaicensis*), great horned owl (*Bubo virginianus*), American marten (*Martes americana*), and gray fox (*Urocyon cinereoargenteus*) (Bull and Jackson 1995). Hawks primarily attack and chase pileated woodpeckers while in flight.

A large, nonmigratory insectivore, the pileated woodpecker may provide an important role in controlling insect outbreaks, particularly those of tree beetles. Also, this woodpecker may be a keystone species because its nest excavations provide habitat for many other species (Aubrey and Raley 2002). The pileated woodpecker hollows out nests 20 cm (7.8 inches) wide and up to 60 m (20 ft) deep.

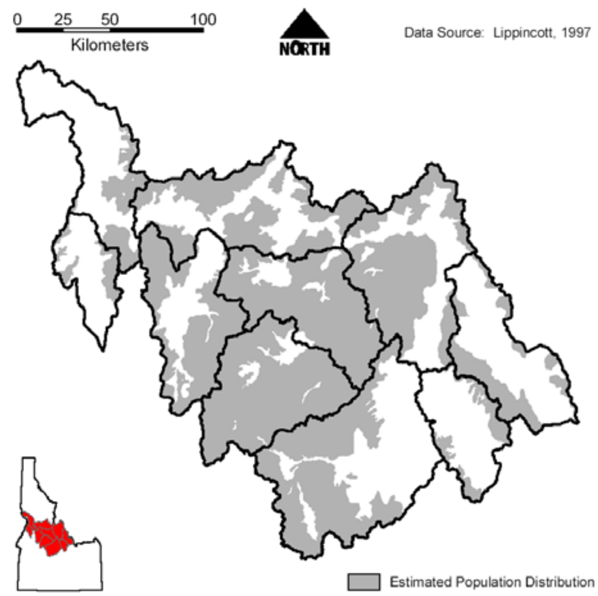
Timber harvest has had the most significant impact on the pileated woodpecker's habitat. Forest fragmentation likely reduces population density and makes the birds more vulnerable to predation as they fly between forest fragments. Removal of large-diameter live and dead trees, downed woody material, and canopy closure eliminates nest and roost sites, foraging habitat, and cover (Bull and Jackson 1995).

Historically, different groups of Native Americans hunted these birds for a variety of reasons. Some tribes believed the red head crest was a talisman against all evil (Gabrielson and Jewett 1940), while other tribes used parts of the woodpecker for medicinal purposes (Bailey 1939). Some believed that possession of the woodpecker's head gave the owner the power to seek out and capture prey (Crabb 1930).

3.2.2 American Marten (*Martes americana*)

In Idaho, the American marten is a game species that prefers to inhabit dense, old growth conifer and mixed stands. Stands must have sufficient understory to support various rodents, such as mice (Cricetids) and voles (Microtines), their major food source. Other small mammal prey include ground squirrels (*Spermophilus* spp.), flying squirrels (Glaucomys spp.), chipmunks (*Eutamias* spp.), and snowshoe hares (*Lepus americanus*). The American marten's diet can also include insects, various fruits and nuts, and passerine birds (Lensink *et al*. 1955, Allen 1984).

Martens usually den in rotten logs (Snyder 1991b). They may also den in rockslides and slash piles (Buskirk *et al*. 1989). They breed in summer and use a life history strategy of delayed implantation. Litters have between one to five young (average 3–4, and less when food is scarce), born in spring. The young are weaned in six weeks and are independent by late summer. Males are sexually mature in one year; females, in one to two years (Snyder 1991b).



Marten activity tends to peak at dusk and dawn in summer; individuals have been frequently observed by day in the winter (Snyder 1991b). The marten forages primarily on the ground but is also observed foraging in trees. The marten's home range varies but usually averages less than 10 km^2 (2,471 acres). This area increases when food becomes scarce. The male's home range tends to be larger than the female's range and may overlap with several females' ranges.

Fires that completely consume the understory and/or reduce the canopy closure to less than 30% are detrimental to American marten populations in the short term (Snyder 1991b). However, fires that create a mosaic of diverse habitats provide the best cover for American marten and their prey in the long term. Marten populations tend to increase several decades after a fire, as adequate food and cover are replaced (Koehler *et al*. 1975, Koehler and Hornocker 1977). Koehler *et al*. (1975) suggested that low-intensity fires on mesic sites where canopy cover is maintained at greater than 30% might not adversely affect American marten habitat.

American marten predators include bear (*Ursus* spp.), mountain lions, lynx, bobcats, coyotes (*Canis latrans)*, gray wolves (*C. lupus*), eagles (Accipitrines), and great horned owls (*Bubo virginianus*) (Snyder 1991b).

3.2.3 Snowshoe Hare (*Lepus americanus*)

The snowshoe hare is crepuscular (i.e., active at dawn and dusk) to nocturnal (i.e., active at night) and active year-round (Sullivan 1995). This hare tends to be shy and secretive and spends most of the day in shallow depressions, called forms, scraped out under clumps of ferns, brush thickets, and downed piles of timber (Sullivan 1995). Diurnal activity level increases during the breeding season. Juveniles are usually more active and less cautious than adults (Maser *et al.* 1981).

The breeding season for hares is stimulated by new vegetation and varies with latitude, location, and yearly events (such as weather conditions and phase of the snowshoe hare population cycle) (Bittner and Rongstad 1982). The breeding period usually starts in March and continues until July. In Idaho, snowshoe hare populations fluctuate widely over a 10- to 11-year cycle.

The gestation period is 37 days, and litters average three to five young, depending on latitude, elevation, and phase of population cycle, but can range from one to seven young (Maser *et al.* 1981, Bittner and Rongstad 1982). Deep snowpack increases the amount of upper-branch browse available to snowshoe hares in winter and, therefore, has a positive relationship with the nutritional status of breeding adults. Litters are usually smaller in the southern sections of the snowshoe hare range since there is less snow. Newborn snowshoe hares are fully furred, open-eyed, and mobile (Sullivan 1995). They leave the natal form within a short time after birth, often within 24 hours. After leaving the birthplace, siblings stay near each other during the day, gathering once each evening to nurse (Maser *et al.* 1981, Bittner and Rongstad 1982). Weaning occurs at 25 to 28 days, except for the last litter of the season, which may nurse for two months or longer (Rongstad and Tester 1971).

Female snowshoe hares can become pregnant anytime after the 35th day of gestation. The second litter can therefore be conceived before the first litter is born (snowshoe hares have twin uteri) (Bittner and Rongstad 1982). Pregnancy rates ranged from 78 to 100% for females during the period of first litter production, 82 to 100% for second litters, and varied with the population cycle for the periods of the third and fourth litters (Cary and Keith 1979).

Snowshoe hares prefer young forests with abundant understories (Sullivan 1995). The presence of cover is the primary determinant of habitat quality for snowshoe hares and is more significant than food availability (Carreker 1985) or species composition (Converse and Morzuch 1981). Species composition does, however, influence population density; dense softwood understories support greater snowshoe hare density than hardwoods do because of cover quality. Snowshoe hares occupy conifer and mixed forests in all stages of succession, but early successional forests foster peak abundance. Snowshoe hares require dense, brushy, usually coniferous cover; thermal and escape cover are especially important for young snowshoe hares (Giusti *et al*. 1992). Low brush provides hiding, escape, and thermal cover.

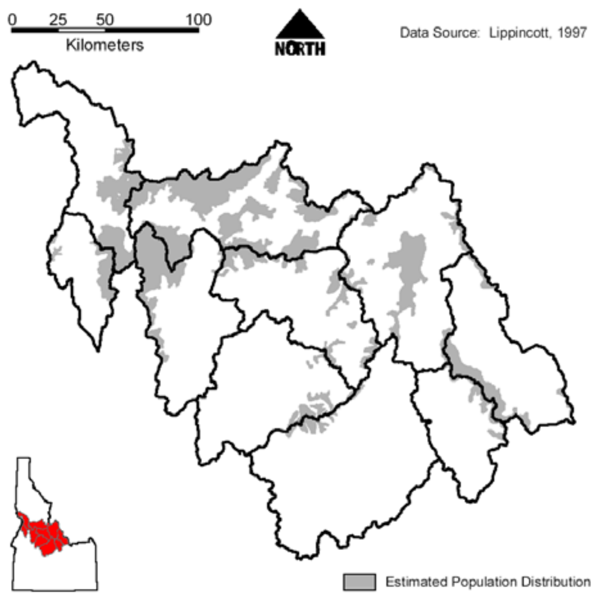
Snowshoe hares eat a variety of plant materials, and forage type varies with season (Sullivan 1995). Succulent green vegetation is consumed when available from spring to fall; after the first frost, buds, twigs, evergreen needles, and bark form the bulk of snowshoe hare diets until spring greenup (Maser *et al.* 1981, Bittner and Rongstad 1982).

The snowshoe hare is a major prey item for a number of predators. Some of the major predators include lynx, bobcats, American martens, long-tailed weasels (*Mustela frenata*), minks (*M. vison*), foxes (*Vulpes vulpes*), coyotes (*Canis latrans*), gray wolves (*Canis lupus*), mountain lions, great horned owls (*Bubo virginianus*), barred owls (*Strix varia*), other owls, red-tailed hawks (*Buteo jamaicensis*), northern goshawks (*Accipiter gentilis*), other hawks (Buteonidae), golden eagles (*Aquila chryseatos*), and crows and ravens (Corvidae) (Maser *et al.* 1981, Bittner and Rongstad 1982, Carreker 1985, Giusti *et al*. 1992). Other predators include black bears (*Ursus americanus*) (Bittner and Rongstad 1982).

The snowshoe hare is an economically important species; its economic impact varies with season, region, and population cycle (Maser *et al.* 1981). It is important prey for many furbearers (coyote, foxes, fishers, etc.) but does not itself produce fur that is economically important. Its importance as prey creates secondary effects during population lows; predators seeking other food sources during those lows often increase predation rates on preferred game species such as ruffed grouse (*Bonasa umbellus*) (Keith 1974). The snowshoe hare is a small game animal and important as food for people in some remote areas (Banfield 1974). It is a pest in tree plantations (Maser *et al.* 1981) and causes damage to both managed and unmanaged conifer stands in the Pacific Northwest (Giusti *et al*. 1992).

When Komarek (1969) compiled a table of observations of wildlife response to fire, he listed snowshoe hares as attracted to fire and smoke, present on black burns (snowshoe hares have been observed consuming ash and char), and present on newly greened burns. Snowshoe hares often abandon fresh burns if cover is sparse and nutritious browse is available elsewhere. Freshly burned clear-cuts are poor snowshoe hare habitat; however, older brushy areas are desirable. Nearly every plant that is important to snowshoe hares is favored by fire: jack pine (*Pinus banksiana*), lodgepole pine, black spruce (*Picea mariana*), quaking aspen, birches, blueberries (*Vaccinium* spp.), fireweed (*Chamerion* spp.), eastern white pine (*Pinus strobus*), white spruce (*Picea glauca*), northern white cedar (*Thuja occidentalis*), tamarack (*Larix laricina*), and eastern hemlock (*Tsuga canadensis*) are all fire followers to some extent and are used by snowshoe hares for food and/or cover (Grange 1965). Prescribed fire could be used to improve snowshoe hare habitat by creating openings and early successional habitat. Fire occurring at less than 5- to 10-year intervals may result in repeated increases and decreases in snowshoe hare populations (Grange 1965).

3.2.4 Canada Lynx (*Lynx canadensis*)



On March 24, 2000, the Canada lynx was federally listed as threatened (65 FR 16051) under the ESA. Lynx populations experience volatile swings, becoming very low about every 10 years (Burt and Grossenheider 1976, Fox 1978, Mech 1980, USFWS 1994). Therefore, the lynx can be rare in any one given area at these times.

Some female lynx can breed as yearlings (Snyder 1991c). Prey scarcity may suppress breeding (Lippincott 1997). The breeding season is from January to February, though sometimes extends into April (Nellis *et al*. 1972, Brainerd 1985). The gestation period is between 62 and 74 days (Snyder 1991c). Females give birth in March or April, sometimes in May or June, producing one litter of three to four kittens (Snyder 1991c). The maximum life span for a lynx is between 15 and 18 years in captivity (Snyder 1991c).

Lynx occur in both dense climax forests and second growth stands. In Alaska and Canada, lynx prefer boreal forests, and in the Intermountain West, they prefer spruce (*Picea* spp.)-subalpine fir (*Abies lasiocarpa*) and lodgepole pine (*Pinus contorta*) forests. Lynx are associated with dense climax forests at elevations above 1,200 m (3,937 ft) (Koehler and Brittell 1990), and they also use early seral-stage communities bordering dense forests. Because their populations are closely tied to snowshoe hare (*Lepus americanus*) numbers, lynx can also be found in second growth forests when hares are numerous (DeVos and Matel 1952, Heinselman 1973).

Lynx require a mix of early and late seral habitats to meet their food and cover needs. Early seral habitats provide lynx with a prey base, while mature forests provide denning space and hiding cover (Snyder 1991c). Pockets of dense forest must be interspersed with prey habitat. Lynx den in rotten logs, beneath tree roots, and in rock crevices. Koehler (Koehler 1990) reported that lynx use forests with a high density of downfall logs.

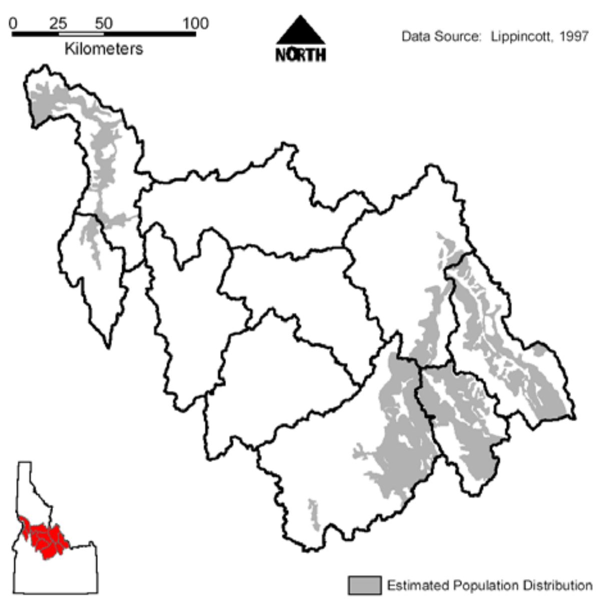
Lynx prey primarily on snowshoe hares. Their diet also includes ducks (*Anas* spp.), upland game birds, especially grouse (*Dendragapus* spp.), and various forest rodents, including squirrels (Sciurids, Spermophilids). Lynx also feed on deer, moose, and caribou carcasses. Saunders (1963) reported that lynx are able to kill these large mammals.

Predators of lynx include humans, mountain lions (*Felis concolor*), bears (*Ursus* spp.), and other lynx. Because of the cyclic nature of the population, one management strategy to ensure kitten recruitment puts a moratorium on trapping for the three years following the declining phase of lynx (USFWS 1994).

Lynx can be managed by managing for snowshoe hare, the primary prey. Hare populations increase dramatically following disturbance, particularly fire (Snyder 1991c). For instance, fires that create snowshoe hare cover and food generally benefit lynx (Heinselman 1973, Koehler and Brittell 1990). Fire may have negative short-term effects by eliminating cover for snowshoe hare and lynx. However, as succession progresses and snowshoe hares become abundant, lynx could benefit. Lynx usually do not cross openings greater than 90 m, and they use travel corridors with tree densities of 450 per hector. Therefore, fires or logging operations that create large openings without leaving travel corridors between pockets of dense forest may be detrimental to lynx (Deems and Pursley 1978, DeVos and Matel 1952, Saunders 1963, Grange 1965).

4 Native Grasslands

4.1 Vesper Sparrow (*Pooecetes gramineus)*



The vesper sparrow is a ground-dwelling bird, common in shrub-steppe and open rangelands. It is a medium-large sparrow, about 15 cm (6 inches) long and weighing on average 25 g (0.9 ounces) (Jones and Cornely 2002). The vesper sparrow is grayish-brown, with the upper and under feathers streaked with blackish-brown. The bird has a narrow whitish eye ring, flesh-colored legs and bill, pale-centered ear coverts with dark borders, and white outer tail feathers. The vesper sparrow is often confused with the song sparrow (*Melospiza melodia*) and savannah sparrow (*Passerculus sandwichensis*), both of which overlap the vesper sparrow in range and share the same habitat.

The vesper sparrow is considered a moderate habitat generalist, breeding in dry, open habitats with short, sparse, and patch herbaceous vegetation, some bare ground, and low to moderate shrub or tall forb cover (Swanson 1996). The bird generally avoids wet areas with tall, dense vegetation (Graber and Graber 1963, Best and Rodenhouse 1984). The vesper sparrow inhabits edge habitats, such as fencerows between two crop fields and edges between croplands and woodland (Berger 1968, Wiens 1969, Perritt and Best 1989). Breeding habitat includes montane meadow, grassland, prairie, and sagebrush steppe. Vesper sparrows favor grasslands having some shrub component, particularly big sagebrush (Rotenberry and Wiens 1980a).

The vesper sparrow is a partial migrant: during summer it breeds in the northern pastures and grasslands and then migrates south, some individuals as far as Mexico, for the winter. After the nesting season, groups of vesper sparrows congregate in the grasslands until mid-September, when they begin to migrate south (Bailey and Niedrach 1965).

The male vesper sparrows return alone to the north breeding areas during the first three weeks of April. The females arrive within a week of the first males (Best and Rodenhouse 1984) and build the nest alone (Rising 1996), usually in a small hollow on the ground (Berger 1968). Vesper sparrows nest from April to mid-August and, depending upon food availability, raise two clutches of about 3 to 5 chicks (Berger 1968, Gordon 2000). Male and female vesper sparrows share incubation and brooding, but the female tends to take primary responsibility. During the feeding of the chicks, the male sparrow may take responsibility, feeding them every 20 minutes (Berger 1968). On average, young vesper sparrows leave the nest between 9 and 10 days after hatch (Dawson and Evans 1960). The longevity record for a banded vesper sparrow is seven years and one month (Klimkiewicz 1997).

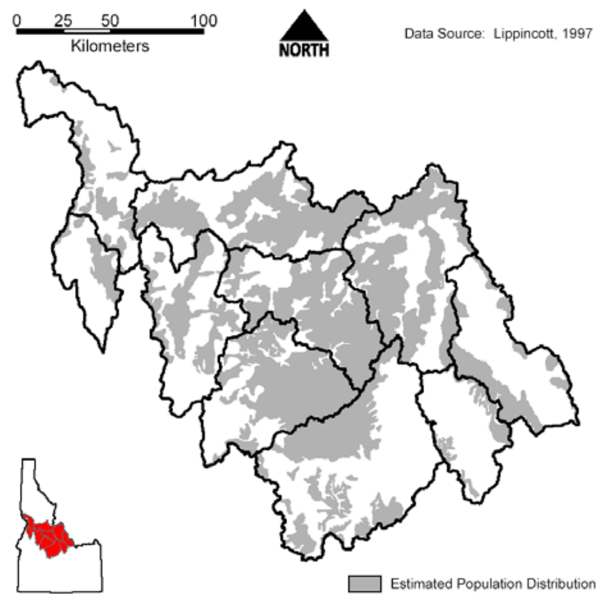
Vesper sparrows move around in response to annual rainfall, and breeding success may vary greatly among years depending on how weather affects habitat (Perritt and Best 1989). During periods of extremely hot weather and drought, vesper sparrows may abandon nests (George *et al*. 1992).

Vesper sparrows eat various invertebrates and insects, including spiders (Arachnida), beetles (Coleoptera), grasshoppers (Orthoptera), and caterpillars (Lepidoptera larvae) during the breeding season. They consume grass seeds, weed seeds, and waste grains in all seasons (Berger 1968).

Predators of the vesper sparrow include the prairie falcon (*Falco mexicanus*), red fox (Vulpes vulpes), spotted skunk (*Spilogale gracilis*), and raccoon (*Procyon lotor*) (Basore *et al*. 1986, Lima and Valone 1991, Patterson and Best 1996). Crows (*Corvus* spp.), snakes, and mammals take eggs (Wray and Whitemore 1979, Wray *et al*. 1982).

Vesper sparrows are the subject of studies on the ecology of grassland birds (Wiens 1969; Rotenberry and Wiens 1980a,b; Wiens and Rotenberry 1981; Askins 1999). Breeding and bird survey data from 1966 to 1999 show a statistically significant annual decline of 0.8% (n = 1,532, P > 0.001) throughout North America (Sauer *et al*. 2000). There is no definite information about the cause of the declines, except that in the eastern United States, declines appear to be caused by grassland loss to reforestation and urbanization. Other causes might be changes in agriculture practices, such as removal of hedgerows and more frequent mowing and haying (Santner 1992, Graham and Cotter 1996). In Oregon, local vesper sparrow population declines were probably due to elimination of grasslands (DeSante and George 1994).

4.2 Bighorn Sheep (*Ovis canadensis*)



There are two bighorn sheep subspecies in Idaho: the Rocky Mountain bighorn sheep (*O. canadensis* ssp. *canadensis*) and California bighorn sheep (*O. canadensis* ssp. *californiana* Douglas). The California bighorn sheep was listed as endangered in the State of California under the ESA on March 18,1998 (63 FR 13134). The State of Idaho lists the California bighorn sheep as a sensitive species. However, this designation applies only to bighorn sheep south of the Snake River in Idaho and not to bighorn sheep located elsewhere in the state (USFWS 1994).

California bighorns are found in desert canyons of southwestern Idaho, while Rocky Mountain bighorns are found in central Idaho.

Historical records show that Rocky Mountain bighorn sheep were widespread throughout central Idaho (IDFG 1990b). The historical records for California bighorns are less exact. It is believed that this subspecies most likely occupied the canyon and mountain habitats in the Owyhee and Bruneau river drainages of southwest Idaho. Regarding the Rocky Mountain bighorn sheep records, however, early explorers, trappers, and settlers reported that the subspecies was one of the most abundant large mammals in the state. Then, in a span of about 50 years (1880–1930), bighorn sheep populations declined and almost disappeared from Idaho. It was estimated that, by between 1920 and 1940, only 1,000 Rocky Mountain bighorn sheep remained in the Salmon River drainage (IDFG 1990b). Today, the Salmon subbasin contains approximately two-thirds of Idaho's Rocky Mountain bighorn sheep population.

Bighorn sheep are polygamous, and rams rut between November and December (Tesky 1993b). The age at which ewes attain sexual maturity is quite variable and depends mainly on their physical condition (Chapman and Feldhamer 1982). Most bighorn sheep become mature at about 2.5 years of age. Large-bodied rams may reach sexual maturity within 18 months, but smaller rams may take as long as 36 months. Very old ewes generally do not breed (Chapman and Feldhamer 1982). The gestation period is between five to six months. The majority of ewes give birth to one lamb per year, with some giving birth to two lambs. Lambing of bighorn sheep occurs between late April and late June, with most lambs being born before the end of May. Bighorn sheep lambs are precocious, and within a day or so, they climb almost as well as their mothers. Within two weeks, lambs can eat grass. They are weaned between four and six months. By their second spring, bighorn sheep are totally independent of their mother. Ewes reach their adult weight by four to five years of age, while rams do not achieve maximum weight until they are six or seven years old (Chapman and Feldhamer 1982).

Mortality is high for bighorn sheep that are 1 to 2 years of age, drops to relatively low rates for sheep between 2 to 8 years old, and then increases to a maximum for those older than 8 to 9 years. Bighorn sheep that live past this age may live to 15 to 17 years of age, but 10 to 12 years is more common (Chapman and Feldhamer 1982).

Bighorn sheep are territorial. By four years of age, individuals have established home ranges that are utilized throughout their life span (Chapman and Feldhamer 1982). They inhabit remote mountain and desert regions that are restricted to semi-open, precipitous terrain with rocky slopes, ridges, and cliffs or rugged canyons (Chapman and Feldhamer 1982, Van Dyke *et al.* 1983). Forage, water, and escape terrain are the most important components of bighorn sheep habitat (Van Dyke *et al.* 1983). Bighorn sheep have two distinct, separate summer and winter ranges (Chapman and Feldhamer 1982, Taylor *et al.* 1993). Most of the year is spent on the winter range, where the elevation is typically below 3,300 m (Tesky 1993b). The aspect is usually south or southwest (Tesky 1993b). Desert bighorn sheep rarely stray far from the base of a mountain and are usually found on eastern aspects, where they use dry gullies (Tesky 1993b). During severe weather, if snow becomes unusually deep or crusted, bighorn sheep move to slightly higher elevations where wind and sunshine have cleared the more exposed slopes and ridges (Chapman and Feldhamer 1982). The spring range is generally characterized by the same parameters as the winter range; however, bighorn sheep begin to respond to local greenups along streambanks and valleys. Bighorn sheep use areas around saltlicks heavily in the spring. Preferred lambing range is in the most precipitous, inaccessible cliffs near forage and generally has a dry, southern exposure (Chapman and Feldhamer 1982). In summer, bighorn sheep are mostly found grazing on grassland meadows and plateaus above the timberline. In early summer, south and southwestern exposures are most frequently utilized, but aspect changes to the more northerly exposures in late summer (Chapman and Feldhamer 1982). Snow accumulation seems to be the principal factor that triggers bighorn sheep to move from summer to winter ranges (Van Dyke *et al.* 1983).

Bighorn sheep obtain water from dew, streams, lakes, springs, ponds, catchment tanks, troughs, guzzlers, and developed seeps or springs (Van Dyke *et al.* 1983). Alkaline water is not suitable. Bighorn sheep spend most of their time within 1.6 km of water but have been located as far as 3.2 km from water (Tesky 1993b). Water sources more than 0.5 km from escape terrain or surrounded by tall dense vegetation tends to be avoided by bighorn sheep (Van Dyke *et al.* 1983).

Escape terrain is an important habitat requirement for bighorn sheep. Cliffs, rock rims, rock outcroppings, and bluffs with sparse cover of trees or shrubs typify escape habitat, which provides both thermal and hiding cover. While bighorn sheep are not always found in precipitous mountain areas, ewes and lambs rely on these areas for escape cover, especially during the lambing period (Chapman and Feldhamer 1982, Van Dyke *et al.* 1983, Woodard and Van Nest 1990). Visibility is another important habitat component for bighorn sheep. It allows for predator detection, visual communication, and efficient foraging (Boyd *et al*. 1986). Bighorn sheep tend to forage in open areas with low vegetation such as grasslands, shrublands, or mixes of these two. They avoid foraging on mild slopes with shrub or canopy cover in excess of 25% and shrubs 60 cm or higher. On steep slopes, they have been noted to travel through or bed in dense brush (Van Dyke *et al.* 1983).

Bighorn sheep graze primarily grasses and forbs but eat other vegetation, depending on availability (Chapman and Feldhamer 1982). They prefer green forage and move up- or downslope or to different aspects for more palatable forage. Forage areas that provide a variety of aspects are preferable because they provide green forage for longer periods (Van Dyke *et al.* 1983). Bighorn sheep eat sedges and a variety of grasses, including bluegrasses (Poa spp.), wheatgrasses, bromes, and fescues. Browse species include sagebrush, willow (*Salix* spp.), rabbitbrush, curl-leaf mountain mahogany (*Cercocarpus ledifolius*), winterfat (*Kraschnennikovia lanata*), bitterbrush, and green ephedra (*Ephedra* spp.). Forbs include phlox (*Phlox* spp.), cinquefoil (*Potentilla* spp.), twinflower (*Linnaea borealis*), and clover (*Trifolium* spp.) (Stelfox 1976, Chapman and Feldhamer 1982).

Bighorn sheep are an incidental food item in the diet of grizzly or black bears (*Ursus arctos*, *U. americanus*) and wolverines (*Gulo gulo*) and generally eaten only as carrion (Tesky 1993b). Wolves (*Canis lupus*), coyotes (*C. latrans*), mountain lions, and bobcats are other predators of bighorn sheep (Chapman and Feldhamer 1982, Van Dyke *et al.* 1983). The number of bighorn sheep taken by predators is usually of little consequence to healthy populations. Predators are most effective when locations of escape terrain or water limit sheep movement and allow predators to concentrate hunting efforts (Van Dyke *et al.* 1983). People also hunt bighorn sheep, and many hunters consider bighorn sheep to be one of the most prized game animals in North America.

Bighorn sheep are very susceptible to diseases. Incidence of lungworm infestation approaches 100% in some herds, although the level of individual infection varies depending on sheep and domestic livestock densities, range conditions, climate, season, and age. A significant correlation exists between the intensity of the lungworm infestation and the amount of precipitation in the spring of the previous year. In Washington, both wild and captive bighorn sheep have been successfully treated with the experimental drug albendazole. Further research is needed to determine the feasibility of treating remote populations (Chapman and Feldhamer 1982).

The future of bighorn sheep depends on the preservation and improvement of critical native ranges. Bighorn sheep are poor competitors with other wild and domestic ungulates, and their range is diminishing (Tesky 1993b). The effect of domestic livestock grazing on bighorn sheep is controversial and depends on the proximity and population size of competing species. Domestic livestock have been reported to have little deleterious effect if they do not graze on critical bighorn sheep winter ranges. Nevertheless, extensive competition by livestock, especially on public lands, persists and is one of the reasons for the decline in density of bighorn sheep populations (Chapman and Feldhamer 1982). Elk (*Cervus elaphus*) and deer (*Odocoileus virginianus* and *O. hemionus*) can also be serious competitors with bighorn sheep on marginal habitat (Chapman and Feldhamer 1982, Peek 1985).

Human activities on bighorn sheep range are the most widespread threat to bighorn sheep (Boyd *et al*. 1986). These activities reduce the number of bighorn sheep by decreasing habitat, causing bighorn sheep to reduce or terminate their use of prime habitat, stop migration, or split from large herds into smaller herds (Van Dyke *et al.* 1983, Boyd *et al*. 1986). Human activities responsible for declines in sheep use of an area include hiking and backpacking, snow skiing, waterskiing, fishing, motorbike use, four-wheel-drive vehicle use, construction and use of roads, urban development, and recreational development. When bighorn sheep are pushed from prime to marginal habitat, mortality usually increases and productivity decreases. Some herds have adapted to human activity (Van Dyke *et al.* 1983).

Fire is an important factor in creating habitats that are heavily used by bighorn sheep (Chapman and Feldhamer 1982, Woodard and Van Nest 1990), and many bighorn sheep populations originally occurred in areas with frequent fire intervals (Stucker and Peek 1984, Peek *et al*. 1985). For instance, bighorn sheep inhabiting the Salmon River drainage occupy a region where over 64% of their habitat has burned since 1900 (Stucker and Peek 1984). Fire exclusion for over 50 years, however, has allowed plant succession to alter many bighorn sheep habitats (Chapman and Feldhamer 1982, Easterly and Jenkins 1991). This practice has allowed conifers to establish on grasslands, decreasing both the forage and security values on many bighorn sheep ranges (Easterly and Jenkins 1991).

Burning may regenerate rangelands and enhance the production, availability, and palatability of important bighorn sheep forage species (Woodard and Van Nest 1990). Bighorn sheep heavily utilized burned winter range the two winters that followed a September 1974 fire in the East Fork Salmon River vicinity (Peek *et al.* 1985). Bighorn sheep had grazed over 66% of the plants on this burned range. Utilization was consistently higher on burned sites than on adjacent unburned sites for at least four years after the fire (Peek *et al.* 1985). Still, fire can negatively affect bighorn sheep habitat when range condition is poor and forage species cannot recover, when nonsprouting species that provide important forage for bighorn sheep are eliminated, or when too much area is burned and forage is inadequate until the next growing season. Another potentially negative effect is when other species, especially elk, are attracted to prescribed burns intended to benefit bighorn sheep (Peek *et al*. 1985).

4.3 Rocky Mountain Elk (*Cervus elaphus nelsoni*)

Rocky mountain elk are Idaho's premier big game species (IDFG 1991). In the 1800s, elk were among the most widespread and abundant large animals in northwestern North America, but by the end of the century, the elk population was reduced to low numbers due mostly to unregulated harvest and habitat destruction. In Idaho, however, elk populations have increased as a result of habitat changes and protection. In addition, wildfires in north and central Idaho created extensive brush fields, which provided abundant forage for elk, resulting in population increases (IDFG 1991).

Because elk have had a historically wide distribution, their preferred habitat also varies widely (Skovlin 1982). Populations in the mountains tend to inhabit coniferous forests associated with rugged, broken terrain or foothill ranges (Snyder 1991d). During summer, elk spend most of their time in high mountain meadows in the alpine or subalpine zones or in stream bottoms (Adams 1982). Studies of elk preferences regarding slope indicate that elk use a variety of slope percentages, although they most frequently chose slopes in the 15 to 30% class (Skovlin 1982). Elk may use more open areas during spring and summer because of earlier spring green-up (Edge *et al*. 1987). During hot summer months, elk seek shaded, cool habitats (Kuchler 1964). Elk need cover for protection against heat and extreme cold, as well as for hiding and calving. Ideal cover is grassland or meadows interspersed with forests that have large amounts of edge (Skovlin 1982). Elk use of open areas tends to decrease at 100 m from cover. Calving cover requirements vary from place to place and within populations (Skovlin 1982). Security or hiding cover is necessary in places of human disturbance (Peek 1982).

Rocky mountain elk are mostly crepuscular to nocturnal. Diurnal feeding is more common in summer than in winter (Snyder 1991d). Also, feeding periods are more prolonged in winter and concentrated in morning an evening (Snyder 1991d). In Idaho, elk herds move to lower elevations in winter to feed. Elk are ruminant herbivores; their food habits are extremely variable throughout their range.

Some elk populations prefer to graze, while others rely more heavily on browse. Grasses and forbs are preferred during spring and early summer, and woody browse is preferred during winter. Elk browse conifers in areas where snow has covered other forage. Some important elk foods include eriogonum (*Eriogonum* spp.), tidytips (*Layia* spp.), blazing-star (*Mentzelia* spp.), scalebud (*Anisocoma acaulis*), five hook bassia (*Bassia* *hyssopifolia*), alkali mallow (*Sida hederacea*), black alfalfa (*Medicago sativa*), antelope bitterbrush (*Purshia tridentata*), greasewood (*Sarcobatus vermiculatus*), galleta (*Hilaria jamesi*), knotgrass (*Paspalum distichum*), bigleaf sandwort (*Arenaria macrophylla*), spotted cat's-ear (*Hypochoeris radicata*), buckthorn plantain (*Plantago lanceolata*), trefoil foamflower (*Tiarella trifoliata*), cowparsnip (*Heracleum lanatum*), sedges (*Carex* spp.), wildrye (*Elymus* spp.), maple (*Acer* spp.), huckleberry and blueberry (*Vaccinium* spp.), larkspur (*Delphinium* spp.), western goldthread (*Coptis occidentalis*), lupine (*Lupinus* spp.), penstemon (*Penstemon* spp.), clover (*Trifolium* spp.), wheatgrass (*Agropyron* spp.), brome (*Bromus* spp.), bluegrass (*Poa* spp.), sagebrush (*Artemisia* spp.), ceanothus (*Ceanothus* spp.), currant (*Ribes* spp.), and quaking aspen (*Populus tremuloides*) (Nelson and Leege 1982).

Elk are gregarious, although some bulls may be solitary (Snyder 1991d). Males shed their antlers in March and April. Mature males defend the female herds during the rut season that extends from September through to October. Older, dominant males do most of the mating. Females breed at two years of age. Most of the births occur in the late spring and are usually a single calf, but twins are common. Gestation lasts between 249 and 262 days (Snyder 1991d).

Elk predators include people, wolves (*Canis lupus*), coyotes (*Canis latrans*), black bears (*Ursus americanus*), grizzly bears (*U. arctos horribilis*), and mountain lions (*Felis concolor*) (Taber *et al.* 1982). Elk can damage a range from overgrazing, as well as damage tree plantations, crops, orchards, and haystacks (Lyon and Ward 1982). Elk compete with cattle and may completely avoid using pastures grazed by livestock (Lyon and Ward 1982). Elk can suffer from fungal, bacterial, and viral diseases, including a parasitic meningeal worm (*Parelaphostrongylus tenuis*) carried by white-tailed deer and an arterial worm carried by mule deer (Geer *et al*. 1982).

Logging operations can negatively affect elk use of an area. Models have been developed to determine elk use of clear-cuts (Lyon 1976). Elk use increases in cutover areas as the vegetation exceeds 1.2 m (4 ft) in height and when slash in and around the cut is less than 0.5 m (1.6 ft) deep. Elk move as far away from areas near active harvest operations as topography allows, such as over ridges (Lyon 1979, Edge and Marcum 1985). Neither an undisturbed forest adjacent to a harvest operation, nor long distances from a harvest operation are as effective as topographic features in providing security cover for elk during logging (Lyon 1979). Recommendations are to log summer range in winter or reduce the length of operation and the number of concurrent harvests in any one management unit. Habitat availability will be reduced for elk within 500 to 1,000 m of an active harvest operation (Edge and Marcum 1985).

Elk avoid well-traveled forest roads from spring through fall (Edge 1982). Less well-traveled roads may receive more use, but without tree cover, elk use will diminish within 750 m (2,460 ft). Recommendations for logging and road building in critical elk habitat are listed by several authors (Kuchler 1964, Edge 1982, Thomas *et al*. 1988). For comprehensive information on the effects of logging on elk in western Montana, refer to the final report of the Montana Cooperative Elk–Logging Study (Lyon *et al.* 1985).

Prescribed fire is used routinely to create or enhance elk habitat in many western states (Snyder 1991d). Historical evidence shows that early Native Americans used fire to attract ungulates (McCabe 1982). Fire can be used to rejuvenate aspen stands, encourage early spring green-up of grasslands by reducing litter, slow or prevent conifer dominance in important foraging areas, increase palatability of foods, reduce the height of browse species, and stimulate regeneration through sprouting or heat scarification of seed (Weaver 1987, Jourdonnais and Bedunah 1990). In Glacier National Park, fires increased carrying capacity on winter range by creating a mosaic of thermal and hiding cover and forage areas (Martinka 1976). Prescribed burns in the Lochsa River drainage of Idaho produced the best results when conducted from the end of March until mid-May (Leege 1968, Leege and Godbolt 1985). Hot summer fires are needed to germinate redstem ceanothus (*Ceanothus sanguineus*), an important forage species (Weaver 1987).

5 Aspen

5.1 Quaking Aspen (*Populus tremuloides*)

Quaking aspen is in subsection Trepidae of the genus Populus. A native deciduous tree, it is small to medium-sized, typically less than 15 m (49 ft) high and 40 cm (16 inches) in diameter (Hickman 1993). It has spreading branches and a pyramidal or rounded crown (Jones and DeByle 1985, Gleason and Cronquist 1991). The bark is thin. Leaves are orb- to ovately shaped, with flattened petioles. The fruit is a tufted capsule bearing six to eight seeds. A single female catkin usually bears 70 to 100 capsules. The root system is relatively shallow, with wide-spreading lateral roots and vertical sinker roots descending from the laterals. Laterals may extend over 30 m (98 ft) into open areas (Jones and DeByle 1985).

Quaking aspen forms clones connected by a common parent root system. It is typically dieocious, with a given clone being either male or female; however, some clones produce both stamens and pistils (Jones and DeByle 1985). Quaking aspen stands may consist of a single clone or aggregates of clones. Clones can be distinguished by differences in phenology, leaf size and shape, branching habit, and bark character, as well as by electrophoresis (Perala 1990). In the West, quaking aspen stands are often even-aged, originating after a single top-killing event. Some stands, resulting from sprouting of a gradually deteriorating stand, may be only broadly even-aged (Jones and DeByle 1985). Clones east of the Rocky Mountains tend to encompass a few acres at most (Perala and Carpenter 1985), and aboveground stems are short-lived. Maximum age of stems in the Great Lakes states is 50 to 60 years. Clones in the West tend to occupy more area, and aboveground stems may live up to 150 years (Johnston and Hendzel 1985).

Optimum conditions for germination and seedling survival include a moist mineral seedbed with adequate drainage, moderate temperature, and freedom from competition (McDonough 1979). In various collections, seeds have germinated at temperatures from 0 to 39 °C (32-102 °F), with germination sharply reduced from 2 to 5 °C (35-41 °F) and progressively curtailed above 25 °C (77 °F) (Faust 1936).

Seedlings may reach 15 to 61 cm (6-24 inches) in height by the end of their first year, and roots may extend 5 to 25 cm (2-10 inches) deep and up to 41 cm (16 inches) laterally. Roots grow more rapidly than shoots; some seedlings show little top-growth until about their third year. During the first several years, natural seedlings grow faster than planted seedlings but not as fast as sprouts. High mortality characterizes young quaking aspen stands regardless of origin. In both seedling and sprout stands, natural thinning is rapid. Stems that occur below a canopy die within a few years (Perala 1990).

Quaking aspen is the most widely distributed tree and a major cover type in North America. Distribution is patchy in the West, with trees confined to suitable sites. Quaking aspen occurs in a large number of other forest cover types over its extensive range. It grows on moist upland woods, dry mountainsides, high plateaus, mesas, avalanche chutes, talus, parklands, gentle slopes near valley bottoms, and alluvial terraces, as well as along watercourses. In the Rocky Mountains, quaking aspen groves are scattered throughout Engelmann spruce-subalpine fir (*Picea engelmannii-Abies lasiocarpa*) forests. Prostrate quaking aspen occur above the timberline (Perala and Carpenter 1985). Throughout its range, quaking aspen occurs in mid to upper riparian zones (Franklin and Dyrness 1973, Perala 1990). Quaking aspen grows on soils ranging from shallow and rocky to deep loamy sands and heavy clays. Good quaking aspen sites are usually well-drained, loamy, and high in organic matter and nutrients (Perala 1990). Cryer and Murray (1992) stated that stable quaking aspen stands are found on only one soil order, mollisols, and a few soil subgroups, of which Agric Pachic Cryoborolls and Pachic Cryoborolls are dominant. The best stands in the Rocky Mountains and Great Basin are on soils derived from basic igneous rock such as basalt and from neutral or calcareous shales and limestones. The poorest stands are on soils derived from granite.

Quaking aspen is not shade tolerant (Perala 1990), nor does it tolerate long-term flooding or waterlogged soils (Perala 1990). Even if quaking aspen survives flooding in the short term, stems subjected to prolonged flooding usually develop a fungus infection that greatly reduces stem life (and renders the wood commercially useless) (Davidson *et al*. 1959). Quaking aspen readily colonizes after fire, clear-cutting, or other disturbances.

Quaking aspen is seral to conifers in most of its range in the West and in some portions of its eastern range. Still, quaking aspen is apparently stable on some sites. These stands can remain stable for decades but eventually deteriorate. Deteriorating stands are often succeeded by conifers, but shrubs, grasses, and/or forbs gain dominance on some sites. Succession to grasses and forbs is more likely on dry sites and is more common in the West than in the East.

Quaking aspen forests provide important breeding, foraging, and resting habitat for a variety of birds and mammals. Wildlife and livestock utilization of quaking aspen communities varies with species composition of the understory and relative age of the quaking aspen stand. Young stands generally provide the most browse. Quaking aspen crowns can grow out of reach of large ungulates in six to eight years (Patton and Jones 1977). Although many animals browse quaking aspen year-round, it is especially valuable during fall and winter when protein levels are high relative to other browse species (Tew 1970).

Quaking aspen is palatable to all browsing livestock and wildlife species (DeByle 1985). The buds, flowers, and seeds are palatable to many bird species including numerous songbirds and grouse. Elk browse quaking aspen year-round, feeding on bark, branch apices, and sprouts. Quaking aspen is important forage for mule and white-tailed deer. Deer consume the leaves, buds, twigs, bark, and sprouts. New growth on burns or clear-cuts is especially palatable to deer. Quaking aspen is valuable moose browse for much of the year (Brinkman and Roe 1975). Moose utilize it on summer and winter ranges. Young stands generally provide the best quality moose browse. However, researchers in Idaho found that in winter, moose browsed mature stands of quaking aspen more heavily than they browsed nearby clear-cuts dominated by quaking aspen sprouts (Ritchie 1978).

6 Juniper/Mountain Mahogany

6.1 Curl-leaf Mountain Mahogany (*Cercocarpus ledifolius*)

A native, xerophytic, evergreen shrub or small tree, curl-leaf mountain mahogany grows up to 10.6 m (35 ft) tall and 0.9 m (3 ft) in diameter (Davis 1990). The thick, tortuous, leaf-scarred branches arise from a short trunk and form a round or umbrella-shaped crown. Leaves are broadly elliptic to lanceolate, 12 to 25 mm (0.5-1.0 inches) long, leathery, somewhat resinous, and curled under at the margins. Flowers are borne singly or in rows of three in the leaf axils. Achenes retain their long, plumose styles. The roots of curl-leaf mountain mahogany play a key role in its ability to inhabit water- and nutrient-deficient substrates. Dealy (1978) suggested that a combination of initial rapid root growth and slow top growth might help curl-leaf mountain mahogany out-compete its associates.

Curl-leaf mountain mahogany can be extremely long-lived, with some trees in Nevada aged at over 1,350 years. In Idaho, curl-leaf mountain mahogany plants at least 150 years old were found; older stems had rotten cores that made accurate aging impossible (Scheldt and Tisdale 1970).

Curl-leaf mountain mahogany occurs throughout the Rocky Mountains and Intermountain West in shrub ecotones or mountain brush communities, in open forests, on ridgetops, and on rock outcrops (Davis 1990). Curl-leaf mountain mahogany usually occurs in isolated, pure patches that are often very dense. In mid-elevation forests, it does not develop dense canopies. It is commonly associated with limber pine (*Pinus flexilis*), lodgepole pine (*P. contorta*), ponderosa pine (*P. ponderosa*), Douglas-fir (*Pseudotsuga menziesii*), Englemann spruce (*Picea engelmannii*), subalpine fir (*Abies lasiocarpa*), and white fir (*A. concolor*) (Bradley *et al.* 1992); it may also occur with quaking aspen (*Populus tremuloides*) and whitebark pine (*Pinus albicaulus*) above 2,743 m (9,000 feet).

As a codominant member of the sagebrush-forest ecotone in Idaho, curl-leaf mountain mahogany is associated with snowberry (*Symphoricarpos* spp.), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), bluebunch wheatgrass (*Pseudoroegneria spicata*), Sandberg bluegrass (*Poa secunda*), Idaho fescue (*Festuca idahoensis*), and Columbia needlegrass (*Achnatherum nelsonii*) (Scheldt and Tisdale 1970).

Curl-leaf mountain mahogany is good forage for all classes of browsing animals in both summer and winter (Stanton 1974, Davis 1990). It is one of the few browse species that meets or exceeds the protein requirements for wintering big game animals (Davis 1990). In Idaho, curl-leaf mountain mahogany is very palatable to bighorn sheep and mountain goats (Dittberner and Olson 1983). In mature stands, much of curl-leaf mountain mahogany foliage is out of reach of browsing animals but provides excellent winter cover (Stanton 1974).

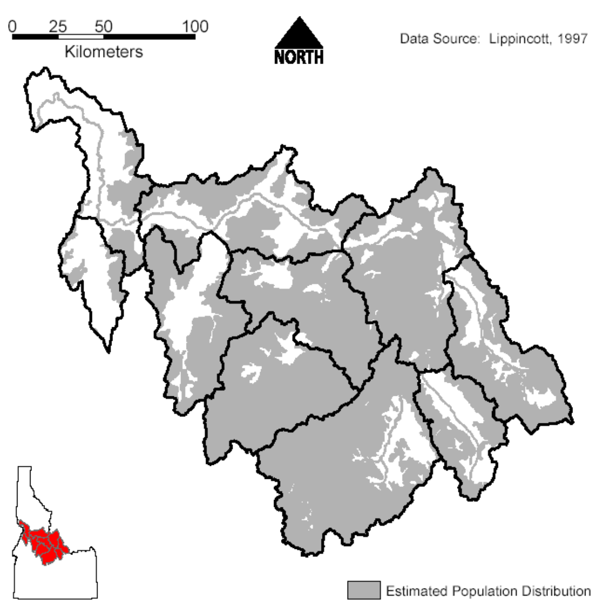
Curl-leaf mountain mahogany may be planted to help stabilize soil in disturbed areas such as roadcuts and mine spoils (Hungerford 1984). Because of its tolerance to heat and drought, curl-leaf mountain mahogany can be used for water-efficient landscaping in arid environments (Gutknecht 1989).

Fire usually kills curl-leaf mountain mahogany. A wildfire occurred at Moose

Creek in the Salmon National Forest, Idaho, in August of 1979. Most of the curl-leaf mountain mahogany plants that were 40 to 80 years old and growing on gentle to moderate slopes near the origin of the fire (which burned with “considerable” severity) were killed. Only lightly seared curl-leaf mountain mahogany survived. Intense heat alone may cause mortality in curl-leaf mountain mahogany by searing green growth.

Curl-leaf mountain mahogany seedlings establish after fire, although establishment may be slow. A curl-leaf mountain mahogany stand near MacKay, Idaho, had burned around 1900. In 1968, it contained plants ranging from 8 to 54 years of age (Scheldt and Tisdale 1970). A stand that burned in 1965 showed no signs of regeneration by 1968. However, Collins (1980) described excellent seedling emergence in post-fire year one after a 1979 wildfire in the Salmon National Forest, possibly due to an unusually wet growing season.

6.2 Moose (*Alces alces*)



The moose is the largest member of the deer family, with mature bulls weighing about 450 kg (992 lbs) (Snyder 1991e). The species is distributed throughout most of northern, central, and southeastern Idaho, but information on abundance is limited (IDFG 1990c). Moose populations fluctuate periodically in any given location, sometimes abundant and other times reaching critically low numbers. Populations are influenced by weather, predators, food availability, and human disturbance, particularly hunting pressure (Davis and Franzmann 1979, Bishop 1988).

Moose breed between September and late October, with gestation lasting between 240 and 246 days (Lippincott 1997). The calving season occurs from May through early June, with females producing one calf; occasional twinning occurs if females receive more than adequate nutrition. The life span of a moose is 20 years or more, with the average at 16 years (Peterson 1955). Moose are capable of reproducing at 16 months; however, females usually produce their first calf at 2 to 3 years (Snyder 1991e). Generally, moose reach full maturity at 5 or 6 years, with maximum fecundity for 10 to 11 years (Snyder 1991e). Only the males have antlers, which are shed between November and January.

Moose are found throughout the boreal forests of North America. They inhabit jack pine (*Pinus banksiana*)-balsam fir (*Abies balsamea*) forests mixed with paper birch (*Betula papyrifera*) and quaking aspen (*Populus tremuloides*). They also inhabit white spruce (*Picea glauca*)-black spruce (*P. mariana*) forests mixed with birch (*Betula* spp.) and willow (*Salix* spp.) (Crete 1988, Rowe and Scotter 1973). In the West, moose inhabit Douglas-fir (*Pseudotsuga menziesii*)/ninebark (*Physocarpus* spp.) habitat types, with snowberry (*Symphoricarpus albus*), redosier dogwood (*Cornus sericea*), and willow. Moose are also found in grand fir (*Abies grandis*)-Pacific yew (*Taxus brevifolia*) forests and subalpine fir (*Abies lasiocarpa*)- Engelmann spruce (*Picea* *engelmannii*) types with aspen (Gordon 1976, Pierce 1984, Pierce and Peek 1984). Moose use riparian communities and herbaceous bogs. They are capable of altering the species composition of plant communities and the overall character of communities through overbrowsing (Euler 1975, Chadde and Kay 1988).

Moose habitat preferences vary with the season. In summer, moose can be found in open plant communities where forage is abundant, such as riparian communities and cutover stands older than 15 years. Moose seem to use bogs and other aquatic areas more frequently in summer and in disproportion to their availability (Bishop and Rausch 1974). During winter, moose prefer forested areas and move into denser, conifer-dominated forests as the winter progresses. In mountainous areas of the West, moose concentrate at elevations below 1,067 m during winter. During summer, they move to higher elevations, usually above 1,524 m (Pierce and Peek 1984, Matchett 1985, Costain 1989). Moose distribution in winter is limited by the availability of woody food plants and by snow conditions, such as depth, density, hardness, and duration (Krefting 1974, Davis and Franzmann 1979).

Moose need a variety of habitats, from dense coniferous forests to more open aquatic and riparian communities with some cover (Snyder 1991e). Moose seek dense forests during mid to late winter as snows deepen and harden. Cover becomes more essential than forage during winter (Phillips *et al*. 1973, Irwin 1975, Ritchie 1978, Peek *et al*. 1982).

Pierce and Peek (1984) noted that, in winter, moose in the Clearwater River drainage of Idaho use dense stands characterized by broken canopies and dominated by subalpine fir (*Abies lasiocarpa*) and grand fir, with Pacific yew as the dominant understory and preferred forage. Allen *et al*. (1987) reported that the quality of winter cover increases as the proportion of conifers increases. Ideal winter range is composed of conifers taller than 6 m, with a canopy closure of 75% or greater. Cover becomes critical during severe winters in areas where snow depth exceeds 100 cm because at these depths moose are impeded (Krefting 1974, Allen *et al*. 1987, Timmermann and McNicol 1988). For calving, cows need dense cover bordering younger stands that provide substantial food. Cow/calf movements are restricted because calves cannot wade through deep snow.

Moose are generalist, ruminant herbivores. Their foods encompass several hundred species worldwide, but moose usually eat about 25 to 30 species in any one locale (Timmermann and McNicol 1988). Throughout their range in North America, moose most commonly browse on alder (*Alnus* spp.), cottonwood (*Populus* spp.), willow, birch, aspen, and balsam fir. Other species frequently found in moose diets are serviceberry (*Amelanchier* spp.), mountain ash (*Sorbus* spp.), bush honeysuckle (*Diervilla lonicera*), dogwood, mountain maple (*Acer spicatum*), Rocky Mountain maple (*Acer glabrum*), viburnum (*Viburnum* spp.), currant (*Ribes* spp.), ceanothus (*Ceanothus* spp.), huckleberry (*Vaccinium* spp.), cherry (*Prunus* spp.), Pacific yew, and wild sarsaparilla (*Aralia nudicaulis*). Moose also eat various species of mushrooms, sedges (*Carex* spp.), grasses such as bluegrass (*Poa* spp.) and brome (*Bromus* spp.), lichens (*Peltigera* spp.), and forbs such as fireweed (*Epilobium* spp.) and lupine (*Lupinus* spp.) (Peterson 1955, Spencer and Hakala 1964, LeResche and Davis 1973, Cushwa and Coady 1976, Ritchie 1978, Pierce 1984, Allen *et al*. 1987). Some preferred aquatic species include water horsetail (*Equisetum fluviatile*), burreed (*Sparganium* spp.), and pondweed (*Potamogeton* spp.) (Peek 1974).

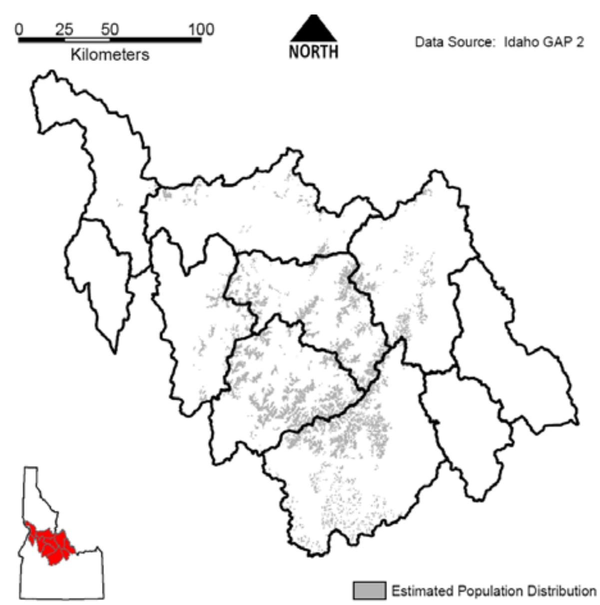
Moose predators include humans, wolves (*Canis lupus*), grizzly bears (*Ursus arctos horribilis*), and black bears (*U. americanus*) (Peterson 1955, LaChapelle *et al*. 1984). Moose tend to be more vulnerable to exploitation by people than deer and elk are because moose are less wary, more conspicuous, and often frequent at roadsides. Consequently, they are especially susceptible to hunting and poaching and being hit by vehicles (IDFG 1990c).

In the past, wildlife managers have assumed that clear-cuts were beneficial to moose because such cuts favor abundant browse production (Snyder 1991e). In general, this assumption is true; however, moose require at least some cover during every season and usually will not venture into large, open areas with no hiding cover (Snyder 1991e). Stelfox *et al*. (1976) reported that moose used clear-cuts after 17 years following the cut only if adequate shelter was available in interspersed stands nearby. Matchett (1985) reported that moose select cutover areas that are more vegetated than not; these cut areas are usually at least 10 to 30 years old. Costain (Costain 1989) recommended maintaining timber in stream bottoms with a minimum of 91 m between cutting units. In most cases, moose will not use clear-cuts until adequate cover has been established, usually in 15 years. Moose select for edges along islands of residual timber within cuts, as opposed to edges of large cuts (McNicol and Gilbert 1980). Pierce and Peek (1984) recommended maintaining grand fir old growth with a yew understory because of the importance of this type to wintering moose.

Occasionally, moose are trapped and killed by fire (Gasaway and DuBois 1985). An extensive review of the literature indicates that fire generally enhances moose habitat by creating and maintaining seral communities and is considered beneficial to moose populations (LeResche *et al*. 1974, Davis and Franzmann 1979, MacCracken and Viereck 1990). The beneficial effects of fire on habitat were estimated to last fewer than 50 years, with moose density peaking 20 to 25 years following fire (LeResche *et al*. 1974). A study in Idaho showed that burning Rocky Mountain maple increased its crude fiber content, resulting in decreased digestibility. Moisture and crude protein in willow and serviceberry (*Amelanchier alnifolia*) increased significantly during post-fire year one but began to decrease by post-fire years two and three (Asherin 1973). Bangs *et al*. (1983) stated that calf recruitment could be low in springs following fires that reduce vegetation on wintering grounds.

7 Whitebark Pine

7.1 Whitebark Pine (*Pinus albicaulis*)



Whitebark pine is a slow-growing, long-lived, ectomycorrhizal, native conifer characteristic of the tree line (Ahlenslager 1987). Trees often reach 400 to 700 years of age. The oldest known cored tree is 750 years old and is in Mount Robson Provincial Park, British Columbia (Arno and Hoff 1990). In

Crowsnest Forest, Alberta, the largest whitebark pine is 37 m (121 ft) high and 79 cm (31 inches) in dbh (Day 1967). The largest reported whitebark pine in the United States is in the Sawtooth Range of central Idaho; it is 21 m (69 ft) high and 2.9 m (9.5 ft) in dbh (Pitel and Wang 1980, Arno and Hoff 1990).

Trees in well-developed stands are 15 to 20 m (50-65 ft) tall and 60 to 90 cm (24-35 inches) in diameter (Ahlenslager 1987). Growing at the uppermost limits of growth, trees are usually dwarfed or contorted. At the upper tree line, this species takes on a spreading growth form and grows in isolated cushions of “alpine scrub” that are between 0.3 and 1 m tall (1-3 ft) (Ahlenslager 1987).

Whitebark pine trees commonly have two or more trunks that are often partially fused at the base. Electrophoretic evidence revealed that two or more trunks of what appears to be a single tree are indeed separate trees with distinct genotypes. This finding supports the idea that several mature trees can arise from single seed caches (Luckman *et al*. 1984) and that seeds cached by Clark’s nutcrackers are instrumental in establishing trees (Steele *et al*. 1983). On most sites, trees develop a deep and spreading root system (Arno and Hoff 1990).

The minimum seed-bearing age of whitebark pine is between 20 and 30 years, and the interval between large seed crops is 3 to 5 years (Ahlenslager 1987). On most sites, significant amounts of seed occur only on trees older than 80 years (Tomback 1986). Large seed crops are produced at irregular intervals, interrupted by smaller crops and crop failures (Lanner 1980). Cone production fluctuates widely between years, and variations in seed crops may play an important role in the initial establishment of a stand (Ahlenslager 1987).

Whitebark pine grows on dry, rocky sites on high mountains between 1,800 m and 3,030 m (5,905-9,941 ft). It is characteristic of tree line, where it forms dense krummholz thickets. The dispersal of whitebark pine seeds by Clark’s nutcrackers strongly affects the distribution and abundance of this species (Tomback 1978). Trees occur on dry, rocky, subalpine slopes and exposed ridges. Stands are generally open, with undergrowth of low shrubs, forbs, and grasses (Hitchcock *et al*. 1969, Arno 1986). Sites where whitebark pine occurs as a climax species are drier than sites where it is seral.

Whitebark pine is important in areas where the mean annual precipitation is 60 to 80 cm (24-32 inches) (Arno and Hoff 1990). The climate is characterized by cool summers and cold winters with deep snowpack. Trees have high frost resistance and low shade tolerance. Trees are also found predominately on acidic substrates, although they have also been reported on calcareous ones. Most soils under whitebark pine stands are Inceptisols (Ahlenslager 1987).

In upper-elevation subalpine forests, whitebark pine is generally seral and competes with and is replaced by more shade-tolerant trees. Subalpine fir, a very shade-tolerant species, is the most abundant associate and most serious competitor of whitebark pine. Although whitebark pine is more shade tolerant than lodgepole pine and subalpine larch (*Larix lyallii*), it is less shade tolerant than Engelmann spruce and mountain hemlock (*Tsuga mertensiana*) (Ahlenslager 1987). Whitebark pine is the potential climax species on high, exposed tree-line sites and exceptionally dry sites (Arno and Hoff 1990). It sometimes acts as a pioneer species in the invasion of meadows and burned areas (Forcella and Weaver 1977). On dry, wind-exposed sites, the regeneration of whitebark pine may require several decades, even though it is often the first tree to become established (Weaver and Dale 1974, Arno and Hoff 1990).

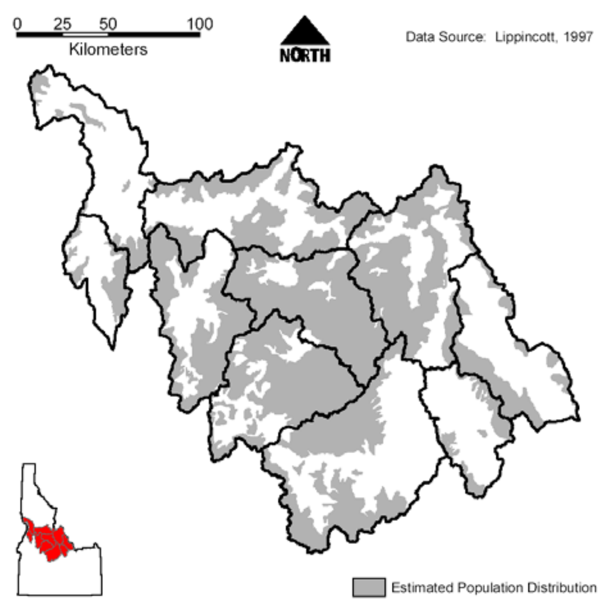
The distribution of seral whitebark pine is strongly affected by the dispersal of seeds by Clark's nutcrackers (Tomback 1978). The fact that bird dispersion of seed occurs allows whitebark pine to be more widespread as a seral species. The dispersal of seeds by them throughout subalpine habitats is partly responsible for the status of whitebark pine as a pioneer and post-fire invader (Steele *et al.* 1983). Additional birds that feed on whitebark pine seeds include Williamson's sapsucker (*Sphyrapicus thyroideus*), white-headed woodpecker (*Picoides albolarvatus*), mountain chickadee (*Poecile gambeli*), white-breasted nuthatch (*Sitta carolinensis*), Cassin's finch (*Carpodacus cassinii*), red crossbill (*Loxia curvirostra*), pine grosbeak (*Pinicola enucleator*), and blue grouse (*Dendragapus obscurus*) (Tomback 1978, 1981, 1982).

Bears are also known to regularly eat pine seeds in spring (March to June) and fall (September and October). Most whitebark pine seed eaten by grizzly and black bears are from red squirrel cone caches. Rodents, such as red squirrels, Douglas squirrels, ground squirrels, and chipmunks, store large quantities of intact cones in middens at the base of trees or underground in caches. Although deer mice cannot gnaw the cones, they eat and cache loose seeds (Kendall 1981, Tomback 1982).

Whitebark pine survives where tree growth is limited and provides hiding and thermal cover for wildlife (Ahlenslager 1987). Cavity-nesting birds use tree trunks and snags. Mule deer, elk, and predatory animals also use whitebark habitat (Pfister *et al.* 1977, Tomback 1981).

An assessment of the interior Columbia River basin found that the area of whitebark pine cover types has declined 45% since the turn of the century (Keane 1995). Most of this loss occurred in the more productive, seral whitebark pine communities: 98% of them have been lost. Practically all of the remaining whitebark pine stands are old. Daubenmire and Daubenmire (1968) found that squirrel pressures on seed crops and blister rust damage are factors in the decline of whitebark pine populations in Idaho and Washington. In addition, regeneration of whitebark pine is sporadic. Rust infection rates in the Sawtooth National Recreation Area in central Idaho are generally light, but low elevations may harbor some heavily infected sites (Smith 1995). Mortality and rust infection levels decline in the drier areas to the south. In addition, successional replacement due to fire exclusion has also contributed to whitebark pine decline (Keane *et al.* 1994, Arno 1995). Whitebark pine cannot maintain its functional role in mountain ecosystems unless areas suitable for its regeneration are available across the landscape (Arno 1995).

7.2 Clark's Nutcracker (*Nucifraga columbiana*)



The Clark's nutcracker is distinctive in appearance and behavior and not easily confused with any other species within its range. The sexes are similar in appearance. The bird is light to medium gray, with varying amounts of white around the eyes, on the forehead, and on the chin. The tail and wings are glossy black, with white at the base of the tail and secondary wing feathers and around the vent. The pointed bill is black and accompanied with short nasal bristles.

Pine seeds are the primary food for both the adults and nestlings, although the bird is known to eat insects, acorns, berries, snails, carrion and sometimes eggs of small birds (Mulder *et al*. 1978, Tomback 1978, Tomback and DeWolfe 1981). The Clark's nutcracker is also aggressive enough to prey upon small vertebrates, such as ground squirrels (*Spermophilus* spp.), chipmunks (*Tamias* spp.), and voles (*Microtus*) (Mulder *et al.* 1978).

Several pines depend on nutcrackers for seed dispersal. One is the whitebark pine. The interaction between whitebark pine and the Clark's nutcracker is mutualistic and a result of coevolution (Tomback 1982). Clark's nutcrackers have evolved a sublingual throat pouch in which to carry pine seeds to sites where they cache them (Bock *et al*. 1973). The birds bury the pine seeds about 1 cm (0.4 inches) below the soil surface in groups of one to five. A nutcracker can carry as many as 150 seeds in its throat pouch and store 850 seeds per day. Over a 42-day period, one bird may cache as many as 32,000 seeds. Birds harvest and cache seeds in the late summer and fall for use during the following winter and spring. Nutcrackers store three to five times their energetic requirements, so more seeds are buried than recovered. Seed dispersal by the Clark's nutcracker has, therefore, resulted in ring tree cluster growths and altered the whitebark pine's genetic population structure compared with that of wind-dispersed pines (Furnier *et al*. 1987, Schuster and Mitton 1991, Carsey and Tomback 1994, Tomback and Schuster 1994).

As early as July, the nutcracker begins to eat unripe seeds from new pinecones, usually at upper montane or subalpine elevations. Storage of ripe pine seeds begins by early September; a few weeks later, many birds switch to new seed sources, usually migrating to lower elevations. The nutcracker may continue making seed stores through December. During winter, the bird harvests the seeds remaining in cones and uses the more accessible seed stores. Nesting begins as early as January or February, despite harsh winter weather. Both sexes participate in building the nest, incubating the eggs, and feeding the young (Mewaldt 1956). Females lay between two and six eggs that hatch in about 18 days (Mewaldt 1956). Fledglings leave the nest about 20 to 22 days after hatching (Mewaldt 1948). Although there is no data on survivorship, the bird is known to live for at least 17 years (Kennard 1975).

The Clark's nutcracker is moderately social and tends to form loose flocks (Tomback 1998). It is vigilant for predators during all activities and will mob avian predators like the red-tailed hawk (*Buteo jamaicensis*) and great horned owl (*Bubo virginianus*) (Johnson 1900). The species is also known to provoke and chase small raptors like the American kestrel (*Falco sparverius*) and sharp-shinned hawk (*Accipiter striatus*). The Clark's nutcracker is also relatively tolerant of people; in national parks, the bird frequents scenic turnouts, picnic areas, and campgrounds for food handouts from tourists.

There is little information on the causes of mortality for the Clark's nutcracker, although predation by raptors is one factor. Habitat loss and availability of seeds from large seeded conifers are probably the principal factors in regulating population size.

7.3 Black Bear (*Ursus americanus*)

The black bear is found throughout the Salmon subbasin. There are a total of 16 subspecies in the United States; at least 2 subspecies are found in Idaho: *U. americanus* ssp. *altifrontalis* and *U. americanus* ssp. *cinnamomum*. Black bears are abundant in most parts of the West, but some eastern populations are at critically low levels (Jonkel 1978).

In Idaho, the black bear breeding season occurs between June and July (Lippincott 1997). Black bears will mate about every 2 years. Implantation is delayed about 4 months, until October or November. The gestation period lasts an average of 220 days, with the females giving birth sometime between January and February (Snyder 1991f). A female will have one to three cubs on average, and the cubs remain with their mother for 1 to 2 years. Black bears mature at about 3 to 5 years and may live for as long as 30 years (10 years in the wild is average) (Snyder 1991f). Black bears also hibernate for 4 to 7 months between October and May (Burt and Grossenheider 1976, Jonkel 1978, Folk *et al*. 1980, Hamilton and Marchinton 1980, Pelton 1987).

Black bears prefer forested and shrubby areas but use wet meadows, high tidelands, ridgetops, burned areas, riparian areas, and avalanche chutes (Pelton 1987). They also frequent swampy hardwood and conifer forests (Manville 1983). Black bears prefer mesic over-dry sites and timbered over-open areas (Unsworth *et al*. 1989). After emerging from their winter dens in spring, they seek southerly slopes at lower elevations for forage and move to northerly and easterly slopes at higher elevations as summer progresses (Jonkel 1978, Young and Beecham 1986, Unsworth *et al*. 1989).

Black bears use dense cover for hiding and thermal protection, as well as for bedding (Jonkel 1978). They climb trees to escape danger and use forested areas as travel corridors. Black bears hibernate during winter, and so they build dens under logs or rocks or in tree cavities, banks, caves, culverts, or shallow depressions (Hamilton and Marchinton 1980, Young and Beecham 1986).

Black bears eat a wide variety of foods, relying most heavily on grasses, herbs, fruits, and mast (Jonkel 1978). They also feed on carrion and insects such as carpenter ants (*Campanotus* spp.), yellow jackets (*Vespula* spp.), bees (Apidae), and termites (*Isoptera*) (Beeman and Pelton 1980, Graber and White 1983). Black bears sometimes kill and eat small rodents and ungulate fawns. Some common plant foods are oak (*Quercus* spp.) and hazel (*Corylus* spp.) mast, mountain ash (*Sorbus* spp.), tree cambium, dogwood (*Cornus* spp.), manzanita and kinnikinnick (*Arctostaphylos* spp.), cranberry (*Vibernum* spp.), blueberry and huckleberry (*Vaccinium* spp.), raspberry and blackberry (*Rubus* spp.), rose hips (*Rosa* spp.), gooseberry (*Ribes* spp.), sarsaparilla (*Aralia nudicaulis*), rhubarb

(*Polygonum alaskanum*), lupine (*Lupinus* spp.), northern bedstraw (*Galium boreale*), lousewort (*Pedicularis* spp.), Labrador tea (*Ledum groenlandicus*), California coffeeberry (*Rhamnus californicus*), squawroot (*Conopholis americana*), dandelion (*Taraxacum officinale*), clover (*Trifolium* spp.), thistle (*Cirsium* spp.), buffaloberry (*Shepherdia canadensis*), lomatium (*Lomatium* spp.), cowparsnip (*Heracleum lanatum*), and pine nuts (Jonkel 1978, Beeman and Pelton 1980, Jorgensen 1983, Young and Beecham 1986, Rogers and Allen 1987). Black bears also eat salmon (*Oncorynchus* spp.) and are known to raid orchards, beehives, and crop fields (Kelleyhouse 1980, Pelton 1987, Elowe and Dodge 1989). They pick from garbage dumps and trash bins of private homes. Black bears may occasionally prey on domestic sheep and pigs when their natural foods are scarce (Jorgensen 1983).

Black bear predators include humans, grizzly bears (*Ursus arctos*), and other black bears. Coyotes (*Canis latrans*) may prey on cubs (Jonkel 1978).

Black bears are as much an important game species as they are the center of controversy across the continent (Snyder 1991f). Because their behavior has been little understood, black bears have been feared and hated (Jonkel 1978). They have also been portrayed as harmless play toys by film and television. Their low reproductive rate and late sexual maturation make them vulnerable to overharvest (Gill and Beck 1990. Both habitat encroachment by humans and the active foraging habits of bears have created man–bear conflicts (Manville 1983, Rogers and Allen 1987, Elowe and Dodge 1989).

Logging can have both positive and negative effects on black bear populations. Many studies show that black bears will use clear-cuts older than 10 years, but in some areas, cuts are not used for 20 years (Young 1984, Young and Beecham 1986). Black bears will use cutover areas if fruit-producing shrubs are present and hiding cover is available. A study in northern Idaho revealed that selection-cuts were the most important habitat component for black bears because these units provided more food and cover than clear-cuts or mature stands did (Young 1984, Young and Beecham 1986). Intensive scarification of clear-cuts can kill important food plants or eliminate them for long time periods (Young 1984, Young and Beecham 1986). Many authors list management strategies for timber harvesting in bear habitat (Young 1984, Young and Beecham 1986, Rogers and Allen 1987, Unsworth *et al*. 1989).

Direct fire-caused mortality probably has little effect on populations as a whole (Landers 1987). Fires that favor early and mid seral fruit-producing shrubs and plentiful grasses and forbs are beneficial to bears (Snyder 1991f). Many bear foods are enhanced by fire (Heinselman 1973, Hanson 1979, Hall and Shay 1981). Fire can also provide a medium for insect invasion, which could provide food. Huckleberries and blueberries are more productive on recently burned sites than on unburned sites (Heinselman 1973, Hanson 1979, Hall and Shay 1981). However, hot, duff-consuming fires can destroy shallow rhizomes (Hall and Shay 1981). Fire can also reduce important food species in the short-term (Landers 1987).

7.3 Grizzly Bear (*Ursus arctos horribilis*)

The grizzly bear was first listed as endangered in the conterminous United States (lower 48 states) on March 11, 1967 (32 FR 4001). Less than a decade later on July 28, 1975, the grizzly bear was listed as threatened (40 FR 31734). Within the area covered by this listing, the grizzly bear occurs in Idaho, Montana, Washington, and Wyoming. On

November 17, 2000, the USFWS published a final rule (65 FR 69644) to designate a grizzly bear "non-essential, experimental population" in the Selway–Bitterroot ecosystem. Later, the USFWS published a notice of intent (June 22, 2001, 66 FR 33623) to reevaluate its decision to establish an experimental population of grizzly bears in east-central Idaho and western Montana.

The grizzly bear tends to be crepuscular, with the least activity occurring at midday (Snyder 1991g). Grizzly bears hibernate, entering their dens in October and emerging in May. The total length of time in hibernation is dependent on food availability, weather conditions, and sex (Snyder 1991g). Grizzly bears may emerge from their den early if disturbed by human activity. Grizzly bears dig their own den, usually excavated in hillsides, although dens are also made in rock caves, in downfall timber, and beneath trees and stumps (Willard and Herman 1977, Servheen 1981).

Grizzly bears breed between May and July, usually in 2- to 4-year intervals. Implantation is delayed, and gestation lasts about 184 days (Snyder 1991g). The birthing season is in late November through February. Litter size varies from one to four cubs, with two cubs being the most common. The cubs remain with the female for the first two winters. The age of maturity for female grizzly bears is between 5 and 8 years (Snyder 1991g). The average life span of a grizzly bear is 25 years, or more in captivity (Jonkel 1978, Servheen 1981, Craighead and Mitchell 1987).

Although timber is an important habitat component, grizzly bear prefer more open habitats. Timbered plant communities most frequented by grizzly bears include subalpine fir (*Abies lasiocarpa*)-whitebark pine (*Pinus albicaulis*), lodgepole pine (*P. contorta*)-Douglas-fir (*Pseudotsuga menziesii*), and spruce (*Picea* spp.)-western red cedar (*Thuja plicata*)-hemlock (*Tsuga* spp.) forests. Sedge (*Carex* spp.)-bluegrass (*Poa* spp.) meadows are also important, as well as shrubfields and lowland high-elevation riparian communities (Willard and Herman 1977, Blanchard 1980, McLellan and Shackleton 1988). They typically choose low-elevation riparian sites, wet meadows, and alluvial plains during spring (Willard and Herman 1977, Reichert 1989). During summer and fall, grizzly bears more frequently use high-elevation meadows, ridges, and open, grassy timbered sites (Servheen 1983, Reichert 1989).

Optimal grizzly bear covers are wooded areas interspersed with grassland and shrubland. Ruediger and Mealy (1978) defined hiding cover as that capable of hiding an animal at 61 m (200 ft) or less in an area of 12 to 20 ha (30-50 acres). Thermal cover was defined as coniferous trees at least 12-m tall with a 70% canopy cover in a 3- to 20-ha area. Ruediger and Mealy (1978) recommended maintaining 30% of grizzly bear habitat as cover. Graham (1978) found that in Yellowstone National Park, grizzly bears preferred open areas that were within 50 m (164 ft) of cover. McLellan and Shackleton (1988) reported that the bears use areas within 100 m (328 ft) of roads during the day but that darkness is sufficient "cover" for road use at night. Grizzly bear use daybeds in timbered areas that are near feeding sites (Blanchard 1980, Reichert 1989).

Grizzly bears eat primarily grasses, forbs, roots, tubers, and fruits. They also eat carrion, grubs, insects—particularly army cutworm moths (Noctuidae) and ladybird beetles (Coccinelidae), fish, small rodents, various bird species, and garbage (Zager and Jonkel 1983). Adult males also prey on subordinate grizzly bears and on black bears (Hechtel 1985). Orchards, beehives, and crops may be damaged by grizzly bears; they may also prey on livestock (Jonkel 1978, Servheen 1983). Some of the more common plant foods are russet buffaloberry (*Shepherdia canadensis*), Saskatoon serviceberry (*Amelanchier alnifolia*), Sitka mountain ash (*Sorbus sitchensis*), snowberry (*Symphoricarpos* spp.), hawthorn (*Crataegus* spp.), honeysuckle (*Lonicera* spp.), whitebark pine seeds, pine (Pinaceae) vascular cambium, willow (*Salix* spp.), dogwood (*Cornus* spp.), huckleberry and blueberry (*Vaccinium* spp.), dandelion (*Taraxacum* spp.), sweetvetch (*Hedysarum* spp.), clover (*Trifolium* spp.), cowparsnip (*Heracleum* spp.), glacier lily (*Erythronium grandiflorum*), horsetail (*Equisetum* spp.), lomatium (*Lomatium* spp.), kinnikinnick (*Arctostaphylos uva-ursi*), strawberry (*Fragaria* spp.), buckthorn (*Rhamnus* spp.), paintbrush (*Castilleja* spp.), thistle (*Cirsium* spp.), fritillary (*Fritillaria* spp.), boykinia (*Boykinia richardsonii*), and sheathed cottonsedge (*Eriophorum vaginatum*) (Graham 1978, Zager 1980, Servheen 1983, Hechtel 1985, Craighead and Mitchell 1987).

Grizzly bear predators include humans and other grizzly bears (Jonkel 1978).

Grizzly bears have a low reproductive rate and late maturation age, which make them susceptible to overharvesting (Snyder 1991g). Also, many grizzly bears are poached or hit by cars and trains. Other factors contributing to the bear's decline are habitat use and disturbance by humans, both for commercial and recreational purposes, and fire control, which in some instances can result in reduced acres of food-rich seral shrubfields (Jonkel 1978, Knight 1980, Zager *et al*. 1983). Grizzly bears have been known to prey on livestock where their ranges overlap with areas containing livestock and to occasionally kill humans as a result of chance encounters, usually in the backcountry. Because of conflicts between grizzly bears and humans, grizzly bear habitat should be isolated from developed areas and preferably be located in areas that receive only light recreational, logging, or livestock use (Spowart and Samson 1986).

Logging can benefit grizzly bear populations if silvicultural treatments promote berry-producing shrubs (Snyder 1991g). However, timber management effects should be considered over the entire rotation because an increase in shrubs may only redistribute grizzly bear and not increase their numbers (Knighton 1981). Logging can also increase human access to critical grizzly bear habitat, disturbing populations. Roads should be located away from feeding areas such as shrubfields, wet meadows, and riparian zones. Road and seasonal trail closures must also be enforced (Ruediger and Mealey 1978, Knighton 1981). Scarification and dozer pile burning can disturb soil and kill valuable food shrubs (Zager *et al*. 1983).

Direct fire-related mortality probably occurs but may not have a significant impact on the grizzly bear population as a whole (Blanchard and Knight 1990).

Many authors have blamed fire suppression in some areas for the decline of grizzly bear (Willard and Herman 1977, Tirmenstein 1983, Contreras and Evans 1986, Moss and LeFranc 1987). Fires can promote and maintain many important berry-producing shrubs and forbs, as well as provide a medium for insects and, in some cases, carrion. Referring to the Yellowstone National Park fires of 1988, Blanchard and Knight (1990) stated, "The most important apparent immediate effect of fires on grizzly bears was the increased availability of some food items, especially carcasses of elk."

Fire can be used to create and maintain seral shrub communities for grizzly bear by rejuvenating shrubs, releasing nutrients, and discouraging conifer dominance (Zager 1980, Moss and LeFranc 1987). In the case of post-harvest treatment, many authors recommend broadcast burning and discourage dozer pile burning. The latter method can damage rhizomes, root crowns, and the soil (Zager 1980, Zager and Jonkel 1983, Contreras and Evans 1986). Natural fire programs, as well as prescribed burning, for improved grizzly habitat are encouraged and practiced by some National Forest managers (Tirmenstein 1983, Contreras and Evans 1986, Moss and LeFranc 1987). A fire-induced increase of berry-producing shrubs may be beneficial only if spread over large areas that encompass home ranges of several bears (Smith 1979). However, pre-fire plant composition may dictate post-fire composition (Miller 1977). Berry-producing shrubs must be provided continually over time to be beneficial (Contreras and Evans 1986). Miller (1977) recommends burning huckleberry during spring in Douglas-fir–western larch (*Larix occidentalis*) communities in Montana.

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