4.0 Lower Snake Subbasin Aquatic Assessment

4.1 Selection of Focal Species

One aquatic species was chosen as focal for Lower Snake Subbasin Planning; steelhead/rainbow trout *Oncorhynchus mykiss.* The criteria used to select focal species was the aspects of the Lower Snake Subbasin ecosystem that the life histories represent; the Endangered Species Act (ESA) status; the cultural importance of the species and whether or not there was enough knowledge of the life history of the species to do an effective assessment. Those species of which too little was known to be included as focal at this time could be included as “species of interest” (see section 4.7). The WDFW suggested the above species as focal for the subbasin. These were then presented to the Nez Perce Tribe, the citizens advisory group, subbasin planning team and other interested agencies and entities. Consensus was achieved on their selection. Lower Snake summer steelhead life history intersects a broad range of the aquatic ecosystem. Spatially, the life history of this species covers the entire subbasin. The species also occupies all levels of the water column including slack water, swift water and the hyporheic zone. Not only are they present but also the ability of theis species to thrive is dependent on being able to successfully occupy these areas. Temporally, this species are present (or were assumed to be present in the past) at one lifestage or another throughout much of the watershed in all seasons. The ability of this species to be present at a particular time in a particular area is also key to the success of this species. Given the wide range of both the spatial and temporal aspects of these life histories it can be assumed that having habitat conditions that are appropriate for this species will also produce conditions that allow for the prosperity of other aquatic life in the Lower Snake Subbasin.

The legal status of this species is important to the people of the Lower Snake Subbasin. This species is currently listed as threatened under the ESA (see sections 4.2.4.4; 4.3.4.4; 4.4.5). Currently the citizens, governments, state and federal agencies and tribes are engaged in planning for recovery through different processes. The intention of subbasin planning to address listed species within the subbasin supports the inclusion of the only this federally listed aquatic species within the subbasin as focal species.

4.2 Lower Snake Subbasin Habitat Assessment Methods

The Lower Snake Subbasin habitat was assessed using the Ecosystem Diagnosis and Treatment (EDT) method; EDT is an analytical model relating habitat features and biological performance to support conservation and recovery planning (Lichatowich et al. 1995; Lestelle et al. 1996; Mobrand et al. 1997; Mobrand et al. 1998). It acts as an analytical framework that brings together information from empirical observation, local experts, and other models and analyses. In the Lower Snake EDT was performed on two streams: Deadman Creek and Almota Creek. The resources were not available to perform this analysis on all nine steelhead bearing tributaries in the subbasin. The results from these two streams are to serve as surrogates for the others

The Information Structure and associated data categories are defined at three levels of organization. Together, these can be thought of as an information pyramid in which each level builds on information from the lower level (Figure 4-1). As we move up the through the three levels, we take an increasingly organism-centered view of the ecosystem. Levels 1 and 2 together characterize the environment, or ecosystem, as it can be described by different types of data. This provides the characterization of the environment needed to analyze biological performance for a species. The Level 3 category is a characterization of that same environment from a different perspective: “through the eyes of the focal species" (Mobrand et al. 1997). This category describes biological performance in relation to the state of the ecosystem described by the Level 2 ecological attributes.

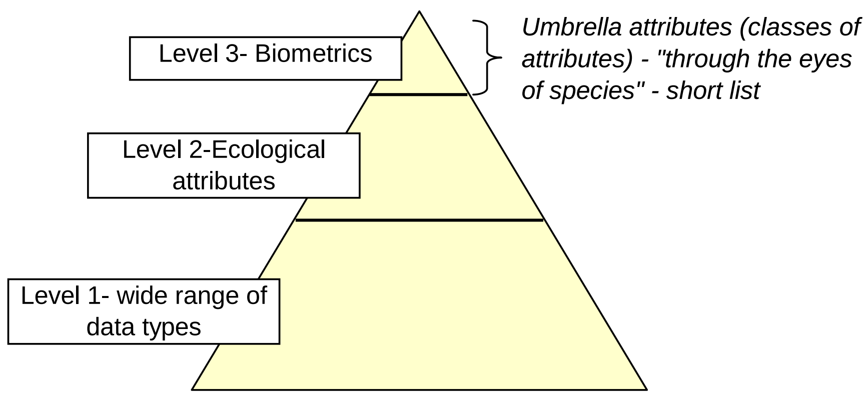

Figure 4-1. Data/information pyramid—information derived from supporting levels.

The organization and flow of information begins with a wide range of environmental data (Level 1 data) that describe a watershed, including all of the various types of empirically based data available. These data include reports and unpublished data. Level 1 data exist in a variety of forms and pedigrees. The Level 1 information is then summarized or synthesized into a standardized set of attributes (Level 2 ecological attributes, see Table 2.1) that refine the basic description of the watershed. The Level 2 attributes are descriptors that specify physical and biological characteristics about the environment relevant to the derivation of the survival and habitat capacity factors for the specific species in Level 3. Definitions for Level 2 and Level 3 attributes can be found at www.edthome.org , together with a matrix showing associations between the two levels and various life stages.

The Level 2 attributes represent conclusions that characterize conditions in the watershed at specific locations, during a particular time of year (season or month), and for an associated management scenario. Hence an attribute value is an assumed conclusion by site, time of year, and scenario. These assumptions become operating hypotheses for these attributes under specific scenarios. Where Level 1 data are sufficient, these Level 2 conclusions can be derived through simple rules. However, in many cases, experts are needed to provide knowledge about geographic areas and attributes where Level 1 data are incomplete. Regardless of the means whereby Level 2 information is derived, the characterization it provides can be ground-truthed and monitored over time through an adaptive process.

In the Lower Snake Subbasin process, conclusions regarding Level 2 attribute conditions were derived using empirical data, where available, and data gaps were filled by a group of natural resource-related professionals with knowledge of the watersheds of interest. These individuals had expertise in such disciplines as fish habitat, hydrology, geomorphology, water quality, and civil engineering.

To perform the assessment we first structured the entirety of the relevant geographic areas, including marine waters, into distinct habitat reaches. Time and resource constraints limited the number of streams on which EDT could be performed. Almota Cr and Deadman Creek were chosen following discussion at the initial coordination meetings because they are representative of habitat conditions across the subbasin. Each of the two streams were subdivided into the stream segments or reaches by WDFW personnel (Table 4-1 and 4-2). We identified reaches on the basis of similarity of habitat features, drainage connectivity, and land use patterns. A set of standard habitat attributes and reach breaks developed by Mobrand Biometrics Incorporated (MBI) were used for the mainstem Columbia and Snake Rivers, estuarine, nearshore, and deep-water marine areas. We then assembled baseline information on habitat and human-use factors and fish life history patterns for the watersheds of interest. This task required that all reaches be completely characterized by rating the relevant environmental attributes.

Table 4-1. Stream reaches defined in Almota Creek for the Ecosystem Diagnosis and Treatment analysis method.

Reach code	Reach location/description	Start RM	End RM
Alm1	Almota Cr, mouth to Little Almota Cr	0	0.12
LAlm1	Little Almota Cr, mouth to impassible headcut	0	1.12
LAlm2	Impassible headcut	OBSTRUCTION	
LAlm3	Little Almota Cr, impassible headcut to cascade/culvert just above Little Almota Rd	1.27	1.27
Alm2	Almota Cr, Little Almota Cr to second Little Almota Cr (Hungate Grade)	0	0.88
2LAlm	Second Little Almota Cr, mouth to steelhead access limit at impassibly steep section just above LB draw in Sec 18	0	1.64
Alm3	Almota Cr, second Little Almota Cr to unnamed RB ephemeral stream which demarcates extremely confined reach	0.88	4.47
Alm4	Almota Cr, extremely confined reach ending at forks in Sec 11	4.47	5.46
NorthBranch	North Branch of upper Almota, mouth to impassibly steep and dewatered section	0	0.25
Alm5	Almota Cr, forks in Sec 11 to impassibly steep section	5.46	6.01

Table 4-2. Stream reaches defined in Deadman Creek for the Ecosystem Diagnosis and Treatment analysis method

Reach code	Reach location/description	Start RM	End RM
Dead1	Deadman embayment	0	1.45
Dead2	Deadman Cr, embayment entry to Willow Gulch Cr	1.45	2.28
Dead3	Deadman Cr, Willow Gulch Cr to Ping Gulch Cr	2.28	4.18
Ping1	Ping Gulch Cr, mouth to aproned bridge obstacle at the Leonard property	0	4.89
Dead4	Deadman Cr, Ping Gulch Cr to Lynn Gulch Cr	4.18	9.17
Lynn1	Lynn Gulch Cr, mouth to perched culvert near mouth	0	0.38
Lynn2	Lynn Gulch culvert	OBSTRUCTION	
Lynn3	Lynn Gulch Cr, culvert to historical access limit at confluence of East Lynn Gulch Cr	0.38	6.65
Dead5	Deadman Cr, Lynn Gulch Cr to confluence of NF & SF Deadman Cr	9.17	12.66
NFDead1	NF Deadman Cr, mouth to current access limit at intermittant zone	0	2.33
NFDead2	NF Deadman Cr, end of current access zone to historical access limit at forks of NF	2.33	7.28
SFDead	SF Deadman Cr, mouth to access limit at confluence of SF Deadman Gulch	0	10.2

A technical work group was formed for the Lower Snake Subbasin for the purpose of rating the Level 2 habitat attributes for the freshwater stream reaches. The work groups drew upon published and unpublished data and information for the basin to complete the task. Expert knowledge about habitat identification, habitat processes, hydrology, water quality, and fish biology was incorporated into the process where data was not available. Attribute rating for EDT was coordinated by WDFW. Protocol for rating attributes was taken from “Attribute Ratings Guidelines (Appendix) and “Attribute ratings Definitions” (Appendix); written and distributed by MBI. In addition MBI personnel were available for consultation and rated some attributes when local resources were not available. The WDFW watershed steward served as coordinator for the attribute rating process. The sources used for rating the individual attributes are outlined in Tables 4-3. The patient (current) condition attribute ratings represent a variety of sources and levels of proof (see **Appendix ##** for complete ratings, levels of proof and explanations of specific attribute rating methods). Levels of proof (or confidence levels) assigned to ratings are directly from developed rating methods by MBI specifically for the EDT process. The attributes assigned to each reach are assigned a numerical value from 1 to 5 where: 1 is empirical observation; 2 is expansion of empirical observation; 3 is derived information; 4 is expert opinion; 5 is hypothetical. The mean and standard deviation for confidence levels assigned to attributes are presented in Table 4-3. The template (historic) conditions were all considered to be the hypothetical or expert opinion of the resource professional that rated the attribute. The rating sources are by the agency or organization for which the individual is employed, represents or is affiliated; or the data/published source that was used.

Table 4-3. Attributes, attribute rating level of proof means/standard deviations and rating sources used for EDT analysis of the Almota Creek and Deadman Creek 2003. (Level of Proof ratings range from 1 to 5 where: 1 is empirical observation; 2 is expansion of empirical observation; 3 is derived information; 4 is expert opinion; 5 is hypothetical) (All Template ratings considered hypothetical or expert opinion; EO= Expert Opinion)

Attribute	**Level of Proof**		**Template Sources**		**Patient Sources**	
	Almota	**Deadman**	**Almota**	**Deadman**	**Almota**	**Deadman**
Alkalinity	Mean = 2 SD = 0	Mean = 2 SD = 0	Mobrand Biometrics Incorporated (MBI).	Mobrand Biometrics Incorporated (MBI).	Mobrand Biometrics Incorporated (MBI).	Mobrand Biometrics Incorporated (MBI).
Bed Scour	Mean = 4 SD =0	Mean = 4 SD =0	Mobrand Biometrics Incorporated (MBI) and WDFW Biologists.	Mobrand Biometrics Incorporated (MBI) and WDFW Biologists.	Mobrand Biometrics Incorporated (MBI) and WDFW Biologists.	Mobrand Biometrics Incorporated (MBI) and WDFW Biologists.
Benthic Community Richness	Mean = 4 SD =0	Mean = 4 SD =0	Mobrand Biometrics Incorporated (MBI) and WDFW Biologists.	Mobrand Biometrics Incorporated (MBI) and WDFW Biologists.	Mobrand Biometrics Incorporated (MBI) and WDFW Biologists.	Mobrand Biometrics Incorporated (MBI) and WDFW Biologists.
Channel Length	Mean = 1 SD = 0	Mean = 1 SD = 0	WDFW Biologist. Stream lengths increases proportionally with estimated increase in sinuosity historically. Estimated sinuosity through Rosgen stream typing potential.	WDFW Biologist. Stream lengths increases proportionally with estimated increase in sinuosity historically. Estimated sinuosity through Rosgen stream typing potential.	Channel length measured using Terrain Navigator® mapping program by WDFW biologist..	Channel length measured using Terrain Navigator® mapping program by WDFW biologist.

Channel Width Max	Mean = 2.4 SD = .8	Mean = 3.2 SD = .9	WDFW Biologist.	WDFW Biologist.	WDFW spawning surveys 2001; WDFW Biologist EO.	WDFW spawning surveys 2001; WDFW Biologist EO.
Channel Width Min	Mean = 4.0 SD = .8	Mean = 2.1 SD = .3	WDFW Biologist.	WDFW Biologist.	WDFW 2001 Electrofishing data and EO.	WDFW 2001 Electrofishing data and EO.
Confinement Hydromodifications	Mean = 4.0 SD = 0	Mean = 4 SD = 0	N/A	N/A	WDFW Biologist EO.	WDFW Biologist EO.
Confinement Natural	Mean = 4.0 SD = 0	Mean = 4 SD = 0	N/A	N/A	WDFW Biologist EO.	WDFW Biologist EO.
Dissolved Oxygen	Mean = 4.0 SD = 0	Mean = 4 SD = 0	N/A	N/A	WDFW Biologist EO.	WDFW Biologist EO.
Embeddedness	Mean = 2.5 SD = .7	Mean = 2.5 SD = 1.5	WDFW Biologist	WDFW Biologist	WDFW unpublished 2001 survey data. Biologist EO	WDFW unpublished 2001 survey data. Biologist EO.
Fine Sediment	Mean = 4.0 SD = 0	Mean = 4.0 SD = 0	WDFW Biologist..	WDFW Biologist..	WDFW Biologist EO	WDFW Biologist EO

Fish Community Richness	Mean = 2.3 SD = 1.5	Mean = 2.3 SD = 1.5	WDFW Biologist..	WDFW Biologist.	From 2001 WDFW surveys.	From 2001 WDFW surveys.
Fish Pathogens	Mean = 1.00 SD = 0	Mean = 1.00 SD = 0	N/A	N/A	From WDFW stocking records	From WDFW stocking records.
Fish Species Exotic	Mean = 2.3 SD = 1.5	Mean = 2.3 SD = 1.5	N/A	N/A	From 2001 WDFW surveys.	From 2001 WDFW surveys.
Flow High	Mean = 4 SD = 0	Mean = 4 SD = 0	N/A	N/A	MBI and WDFW Biologist EO.	MBI and WDFW Biologist EO.
Flow Low	Mean = 4 SD = 0	Mean = 4 SD = 0	N/A	N/A	MBI and WDFW Biologist EO.	MBI and WDFW Biologist EO.
Flow Diel Variation	Mean = 4 SD = 0	Mean = 4 SD = 0	N/A	N/A	MBI and WDFW Biologist EO.	MBI and WDFW Biologist EO.
Flow Flashy	Mean = 4 SD = 0	Mean = 4 SD = 0	N/A	N/A	MBI and WDFW Biologist EO.	MBI and WDFW Biologist EO.
Gradient	Mean = 2 SD = 0	Mean = 2 SD = 0	WDFW biologist adjusted gradients for increase in stream length (sinuosity) historically. Gradients decreased by proportion of stream length increase; potential or historic sinuosity derived from Rosgen stream typing.	WDFW biologist adjusted gradients for increase in stream length (sinuosity) historically. Gradients decreased by proportion of stream length increase; potential or historic sinuosity derived from Rosgen stream typing.	WDFW Biologist estimations using Terrain Navigator®.	WDFW Biologist estimations using Terrain Navigator®.
Habitat Types (% of Backwater Pools, Glides, Beaver Ponds, Pools, Large Substrate Riffles, Small Substrate Riffles, Pool Tail-outs)	Mean = 4.5 SD = .8	Mean = 2.7 SD = 1.0	WDFW Biologist	WDFW Biologist	WDFW 2001 surveys. WDFW Biologist EO	WDFW 2001 surveys. WSU 2001 macroinvert. Survey. WDFW Biologist EO

Habitat Off-Channel	Mean = 3.1 SD = 1.0	Mean = 4.4 SD = .5	MBI and WDFW.	MBI and WDFW.	WDFW 2001 surveys. WDFW EO.	WDFW 2001 surveys. WDFW EO.
Harassment	Mean = 4 SD = 0	Mean = 4 SD = 0	WDFW Biologist EO.	WDFW Biologist EO.	WDFW Biologist EO.	WDFW Biologist EO.
Hatchery Outplants	Mean = 1 SD = 0	Mean = 1 SD = 0	N/A	N/A	WDFW fish stocking records.	WDFW fish stocking records.
Hydrologic Regime Natural	Mean = 4 SD = 0	Mean = 4 SD = 0	MBI	MBI	MBI, Based on MBI developed hydroregime categories.	MBI, Based on MBI developed hydroregime categories.
Hydrologic Regime Regulated	N/A	N/A	N/A	N/A	MBI	MBI
Icing	Mean = 4.0 SD = 0	Mean = 4 SD = 0	WDFW Biologist.	WDFW Biologist.	WDFW Biologist EO.	WDFW Biologist EO.
Metals in Water Column	Mean = 5.0 SD = 0	Mean = 5.0 SD = 0	N/A	N/A	WDFW Biologist EO.	WDFW Biologist EO.
Metals in Soils and Sediment	Mean = 5.0 SD = 0	Mean = 5.0 SD = 0	N/A	N/A	WDFW Biologist EO.	WDFW Biologist EO.
Misc Toxics	Mean = 5.00 SD = 0	Mean = 5.00 SD = 0	N/A	N/A	WDFW Biologist EO.	WDFW Biologist EO.
Nutrients	Mean = 4.4.0 SD = 0	Mean = 4 SD = 0	N/A	N/A	WDFW Biologist EO.	WDFW Biologist EO.
Obstructions	*Obstruction rated by percent passage of average adult. Obstruction ratings were the expert opinion of WDFW biologists.	*Obstruction rated by percent passage of average adult. Obstruction ratings were the expert opinion of WDFW biologists.	N/A	N/A	Obstructions rated by WDFW Biologists EO.	Obstructions rated by WDFW Biologists EO.
Predation Risk	Mean = 4.0 SD = 0	Mean = 4.0 SD = 0	N/A	N/A	WDFW Biologist EO.	WDFW Biologist EO.

Riparian Function	Mean = 4.2 SD = .4	Mean = 4.0 SD = 0	N/A	N/A	WDFW Biologist EO.	WDFW Biologist EO.
Salmon Carcasses	Mean = 4.0 SD = 0	Mean = 4.0 SD = 0	WDFW Biologist EO.	WDFW Biologist.	WDFW Biologist EO.	WDFW Biologist EO.
Temperature Max	Mean = 2.7 SD = .6	Mean = 2.7 SD = .6	WDFW Biologist.	WDFW Biologist.	2001, 2002 WDFW temperature data. WDFW Biologist derived and EO.	2001, 2002 WDFW temperature data. WDFW Biologist derived and EO.
Temperature Min	Mean = 4.0 SD = 0	Mean = 4.0 SD = 0	WDFW Biologist.	WDFW Biologist.	WDFW Biologist EO.	WDFW Biologist EO.
Temperature Spatial Variation	Mean = 4 SD = 0	Mean = 4 SD = 0	WDFW Biologist.	WDFW Biologist.	WDFW Biologist EO.	WDFW Biologist EO.
Turbidity	Mean = 4 SD = 0	Mean = 4 SD = 0	WDFW Biologist.	WDFW Biologist.	WDFW Biologist EO.	WDFW Biologist EO.
Withdrawl	Mean = 4 SD = 0	Mean = 4 SD = 0	WDFW Biologist.	WDFW Biologist.	WDFW Biologist EO.	WDFW Biologist EO.
Woody Debris	Mean = 3.0 SD = 0	Mean = 4.0 SD = 0	WDFW Biologist.	WDFW Biologist.	2001 WDFW survey Data. WDFW Biologist EO.	. WDFW Biologist EO.

The template (reference) conditions for the watersheds were estimated to determine the level of change from current conditions. In Deadman Creek the lower, low gradient elevations of the subbasin were assumed to have cottonwood galleries and a healthy beaver population. This would have created a very complex habitat with long-lived large wood and many pools/backwater areas. Woody shrub vegetation would give way to shrub-steppe transition areas as you moved upland away from the creek. Deadman mainstem would have had more sinuosity as it would have been free to cut and re-cut across the valley floor. This would have held true to Ping Gulch and Lynn Gulch and beyond on the mainstem. Ping Gulch rises steeply from Deadman and quickly exceeds 2% gradient. Woody growth of trees and shrubs would have stretched across the narrow valley. The stream would have maintained enough wood to form a step pool environment. Pools would have been greatly increased over present. Lynn Gulch gradually increases in elevation upstream and the canyon begins to narrow. This would have given you a thinner band of riparian growth dominated by scattered cottonwoods and heavy brushy growth. Beaver would not be as prevalent in the steeper side canyons such as Lynn Gulch. As elevation increases up Deadman the mixed cottonwood, conifer growth would have begun to dominate valley floors would have thick stands of a diverse shrub life. Some areas of the Deadman have conditions similar to this today.

Almota Creek would have been different than Deadman. This is a much steeper watershed. Beaver influence would have been great toward the mouth where there work would have allowed for comparatively large pools and slow riffle rearing areas. As you moved up the side canyons of Little Almota and Second Little Almota the steep grade would have eliminated beaver. These would likely have been more step-pool type streams. Large wood would not have been long-lived but the amount that stayed would greatly influence the stream in its narrow canyon floor. Mainstem Almota would have had a riparian growth that stretched up the canyon walls, particularly on the north facing slopes. Year around flow and cool water from the high infiltration rates in the uplands would have made this an excellent rearing area. Canopy cover over the stream would have been near complete inmost areas. The upper reaches of Almota would have been similar to today. Shrub and grassland would dominate the upper valley. Mixed cottonwood growth would have been heavier than today. One of the biggest changes would be the near complete ground cover in the upland areas. This would have controlled sediment and retained water at a much better rate.

The watershed as a whole was considered to have been ecologically fit for the species of fish that were likely to have resided here (i.e. the focal species) to thrive. It was assumed that temperatures would have generally been lower and flow higher though, not greatly so. Large wood was assumed to have been much more prevalent throughout the watershed, as were the pools they help to create. Beaver was also thought to have been present in fair numbers, but only in the lower elevations.

We characterized three baseline reference scenarios for the Lower Snake Subbasin; predevelopment (historic or template as described above) conditions, current conditions, and properly functioning conditions (PFC). The comparison of these scenarios formed the basis for diagnostic conclusions about how the Lower Snake and associated summer steelhead performance have been altered by human development. The historic reference scenario also served to define the natural limits to potential recovery actions within the basin. Properly functioning conditions were a set of standardized guidelines that NOAA Fisheries provided that were designed to facilitate and standardize determinations of the effect for Endangered Species Act (ESA) conferencing, consultations, and permits focusing on anadromous salmonids (Stelle 1996). The objective of the diagnosis then became identifying the relative contributions of environmental factors to the losses in summer steelhead performance. To accomplish this, we performed two types of analyses, each at a different scale of overall effect.

The first analysis considered conditions within *individual stream reaches* and identified the most important factors contributing to a loss in performance corresponding to each reach. This analysis, called the *Stream Reach Analysis* (Appendix A), identified the factors (classes of Level 2 attributes) that, if appropriately moderated or corrected, would produce the most significant improvements in overall fish population performance. It identified the factors that should be considered in planning habitat restoration projects.

These results were available in two forms, scaled and unscaled. Scaled results take into account the length of the geographic area being analyzed by taking the original out put from EDT (i.e. percent productivity change, etc.) and dividing it by the length of stream in kilometers. This gives a value of the condition being measured per kilometer which represents the most efficient areas to apply restoration or protection measures. The unmodified results are termed unscaled. Both results are presented here, though the scaled version was given more weight in the conclusions portion of the assessment.

A Reach Analysis identifies the life stages most severely impacted (relative to historical performance) on a reach-by-reach basis, as well as the environmental conditions most responsible for the impacts. This three-part diagnosis can then be used to develop a plan designed to protect areas critical to current production, and to implement effective restoration actions in reaches with the greatest production potential.

The first pair of charts in Appendix A describe this analysis in greater detail. The rest of the charts in Appendix A consist of the Reach Analysis for the Lower Snake Subbasin. The Reach Analysis is intended to serve as a reference tool to be used in all types of watershed planning related to salmon conservation and recovery.

4.3 Focal Species Summer Steelhead/ Rainbow Trout (*O. mykiss*)

4.3.1 Life history

The steelhead in the small tributaries of the lower Snake River are typical "A" run strain. "A" run steelhead enter freshwater from June to August and generally pass Bonneville Dam before August 25. They begin passing Lower Granite Dam in early June and can continue through the following spring. Adult steelhead may enter these small streams as early as February or early March and continue through early May if there is sufficient water in May. Peak entry is suspected to occur in mid-March to early April. Spawning begins in mid to late March or early April. Spawning peaks in early to mid April and continues through early to mid May.

Juveniles likely emerge from spawning gravels in May or June. Steelhead typically rear for more than one year in freshwater before migrating to the ocean. Juvenile migration possibly occurs as early as late October, but because of limited water available in the fall migration is more likely in March through May, with a peak in April. Most juveniles likely migrate at age 1 or 2 because of high rearing temperatures and growth rates, and limited carrying capacity (limited water).

4.3.2 Historical and Current Distribution

Little is known about the historical distribution of steelhead in the small tributaries of the Lower Snake River. It seems likely that historic distribution was probably more extensive than at present. Adult steelhead enter these streams during spring when high stream flows enable access throughout most of the watersheds. Some passage impediments exist in several of these streams (most notably in lower Wawawai Creek) that obstruct some or all passage. Current juvenile distribution is reduced due to water withdrawals (e.g. Deadman Creek), late summer dewatering of stream reaches, degraded habitat quality and possible barriers to migration.

At present summer steelhead and resident rainbow trout appear to utilize all accessible portions of these streams with adequate flows and temperature for spawning and rearing (Mendel et al. 2004, Mendel 1999). Figure 4-2 shows the location of tributaries to the Lower Snake that are known or presumed to support steelhead/rainbow populations.

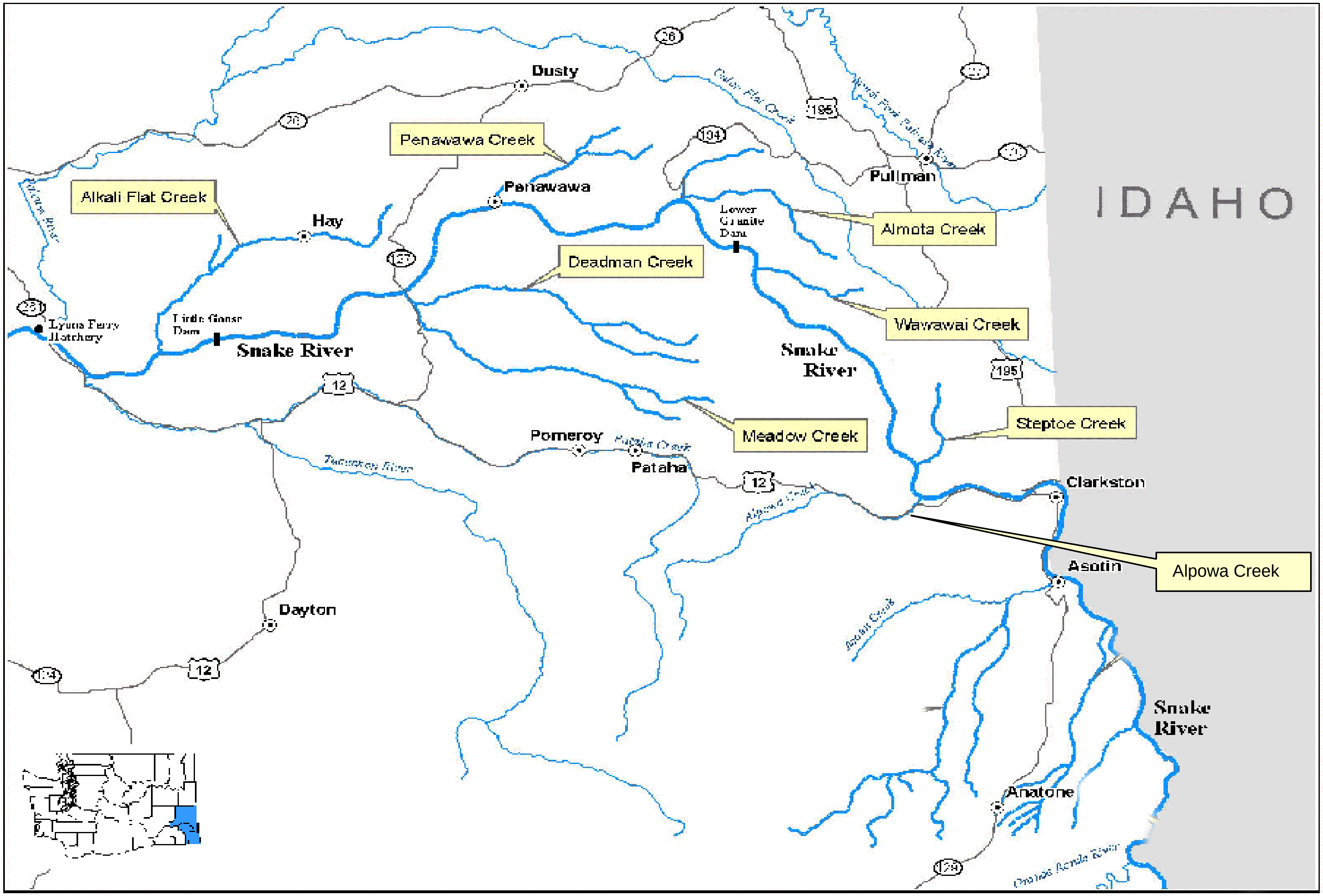

Figure 4-2. Current known and presumed steelhead bearing streams in Lower Snake Subbasin Data not pictured is (Knoxway Canyon). Modified from Mendel et al. 2004.

4.3.3 Population Identification

The TRT has not recognized the steelhead in these streams as separate populations, but instead they have included them with Tucannon River (for Alkali Flat Creek, Almota, Penewawa, Alpowa) as these streams are within the 30 km of the Tucannon River. Although Deadman, Meadow, Steptoe and Wawawai creeks were not mentioned in the TRT document, they would likely be lumped with the Tucannon population. WDFW's SaSI document also does not mention these streams or recognize these as separate populations. None of these streams is likely to ever have high enough abundance to be recognized by the TRT as a separate population, except maybe Almota and Alpowa, because of the presence of resident O. mykiss. WDFW has begun collection of genetic data from some of these streams to assist in determination of stock and population status.

4.3.4 Lower Snake Steelhead/Rainbow Trout Population

4.3.4.1 Population Characterization.

4.3.4.1.1 Empirical Data

Deadman, Meadow, Almota, Alpowa, Penawawa, Alkali Flat, Steptoe and Wawawai Creeks

Little empirical data for fish, or fish habitat, exist for these drainages. All that has been documented in recent years is included in recent assessment efforts by WDFW (Mendel 1999; Mendel et al. 2001; Mendel et al. 2004).

Steelhead are believed to exist in all these drainages, at least occasionally. Steelhead spawning has been documented recently in Alpowa, Almota, Deadman, Penawawa, and lower Wawawai creeks. Juvenile steelhead or resident O. mykiss have been found in all the streams under consideration, except Steptoe Creek, since 1997. Sampling in Steptoe Creek occurred after a flash flood severely damaged the habitat in 2001 and that likely affected our results.

WDFW's limited steelhead spawning survey data can be used to evaluate the results of the EDT model for abundance of adult steelhead. In 2001, WDFW found 25 redds in Almota (with 10 adult steelhead observed). In 2002, WDFW found at least 14 redds and 16 adult fish, but the surveys were conducted too late in the season in 2002 for complete counts. Penewawa had eight redds (and 5 adults) observed in 2002 and nine redds (24 adults) were seen in Deadman Creek (Mendel et al. 2004). Based on the 2001 redd counts, the estimated number of steelhead in Almota was 34 adults, and 24 adults in Deadman Creek (Table 4-4). Capacity was not calculated here, but 2001 Potential Parr Production (PPP) estimates of capacity for Almota and Deadman produced 22 and 14 adults, respectively. The PPP model likely underestimates the capacity of this stream because it was based on only 4.1 miles of Almota Creek. The PPP for Alpowa Creek was estimated at 78 adult steelhead.

Table 4-4. Estimated escapement numbers of steelhead in Almota and Deadman creeks based on redd counts in 2001 (data from Mendel et al. 2004).

	Redds	Estimated number of adults*
Almota	25	34
Deadman	9	24**

* redds x 0.81 females per redd divided by 0.6 (proportion of males)
** approximately 24 adults were seen by WDFW in 2001, but the calculations based on redds produced only 12 adults. The redd count should be considered incomplete.

The EDT and empirical data are similar for Almota and Deadman creeks. EDT estimated 29 adult steelhead for Almota Creek and 6 adults for Deadman while our empirical data suggests 34 for Almota and 24 for Deadman in 2001.

Juvenile steelhead or resident O. mykiss densities are highest in Almota and Alpowa creeks, especially for age 1 and older fish, with few found in Deadman Creek or Penawawa Creek (Table 4-5). Almota and Alpowa also have the most water available during summer. Alkali Flat Creek, Meadow, Steptoe and Wawawai have very limited water during summer and few salmonids, or limited distribution of salmonids in summer. Salmonids are generally limited to the area from above Rock Spring Creek to the town of Hay in Alkali Flat Creek. Meadow Creek has limited water and few salmonids present. Steptoe Creek was not found to contain salmonids in 2001 or 2002 (Mendel et al. 2004). Wawawai Creek contains rainbow/steelhead in limited numbers above the lower culvert and higher numbers below the culvert near the mouth.

Table 4-5. Average densities of juvenile steelhead or resident O. mykiss from multiple sample sites in Almota, Alpowa, Penawawa and Deadman creeks (derived from Mendel 1999, and Mendel et al. 2004).

Location (Year)	Avg. Total Density (#/100 m2)	Avg. Age 1+ Density (#/100 m2)	Number of sites	Comments
Almota * ('01)	25.9	9.6	8	
Alpowa (1998)	17.1	11.7	9	whitefish ***
Penawawa ('02 & '03)**	18.9	0.6	10	whitefish ***
Little Penawawa * ('03)	5.0	5.0	3	

Deadman * ('01, '02)	4.3	0.6	9
S.F. Deadman * ('01, '02)	0	0	3
N.F. Deadman ('01, '02)	*1.1	0.5	2

* includes qualitative sites, which should be considered as a minimum estimate
** average is only 0.9 for total density if the lower two sites are excluded (159.2 , 21.5)
*** juvenile whitefish found near the mouth of the creek.

Bull trout and spring Chinook are not known or suspected to exist in any of these streams.

4.3.4.1.2 EDT Analysis

Almota Creek

Almota Summer Steelhead Baseline Population Performance.—Model results for Almota Creek summer steelhead are based on life history assumptions summarized in Table 4-6. The EDT model estimated the average spawning population size of the current Almota Creek summer steelhead to be 26 fish, with a carrying capacity of 74 fish and a productivity of just 1.6 adult returns per spawner (Table 4-7). The life history diversity value indicated only 17 % of the historic life history pathways could be successfully used under current conditions. The analysis also suggests that the Almota Creek watershed had a much greater production potential for summer steelhead than it now displays, as historical abundance was estimated at 806 spawners, with a productivity of 28.4 returning adults per spawner (Table 4-7). The EDT model predicted that with properly functioning habitat conditions Almota Creek could have an abundance of 110 fish, productivity of 6.2 returning adults per spawner, and a life history diversity of 53 % (Table 4-7).

Table 4-7. Life history assumptions used to model summer steelhead in Almota Creek, Washington.

Stock Name:	Almota Creek Summer Steelhead
Geographic Area (spawning reaches):	All reaches
River Entry Timing (Columbia):	Bonneville Dam: mostly July-August, but as late as November
River Entry Timing (Almota):	Early January through mid-April; mean entry date in mid-February
Adult Holding:	Adults begin holding in Lower Monumental Pool and Almota Ck. (between September and February)
Spawn Timing:	Begins week of March 1, ends 20th of May, with a peak in mid-April

Spawner Ages:	60% 1-Salt, 39% 2-Salt, <1% 3-Salt	
Emergence Timing (dates):	Lasts 2 weeks beginning as early as mid April and as late as early July, with an average period of May 25 – June 8.	
Smolt Ages:	40% Age 1, 60% Age 2	
Juvenile Overwintering:	Snake River:	10% (late October – March)
	Almota Ck.:	90% (late October – March)
***Stock Genetic Fitness:**	90% wild	
Harvest (In-watershed):	No Harvest	

Table 4-7. Baseline spawner population performance parameters for summer steelhead in the Almota Creek, Washington as determined by EDT, 2003.

Scenario	**Diversity Index**	**Productivity**	**Capacity**	**Adult Abundance**
Patient (Current)	17 %	1.6	74	26
PFC (Properly Functioning Conditions)	53 %	6.2	131	110
Template (Reference)	100 %	28.4	832	803

<u>*Deadman Creek*</u>

Deadman Creek Summer Steelhead Baseline Population Performance.—Model results for Deadman Creek summer steelhead are based on life history assumptions summarized in Table 4-8. The EDT model estimated the average spawning population size of the current Deadman Creek summer steelhead to be 6 fish, with a carrying capacity of 165 fish and a productivity of just 1.0 adult returns per spawner (Table 4-9). The life history diversity value indicated only 1 % of the historic life history pathways could be successfully used under current conditions. The analysis also suggests that the Deadman Creek watershed had a much greater production potential for summer steelhead than it now displays, as historical abundance was estimated at 1,868 spawners, with a productivity of 17.1 returning adults per spawner (Table 4-9). The EDT model predicted that with properly functioning habitat conditions Deadman Creek could have an abundance of 356 fish, productivity of 5.2 returning adults per spawner, and a life history diversity of 83 % (Table 4-9).

Table 4-8. Life history assumptions used to model summer steelhead in Deadman Creek, Washington.

Stock Name:	Deadman Creek Summer Steelhead	
Geographic Area (spawning reaches):	All reaches	
River Entry Timing (Columbia):	Bonneville Dam: mostly July-August, but as late as November	
River Entry Timing (Deadman):	Early January through mid-April; mean entry date in mid-February	
Adult Holding:	Adults begin holding in Lower Monumental Pool and Deadman Ck. (between September and February)	
Spawn Timing:	Begins week of March 1, ends 20th of May, with a peak in mid-April	
Spawner Ages:	60% 1-Salt, 39% 2-Salt, <1% 3-Salt	
Emergence Timing (dates):	Lasts 2 weeks beginning as early as mid April and as late as early July, with an average period of May 25 – June 8.	
Smolt Ages:	40% Age 1, 60% Age 2	
Juvenile Overwintering:	Snake River:	10% (late October – March)
	Deadman Ck.:	90% (late October – March)
***Stock Genetic Fitness:**	90% wild	
Harvest (In-watershed):	No Harvest	

Table 4-9. Baseline spawner population performance parameters for summer steelhead in the Deadman Creek, Washington as determined by EDT, 2003.

Scenario	Diversity Index	Productivity	Capacity	Adult Abundance
Patient	1 %	1.0	165	6

(Current)				
PFC (Properly Functioning Conditions)	83 %	5.2	440	356
Template (Reference)	100 %	17.1	1,984	1,868

4.3.4.2. Population characteristics consistent with VSP.

Almota Creek

The NOAA Fisheries Technical Recovery Team (TRT) has not identified Almota Creek summer steelhead as an independent population (TRT 2003). The NOAA Fisheries Viable Salmonid Population (VSP) document (McElhany 2000) identified four parameters that are key in determining the long-term viability of a population, those are: abundance, population growth rate, population spatial structure and diversity. Given the small size of the watershed and its limited capacity (even under PFC), it is not likely that it could ever meet the minimum requirements of an independent population.

Deadman Creek

The NOAA Fisheries Technical Recovery Team (TRT) has not identified Deadman Creek summer steelhead as an independent population (TRT 2003). The NOAA Fisheries Viable Salmonid Population (VSP) document (McElhany 2000) identified four parameters that are key in determining the long-term viability of a population, those are: abundance, population growth rate, population spatial structure and diversity. Given the small size of the watershed and its limited capacity (even under PFC), it is not likely that it could ever meet the minimum requirements of an independent population.

4.3.4.3 Population Status

Endangered Species

The Snake River ESU, which includes these small tributaries of the Lower Snake River, was listed as "Threatened" under the federal Endangered Species Act (ESA) by NOAA Fisheries in August, 1997 (62 FR 43937). Threatened status means that the listed group is likely to become endangered (in danger of extinction) within the foreseeable future throughout all or a significant portion of its range. The threatened determination for the ESU was made based on the following considerations:

- Severe declines in adult (escapement estimates) and juvenile abundance (parr densities) compared with historical levels, especially for B-run fish.
- The high proportion of hatchery-origin steelhead in the ESU (80% of steelhead passing Lower Granite Dam are hatchery fish) leading to concerns about straying

and introgression with native steelhead, especially when the hatchery fish area from composite stocks that have been domesticated for several generations.

SaSI Status
The summer steelhead in these small tributaries of the Lower Snake River are not included in the 1992 or 2002 SaSI (Salmon and steelhead inventory). This omission will be reevaluated in the near future now that some data are available. Genetic samples have been collected from some of these streams and will be analyzed to assist with a determination of the population characterization for Lower Snake River tributaries.

4.3.4.4 Harvest Assessment

The hatchery steelhead released at Lyons Ferry Hatchery with CWTs can be used as a surrogate for wild steelhead in nearby tributaries to evaluate their harvest locations (Table 4-10). Few fish are recovered in the ocean. Columbia River net fisheries accounted for 16.5-30.1% of the recoveries of wire tagged fish prior to ESA listings for steelhead. The recovery of CWTs in the Columbia River net fisheries has been reduced to less than 6.1% since the ESA listings. The highest recoveries are at Snake River traps and Snake River harvest. Total exploitation rates cannot be determined because adult returns that escape to spawn are not accounted for in the table below. Sport harvest is restricted to adipose clipped steelhead in the Columbia, Snake and Tucannon rivers. Therefore, the sport harvest shown in the table below is not reflective of the sport harvest effects on unmarked wild steelhead.

Table 4-10. Percentages of expanded coded-wire tag recoveries, by location, for hatchery steelhead releases in the Snake River at Lyons Ferry Hatchery (1990 - 2001).

			Release Year					
Recovery Location	90	91	96	97	98	99	00	01
Ocean harvest		0.5	0.1					
Columbia R. net	16.5	30.1	4.1	6.2	1.9	1.8	4.8	6.1
Columbia R. trib. trap								0.5
Columbia R trib.sport			1.1	13.3		0.6		
Columbia R. test fishery	0.1	0.2						
Columbia R. sport	7.3	0.2	4.6	4.3	3.9	3.8	1.7	10.3
Deschutes	0.4	2.1	1.2	0.7		0.7	0.7	2.3
Snake R sport	34.7	48.6	20.2	12.0	20.0	13.3	33.1	27.2
Snake R trap	40.9	18.2	68.7	63.4	74.1	79.7	59.6	53.4
Total expanded recoveries	968	418	983	577	205	701	706	552

Harvest rates in the Columbia basin have been reduced since the late 1980s and early 1990s to protect ESA listed salmon and steelhead. The Technical Advisory Committee, under US v OR, estimates harvest rates for naturally produced “A” run steelhead in the Columbia Basin. Harvest rates averaged about 18% in the 1980s, 15% in the early 1990s, and it was reduced to 4-6% in the 2001-2002 fisheries (Cindy LeFleur, WDFW, pers. Communication).

Steelhead harvest is not allowed in any of these tributaries of the Snake River.

Juvenile steelhead/rainbow trout may be harvested as resident trout in the tributaries in this subbasin during June through October of each year. Resident trout fisheries are closed during the peak of the juvenile salmon and steelhead out-migration in the Snake River (April, May and early June). Daily limits in the tributaries in the subbasin are 2 fish per day with an 8 in minimum size for trout.

Descriptions of fisheries and their estimated effects on listed species of fish in the Snake River basin are discussed in the WDFW Fishery Management and Evaluation Plan (FMEP) for the incidental Take of listed species in the Snake River submitted under ESA Section 10/4d (submitted to NOAA-fisheries on Dec. 2, 2002).

4.3.4.5 Hatchery Assessment

Only three streams within the subbasin have received out-plants of hatchery origin trout. Current WDFW records show catchable size (7" – 10") trout being released between 1983 and 1997 (Table 4-11). Management emphasis changed to conserve natural populations after 1997 and releases were discontinued. Natural origin juvenile rainbow were electrofished from Alkali Flat Ck in 2002 and 2003. It is not clear whether these are endemic origin rainbow or the result of spawning hatchery rainbow planted in previous years. The fish were sampled from an area near a falls that is believed to be impassable to steelhead, and total numbers of fish in the creek were low. Both Alpowa and Deadman creeks are accessible by steelhead. It is unknown what impact historical rainbow trout plants and the resulting fishery had on the steelhead population. There are no current plans to resume hatchery rainbow or steelhead out-plants in any of the Lower Snake subbasin tributaries.

Table 4-11. Releases of hatchery rainbow trout in Lower Snake Subbasin Tributaries, 1983 to present.

YEAR	SPECIES	WATER NAME			Total
		Alkali Flat Ck	Alpowa Ck	Deadman Ck	
1983	RB	500	1,760		2,260
1984	RB		2,048		2,048
1985	RB		2,106		2,106
1986	RB	468	2,604		3,072
1987	RB	540	1,575		2,115
1988	RB	816	1,995		2,811
1989	RB	1,056	1,485		2,541
1990	RB	540	1,044		1,584
1991	RB	1,044			1,044
1992	RB	504	1,008	1,000	2,512
1993	RB	684	1,620	1,620	3,924
1994	RB	504	1,020	1,020	2,544
1995	RB		570	998	1,568
1996	RB		288	504	792
1997	RB		315	507	822
Total		**6,656**	**19,438**	**5,649**	**31,743**

4.3.4.6 Steelhead Assessment Summary

Almota Creek

Restoration and Protection Potential

We assessed habitat priorities for Almota Creek summer steelhead in three basic ways. Two of these ways emphasized the "where" of a fish management plan while the third emphasizes the "what". Places where a strategic plan should be focused were determined by identifying areas critical to preserving current production (viz., by identifying areas with high "Protection Value"), and by identifying areas with the greatest potential for restoring a significant measure of historical production (viz., by identifying areas with high "Restoration Potential"). The kinds of actions a management plan should include were determined by performing a "Reach Analysis" (Section 4.2).

The restoration potential for steelhead within the Almota Creek watershed was 34% for life history diversity, 86% for productivity, and 48% for abundance (Figure 4-3). This suggests that 14-66 % of the potential for improving performance of Almota summer steelhead is tied to actions in the mainstem Columbia and Snake Rivers.

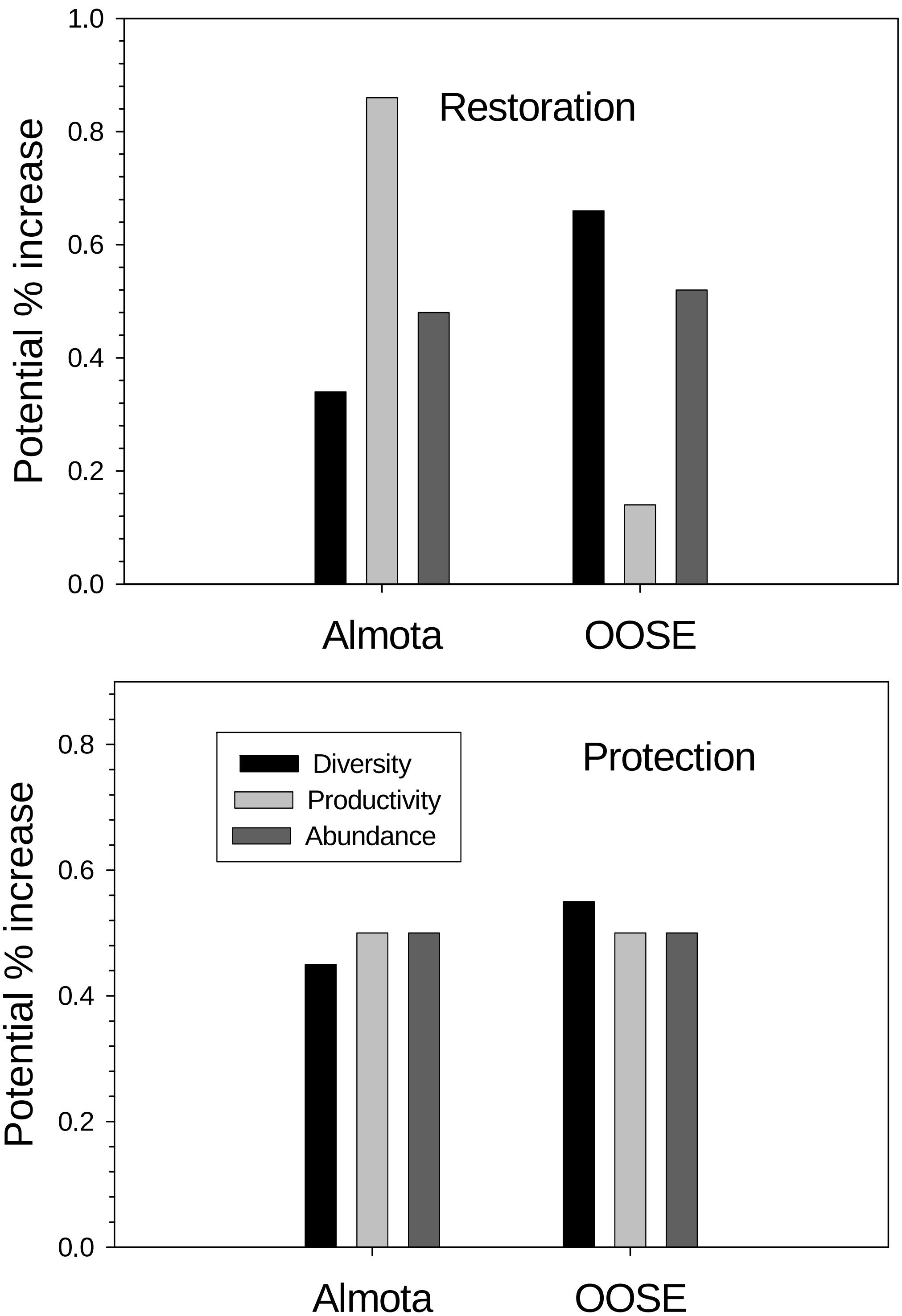

Figure 4-3. Contribution of reaches inside the Almota Creek watershed and outside the Almota Creek watershed to the total restoration and protection potential of Almota Creek, Washington summer steelhead. Out Of Subbasin Effects (OOSE) include the Snake River

Within the watershed, Almota Creek [from Little Almota 2 to unnamed RB trib (467 %)] and Almota Creek [from Little Almota to Little Almota 2 (336%)] geographic areas ranked highest for restoration potential, when summing the potential for life history diversity, productivity, and abundance (Table 4-12). There was little variation (121-171%) in the restoration potential of the next six priority geographic areas (Table 4-12). When scaling the potential for restoration benefit on a per kilometer basis, the North Branch (mouth to access limit) and Almota (mouth to Little Almota) ranked first and second, primarily due to their extremely short reach lengths of 0.27 and 0.14 mi., respectively (Table 4-12).

Reaches within the Almota watershed accounted for 45 % of the total protection value for life history diversity, 50 % for productivity, and 50% for abundance (Figure Alm1). This suggests that approximately one half of the potential for protecting the performance of Almota summer steelhead is tied to actions in the mainstem Columbia and Snake Rivers.

Within the Almota watershed, Almota Creek (from Little Almota 2 to unnamed RB trib) ranked first overall for protection value, with a cumulative degredation potential of – 179% when summing life history diversity, productivity, and abundance (Table 4-13). Other important areas included Almota Creek [from Little Almota to Little Almota 2 (59%)] and Little Almota 2 [from mouth to access limit (53%)](Table 4-13). Rankings were similar when scaling the potential for protection benefit on a per kilometer basis; however, the North Branch (mouth to access limit) ranked first, primarily due to its extremely short reach length of 0.27 mi (Table 4-13).

Table 4-12. Ecosystem Diagnosis and Treatment Model predictions of restoration potential for summer steelhead in Geographic Areas of the Almota Creek watershed, Washington. The scaled rank adjusted the unscaled rank by dividing by the length of stream in the geographic area to evaluate restoration potential on a per kilometer basis. Prod. was productivity and N(eq) was the equilibrium abundance of returning adult spawners.

				Unscaled		Scaled (% / km)	
Geographic area	Diversity Index	Prod.	N(eq)	Sum	Rank	Sum	Rank
Snake Mainstem	203%	125%	496%	824%	1	3%	10
Almota, L. Almota 2 to unnamed RB trib	23%	316%	127%	467%	2	108%	7
Almota, L. Almota to L. Almota 2	9%	215%	111%	336%	3	264%	3
Columbia Mainstem & Estuary	66%	46%	127%	239%	4	0.3%	11
L. Almota 2, mouth to access limit	12%	98%	60%	171%	5	104%	8
L. Almota, mouth to headcut	9%	83%	62%	155%	6	193%	4
Almota, forks to access limit	22%	81%	51%	153%	7	189%	5
Almota, unnamed trib to forks	20%	74%	59%	153%	8	139%	6
L. Almota, headcut to culvert	16%	71%	45%	132%	9	0.0%	12
North Branch, mouth to access limit	17%	63%	42%	121%	10	574%	1
Almota, mouth to L. Almota	8%	15%	14%	37%	11	494%	2
L. Almota, headcut	0%	0%	0%	0%	12	9%	9

Table 4-13. Ecosystem Diagnosis and Treatment model predictions of degradation potential (protection benefit) for summer steelhead in Geographic Areas of the Almota Creek watershed, Washington. The scaled rank adjusted the unscaled rank by dividing by the length of stream in the geographic area to evaluate restoration potential on a per kilometer basis. Prod. was productivity and N(eq) was the equilibrium abundance of returning adult spawners.

	Unscaled					Scaled (% / km)	
Geographic area	Diversity Index	Prod.	N(eq)	Sum	Rank	Sum	Rank
Snake Mainstem	-89%	-50%	-100%	-239%	1	-0.5%	8
Almota, L. Almota 2 to unnamed RB trib	-42%	-45%	-91%	-179%	2	-35.1%	2
Columbia Mainstem & Estuary	-41%	-23%	-47%	-110%	3	-0.1%	9
Almota, L. Almota to L. Almota 2	-16%	-15%	-28%	-59%	4	-13.4%	4
L. Almota 2, mouth to access limit	-34%	-7%	-12%	-53%	5	-18.3%	3
Almota, forks to access limit	-6%	-2%	-2%	-10%	6	-9.1%	6
Almota, unnamed trib to forks	-3%	-2%	-5%	-10%	7	-10.9%	5
North Branch, mouth to access limit	-2%	-2%	-3%	-7%	8	-35.7%	1
L. Almota, mouth to headcut	-2%	0%	-4%	-5%	9	-5.2%	7
L. Almota, headcut to culvert	0%	0%	0%	0%	10	0.0%	11
Almota, mouth to L. Almota	0%	0%	0%	0%	11	0.0%	10
L. Almota, headcut	0%	0%	0%	0%	12	0.0%	12

Limiting Habitat Attributes

Throughout most of Almota Creek, habitat diversity, sediment load, key habitat quantity, and flow were primary limiting factors, whereas channel stability and food were secondary. Loss of habitat diversity (floodplain/offchannel connectivity, LWD, and riparian vegetation) had moderate effects on all life stages throughout Almota Creek, except in the first reach (mouth to Little Almota) and last reach (forks to access limit) where high impacts were estimated for age-0 and age-1 rearing and spawning (last reach only) (Appendix x). Sediment load had extreme impacts to egg incubation and moderate to high impacts to age-0,1 winter rearing in all reaches. Loss of key habitat types had high impacts to spawning, age-2 migrants, and prespawning migrants in the first reach (mouth to Little Almota), high impacts to most life stage (except spawning and incubation) in the second reach (Little Almota Creek to Little Almota Creek 2), and small to moderate impacts to most life stages in the upper two reaches (RM 5-6.7). Low summer flows had high impacts to age-0 active rearing and small to moderate impacts to all other juvenile life stages in most reaches (Appendix x). Reduced food (salmon carcasses and benthic productivity) and channel stability had small to moderate impacts to most juvenile life stages. Predation had small to moderate impacts to most juvenile life stages in the first reach, due to the influence of predators from the Snake River mainstem.

Little Almota Creek

In Little Almota Creek, obstructions, habitat diversity, sediment load, key habitat quantity, and flow were primary limiting factors, whereas channel stability and food were secondary. There is an impassable headcut at RM 0.17, above this obstruction are many other obstructions along a 1.3 mile reach that may have supported steelhead in the past. Loss of habitat diversity (floodplain/offchannel connectivity, LWD, and riparian vegetation) had moderate effects to all life stages throughout Little Almota Creek, with high impacts to fry colonization. (Appendix x). Sediment load had extreme impacts to egg incubation and loss of key habitat types had high impacts to prespawn holding with moderate impacts to all other life stages. Low summer flows had high impacts to age-0,1 summer and winter rearing and small to moderate impacts to all other juvenile life stages (Appendix x). Reduced food (salmon carcasses and benthic productivity) and channel stability had small to moderate impacts to age-0,1 life stages (Appendix x).

Little Almota Creek 2

In Little Almota Creek 2, habitat diversity, sediment load, and flow were the primary limiting factors. Loss of habitat diversity (floodplain/offchannel connectivity, LWD, and riparian vegetation) had small to moderate effects to most life stages (except prespawning and egg incubation) (Appendix x). Sediment load had extreme impacts to egg incubation and low summer flows had high impacts to age-0 rearing and small to moderate impacts on all other juvenile rearing life stages (Appendix x).

North Branch Almota Creek

In the North Branch of Almota Creek, habitat diversity, sediment load, key habitat quantity, and flow were primary limiting factors, whereas channel stability and food were secondary. Loss of habitat diversity (floodplain/offchannel connectivity, LWD, and riparian vegetation) had high impacts to age-0,1 rearing and moderate impacts to most other life stages (Appendix x). Sediment load had high impacts to egg incubation and age-0,1 winter rearing. Loss of key habitat types had high impacts to prespawn holding with moderate impacts to most other life stages. Low summer flows had high impacts to age-0 summer rearing and small to moderate impacts to all other juvenile life stages (Appendix x). Reduced food (salmon carcasses and benthic productivity) and channel stability had small to moderate impacts to most juvenile life stages (Appendix x).

Deadman Creek

<u>*Restoration and Protection Potential*</u>

We assessed habitat priorities for Deadman Creek summer steelhead in three basic ways. Two of these ways emphasized the "where" of a fish management plan while the third emphasizes the "what". Places where a strategic plan should be focused were determined by identifying areas critical to preserving current production (viz., by identifying areas with high "Protection Value"), and by identifying areas with the greatest potential for restoring a significant measure of historical production (viz., by identifying areas with high "Restoration Potential"). The kinds of actions a management plan should include were determined by performing a "Reach Analysis" (Section 4.2).

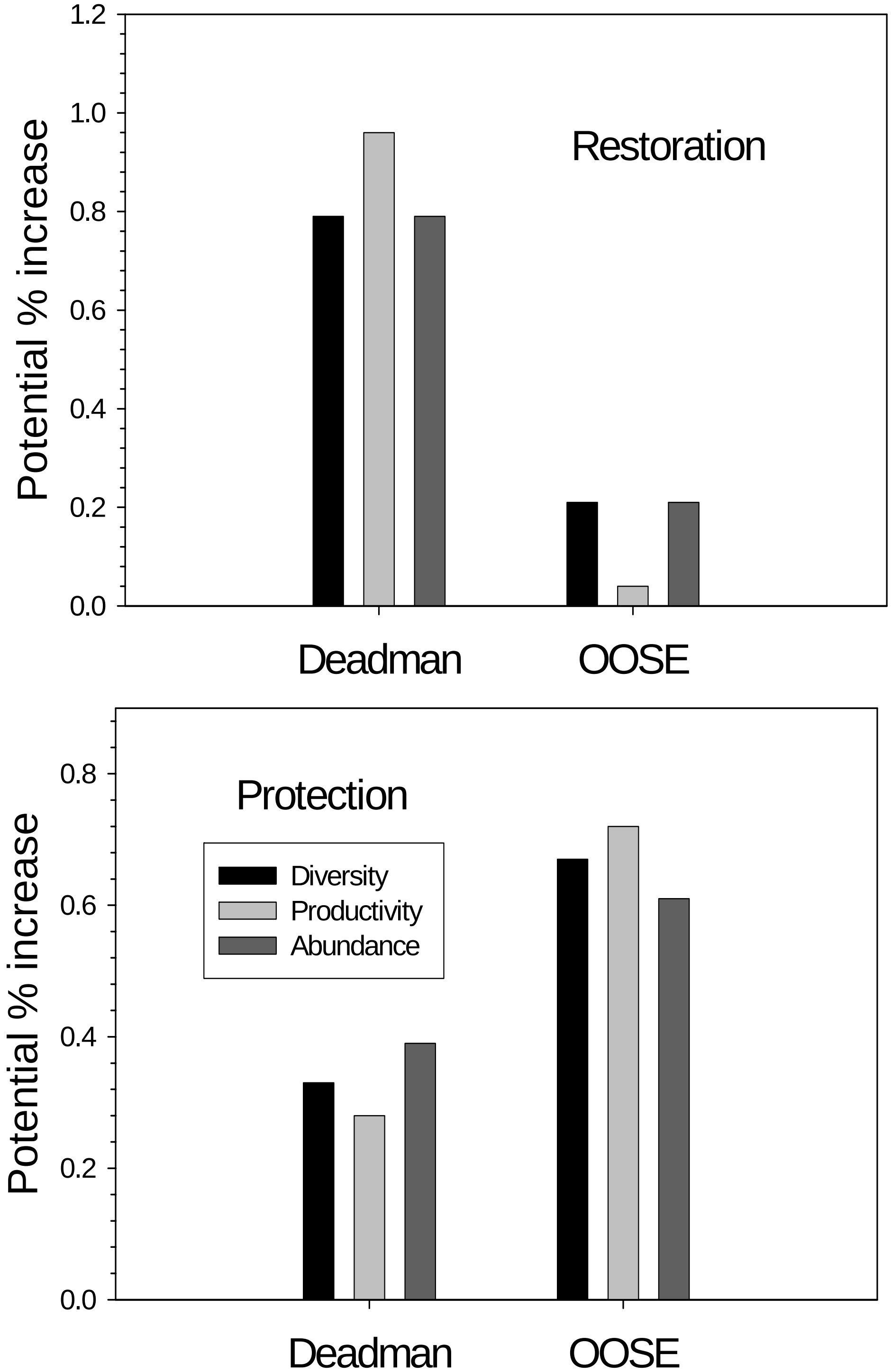

Figure 4-4. Contribution of reaches inside the Deadman Creek watershed and outside the Deadman Creek watershed to the total restoration and protection potential of Deadman Creek, Washington summer steelhead. Out Of Subbasin Effects (OOSE) include the Snake River

The restoration potential for steelhead within the Deadman Creek watershed was 79% for life history diversity, 96% for productivity, and 79% for abundance (Figure 4-4). This suggests that only 4-21 % of the potential for improving performance of Deadman summer steelhead is tied to actions in the mainstem Columbia and Snake Rivers.

Within the watershed, the South Fork of Deadman Creek (mouth to access limit) was the highest priority restoration assessment unit for both unscaled (5050%) and scaled (649% / km) results when summing the potential increases for life history diversity, productivity, and abundance (Table 4-14). The scaled results adjust the restoration benefit on a per kilometer basis to identify areas that would be most efficient to apply restoration dollars. In the Deadman Creek watershed, there was very close agreement between the two outputs and the top five geographic areas for restoration included Deadman (Ping to Lynn Gulch), North Fork of Deadman (intermittent zone to historical access limit), Deadman (Lynn Gulch to forks), and Ping Creek (mouth to bridge obstruction) (Table 4-14). However, the remaining geographic areas (except Lynn Gulch culvert), also had excellent restoration potential for both unscaled (1177-2682%) and scaled outputs (132-312% / km).

Reaches within the Deadman watershed accounted for 33 % of the total protection value for life history diversity, 28 % for productivity, and 39 % for abundance (Figure DM1). This suggests that approximately two thirds of the potential for protecting the performance of Deadman summer steelhead is tied to actions in the mainstem Columbia and Snake Rivers.

Within the Deadman watershed, the South Fork of Deadman Creek (mouth to access limit) ranked first overall for protection value, with a cumulative degredation potential of –225% when summing life history diversity, productivity, and abundance (Table 4-15). Once again, rankings were similar when scaling the potential for protection benefit on a per kilometer basis. Other important areas for protection included Deadman (Embayment to Willow, Ping to Lynn Gulch; and Lynn Gulch to forks) and the North Fork of Deadman (both reaches) (Table 4-15).

Table 4-14 Ecosystem Diagnosis and Treatment Model predictions of restoration potential for summer steelhead in Geographic Areas of the Deadman Creek watershed, Washington. The scaled rank adjusted the unscaled rank by dividing by the length of stream in the geographic area to evaluate restoration potential on a per kilometer basis. Prod. was productivity and N(eq) was the equilibrium abundance of returning adult spawners.

				Unscaled		Scaled (% / km)	
Geographic Area	**Diversity Index**	**Prod.**	**N(eq)**	**Sum**	**Rank**	**Sum**	**Rank**
SF Deadman, mouth to access limit	3450%	395%	1206%	5050%	1	649%	1
Snake Mainstem	2775%	93%	2114%	4982%	2	2%	13
Deadman, Ping to Lynn Gulch	1950%	330%	1101%	3381%	3	413%	3
NF Deadman, intermittent zone to historical access limit	1625%	338%	854%	2817%	4	477%	2
Deadman, Lynn to forks	1575%	330%	897%	2802%	5	373%	5
Ping, mouth to bridge obstruction	1475%	310%	920%	2705%	6	398%	4
Lynn, culvert to access limit	1750%	175%	758%	2682%	7	269%	8
NF Deadman, mouth to intermittent zone	825%	418%	914%	2158%	8	294%	7
Deadman, Willow to Ping	725%	304%	856%	1885%	9	312%	6
Deadman, embayment to Willow	475%	328%	787%	1590%	10	168%	9
Columbia Mainstem & Estuary	1000%	35%	500%	1535%	11	0%	14
Lynn, mouth to perched culvert	225%	306%	764%	1296%	12	146%	10
Deadman embayment	350%	163%	664%	1177%	13	132%	11
Lynn2(culvert)	0%	0%	4%	4%	14	2%	12

Table 4-15. Ecosystem Diagnosis and Treatment model predictions of degradation potential (protection benefit) for summer steelhead in Geographic Areas of the Deadman Creek watershed, Washington. The scaled rank adjusted the unscaled rank by dividing by the length of stream in the geographic area to evaluate restoration potential on a per kilometer basis. Prod. was productivity and N(eq) was the equilibrium abundance of returning adult spawners.

				Unscaled		Scaled (% / km)	
Geographic Area	**Diversity Index**	**Prod.**	**N(eq)**	**Sum**	**Rank**	**Sum**	**Rank**
Snake Mainstem	-100%	-48%	-100%	-248%	1	-1%	11
SF Deadman, mouth to access limit	-100%	-25%	-100%	-225%	2	-166%	1
Columbia Mainstem & Estuary	-100%	-15%	-100%	-215%	3	-0.1%	12
Deadman, Ping to Lynn Gulch	0%	0%	-6%	-6%	4	-30%	4
Deadman, Lynn to forks	0%	0%	-5%	-5%	5	-39%	3
NF Deadman, mouth to intermittent zone	0%	0%	-4%	-4%	6	-42%	2
NF Deadman, intermittent zone to historical access limit	0%	0%	-3%	-3%	7	-27%	5
Deadman, embayment to Willow	0%	0%	-2%	-2%	8	-14%	6
Deadman embayment	0%	0%	-2%	-2%	9	-3%	8
Lynn, culvert to access limit	0%	0%	-2%	-2%	10	-1%	10
Deadman, Willow to Ping	0%	0%	-1%	-1%	11	-7%	7
Ping, mouth to bridge obstruction	0%	0%	-1%	-1%	12	-2%	9
Lynn, mouth to perched culvert	0%	0%	-1%	-1%	13	-0.1%	13
Lynn culvert	0%	0%	0%	0%	14	0.0%	14

Limiting Habitat Attributes

Deadman Creek

Throughout most of Deadman Creek, habitat diversity, sediment load, key habitat quantity, and flow were primary limiting factors, whereas temperature, channel stability, predation, and food were secondary. Loss of habitat diversity (floodplain/offchannel connectivity, LWD, and riparian vegetation) had small to moderate effects on most life stages throughout Deadman Creek, but high impacts to spawning, fry colonization, and age-0 summer rearing in reaches Dead 3-5 (Appendix x). Sediment load had high impacts to egg incubation and age-0,1 winter rearing and small to moderate impacts to spawning and fry colonization. Loss of key habitat types varied by reach, with the greatest losses occurring to prespawn holding and juvenile rearing life stages in reach Dead1 (and reaches Dead 3,5 for prespawn holding). Low summer flows had high impacts to age-0 active rearing and small to moderate impacts to all other juvenile life stages in most reaches (Appendix x). Warm summer temperatures had high impacts to egg incubation and moderate impacts to fry colonization and age-0 summer rearing. Reduced food (salmon carcasses and benthic productivity) and channel stability had small to moderate impacts to most juvenile life stages. Predation had high impacts to fry colonization and small to moderate impacts to most other juvenile life stages in the first reach, due to the influence of predators from the Snake River mainstem.

Ping Creek and Lynn Gulch

In Ping Creek and Lynn Gulch, habitat diversity, sediment load, key habitat quantity, and flow were primary limiting factors, whereas obstructions, channel stability and food were secondary. Loss of habitat diversity (floodplain/offchannel connectivity, LWD, and riparian vegetation) had high impacts on spawning and age-0,1 rearing life stages and moderate effects to most other life stages (Appendix x). Sediment load had high impacts to egg incubation and loss of key habitat types had high impacts to prespawn holding and age-0 summer rearing. Low summer flows had high impacts to fry colonization and age-0,1 summer and winter rearing and small to moderate impacts to age-1,2 summer rearing (Appendix x). Reduced food (salmon carcasses and benthic productivity) and channel stability had small to moderate impacts to age-0,1 life stages (Appendix x). There is a perched culvert in Lynn Gulch that partially blocks upstream passage of prespawning migrants.

North and South Forks of Deadman Creek

In the North and South Forks of Deadman Creek, habitat diversity, sediment load, key habitat quantity, and flow were primary limiting factors, whereas channel stability and food were secondary. Loss of habitat diversity (floodplain/offchannel connectivity, LWD, and riparian vegetation) had high impacts spawning and fry colonization and moderate impacts to most other life stages (Appendix x). Sediment load had high impacts to egg incubation and age-0,1 winter rearing. Loss of key habitat types varied by reach, with high to extreme losses for prespawning migrants in NFDead1 and the South Fork, high losses to spawning and egg incubation for NFDead1 and small to moderate impacts to other life stages. Low summer and winter flows had high impacts to age-0,1 rearing and small to moderate impacts to all other juvenile life stages (Appendix x). Reduced food (salmon carcasses and benthic productivity) and channel stability had small to moderate impacts to most juvenile life stages (Appendix x).

4.4 Assessment Analysis Summary

The combined restoration and protection rankings for Almota and Deadman Creek are presented in Table 4-16 below. In small streams such as these where only a few reaches are available it is useful information to know where in the stream both restoration and protection can provide the greatest increase in species potential. Rankings were based on the total combined ranks for protection and restoration as presented above. In the Almota, North Branch was the number one ranked reach for restoration and protection as was South Fork Deadman in Deadman Creek.

Table 4-16. Combined Protection and restoration rankings for Deadman Creek and Almota Creek as determined by EDT analysis. Rankings were ascertained by combining the rank lpaces from the restoration and protection results.

Almota

Reach	EDT Protection/Restoration Priority Scaled Rank Total	Potential Performance Increase (% / km)	Potential Performance Decrease (% / km)
North Branch, mouth to access limit	2	574%	-35.7%
Almota, L. Almota to L. Almota 2	7	264%	-13.4%
Almota, L. Almota 2 to unnamed RB trib	9	108%	-35.1%
Almota, mouth to L. Almota	10	494%	0.0%
Almota, forks to access limit	11	189%	-9.1%
Almota, unnamed trib to forks	11	139%	-10.9%
L. Almota 2, mouth to access limit	11	104%	-18.3%
L. Almota, mouth to headcut	11	193%	-5.2%
L. Almota, headcut	19	9%	0.0%
L. Almota, headcut to culvert	19	0.0%	0.0%

Deadman

Reach	EDT Protection/Restoration Priority Scaled Rank Total	Potential Performance Increase (% / km)	Potential Performance Decrease (% / km)
SF Deadman, mouth to access limit	2	649%	-225%
Deadman, Ping to Lynn Gulch	5	413%	-6%
NF Deadman, intermittent zone to historical access limit	7	477%	-3%
Deadman, Lynn to forks	8	373%	-5%
NF Deadman, mouth to intermittent zone	11	294%	-4%
Ping, mouth to bridge obstruction	14	398%	-1%
Deadman, embayment to Willow	15	168%	-2%
Deadman, Willow to Ping	15	312%	-1%
Lynn, mouth to perched culvert	16	146%	-2%
Deadman embayment	18	132%	-2%
Lynn, mouth to culvert	21	2%	-1%
Lynn, culvert to access limit	24	269%	0%

Analysis Discussion

The subbasin assessment has many findings that are comparable to other recent assessments and planning efforts. Habitat Diversity, Key Habitat by Lifestage, Sediment and Riparian Function were the most common limiting attribute identified with the assessment; this compared favorably with earlier assessments (Table 4-17).

Table 4-17. Assessments performed in the Lower Snake Subbasin and the key limiting factors identified.

Assessment	Key Limiting Factors Identified
EDT	Habitat Diversity (Includes: riparian Function, confinement, gradient, LWD density for most life stages); Sediment Load (Including embeddedness; and percent fines); Key Habitat (pools and pool tail-outs)
Limiting Factors Analysis (Kuttle 2002)	a) protect riparian vegetation b) re-establish riparian veg. c) practice proper riparian management d) continue to reduce fine sediment e) reduce summer stream temperatures f) inventory surface water diversions g) increase channel complexity h) enforce existing landuse regulations i) inventory habitat conditions and fish presences and abundance every 5 years.
Subbasin Summary (Bartels 2001)	a) conduct baseline assessments and periodic monitoring of fish abundance and habitat conditions in tributaries. b) collect hydrologic data to thoroughly characterize the area. c) identify the location of channel and riparian vegetation alteration and the amount of water removed from the streams d) restore riparian habitat e) reduced sediment

Assessment Conclusions

As stated earlier in the assessment it is appropriate to identify areas within the Lower Snake Subbasin that rank highest for restoration and protection. This, in affect, gives us the highest value areas in which to devote limited resources. It was assumed in this assessment that obtaining funding for work in this area will be difficult given the relatively small population of steelhead. It is unlikely that the more expensive active restoration work will be funded. That said, we felt that by identifying our highest value areas for the management group and advocating passive measures, we could both address the limiting factors below and help develop a strategy that would be successful in bringing funding to the Lower Snake.

The EDT analysis was conducted on only two of the nine known or presumed steelhead bearing tributaries in the Lower Snake subbasin. Results from these were to be applied to the other streams within the subbasin. The assumption is that the habitat conditions are similar across these streams. Given that, the limiting factors and life stages identified in **Almota** or **Deadman** Creeks can assumed to be the same in the other tributaries. Performing EDT analysis on these streams allowed us to identify priority reaches within these streams based on the EDT output while considering empirical data and past planning efforts. It did not, however, provide information with which to identify other areas in the subbasin that may be priority for restoration and protection. Based on the empirical data presented in section 4.3.4.1.1, **Alpowa** Creek and **Penawawa** Creek should also be priorities for restoration and protection in the subbasin. Besides Almota Creek these two streams have the highest densities of juvenile steelhead in the subbasin. While this assessment puts forward these two streams as priorities with Deadman and Almota, it does not identify reaches within these streams that should be the focus of restoration and protection. In order to focus efforts clearly in the subbasin this step needs to be accomplished. Given the lack of an EDT analysis the decision on a priority reaches for these streams would be best accomplished during the first management workshop with the assembled technical and citizen groups.

Restoration/Protection Priority Areas

The following streams and reaches have the **highest restoration/protection value** in the Lower Snake Subbasin according to the EDT analysis of steelhead and taking into account other factors, such as previous planning efforts and empirical data:

a. Almota Creek
   i. Alm1
   ii. Alm2
   iii. Alm3
   iv. Alm4
   v. North Branch

b. Deadman Creek
   i. Dead4
   ii. Dead5
   iii. SFDeadman

c. Alpowa Creek
   i. Reach to be determined.

d. Penawawa Creek
   i. Reach to be determined

A continuous block of stream was identified on Almota Creek. It starts at the mouth and continues up the mainstem to the forks; and then up the North Branch. The priority area for Deadman is also contiguous starting at Ping Gulch and continuing to the forks and up South Fork Deadman to the steelhead access limit.

Divergence from EDT – NF Deadman from the intermittent flow zone to the end of steelhead access was not included in the final priority list. The empirical data did not support the inclusion of this reach at the cost of excluding the mainstem Deadman from Lynn Gulch to the forks. There is also added value from including the mainstem reach on Deadman; it maintains a continuous corridor along the stream as being priority restoration and protection.

Impacted Life Stages
Within the priority restoration/protection areas above the following life stages are the most impacted according to the EDT analysis:

i. Incubation
ii. Fry
iii. Subyearling Rearing
iv. Overwintering

The impacted life stages are strictly from the EDT analysis performed on Almota and Deadman Creeks. It is assumed that the same life stages are limited in Alpowa and Penawawa. These represent the top four by life stage rank for the areas as determined from the reach analysis. Life stage ranks are determined through EDT for each reach by considering all three EDT population performance measures (life history diversity, abundance and production). Almota1 was the only exception to the four listed life stages. Spawning was actually ranked higher when considering all three performance measures. Overwintering in this reach was determined to actually be more limiting due to a much larger performance impact on productivity (55% vs. 7%). It should be noted that in order to develop a well targeted subbasin plan we determined to make this distinction in life stage impacts. However, throughout the system the habitat factors that were identified as most limiting to these life stages actually impact all life stages of salmonids to one degree or another. The previous assessment and planning documents did not usually go into this fine of detail, in that limited life stages were not clearly defined within specific reaches.

Limiting Habitat Attributes
The following habitat attributes are considered to have the most impact as determined by EDT within the above Lower Snake reaches and key life stages listed above:

a) Attributes common to all reaches in both Almota and Deadman
    i. LWD
    ii. Sediment (Turbidity, Fines and Embeddedness)
    iii. Key Habitat (pools)
    iv. Flow

b) Attributes present in one or more reaches in both Almota and Deadman
    i. Confinement
    ii. Riparian Function

c) Attribute present only in Deadman
    i. Temperature

These habitat attributes were taken directly from the EDT analysis. They were then examined for accuracy given local knowledge and for consistency with previous assessment and planning documents. Please note the commonality of compromised habitat attributes in the above reaches. When the data was presented to the technical and citizen workgroups it was accepted that the attribute as distributed above correctly characterize not just the streams analyzed but the tributaries in general that are in the Lower Snake Subbasin. Large wood and pools are considered lacking throughout the basin and it is clearly accepted that sediment input to the stream is quite likely limiting steelhead production. Less widely accepted is the notion of limited flow compared to historical conditions. Water withdrawals from the streams is present in the Lower Snake but not common. It is agreed that flow is likely somewhat reduced due to the lack of ground cover in the uplands and removal of riparian vegetation. The question is: How reduced is the flow from historical? That question is not readily answered. It was agreed, however, actions in the subbasin that benefit the other limiting attributes will also benefit flow.

Mainstem Snake River

The mainstem portion of the Snake River from the mouth to the confluence with the Clearwater River is considered part of the Lower Snake Subbasin. The assessment team considered this area for further assessment work. It was decided that the there were not enough resources to do credible job on the tributaries and to also take on the task of re-summarizing the extensive empirical data that has been gathered on the mainstem. Also considered was the fact that the mainstem had already undergone the amendment process to the Fish and Wildlife Program. The mainstem Amendments to the Fish and Wildlife Program were adopted by the Northwest Power and Conservation Council (NPCC) in April of 2003 and posted to the federal register on August 6, 2003 (volume 68, number 151). Given that the mainstem amendment has a vision, set of biological objectives and strategies it is recommended by the assessment team that the management plan development group defer to the Mainstem Amendment. The general guidance given in the mainstem amendment should serve as the basis and support for projects proposals and funding based in the mainstem (see NPCC memo dated September 30, 2002, Appendix ##).

EDT Analysis

The EDT analysis used in this assessment has proved to be a valuable tool. While conducting this assessment we have tried to use this tool in a responsible manner. We believe that the most value from EDT is in the future. The time frame that we operated under and the shortage of data available for some key attributes (see below) encouraged us to use caution with the results. It is our determination that the current data set used for this EDT run should be re-examined and revised between each rolling provincial review. This should also occur before it is used for other planning efforts. We believe that its use in its present state for this Subbasin Plan was necessary, however, with more time and better data the model results can certainly be improved upon.

Habitat Data

While conducting this assessment and particularly while performing the attribute ratings for EDT, it became quite clear that in many cases we were lacking even the most basic habitat information. This made the assessment work quite difficult. In order to properly assess the subbasin and provide better information for the management strategy process it is vital that additional habitat and life history surveys be conducted. There were some reaches for which we had no empirical data on habitat types (pools:riffles:glides, etc.), embeddedness, LWD density, winter temperature or percent fines. The entire subbasin is lacking in, bedscour, bankfull widths, flow and riparian function data. Gradient measurements for individual reaches was also a concern. Gradients were measured using Terrain Navigator; the accuracy of these gradients is unknown and needs to be ground-truthed. Gradients for EDT input were derived using Terrain Navigator software. These gradients have not been ground truthed and some doubt remains as to whether any of the reaches actually exceed 3%. This could lead to habitat diversity appearing to be a higher magnitude problem than it actually is. It is the strong finding of this assessment that the above information begin to be acquired as soon as possible in order to better inform the land managers, public and private, during future planning efforts.

4.7 Species of Interest

4.7.1 Introduction

Species of Interest (SOI) was included within the plan to provide a venue to present species that may have ecological and/or cultural significance but for which there is not enough known about the species to include them in the focal species category for planning purposes. SOI were submitted to the subbasin planning team for approval to be included within the plan. SOI that are submitted have an unknown quantity of ecological significance; in order to determine whether or not these species should be considered as focal for the subbasin more must be learned about subbasin specific life histories and conditions that may be limiting there productivity. Each SOI has a corresponding section within the research, monitoring and evaluation section that includes either a research plan for the SOI or a place holder with the intention of inserting a plan in a later iteration of the subbasin plan. Species of Interest were not to be submitted without either a research plan or the intention of developing one.

4.7.2 Species of Interest

White Sturgeon (submitted by the Nez Perce Tribe and is still under development)

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