8 Fishery Resources

8.1 Fish Status

Currently more than 30 species of fish inhabit the Clearwater subbasin, including 19 native species, two of which have been reintroduced (Table 43). Salmonids and cyprinids are most numerous, representing 10 and 6 species, respectively. Exotic species within the subbasin are generally introduced sport or forage species, and include primarily centrarchids, ictalurids, and salmonids.

Five fish species have been chosen as aquatic focal species in this assessment: chinook salmon (*Oncorhynchus tshawytscha*), steelhead trout (*Oncorhynchus mykiss* subspecies), westslope cutthroat trout (*Oncorhynchus clarki lewisi*), bull trout (*Salvelinus confluentus*) and brook trout (*Salvelinus fontinalis*). Aquatic focal species may serve as indicators of larger communities, and are listed by federal and/or state agencies as species of concern or, in the case of brook trout, have the potential to negatively impact other selected species. In addition, aquatic focal species had adequate data available for species status, distribution, and habitat use to aid future decision making.

Information is also provided for additional species of interest for which only limited data exists, redband trout (*Oncorhynchus mykiss* subspecies), Pacific lamprey (*Lampetra tridentata*) and coho salmon (*Oncorhynchus kisutch*). Although species status is discussed, data limitations for these species prohibits substantial consideration of limiting factors and distribution or condition of existing habitat areas.

The resident fishery in Dworshak Reservoir is also considered a substantial fishery resource in the Clearwater subbasin. The Dworshak Reservoir fishery involves multiple species, and is addressed as a single fishery rather than as a large number of individual species.

Distribution and status information was compiled for the five aquatic focal species using 23 data sources. Sources included regional, state, and localized databases, recent agency publications and assessments, and personal interviews with regional biologists. For the purpose of starting with consistent and subbasin-wide distribution and status information for each species, GIS layers were obtained from the most recent (2000) updates to the ICBEMP database. The ICBEMP layers were then modified using data from the other 22 sources. In making revisions to the ICBEMP data layers, a list of rules was applied to ensure consistent consideration of sources (based on data age, etc.) and resolution of conflicting data sources (i.e. presence vs. absence).

8.1.1 Chinook Salmon

Two chinook salmon ESUs are recognized by the National Marine Fisheries Service under the Endangered Species Act, spring/summer and fall chinook salmon. For the purpose of this document, three life history forms of chinook salmon will be discussed; spring, fall, and early-fall chinook salmon. Early-fall chinook salmon are distinguished by the NPT (Hesse and Cramer 2000) as "fish that spawn principally in October, and would have a life history similar to that of summer chinook salmon in the mid-Columbia (October spawning and subyearling smolts), but not to the Snake River summer chinook salmon (late August-early September spawning and yearling smolts)." Early fall chinook are not recognized or described by other management agencies. The historical summary of life-history/run timing of summer chinook salmon in the Clearwater River subbasin is described in Richards (1967) and NPT and IDFG (1990).

Table 43. Fish species inhabiting the Clearwater subbasin

Species – Common Name	Scientific Name	Origin
Bridgelip Sucker	*Catostomus columbianus*	Native
Bull Trout	*Salvelinus confluentus*	Native
Chiselmouth	*Acrocheilus alutaceus*	Native
Largescale sucker	*Catostomus machrocheilus*	Native
Longnose Dace	*Rhinichthys cataractae*	Native
Mottled Sculpin	*Cottus bairdi*	Native
Mountain Whitefish	*Prosopium williamsoni*	Native
Northern pikeminnow	*Ptychocheilus oregonensis*	Native
Pacific Lamprey	*Lampetra tridentata*	Native
Paiute sculpin	*Cottus beldingi*	Native
Peamouth	*Mylocheilus caurinus*	Native
Redside shiner	*Richardsonius balteatus*	Native
Sandroller	*Percopsis transmontana*	Native
Shorthead sculpin	*Cottus confusus*	Native
Speckled Dace	*Rhinichthys osculus*	Native
Steelhead/Rainbow/Redband Trout	*Oncorhynchus mykiss*	Native/Exotic [1]
Torrent sculpin	*Cottus rhotheus*	Native
Westslope Cutthroat Trout	*Oncorhynchus clarki lewisi*	Native
Chinook Salmon (Fall)	*Oncorhynchus tshawytscha*	Native/Reintroduced
Chinook Salmon (Spring)	*Oncorhynchus tshawytscha*	Reintroduced
Coho Salmon	*Oncorhynchus kisutch*	Reintroduced
Arctic Grayling	*Thymallus arcticus*	Exotic
Black Bullhead	*Ictalurus melas*	Exotic
Black crappie	*Pomoxis nigromaculatus*	Exotic
Bluegill	*Lepomis macrochirus*	Exotic
Brook Trout	*Salvelinus fontinalis*	Exotic
Brown bullhead	*Ictalurus nebulosus*	Exotic
Carp	*Cyprinus carpio*	Exotic
Channel catfish	*Ictalurus natalis*	Exotic
Golden Trout	*Salmo aguabonita*	Exotic
Kokanee	*Oncorhynchus nerka*	Exotic
Largemouth bass	*Micropterus salmoides*	Exotic
Pumpkinseed	*Lepomis gibbosus*	Exotic
Smallmouth bass	*Micropterus dolomieu*	Exotic
Tiger Muskie	*Esox lucius x masquinongy*	Exotic
Yellow Perch	*Perca flavescens*	Exotic

1 Includes exotic resident rainbow trout

Indigenous chinook salmon in the Clearwater River subbasin were eliminated by Lewiston Dam (Schoen et al. 1999; USFWS 1999c; Murphy and Metsker 1962). However, naturalized populations of spring chinook salmon have been reestablished in some portions of the subbasin as a result of reintroduction efforts (Schoen et al. 1999; Larson and Mobrand 1992). Reintroduction efforts for fall chinook salmon were considered unsuccessful (Hoss 1970), and the existing fall chinook runs in the lower Clearwater subbasin may likely represent a combination of recent hatchery supplementation efforts and recolonization by Snake River stock(s). Fall chinook salmon upstream of Lower Granite Dam (including the Clearwater River) are considered part of a single genetically similar aggregate and represent one evolutionarily significant unit (Waples et al. 1991).

Historical status

Sources suggest that spring, summer (Simpson and Wallace 1982), and fall (Clearwater National Forest 1997; NPT and IDFG 1990; CBFWA 1991) chinook were likely present within the mainstem Clearwater River prior to 1900. The USFWS (1999) claim it is reasonable to assume that fall chinook spawning occurred within the lower Clearwater River prior to dam construction on the Snake River.

Historical numbers of chinook salmon entering the Clearwater River subbasin are assumed to be substantial, but no documentation on actual numbers is available (NPT and IDFG 1990). Chapman (1981) modeled “pristine production” of chinook salmon (race not clearly defined, presumably spring and fall) from the Clearwater subbasin, estimating that 1.8 million smolts were produced resulting in 94,169 adults returning to the mouth of the Columbia River annually. Of those fish, 63,617 originated from tributaries and 30,552 were from the mainstem[3]. The majority of historical chinook salmon (again, race not clearly defined, presumably spring and fall) production was thought to occur in major tributary systems of the Clearwater River (North, South, and Middle Forks), with less than 10% of total production in the mainstem reach (Clearwater National Forest 1997). Within the mainstem portion of the Clearwater River, the most substantial production of spring chinook salmon probably occurred in the Lolo and Potlatch Creek drainages (Clearwater National Forest 1997; Clearwater subbasin Bull Trout Technical Advisory Team 1998b).

Spring Chinook Salmon

Spring chinook salmon within the Clearwater subbasin are excluded from the ESU encompassing other spring/summer stocks throughout the Snake River basin, but represent an important effort aimed at restoring an indigenous fish population to an area from which they had been extirpated. Efforts to reestablish spring chinook salmon in the subbasin were extensive and have previously been summarized by NPT and IDFG (1990), Cramer and Neeley (1992), and Cramer (1995), and Bowles and Leitzinger (1991). Currently, hatchery spring chinook are released for harvest mitigation and to supplement natural production (NPT and IDFG 1990; IDFG 2001c)

Reintroduction of spring chinook salmon following removal of the Lewiston Dam has resulted in naturally reproducing runs in Lolo Creek and mainstem/tributary reaches of the Lochsa, Selway, and South Fork Clearwater Rivers (Larson and Mobrand 1992). Founding

[3] Calculation error(s) were made in estimating production from South Fork tributaries in the original publication (D. Chapman, Chapman Consultants, personal communication, August 2, 2001). Appropriate corrections have been made, and numbers presented here are therefore derived from, but do not directly reflect those presented in the published report

hatchery stocks used for spring chinook salmon reintroductions were primarily obtained from the Rapid River Hatchery (Kiefer et al. 1992; NPT and IDFG 1990). Initially however, spring chinook stocks imported for restoration came from Carson, Big White, Little White or other spring chinook captured at Bonneville Dam (NPT and IDFG 1990). Genetic analyses confirm that existing natural spring chinook salmon in the Clearwater River subbasin are derived from reintroduced Snake River stocks (Matthews and Waples 1991).

Spring chinook salmon enter the Columbia River and begin spawning migrations during April and May, reaching the Clearwater subbasin from April through July (NPT and IDFG 1990). Spring chinook salmon indigenous to the Snake River basin tend to spawn earlier and higher in elevation than summer (early-fall) and fall races (Chapman et al. 1991). Spawning of spring stocks typically occurs in tributaries and headwater streams in August and September. Eggs hatch in December with emergence completed by April (NPT and IDFG 1990; USFWS 1999c). Spring chinook salmon remain in freshwater for one year, migrating to the ocean in the spring of their second year, typically from March through June (USFWS 1999c; Walters et al. 2001). Nearly all adult spring and summer chinook that return to the Snake River basin result from fish that smolted as yearlings in April-May (Matthews and Waples 1991).

Although spring chinook salmon smolt as yearlings, in-basin migrations as fry or parr are not uncommon. Fry dispersal was well documented in the Selway River during studies of chinook salmon reintroductions (Cramer 1995). A second downstream migration of spring chinook salmon in the upper portion of the rearing areas again occurs in the fall as juveniles seek suitable winter habitat (Hesse et al. 1995; Walters et al. 2001).

Little is known about the distribution of Snake River spring chinook salmon in the ocean, because few are ever caught in ocean fisheries. Analyses of Coded-Wire Tag (CWT) recoveries from Snake River spring chinook salmon during the intensive ocean fisheries of the 1980s indicated that harvest rate of these fish in the ocean was less than 1% (Berkson 1991).

Distribution of spring chinook salmon to the North Fork Clearwater River is blocked by Dworshak Dam, and with the exception of the mainstem migration corridor, they are absent from the Lower Clearwater AU (Figure 100). The current distribution of spring chinook salmon within the Clearwater subbasin includes the Lolo Creek drainage and all major drainages above the confluence of the Middle and South Forks of the Clearwater River. Relatively contiguous distributions of spring/summer chinook salmon exist in the Lolo/Middle Fork, South Fork, and Upper and Lower Selway AUs. Spring/summer chinook salmon are absent from many tributaries in the Lochsa River drainage, but found in Pete King and Fish Creeks, and most tributaries above (and including) Warm Springs Creek.

Spring chinook salmon are classified as “present – depressed” in all areas of the Clearwater subbasin where status information is available (Figure 100). Aerial surveys of spring chinook salmon redds in the Clearwater subbasin have been conducted since 1966. Data has been collected from established reaches on an annual basis in both natural production areas as well as areas where production is regularly influenced by hatchery releases of chinook salmon. Table 44 illustrates trends in chinook salmon redds counted by aerial surveys (summarized by AU) since 1966. Additional redd count information is also presented for spring chinook salmon in Nez Perce Tribal Hatchery Monitoring and Evaluation streams and for Idaho Supplementation Studies streams (Table 45).

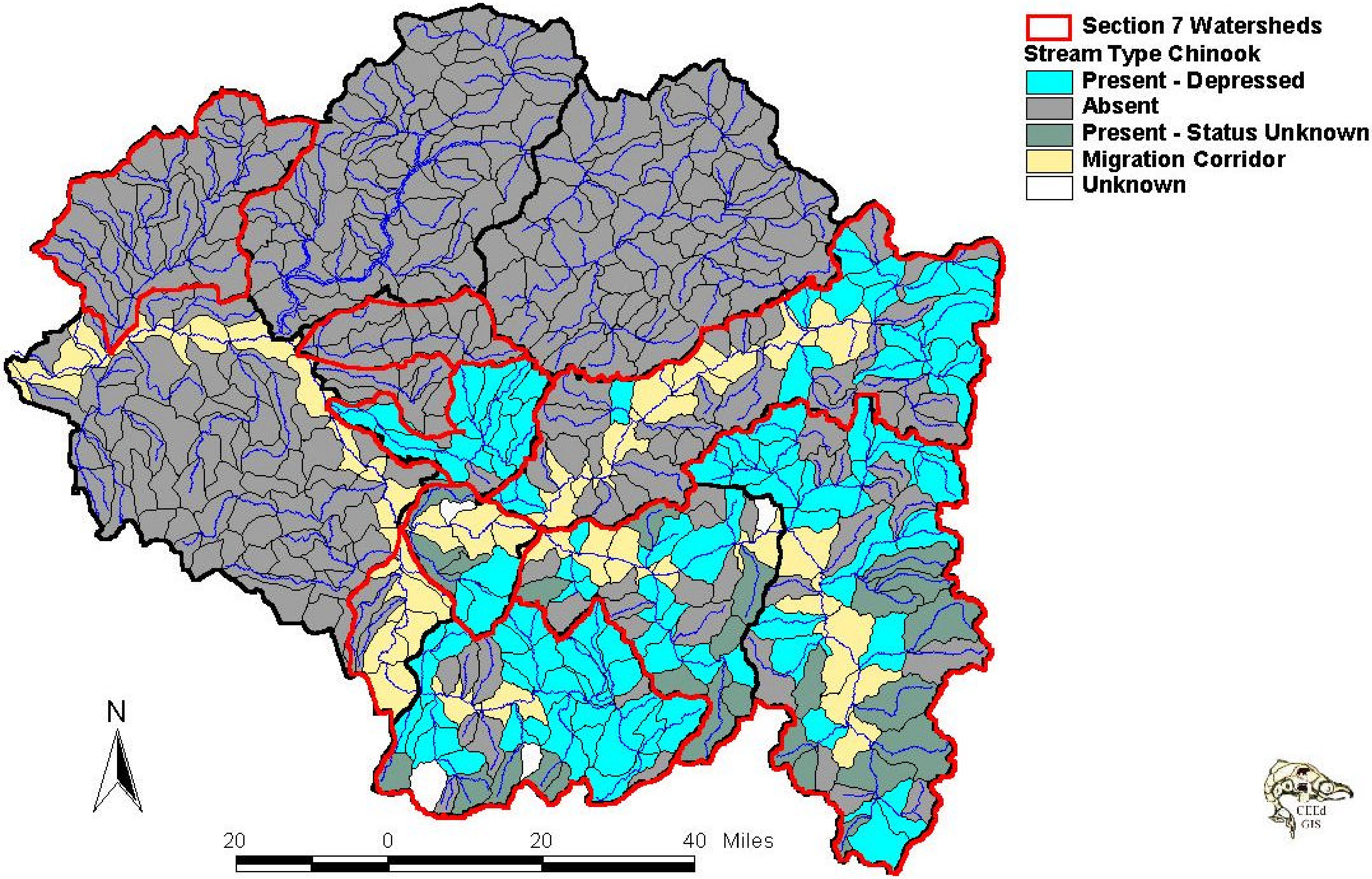

Figure 100. Known distribution and relative status of spring chinook salmon in the Clearwater subbasin. Red lines delineate consultation watersheds defined under Section 7 of the ESA

Table 44. Clearwater River subbasin spring chinook salmon traditional trend aerial redd counts, 1966-2000

Year	South Fork Clearwater [1]	Lochsa River [2]	Selway River [3]		Clearwater subbasin Index Areas Combined
1966	---	---	44		44
1967	---	0	29		29
1968	---	15	27		42
1969	---	112	84		196
1970	---	34	98		132
1971	---	1	77		78
1972	---	63	232		295
1973	---	60	347		407
1974	17	28	97		142
1975	59	35	31		125
1976	33	62	94		189
1977	88	66	141		295
1978	77	62	161		300
1979	27	18	30		75
1980	46	26	55		127
1981	75	52	65		192
1982	112	51	54		217
1983	113	13	44		170
1984	87	37	49		173
1985	130	61	15		206
1986	109	41	56		206
1987	143	36	63		242
1988	110	51	62		223
1989	53	17	22		92
1990	78	20	35		133
1991	6	15	23		44
1992	98	41	29		168
1993	209	77	61		347
1994	17	11	19		47
1995	6	10	9		25
1996	44	37	11		92
1997	242	75	18[4]		335
1998	64	21	34		119
1999	5	1	12		18
2000	154	35	84[5]		273

1 South Fork Clearwater counts in Red, American, Crooked Rivers and Newsome Creek; Newsome Ck had 280 excess adult outplants during 1997 and 362adults, 125 jacks excess adult outplants during 2000.
2 Lochsa River counts in Brushy Fork and Crooked Fork Cks; 100 excess adult outplants White Sands Ck in 2000.
3 Selway River counts in Bear, Moose, White Cap, Running creeks and mainstem between Bear Creek and Thompson Flat
4 Excess Rapid River stock adult chinook (514) outplanted in Selway River Magruder Corridor, 1997. Count taken before outplant.
5 Excess Dworshakstock adult chinook (872) outplanted in Selway River Magruder Corridor, 2000.

Table 45. Summary of spring chinook salmon redds counted and redds per kilometer for Idaho Supplementation Studies (ISS) and Nez Perce Tribal Hatchery (NPTH) streams 1991-2000

AU Stream Name	Year	Stream Length Sampled (km)	Redds Counted	Number of Redds per kilometer	Program
Lolo/Middle Fork AU					
Clear Cr	2000	20.2	30	1.5	ISS
	1999	16.1	0	0	ISS
	1998	18.5	2	0.11	ISS
	1997	18.5	17	0.92	ISS
	1996	16.1	3	0.19	ISS
	1995	16.1	0	0.00	ISS
	1994	16.1	1	0.06	ISS
	1993	16.1	7	0.43	ISS
	1992	16.1	1	0.06	ISS
Eldorado Cr[1]	2000	3.5	0	0.00	NPTH
	1999	3.5	0	0.00	NPTH
	1998	3.5	0	0.00	NPTH
	1997	3.5	0	0.00	NPTH
	1996	3.5	0	0.00	NPTH
	1995	3.5	0	0.00	NPTH
	1994	3.5	0	0.00	NPTH
	1993	3.5	2	0.57	NPTH
	1992	3.5	0	0.00	NPTH
Eldorado Cr[3]	2000		1		NPTH
	1999	2.0	0	0.00	NPTH
	1998	13.3	0	0.00	NPTH
	1997	1.3	0	0.00	NPTH
Lolo Cr[1]	2000	18.3	98[g]	5.36	NPTH
	1999	18.3	9	0.49	NPTH
	1998	18.3	26	1.42	NPTH
	1997	18.3	110[b]	6.01	NPTH
	1996	16.7	21	1.26	NPTH
	1995	16.7	6	0.36	NPTH
	1994	16.7	7	0.42	NPTH
	1993	16.7	23	1.38	NPTH
	1992	16.7	19	1.14	NPTH
Lolo Cr[3]	2000		10		NPTH
	1999	41.5	1	0.02	NPTH
	1998	3.2	0	0.00	NPTH
	1997	23.5	29	1.23	NPTH
	1996	41.5	0	0.00	NPTH
Musselshell Cr[3]	2000		0	0.00	NPTH
	1999	8.8	0	0.00	NPTH
	1998	8.8	0	0.00	NPTH
	1997	8.8	1	0.11	NPTH
	1996	8.8	1	0.11	NPTH

Table 45 (Continued)

AU Stream Name	Year	Stream Length Sampled (km)	Redds Counted	Number of Redds per kilometer	Program
Lolo/Middle Fork AU (continued)					
Yoosa Cr[1]	2000	4.4	2	0.45	NPTH
	1999	4.4	0	0.00	NPTH
	1998	4.4	5	1.14	NPTH
	1997	4.4	0	0.00	NPTH
	1996	4.4	0	0.00	NPTH
	1995	4.4	0	0.00	NPTH
	1994	4.4	0	0.00	NPTH
	1993	4.4	1	0.23	NPTH
	1992	4.4	0	0.00	NPTH
Lochsa AU					
Bear (Papoose) Cr	1996	3	7	2.33	ISS
	1995	3	1	0.33	ISS
	1994	3	0	0.00	ISS
	1993	3	15	5.00	ISS
	1992	3	10	3.33	ISS
Big Flat Cr	2000	4.8	0	0	ISS
	1999	NC	NC	NC	ISS
	1998	NC	NC	NC	ISS
	1997	4.8	7	1.46	ISS
	1996	1.5	0	0.00	ISS
	1995	5.8	0	0.00	ISS
	1994	NC	NC	NC	ISS
	1993	6	3	0.50	ISS
	1992	8	8	1.00	ISS
Brushy Fork Cr	2000	12.6	16	1.27	ISS
	1999	12.6	3	0.24	ISS
	1998	12.6	19	1.51	ISS
	1997	20.7	75	3.62	ISS
	1996	21.5	5	0.23	ISS
	1995	14	5	0.36	ISS
	1994	21.5	0	0	ISS
	1993	18.1	25	1.38	ISS
	1992	14	7	0.50	ISS
Colt Killed Cr	2000	50.2	2	0.04	ISS
	1999	40.6	0	0	ISS
	1998	40.6	0	0.03	ISS
	1997	35.7	22	0.6	ISS
	1996	6.8	0	0.00	ISS
	1995	2.6	0	0.00	ISS
	1994	NC	NC	NC	ISS
	1993	7	2	0.29	ISS
	1992	11.5	3	0.26	ISS

Table 45 (Continued)

AU Stream Name	Year	Stream Length Sampled (km)	Redds Counted	Number of Redds per kilometer	Program
Lochsa AU (continued)					
Crooked Fork Cr	2000	18	100	5.56	ISS
	1999	18	8	0.44	ISS
	1998	19	17	0.94	ISS
	1997	19	118	6.2	ISS
	1996	21.5	76	3.53	ISS
	1995	19	4	0.21	ISS
	1994	21.5	0	0	ISS
	1993	28	10	0.36	ISS
	1992	29.5	11	0.37	ISS
Fishing (Squaw) Cr	1996	6	1	0.17	ISS
	1995	6	0	0.00	ISS
	1994	6	0	0.00	ISS
	1993	6	0	0.00	ISS
	1992	6	1	0.17	ISS
Pete King Cr	2000	8.0	2	0.3	ISS
	1999	8.0	0	0	ISS
	1998	8.0	0	0	ISS
	1997	8.0	4	0.13	ISS
	1996	8.0	0	0.00	ISS
	1995	8.0	0	0.00	ISS
	1994	8.0	0	0.00	ISS
	1993	8.0	0	0.00	ISS
	1992	8.0	0	0.00	ISS
Lower Selway AU					
Meadow Cr[2]	2000	68.0	18[h]	0.26	NPTH
	1999	68.0	3	0.04	NPTH
	1998	68.0	5	0.07	NPTH
	1997	68.0	146[c]	2.15	NPTH
	1996	68.0	0	0.00	NPTH
	1995	68.0	0	0.00	NPTH
	1994	68.0	3	0.04	NPTH
Upper Selway AU					
White Cap Cr	2000	19.8	8	0.40	ISS
	1999	12.9	0	0	ISS
	1998	19.8	4	0.20	ISS
	1997	19.8	0	0	ISS
	1996	19.8	3	0.15	ISS
	1995	19.8	0	0	ISS
	1994	19.8	2	0.10	ISS
	1993	19.8	6	0.30	ISS
	1992	19.9	2	0.10	ISS

Table 45 (Continued)

AU Stream Name	Year	Stream Length Sampled (km)	Redds Counted	Number of Redds per kilometer	Program
South Fork AU					
American River	2000	34.6	129	3.72	ISS
	1999	34.6	1	0.03	ISS
	1998	34.6	112	3.23	ISS
	1997	34.6	311	8.99	ISS
	1996	34.6	9	0.26	ISS
	1995	34.6	0	0	ISS
	1994	34.6	9	0.26	ISS
	1993	34.6	209	6.04	ISS
	1992	33.3	5	0.15	ISS
Crooked River	2000	21.9	93	4.25	ISS
	1999	21.9	1	0.05	ISS
	1998	21.9	30	1.43	ISS
	1997	21.9	62	2.96	ISS
	1996	21.9	6	0.18	ISS
	1995	21.9	0	0	ISS
	1994	21.9	4	0.18	ISS
	1993	21.9	54	2.47	ISS
	1992	21.9	54	2.47	ISS
	1991	21.9	4	0.18	ISS
Newsome Cr	2000	15.1	46[i]	3.05	NPTH
	1999	15.1	0	0	NPTH
	1998	15.1	32	2.12	NPTH
	1997	15.1	67[d]	4.44	NPTH
	1996	15.1	4	0.26	ISS
	1995	15.1	0	0	ISS
	1994	15.1	0	0	ISS
	1993	15.1	55[e]	3.64	ISS
	1992	15.1	2	0.13	ISS
Red River	2000	40.1	235	5.86	ISS
	1999	39.6	14	0.35	ISS
	1998	44.2	93	2.10	ISS
	1997	44.2	344	7.78	ISS
	1996	34.1	41	1.20	ISS
	1995	43.0	17	0.40	ISS
	1994	43.0	23	0.53	ISS
	1993	38.5	69	1.79	ISS
	1992	43.0	44	1.02	ISS
	1991	23.6	6	0.25	ISS

1 includes index reaches surveyed by ground counts
2 includes index reaches surveyed by ground and aerial counts
3 includes expanded reaches surveyed by ground and/or aerial counts
b 474 adults were outplanted from Dworshak National Fish Hatchery
c 601 adults were outplanted from Rapid River Fish Hatchery
d 280 adults were outplanted from Rapid River Fish Hatchery
e 250 adults were outplanted from Rapid River Fish Hatchery
f 300 adults were outplanted from Rapid River Hatchery
g 531 adults were outplanted from Dworshak National Fish Hatchery
h 399 adults were outplanted from Clearwater Hatchery and Dworshak National Fish Hatchery
i 500 adults were outplanted from Clearwater and Rapid River hatcheries

Spring chinook salmon carrying capacity was estimated for each subwatershed in which spawning and rearing is known to occur (Figure 101). Estimates are based on data downloaded from the Streamnet website (Pacific States Marine Fisheries Commission 2001) which was originally produced using the smolt density model developed in 1989 as part of the Northwest Power Planning Council Presence/Absence database. Detailed overview of methods used to estimate smolt carrying capacity are presented in NPPC (1989). In short, the smolt density model estimates potential smolt capacity accounting for both the amount of available habitat and the relative quality of that habitat within a given stream reach.

Based on NPPC data, spring chinook carrying capacity estimates for individual subwatersheds are variable throughout all AUs with little discernable pattern with regard to high or low production areas. Estimates ranged from 205 to 147,015 smolts per subwatershed (Figure 101). The highest estimates by AU were associated with the Upper Selway (approximately 1.2 million) and Lochsa AUs (approximately 900,000; Table 46). The lowest spring chinook smolt carrying capacity estimates at the AU scale are associated with the Lower Clearwater and Lower North Fork AUs where available habitat is most limited (Table 46). Only two miles of the North Fork Clearwater River are accessible below Dworshak dam, and use of the lower Clearwater AU by chinook is limited to mainstem reaches. Based on NPPC data, the estimated carrying capacity for spring chinook salmon in the entire Clearwater subbasin is 3,491,240 smolts.

Chapman (1981) used a different approach to estimate production (not carrying capacity) of chinook salmon smolts from the Clearwater subbasin under pristine conditions. Chapman (1981) estimated potential smolt production based solely on the amount of available habitat and, since he was considering pristine production, included potential production from areas no longer utilized by chinook salmon (including the North Fork Clearwater and Potlatch River drainages). Chinook salmon smolt production from the Clearwater subbasin was estimated by Chapman (1981) to be 1,817,625[3]. Chapman's data suggests that tributary systems in the Lower Clearwater and Upper and Lower North Fork AUs were historically substantial producers of chinook salmon, accounting for roughly 65 percent of chinook salmon smolt production from the Clearwater subbasin tributaries (excluding mainstem production).

Table 46. Estimated spawning/rearing area, total carrying capacity (smolt) and average percent of carrying capacity (parr) realized between 1985 and 1997 for spring chinook salmon within each Clearwater subbasin AU

Assessment Unit	Usable Area [1] (stream miles)	Estimated Capacity (# smolts)	Avg. percent realized [2] (85-97) (IDFG 1999a)
Lower Clearwater	78.7	62,296	0
Lower North Fork	2.0	7,628	Unknown
Upper North Fork	Not Accessible	--	--
Lolo/Middle Fork	154.5	311,794	14
Lochsa	278.9	919,444	6
Lower Selway	146.1	408,892	3
Upper Selway	301.8	1,217,129	1
South Fork	291.8	564,057	23
Subbasin Total	1,253.6	3,491,240	14

1 Excludes reaches used only for migration purposes.

2 Derived from Parr Monitoring Database and presented for comparative purposes. No direct link has been established between parr and smolt production.

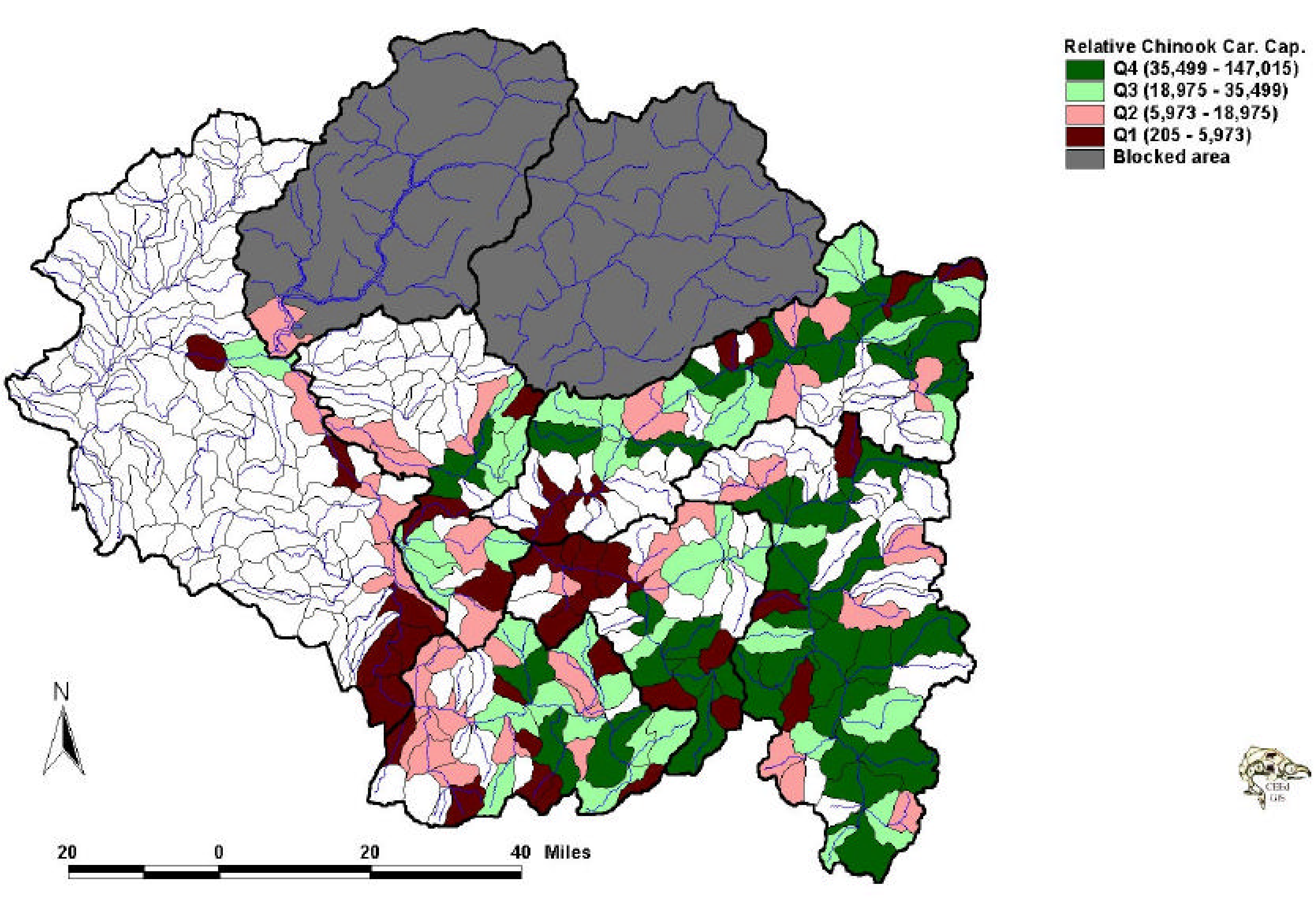

Figure 101. Estimated carrying capacity of spring chinook smolts based on usable area and habitat quality within each subwatershed. Estimates are grouped into quartiles (Q1-Q4), with an equal number of subwatersheds in each

Direct comparison of Chapman's (1981) production estimates with the NPPC carrying capacity estimates (i.e. comparison of historic vs. current condition) is not appropriate. The two databases were developed to represent different spatial and temporal areas, the methods used vary substantially, as does the general intent of each (production vs. carrying capacity).

Fall Chinook Salmon

Natural recolonized and reintroduced fall chinook salmon within the Clearwater subbasin are part of the Snake River evolutionarily significant unit (ESU) as defined by the ESA. As such, fall chinook salmon within the Clearwater subbasin represent an important metapopulation within the Snake River ESU. Maintenance and function of fall chinook salmon metapopulation dynamics within the Clearwater subbasin itself will play an important role in recovery of the Snake River ESU.

Fall chinook salmon reintroduction efforts in the Clearwater subbasin began in 1960. A total of 6,733,000 fall chinook were reintroduced by the IDFG into the upper Clearwater subbasin from 1960-1967, mainly through eyed-egg plants in artificial spawning channels along the Selway River near the Fenn Ranger Station (Richards 1968). Counts of fall chinook at the Lewiston Dam increased from three in 1962 to a high of 122 in 1966, and back down to 90 in 1969. Due to insignificant returns of fall chinook, the original reintroduction program was terminated in 1968 (Hoss 1970).

Fall chinook salmon begin spawning migrations during August or September and reach the Clearwater subbasin from September through December. Spawning of fall chinook salmon in the Clearwater River subbasin occurs principally in the mainstem below the confluence with the North Fork Clearwater River (Arnsberg and Connor 1992; Garcia et al. 1999). However, spawning adults have been observed throughout the mainstem Clearwater River, and in the lower portions of the mainstem South Fork Clearwater River (Figure 102). Emergence of fall chinook salmon typically occurs in early April and May in the Clearwater River (Arnsberg and Statler 1995). Fall chinook salmon outmigration typically occurs from the Clearwater subbasin from June through August (USFWS 1999c).

Aerial fall chinook redd surveys of the mainstem Clearwater have occurred annually since 1988 (Arnsberg and Connor 1992; Arnsberg and Statler 1995). Over the course of the study, both the timing and number of redds constructed has changed. Redd observations, which initially were most frequent during the month of November, have become increasingly more common during October, and have been even noted as early as October 5 (Garcia et al. 1999). Similarly, the number of redds observed have recently increased from a range of 4-36 during 1988-1995, to 78 in 1998 and 184 in 1999 (Table 47). Fall chinook redds decreased slightly in the subbasin to 172 in 2000, with eight redds observed in the mainstem above the North Fork Clearwater confluence and one redd found in the South Fork Clearwater River. This was the highest number of redds observed in the Clearwater River subbasin above the North Fork than in all previous years combined since 1988. Hatchery fish released in the Clearwater River first returned as adults in 1999, with 43% of carcasses in 1999, and 60% of carcasses in 2000 determined to be hatchery fish (Bill Arnsberg, Nez Perce Tribal Fisheries, personal communication). Nearly all carcasses collected in 2000 were found in a spent state, therefore, it appears that supplementation fish are contributing to natural reproduction (Bill Arnsberg, Nez Perce Tribal Fisheries, personal communication, April 20, 2001).

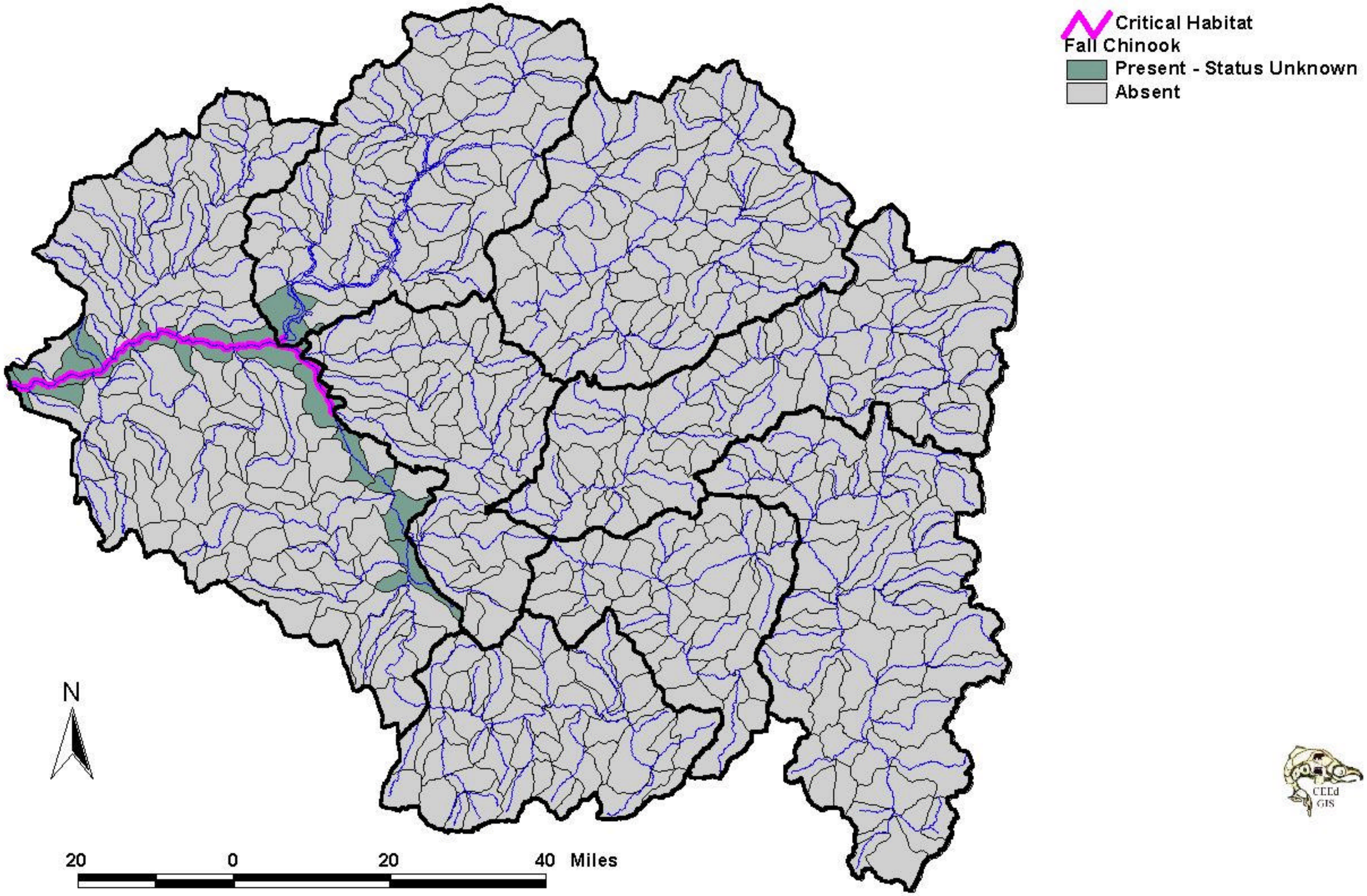

Figure 102. Known distribution of spawning habitat utilized by fall chinook salmon in the Clearwater subbasin. Heavy pink line indicates designated critical habitat for fall chinook salmon

Table 47. Number of fall chinook salmon redds observed by aerial surveys in the Clearwater River Subbasin, 1988-2000

Year	Clearwater (Rm 0-41)	Clearwater (Rm 41-74)	N.F. Clearwater	S.F. Clearwater
1988	21	--	--	--
1989	10	--	--	--
1990	4	--	--	--
1991	4	--	--	--
1992	25	1	0	0
1993	36	0	0	0
1994	30	0	7	0
1995	20 [1]	0	0	0
1996	66	0	2	1
1997	58	0	14	0
1998	78	0	0	0
1999	179	2	1	2
2000	163	8	0	1

1 A flood event during peak spawning prevented an accurate redd count in the Clearwater subbasin for 1995.

No status designations were found regarding fall chinook salmon in the Clearwater subbasin. However, between 1988 and 1997 fall chinook redds counted in the Clearwater River accounted for 25% of all fall chinook redds observed above Lower Granite Dam (Garcia 1998, cited in USFWS 1999c). The proportion of fall chinook redds above Lower Granite Dam observed in the Clearwater River has increased since 1993 (USFWS 1999c).

Arnsberg and Connor (1992) used the Instream Flow Incremental Methodology (IFIM) to quantify the amount of fall chinook spawning habitat available in the lower Clearwater River. Based on habitat suitability criteria alone, 95,000 redds was given as an estimated capacity. This was thought to be a liberal estimate, since IFIM tends to overestimate spawning habitat in large rivers (Shrivell 1990) and other hydraulic and biological factors that may influence spawning selection were not measured (Arnsberg and Connor 1992). However, spawning habitat is not a limiting factor for fall chinook recovery in the lower Clearwater based on the vast amount of suitable habitat measured and the number of redds documented within and around these measured sites since redd counts began in 1988 (Bill Arnsberg, Nez Perce Tribal Fisheries, personal communication, April 20, 2001).

As a consequence of cold winter water temperatures, the early life history timing of fall chinook salmon in the Clearwater River occurs on the latest schedule of all present-day Snake River stocks. Many young Clearwater River fall chinook salmon do not reach smolt size or migrate seaward during the first year of life because growth is out of synchronization with environmental cues such as photoperiod (Connor et al. 2001). In some years, releasing cool water from Dworshak Reservoir for summer flow augmentation could cause juvenile fall chinook salmon to hold over an extra year in freshwater by markedly reducing water temperatures and disrupting water temperature cues that prompt outmigration (Connor et al. 2001).

Early-Fall Chinook Salmon

The Nez Perce Tribe uses the term 'early-fall chinook salmon' to refer to fish that spawn principally in October, and would have a life history similar to that of "summer" chinook salmon in the mid-Columbia (October spawning and subyearling smolts), but not to the Snake River summer chinook salmon (late August-early September spawning and yearling smolts). Temperature data indicate that late September and early-October would be the most favorable spawning times in much of the Clearwater River subbasin, whereas spawning before or after that time might lead to high egg mortality from thermal stress in many years (Arnsberg and Statler 1995; Cramer 1995). Hatchery records in the Grande Ronde subbasin in the early 1900s indicate that spawning of chinook salmon extended from early September all of the way through October (Van Dusen 1903 and 1905). Evermann (1896) presented data on catches and spawning of chinook salmon in the Snake River indicating that peak spawning occurred during mid-October in 1894.

No known populations of early-fall chinook salmon remain in the Snake River basin that spawn through October, but temperature data indicate that late September and early October would be the favorable spawning times in the lower Selway, Lochsa, South Fork Clearwater, and mainstem Clearwater (above the North Fork confluence) rivers (Arnsberg and Statler 1995). Because of Dworshak Reservoir on the North Fork of the Clearwater River, temperature of the mainstem Clearwater River below the North Fork is 2-5^{0}C cooler during July-September and 1-2^{0}C warmer during November through March than the mainstem above the North Fork (Arnsberg and Connor 1992), and is therefore the only section of river in the Clearwater River subbasin suited to November spawning chinook salmon (Cramer 1995). Cramer (1995) presented evidence that spawning of chinook salmon, in order to coincide with thermal optimums for egg survival, must occur sufficiently early in the fall for eggs to develop to eyeing before water temperatures drop below 4-5^{0}C, but sufficiently late in the year that water temperatures have dropped below the upper tolerance limits of freshly spawned eggs (approximately 14^{0}C). These temperature conditions would be met by spawning that occurs between late September through mid-October for most streams of the subbasin at elevations below 770 m (2,500 ft). Although the October spawning segment of the run has been nearly eliminated, the genetic potential to reproduce it may still be contained in the genome, and could be re-expressed through natural selection or selective breeding with Snake River stock.

The juvenile life history of chinook salmon that spawned in October was not documented, and can only be deduced. Cramer (1995) concluded that the race of October-spawning chinook salmon would likely have smolted as subyearlings, because high stream temperatures at the elevation they were adapted to would have promoted rapid growth in the spring, but stressful rearing conditions during the summer. October spawning chinook salmon in the mid-Columbia smolt primarily as subyearlings. Most likely, early-spawning fall chinook salmon to be developed in the Clearwater River from the Lyons Ferry stock will be predominantly subyearling migrants. Additionally, their migration patterns in the ocean and vulnerability to ocean fisheries are also likely to parallel those of Lyons Ferry fall chinook salmon.

Since the historical presence of early fall chinook salmon in the Clearwater subbasin is inferred, no status designations or carrying capacity estimates have been made. However, on-going research by the Nez Perce Tribe could be used to estimate carrying capacity. It is anticipated that when the research is concluded, fisheries managers will be able to more accurately define the potential for the self-propogation of the stock and the potential for a sustainable fish harvest.

Two satellite facilities of the Nez Perce Tribal Hatchery on the lower South Fork Clearwater River and the lower Selway River (near Fenn Ranger Station) will initiate the restoration of early-fall chinook salmon to the Clearwater subbasin. The stock will be developed by selecting early spawners from Snake River fall chinook broodstock at Lyons Ferry Hatchery and capture of fish spawning in the Clearwater River (Ed Larson, NPT, personal communication, May 11, 2001).

8.1.2 Steelhead Trout

Summer run steelhead trout in the Clearwater subbasin are listed as threatened under the ESA. Both A-run and B-run steelhead trout exist in the Clearwater subbasin and are included in the Snake River ESU of steelhead trout (Busby et al. 1996). A-run steelhead occupy the lower Clearwater, including the Middle Fork Clearwater and Lower South Fork Clearwater rivers and tributaries (Kiefer et al. 1992). B-run steelhead occupy the Lochsa, Selway, and upper South Fork Clearwater rivers, and were extirpated by Dworshak Dam on the North Fork Clearwater River (Kiefer et al. 1992). B-run steelhead have been documented from only two subbasins in the Columbia River system, the Clearwater and Salmon (NPT and IDFG 1990). A-run steelhead trout from the Clearwater subbasin have typically spent one year in saltwater environments; B-run steelhead trout spend 1-3 years in saltwater environments before returning to spawn, with over 90 percent having spent two years (W. Miller, USFWS, personal communication, March 5, 2001). Due to differing lengths of ocean residence, differentiation of the two forms of Clearwater steelhead trout can be based on size, with B-run fish averaging 75-100 mm larger than A-run fish (CBFWA 1991). In addition, B-run steelhead enter the Columbia River later in the year than A run and benefit from the extra ocean time to rear, resulting in a 2 ocean A-run fish being smaller than a 2 ocean B-run fish (W. Miller, USFWS, personal communication, April 20, 2001).

Historical Status

Mallett (1974) estimated that 55% of all Columbia River steelhead trout historically originated from the Snake River basin, of which Clearwater steelhead made up a substantial component. Over 43,000 steelhead were counted at Lewiston Dam near the mouth of the Clearwater River during the 1962-63 run year (Miller 1987) and historic runs may have ranged as high as 40,000 - 60,000 steelhead annually (W. Miller, USFWS, personal communication, March 5, 2001). Wild steelhead trout historically occupied all major drainages and a majority of the tributaries within the Clearwater subbasin. However, no documentation of historic distributions specific to the Lochsa or Selway River systems could be located.

The upper half of the South Fork Clearwater watershed maintained a historically strong population of steelhead trout (Nez Perce National Forest 1998). Spawning habitat in the South Fork Clearwater occurred primarily in the lower canyon portions of mainstem tributaries such as Newsome Creek, American River, Red River, Crooked River, and low gradient reaches along the mainstem South Fork Clearwater River (Nez Perce National Forest 1998; Paradis et al. 1999b). Historic spawning distributions of steelhead trout also likely included Tenmile, Johns, Meadow, and Mill creeks (Jody Brostrom, IDFG, personal communication March 30, 2001). Low order streams and accessible headwater portions of high order streams provided early rearing habitat (Nez Perce National Forest 1998).

The South Fork Clearwater River may have historically maintained a genetically unique stock of steelhead trout within the Clearwater subbasin, but hatchery supplementation has since clouded the lines of genetic distinction between stocks throughout the subbasin (Nez Perce National Forest 1998). Robin Waples (In a letter to Sharon Kiefer, IDFG, August 25, 1998) found that steelhead trout in Johns and Tenmile creeks are genetically most similar to fish originating from the Selway River system, suggesting that some genetic difference may have existed historically within the South Fork Clearwater drainage. A statewide genetic analysis is currently being conducted using DNA markers, and may provide more information on past and current genetic distinctions between steelhead trout stocks in the Clearwater subbasin (Byrne 2001).

The North Fork Clearwater provided substantial amounts of spawning and rearing habitat for steelhead trout prior to the construction of Dworshak Dam in 1969, which blocked 26% of Clearwater subbasin habitat from anadromous fish (NPT and IDFG 1990). An estimated 50 to 60 percent of the steelhead entering the Clearwater River spawned in the North Fork Clearwater River and its tributaries (Miller 1987). Similar to the South Fork, the mouths of the larger North Fork tributaries were likely the primary spawning areas, while the accessible headwater sections of the tributaries provided habitat for rearing and resident rainbow/redband trout populations (Clearwater National Forest 1999). In addition to spawning and rearing, mainstem habitat was used for migration and overwintering.

Historical spawning and rearing habitat in the Selway River occurred throughout the subbasin. Lower portions of mainstem tributaries hosted overwintering habitat for juveniles, while the upper portions provided rearing habitat.

Current Status

Steelhead trout ascend the Columbia River between May and October, and generally arrive at the mouth of the Clearwater River in the fall (September-November). Adult steelhead trout remain in the large pools of the mainstem Clearwater or Snake Rivers or in Lower Granite Reservoir through the winter. This timing is different than before the Snake River dams were built, when the majority of the fish arrived to Lewiston dam in March-May (Whitt 1954). Spawning of B-run steelhead trout in the Clearwater subbasin occurs from mid-March through early June, with emergence during June and July. A-run steelhead spawn from February through early May, with emergence from mid-April through May (NPT and IDFG 1990). The majority of juveniles rear for two years in freshwater with subsequent outmigration from March through May.

With the exception of the genetically distinct North Fork origin B-run steelhead, the only remaining steelhead trout runs in the Clearwater subbasin with limited or no hatchery influence occur in the Lochsa and Selway River systems (B-run) and lower Clearwater River tributaries (A-run; Busby et al. 1996; IDFG 2001c). Steelhead trout in other portions of the subbasin have been heavily influenced by hatchery stocking, with the majority originating from Dworshak National Fish Hatchery (NPT and IDFG 1990). Steelhead trout production at Dworshak National Fish Hatchery is made up entirely of B-run steelhead trout originating from North Fork Clearwater stock.

Steelhead trout are widely distributed throughout the Clearwater subbasin, using at least a portion of all accessible watersheds (5^{th} code HUCs; Figure 103). Excluding areas blocked by Dworshak Dam, subwatersheds (6^{th} code HUCs) currently not being used by steelhead trout are typically singular, scattered, and associated with low order tributaries.

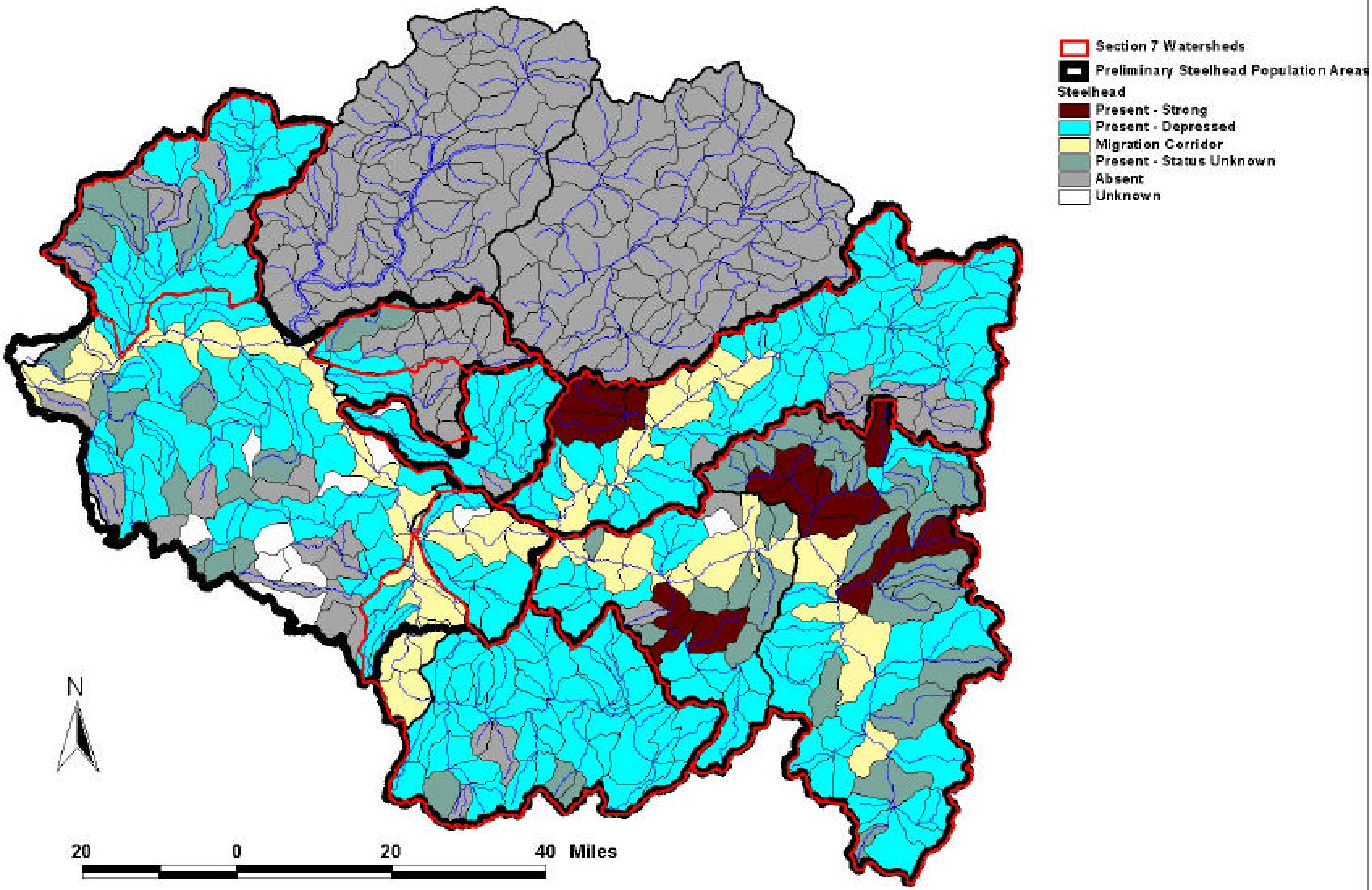

Figure 103. Known distribution and relative status of steelhead in the Clearwater subbasin. Heavy black lines represent preliminary steelhead population areas defined by NOAA Fisheries. Red lines delineate consultation watersheds defined under ESA Section 7

Clusters of 6th code HUCs are not currently used by steelhead trout in Orofino and Jim Ford Creeks (Lolo/Middle Fork AU) where a passage barrier exist in the lower mainstem of each creek (Johnson 1985; Clearwater Soil and Water Conservation District 1993), and the headwaters of the White Sands Creek drainage (Lochsa AU). The relatively contiguous distribution of steelhead trout throughout the subbasin suggests a potentially high degree of connectivity exists.

Status and distribution of A-run steelhead in lower Clearwater River tributary streams was described by Kucera et al. (1983), Fuller et al. (1984), and Johnson (1985). No adult steelhead abundance estimates are available for tributaries in the lower Clearwater AU, although an experimental weir was operated on weekdays in Big Canyon Creek in 1995 (USFWS and NPT 1997). Quantification over time of B-run adult steelhead escapement to individual tributaries or spawning aggregates is limited to four locations in the Clearwater River subbasin where adult weirs are operated: Clear Creek (Middle Fork Clearwater River), Fish Creek (Lochsa River), Red River and Crooked River (South Fork Clearwater). Some additional information is available from the hatchery facility at Powell (Lochsa River). Adult steelhead abundance information in the Selway River system is comprised of angler survey data collected during the 1950s, catch in the Selway Falls fish ladder during the mid 1990s, and steelhead caught and radio-tagged below Selway Falls in 1998. Unfavorable environmental/stream conditions during the spawning season preclude conducting accurate spawning ground surveys for steelhead in the Clearwater subbasin although attempts have been made and limited data does exist (Table 48).

Wild A-run steelhead trout within the Clearwater subbasin occurs only in the lower mainstem tributaries (Rich et al. 1992), South Fork Clearwater tributaries up to Butcher Creek, and Maggie Creek in the Middle Fork Clearwater (NPT and IDFG 1990). The Potlatch River and East Fork Potlatch River are considered important streams for production of wild A-run steelhead trout because of their accessibility in relation to the mainstem Clearwater (A. Espinosa, Espinosa Consulting, personal communication 1999). Wild A-run steelhead trout also occur in Big Canyon, Cottonwood, Lapwai, Mission, Bedrock, and Jacks Creeks (Clearwater National Forest 1997; USFWS and NPT 1995; Kucera and Johnson 1986), with Big Canyon and Cottonwood creeks as the primary aggregates based on available habitat and observed juvenile densities (USFWS and NPT 1997). No hatchery outplanting of A-run steelhead trout has occurred within the Clearwater subbasin, and interbreeding of A-run and hatchery produced B-run steelhead trout is thought to be minimal due to differences in spawn timing (USFWS and NPT 1997). Habitat problems in A-run streams include high soil erosion rates, high bedload movement rates, altered channel morphology and riparian areas, variable streamflows with severely limited late summer flows, and high summer temperatures in lower tributary reaches (Kucera and Johnson 1986; NPT and IDFG 1990).

Steelhead trout status is present–depressed throughout the majority of their range in the Clearwater subbasin (Figure 103). Designations of present–strong for steelhead trout are only noted in Fish and Hungery Creeks (Lochsa AU), the lower portions of Meadow Creek (Lower Selway AU), and portions of Moose and Bear Creeks (Upper Selway AU)(Figure 103). The Lochsa and Selway River systems have been identified as refugia areas for steelhead trout (Thompson 1999) based on location, accessibility, habitat quality, and number of roadless tributaries.

Recent trend information related to steelhead populations in the Clearwater subbasin consists primarily of weir counts. Table 49 presents available information on adult steelhead collections at various weir sites within the subbasin.

Table 48. Aerial steelhead redd counts in Clearwater subbasin streams, 1990-2000

AU Stream	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
South Fork AU											
Crooked R.	219	50	20	4	3	4	0	0	0	NC[1]	NC
Red River	2	NC	NC	5	6	6	2	0	1	NC	NC
Lochsa AU											
Lochsa R	5	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Colt Killed Cr	12	7	20	NC	12	3	3	7	3	NC	NC
Storm Cr	11	0	3	NC	3	8	1	0	1	NC	NC
Crooked Fk Cr	33	7	10	NC	8	11	1	6	2	NC	NC
Fish Cr	9	0	3	NC	5	5	NC	NC	NC	NC	NC
Hungery Cr	2	0	NC	NC	NC	NC	NC	NC	NC	NC	NC
Selway AU											
Mainstem	NC	NC	NC	NC	NC	1	NC	NC	0	NC	NC
Bear Cr	15	2	4	NC	6	8	2	2	2	NC	NC
EF Moose Cr	NC	NC	NC	NC	3	6	6	5	5	NC	NC
Running Cr	0	0	NC	NC	NC	NC	NC	NC	NC	NC	NC
Whitecap Cr	4	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

[1/]NC – No counts

Table 49. Adult steelhead returning to weirs, Clearwater subbasin, 1990-2000

	Fish Creek		Crooked River		Red River		Powell		Clear Creek	
Year	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery
1990	ND	ND	17	32	ND	ND	50	1	5	11
1991	ND	ND	5	44	ND	ND	ND	ND	ND	25
1992	105	0	19	34	ND	ND	32	1	13	45
1993	267	0	17	32	ND	ND	0	0	24	200
1994	70	0	5	1	ND	ND	0	0	43	303
1995	32[a]	0	15	2	ND	ND	1	0	48	421
1996	32 [a]	0	2	1	ND	ND	0	0	24	385
1997	21 [a]	0	5	0	0	0	2	0	61	450
1998	75	0	2	0	0	0	ND	ND	18	235
1999	72 [a]	0	3	7	0	0	ND	ND	53	722
2000	26	0	6	10	0	0	ND	ND	17	320

(a) Weir was breached by high flows and debris, so counts don't represent total escapement

According to the IDFG's parr monitoring database, steelhead trout parr densities in the Clearwater subbasin averaged approximately 27% of the estimated carrying capacity between 1985 and 1997 (IDFG 1999a; Table 50). Monitoring surveys included in the database indicate the highest relative densities of steelhead trout in the Lower Selway, Lower Clearwater, and Lochsa AUs where the average percentages of carrying capacity were 46, 38, and 38%, respectively. Lesser percentages of estimated carrying capacity are being realized in the Upper Selway (12%), Lolo/Middle Fork (23%), and South Fork (25%) AUs.

Carrying Capacity

The carrying capacity for steelhead trout was estimated for each subwatershed in which spawning and rearing is known to occur (Table 50). Estimates are based on data downloaded from the Streamnet website (Pacific States Marine Fisheries Commission 2001) which was originally produced using the smolt density model developed in 1989 as part of the Northwest Power Planning Council Presence/Absence database (NPPC 1989).

Estimates of carrying capacity for steelhead smolts ranged from 31 to 54,708, with the highest subwatershed estimates associated with the Lochsa (approximately 482,000) and Upper Selway AUs (approximately 488,000). The lowest steelhead smolt carrying capacity estimates at the AU scale are associated with the Lolo/Middle Fork and Lower Clearwater AUs and the Lower North Fork AU where available habitat is limited by the presence of Dworshak Dam (Table 50).

Table 50. Estimated spawning/rearing area, total carrying capacity (smolt) and average percent of carrying capacity (parr) realized between 1985 and 1997 for steelhead trout within each Clearwater subbasin AU

Assessment Unit	Usable Area [1] (stream miles)	Estimated Capacity (# smolts)	Avg. percent realized [2] (85-97) (Idaho Dept Fish and Game 1999a)
Lower Clearwater (A-run)	525.5	184,746	38
Lower North Fork	2.0	4,709	Unknown
Upper North Fork	Not Accessible	--	--
Lolo/Middle Fork	263.7	135,419	23
Lochsa	437.3	482,182	37
Lower Selway	241.8	238,978	46
Upper Selway	563.7	487,849	12
South Fork	389.2	201,358	25
Subbasin Total	2,423.2	1,735,259	27

1 Excludes reaches used only for migration purposes

2 Derived from Parr Monitoring Database and presented for comparative purposes. No direct link has been established between parr and smolt production.

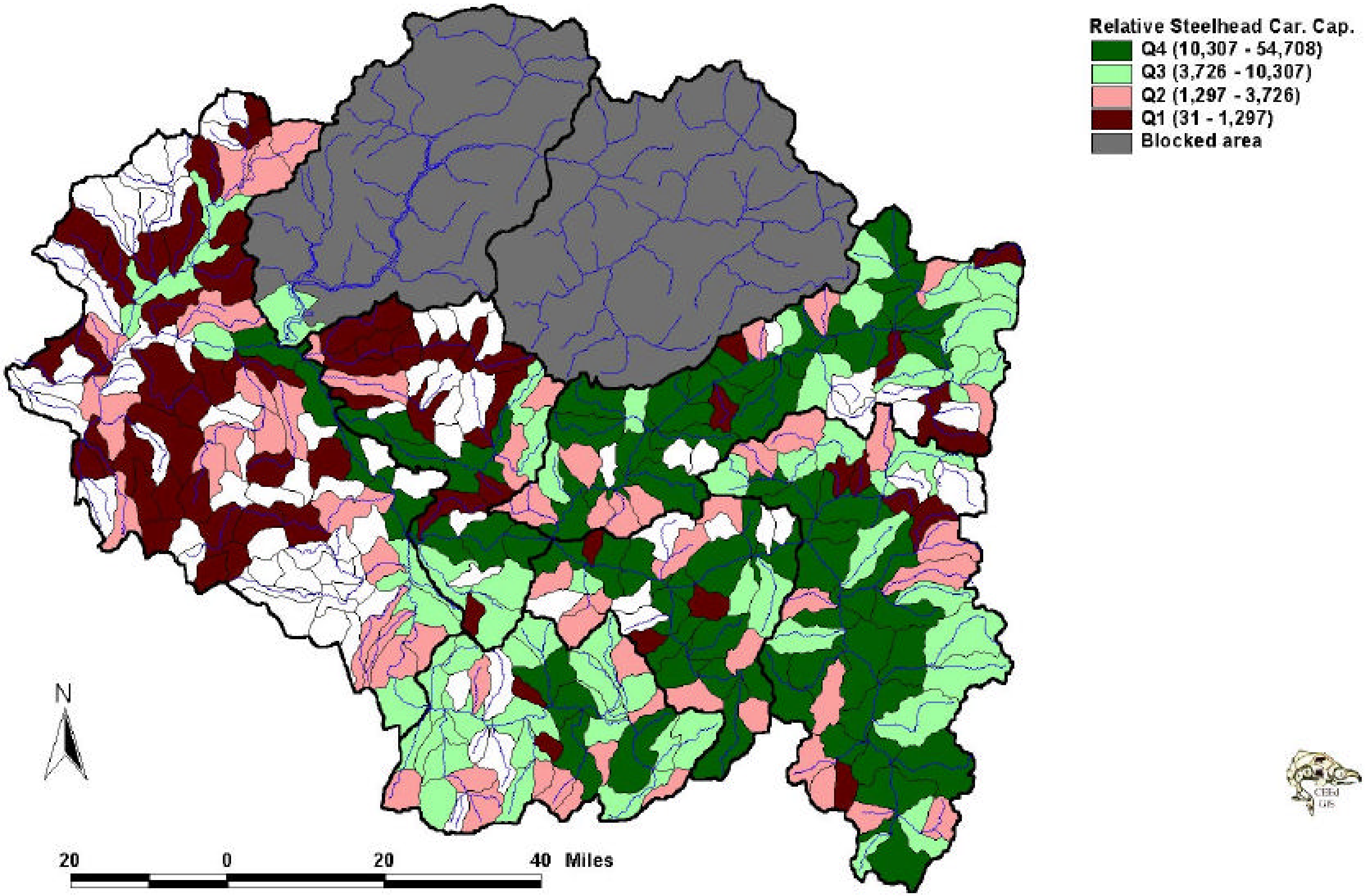

Figure 104. Estimated carrying capacity of steelhead trout smolts based on usable area and habitat quality within each subwatershed. Estimates are grouped into quartiles (Q1-Q4), with an equal number of subwatersheds in each

8.1.3 Coho Salmon

Coho salmon are believed to have historically migrated to and spawned in the Clearwater subbasin (Fulton 1970 cited in NPT and IDFG 1990). The NPT Office of Legal Counsel documented the historical presence of 'cuhlii or kallay' (coho) in their language and records this species as having been present throughout several streams in the Clearwater subbasin (Ed Larson, NPT, personal communication, May 11, 2001). However, coho runs throughout the Snake River basin were officially declared extinct in 1986. In the Clearwater subbasin, poor passage facilities at the Lewiston Dam (constructed in 1927) are generally accepted as having caused extirpation of coho salmon runs (NPT and IDFG 1990). Efforts were made by the Idaho Department of Fish and Game to reintroduce coho salmon to the Clearwater subbasin between 1962 and 1968, but were curtailed due to lack of success.

The Nez Perce Tribe currently has a reintroduction program underway for coho salmon in the Clearwater subbasin. Three primary factors may constrain success of coho production in the Clearwater during reintroduction: stock selection, habitat availability, and out-of-subbasin mortality related to dams and fisheries (NPT and IDFG 1990).

Coho salmon spawn in October over gravel/cobble-sized substrate with a fairly swift current. Fry emergence generally occurs between March-April, after which time they will reside in freshwater for one to two years. In fresh water, the diet of juvenile coho consists of aquatic insects and zooplankton (Simpson and Wallace 1982).

Historical Status

Coho salmon were likely present within the larger mainstem Clearwater tributaries, and depending on the amount of flow, accessed habitat in some of the smaller tributaries for spawning and rearing (Clearwater National Forest 1997). Specifically, the Potlatch River, Fish Creek and Lolo Creek likely provided habitat for spawning and rearing of historic coho populations (Clearwater National Forest 1997; A. Espinosa, Espinosa Consulting, personal communication 1999). Reviews of historical documents and interviews of residents by Johnston (1993, cited in Clearwater National Forest 1997) support the fact that the Potlatch River contained historical runs of chinook, steelhead and coho during the late 1800s and early 1900s. Run presence was likely a function of migration corridor connectivity, habitat suitability and water temperatures.

The lower South Fork Clearwater River was considered as supporting runs of coho salmon, however this documentation is largely anecdotal (Paradis et al. 1999b). The Idaho Department of Fish and Game has records of eyewitness accounts of historic coho runs in the Clearwater River (Richards 1967). The Nez Perce Tribe, through testimony of elders and review of historic literature, have identified several streams that historically supported populations of coho salmon in the Clearwater River subbasin (P. Kucera, NPT, personal communication, March 8, 2001).

The only recorded counts of coho salmon entering the Clearwater River were made at Lewiston Dam following reintroduction efforts by the Idaho Department of Fish and Game. Lewiston Dam counts, which were sporadic at best, ranged from 325 fish in 1968 to as low as 9 adults in 1972 (Table 51). As shown in Table 51, Clearwater coho comprised a relatively small proportion of Snake River coho that passed Ice Harbor dam between 1965-1972.

Clearwater subbasin coho supplementation projects were initiated in 1962 by IDFG under the auspices of the Columbia River Fisheries Department Program (NPT and IDFG 1990). Over 11 million eggs were planted into two controlled-flow hatching channels on the Red River and Crooked River within the South Fork subbasin (NPT and IDFG 1990). Fry releases occurred within mainstem channels and South Fork tributaries, although subsequent adult escapement rates were poor. The project was discontinued in 1968 because of the poor return rates, however, coho were still being counted over the dam up until its removal in 1972-73 (NPT and IDFG 1990).

Table 51. Number of coho salmon counted over the Lewiston Dam and over Ice Harbor Dam from 1965-1972 (Simpson and Wallace 1982)

Run Year	Adult Coho Salmon Counted	
	Lewiston Dam	Ice Harbor Dam
1965	21	320
1966	115	878
1967	43	3,770
1968	325	6,227
1969	31	5,316
1970	40	3,682
1971	61	3,029
1972	10	2,522

Current Status

Reintroduction of coho salmon in the Clearwater River subbasin was initiated in 1995 by the Nez Perce Tribe. Broodstock from Willard and Eagle Creek National Fish Hatcheries in Oregon has been used to stock eyed eggs, fry, parr, and smolts into tributaries of the lower mainstem Clearwater and South Fork Clearwater rivers. Stocking locations and life stages have varied across years, with the Potlatch River, Lapwai Creek, Mission Creek, Quartz Creek, Cottonwood Creek, Big Canyon Creek, Orofino Creek, Lolo Creek, Meadow Creek (Selway), and Meadow Creek (South Fork Clearwater) being supplemented at least once. Primary efforts have been focused in Lapwai Creek, Potlatch River, Eldorado Creek, and Meadow Creek (Selway River) with parr and smolt outplants (Table 52).

Post-release survival and life history traits are being monitored. Representative groups of parr and smolt releases have been coded-wire tagged and PIT tagged. Subsequent tag detection and recovery is being used to establish baseline emigration survival and smolt-to-adult return rate survival estimates.

Adult escapement abundance is being monitored at Lower Granite Dam, Lapwai Creek, Potlatch River, Clear Creek, Meadow Creek (Selway), and Dworshak National Fish Hatchery ladder. Adult escapement counts at Lower Granite Dam since 1997 have range from 12 to 1,089 (Table 53). Tributary specific returns have fluctuated across years with streams receiving smolt outplants generally having the highest return number. The Dworshak National Fish Hatchery may capture up to 190 adults even though fish are not released there (rearing does occur at the hatchery). Aerial and ground spawning ground surveys for coho salmon have been conducted with only a limited number of redds being observed in Lapwai Creek, Potlatch River, and Meadow Creek (Selway). Age of adult at return is predominately 2-ocean with a small percentage of jacks (1-ocean). The Nez Perce Tribe is currently in the process of developing a localized coho salmon brood stock from adult returns to the Clearwater River subbasin to support reintroduction efforts. To date no tribal or sport harvest season has occurred, however incidental capture during steelhead season is likely.

Table 52 Stocking summary of parr and smolt coho salmon releases since 1995 into Clearwater River tributaries

Location	1995	1998	1999	2000
Lapwai Creek	--	244,640 smolt	290,176 smolt	267,102 smolt
Potlatch River	142,456 parr	231,076 smolt 175,000 parr	276,682 smolt 175,000 parr	267,166 smolt
Orofino Creek	49,849 parr	--	--	--
Eldorado Creek	94,777 parr	125,000 parr	125,000 parr	124,470 parr
Clear Creek	--	218,501 smolt	245,168 smolt	280,750 smolt
Meadow Creek (South Fork Clearwater)	--	--	--	148,578 parr
Meadow Creek (Selway)	335,145 parr	150,000 parr	150,000 parr	149,300 parr

Table 53 Coho salmon adult escapement counts at Lower Granite Dam and tributary specific weir sites from 1997 to 2000.

	1997		1998		1999		2000	
	Adults	Jacks	Adults	Jacks	Adults	Jacks	Adults	Jacks
Lower Granite Counts	94	10	10	2	271	29	1033	56
Total Weir Counts			--	--	189	6	487	98

8.1.4 Pacific Lamprey

Pacific lamprey are considered an endangered species by the state of Idaho (IDFG 2001c). Throughout their range in the Columbia River Basin, Pacific lampreys have declined to only a remnant of their pre-1940s populations. Lower Snake dam counts numbered over 30,000 in the late 1960s, but have declined to less than 500 fish in recent years. Currently, an estimated 3% of the lamprey that pass Bonneville Dam are counted at Lower Granite Dam (Close 2000). Based on adult lamprey observations at Lower Granite Dam the current status in the Clearwater subbasin is thought to be extremely depressed (CBFWA 1999).

Pacific lamprey in Idaho are threatened by dams on the Snake and Columbia Rivers, stream alteration, and ammocoete harvest by bait fishermen according to a status review by the Idaho Chapter of the American Fisheries Society (cited in Paradis et al. 1999b). Because they spend extended periods in freshwater, Pacific lamprey are especially vulnerable to degraded stream conditions, including sedimentation due to land disturbance, and water quality limitations that impact diatom (food) production in nursery streams (Paradis et al. 1999b).

General life history and habitat descriptions can be found in several sources which are summarized in Close (2000). Migration of adult lampreys into fresh water typically occurs from May through September, with spawning the following March or April. Hatching occurs 2-3 weeks following fertilization. Following hatching, ammocoetes burrow into mud where they remain for 5 or more years before transforming to adults. As juveniles, Pacific lamprey feed primarily on diatoms and desmids. Following transformation, lampreys migrate to the ocean and become parasitic, attaching themselves to fish and consuming blood and body fluids from their prey (Simpson and Wallace 1982).

Historical Status

One of the earliest documented occurrences of Pacific lamprey in Idaho was in the Snake River near Lower Salmon Falls, and downstream near Lewiston (Gilbert and Evermann 1895). Culturally important to native tribes (Columbia River Inter-Tribal Fish Commission 1996), they were also popular for use of their oily flesh and as sturgeon bait (Gilbert and Evermann 1895). Ecologically, they are an important food for white sturgeon, and the carcasses of spawned adults provide nutrients to tributaries that also rear salmon and steelhead (Kan 1975).

It is thought that Pacific lamprey formerly migrated to all streams accessible to salmon and steelhead (Simpson and Wallace 1982), suggesting that they were present in all major drainages in the Clearwater subbasin. Sightings of, and parasitism by, Pacific lamprey in Dworshak Reservoir declined rapidly after impoundment (Simpson and Wallace 1982), suggesting that they may not have residualized in the North Fork Clearwater AUs. Lamprey were collected in Dworshak Reservoir as late as 1989 (16 years after impoundment), but have not been seen after this date (Melo Maiolie, IDFG, personal communication, April 20, 2001).

Current Status

Pacific lamprey populations in the western half of the Clearwater subbasin may be limited to the mainstem Clearwater River and larger accessible tributaries, including the Potlatch and Lolo Creek drainages (U.S. Bureau of Land Management 2000). Lapwai, Big Canyon, Orofino, Lolo and Lawyer Creek may also be used by Pacific lamprey (U.S. Bureau of Land Management 2000). According to Schoen et al. (1999), Pacific lamprey utilize the Lochsa River drainage although no information on their distribution within the system is provided. Hammond (1979) studied larval lamprey biology on the Potlatch River, and presented limited information on juvenile lamprey in Lolo Creek and the Clearwater River. Ammocoetes have been caught in recent years in smolt traps on Lolo Creek (NPT), Red River (IDFG 1998a), the Clearwater River (IDFG, Unpublished Data) and the Selway River near O'Hara Creek (IDFG, Unpublished Data). They are thought to occur in the American River system as well (Paradis et al. 1999b). A life history study currently being conducted in the South Fork Clearwater documented lamprey rearing in Red River and the mainstem South Fork (Cochnauer and Claire 2001). A recent biological assessment of the Lower Selway River (Thompson 1999) did not document the presence of Pacific lamprey in that area, although they have been observed at rkm 70 (RM 43) in recent years (Tim Cochnauer, IDFG, personal communication, March 30, 2001).

Potential factors affecting declines include problems with habitat and the migratory corridor (Close et al. 1995). Ammocoete abundance may be affected by water temperature and other physical characteristics during early development (Young et al. 1990 cited in Stone et al. 2001). Availability and accessibility of suitable spawning habitat may limit the amount of reproduction that occurs within a basin. Factors influencing survival of early life history stages may be critical to determining recruitment to the population (Houde 1987).

Within the Clearwater subbasin, limiting factors include habitat disturbance. Low flows, poor riparian conditions and resultant high water temperatures reduce the quality and quantity of adult spawning and juvenile rearing areas (Close 2000).

Out of the subbasin, the major limiting factors for ammocoetes and macrothalmia are passage and bypass mortalities at facilities on mainstem Snake and Columbia dams as well as migration delays through the reservoirs (Hammond 1979). For adults, the primary limiting factor is higher water velocities in the adult fish ladders and migration system. Adults have extreme difficulty negotiating the fish ladder weir orifices (T. Bjornn cited in Close 2000).

The Columbia Basin Lamprey Technical Workgroup (Close 2000), Close et al. (1995) and the Idaho Department of Fish and Game (1996 and 2001b) state that basic distribution, life history and population status are urgently needed to fully understand this species and to begin intensive management before extinction occurs and supplementation programs are implemented. Understanding the cause of decline through various data gathering and research efforts will be critical to implementing effective restoration actions for Pacific lamprey in the Columbia River Basin (Close et al. 1995).

8.1.5 Redband (Rainbow) Trout

Redband trout are thought to represent the resident form of steelhead trout in areas where they coexist (or coexisted historically), although the subspecies also exists in areas outside the historic range of steelhead trout (Behnke 1992). Redband trout are considered a species of special concern by the American Fisheries Society and the state of Idaho, and are classified as a sensitive species by the U.S. Forest Service and Bureau of Land Management (Quigley and Arbelbide 1997).

Although redband trout likely existed historically throughout the Clearwater subbasin (Quigley and Arbelbide 1997), little is known about the current distribution or status of redband trout populations in the subbasin. One reason for the lack of information is the inability to differentiate juvenile steelhead and resident redband trout phenotypically, and coexistence of the two subspecies throughout most of the Clearwater subbasin complicates efforts to gather information on redband trout population(s).

Hybridization of redband trout and stocked rainbow trout is common (Quigley and Arbelbide 1997), and often leads to questions over the genetic integrity of existing redband trout population(s). In the North Fork Clearwater drainage, where steelhead trout have been excluded by Dworshak dam, potential hybridization with stocked rainbow trout leaves the current distribution of redband trout in question. Methodology using DNA markers exists to differentiate redband trout from the common coastal rainbow stocks that have been used for hatchery stocking. For example, initial results from a study conducted by Mays (2001) in the Salmon River, suggests few genetic introgression legacy effects from past stocking of exotic trout in redband waters. There remains a need to identify the genetic integrity of redband populations in the Clearwater subbasin in areas naturally or artificially blocked, heavily or sparsely stocked, and where they are sympatric with or isolated from steelhead.

8.1.6 Westslope Cutthroat Trout

Westslope cutthroat trout are currently listed as federal and state (Idaho) species of concern and sensitive species by the USFS and BLM. The subspecies has been proposed for listing under the ESA in some portions of its range. The historic range of westslope cutthroat trout has been reduced substantially (Rieman and Apperson 1989), and the existence of relatively strong population(s) throughout north-central Idaho may provide an important component to regional recovery efforts.

Westslope cutthroat trout exhibit resident, fluvial, and adfluvial life histories within the Clearwater subbasin (Thompson 1999; Weigel 1997). Westslope cutthroat mature at approximately five years of age, with fish in some areas spawning at three or four years (Simpson and Wallace 1982). Spawning typically occurs in April and May, with emergence during June and July. Migratory behaviors in cutthroat trout are seasonal in nature and associated with finding suitable spawning or wintering habitat (Bjornn and Mallett 1964). Westslope cutthroat trout are highly dependent upon substrate conditions for overwintering survival, particularly in headwater streams. Overwintering occurs in large deep pools or within crevices and interstitial spaces in the substrate in streams without adequate pools (Paradis et al. 1999a; Meehan and Bjornn 1991).

Three primary factors have been identified which have contributed to the decline of westslope cutthroat populations: species introductions, angling mortality, and habitat disruption (Quigley and Arbelbide 1997). Hybridization with exotic trout is considered the greatest threat to the conservation of native westslope cutthroat trout in northern Idaho and Montana (Allendorf and Leary 1988, cited in Weigel 1997). Both westslope and yellowstone cutthroat have been stocked in most of the AUs in the past although, since the late 1970s, only westslope cutthroat have been stocked, and then only in mountain lakes (Jody Brostrom, IDFG, personal communication, April 22, 2001).

Evolution of cutthroat trout has occurred with a variety of salmonid species, and habitat segregation is common when cutthroat trout coexist with other salmonids (Thompson 1999; Pratt 1984; Hansen 1977). Hybridization with rainbow trout is common in some areas where the species coexist, while in other areas coexistence occurs with minimal hybridization (Behnke 1992). Behnke (1992) stated that areas exist within the Clearwater subbasin where essentially pure native westslope populations are relatively common. More recent investigations by Weigel (1997) suggest that introgression between westslope cutthroat trout and introduced rainbow trout in the North Fork Clearwater River may be widespread and substantial in some areas. Weigel (1997) also located genetically pure westslope cutthroat trout stocks within the higher elevations of the study area. Weigel and Statler (2001) indicated that genetic introgression with rainbow trout was detected in about 2/3 of the sites sampled in the North Fork Clearwater subbasin (1/3 low introgression, 1/3 moderate introgression). Current methodology precludes the ability to distinguish between hatchery influenced and natural introgression of rainbow trout into cutthroat trout populations. However, Liknes and Graham (1988) indicated that westslope cutthroat trout and steelhead/rainbow trout in the Clearwater drainages evolved sympatrically without significant hybridization. The mechanisms that limit the potential for hybridization between those two species include aggressive spawning behavior and spatial separation between spawning sites (Liknes and Graham 1988). No baseline genetic data exists on natural introgression of rainbow trout into populations of the North Fork Clearwater River (Jody Brostrom, IDFG, personal communication, March 30, 2001). It is also unknown what effect Dworshak Dam and the removal of the anadromous component had on the degree of natural introgression in the North Fork Clearwater drainage. A need exists to document natural or hatchery influenced introgression in cutthroat trout populations in the Clearwater subbasin so that remaining populations can be protected and managed.

Westslope cutthroat trout are highly susceptible to angling pressure and angling mortality has contributed to declines in the status of westslope cutthroat throughout their range (Behnke 1992). However, many populations have been shown to respond to restrictive angling regulations (Nez Perce National Forest 1998) with increased survival, abundance, and size (Bjornn and Johnson 1978, cited in Behnke 1992).

Effects of habitat disruption on westslope cutthroat trout populations are similar to those on other salmonid species. Extensive land use activities have led to population declines by increasing stream temperatures, decreasing the quality and quantity of suitable gravel and cover, and fragmenting existing populations. A strong association with roadless and wilderness areas suggests a substantial vulnerability to habitat alterations (Quigley and Arbelbide 1997).

Historic Status

Westslope cutthroat trout were historically the dominant salmonid in streams of northern and central Idaho (Behnke and Wallace 1986, cited in Nez Perce National Forest 1998), although documentation of status and distribution is limited. In the Lower Clearwater and Lolo/Middle Fork AUs, westslope cutthroat trout were likely abundant throughout the headwaters of mainstem tributaries, with limited use of the mainstem Clearwater River (Clearwater National Forest 1997). The upper reaches of both the Potlatch River and Lolo Creek historically maintained healthy populations of westslope cutthroat trout according to the Clearwater National Forest (1997), although Duff (1996) suggests that the Potlatch River did not historically support the subspecies. The majority of the South Fork AU was identified as a historic stronghold for westslope cutthroat (Nez Perce National Forest 1998). Past distribution and status of the subspecies within the Upper and Lower Selway AUs is thought to have been similar to current conditions, although large fluvial forms may have been more abundant historically (Thompson 1999). In the Upper and Lower North Fork AUs, westslope cutthroat trout populations are thought to have been historically strong (Liknes and Graham 1988). No information was found on the historic status of westslope cutthroat trout populations in the Lochsa River drainage, although they were thought to exist throughout (Duff 1996).

Current Status

Strong populations of westslope cutthroat trout currently exist in only about 11% of their historical Idaho range (Rieman and Apperson 1989). Westslope cutthroat trout are widespread in all portions of the Clearwater subbasin except the Lower Clearwater AU and are considered present–strong throughout the majority of their current range (Figure 105).

Available status information indicates that westslope cutthroat trout populations throughout the Upper North Fork, Lochsa, Upper and Lower Selway AUs are typically present-strong with the exception of a few tributaries or tributary systems. Data collected by IDFG suggest that the population of westslope cutthroat trout within the Selway River subbasin has experienced slight declines in the abundance of large fluvial individuals over the past two decades, but is still considered stable (Thompson 1999). Smolt traps operated in the Lochsa AU (Fish Creek and Crooked Fork Creek) regularly catch juvenile westslope cutthroat (IDFG 1998a; Byrne 2001). Westslope cutthroat tagged at the Fish Creek trap have been recaptured in later years, suggesting that the Lochsa is an important rearing area and the Fish Creek population is not entirely resident (Byrne 2001).

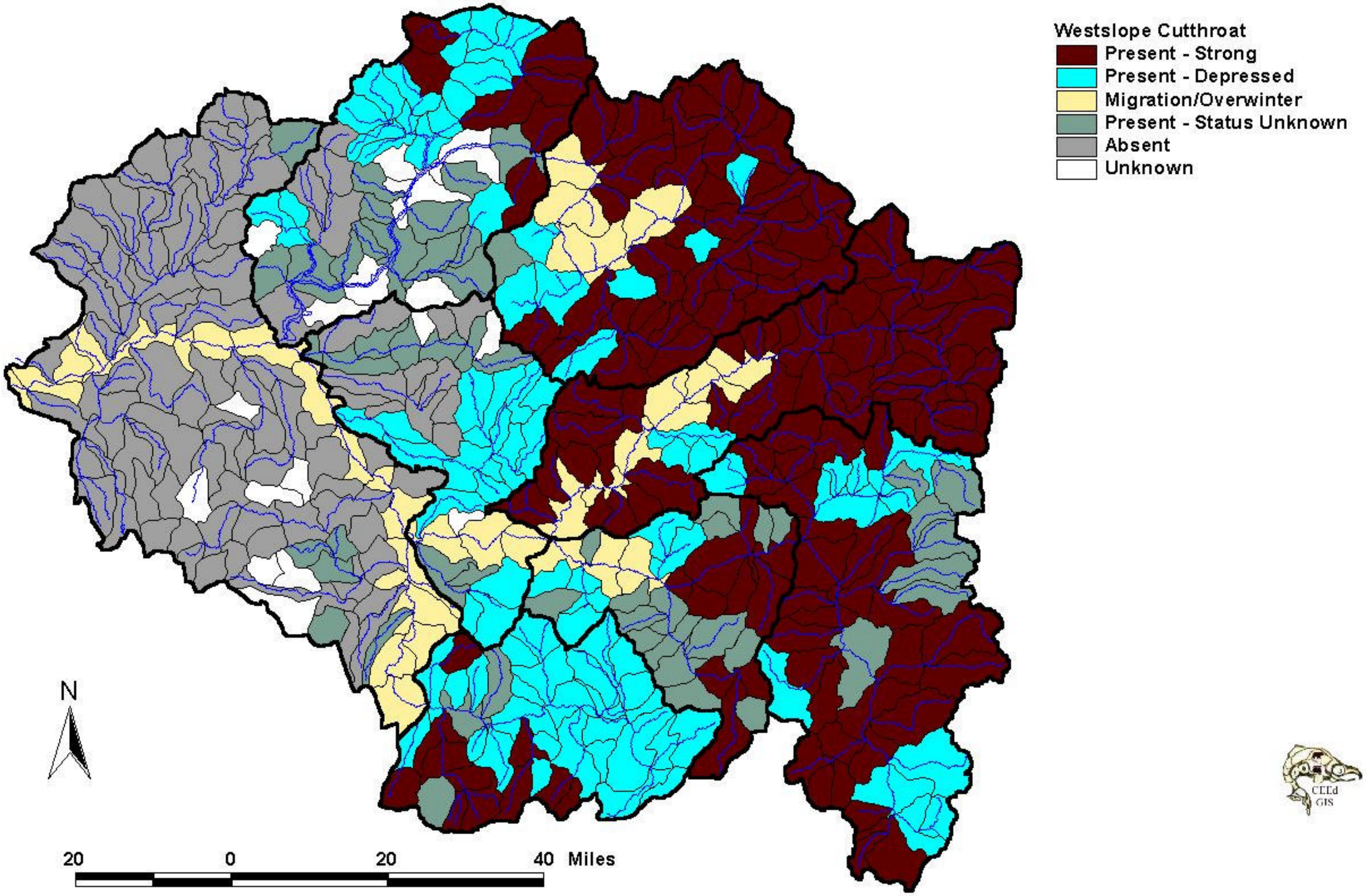

Figure 105. Known distribution and relative status of westslope cutthroat trout in the Clearwater subbasin

Westslope cutthroat trout are considered absent from the vast majority of tributaries in the Lower Clearwater AU, although rare sightings have occurred in some streams. Based on the frequency and distribution of sightings in the Lower Clearwater AU, westslope cutthroat trout that have been documented in most drainages are likely strays or dispersing juveniles from other areas within the subbasin. Only 15 were sampled during Gas Bubble Trauma monitoring between 1995-1999 (Cochnauer 1999).

In the Lolo/Middle Fork AU, westslope cutthroat trout are absent from Jim Ford Creek, but present in all other major drainage systems. Westslope cutthroat trout are defined as present–depressed in all areas of the Lolo/ Middle Fork AU where status information is available.

In the Lower North Fork AU, westslope cutthroat trout are absent from the Elk Creek drainage but present in all other major drainages. Little status information is available in areas other than the Little North Fork Clearwater, where status designations are relatively evenly divided between present–depressed and present–strong.

Although widely distributed, westslope cutthroat trout are present–depressed through the majority of their range in the South Fork AU. Designations of present–strong within the South Fork AU are limited to Johns and Tenmile Creeks and the headwater reaches of Mill and Meadow Creeks and Crooked River. The Nez Perce National Forest (1998) describes the distribution of cutthroat trout within the South Fork drainage as similar to historical, with remaining stronghold areas closely associated with roadless/wilderness areas.

The Idaho Department of Fish and Game has taken steps to protect wild trout, including cutthroat, in the past 30 years. Most streams that contain westslope cutthroat trout have a restrictive sport fishing regulation, and the season is opened after the fish are believed to have spawned. Only sterile rainbow trout are used for most stocking to prevent hybridization with wild trout.

8.1.7 Bull Trout

The current distribution of bull trout within the Columbia River Basin occupies about 44% of their estimated historic range, with the core remaining distribution in the central Idaho mountains, including the Clearwater River subbasin (Nez Perce National Forest 1998). Bull trout were listed under the ESA as threatened in Idaho in June 1998 (63 FR 31647). Concern over declines in bull trout abundance and distribution led to the development of a statewide conservation plan by the state of Idaho in 1996 (Batt 1996). Major goals of this plan include identification and maintenance of critical bull trout habitats, implementation of recovery strategies aimed at both abundance and habitat, and establishment of key watersheds to achieve stable or increasing populations and maximize potential for recovery. Under this plan, 10 watersheds in the Clearwater River subbasin were identified as key watersheds for bull trout conservation (Table 54). Bull trout were closed to sport fishing harvest in 1994. The extent and impact of tribal harvest on bull trout populations is not known.

Bull trout exhibit adfluvial, fluvial, and resident life history patterns within the Clearwater subbasin. Fluvial and resident bull trout populations have been commonly cited throughout the current range of bull trout in the Clearwater subbasin (Paradis et al. 1999b; Thompson 1999). The only suspected adfluvial bull trout population within the Clearwater subbasin is associated with Fish Lake in the Upper North Fork AU (Clearwater Subbasin Bull Trout Technical Advisory Team 1998c). Although bull trout in fish lake are assumed to be adfluvial in origin, no radiotagged bull trout were documented entering the lake, but one spawned in the outlet, Lake Creek (Schriever and Schiff 2001). Fifty bull trout PIT-tagged in

Fish Lake did not move out of the lake during summer and fall months suggesting that the Fish Lake population may be resident. Size of fish captured in the lake support this contention, as does the fact that mature females were also captured. Further research is ongoing to define the status of the Fish Lake bull trout population.

Bull trout have more specific habitat requirements than other salmonids (Batt 1996). Strong bull trout populations are associated with a high degree of channel complexity, including woody debris and substrate with clear interstitial spaces (Batt 1996). Perhaps one of the most critical habitat requirements of bull trout is water temperature. Bull trout may experience considerable stress when temperatures exceed 15°C (59°F; Pratt 1992, cited in Clearwater subbasin Bull Trout Technical Advisory Team 1998c; Batt 1996). Optimum temperatures for incubation and rearing have been cited between 2 and 4°C (35.6 - 39.2°F) and 7 and 8°C (44.6 – 46.4°F), respectively (Rieman and McIntyre 1993). Other habitat parameters of particular importance to bull trout populations include channel stability, substrate composition, cover, and maintenance of migratory corridors (Rieman and McIntyre 1993).

Table 54. List of key watersheds within the Clearwater subbasin identified in the state of Idaho's Bull Trout Conservation Plan (Batt 1996)

Key Watershed	Description
North Fork Clearwater	The North Fork of the Clearwater River from Dworshak Reservoir upstream to Kelly Creek
Little North Fork Clearwater	The Little North Fork of the Clearwater River upstream of Dworshak Reservoir
Weitas Creek	Entire Weitas Creek Drainage, tributary to the North Fork of the Clearwater River
Kelly Forks	The entire North Fork of the Clearwater River drainage from the mouth of Kelly Creek upstream
South Fork of the Clearwater	The entire South Fork of the Clearwater drainage upstream from the Meadow Creek drainage
Lochsa River	The entire Lochsa River drainage
Meadow Creek	Selway River upstream from mouth of Lochsa River encompassing entire Meadow and Gedney Creek drainages
Selway River, Middle	The Selway River encompassing the Mink Creek, Marten Creek, Three Links Creek, Petibone Creek, Bear Creek and Bad Luck Creek drainage
Moose Creek	The entire Moose Creek drainage, tributary to the Selway River
Selway River, Upper	The Selway River encompassing the White Cap Creek, Indian Creek, Clearwater Creek, Swet Creek, Deep Creek, and Selway River headwaters

Historical Status

The entire Clearwater subbasin lies within the native range of bull trout (Meehan and Bjornn 1991). However, historic abundance and trend data are scarce because bull trout were considered a nuisance species (Clearwater subbasin Bull Trout Technical Advisory Team 1998a, 1998b, 1998c, 1998d), and few records of their status were maintained.

The Nez Perce National Forest (1998) states that historic distribution of fishes in the South Fork Clearwater were probably similar to current distributions, although the status of existing stocks (including bull trout) has declined significantly. This report also indicates that migratory (fluvial) bull trout were likely found throughout the South Fork Clearwater subbasin, with concentrations in mainstem tributaries. Historic abundance and distribution information for bull trout in other areas of the Clearwater subbasin is rare or nonexistent (Clearwater subbasin Bull Trout Technical Advisory Team 1998a, 1998b, 1998c, and 1998d), and existing records do not allow for interpretation of historical distribution or abundance at the subbasin scale. In addition, the connectivity of bull trout populations between assessment units is not known.

Current Status

Bull trout are distributed throughout most of the large river and associated tributary systems within the Clearwater subbasin (Figure 106). Relatively contiguous distributions of bull trout exist in the South Fork, Selway, and Upper North Fork AUs. Although bull trout are widely distributed in the Lochsa River AU, they are absent from many tributary systems in the lower half of the Lochsa drainage. Bull trout are sparsely distributed in the Lolo/Middle Fork AU, using the mainstem reaches of Lolo Creek and upper reaches of Clear Creek for spawning/rearing, and the Middle Fork Clearwater River for migration.

The Lower North Fork AU contains bull trout in portions of the North Fork Clearwater and Little North Fork Clearwater Rivers upstream of Dworshak Reservoir. Bull trout also occupy Dworshak Reservoir, and spawner size in some tributaries of the North Fork Clearwater River suggest that some bull trout spend extensive amounts of time feeding in the reservoir (A. Espinosa, Espinosa Consulting, personal communication, 1999). Current research documents bull trout catches in Dworshak Reservoir, and through use of radio-tags, has documented their migration into headwater tributaries of the North Fork Clearwater River to spawn (Schriever and Schiff 2001) and return to the reservoir for overwintering.

With the exception of the mainstem Clearwater River, bull trout are essentially absent from the Lower Clearwater AU (Figure 106). Occasional documentation of bull trout has occurred in Lower Clearwater tributaries, but such sightings are regarded as random occurrences associated with juvenile dispersal. Bull trout may regularly use the mainstem Clearwater River. Recent sampling events directed at monitoring gas bubble trauma in the mainstem Clearwater River have regularly collected adult bull trout (Cochnauer 1999) and the trap at the base of Dworshak Dam catches subadult and adult bull trout every year in the spring. Dworshak Dam has likely fragmented the Clearwater subbasin bull trout population, and it is not known whether fish in the lower Clearwater have come from Dworshak Reservoir (Schriever and Schiff 2001).

Interpretation of bull trout status throughout the Clearwater subbasin is complicated by a lack of available information in many areas. Where status information is available, bull trout are most commonly designated as "present–depressed" (Figure 106). Designations of "present–strong" are assigned to 18 subwatersheds in the subbasin. Of seven AUs utilized by bull trout for purposes other than migration, five contain at least one subwatershed where bull trout are designated as present-strong. These include the Lower North Fork, Lochsa, Upper and Lower Selway, and South Fork AUs. Of 10 key watersheds defined for bull trout by the state of Idaho within the Clearwater subbasin, six contain areas where bull trout status is defined as present–strong in at least one subwatershed.

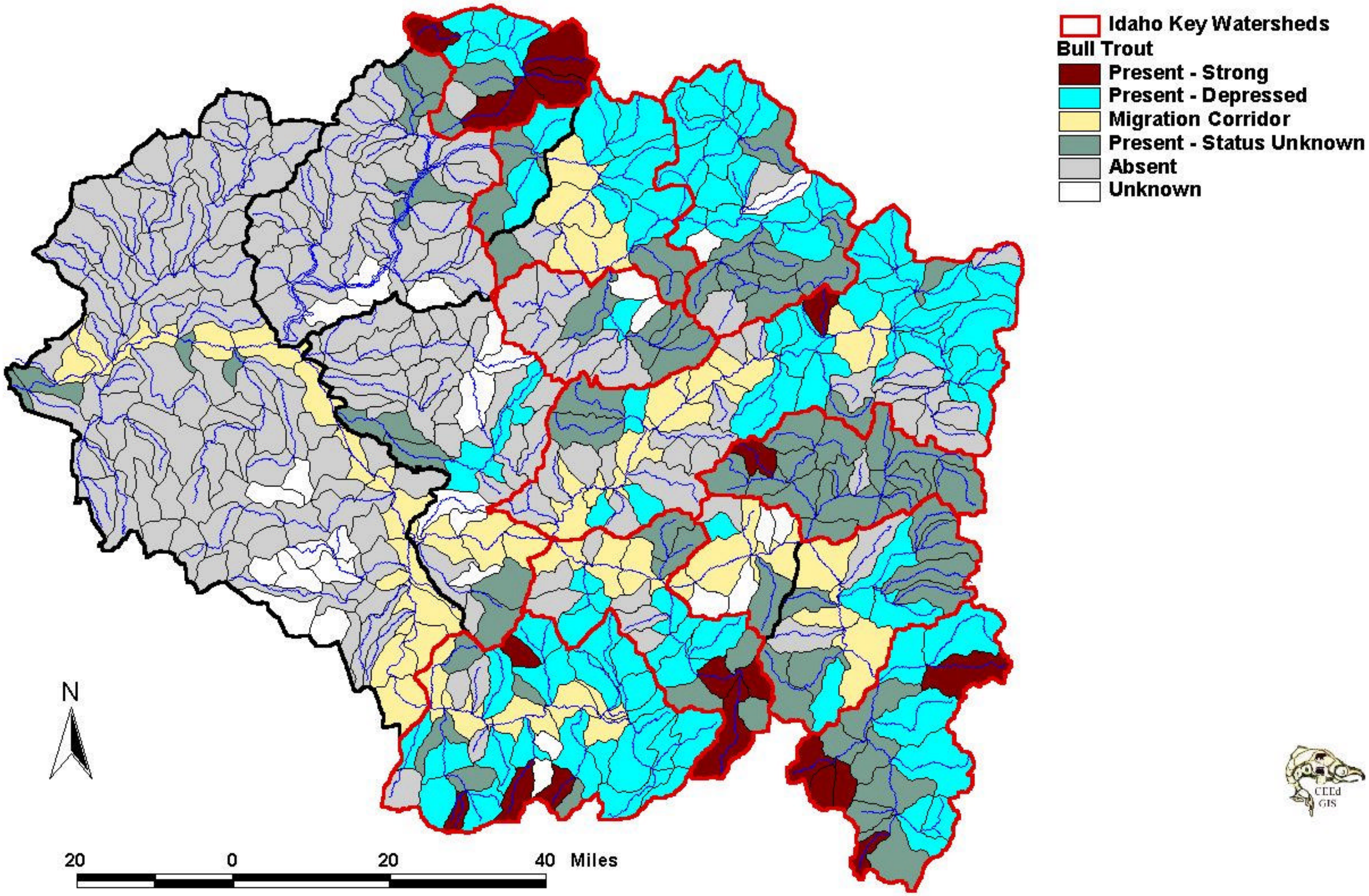

Figure 106. Known distribution and relative status of bull trout in the Clearwater subbasin. Red lines delineate key watersheds defined in the Idaho Bull Trout Conservation Plan

The Nez Perce National Forest (Paradis et al. 1999b) states that connectivity between the Lochsa and Selway subbasins is high, and that regular exchange of bull trout between these areas is likely. Bull trout are also thought to use the Middle Fork Clearwater River (Paradis et al. 1999a).

Based on available status information, contiguous areas with defined (or apparent potential for) strong bull trout subpopulations exist in the Little North Fork Clearwater drainage (Lower North Fork AU), the upper reaches of Meadow Creek in the Lower Selway AU, and portions of the Upper Selway AU. Strong subpopulations of bull trout in the South Fork AU are scattered and limited to headwater portions of Johns, Newsome, and Tenmile Creeks and Crooked and Red Rivers.

The South Fork AU has the most comprehensive data known about bull trout in the Clearwater subbasin. A multi-year study documented juvenile distribution in most major tributaries and headwater streams within the AU (IDFG 2001d). The anadromous weir operated at Crooked River has captured subadult and adult bull trout since the early 1990s. From 1993-1999 an average of 16 were caught (range 0-32 fish; IDFG 2001d). Fish captured at this weir in 1998 and implanted with radiotags show that bull trout migrate over 25 miles from the middle reach of the mainstem South Fork Clearwater River to spawn in Crooked River. In addition, juvenile bull trout captured in smolt traps have been implanted with PIT-tags, and recapture data shows movement within and between tributaries in the South Fork AU (IDFG 2001d).

The Selway River supports a significant metapopulation of fluvial bull trout that are widely distributed through the subbasin in variable densities (Thompson 1999). The subbasin also supports widely distributed resident populations in some upper tributary reaches (Thompson 1999). The Selway population is thought to contain "thousands of individuals" and be fluctuating around an equilibrium, but not growing (Thompson 1999).

The only subpopulation of bull trout defined as present–strong in the Lochsa AU is in Fishing (a.k.a. Squaw) Creek. Fishing Creek contains both resident and fluvial stocks of bull trout, with some of the most significant known bull trout habitat within the Lochsa drainage. An estimated 81 adults returned to spawn in Fishing Creek in 1997 and 1998 (Schoen et al. 1999). Based on the quantity of suitable habitat in Fishing Creek, this population size is considered low to moderate (Schoen et al. 1999).

8.1.8 Brook Trout

Brook trout are indigenous to eastern North America and have been introduced throughout the western states. Brook trout have been introduced in areas throughout the Clearwater River subbasin (Nez Perce National Forest 1998; Thompson 1999) beginning as early as 1936. Recent records indicate that the state of Idaho has not stocked brook trout in the Clearwater subbasin since 1984. Figure 107 shows the documented current distribution and relative status of brook trout population(s) within the Clearwater subbasin.

Introductions and subsequent spread of brook trout within the Clearwater subbasin may threaten bull trout populations in areas of coexistence. Hybridization of bull trout and brook trout is a common problem where populations overlap, and hybrids are often sterile (Clearwater subbasin Bull Trout Technical Advisory Team 1998d). Brook trout will outcompete bull trout in degraded streams (Clearwater subbasin Bull Trout Technical Advisory Team 1998a), although the opposite may be true in very cold streams (less than 10°C; Adams and Bjornn 1994, cited in Clearwater subbasin Bull Trout Technical Advisory Team 1998a). Currently methods are being tested in the Clearwater subbasin to remove brook trout from mountain lakes and adjacent tributaries where they are threats to bull trout (Murphy et al.2001).

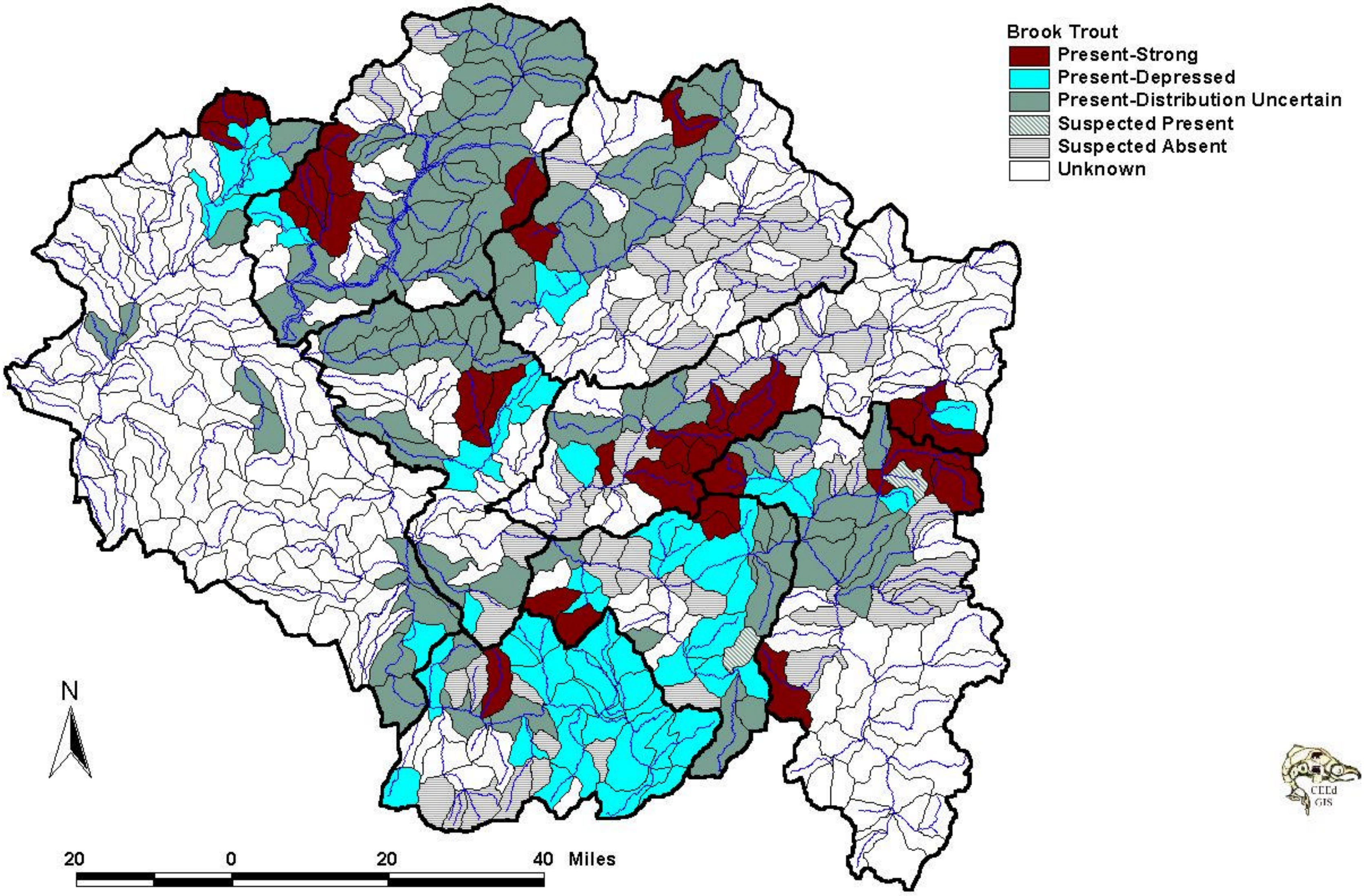

Figure 107. Known distribution and relative status of brook trout in the Clearwater subbasin

A statewide bonus harvest limit for brook trout exists (currently 25 brook trout) in addition to the general limit. In the Clearwater subbasin this applies to all waters except Elk Creek. There are no cutthroat or bull trout in Elk Creek, and the brook trout attain a large size and are highly sought after by anglers.

Brook trout may also displace westslope cutthroat trout from some native habitat (Behnke 1992). Griffith (1988, cited in Behnke 1992) stated that brook trout are more likely to displace cutthroat trout from lower gradient stream reaches, whereas cutthroat trout are likely to outcompete brook trout in areas of higher gradient.

Brook trout typically mature by age two or three, and rarely exceed six years of age (Simpson and Wallace 1982). Spawning usually occurs during late September and October, and the young emerge during April and May. Brook trout most often construct redds in gravel, but if groundwater upwelling is sufficient, they may spawn on sand or silty bottoms (Meehan and Bjornn 1991).

8.1.9 Dworshak Reservoir Resident Fishery

The Idaho Department of Fish and Game, U.S. Army Corp of Engineers, U.S. Fish and Wildlife Service and Nez Perce Tribe work together to provide and manage a fisheries program for Dworshak Reservoir (Idaho Department of Water Resources 2000). The program recognizes the importance of optimizing the kokanee fishery, enhancing the smallmouth bass fishery, stocking rainbow trout, and managing native species such as bull trout and westslope cutthroat trout (Idaho Department of Water Resources 2000).

Dworshak Dam blocked upstream fish passage to all but the lower 1.9 miles of the North Fork Clearwater River drainage. Dworshak hatchery was constructed to mitigate the resultant loss of steelhead production areas. In addition, the USACE has the legal responsibility to mitigate the effects of lost fishing opportunity resulting from construction of Dworshak Dam and Reservoir on the North Fork Clearwater River. Mitigation was originally defined as 100,000 pounds of hatchery reared fish annually, a goal which has only been reached three times since 1972. Annual stocking rates in Dworshak Reservoir have averaged 38,500 pounds over the past 25 years, and less than 15,000 pounds in the past 10 years (Idaho Department of Water Resources 2000).

Originally the Dworshak Reservoir fishery was comprised primarily of rainbow trout stocked as part of a federal fisheries mitigation requirement. From 1972 through 1980, rainbow trout dominated the fishery in Dworshak Reservoir, with angler use averaging about 88,000 hours annually (Idaho Department of Water Resources 2000). Smallmouth bass and kokanee were subsequently introduced to the reservoir, and by the 1980s, kokanee had replaced rainbow trout as the dominant fishery (Idaho Department of Water Resources 2000).

Kokanee are a landlocked form of sockeye salmon, which are not native to the Clearwater subbasin. Kokanee were first stocked into Dworshak Reservoir in 1972 (Horton 1980). Four sources of fish were initially used, but the early spawning strain from Anderson Ranch Reservoir, Idaho now populates the reservoir (Winans et al. 1996). These fish spawn during September in tributary streams as far as 140 km above the reservoir. They reach maturity primarily at age 2, although age 1 and age 3 spawners were occasionally found. Adults range in size from 200 to 400 mm in total length depending on density in the reservoir, but generally average 300 mm during spawning (Maiolie and Elam 1995).

Kokanee provide a highly desirable and popular sport fishery in Dworshak Reservoir. They are unique in their ability to build to high population numbers in this drawdown reservoir environment. Winter water releases from Dworshak Dam result in entrainment of kokanee, and a high degree of annual fluctuation in population levels of kokanee (Idaho Department of Water Resources 2000). Summer water releases result in substantially less kokanee entrainment because fish are more active and tend not to be congregated near the dam (Idaho Department of Water Resources 2000). In years when their numbers are good, kokanee have provided fisheries with harvests of over 200,000 fish per year (Mauser et al. 1989). Kokanee abundance within the reservoir, however, fluctuates widely (as much as 50 fold) due to entrainment losses into the dam (Figure 108). Kokanee spawner counts also fluctuate widely with the change in reservoir populations and entrainment loss (Table 55).

Entrainment losses limit the kokanee population in Dworshak Reservoir. Currently, strobe lights are being tested near Dworshak Dam as a method to reduce kokanee entrainment, and results are promising. Strobe light testing at off-site locations was successful and statistically significant reductions in densities of kokanee were found near the lights (Maiolie et al. 1999a; Maiolie et al. 1999b).

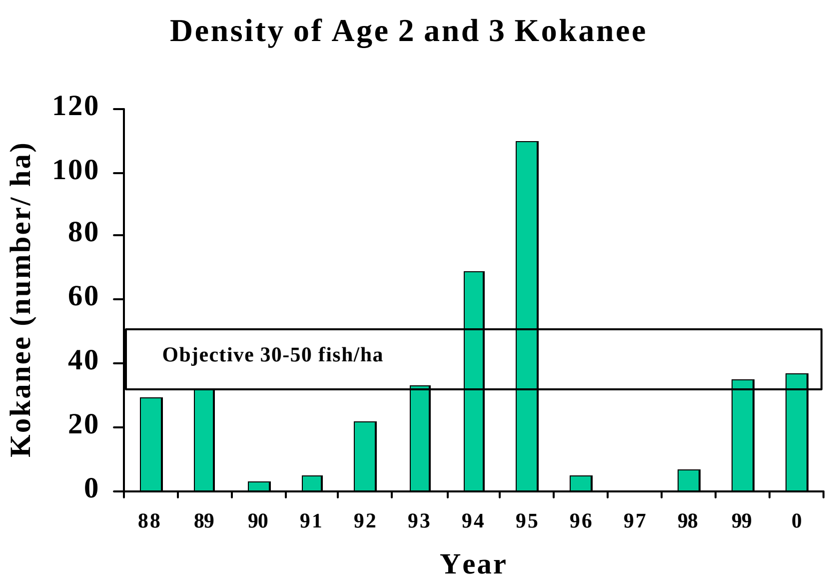

Figure 108. Abundance of age 2 and age 3 kokanee in Dworshak Reservoir, Idaho, from 1988 to 2000. Note the wide fluctuations in the population both above and below the objective to optimize the fishery

Table 55. Number of spawning kokanee observed in Dworshak Reservoir tributaries, 1981-2000

Year	Number of Spawning Kokanee
1981	8,070
1982	10,576
1983	2,451
1984	12,200
1985	20,000
1986	NC
1987	6,348
1988	21,820
1989	19,985
1990	15,456
1991	5,995
1992	13,192
1993	39,221
1994	31,424
1995	36,480
1996	2,569
1997	144
1998	678
1999	11,320
2000	4465

Success and consistency of the smallmouth bass fishery is also defined largely by the operational effects of Dworshak Dam and a general lack of productivity in the reservoir (Idaho Department of Water Resources 2000). Water level fluctuations in the reservoir also have eliminated successful spawning of redside shiners, substantially reducing forage availability for smallmouth bass (Idaho Department of Water Resources 2000). Smallmouth bass in Dworshak Reservoir have the slowest growth rate of any regional population, due primarily to a lack of forage, and the smallmouth bass fishery currently produces only limited harvest opportunity (Idaho Department of Water Resources 2000).

Rainbow trout stocking in Dworshak Reservoir has had mixed results, and in years of low kokanee abundance rainbow trout comprise the majority of consumptive fishing opportunities (Idaho Department of Water Resources 2000). Hatchery reared rainbow trout also dominate the creel of shoreline anglers in the reservoir (Idaho Department of Water Resources 2000). Beginning in 2000, all hatchery rainbow stocked in the reservoir are sterile to minimize risk of hybridization with native cutthroat trout and redband trout (Jody Brostrom, IDFG, personal communication, May 7, 2001).

8.2 Artificial Production

A general overview of artificial production facilities located within the boundaries of the Clearwater subbasin is presented in Table 56. More detailed information on artificial production facilities follows.

8.2.1 Idaho Department of Fish and Game

The Idaho Department of Fish and Game operates the Clearwater Fish Hatchery, located at the mouth of the North Fork Clearwater River. Clearwater Fish Hatchery was authorized and constructed under the Lower Snake River Compensation Program (LSRCP), and is the newest LSRCP hatchery program in the Snake River basin (The overall Snake River basin LSRCP program is described in USFWS 2001b). The hatchery was completed and became operational in 1990. The implementation of the Clearwater Fish Hatchery program was guided by the following management objectives: 1) restore and maintain natural spawning populations, 2) re-establish historic recreational and tribal fisheries, 3) establish total adult returns that meet LSRCP goals, 4) operate the hatchery programs so that genetic and life history characteristics of hatchery fish mimic wild fish, and 5) minimize impacts on resident stocks of game fish. The IDFG strongly emphasizes maintaining selective fisheries with the steelhead and chinook salmon programs. Clearwater Fish Hatchery also produces steelhead and chinook salmon juveniles for release as part of the Idaho Supplementation Studies (chinook salmon) and Steelhead Supplementation Studies projects occurring in the subbasin. The Clearwater Fish Hatchery salmon and steelhead artificial production programs conform to statewide fisheries policies and management goals identified in the 2001-2006 Fisheries Management Plan (IDFG 2001c).

Clearwater Fish Hatchery serves only incubation and early rearing functions for steelhead and chinook salmon. All juvenile production is released off site. Dworshak National Fish Hatchery supplies fertilized B-run steelhead eggs for the Clearwater Fish Hatchery steelhead program. Adult spring chinook salmon trapping and spawning, and juvenile fish final rearing and release are conducted at the hatchery's three satellite facilities. The Powell satellite, located on the Lochsa River was completed in 1989. Red River (completed in 1986) and Crooked River (completed in 1990) satellites are located in the South Fork Clearwater subbasin. Juvenile fish pond capacities at the satellite facilities are 334,000 at Powell, 334,000 at Red River, and 700,000 at Crooked River. The chinook salmon total juvenile release target of 1.3695 million fish was intended to return about 12,000 adult spring chinook salmon back to the LSRCP project area (above Lower Granite Dam). The steelhead total juvenile release target of 2.8 million smolts (8 fish per pound) was intended to return about 14,000 adult steelhead to the LSRCP project area above Lower Granite Dam.

An extensive monitoring and evaluation program documents hatchery practices and evaluates the success of hatchery programs at meeting LSRCP mitigation objectives, IDFG management objectives, and monitors and evaluates the success of supplementation programs. The IDFG-LSRCP hatchery monitoring and evaluation program identifies hatchery rearing and release strategies that will allow the LSRCP program to meet its mitigation requirements and improve the survival of hatchery fish while avoiding negative impacts to natural (including listed) populations. In some cases, particularly in light of ESA requirements and Idaho Supplementation Study (ISS) plans, hatcheries may be used to enhance naturally reproducing populations.

Table 56. Description of production programs utilized within the Clearwater subbasin

Stock	Intent	Initial Broodstock	Operating Broodstock	Adult Collection/Holding	Central Facility (Incubation/rearing)	Acclimation and release sites	Status	Funding Source
Chinook - S	Harvest/Mitigation	Little White/ Leavenworth/ Rapid River	Dworshak	Dworshak	Dworshak NFH/ Kooskia NFH	Dworshak N.F. Clearwater	Ongoing	LSRCP
Chinook - S	Supplementation (ISS)	Rapid R., Crooked R., Red R., Powell., Kooskia	Rapid R., Crooked R., Red R., Powell., Kooskia	Red R, Crooked R., Powell, Kooskia	Clearwater Hatchery, Kooskia NFH	Upper Red and Crooked rivers, Clear Cr., Pete King Cr, Fishing (Squaw) Cr., Bear (Papoose) Cr., Colt Killed Cr., Big Flat Cr	Ongoing	LSRCP
Chinook - S	Supplementation	Rapid River	Rapid River Dworshak	Yoosa, Newsome, Mill Cks	Nez Perce Tribal Hatchery (under construction)	Yoosa, Newsome, Mill Creeks – Ponds; Meadow, Boulder, Warm Springs- direct	Step 3 (5/3/99)	NPPC
Chinook - S	Harvest/Mitigation	Carson/ Rapid River	Kooskia	Kooskia/Dworshak	Dworshak, Kooskia NFH	Kooskia at Clear Creek	Ongoing	USFWS
Chinook - F	Supplementation	Snake R. @ Hells Canyon Dam	Lyons Ferry	Lyons Ferry	Lyons Ferry; FCAP Project	Big Canyon, Clearwater R.	Ongoing	BPA/LSRCP
Chinook - F	Supplementation	Lyons Ferry	Local	N. Lapwai, Lukes Gulch	Sweetwater Springs and NPTH	Cedar Flats/Selway R, mainstem Clearwater R. N. Lapwai, Lukes Gulch/ S.F. Clearwater R.	Step 3 (5/3/99)	NPPC
Steelhead	Harvest/ Mitigation	Dworshak – North Fk. Clearwater B-run	Dworshak	Dworshak	Dworshak NFH	mainstem-direct, SF and MF	Ongoing	USACE
Steelhead	Harvest/ Mitigation	Dworshak – North Fk. Clearwater B-run	Dworshak	Dworshak	Clearwater Hatchery	SF and MF Clearwater,	Ongoing	LSRCP
Steelhead	Supplementation	Dworshak – North Fk. Clearwater B-run	Dworshak	Dworshak	Clearwater Hatchery and Dworshak and Hagerman NFHs	Lolo, Mill, Newsome, Meadow Crks, American, Red and Crooked R./Dworshak direct	Ongoing - 2002	LSRCP/USACE
Coho	Reintroduction	Eagle Creek, Bonneville,	Creating Broodstock w/ Adult Returns	Kooskia,Dworshak, Potlatch R., Lapwai, Crk.	Dworshak,Clear-water, Sweetwater, NPTH	Sweetwater Springs, Kooskia, Potlatch R., Meadow/Lolo/Lapwai Creeks	Ongoing	NPPC

To properly evaluate the compensation effort, adult returns to facilities, spawning areas, and fisheries that result from hatchery releases are documented. IDFG's LSRCP program requires the cooperative efforts of the Hatchery Evaluation Study, the Harvest Monitoring Project, and the Coded Wire Tag Laboratory program. The Hatchery Evaluation Study evaluates and provides oversight of certain hatchery operational practices, e.g., brood stock selection, size and number of fish reared, disease history, and time of release. Hatchery practices are assessed in relation to their effects on adult returns and recommendations made for improvement of hatchery operations. Continuous coordination between the Hatchery Evaluation Study and IDFG's BPA-funded supplementation research project is required because these programs overlap in several areas, including juvenile outplanting, brood stock collection, and spawning (mating) strategies. LSRCP hatchery production will play a substantial role in IDFG's supplementation research. The Harvest Monitoring Project provides comprehensive harvest information for evaluating the success of the LSRCP in meeting adult return goals. The number of hatchery and wild/natural fish in overall returns to the project area in Idaho are estimated, and data on the timing and distribution of hatchery and wild stocks are collected and analyzed to develop LSRCP harvest management plans. Harvest data provided by the Harvest Monitoring Project are coupled with hatchery return data to provide an estimate of returns from LSRCP releases. Coded-wire tags continue to be used extensively to evaluate fisheries contribution of representative groups of LSRCP production releases. However, most of these fish serve experimental purposes as well, e.g., for evaluation of hatchery controlled variables such as size, time, and location of release, rearing densities, and so on.

More detailed information on the Clearwater Fish Hatchery steelhead and chinook salmon programs is contained in Appendix G, Draft Hatchery and Genetic Management Plan (HGMP) – Clearwater Fish Hatchery. A complete HGMP for the program will be submitted to NOAA Fisheries.

8.2.2 Nez Perce Tribe Department of Fishery Resource Management

Nez Perce Tribe Resident Fish Substitution Program

The goal of this program is to substitute resident fisheries in confined ponds as partial mitigation for loss of anadromous fisheries resulting from construction of Dworshak Dam. This program does not operate a hatchery, nor does it propagate species or populations in a hatchery. Hatchery products are used in the execution of the project, however, and within that context a Hatchery and Genetic Management Plan (HGMP) is provided for the program (See Subbasin Inventory, Section 3.5).

Nez Perce Tribal Hatchery

The Nez Perce Tribal Hatchery mitigates for the loss of naturally-reproducing salmon in the Clearwater River subbasin. The overall goal is to produce and release fish that will survive to adulthood, spawn in the Clearwater River subbasin and produce viable offspring that will support future natural production and genetic integrity. Several underlying purposes of fisheries management will be maintained through this program:

- protect, mitigate, and enhance Columbia River subbasin anadromous fish resources
- develop, reintroduce, and increase natural spawning populations of salmon within the Clearwater River subbasin

- Provide long-term harvest opportunities for Tribal and non-Tribal anglers within Nez Perce treaty lands within four generations (20 years) following project completion
- Sustain long-term fitness and genetic integrity of targeted fish populations
- Keep ecological and genetic impacts to nontarget populations within acceptable limits
- Promote Nez Perce Tribal management of Nez Perce Tribal hatchery facilities and production areas within Nez Perce treaty lands (Bonneville Power Administration et al. 1997).

Previous reports that describe the NPTH program include

- Nez Perce Tribal Hatchery Master Plan and Appendices (Larson and Mobrand 1992)
- Genetic Risk Assessment of the Nez Perce Tribal Hatchery Master Plan (Cramer and Neeley 1992)
- Selway Genetic Resource Assessment (Cramer 1995)
- Supplement to the Nez Perce Tribal Hatchery Master Plan (Johnson et al. 1995).
- Monitoring and Evaluation Plan for the Nez Perce Tribal Hatchery (Steward 1996).
- Nez Perce Tribal Hatchery Program Final Environmental Impact Statement (Bonneville Power Administration et al. 1997)
- Hatchery Genetic Management Plan (Kincaid 1998)
- Nez Perce Tribal Hatchery Benefit Risk Analysis (Columbia River Inter-Tribal Fish Commission 1999)
- Nez Perce Tribal Hatchery Monitoring and Evaluation Action Plan (Hesse and Cramer 2000).

In the Nez Perce Tribal Hatchery Master Plan, Larson and Mobrand (1992) propose the restoration of spring, summer and fall chinook as the principle management strategy. The Nez Perce Tribe Office of Legal Counsel has released documents which are part of the Snake River Basin Adjudication instream flow claims in which Tribal members and others substantiate the fishery resources used historically and presently by the Nez Perce Tribe (Marshall 1998; Greiser 1998; Slickpoo 1989; Carter 1998; Whitman 1998; Oatman 1998; Axtell 1998; Crow 1998). These documents, along with Reiser (1998), substantiate the presence of anadromous and resident species that historically occurred in the Clearwater subbasin prior to dams, irrigation, and other commercial practices that lead to their demise. Based on these documents, species which would constitute an all species, stock and population approach to recovery and restoration for the Clearwater River subbasin would include

- Spring Chinook Salmon
- Summer Chinook Salmon
- Fall Chinook Salmon, to include an “early”-type
- A-type (run) Steelhead Salmon
- B-type (run) Steelhead Salmon
- Coho Salmon
- Sturgeon
- Pacific Lamprey
- Resident species including bull trout, westslope cutthroat trout, suckers, etc.

While projects and plans for the immediate recovery of all these species will not be included in this document, they should be noted as a restoration need for future planning as the ecosystem is recovered.

Fall Chinook Acclimation Project, Big Canyon Acclimation Site

Initial design and funding occurred under a 1995 Congressional grant organized by Senator Hatfield wherein the U.S. Oregon process provided oversight and direction to the U.S. Army Corps of Engineers to construct facilities. This program designed and constructed three acclimation facilities above Lower Granite Dam to aid in restoring natural spawning Snake River fall chinook. The Nez Perce Tribe operates and maintains three satellite facilities developed since 1996, 2 on the Snake River and 1 at Big Canyon Creek/Clearwater River confluence. Each satellite acclimates and releases smolts reared at Lyons Ferry Hatchery. Up to 150,000 yearling smolts are acclimated and released each year. Up to 1.8 million subyearling have also been acclimated and released by dividing them between the 3 satellite facilities. All fish are marked for identification as emigrants, and as adult returns they are allowed to ascend above Lower Granite Dam to spawn naturally. Present adult response indicates a major increase in redd counts and smolt emigration counts. The goals and objectives of this program are identical to those shown under the Nez Perce Tribal Hatchery project.

Nez Perce Clearwater Coho Restoration Project

This project started because State and Federal agencies in U.S. v. Oregon PAC (Production Advisory Committee) identified surplus coho eggs not being used for production. A portion of the project is linked to the NMFS Mitchell Act Program calling for restoration of coho stocks for the Tribes upriver of Bonneville Dam. Initial funding was created from BIA 638 budget at the Nez Perce Tribe. Mitchell Act funding occurred in 1999 and 2000. BPA as authorized by NPPC, has provided planning funds in 1998 to present. Additional BIA funds have maintained supplies and transport costs for the past 3 years. Joint in-kind support by USFWS, IDFG and NPT has provided personnel and allowed on-the-job training for NPTH staff during construction. In 1994, PAC, which had 10-14 million surplus eggs; received a request from the Nez Perce Tribe for 800,000 eyed-eggs to be imported annually. This project has expanded to provide annually up to 450,000 coho parr produced at Clearwater Hatchery and 280,000 coho smolts reared at Dworshak with acclimation and release at Kooskia Hatchery. In addition, 570,000 Mitchell Act/USFWS smolts are imported and directly released each year at Lapwai Creek and Potlatch River, approximately half per stream. A multiphased approach is proposed to enhance the recovery of this species in a Master Plan being rewritten at this time. Adult returns from this program have occurred in 1997, 1998, 1999, and 2000. Broodstock from returning adults has been incorporated to replace the out-of-basin eggs take in 1999 and 2000 and has provided 3/8ths and 5/8ths of the eggs needed in 1999 and 2000, respectively. The 2001 adult returns are anticipated to meet all egg import needs and perhaps to partially replace the need to import smolt broodstock. Completion of the Clearwater Coho Master Plan is anticipated to occur in conjunction with the Provincial Review and Subbasin Assessment process being conducted by the NPPC. The goals and objectives of this program are identical to those shown under Nez Perce Tribal Hatchery project above.

8.2.3 U.S. Fish and Wildlife Service

Dworshak National Fish Hatchery - Summer Steelhead Program

Dworshak National Fish Hatchery (NFH) is located at the confluence of the North Fork and the mainstem of the Clearwater River near Ahsahka, Idaho. Construction of the hatchery was included in the authorization for Dworshak Dam and Reservoir (Public Law 87-847, October 23, 1962) to mitigate for losses of steelhead trout caused by the dam and reservoir. The hatchery was designed and constructed by the U.S. Army Corps of Engineers (USACE) and has been administered and operated by the U.S. Fish and Wildlife Service since the first phase of construction was completed in 1969. At that time, the hatchery had 25 ponds on a single reuse system and 59 other ponds on single-pass water. In 1972, a second phase of construction placed all ponds on three reuse systems with the option of operating on either reuse or single-pass. The hatchery began using only single-pass for the oldest system (25 ponds) in 1986. Present production is 2.3 million smolts at an average size of 200mm in length.

The North Fork Clearwater River summer steelhead trout stock maintained by Dworshak NFH is unique. As a result of the blocked habitat behind Dworshak Dam, currently no natural populations remain in the North Fork Clearwater River. Recent collections of rainbow trout in tributaries of the North Fork Clearwater River above the dam show genetic profiles very close to the genetic profile of steelhead trout returning to the hatchery. Genetic analysis indicates that Dworshak B-run steelhead trout more closely resemble the North Fork rainbow trout than any other rainbow trout or steelhead trout collected in Idaho. The stock has been included as part of the Snake River steelhead trout ESU identified by the NOAA Fisheries under the Endangered Species Act (ESA), but is not needed for recovery.

At maturity, males and females of this particular stock of "B" run steelhead trout average about 91 cm (36 inches) and 82 cm (33 inches) in length, respectively. Spawning stock is comprised of three age classes; I-, II-, and III-"salt" fish. This nomenclature refers to the number of complete years fish have spent in salt water. Fish are actually two years older than this system indicates, as they are reared for one year in the hatchery and spend another year migrating to and from the ocean.

Most "B" run steelhead trout enter the Columbia River in August through September, usually later than the smaller "A" run fish. The Clearwater "B" run steelhead trout may reach the Snake and Clearwater rivers in the fall, then overwinter until their final run into the hatchery. Some of the fish arrive at Dworshak NFH in the fall. The Dworshak NFH fish ladder and trap is operated during the fall to insure inclusion of sufficient early arriving steelhead (~500 adults) into the hatchery gene pool. The ladder is then reopened from February through April to capture broodstock from the mid- and late portions of the run.

The Dworshak NFH steelhead trout program has the potential to affect listed A-run steelhead trout and Snake River fall chinook salmon in several ways: 1) predation; 2) competition; 3) adverse behavioral interactions; 4) disease transmission; 5) alteration of the gene pool; (6) harvest and/or (7) facility operation and maintenance. Although some potential exists for the program to affect listed species, the USFWS has concluded that any affect would not be significant. In addition, the USFWS continues to evaluate and improve the production program to produce the healthiest and most physiologically fit smolts at release in order to minimize residualization and potential interactions with listed species.

Releases of steelhead trout smolts from Dworshak NFH began in 1970 with the first hatchery produced adults returning in 1972. The 1999-2000 return marked the 28th year that artificially spawned North Fork Clearwater River steelhead trout have returned to Dworshak NFH. The adult return goal for Dworshak NFH is 20,000 adults to the Clearwater River. Since the male to female ratio is about 1:1 and spawning protocol calls for 1:1 spawning, the goal for broodstock collection is about 400 adults. Table 57 summarizes the Dworshak NFH steelhead trout returns to the Clearwater River from 1972-2000. Table 58 summarizes smolts released, adults returned by age, and the smolt-to-adult rate of return from 1980-1998.

Dworshak National Fish Hatchery - Rainbow Trout Program

To mitigate for the lost resident sports fishery in the North Fork Clearwater River, the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service agreed that 100,000 pounds of rainbow trout would be reared at Dworshak NFH for stocking in Dworshak Reservoir annually. During the early years rainbow were produced at Dworshak NFH and stocked directly into the reservoir. Numbers and pounds of fish stocked has varied over the years, but 100,000 pounds per year has never been stocked. The rainbow trout are from sources outside of Idaho and concerns exist about hatchery rainbow trout from Dworshak Reservoir ascending into the North Fork of the Clearwater River to hybridize with native cutthroat trout. This issue and concerns about the cost/benefit ratio of stocking rainbow trout into Dworshak Reservoir is under review by IDFG, NPT, USFWS, and USACE. Currently, some rainbow are raised at Hagerman NFH and released into reservoirs in southern Idaho. In replacement, the Idaho Department of Fish and Game releases a quantity of rainbow trout into Dworshak Reservoir from a disease free hatchery, and in recent years the trout have been sterile. In addition to rainbow, the USFWS has stocked other species such as small mouth bass and kokanee salmon into Dworshak. Kokanee are now the primary sport fish in the reservoir and are primarily self-sustaining. Table 55 provides a history of early stocking of resident fish in Dworshak Reservoir.

Kooskia National Fish Hatchery - Spring Chinook Program

Kooskia NFH was authorized by Congress (75 Statute 255) in August 1961 and was built by U.S. Fish and Wildlife Service (USFWS) to raise spring chinook salmon. The program called for releases of spring chinook salmon smolts into the Clearwater subbasin to mitigate for fish losses from federal water development projects in the Columbia River Basin. Kooskia NFH is located about 1.5 miles southeast of Kooskia, Idaho, near the confluence of Clear Creek and Middle Fork of the Clearwater River and is funded by the USFWS.

The Kooskia NFH Spring Chinook Salmon Program was started using a variety of stocks from the Lower Columbia River and Rapid River State Fish Hatchery. However, from 1973 through 1980, smolt releases had a very strong Carson stock influence. Egg transfers of Carson type stock from Dworshak NFH in 1985 and 1986 resulted in smolt releases in 1987 and 1988 of a mixed stock, referred to as Clearwater stock (Table 60). Since the Kooskia NFH program already had stock made up primarily of Carson derivatives, the resultant program (1989 and later) is still considered a Carson type stock, and is referred to as Kooskia stock. Length frequency data, ocean age class at return time information, and allele frequencies all support a distinction between Dworshak and Kooskia stocks.

The first smolt releases were made in 1971. The first adults began to arrive back at the hatchery in 1972. A summary of the program to date is provided in Table 61. The production goal has been modified over the years. Currently, Kooskia NFH has the capacity to rear about 600,000 to 650,000 spring chinook salmon from the egg stage through smolt size. Smolts are released directly into Clear Creek at a size of about 20 fish per pound or 140 mm (TL). To meet this objective, about 200 adult females are needed for spawning. Since the male to female ratio is about 1:1 and spawning protocol calls for 1:1 spawning, the goal for broodstock collection is about 400 adults.

Table 57. Number of steelhead returning to Dworshak NFH, estimates of hatchery fish harvested, and total hatchery returns to the Clearwater River, Idaho, 1972-2000 (1972-73 to 1983-84 data from Pettit 1985).

Return[1]	Number Back to Dworshak NFH	Estimated Clearwater Sport Harvest[2]	Estimated Clearwater Tribal Harvest[3]	Unharvested Clearwater Hatchery Fish[4]	Total Hatchery Fish Returning to Clearwater River
1972-73	9,938	2,068	-	0	12,006
1973-74	7,910	2,320	-	0	10,230
1974-75	1,698	N.S.[5]	290	0	1,988
1975-76	1,858	N.S.	430	0	2,288
1976-77	3,100	N.S.	410	0	3,510
1977-78	12,272	14,000	(1000)[6]	0	27,272
1978-79	4,939	4,610	(500)	0	10,049
1979-80	2,519	N.S.	1,250	300	4,069
1980-81	1,968	4,510	(1000)	500	7,978
1981-82	3,054	1,665	(1000)	0	5,719
1982-83	7,672	13,967[7]	(1,500)	0	23,139
1983-84	3,284	6,500	(500)	100	11,384
1984-85	14,018	19,410	(1,500)	2,700	37,628
1985-86	4,462	7,240	1,471	1,800	15,002
1986-87	5,286[8]	15,679	4,210	3,000	28,175
1987-88	3,764	8,766	1,478	2,000	16,008
1988-89	6,041	11,332	1,242	3,700	22,315
1989-90	10,630	27,952	1,710	3,650	43,943[9]
1990-91	7,876	12,973	1,211	2,250	24,147
1991-92	3,700	10,416	1,326	1,650	17,092
1992-93	7,900	19,351	1,184	3,368	31,803
1993-94	3,757	14,063	675	1,457	17,096
1994-95	1,394	5,953	730	1,307	9,384
1995-96	4,480	2,139	992	1,315	9,106
1996-97	2,980	4,926	513	779	9,198
1997-98	3,601	7,611	145	479	11,836
1998-99	5,419	8,773	1,007	1,137	16,335
1999-00	2,882	7,177	1,000	720	11,775

[1]Return year is from October through May.
[2]Unless otherwise noted, estimates of sport harvest in the Clearwater River taken from IDFG annual reports.
[3]Unless otherwise noted, estimates of tribal harvest in the Clearwater River were taken from Nez Perce Tribe Department of Fishery Resource Management annual reports.
[4]Based on return percentage back to hatchery to calculate returning II-salts from upstream releases.
[5]N.S., no sport fishing season.
[6]( ) guesstimate on tribal harvest by author.
[7]Pettit IDFG, Lewiston, Idaho (personal communication) included an additional 2,000 fish in harvest from Snake River for a total of 15,967.
[8]Ladder was closed for several days due to high number of returns; not a total hatchery return figure.
[9]We believe the sport estimate of 27,953 is about 8,000 too high and the total number of Dworshak steelhead to the Clearwater River was in the range of 32,000 to 35,000.

Table 58. Return vs. release numbers for summer steelhead at Dworshak NFH, release years 1980-1998

Release Year	Smolts Released	Returns				Rack Return %
		I-Salt	II-Salt	III-Salt	Total	
1980	2,666,085	400	6,613	652	7,665	0.2875
1981	1,930,047	124	1,538	1,219	2,881	0.1493
1982	2,108,319	1,094	12,679	403	14,176	0.6724
1983	1,259,110	120	3,359	239	3,718	0.2953
1984	1,208,319	700	8,318	119	9,137	0.7562
1985	1,035,573	431	3,487	317	4,235	0.4090
1986	1,239,541	168	5,296	215	5,679	0.4582
1987	1,206,580	428	9,896	314	10,638	0.8817
1988	1,432,125	487	7,339	250	8,076	0.5639
1989	1,073,900	218	3,132	162	3,512	0.3270
1990	1,466,664	313	7,349	153	7,815	0.6699
1991	1,192,503	389	3,543	76	4,008	0.3361
1992	1,224,101	61	1,270	71	1,331	0.1087
1993	1,217,990	48	4,005[1]	83	4,136	0.3396
1994	1,153,417	384	2,537	38	2,959	0.2565
1995	1,213,577	349	3,308	87	3,744	0.3085
1996	1,377,435	253	4,976	69	5,298	0.3846
1997	1,361,034	356	2,225			
1998	1,228,944	588				

1 Does not include twenty unmeasured fish.

Table 59. Dworshak Reservoir rainbow trout stocking history, 1972-2000

Year	Number	Weight(lbs.)	Size (#/lb.)	Stock	Hatchery
1972	1,043,506	99,917		Unknown	Dworshak
1973	2,554,170	134,808		Unknown	Dworshak
1974	1,070,260	19,075		Unknown	Dworshak
1975	917,856	114,301		Unknown	Dworshak
1976	763,286	64,133		Unknown/ WY	Dworshak/Hagerman
1977	1,162,670	34,217		Unknown	Dworshak
1978	25,936	13,412		Unknown	Dworshak
1979	1,313,524	92,541		Unknown	Dworshak
1980	1,616,245	36,052		Unknown	Dworshak
1981	861,429	87,049		Ennis/Ca	Dworshak
1982	153,956	34,940		Unknown	Dworshak
1983	574,255	58,503	9.8	Unknown	Dworshak
1984	67,561	27,285	2.5	Unknown	Dworshak
1985	120,000	40,000	3.0	Unknown	American Falls/Mackay
1986	156,773	14,388	10.9	Shasta	Hagerman
1987	93,856 80,400	3,755 1,340	25.0 132.0	Kamloops Unknown	Hagerman Grace
1988	294,906	28,120	10.5	Arlee & Shasta	Hagerman
1989	245,380	23,202	10.6	Arlee & Shasta	Hagerman
1990	222,026	14,350	15.5	Arlee & Shasta	Hagerman
1991	NONE				
1992	101,186	2,844	35.6	Arlee & Shasta	Kooskia
1993	195,760	9,732	20.1	Arlee & Shasta	Kooskia
1994	NONE				
1995	17,700	5,900	3.0	Kamloops	Nampa
1996	30,500	8,350	3.7	Kamloops	Nampa
1997	40,000	10,592	3.8	Hayspur	Clearwater
1998	28,640	8,183	3.5	Mixed	Hayspur
1999	150,155	49,150	3.1	Kamloops	Nampa
2000	132,630	44,665	3.0	T9 sterile	Hayspur

Table 60. Genetic background of Kooskia NFH spring chinook salmon smolts directly released from the hatchery, 1971-2000

Release Year	Genetic Background [1]
1971	86% RR,14% WR
1972	100% RR
1973	100% CA
1974	100% CA
1975	58% RR, 42% CA
1976	100% SS
1977	84% CA, 11% KK, 5% LW
1978	75% RR, 25% CA
1979	69% KK, 31% CA
1980	31% KK, 69% CA
1981	64% CA, 19% KK, 17% RR
1982	100% CA
1983	65% KK, 35% LE
1984	89% KK, 11% RR
1985	100% KK
1986	100% KK
1987	100% CL
1988	100% CL
1989 -2000	100% KK

1 RR = Rapid River, KK = Kooskia, LE = Leavenworth, SS = South Santiam, CL = Clearwater, LW = Little White Salmon, CA = Carson, WR = Wind River

Table 61. Hatchery rack returns and age composition of spring chinook salmon for Kooskia NFH, 1972-2000

Year	I-Salt	II-Salt	III-Salt	Unmeasured	Total Return
1972	5	0	0	0	5
1973	5	45	0	0	50
1974	16	35	2	0	53
1975	15	284	27	0	326
1976	409	286	106	0	801
1977	333	2,539	154	0	3,026
1978	23	1,676	336	0	2,035
1979	11	100	264	0	375
1980	9	55	3	0	67
1981	1	168	78	0	247
1982	3	116	139	0	258
1983	1	231	141	0	373
1984	55	80	206	0	341
1985	26	449	54	0	529
1986	21	159	103	0	283
1987	16	607	64	0	687
1988	39	363	193	0	595
1989	107	717	142	7	973
1990	11	921	209	0	1,141

Table 61 (cont.)

Year	I-Salt	II-Salt	III-Salt	Unmeasured	Total Return
1991	10	98	350	9	467
1992	14	239	38	21	312
1993	11	749	409	11	1,180
1994	1	96	135	0	232
1995[1]	21	7	12	0	40
1996	86	113	3	0	202
1997	7	1,523	127	0	1,657
1998	1	200	207	0	408
1999	72	28	57	0	157
2000	966	604	11	0	1,581

Production is primarily limited by the hatchery well water supply. Because of this constraint, temperature considerations, and other factors, Dworshak NFH holds and spawns spring chinook salmon adults trapped at Kooskia NFH. Kooskia NFH eggs and juveniles are also often held at Dworshak NFH. However, each stock is released at its own facility. In the past two years Kooskia NFH has been used for incubation and early rearing of Dworshak NFH chinook because of the cold well water supply. In 1995 Kooskia NFH was included in the Dworshak Fisheries Complex and fish production at the two hatcheries is closely coordinated.

The Kooskia spring chinook salmon program has the potential to affect listed A-run steelhead and Snake River fall chinook salmon in several ways: 1) competition; 2) adverse behavioral interactions; 3) disease transmission; and 4) facility operation and maintenance. As with the steelhead program at Dworshak NFH, the USFWS has concluded that any affect of the spring chinook salmon program at Kooskia NFH on listed species would not be significant. The USFWS continues to evaluate and improve spring chinook salmon production to minimize interactions with listed species.

8.2.4 Miscellaneous Anadromous Stocking

During years with surplus adult hatchery returns, outplanting of adult steelhead or spring chinook salmon is conducted in areas of agreement between subbasin salmon managers. Streams receiving outplants have past stocking histories, and wild steelhead areas are not stocked. Fish outplanted have originally returned to Dworshak and Kooskia National Fish Hatcheries, Clearwater Hatchery satellites or, in some cases, Rapid River Hatchery (chinook). These are not part of any program and only occur when there is a surplus. No monitoring and evaluation program is currently being conducted on these releases.

8.3 Fish Limiting Factors

Six types of information have been considered for review of limiting factors to fish populations in the Clearwater subbasin, each differing in relative scale and species considerations:

1. Regional documentation of nonspecies specific factors limiting production of resident and anadromous fish in the subbasin as a whole;
2. Past subbasin specific research documents and current professional judgement of species specific factors limiting populations in individual AUs within the subbasin;
3. Information compiled by the Northwest Power Planning Council as part of the subbasin planning process for review of reach specific limiting factors related to spring chinook and steelhead;
4. The 1998 §303(d) list compiled by IDEQ of reach specific factors limiting beneficial use(s), including cold water biota and/or salmonid spawning;
5. Potential connectivity/passage issues related to road culverts with potential to impact all species of fish throughout the subbasin.
6. Temperature modeling was conducted to examine broad-scale patterns in temperature variations in the Clearwater subbasin as they relate to potential fish distribution.

Hatchery influences to fish populations are not addressed here as limiting factors due to the debatable and often site specific nature of hatchery influences to existing fish stocks. Hatchery supplementation of wild fish stocks has the potential to adversely impact the genetic or biological integrity of existing stocks (Busby et al. 1996; Evans et al. 1997; USFWS and NPT 1995). However, the degree of impact often depends on numerous factors including stocking densities and distribution, and the status of existing wild/natural stocks. Interactions of hatchery and wild anadromous fish stocks in the Clearwater subbasin have been investigated and potentially negative impacts to wild stocks have been suggested (USFWS and NPT 1995 and 1997). However, such impacts have not been clearly defined in the Clearwater subbasin.

8.3.1 Subbasin Scale – Regional Sources

Primary factors limiting resident salmonid populations in the Clearwater subbasin relate to the impacts of land management activities on hydrology, sedimentation, habitat distribution and complexity, and water quality (CBFWA 1999). In addition, bull trout and other resident and anadromous fish may be limited by reductions in available forage, aquatic macroinvertebrate biomass and taxonomic richness, and reduced growth rates due to loss of anadromous fish production and the nutrients that carcasses provide (Cederholm et al. 2000; CBFWA 1999, Piorkowski 1995, Minakawa 1997, Wipfli et al. 1998). Another significant limiting factor to resident fish populations is the loss of 53 miles of resident salmonid spawning habitat inundated by Dworshak Reservoir (Dave Statler, NPT, personal communication, April 20, 2001).

At the subbasin scale, anadromous fish production in the Clearwater subbasin is limited by three primary factors: 1) adult escapement of salmon and steelhead is currently limited by out-of-subbasin factors (e.g. dams and ocean conditions) and is insufficient to fully seed available habitat; 2) habitat carrying capacity and fish survival have been reduced within the subbasin by land management activities which impact hydrology, sedimentation, habitat distribution and complexity, and water quality (CBFWA 1999); and 3) Dworshak Dam blocks access to habitat that once produced up to 60% of steelhead and provided excellent spawning and rearing habitat for spring chinook salmon, and is a limiting factor at the subbasin scale.

General agreement exists that hydropower development on the lower Snake River and Columbia River is the primary cause of decline and continued suppression of Snake River salmon and steelhead (IDFG 1998a; CBFWA 1991; NPPC 1992; NMFS 1995 and 1997; NRC 1995; Williams et al. 1998). However, less agreement exists about whether the hydropower system is the primary factor limiting recovery (Marmorek et al. 1998).

Impacts of hydropower development limit anadromous populations within the Clearwater subbasin by keeping yearly effective population size low, thereby increasing genetic and demographic risk of localized extinction. Small populations may develop intrinsic demographic problems such as unbalanced sex ratios, unstable age distributions, random failures in survival and fertility (Foose et al.1995) that can fatally disrupt persistence (Goodman 1987). Small population size also disposes a population to inbreeding depression (Soule 1980, Franklin 1980). Stochastic environmental events such as droughts, floods, ice flows, landslides, have the potential to negatively affect reproductive success and thus population persistence. A sufficiently robust population size is necessary to maintain an effective population size to buffer against risks of extinction, and for short term survival and continuing adaptation.

Adult escapement of anadromous species remains low even given significant hatchery production/reintroduction efforts. Low adult abundance in Idaho Supplementation Study streams has resulted in stocking at variable rates between years, depending on the availability of brood fish (Walters et al. 2001). Smolt-to-adult return rates (SAR), from smolts at the uppermost dam to adults returning to the Columbia River mouth, averaged 5.2% in the 1960s before hydrosystem completion and only 1.2% from 1977-1994 (Petrosky et al. 2001; Figure 109). This is below the 2%-6% needed for recovery (Marmorek et al. 1998).

In contrast to the decline in SAR, numbers of smolts per spawner from Snake River tributaries did not decrease during this period, averaging 62 smolts per spawner before FCRPS completion and 100 smolts per spawner afterward (Petrosky et al. 2001; Figure 109). In this summary both spawner escapement and smolt yield are measured at the uppermost mainstem dam (currently Lower Granite). Smolt increase per spawner was due to a reduction in density dependent mortality as spawner abundance declined. Accounting for density dependence, there was a modest decrease in smolts per spawner from Snake River tributaries over this period, but not of a magnitude to explain the decline in life-cycle survival (Petrosky et al. 2001).

The dams cause direct, indirect, or delayed mortality, mainly to emigrating juveniles (IDFG 1998a; Nemeth and Kiefer 1999). As a result, Snake River spring and summer chinook declined at a greater rate than downriver stocks, coincident with completion of the FCRPS (Schaller et al. 1999). Schaller et al. (1999) concluded that factors other than hydropower development have not played a significant role in the differential decline in performance between upriver and downriver stocks. The Snake River stocks above eight dams survived one-third as well as downriver stocks migrating through 3 dams (Schaller et al. 1999; Deriso *in press*) for this time period, after taking into account factors common to both groups. Additional declines in productivity of upriver stocks relative to downriver stocks indicate this portion of the mortality is related to factors unique to upriver stocks. Patterns of Pacific Decadal Oscillation and salmon production suggest that poor ocean conditions existed for Columbia River salmon after the late 1970s (Hare et al. 1999). However, natural fluctuations of ocean productivity affecting all Columbia River stocks, in combination with hydrosystem mortality, appear to have caused the severe declines in productivity and survival rates for the Snake River stocks. Temporal and spatial patterns of hatchery release numbers did not coincide with the differential changes in survival rates between upriver and downriver stocks (Schaller et al. 1999). Harvest rates were drastically reduced in the early 1970s in response to declines in upriver stream-type chinook abundance. Given that changes in smolts per spawner cannot explain the decreases in SAR or overall survival rates for Snake River stocks, it appears the altered migration corridor has had a strong influence on the mortality that causes these differences in stock performance.

The SAR and smolt per spawner observations (Figure 109) indicate that the overall survival decline is consistent primarily with hydrosystem impacts and poorer ocean (out-of-subbasin factors), rather than large-scale impacts within the subbasins between the 1960s and present (Schaller et al. 1999; Petrosky et al. 2001). Because the smolt per spawner data represent aggregate populations from a mix of habitat qualities throughout the Snake River basin after dam development, they do not imply that no room exists for survival improvement within the Salmon, Clearwater, Grande Ronde and Imnaha subbasins. However, because of limiting factors outside the subbasin, and critically reduced life-cycle survival for populations, even in pristine watersheds, it is unlikely that potential survival improvements within the Snake River subbasins alone can increase survival to a level that ensures recovery of anadromous fish populations.

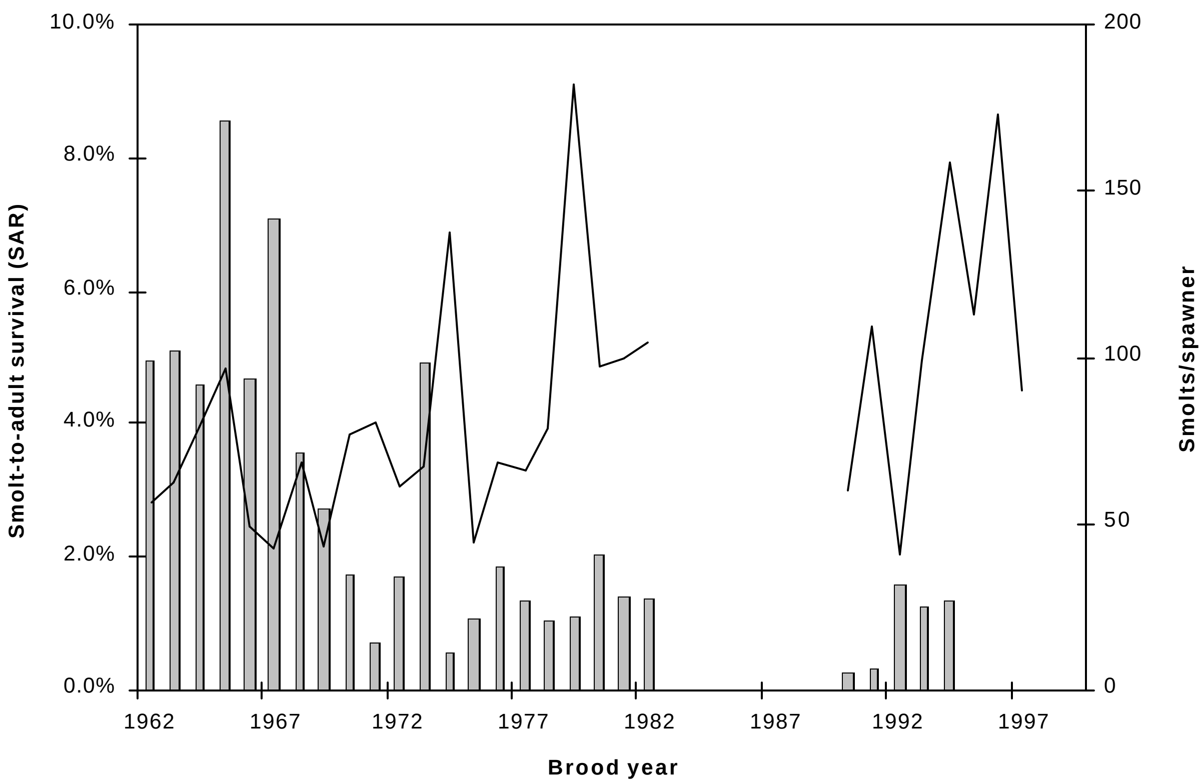

Figure 109. Smolt-to-adult survival rates (bars; SAR) and smolts/spawner (solid line) for wild Snake River spring and summer chinook. The SAR describes survival during mainstem downstream migration back to returning adults; smolts per spawner describes freshwater productivity in upstream freshwater spawning and rearing areas (From Petrosky et al. 2001)

8.3.2 Assessment Unit Scale – Local Sources

Numerous sources were reviewed for documentation of limiting factors at scales similar to the defined assessment units (Sources are listed in Appendix G). Note that factors limiting local fish production or survival may differ from those defined across broader scales, and that limiting factors in a given location may vary between species. The information presented in Table 62 attempts to address these issues by summarizing limiting factors over areas of intermediate size (assessment units) and for individual fish species. It does not address factors found to limit fish production or survival in individual streams or stream reaches.

Limiting factors have been assigned a value of 1-3, depending on the degree to which they are thought to limit specific species within each AU[4]. A value of 1 indicates a principal or most influential limiting factor, whereas a value of 3 indicates a less influential factor limiting population(s). A value of 2 represents factors of intermediate influence on populations. While factors have been individually "ranked" to aid in interpretation, all factors listed in Table 62 are considered limiting to local populations, and cumulative impacts of several factors ranked as 2 or 3 may outweigh the influence of an individual factor ranked as 1.

In order to rectify different reporting methods, limiting factor designations were standardized in some cases. This process particularly affects the categories of sediment, watershed disturbance, habitat degradation, and connectivity. Within the context of Table 62**,** the definitions of these categories are:

- Sediment = Natural and/or elevated sediment loading from undefined sources
- Watershed Disturbance = Upland disturbances such as mining, timber harvest and roading, including instream sediment resulting from defined upland sources (i.e., roads)
- Habitat Degradation = Riparian or instream habitat loss or disturbance
- Connectivity/Passage = All forms of population fragmentation including physical, chemical, or thermal barriers

Limited information is available in some areas and for some species (e.g. few limiting factors specific to westslope cutthroat trout have been defined at the landscape level within the subbasin). The approach is intended to provide a relative picture of limiting factors within, not necessarily between, each assessment unit. For example, documented temperature and sediment limitations in the Lower Selway AU are most likely related to natural regimes (Thompson 1999). In contrast, temperature limitations in the Lower Clearwater AU are likely due to a combination of natural and altered conditions, including low elevation, low degree of natural shading, agricultural impacts to runoff, water withdrawals, and Dworshak Dam operations.

Subwatersheds, streams or stream reaches throughout the subbasin may realize limitations due to factors not documented here. Proposals directed at addressing such factors should supply additional information as necessary to justify the project(s). Additional information may come from finer scale assessments or research, be based on results of recent or ongoing studies, or unpublished information sources.

[4] Values were assigned by technical advisory team members using their best professional judgment. Judgments were supplied by team members only for areas/species with which they were familiar; Two to four judgments were typically supplied for each AU/species combination. Where discrepancies existed amongst judgments, a 'majority rules' approach was used to assign the value, applying the most commonly suggested value. If judgements were similar but no value constituted a majority (e.g. four judgements supplied: 1, 1, 2, and 2), the lowest value suggested was assigned. In cases where judgements were dissimilar and none was in majority (e.g. 1, 1, 3, and 3), the technical advisory team discussed the matter until assigning a value by consensus.

Table 62. Limiting factors defined by species and AU during previous research or assessments. Factors are ranked from most (1) to least (3) substantial, although all are considered limiting

AU/Species	Temperature	Base Flow	Flow Variation	Sediment	Instream Cover	Watershed Disturbances[1]	Habitat Degradation[2]	Exotics/Introgression	Harvest[3]	Connectivity/ Passage[4]
Lower Clearwater										
Bull Trout	3	3	3						3	3
Westslope Cutthroat	3		3			3				
Steelhead	1	1	2	1		1	1	3		3
Chinook	2	1		2		1	2			3
Pacific Lamprey										
Lower North Fork										
Bull Trout	2			1		1	1	1	3	3
Westslope Cutthroat	2			1		2	2	2	2	3
Steelhead	--	--	--	--	--	--	--	--	--	--
Chinook	--	--	--	--	--	--	--	--	--	--
Pacific Lamprey										
Upper North Fork										
Bull Trout	2			2		2		1	3	
Westslope Cutthroat				2		2	2	2	2	
Steelhead	--	--	--	--	--	--	--	--	--	--
Chinook	--	--	--	--	--	--	--	--	--	--
Pacific Lamprey										
Lolo/Middle Fork										
Bull Trout	1			1	2	1	1		3	
Westslope Cutthroat	2		3	1	2	1	1		3	
Steelhead	2	3		1	2	1				
Chinook	3			1	2	1	2			
Pacific Lamprey	2			1		1	1			3
Lochsa										
Bull Trout	3			2	3	2	2	3	3	
Westslope Cutthroat	2			2	3	2	2	3	2	
Steelhead	3			3	3	2	2			2
Chinook	3			3	3	2	2			2
Pacific Lamprey										
Lower Selway										
Bull Trout	2						2	3	3	
Westslope Cutthroat	3			2				2	2	
Steelhead	3			2						
Chinook	3									
Pacific Lamprey										

Table 62 (Continued)

AU/Species	Temperature	Base Flow	Flow Variation	Sediment	Instream Cover	Watershed Disturbances[1]	Habitat Degradation[2]	Exotics/Introgression	Harvest[3]	Connectivity/ Passage[4]
Upper Selway										
Bull Trout							3	3	3	
Westslope Cutthroat				3				3	3	
Steelhead	3			3						3
Chinook										3
Pacific Lamprey										
South Fork										
Bull Trout	2			1	1	1	1	2	3	2
Westslope Cutthroat	1			1	1	1	1	2	2	2
Steelhead	1			1	1	1	1	2	3	
Chinook	1			1	1	1	1			
Pacific Lamprey	1			3		1	1			3
Dworshak Reservoir Resident Fishery										
Kokanee			1[5]							
Smallmouth Bass							1			
Redside Shiner							1			

1 Includes upland disturbances such as mining, timber harvest and roading.
2 Includes riparian, instream habitat loss and disturbance or reservoir drawdowns.
3 Sport harvest of bull trout is not permitted in the subbasin, although poaching and some tribal harvest of the species may occur.
4 Includes passage barriers or other forms of population fragmentation.
5 Entrainment as influenced by flow variations through Dworshak Dam.

Dworshak Dam

Anadromous Species

As mentioned previously, the construction of Dworshak Dam in 1972 has eliminated anadromous access to one of the most productive systems in the subbasin, and has modified the fishery downriver from the impoundment. Although differing views exist relative to the degree to which the structure should be considered an "active" limiting factor to anadromous production, its discussion is nonetheless merited.

Located two miles (3 km) above the mouth of the North Fork Clearwater River, the dam blocked passage to 26% of the subbasins anadromous spawning and rearing habitat (NPT and IDFG 1990). For steelhead, this loss was considerable, as it is estimated that the North Fork Clearwater once supported as much as 60% of the subbasins spawning habitat (an area that could potentially accommodate 109,000 steelhead trout redds) and a significant amount of rearing and overwintering habitat (USFWS 1962; Miller 1987). Spring chinook salmon were similarly affected by the impoundment, as tributary systems in the Lower Clearwater and Upper and Lower North Fork AUs were historically substantial producers of chinook salmon, accounting for roughly 65 percent of the total chinook salmon smolt production from the Clearwater subbasin tributaries (excluding mainstem production; Chapman 1981). The degree to which Clearwater lamprey populations have been affected following their exclusion from the North Fork system has not been assessed. Some lamprey that remained upstream from the impoundment may have residualized in the North Fork Clearwater AUs, as they were collected in Dworshak Reservoir as late as 1989 (16 years after impoundment). None, however, have been seen after this date (Melo Maiolie, IDFG, personal communication, April 20, 2001).

The operation of Dworshak currently represents a limiting factor to fall chinook populations occurring downriver from the dam. In 1992 Dworshak flow releases were modified to facilitate anadromous fish migration in the lower Snake River. The change meant that up to 25 kcfs of cool water were released during parts of July, a period of the year that is typified by warmer water temperatures. As a consequence of cold winter water temperatures, the early life history timing of fall chinook salmon in the Clearwater River occurs on the latest schedule of all present-day Snake River stocks. Many young Clearwater River fall chinook salmon do not reach smolt size or migrate seaward during the first year of life because growth is out of synchronization with environmental cues such as photoperiod (Connor et al. 2001). In some years, releasing cool water from Dworshak Reservoir for summer flow augmentation could cause juvenile fall chinook salmon to hold over an extra year in freshwater by markedly reducing water temperatures and disrupting water temperature cues that prompt outmigration (Connor et al. 2001).

Resident Species

The construction of Dworshak Dam was a limiting factor to several resident fish populations. The dam replaced part of the North Fork of the Clearwater River and numerous tributaries with a reservoir environment. IDFG estimated that 200 km of river and stream habitat was lost. Based on densities of fish in other areas, this habitat could have supported 264,000 mountain whitefish, 110,000 cutthroat trout, 6,700 bull trout, 256,000 redside shiners, 93,000 suckers, 44,000 longnose dace, 4,400 northern pikeminnow, 27,000 sculpins and an unknown number of redband trout. The Department estimated 14,800 m^2 (3.6 acres) of stream habitat was inundated by the reservoir in first to fourth order tributaries and, an additional 962 ha (3.7 mi^2) of habitat was inundated in North Fork Clearwater tributaries larger than fourth order (IDFG, unpublished data).

The dam also blocked resident fish from using habitat above and below the dam site. The splitting of habitat into discontinuous areas could increase the risk of extinction for fish above and below the dam.

The current operation of Dworshak Dam is a limiting factor to fish populations within Dworshak Reservoir. Drawdowns of the reservoir can be a much as 47 m (154 ft.) and reduce the surface area by 52%, thereby reducing habitat for fish populations. Drawdowns also prevent the establishment of productive littoral areas around the shorelines of the reservoir, which affects near-shore spawning and feeding species.

Kokanee are the best-adapted species for this fluctuating reservoir since they occupy the pelagic, offshore, areas and spawn in tributary streams. Their densities have exceeded 100 adult kokanee per hectare, and harvest of kokanee by anglers has exceeded 200,000 fish in some years. The population's biggest limiting factor has been entrainment into Dworshak Dam outflows. For example in the spring of 1996, Idaho Department of Fish and Game estimated that 1.3 million kokanee were entrained, potentially reducing the kokanee population in the reservoir by 95%. These losses impacted the kokanee sport fishery for the next three years. Fickeisen and Geist (1993) noted that the principle bottleneck to the population appeared to be the entrainment losses of fish through the dam.

Reservoir operations also limit smallmouth bass populations. Fluctuating water levels during incubation have resulted in desiccation of nests and limited beds of aquatic vegetation that provide habitat for production of food needed by age 1 to age 4 fish (Fickeisen and Geist 1993).

8.3.3 Stream Reach Scale – NPPC Data

Constraints to production of chinook salmon and steelhead trout in the Clearwater subbasin were delineated for individual stream reaches during the prior subbasin planning process (NPT and IDFG 1990). Fourteen individual constraints were defined for steelhead trout, and twelve for chinook salmon in the Clearwater subbasin, any of which may inhibit spawning, rearing or migration of these species.

One major weakness of this database is its failure to address constraints in areas not currently being used by anadromous species at the time the data was compiled. It does not address constraints in areas of substantial historical distribution (e.g., the Potlatch River for chinook salmon), and did not delineate potential constraints in areas that might be accessible to either species in the future. Addressing these issues would require considerable time to replicate the methods and analyses used in developing the original database, and has therefore not been attempted.

Strength(s) of the database include that constraints to chinook salmon and steelhead trout have not likely changed much in the past 10 years, except in very localized areas with significant restoration efforts. The database should therefore still provide a good understanding of current constraints to anadromous production in the Clearwater subbasin.

As defined in the NPPC database, spring chinook salmon production in the Clearwater subbasin is predominantly constrained by steep gradient (520 stream miles) and sedimentation (411 stream miles; Table 63). Steep gradient is the primary constraint (in terms of stream miles impacted) to chinook production in the Upper Selway AU, and also important in the Lochsa, Lower Selway, and South Fork AUs. The Lochsa AU is also notably impacted by habitat constraints including lack of high quality pools and poor instream cover. Sedimentation is the principle constraint in the Lolo/Middle Fork and South Fork AUs. Constraints to spring chinook salmon production for individual stream reaches throughout the Clearwater subbasin are presented in Appendix H (Figure 123, Figure 124, Figure 125, Figure 126).

Table 63. Summary of stream miles where spring chinook use is constrained by various factors in the Clearwater subbasin (defined by NPPC and downloaded from Streamnet.org). Numbers in parenthesis represent the estimated total stream miles with habitat suitable for spawning, rearing, and/or migration by spring chinook

	Assessment Unit								
Constraint	Lower Clearwater	Lower North Fork	Upper North Fork	Lolo/Middle Fork	Lochsa	Lower Selway	Upper Selway	South Fork	Total
	(111.8)	(2.0)	(0.0)	(154.5)	(278.9)	(146.1)	(301.8)	(291.8)	(1,286.7)
Large Stream Size	78.3	2.0	---	7.1	68.8	40.0	13.0	15.8	225.0
Steep Gradient	0.0	0.0	---	59.2	107.5	74.8	176.9	101.5	520.1
Temperature	93.6	0.0	---	76.6	28.8	19.1	0.0	13.1	231.3
Sedimentation	39.5	0.0	---	146.9	22.6	3.5	15.1	183.7	411.3
Gravel Quantity	0.0	0.0	---	0.0	71.9	0.0	0.0	0.0	71.9
Blocked Passage	0.0	0.0	---	0.0	28.7	21.4	85.4	4.7	140.2
Impeded Passage	0.0	0.0	---	0.0	47.2	0.0	0.0	0.0	47.2
Poor Instream Cover	0.0	0.0	---	11.3	77.3	0.0	0.0	64.4	153.0
Lack of High Quality Pools	0.0	0.0	---	0.0	117.4	0.0	0.0	0.0	117.4
Bank Degradation	0.0	0.0	---	0.0	0.0	0.0	0.0	6.2	6.2
Channelization	0.0	0.0	---	0.0	0.0	0.0	0.0	14.6	14.6
Dewatering	0.0	0.0	---	11.3	0.0	0.0	0.0	0.0	11.3

The four principle factors constraining steelhead trout production in the Clearwater subbasin are sedimentation (965 stream miles), temperature (520 stream miles), dewatering (374 stream miles), and blocked or impeded passage (451 stream miles; Table 64). These four factors, with the addition of the mainstem Clearwater River's large stream size, also represent the principle constraints to steelhead trout in the Lower Clearwater AU. Important constraints to steelhead trout production vary considerably between other AUs. Sedimentation is an important constraint to steelhead trout production in the Lolo/Middle Fork and South Fork AUs, although temperature is also an important concern in the Lolo/Middle Fork AU. Instream habitat forming processes appear to present constraints to steelhead trout in the Lochsa AU, resulting in concern over lack of high quality pools, limited gravel quantity, and poor instream cover. In the Selway River AUs, steelhead trout population(s) are constrained predominantly by large stream size (Lower Selway AU) and blocked passage (Upper Selway AU). Constraints to steelhead trout production for individual stream reaches throughout the Clearwater subbasin are presented in Appendix H (Figure 127, Figure 128, Figure 129, Figure 130, Figure 131).

8.3.4 Stream Reach Scale - §303(d)

The majority of streams within the Clearwater subbasin have designated beneficial uses defined by IDEQ which include salmonid spawning and/or cold water biota. The IDEQ maintains the §303(d) list for stream reaches with impaired beneficial uses. These stream reaches and the associated pollutants have been summarized in the water quality section (4.9) of this report, and individual stream reaches listed under §303(d) for impairment are mapped in Appendix B.

8.3.5 Passage/Connectivity - Road Culverts

The degree to which connectivity limits fish migration and production within the Clearwater subbasin is thought to be underrepresented by existing data and reports. No data source exists which accurately documents known or potential barriers to fish migration within the Clearwater subbasin in a useable and widespread format. Particularly lacking are records of culvert conditions in relation to fish passage, which is thought to be a substantial issue throughout the Clearwater subbasin. Although data is regularly collected on culvert conditions during a variety of field surveys, the data often are not available in the detail and format necessary to map the locations of surveyed culverts.

In the absence of available information regarding culvert locations and condition, we constructed an index of culvert abundance by overlaying the road (1:24,000) and stream (1:100,000) coverages. Points of intersections were defined, and likely represent a reasonable estimate of the relative (not actual) distribution and density of culverts throughout the Clearwater subbasin (Figure 110).

Table 64. Summary of stream miles where steelhead trout use is constrained by various factors in the Clearwater subbasin (defined by NPPC and downloaded from Streamnet.org). Numbers in parenthesis represent the estimated total stream miles with habitat suitable for spawning, rearing, and/or migration by steelhead trout

	Assessment Unit								
Constraint	Lower Clearwater	Lower North Fork	Upper North Fork	Lolo/Middle Fork	Lochsa	Lower Selway	Upper Selway	South Fork	Total
	(525.5)	(2.0)	(0.0)	(263.7)	(437.3)	(241.8)	(563.7)	(389.2)	(2,423.2)
Large Stream Size	78.3	2.0	---	7.1	68.8	40.0	11.5	15.8	223.4
Steep Gradient	0.0	0.0	---	26.8	62.0	10.2	15.2	45.2	159.8
Temperature	342.2	0.0	---	116.8	28.8	19.1	0.0	13.1	520.0
Sedimentation	434.5	0.0	---	201.7	73.7	9.1	8.5	237.6	965.0
Gravel Quantity	0.0	0.0	---	0.0	145.1	0.0	0.0	0.0	145.1
Blocked Passage	94.2	0.0	---	66.1	52.6	27.0	84.7	4.7	329.3
Impeded Passage	51.2	0.0	---	0.0	57.7	0.0	13.3	0.0	122.2
Poor Instream Cover	38.8	0.0	---	11.3	83.4	0.0	0.0	70.9	204.4
Lack of High Quality Pools	16.3	0.0	---	40.1	185.5	0.0	0.0	0.0	241.9
Bank Degradation	19.8	0.0	---	0.0	0.0	0.0	0.0	2.0	21.7
Channelization	52.4	0.0	---	3.2	0.0	0.0	0.0	14.6	70.1
Dewatering	301.2	0.0	---	73.1	0.0	0.0	0.0	0.0	374.3
Poor Diversions	24.4	0.0	---	0.0	0.0	0.0	0.0	0.0	24.4
Chemicals	18.6	0.0	---	0.0	0.0	0.0	0.0	0.0	18.6

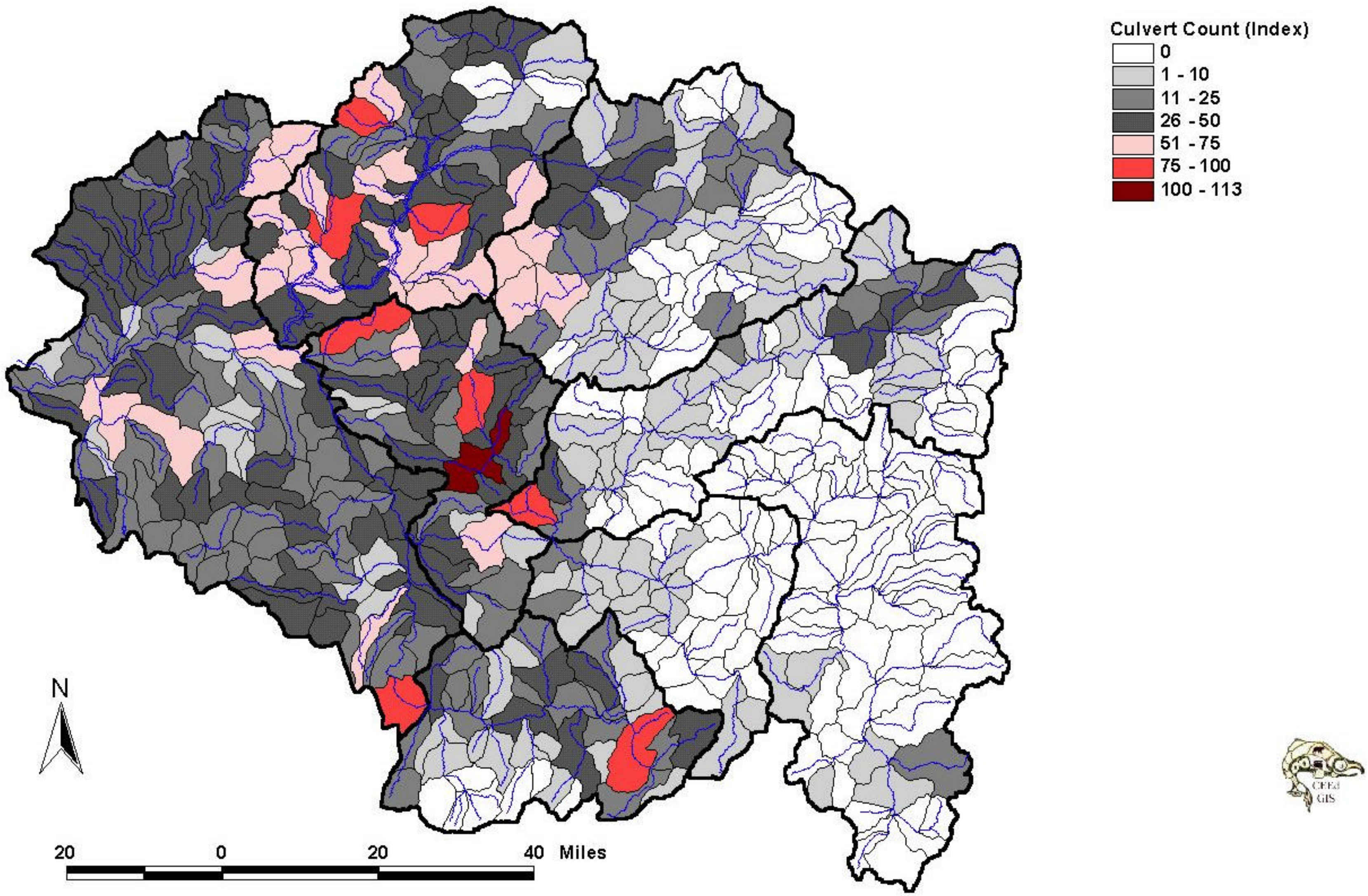

Figure 110. Estimated number of culvert locations (stream-road crossings) by 6th field HUC throughout the Clearwater subbasin

The Idaho Department of Lands has estimated that over 50% of existing culverts may pose either a partial or complete barrier to fish migration (J. Dupont, IDL, personal communication, February 6, 2001). Based on this information, it is reasonable to assume that the greatest potential for fish passage issues related to culverts is coincidental with areas of greatest culvert density. However, information presented in Figure 110 should be used only as a guide for planning culvert surveys or data collection. Additional information will be needed to define the impacts of culverts to fish populations. Such information will include fish distributions and seasonal habitat use, culvert design and construction, and availability and quality of fish habitat upstream.

Fish passage barriers have beneficial impacts in some areas as well. Although passage barriers are most typically considered to have negative impacts, they may be important mechanisms in limiting the spread of exotic species and subsequent introgression with native species of concern including bull trout and westslope cutthroat trout.

8.3.6 Temperature Limitations (modeled)

Suitable water temperature is an important habitat component for most fish species, and temperature is commonly cited as a limiting factor to fish distribution or production (See Table 62 and Appendix H). The Idaho Department of Lands (2000) developed a model to predict the seven-day rolling average of maximum daily stream temperature, otherwise called the mean weekly maximum temperature (MWMT). The relative simplicity made this particular model practical for use in this assessment, and results are likely adequate for examining broad-scale patterns in temperature variations in the Clearwater subbasin as they relate to potential fish distribution.

Based in part on work by Sugden et al. (1998), predicted MWMTs were related to Idaho's stream temperature standards for numerous fish species (Table 65). Guidelines relating fish use to MWMT are based on species presence and use patterns (i.e. fall vs. spring spawners) and expected to result in conditions meeting applicable Idaho standards for each species throughout the year. For example, spring/summer chinook are most likely to spawn during the periods of highest water temperatures, and therefore require the lowest MWMT to ensure adequate conditions during spawning and incubation. Although bull trout typically require colder water than spring/summer chinook for spawning, they spawn later in the fall during periods of declining temperatures, allowing for a slightly higher MWMT.

Idaho DEQ has compiled an issue paper concerning the application of uniform temperature criteria in diverse environments (Essig 1998) suggesting that uniform standards applied to individual species may not be the most appropriate manner in which to evaluate temperature limitations. However, for the purposes of this assessment, comparison of species distributions to uniform standards has been conducted to ensure consistency and uniform interpretability across broad scales.

The IDL temperature model has demonstrated limited accuracy when applied to areas in north Idaho (r^2=0.58; Idaho Department of Lands 2000), and reliance on available GIS coverages to estimate the data necessary to model MWMT across the subbasin has likely added additional sources of error to the results. For these reasons, results presented here should not be used for site specific planning purposes or to make implications about localized water quality.

The model predicts the MWMT, using three variables (stream shade, elevation, and drought index) as

MWMT (°C) = 29.09861 – (elevation in feet*0.00262)-(canopy cover*0.08492)-(DI*0.29433)

For the purposes of this assessment, normal climatic conditions (DI=0) were assumed. Stream shade was estimated using four canopy cover classes delineated by the Idaho GAP project (<15%, 15-39%, 40-69%, and $\geq$70%). We assumed that the actual canopy cover for each cell was equal to the midpoint of the range depicted by the Idaho GAP data layer (7.5, 27, 55, and 85%, respectively, for each of four classes). The GAP canopy coverage was obtained as a GIS grid coverage with 30m cell resolution, matching the degree of resolution of the available DEM elevation data. Modeling was conducted for cells overlain by a 1:100,000 scale stream coverage. The decision to use the 1:100,000 scale stream layer was based on prior work indicating that finer scale stream layers include substantial numbers of intermittent streams that would be dry during periods of highest stream temperatures and which, therefore needed to be excluded from predictions of MWMT.

Results of stream temperature modeling are presented in Figure 111 and summarized by 6th field HUC in Figure 112. Both maps also illustrate expected species presence based on the predicted MWMT (see Table 65). In general, expected species distributions are similar to those currently observed (See Section 8), illustrating the role of temperature in determining habitat suitability throughout the Clearwater subbasin. However, exceptions to this trend do exist for some species.

Based on predicted temperature conditions, westslope cutthroat trout in the Clearwater subbasin appear to currently occupy virtually all suitable habitat areas. Some use of potentially marginal temperature conditions (15-18°C MWMT) by westslope cutthroat trout are evident in the Lolo/Middle Fork AU, a situation not typically seen in other areas of the subbasin with similar temperature regimes.

Existing distributions of bull trout are generally similar to areas of predicted suitable temperatures, with the primary exception(s) occurring in the Lochsa AU. Based on predicted temperature conditions, suitable habitat for bull trout exists throughout the vast majority of the Lochsa AU (Figure 112). Bull trout however, are presumed absent from a substantial portion of the tributary habitat in the central and lower portions of the Lochsa drainage (See Figure 106). Similar instances bull trout absence from predicted potential habitat can be seen in the Upper and Lower Selway, South Fork, and Upper and Lower North Fork AUs, although less frequently than in the Lochsa AU. It is unclear if these discrepancies result from modeling errors, patchy population structure, or the influence of other habitat conditions influencing bull trout populations in some areas.

Based on predicted temperatures, both westslope cutthroat trout and bull trout appear to utilize some areas of marginal habitat within the Lolo/Middle Fork AU. For both species, suitable temperature conditions are predicted in headwater areas, and their use of marginal habitats may arise from downstream dispersal of individuals from these areas (Figure 111 and Figure 112).

Table 65. Mean weekly maximum temperatures anticipated to result in applicable temperature standards being met for various species or types of fish

Species Present	Suitable MWMT
Spring/Summer Chinook	$\leq$ 12°C (53°F)
Bull Trout	$\leq$ 13°C (55.4°F)
Other Salmonids	$\leq$ 15°C (59°F)
No Salmonids	$\leq$ 21°C (69.8°F)

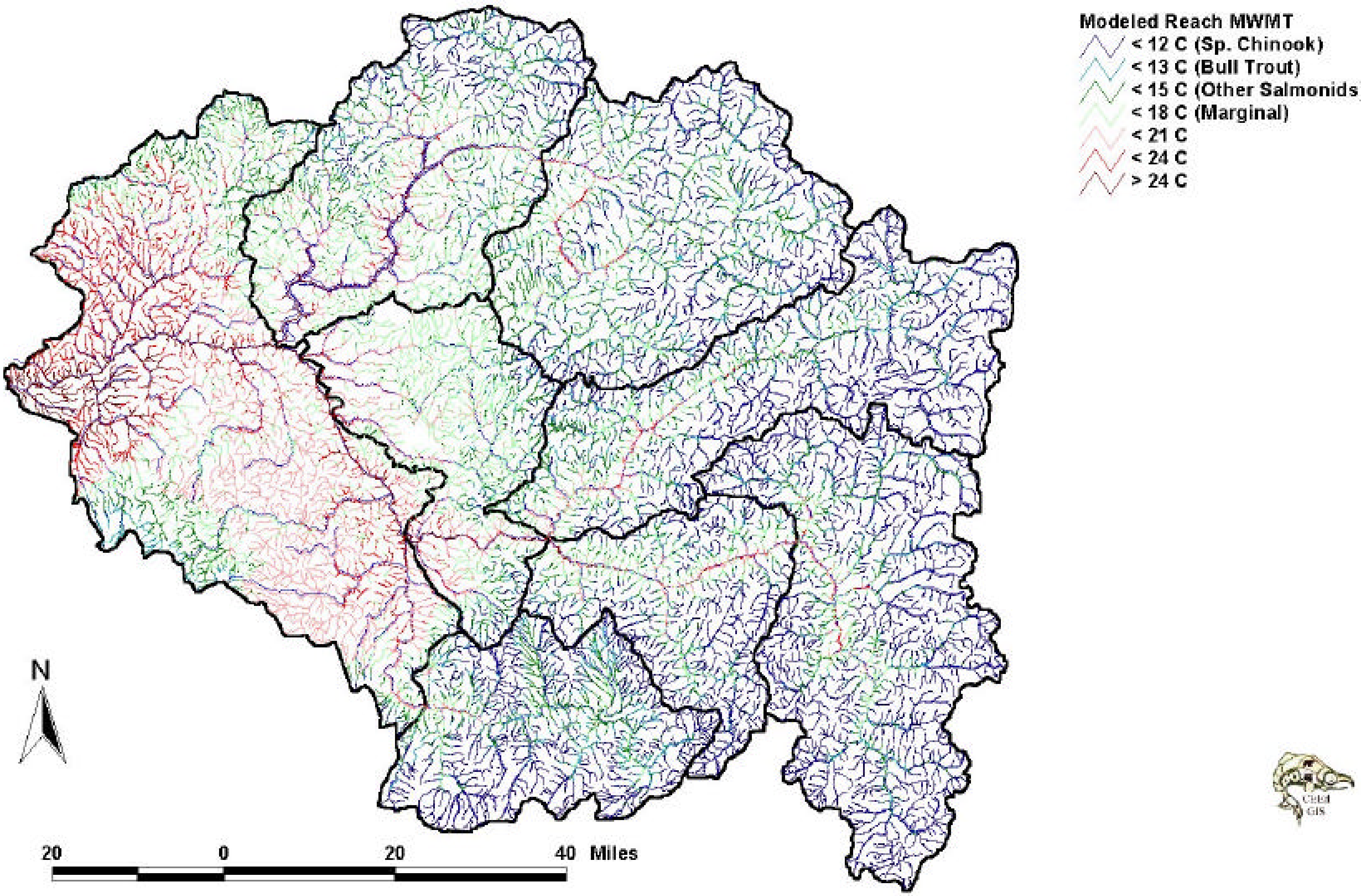

Figure 111. Modeled maximum weekly maximum temperatures (MWMT) for streams throughout the Clearwater subbasin

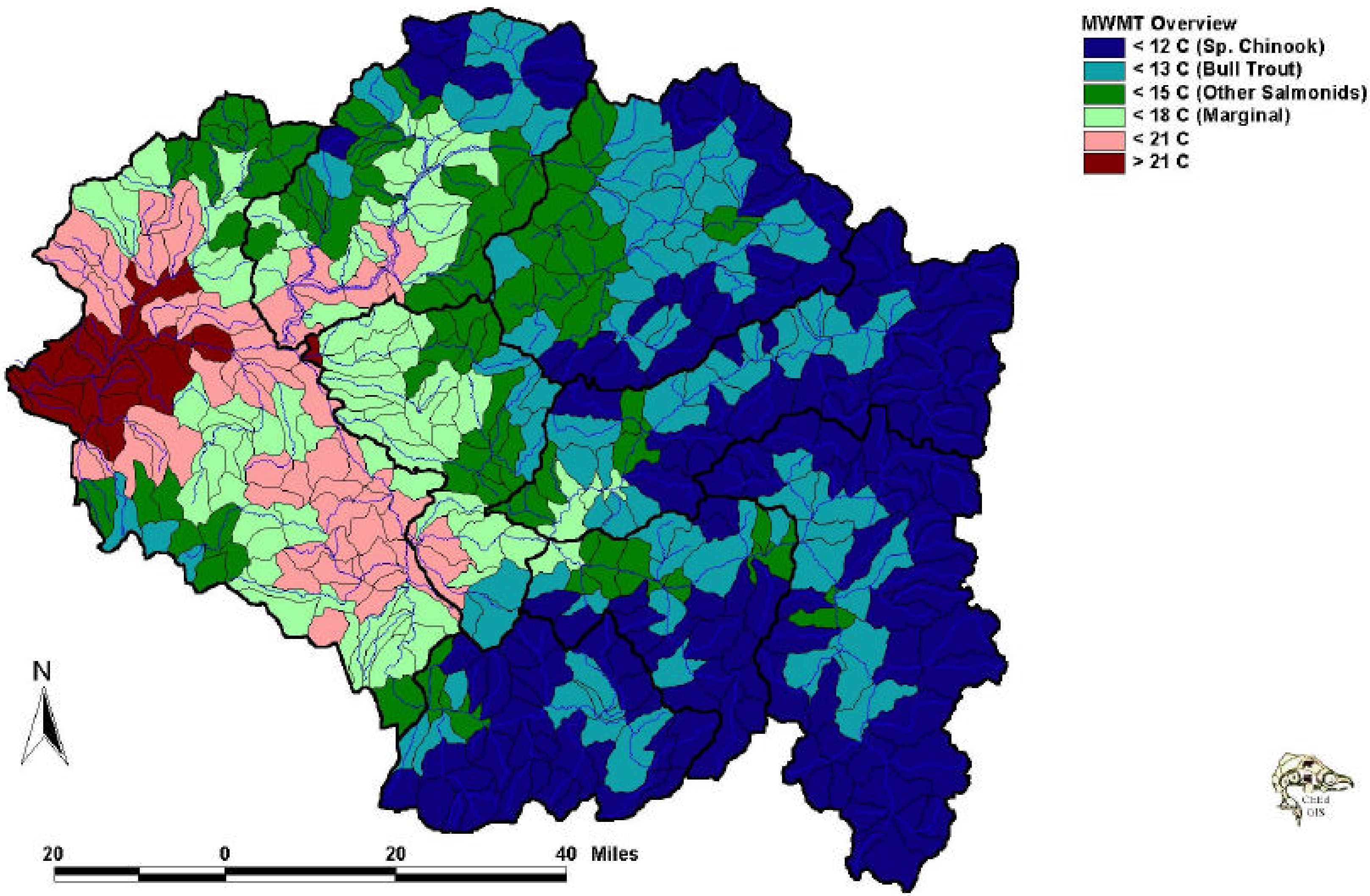

Figure 112. General overview of anticipated MWMT and associated salmonid species distribution

The relationship between spring chinook salmon distribution and predicted temperature conditions follows a similar pattern to that presented for bull trout. With the exception of substantial amounts of tributary habitats within the Lochsa AU, spring chinook salmon appear to currently utilize nearly all suitable areas within the Clearwater subbasin (See section 8.1.1 and Figure 96). Modeling suggests that although marginal temperature conditions exist in the headwaters of the Lolo Creek drainage, temperatures there are generally unsuitable for chinook salmon (Figure 112). Spring chinook salmon are, however, widespread throughout the Lolo Creek drainage (See section 8.1.1). The reason for the discrepancy between expected and realized distribution of spring chinook salmon throughout the Lolo Creek drainage is unclear, but may result from inaccuracies in the modeled temperatures, inaccuracy in the predicted species relationships to MWMT (see Table 65), or the heavy hatchery influence in the drainage.

Historic accounts suggest that spring chinook salmon utilized the Potlatch River system, although they are not currently known to do so (See sections 7.1 and 8.1.1). Predicted temperature conditions suggest highly unfavorable habitat conditions currently exist for spring chinook salmon within the Potlatch drainage (See Figure 111 and Figure 112). If historical accounts are accurate, temperature regimes in the Potlatch River system have been altered substantially from historic times. Impacts to temperature regimes in the Potlatch River system are likely cumulative in nature, and related largely to the predominantly private ownership and consumptive land uses (forestry and agriculture) throughout the watershed.

Based on information presented in Table 65, suitable temperatures for steelhead trout are found throughout much of the Clearwater subbasin, with the primary exception in the Lower Clearwater AU (Figure 111 and Figure 112). Temperature conditions in some areas of the Lolo/Middle Fork AU may be marginal for steelhead (15-18°C [59-64°F] MWMT), although use does occur in these areas. Predicted suitable temperatures for steelhead trout ($\leq$15°C MWMT; Table 65) reasonably represent the current range of B-run steelhead trout throughout the Clearwater subbasin, with A-run steelhead trout generally distributed throughout areas of substantially higher temperatures in the Lower Clearwater AU. Many tributaries of the Lower Clearwater AU, where A-run steelhead predominantly exist, are expected to experience MWMTs exceeding 21°C (69.8°F) in normal years, and temperatures would be expected to be higher in dry years. Temperature limitation of steelhead populations throughout the Lower Clearwater tributaries is widely acknowledged (See Table 62 and Appendix H; NPT and IDFG 1990; Kucera and Johnson 1986; Johnson 1985; Fuller et al. 1984; Kucera et al. 1983) and presents a potentially substantial concern to the recovery of A-run steelhead within the subbasin.