HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

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

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Hatchery: McCall Fish Hatchery.
Program: Summer Chinook Salmon.

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

Summer Chinook Salmon *Oncorhynchus tshawytscha*.
Components of the hatchery population are and are not ESA-listed according to parental origin. The natural (unmarked) population is ESA-listed.

1.3) Responsible organization and individuals

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

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

Nez Perce Tribe – The IDFG coordinates with the Nez Perce Tribe to hold and spawn adult summer chinook salmon for the Tribe's Johnson Creek supplementation program. Juvenile chinook are reared at the McCall Fish Hatchery and generally released as smolts as part of the current hatchery capacity.

Shoshone-Bannock Tribes – The Shoshone-Bannock Tribes may receive summer chinook salmon eggs for an ongoing supplementation program.

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

U.S. Fish and Wildlife Service – Lower Snake River Compensation Plan funded.
Staffing level: 5.1 person-years.

Annual budget: $471,000.

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

McCall Fish Hatchery – The McCall Fish Hatchery is located approximately 2.25 km south of state highway 55 at 300 Mather Road in the city limits of McCall, Idaho. The facility includes an adult weir and trap located on the South Fork Salmon River approximately 42 km east of Cascade, ID. The hydrologic unit codes for the hatchery and weir are 17050123 and 17060208, respectively.

1.6) Type of program.

The McCall Fish Hatchery program was designed as an *Isolated Harvest Program*. However, some broodstock management, rearing, and juvenile releases support ongoing supplementation research.

1.7) Purpose (Goal) of program.

Define as either: Augmentation, Mitigation, Restoration, Preservation/Conservation, or Research (for Columbia Basin programs, use NPPC document 99-15 for guidance in providing these definitions of "Purpose"). Provide a one sentence statement of the goal of the program, consistent with the term selected and the response to Section 1.6. Example: "The goal of this program is the restoration of spring chinook salmon in the White River using the indigenous stock".

<u>Mitigation</u> - The goal of this program is to return 8,000 summer chinook salmon above Lower Granite Dam to mitigate for survival reductions resulting from construction and operation of the four lower Snake River dams.

1.8) Justification for the program.

The primary purpose of this program is harvest mitigation. The Lower Snake River Compensation Program has been in operation since 1983 to provide for mitigation for lost chinook salmon and steelhead production caused by the construction and operation of the four lower Snake River dams.

Actions taken to minimize adverse effects on listed fish include:

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

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

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

4. Acclimating a portion of the annual production at an acclimation pond adjacent to the upper South Fork Salmon River.

5. Attempting to program time of release to mimic natural fish for South Fork Salmon hatchery reserve releases.

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

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

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

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

1.9) List of program "Performance Standards".

3.1 Legal Mandates.
3.2 Harvest.
3.3 Conservation of natural spawning populations.
3.4 Life History Characteristics.
3.5 Genetic Characteristics.
3.6 Research Activities.
3.7 Operation of Artificial Production Facilities.

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

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

3.1.1 Standard: Program contributes to fulfilling tribal trust responsibility mandates and treaty rights, as described in applicable agreements such as under U.S. v. Oregon and U.S. v. Washington.

Indicator 1: Total number of fish harvested in tribal fisheries targeting program.

3.1.2 Standard: Program contributes to mitigation requirements.

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

3.1.3 Standard: Program addresses ESA responsibilities.

Indicator 1: ESA Section 7 Consultation completed.

3.2.1 Standard: Fish are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while avoiding over harvest of not-target species.

Indicator 1: Number of target fish caught by fishery estimated.
Indicator 2: Number of non-target fish caught in fishery estimated.
Indicator 3: Angler days by fishery estimated.
Indicator 4: Escapement of target fish estimated.

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

Indicator 1: Marking rate by type in each release group documented.
Indicator 2: Sampling rate by mark type for each fishery estimated.
Indicator 3: Number of marks by type observed in fishery documented.

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

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

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

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

1.10.2) "Performance Indicators" addressing risks.

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

Indicator 1: Temporal distribution of broodstock collection managed.
Indicator 2: Age composition of broodstock collection managed.

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

Indicator 1: Number of spawners of natural origin removed for broodstock managed.
Indicator 2: Number and origin of spawners migrating to natural spawning areas managed.
Indicator 3: Number of eggs or juveniles placed in natural rearing areas managed.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Indicator 1: Mortality rates in trap documented. No ESA-listed fish targeted.
Indicator 2: Prespawning mortality rates of trapped fish in hatchery or after release documented. No ESA-listed fish targeted.

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

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

1.11) Expected size of program.

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

Adult spawn target: approximately 380 females and 760 males needed to produce approximately one million smolts.

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

Note: the following abbreviations are used in the table:

NPT supplementation = Nez Perce Tribe Johnson Creek Supplementation Studies
ISS = Idaho Supplementation Studies
LSRCP = Lower Snake River Compensation Program.

The IDFG anticipates that the production of progeny associated with the Idaho Supplementation Studies project (ISS) will end with the development of the 2002 brood group.

Life Stage	Release Location	Annual Release Level
Eyed Eggs		
Unfed Fry		
Fry		
Fingerling	South Fork Salmon River – Stolle Pond acclimation site - ISS	60,000, ventral clip or CWT only
Yearling	South Fork Salmon River – Knox Bridge – LSRCP	1,000,000, 100% ad-clipped, evaluation CWT and PIT groups
	South Fork Salmon River – Knox Bridge - ISS	100,000, ventral clip or CWT only
	Johnson Creek – NPT	100,000 100% VIE, CWT, evaluation PIT groups.

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

The most recent Idaho Department of Fish and Game performance data for the South Fork Salmon River hatchery program is presented below. **Adult return information after 1995 does not include unmarked fish**. As such, numbers presented in the following tables may be lower than numbers presented in subsequent tables in this HGMP. In addition, any loss of adults due to harvest or straying has not been accounted for in the following tables. As such, SAR information presented below are minimum estimates.

South Fork Salmon River Adult Weir

			Return Age From BY				
Brood Year	Number Released	Year Released	1-ocean	2-ocean	3-ocean	Total	SAR (%)
1980	122,247	1982	504	713	151	1,368	1.12
1981	183,896	1983	595	1,259	203	2,057	1.12
1982	269,880	1984	828	1,259	202	2,289	0.85
1983	564,405	1985	1,228	2,117	1,416	4,761	0.84
1984	100,149 970,483	1985 1986	386	927	90	1,403	0.15
1985	177,606 958,300	1986 1987	50	350	8	408	0.04
1986	118,400 1,060,400	1987 1988	495	933	43	1,471	0.14
1987	757,582 947,395	1988 1989	28	348	42	418	0.04
1988	791,900 1,032,500	1989 1990	821	2,597	683	4,101	0.40
1989	708,600	1991	209	1,994	416	2,619	0.37
1990	901,500	1992	20	43	17	80	0.01
1991	607,298	1993	68	171	35	274	0.05
1992	1,060,163	1994	87	312	113	512	0.05
1993	51,163 1,074,598	1994 1995	no data 695	no data 3,198	no data 486	no data 4,379	no data 0.41
1994	559,226	1996	41	264	226	531	0.09
1995	238,647	1997	64	752	62	878	0.37
1996	24,990 393,873	1997 1998	4 688	11 3,032	0 205	15 3,925	0.06 1.00
1997	48,376 1,143,083	1998 1999	- 2,988	- 8,384	- -	- -	- -
1998	1,039,930	2000	-	-	-	-	-

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

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

The McCall Fish Hatchery was completed in 1979.

1.14) Expected duration of program.

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

1.15) Watersheds targeted by program.

Listed by hydrologic unit code –

South Fork Salmon River: 17060208

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

The McCall Fish Hatchery was constructed to mitigate for fish losses caused by construction and operation of the four lower Snake River federal hydroelectric dams. The McCall Fish Hatchery has a federally authorized goal of returning 8,000 adult summer chinook salmon back to the project area upstream of Lower Granite Dam. The Idaho Department of Fish and Game's objective is to ensure that harvestable components of hatchery-produced chinook salmon are available to provide fishing opportunity, consistent with meeting spawning escapement and preserving the genetic integrity of natural populations (IDFG 1992). The Idaho Department of Fish and Game has not considered alternative actions for obtaining program goals. Stated goals are mandated by the U.S. Fish and Wildlife Service and administered through the Lower Snake River Compensation Program. Any change in the original mandate brought about by substantive changes in the hydropower corridor would be initiated by the U.S. Fish and Wildlife Service.

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

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

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

Section 10 Permit Number 921 for McCall Fish Hatchery trapping and spawning activities (expired, reapplied for 1/10/00).

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

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

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

Idaho's stream-type chinook salmon are truly unique. Smolts leaving their natal rearing areas migrate 700 to 950 miles downstream every spring to reach the Pacific Ocean. Mature adults migrate the same distance upstream, after entering freshwater, to reach their place of birth and spawn. The life history characteristics of spring and summer chinook are well documented by IDFG et al. (1990); Healey (1991); NMFS: 57 FR 14653 and 58FR68543). Kiefer's (1987) An Annotated Bibliography on Recent Information Concerning Chinook Salmon in Idaho, prepared for the Idaho Chapter of the American Fisheries Society, provides a reference of information available through the mid-1980s on life history, limiting factors, mitigation efforts, harvest, agency planning, and legal issues.

Snake River spring and summer chinook salmon, of which spawning populations in the Salmon Subbasin are a part, were listed as Threatened under the Endangered Species Act in 1992 (57 FR 14653); critical habitat was designated in 1993 (58 FR 68543). Recent and ongoing research has provided managers with more specific knowledge of the Salmon Subbasin stocks. Intensive monitoring of summer parr and juvenile emigrants from nursery streams has provided insights into freshwater rearing and migration behavior (Walters et al. 2001; Achord et al. 2000; Hansen and Lockhart 2001; Nelson and Vogel 2001). Recovered tags and marks on returning adults at hatchery weirs and on spawning grounds have indirectly provided stock specific measures of recruitment and fidelity (Walters et al. 2001; Berggren and Basham 2000). Since 1992, most hatchery-produced chinook have been marked to distinguish them from naturally produced fish.

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

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

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

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

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

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

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

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

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

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

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

Bull trout (T – 6/98)

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

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

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

1) South Fork Salmon River: 9,200

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

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

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

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

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

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

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

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

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

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

Brood Year	**1990**		**1991**		**1992**	
Run	Spring	Summer	Spring	Summer	Spring	Summer
Dam Counts	17,315	5,093	6,623	3,809	21,391	3,014
% Females	48	44	44	52	49	43
# of Females	8,368	2,246	2,906	1,961	10,482	1,294
# of Females in Hatcheries	3,395	421	1,330	252	2,747	462
Adjustment for Migration Mortality	4,244	526	1,663	350	3,434	578
# of Females in Harvest	796	10	1	0	897	43
Female Escapement	3,328	1,710	1,292	1,611	6,151	673
Combined Female Escapement	5,038		2,853		6,824	
Combined W/N Smolts	527,000		627,037		627,942	
# of Smolts/Female	105		220		92	

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

Brood Year	**1996**		**1997**		**1998**	
Run	Spring	Summer	Spring	Summer	Spring	Summer
Dam Counts	4,215	2,608	33,855	10,709	9,854	4,355

% Females	38	40	55	44	54	54
# of Females	2,023	1,032	18,620	4,766	5,333	2,346
# of Females in Hatcheries	1.036	148	5,503	894	2,229	365
Adjustment for Migration Mortality	1,295	185	6,879	1,118	2,786	456
# of Females in Harvest	20	0	3,183	322	643	67
Female Escapement	708	847	8,558	3,326	1,904	1,823
Combined Female Escapement	1,555		11,884		3,727	
Combined W/N Smolts	599,159		1,560,298		1,344,382	
# of Smolts/Female	385		131		361	

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

Return Year	McCall Fish Hatchery Total Returns (Hatchery-Produced/Natural)	Total Number of Natural Adults Released Upstream of Weir
1995	307 (269/38)	23
1996	1,199 (1,042/157)	124
1997	3,659 (3,371/288)	186
1998	974 (822/152)	62
1999	1,961 (1,670/291)	216
2000	6,812 (6,093/719)	660
2001	10,922 (9,144/1,778)	1,740
2002	8,603 (7,322/1,281)	1,160

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

Numbers of natural-origin summer chinook salmon released for natural spawning are presented in the above table for the McCall Fish Hatchery.

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

See below.

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

ESA-listed, summer chinook salmon are trapped during broodstock collections periods at the South Fork Salmon River trap.

The McCall Fish Hatchery collects broodstock to meet LSRCP mitigation objectives in addition to objectives associated with an ongoing supplementation experiment. Annually, natural-origin, hatchery-origin, and supplementation adults may be trapped at this facility. Supplementation adults have resulted from hatchery x natural crosses. Based on federal permit and consultation language and on agreements with supplementation studies cooperators, annual weir management plans are developed. Depending on run size and composition, supplementation and natural-origin adults may be retained in the hatchery to produce future supplementation broodstocks. Generally, a minimum of 50% of the natural-origin adults that return annually are released upstream for natural spawning. At this time, brood year 2002 was the last year that supplementation broodstocks were developed at the McCall Fish Hatchery to meet IDFG supplementation study objectives.

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

The following reviews the number of natural-origin adult spring chinook salmon retained ("ponded") in the hatchery and incorporated in annual spawning designs for supplementation research.

Return Year	McCall Fish Hatchery Trapping History (Hatchery-Produced/Natural)	Total Spawned (H/N)	Total Males Spawned (H/N)	Total Females Spawned (H/N)
1995	307 (269/38)	171 (159/12)	114 (106/8)	57 (53/4)
1996	1,199 (1,042/157)	333 (303/30)	222 (202/20)	111 (101/10)
1997	3,659 (3,371/288)	1,689 (1,587/102)	1,126 (1,058/68)	563 (529/34)
1998	974 (822/152)	897 (807/90)	598 (538/60)	299 (269/30)
1999	1,961 (1,670/291)	1,281 (1,212/69)	854 (808/46)	427 (404/23)
2000	6,812 (6,093/719)	1,083 (1,032/51)	722 (688/34)	361 (344/17)
2001	10,922 (9,144/1,778)	1,251 (1,221/30)	834 (814/20)	417 (407/10)
2002	8,603 (7,322/1,281)	1,143 (1,029/114)	762 (686/76)	381 (343/38)

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

See Table 1 (attached).

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

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

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

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

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

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

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

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

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

3.3) Relationship to harvest objectives.

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

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

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

Sport fishery information for the South Fork Salmon River is presented in the following table.

Year	Estimated Number of Angler Visits	Estimated Angler Effort (hours)	Estimated Sport Angler Harvest
1990	no fishery held	n/a	n/a
1991	no fishery held	n/a	n/a
1992	no fishery held	n/a	n/a
1993	no fishery held	n/a	n/a
1994	no fishery held	n/a	n/a
1995	no fishery held	n/a	n/a
1996	no fishery held	n/a	n/a
1997	2,217	10,876	434
1998	no fishery held	n/a	n/a
1999	no fishery held	n/a	n/a
2000	1,773	9,400	868
2001	9,963	53,208	6,082
2002	13,660	75,946	6,844

3.4) Relationship to habitat protection and recovery strategies.

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

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

We considered hatchery water withdrawal in the South Fork Salmon River to have no effect upon listed salmon. Water is only temporarily diverted from the river on a seasonal basis (June 1, through September 15) for holding and spawning adults. The annual average use of water is 9 to 12 cfs. We have not observed dewatered redds as a result of water diversion.

There is no gauge station at the South Fork Salmon River weir to allow determination of the amount of river flow diverted. Chinook salmon juveniles are found in the vicinity of the intake so we assume that water volume is sufficient for chinook salmon rearing and that water diversion is not detrimental. We believe that flows during summer chinook salmon release operations are sufficient for all life history stages of listed species in the short stretches of river between where water is extracted and returned.

We considered hatchery discharge to have no effect on listed salmon and steelhead because discharge from adult holding ponds is consistently within NPDES standards.

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

Potential adverse effects to listed salmon could occur from the release of hatchery-produced summer chinook juveniles through the following interactions: predation, competition, behavior modification, and disease transmission.

There are potential adverse effects to listed adult summer chinook salmon and their progeny from the release of hatchery summer chinook salmon upstream of the South Fork Salmon River weir for natural spawning. None will result in direct mortality of adults. These effects include: changes in fitness, growth, survival and disease resistance of the listed population. The effects may result in decreased productivity or long-term adaptability (Kapuscinski and Jacobson 1987; Bowles and Leitzinger 1991). These changes are more likely when the hatchery and natural stocks are not genetically similar or locally adapted. However, some increase in natural production can be expected when hatchery-reared fish are sufficiently similar to wild fish and natural rearing habitats are not at capacity (Reisenbichler 1983). We believe this is the case with the South Fork Salmon River recognizing that releasing hatchery summer chinook salmon to spawn naturally can increase natural production, but not necessarily productivity.

From the work of Sankovich and Bjornn (1992), it appears that hatchery adults released upstream of the South Fork Salmon River weir spawn with listed summer chinook salmon. By trucking many of the hatchery fish to Stolle Meadows in 1992 and 1993, we minimized the interaction, although some adults released at the weir did move upstream to Stolle Meadows in 1994. Currently, the IDFG is summarizing the results of outplanting work continued through 1996. Preliminary results suggest that progeny of trucked adults develop a fidelity to spawn in ideal upstream locations on the South Fork Salmon River. Subsequent generations of natural adults have exhibited similar spawning site fidelity. Bowles and Leitzinger (1991) stated that introduction of locally adapted adults appears to minimize negative interaction potential between their offspring and offspring of wild fish. The IDFG (in cooperation with NMFS) has developed criteria to avoid totally swamping natural production with hatchery fish (the 50:50 guideline). However, we believe that returning hatchery reserve adults must continue to play a role in natural production, particularly in under-escaped years.

Sankovich and Bjornn (1992) concluded that the native South Fork Salmon River run has been integrated into the hatchery with most fish having some hatchery lineage influence. They also determined that spawning times for hatchery and natural fish were similar. Their work suggested that neither hatchery or natural adults were restrictive in mate selection, although they did not witness many spawning acts. Sankovich and Bjornn (1992) also concluded that though hatchery adults appeared slightly longer at a given age than natural adults (1 to 2 cm difference), the differences were not such that hatchery fish would have a reproductive advantage in terms of fecundity or competition for mates. Waples et al. (1991) found little evidence of genetic change in brood years 1981 – 1982 and brood year 1988 summer chinook salmon tissue samples from the McCall Fish Hatchery. Their interpretations, applied to the combined hatchery/wild population, was that effective population size was not too small and that straying and transfers of genetically distinct stocks into the hatchery were not an important factor during the 1981 – 1988 period. The hatchery has not been managed as a closed population as broodstock have been developed from a mixture of hatchery and naturally produced adults. Genetically, the McCall Fish Hatchery summer chinook salmon clustered closely with Secesh drainage chinook salmon, which have been managed as a native, summer-run population. Our assumption is that both production components of the South Fork Salmon River summer chinook salmon run are genetically similar.

There is potential that returning hatchery-produced adults pose a genetic risk to listed salmon by straying. Strays or wandering adults may spawn with natural adults. This is most likely to occur just below the South Fork Salmon River weir. The primary risk associated with straying is loss of genetic diversity due to genetic drift (Bowles and Leitzinger 1991). In the South Fork Salmon River, this risk is minimized due to the fact that broodstock for this program were sourced from locally adapted wild fish (Waples et al. 1991).

Idaho Department of Fish and Game information collected from PIT and coded wire tags indicate that hatchery-produced adults of McCall Hatchery origin rarely, if at all, are identified at other stream or hatchery locations.

The IDFG does not believe that the release of juvenile summer chinook salmon in the South Fork Salmon River will affect listed sockeye salmon in the free-flowing migration corridor. Adults and juveniles of these two runs of salmon are temporally and spatially separated with juvenile sockeye having a later outmigration timing than summer chinook salmon released in April. The NMFS (1994) agreed that there appeared to be some separation in run timing in the migration corridor, which would minimize effects to listed sockeye salmon.

Although it is possible that both hatchery-produced summer chinook salmon smolts and fall chinook salmon fry could be present in the Snake River at the same time, we believe that hatchery smolts released in late March and April will be out of the Snake River production area when fall chinook salmon emerge in late April and early May (IFRO 1992). Because of their larger size, summer chinook salmon smolts migrating through the lower Salmon and Snake rivers will probably be using different habitat than emerging fall chinook salmon fry (Everest 1969). Thus, we assume that there is no effect to fall chinook salmon juveniles in the production area or free-flowing migration corridor from the LSRCP summer chinook salmon releases in the South Fork Salmon River. Fall chinook salmon adults would be temporally and spatially separated from summer chinook salmon adults returning from the release as well.

Unlisted, reserve summer chinook salmon smolts are spatially separated from listed species during early rearing. Therefore, effects are possible only in the migration corridor, primarily with listed spring/summer chinook salmon and steelhead. Wild chinook salmon fry are just beginning to emerge from the gravel during the release period and few would be available as food to hatchery chinook salmon smolts.

Hatchery-produced smolts are spatially separated from listed species during early rearing so effects are likely to occur only in the migration corridor after release. Perry and Bjornn (1992) documented that natural, chinook salmon fry movement in the upper Salmon river began in early March, peaked in late April, and early May, and then decreased into the early summer as the fish grew to parr size. Average mean length of spring chinook salmon fry ranged from 32.9 – 34.9 mm through late April in the upper Salmon River. Mean fry size increased to 39.8 mm by mid-June (Perry and Bjornn 1992). Assuming that hatchery-produced chinook salmon smolts could feed on prey up to 1/3 of their body length, natural fry would be in a size range to be potential prey. However, emigration from release sites generally occurs within a few days and the IDFG does not believe that hatchery-produced smolts would convert from a hatchery diet to a natural diet in such a short time (USFWS 1992, 1993). Buettner and Nelson (1990, 1991) reported travel times for freeze-branded hatchery-produced summer chinook salmon juveniles released in the South Fork Salmon River to their Snake River smolt trap. They reported migration times ranging from five to 18 miles per day (eight to 29 km per day). At these migration rates, hatchery-product smolts would quickly leave the South Fork Salmon River production area. Additionally, the IDFG is unaware of any literature that suggests that juvenile chinook salmon are piscivorous.

The release of a large number of prey items, which may concentrate predators, has been identified as a potential effect on listed salmon and steelhead. Hillman and Mullan (1989) reported that predaceous rainbow trout (>200 mm) concentrated on wild salmon within a moving group of hatchery-produced age-0 chinook salmon juveniles. Releasing fish over a number of days is expected to minimize the risk associated with this situation.

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

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

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

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

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

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

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

Bacterial kidney disease and other diseases can be horizontally transmitted from hatchery fish to natural, listed species. However, in a review of the literature, Steward and Bjornn (1990) stated that there was little evidence to suggest that horizontal transmission of disease from hatchery-produced smolts to natural fish is widespread in the production area or free-flowing migration corridor. However, little additional research has occurred in this area. Hauck and Munson (IDFG, unpublished) stated that hatcheries with open water supplies (river water) may derive pathogen problems from natural populations. The hatchery often promotes environmental conditions favorable for the spread of specific pathogens. When liberated, infected hatchery-produced fish have the potential to perpetuate and carry pathogens into the wild population.

The IDFG monitors the health status of hatchery-produced summer chinook salmon from the time adults are ponded at the South Fork Salmon River weir until juveniles are released as pre-smolts or smolts. Sampling protocols follow those established by the PNFHPC and AFS Fish Health Section.

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

SECTION 4. WATER SOURCE

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

McCall Fish Hatchery **–** The hatchery receives water through an underground 36 inch gravity line from Payette Lake. Water may be withdrawn from the surface or up to a depth of 50 ft. The IDFG has an agreement with the Payette Lake Reservoir Company to withdraw up to 20 cfs.

South Fork Salmon River Weir **–** The weir receives water directly from the South Fork Salmon River. Water is supplied through a 33 inch underground pipeline.

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

The intake screens are in compliance with NMFS screen criteria by design of the Corp of Engineers.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Adult summer chinook salmon are collected at the South Fork Salmon River weir. The facility consists of a removable weir, fish ladder, trap, two adult holding ponds (10 ft x 90 ft), and a covered spawning area. The holding capacity for the facility is approximately 1,000 adult salmon. Adults are collected and spawned at this facility. Fertilized eggs are transported to the McCall Fish Hatchery for incubation, hatch, and rearing through release.

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

The following transportation equipment is available for use by the Clearwater Fish Hatchery:

1. 10 wheel smolt transport truck fitted with three 1,000 gallon compartments supplied with oxygen and fresh flow agitator systems.

2. Two ton, 1,000 gallon tank with oxygen and fresh flows.

5.3) Broodstock holding and spawning facilities.

McCall Fish Hatchery – No adult holding occurs at the main hatchery facility.

South Fork Salmon River Weir – Adult summer chinook salmon are collected at the South Fork Salmon River weir. The facility consists of a removable weir, fish ladder, trap, two adult holding ponds (10 ft x 90 ft), and a covered spawning area. The holding capacity for the facility is approximately 1,000 adult salmon. Adults are collected and spawned at this facility. Fertilized eggs are transported to the McCall Fish Hatchery for incubation, hatch, and rearing through release.

5.4) Incubation facilities.

The McCall Fish Hatchery has 26 eight-tray vertical incubation stacks (Heath-type) available for incubating eggs.

5.5) Rearing facilities.

Rearing facilities at the McCall Fish Hatchery include 14 concrete vats (4 ft wide x 40 ft long x 2 ft deep) used for early rearing, two concrete ponds (4 ft wide x 196 ft long x 4 ft deep) used for intermediate rearing, and one concrete collection basin (15 ft wide x 101 ft long x 4 ft deep).

5.6) Acclimation/release facilities.

Smolts are transported and released into the South Fork Salmon River at Knox Bridge. Releases occur in early April. River water is pumped into transport vehicles where fish acclimate for a short period of time. Smolt releases take place over a period of four to five days.

Parr may be released to an acclimation pond in Stolle Meadows (South Fork Salmon River) during summer months. Fish remain in the pond through winter and volitionally out-migrate through the following spring.

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

No significant mortality associated with this program has occurred.

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

McCall Fish Hatchery – The McCall Fish Hatchery water supply operates on a gravity flow principal from Payette Lake. The hatchery has a flow alarm installed that automatically dials an emergency provider that notifies hatchery personnel when flow is interrupted. An emergency generator in installed to accommodate periods of power interruption.

South Fork Salmon River Weir – No flow alarms are installed at this adult collection and holding facility. During periods of the year when adult chinook salmon are being held, the facility is permanently staffed.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

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

6.1) Source.

The program was founded with adult summer chinook salmon collected between 1974 and 1979 at Ice Harbor, Little Goose, and Lower Granite dams. Adults were collected from the summer run period at the dams to collect fish that were locally adapted to the South Fork Salmon River. Early collections established an egg bank program prior to the completion of the hatchery. Between 1976 and 1980, smolts produced from these early collections were planted in the South Fork Salmon River upstream of the present location of the weir. Since 1981, all adults used for broodstock purposes have been collected at the South Fork Salmon River weir.

6.2) Supporting information.

6.2.1) History.

See Section 6.1 above.

6.2.2) Annual size.

Approximately 380 females and 760 males are needed annually to produce to meet smolt production targets.

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

Summer chinook salmon adult return numbers (natural-origin and hatchery-origin) for the McCall Fish Hatchery are presented in the following table. Beginning in 1995, hatchery-origin and natural-origin adults were identifiable based on marks.

Return Year	McCall Fish Hatchery Total Returns (Hatchery-Produced/Natural)	Total Spawned (H/N)	Total Males Spawned (H/N)	Total Females Spawned (H/N)
1995	307 (269/38)	171 (159/12)	114 (106/8)	57 (53/4)
1996	1,199 (1,042/157)	333 (303/30)	222 (202/20)	111 (101/10)
1997	3,659 (3,371/288)	1,689 (1,587/102)	1,126 (1,058/68)	563 (529/34)
1998	974 (822/152)	897 (807/90)	598 (538/60)	299 (269/30)
1999	1,961 (1,670/291)	1,281 (1,212/69)	854 (808/46)	427 (404/23)
2000	6,812 (6,093/719)	1,083 (1,032/51)	722 (688/34)	361 (344/17)
2001	10,922 (9,144/1,778)	1,251 (1,221/30)	834 (814/20)	417 (407/10)
2002	8,603 (7,322/1,281)	1,143 (1,029/114)	762 (686/76)	381 (343/38)

6.2.4) Genetic or ecological differences.

The following excerpt was taken from:

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

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

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

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

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

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

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

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

Some studies have indicated that Snake River spring- and summer-run chinook salmon have reduced levels of genetic variability. Utter et al. (1989) estimated gene diversities with 25 polymorphic loci for 65 population units and found that gene diversities in the Snake River were lower than those in the Columbia River. Winans (1989) estimated levels of gene diversity with 33 loci for spring-, summer-, and fall-run chinook salmon at 28 localities in the Columbia River Basin. Fall-run chinook salmon tended to have significantly greater levels of gene diversity ($N=12$, mean $H=0.081$) than both spring- ($N=17$, $H=0.065$) and summer-run ($N=3$, mean $H=0.053$) chinook salmon. Spring-run fish in the Snake River had the lowest gene diversities ($N=4$, mean $H=0.044$). However, Waples et al. (1991a) found that, with a larger sample of 65 loci, gene diversities in

Snake River spring-run and summer-run chinook salmon were not as low as that suggested by earlier studies.

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

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

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

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

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

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

6.2.5) Reasons for choosing.

The South Fork Salmon River endemic summer chinook salmon stock was used to found this program. Reasons for choosing include: availability, and local adaptability.

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

The selection of natural-origin adults for broodstock purposes conforms with federal ESA permit and biological opinion language. Annually, escapement targets are prioritized to insure that a minimum number of natural-origin adults escape to spawn. Similarly, the release hatchery-origin adults in natural production areas is managed.

SECTION 7. BROODSTOCK COLLECTION

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

Adult chinook salmon are collected for this program. Three groups of chinook salmon adults are collected at the McCall Fish Hatchery weir: natural (unmarked), supplementation (CWT marked or ventral fin clipped) and hatchery reserve (adipose fin-clipped). Supplementation broodstocks have been developed at the McCall Fish Hatchery as part of the cooperative Idaho Supplementation Studies project and are developed according to ISS genetic criteria.

7.2) Collection or sampling design.

Natural escapement criteria drives the selection process. Typically, this entails releasing a minimum of natural females, adult males and jack returns above the South Fork Salmon River weir to spawn naturally. The component of the adult return released above the weir to spawn may include up to 50% of hatchery or supplementation origin Surplus supplementation adult returns will be passed *over* the weir to supplement natural production up to natural equivalents. Supplementation adults surplus to management criteria for the South Fork Salmon River may be utilized for other purposes such as outplanting. Juvenile targets of supplementation broodstock are estimated to match natural smolt production upstream of the weir

7.3) Identity.

All harvest mitigation hatchery-produced fish are marked with an adipose fin clip and are progeny of hatchery x hatchery crosses. Releases for supplementation programs may be marked with a pelvic fin clip or CWT and no fin clip.

7.4) Proposed number to be collected:

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

Approximately 380 female and 760 male chinook salmon are needed annually to meet state and federal production objectives for the McCall Fish Hatchery.

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

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

McCall Fish Hatchery broodstock collection history.

Return Year	McCall Fish Hatchery Total Returns (Hatchery-Produced/Natural)	Total Spawned (H/N)	Total Males Spawned (H/N)	Total Females Spawned (H/N)
1995	307 (269/38)	171 (159/12)	114 (106/8)	57 (53/4)
1996	1,199 (1,042/157)	333 (303/30)	222 (202/20)	111 (101/10)
1997	3,659 (3,371/288)	1,689 (1,587/102)	1,126 (1,058/68)	563 (529/34)
1998	974 (822/152)	897 (807/90)	598 (538/60)	299 (269/30)
1999	1,961 (1,670/291)	1,281 (1,212/69)	854 (808/46)	427 (404/23)

2000	6,812 (6,093/719)	1,083 (1,032/51)	722 (688/34)	361 (344/17)
2001	10,922 (9,144/1,778)	1,251 (1,221/30)	834 (814/20)	417 (407/10)
2002	8,603 (7,322/1,281)	1,143 (1,029/114)	762 (686/76)	381 (343/38)

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

The disposition of surplus, hatchery-origin chinook salmon could include the sacrifice of fish and the distribution of carcasses to the tribes or to human assistance organizations for subsistance. In addition, surplus fish may be released in South Fork Salmon River tributary locations where potential interaction with natural spawners is expected to be minimal to non existent (e.g., East Fork of the South Fork Salmon River) or spawned to produce eggs for the Shoshone-Bannock Tribes experimental egg box program.

7.6) Fish transportation and holding methods.

Adult summer chinook salmon are trapped and spawned at the South Fork Salmon River trap site. Fish are held in two 10 ft wide x 90 ft long holding ponds. Trapped adults are sorted, checked for mark types, and separated by sex.

7.7) Describe fish health maintenance and sanitation procedures applied.

Fish receive routine treatments with formalin (167 ppm) to control the spread of fungus. At spawning, eggs from females exhibiting gross clinical signs of bacterial kidney disease may be culled. Tissue is sampled from each female spawned and analyzed for viral pathogens and for the causative agent responsible for bacterial kidney disease.

7.8) Disposition of carcasses.

Carcasses that result from adult holding and spawning are returned to the river (both upstream and downstream of the weir) or disposed of in a landfill.

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

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

SECTION 8. MATING

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

8.1) Selection method.

Spawning protocols at the McCall Fish Hatchery follow plans developed annually (pursuant to ESA Section 7 and Section 10 language) to maintain a hatchery-reserve component and a supplementation component. Female spring chinook salmon are sorted two times per week. Generally, two spawn days occur each week. Males are randomly selected for spawning on each spawning day.

As each male is spawned it receives an opercle punch and is placed back into the holding pond. Males are generally not used more than two times. Every effort is made to use all returning fish for spawning during the spawning year. At least five to ten percent of the jacks will be used during the spawning process.

8.2) Males.

See Section 8.1.

8.3) Fertilization.

A spawning ratio of two males to one female is used. Each female sub-family is fertilized using a different male. Following fertilization, sub-family eggs are recombined into one container, disinfected in 100 ppm Iodophor for 60 minutes, and packed in perforated egg tubes for transportation to incubator stacks at the McCall Fish Hatchery.

8.4) Cryopreserved gametes.

Milt is not cryopreserved as part of this program and no cryopreserved gametes are used in this program. However, the Nez Perce Tribe may harvest milt for their gamete preservation program.

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

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

SECTION 9. INCUBATION AND REARING -

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

9.1) Incubation:

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

The original Lower Snake River Compensation Program production target of 8,000 adults back to the project area upstream of Lower Granite Dam was based on a smolt-to-adult survival rate of 0.8 to 0.87%. With the exception of return year 2000 and 2001, the program has not met its adult return target. This is not due to lower than expected "in-hatchery" performance. Typically, egg survival to the eyed stage of development averages 80% or better for the McCall Fish Hatchery. Survival from ponding to release is typically greater than 80%. Egg survival information is presented in the following table.

Spawn Year	Green Eggs Taken	Eyed-eggs	Survival to Eyed Stage (%)
1992	1,428,819	1,220,600	85.4
1993	1,731,515	1,584,938	91.5
1994	689,039	607,733	88.2
1995	238,344	n/a	n/a
1996	486,644	436,509	89.7
1997	1,970,644	1,698,695	86.2
1998	1,433,237	1,053,017	73.5
1999	1,624,771	1,359,934	83.7
2000	1,487,809	1,149,313	77.3
2001	1,793,667	1,139,385	63.5
2002	1,683,642	1,469,819	87.3

Note: Survival to the eyed-stage of development data presented in the above table includes losses experienced from culling eggs for the management of BKD. As an example, in spawn year 2001, 1,793,667 green eggs were taken; 361,301 were picked as bad, and 270,523 eggs from females with high ELISA O.D. values were culled. The survival to eye value presented was calculated by adding the bad and culled egg total and dividing by the total number of green eggs taken. Therefore, egg survival information presented above may be lower than what was actually experienced.

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

Surplus eggs may be generated (~ 10% above need) to provide a buffer against culling associated with the presence of bacterial kidney disease.

9.1.3) Loading densities applied during incubation.

Fertilized chinook salmon eggs are loaded in incubation trays at densities not to exceed 9,000 eggs per tray. If chinook salmon spawn targets are met (number of females spawned), eggs produced from crossing hatchery-reserve adults (adipose fin-clipped) are typically loaded in trays at a density of two females per tray. Eggs produced from crossing supplementation and natural adults are loaded at a density of one female per tray. This protocol is followed to better accommodate BKD culling criteria.

9.1.4) Incubation conditions.

The McCall Fish Hatchery has 26 eight-tray vertical incubation stacks (Heath-type) available for incubating eggs. In years where hatchery spawn targets are met (number of females spawned), eggs are typically loaded in incubation trays at densities not to exceed 9,000 eggs per tray. In years where spawn targets are not met, eggs from single females are typically loaded in incubator trays. Incubator flows are set at 5 to 6 gpm. Eggs typically reach the eyed-stage of development at approximately 600 Fahrenheit temperature units (FTUs).

9.1.5) Ponding.

Fry are typically ponded in hatchery vats approximately three days prior to initial feeding. Initial feeding typically occurs when 1,750 to 1,775 FTUs have been accumulated. Water flow to vats is set at approximately 80 gpm. Vats are initially loaded with between 30,000 and 35,000 fry. Fry are initially held in half-vat sections. When density indices (DI) reach between 0.30 and 0.35 (Piper et al. 1982), half-vat screens are pulled.

9.1.6) Fish health maintenance and monitoring.

Following fertilization, eggs are typically water-hardened in a 100 ppm Iodophor solution for up to 60 minutes. During incubation, eggs routinely receive scheduled formalin treatments to control the growth of fungus. Treatments are typically administered three times per week at a concentration of 1667 ppm active ingredient. Formalin treatments are discontinued prior to hatching. Prior to hatching, dead eggs are picked on a regular schedule (approximately 2 times per week) to discourage the spread of fungus.

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

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

9.2) <u>Rearing</u>:

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

Brood Year	Eyed-Eggs	Number of Fry Ponded to Vats (% survival from eye)	Number of Fingerlings Transferred From Vats to Raceways (%	Number of Smolts Released	Percent Survival From Eyed-Egg to

			survival from eye)		Release
1990	1,020,284	n/a	n/a	901,500	88.4
1991	n/a	n/a	n/a	n/a	n/a
1992	1,220,600	n/a	n/a	1,060,158	86.9
1993	1,584,938	1,341,332 (84.6)	1,091,989 (68.9)	1,074,598	67.8
1994	607,733	594,114 (97.8)	n/a	585,654	96.4
1995	250,599	246,840 (98.5)	239,263 (95.5)	238,647	95.2
1996	436,509	402,235 (92.1)	401,992 (92.1)	393,872	90.2
1997	1,698,695	1,447,670 (85.2)	1,340,370 (78.9)	1,142,036	67.2
1998	1,053,017	1,048,092 (99.5)	n/a	1,039,930	98.8
1999	1,359,934	1,347,660 (99.1)	n/a	1,286,404	94.6
2000	1,149,313	1,113,260 (96.9)	1,066,093 (92.8)	1,064,250	92.6

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

At the swim-up stage of development, unfed fry are moved to inside vats and distributed as evenly as possible (typically 30,000 to 35,000 fish per vat at ponding). Density (DI) and flow (FI) indices are maintained to not exceed 0.30 and 1.5, respectively (Piper et al. 1982).

9.2.3) Fish rearing conditions

Early rearing space consists of 14 concrete vats. Each vat measures 40 ft long x 4 ft wide x 2 ft deep and contains 320 cubic feet of rearing space. During early rearing, vats are cleaned daily and dead fish removed.

Fish are transferred to outside rearing ponds (two ponds 196 ft long x 40.5 ft wide x 4 ft deep) in early May and early July. Generally, transfer to outside rearing ponds occurs concurrently with fin clipping and tagging. Design capacity for outside rearing ponds is 500,000 fish per pond. Density and flow indices generally average less than 0.3 and 1.5, respectively. During final rearing, outside raceways are cleaned every other day but dead fish are removed daily.

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

Juvenile spring chinook salmon are sample-counted monthly. Fish length and weight are recorded. Condition factor and conversion rate are calculated. See Table in Section 9.2.5 below.

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

First year growth information (monthly length increase) for spring chinook salmon reared at the McCall Fish Hatchery are presented below.

Month in Culture	Growth Increase Per Month (mm)
January	2.1
February	2.5
March	2.6
April	5.0
May	10.2
June	12.7
July	15.3
August	17.7
September	10.2
October	5.1
November	5.1
December	5.0
January	2.6
February	0
March	2.5

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

During early rearing, summer chinook fry are fed a starter and grower diets produced by BioOregon. During final rearing in outside raceways, summer chinook salmon are fed BioOregon's grower diet. Specific hatchery variables are presented in the following table.

Month	Water Temp (ºC)	Fish Length (mm)	Percent Body Weight Fed Per Day	Conversion Rate
December	4.3	36.0	0.9	4.4
January	3.4	38.1	1.3	3.7
February	3.3	40.6	1.4	1.8
March	3.4	43.2	1.6	1.7
April	3.8	48.2	1.7	1.5
May	5.7	58.4	1.7	1.2
June	8.8	71.1	2.0	1.0
July	11.5	86.4	2.1	1.3
August	11.1	104.1	2.1	1.4
September	9.5	114.3	1.3	1.6
October	7.9	119.4	0.9	2.1
November	6.6	124.5	0.6	1.9
December	4.3	129.5	0.3	1.6

January	3.4	132.1	0.2	2.4
February	3.3	132.1	0.2	2.5
March	3.4	134.6	0.2	n/a

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

At spawning, all summer chinook salmon are screened for bacterial and viral pathogens. Eggs from females positive for bacterial kidney disease *Renibacterium salmoninarum* (BKD) are culled to an acceptable risk level established annually by all stakeholders.

During rearing at the McCall Fish Hatchery, regular fish health inspections are conducted. If disease agents are suspected or identified, more frequent inspections will be conducted. Recommendations for treating specific disease agents comes from the Idaho Department of Fish and Game Fish Health Laboratory in Eagle, ID.

Prior to release, the Eagle Fish Health Laboratory conducts a final pre-release fish health inspection.

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

No smolt development indices are developed in this program.

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

No semi-natural or natural rearing objectives are applied during chinook salmon incubation or rearing at the McCall Fish Hatchery. The Stolle Meadows acclimation ponds is used for some but not all juveniles released from this program.

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

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

SECTION 10. RELEASE

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

10.1) Proposed fish release levels.

The following release levels are proposed for release year 2003.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry				
Fingerling	60,000	125	July	Stolle Meadows Pond
Yearling	1,025,000	20	March/April	South Fork Salmon River Knox Bridge

10.2) Specific location(s) of proposed release(s).
Stream, river, or watercourse:

Release point: (*river kilometer location, or latitude/longitude*)
Major watershed: (e.g. "Skagit River")
Basin or Region: *(e.g. "Puget Sound")*

Stream: South Fork Salmon River (Knox Bridge)
Release Point (EPA Number): 17060208
Major Watershed: South Fork Salmon River
Basin or Region: Snake River

Stream: South Fork Salmon River (Stolle Meadows Pond)
Release Point (EPA Number): 17060208
Major Watershed: South Fork Salmon River
Basin or Region: Snake River

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

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1991					0	n/a	708,600	23.8
1992					0	n/a	901,500	23.8
1993					0	n/a	607,298	17.87
1994					51,163	n/a	1,060,163	25.58
1995					0	n/a	1,074,598	21.8
1996					0	n/a	559,226	17.87
1997					24,990	193.9	238,647	18.65

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1998					48,376	149.7	393,873	17.50
1999					0	n/a	1,143,083	23.90
2000					54,234	n/a	1,039,930	23.30
2001					46,981	101.0	1,286,404	19.4
2002					61,800	125.0	1,064,250	22.97
Average							839,798	21.00

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

Release data information by life stage is presented for the most recent five-year period in the following table.

Brood Year	Release Year	Life Stage	Release Dates
1995	1997	Yearling	3/19 – 3/21/97
1996	1997	Fingerling	7/7 – 7/10/97
1996	1998	Yearling	3/29 – 4/6/98
1997	1998	Fingerling	no data
1997	1999	Yearling	4/5 – 4/8/99
1998	2000	Yearling	4/3 – 4/6/00
1999	2000	Fingerling	7/23 – 7/31/00
1999	2001	Yearling	3/27 – 3/29/01
2000	2001	Fingerling	7/20/01
2000	2002	Yearling	3/25 – 3/28/02

10.5) Fish transportation procedures, if applicable.

All fish reared at the McCall Fish Hatchery are transported off station for release in the South Fork Salmon River at Knox Bridge or to Stolle Meadows Pond for acclimation prior to release to the South Fork Salmon River. Fish are loaded into transport trucks using a Magic Valley Heliarc fish pump. The loading density guideline for transport vehicles is ½ pound per gallon of water. The transport tanks are insulated to maintain good temperature control. Each tank is fitted with an oxygen system and fresh flow agitators. Maximum transport time is approximately 1 hour.

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

Up to approximately 100,000 juvenile summer chinook salmon may be acclimated annually in Stolle Meadows Pond. During the peak outmigration period, outlet screens are removed to allow fish to migrate volitionally. Following the volitional emigration period, the dam boards are removed and fish remaining in the ponds are forced out.

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

All harvest mitigation fish are marked with an adipose fin clip. To evaluate emigration success and out-migration timing to meet state fisheries management needs, approximately 2,000 PIT tags are inserted in McCall Fish Hatchery release groups annually. Currently, a multi-year comparative survival rate study is underway (Berggren and Basham 2000) to collect additional out-migration to adult survival information. As part of this program, approximately 55,000 additional hatchery mitigation smolts are PIT tagged annually. As part of U.S. v. Canada quidelines, approximately 300,000 smolts are coded wire tagged annually. In addition, fish released to satisfy IDFG and cooperator supplementation studies project design are 100% coded wire tagged. Supplementation juveniles may be ventral fin clipped or 100% CWT tagged with no fin clip. Other studies may dictate additional evaluation marks.

Nez Perce Tribal supplementation juveniles reared at the McCall Fish Hatchery and released in Johnson Creek are typically 100% coded wire tagged and visual implant tagged. Approximately 10,000 PIT tags are inserted in tribal fish annually. Tribal fish are not fin clipped.

The number of juveniles produced to meet IDFG and cooperator supplementation studies objectives may change from year to year. Annual in-season brood stock planning is adapted to actual adult returns for each brood year. The following table reviews the proportion of summer chinook salmon produced at the McCall Fish Hatchery that have been dedicated to supplementation or production strategies for the past five years. As mentioned above, supplementation juveniles are not marked with an adipose fin clip; coded-wire tags and ventral fin clips may used to evaluate adult returns. Supplementation release groups are generally developed from natural x natural or natural x hatchery crosses. Harvest mitigation fish are developed from hatchery x hatchery crosses and are 100% adipose fin-clipped. It is important to note that a combination of evaluation tools including: dam counts, hatchery rack returns, harvest, and spawning ground surveys are used to reconstruct runs and estimate the total, annual contribution LSRCP hatchery programs are making. (see Attachment 1. for a review of the Idaho Supplementation Studies project).

The proportion of fish marked to meet IDFG and LSRCP mitigation and supplementation objectives for the most recent five-year period is presented in the following table.

Brood year	Proportion of annual production dedicated to IDFG supplementation programs	Proportion of annual production dedicated to IDFG and LSRCP harvest mitigation programs (100% ad fin-clipped)
McCall Fish Hatchery spring chinook salmon		

2000	8.0%	92.0%
1999	10.6%	89.4%
1998	18.7%	81.3%
1997	24.8%	75.2%
1996	11.5%	88.5%

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

Adults may be utilized for fishery recycling, tribal, and non tribal subsistence use. Adults may also be outplanted into production areas that do not conflict with other programs or management. Gametes may be generated for tribal programs such as the Shoshone-Bannock Tribes experimental egg box program.

10.9) Fish health certification procedures applied pre-release.

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

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

Emergency procedures are in place to guide activities in the event of potential catastrophic event. Plans at the McCall Fish Hatchery include a trouble shooting and repair process followed by the implementation of an emergency action plan if the problem can not be resolved. Emergency actions include fish consolidations and supplemental oxygenation. The final emergency action is to release early to the South Fork Salmon River.

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

Actions taken to minimize adverse effects on listed fish include:

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

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

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

4. Continuing to reduce effect of the release of large numbers of hatchery chinook salmon at a single site by spreading the release over a number of days by trucking strategy or volitional release from ponds.

5. Attempting to program time of release to mimic natural fish for South Fork Salmon hatchery reserve releases.

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

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

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

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

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

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

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

Document LSRCP fish rearing and release practices.

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

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

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

Performance Standards and Indicators: 3.1.1,3.1.2, 3.1.3, 3.2.1, 3.2.2, 3.3.1, 3.3.2, 3.4.3, 3.4.4, 3.5.1, 3.5.2, 3.5.3, 3.5.4, 3.5.5, 3.5.6, 3.6.1, 3.6.2, 3.7.6, 3.7.7, 3.7.8

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

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

Performance Standards and Indicators: 3.6.1, 3.6.2

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

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

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

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

Risk aversion measures for research activities associated with the evaluation of the Lower Snake River Compensation Program are specified in our ESA Section 7 Consultation and Section 10 Permit 1124. A brief summary of the kinds of actions taken is provided.

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

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

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

Marking and tagging activities are designed to protect ESA-listed species and allow mitigation harvest objectives to be pursued/met. All McCall Fish Hatchery mitigation summer chinook salmon are visibly marked to differentiate them from their wild/natural counterpart.

SECTION 12. RESEARCH

12.1) Objective or purpose.

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

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

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

Continuous coordination between the hatchery evaluation study and Idaho Department of Fish and Game's BPA-funded supplementation research project is required because these programs overlap in several areas for different species including: juvenile outplanting, broodstock collection, and spawning (mating) strategies. Readers are referred to Attachment 1. for a review of the IDFG supplementation studies project.

12.2) Cooperating and funding agencies.

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

U.S. Forest Service

Nez Perce Tribe.

Shoshone Bannock Tribes.

12.3) Principle investigator or project supervisor and staff.

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

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

N/A

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

Research techniques associated with the operation of the McCall Fish Hatchery summer chinook salmon program involve: hatchery staff; LSRCP hatchery evaluation, and coded-wire tag laboratory staff; Idaho supplementation studies staff, and IDFG regional fisheries management staff.

Hatchery staff routinely investigate hatchery variables (e.g., diet used, ration fed, vat or raceway environmental conditions, release timing, size at release, acclimation, etc.) to improve program success. Hatchery-oriented research generally involves the cooperation of LSRCP hatchery evaluation staff. In most cases, PIT and coded-wire tags are used to measure the effect of specific treatments. The IDFG works cooperatively with the Nez Perce Tribe and the U.S. Fish and Wildlife Service to develop annual mark plans for summer chinook salmon juveniles produced at the McCall Fish Hatchery. Cooperation with regional harvest monitoring and LSRCP coded-wire tag laboratory staff is required to thoroughly track the distribution of tags in adult salmon. Generally, most hatchery-oriented research occurs prior to the release of fall pre-smolt or spring smolt groups. As such, no field trapping occurs.

Regional harvest monitoring staff assemble information on chinook salmon sport fisheries. Estimates of harvest, pressure, and catch per unit effort are developed in years when sport fisheries occur. The contribution LSRCP-produced fish make to the fishery is also assessed.

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

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

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

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

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

Juvenile out-migration is monitored during fall, spring, and summer trapping seasons in Idaho. Out-migration through the hydro system corridor is typically monitored from March through December. Juvenile chinook salmon population abundance and density is monitored during late spring and summer months. Juvenile tagging and marking occurs during late summer, fall, and spring periods of movement. The PSMFC PIT Tag Information System is queried on a year-round basis to retrieve juvenile PIT tag information.

Fish health monitoring occurs year round.

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

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

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

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

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

See Table 1.

12.10) Alternative methods to achieve project objectives.

Alternative methods to achieve research objectives have not been developed.

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

N/A.

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

See Section 11.2 above.

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Attachment 1.

The following excerpts were taken from:

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

Note: as this information first appeared in the original 1991 experimental design document for this program, some information may be outdated. The text has not been modified.

Study Streams

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

General Criteria

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

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

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

- Supplementation strategies (e.g.. broodstock, rearing and release techniques) should be selected to maximize compatibility and introgression with the natural stock and minimize reduction in natural productivity. Harvest augmentation strategies should be selected to maximize adult returns for harvest and minimize interaction/introgression with natural populations.
- Success of hatchery supplementation programs are dependent upon our ability to circumvent some early life history mortality without compromising natural selective processes or incurring hatchery selective mortality. Supplementation programs should be designed to minimize mortality events operating randomly (non-selective) and duplicate mortality events operating selectively on chinook in the natural environment. This, in essence, is the only role of a supplementation hatchery, to reduce random mortality effects in order to produce a net gain in productivity.
- Although our experimental design does not pursue the above assumption vigorously, we encourage implementation of hatchery practices in an adaptive framework to investigate this assumption. Some of this will be initiated in our small-scale studies, or through the LSRCP Hatchery Evaluation Study. Careful design, monitoring and evaluation with treatment and control groups will be necessary to avoid confounding our study results.
- In areas with existing (target) natural populations, we recommend supplementation should not exceed a 50:50 balance between hatchery and natural fish spawning or rearing in the target streams. Under this criteria, supplementation programs are driven by natural fish escapement or rearing abundance, not necessarily hatchery fish availability. Adherence to this criteria results in a slow, patient supplementation approach when existing stocks are at only 10% to 20% carrying capacity, which is typical in Idaho. This concept is nothing new and is promulgated in the IDFG Anadromous Five Year Plan (IDFG 1991) and Oregon's Wild Fish Management Policy (Oregon Administrative Rule 635-07-525 through 529).
- In areas with existing natural populations, we recommend supplementation broodstocks incorporate a relatively high proportion (~40%) of natural fish selected systematically from the target stock. This approach will minimize domestication effects and naturalize hatchery fish as quickly as possible.
- By following the criteria of using natural broodstock and mimicking natural selective pressures to some degree, we anticipate supplementation programs will experience lower in-hatchery survival than is typical of conventional hatchery programs. We believe the very causes of higher in-hatchery mortality will also provide for substantially higher release-to-adult survival and long term fitness. Our modeling indicates that enhanced survival during this post-release stage is critical to the success of supplementation, much more so than the pre-release.
- In areas without existing (target) natural populations, we recommend supplementation-restoration programs be designed to provide 25% to 50% of the

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

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

Supplementation Protocols

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

Existing Programs

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

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

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

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

Supplementation Broodstocks

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

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

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

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

Spawning

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

Incubation

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

Rearing

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

Marking

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

Releases

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

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

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

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

Adult Returns

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

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

Risk Assessment

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

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

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

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

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

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

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

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

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

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

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

Potential Harvest Opportunities

Although it is not the role of ISS to recommend additional management strategies, nor would we presume that prerogative, we do feel it is important to address harvest augmentation opportunities. The justifiably high demand for recreational, ceremonial and subsistence fisheries may have a direct impact on the acceptance and long-term integrity of ISS. The 1.5s Design does not preclude potential harvest opportunities. Implementation of harvest augmentation programs using strategies designed to minimize risks to natural populations can provide for needed fisheries. These interim measures will also buy time and support for the slow, patient rebuilding process required to supplement natural populations. The IDFG Anadromous Fisheries Management Plan provides a detailed discussion of harvest opportunities and programs (IDFG 1991).

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

Stream	Basin	Year	Stream Length	Number of Redds Counted	Redds per kilometer	New Length	New Redds	New Redds/km	Comments
American River	Clearwater	2001	34.6	390	11.27	34.60	390	11.272	
American River	Clearwater	2000	34.6	130	3.76	34.60	130	3.757	
American River	Clearwater	1999	34.6	1	0.03	34.60	1	0.029	
American River	Clearwater	1998	34.6	112	3.24	34.60	112	3.237	
American River	Clearwater	1997	34.6	311	8.99	34.60	311	8.988	
American River	Clearwater	1996	34.6	9	0.26	34.60	9	0.260	
American River	Clearwater	1995	34.6	0	0.00	34.60	0	0.000	
American River	Clearwater	1994	34.6	9	0.26	34.60	9	0.260	
American River	Clearwater	1993	34.6	209	6.04	34.60	209	6.040 [c]	
American River	Clearwater	1992	33.3	5	0.15	33.30	5	0.150	
Big Flat Creek	Clearwater	2001	4.8	14	2.92	4.80	14	2.917	
Big Flat Creek	Clearwater	2000	4.8	0	0.00	4.80	0	0.000	
Big Flat Creek	Clearwater	1999	NC[d]	NC					
Big Flat Creek	Clearwater	1998	NC[d]	NC					
Big Flat Creek	Clearwater	1997	4.8	7	1.46	4.80	7	1.458	
Big Flat Creek	Clearwater	1996	1.5	0	0.00	4.8	0	0.000	New length adjusted for comparisons
Big Flat Creek	Clearwater	1995	5.6	0	0.00	4.8	0	0.000	3.6 miles walked but no redds found
Big Flat Creek	Clearwater	1994	NC	NC					
Big Flat Creek	Clearwater	1993	6	3	0.50	6	3	0.500	
Big Flat Creek	Clearwater	1992	8	8	1.00	8	8	1.000	
Brushy Fork and Spruce Creek	Clearwater	2001	16.1	143	8.88	12.1	127	10.496	
Brushy Fork and Spruce Creek	Clearwater	2000	16.1	16	0.99	12.1	16	1.322	
Brushy Fork and Spruce Creek	Clearwater	1999	16.1	3	0.19	12.1	3	0.248	
Brushy Fork and Spruce Creek	Clearwater	1998	16.1	19	1.18	12.1	19	1.570	
Brushy Fork and Spruce Creek	Clearwater	1997	20.7	75	3.62	12.1	74	6.116	The entire section from the mouth to spruce was surveyed. 12 redds were observed from the mouth to the lower meadow. While the lower meadow is above Pestle Rock, we were unable to determine where the redds were. Since we see very few redds below Pestle Rock, we decided to put all 12 redds above Pestle Rock and truncate the distance to 12.1 km
Brushy Fork and Spruce Creek	Clearwater	1996	21.5	5	0.23	12.1	5	0.413	
Brushy Fork and Spruce Creek	Clearwater	1995	14	5	0.36	8.5	5	0.588	
Brushy Fork and Spruce Creek	Clearwater	1994	21.5	0[h]	0.00	12.1	0	0.000 [h]	
Brushy Fork and Spruce Creek	Clearwater	1993	18.1	25	1.38	12.1	25	2.066	The entire section from the mouth to spruce was surveyed but no redds were observed from the mouth to pestle rock so we truncated the distance to 12.1 km
Brushy Fork and Spruce Creek	Clearwater	1992	14	7	0.50	12.1	7	0.579	Redd number not verified
Clear Creek	Clearwater	2001	20.2	166s	8.2	18.2	127	6.978	
Clear Creek	Clearwater	2000	20.2	30	1.50	18.2	19	1.044	
Clear Creek	Clearwater	1999	16.1	0	0.00	18.2	0	0.000	
Clear Creek	Clearwater	1998	18.5	2	0.11	18.2	1	0.055	
Clear Creek	Clearwater	1997	18.5	17	0.92	18.2	12	0.659	
Clear Creek	Clearwater	1996	16.1	3	0.19	18.2	3	0.165	

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

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

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

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

North Fork Salmon River	Salmon	1998	36.8	3	0.08	36.8	3	0.082	
North Fork Salmon River	Salmon	1997	36.8	10	0.27	36.8	10	0.272	
North Fork Salmon River	Salmon	1996	36.8	5	0.14	36.8	5	0.136	
North Fork Salmon River	Salmon	1995	36.8	1	0.03	36.8	1	0.027	
North Fork Salmon River	Salmon	1994	36.8	3	0.08	36.8	3	0.082	
North Fork Salmon River	Salmon	1993	36.8	17	0.46	36.8	17	0.462	
North Fork Salmon River	Salmon	1992	36.8	12	0.33	36.8	12	0.326	
North Fork Salmon River	Salmon	1991	36.8	8	0.22	36.8	8	0.217	
Pahsimeroi River	Salmon	2001	24.5	146	5.96	24.5	146	5.959	Redds upstream of PBS1 and P8A removed
Pahsimeroi River	Salmon	2000	24.5	46	1.88	17.8	46	2.584	Redds upstream of PBS1 and P8A removed
Pahsimeroi River	Salmon	1999	24.5	61	2.49	17.8	61	3.427	Redds upstream of PBS1 and P8A removed
Pahsimeroi River	Salmon	1998	31.1	31	1.00	17.8	28	1.573	Redds upstream of PBS1 and P8A removed
Pahsimeroi River	Salmon	1997	15.7	23	1.46	16	23	1.438	Hatchery weir to PBS1. Did not count above Patterson Cr. on the main Pahsimeroi R.
Pahsimeroi River	Salmon	1996	14.5	13	0.90	16.5	13	0.788	Did not do PBS1 to mouth
Pahsimeroi River	Salmon	1995	15.5	11	0.71	16.5	11	0.667	Did not do PBS1 to mouth
Pahsimeroi River	Salmon	1994	16.5	19	1.15	17.8	19	1.067 [f]	Aerial count on 9/7, only ground count was from dowton lane to p11
Pahsimeroi River	Salmon	1993	23	63	2.74	16.5	63	3.818	Did not do PBS1 to mouth
Pahsimeroi River	Salmon	1992	26.5	32	1.21	26.5	32	1.208	It is likely that areas where fish do not spawn were surveyed but we were unable to find any data sheets that listed areas walked or redd distribution
Secesh River	Salmon	2001	32.1	381	11.87	11.9	239	20.084	Based on index count
Secesh River	Salmon	2000	32.1	148	4.61	11.9	104	8.739	Based on index count
Secesh River	Salmon	1999	32.1	42	1.31	11.9	34	2.857	Based on index count
Secesh River	Salmon	1998	32.1	69	2.15	11.9	50	4.202	Based on index count
Secesh River	Salmon	1997	32.1	90	2.80	11.9	74	6.218	Based on index count
Secesh River	Salmon	1996	10.3	42	4.08	11.9	41	3.445	Based on index count
Secesh River	Salmon	1995	10.3	18	1.75	11.9	18	1.513	Based on index count
Secesh River	Salmon	1994	10.3	21	2.04	11.9	21	1.765	Based on index count
Secesh River	Salmon	1993	10.3	91	8.83	11.9	91	7.647	Based on index count
Secesh River	Salmon	1992	10.3	66	6.41	11.9	66	5.546	Based on index count
Secesh River	Salmon	1991	10.3	62	6.02	10.3	62	6.02	New redds not verified
Slate Creek	Salmon	2001	34.61	26	0.75	5.53	18	3.255	Based on index count
Slate Creek	Salmon	2000	34.61	5	0.14	5.53	4	0.723	Based on index count
Slate Creek	Salmon	1999	34.61	2	0.06	5.53	2	0.362	Based on index count
Slate Creek	Salmon	1998	28.6	8	0.28	5.53	6	1.085	Based on index count
Slate Creek	Salmon	1997	15	8	0.53	5.53	5	0.904	Based on index count
Slate Creek	Salmon	1996	5.5	0	0.00	5.53	0	0.000	Based on index count
Slate Creek	Salmon	1995	5.5	3	0.55	5.53	3	0.542	Based on index count
Slate Creek	Salmon	1994	5.5	1	0.18	5.53	2	0.362	Based on index count
Slate Creek	Salmon	1993	5.5	1	0.18	5.53	1	0.181	Based on index count
Slate Creek	Salmon	1992	5.5	4	0.73	5.53	4	0.723	Based on index count
Slate Creek	Salmon	1991	5.5	6	1.09	5.5	6	1.09	New redds not verified
South Fork Salmon River	Salmon	2001	24.5	493	20.12	20.2	430	21.287	Removed tributaries from survey
South Fork Salmon River	Salmon	2000	24.5	315	12.86	20.2	290	14.356	Removed tributaries from survey
South Fork Salmon River	Salmon	1999	22.6	281	12.43	20.2	259	12.822	Removed tributaries from survey
South Fork Salmon River	Salmon	1998	20.2	149	7.38	20.2	149	7.376	
South Fork Salmon River	Salmon	1997	20.2	264	13.07	20.2	264	13.069	

South Fork Salmon River	Salmon	1996	20.2	78	3.86	20.2	78	3.861	
South Fork Salmon River	Salmon	1995	20.2	61	3.02	20.2	61	3.020	
South Fork Salmon River	Salmon	1994	20.2	76	3.76	20.2	76	3.762	
South Fork Salmon River	Salmon	1993	20.2	694	34.36	20.2	694	34.356	
South Fork Salmon River	Salmon	1992	20.2	454	22.48	20.2	454	22.475	
Upper Salmon River	Salmon	2001	59	257	4.36	59	257	4.356	Aerial survey
Upper Salmon River	Salmon	2000	59	146	2.47	59	146	2.475	Aerial survey
Upper Salmon River	Salmon	1999	59	14	0.24	59	14	0.237	Aerial survey
Upper Salmon River	Salmon	1998	59	25	0.42	59	25	0.424	Aerial survey
Upper Salmon River	Salmon	1997	59	8	0.14	59	8	0.136	Aerial survey
Upper Salmon River	Salmon	1996	59	14	0.24	59	14	0.237	Aerial survey
Upper Salmon River	Salmon	1995	59	0	0.00	59	0	0.000	Aerial survey
Upper Salmon River	Salmon	1994	59	22	0.37	59	22	0.373	Aerial survey
Upper Salmon River	Salmon	1993	59	127	2.15	59	127	2.153	Aerial survey
Upper Salmon River	Salmon	1992	59	27	0.46	59	27	0.458	Aerial survey
Valley Creek	Salmon	2001	32.2	59	1.83	32.2	59	1.832	
Valley Creek	Salmon	2000	33.2	23	0.69	33.2	23	0.693	
Valley Creek	Salmon	1999	33.2	18	0.54	33.2	18	0.542	
Valley Creek	Salmon	1998	33.2	33	0.99	33.2	33	0.994	
Valley Creek	Salmon	1997	33.2	5	0.15	33.2	5	0.151	
Valley Creek	Salmon	1996	48.7	1	0.02	48.7	1	0.021	
Valley Creek	Salmon	1995	48.7	0	0.00	48.7	0	0.000	
Valley Creek	Salmon	1994	43.7	4	0.09	43.7	4	0.092	
Valley Creek	Salmon	1993	52.3	73	1.40	52.3	73	1.396	
Valley Creek	Salmon	1992	33.2	7	0.21	33.2	7	0.211	
West Fork Yankee Fork Salmon River	Salmon	2001	11.6	36	3.10	11.6	36	3.103	
West Fork Yankee Fork Salmon River	Salmon	2000	11.6	4	0.34	11.6	4	0.345	
West Fork Yankee Fork Salmon River	Salmon	1999	11.6	0	0.00	11.6	0	0.000	
West Fork Yankee Fork Salmon River	Salmon	1998	11.6	12	1.03	11.6	12	1.034	
West Fork Yankee Fork Salmon River	Salmon	1997	11.6	6	0.52	11.6	6	0.517	
West Fork Yankee Fork Salmon River	Salmon	1996	11.6	7	0.60	11.6	7	0.603	
West Fork Yankee Fork Salmon River	Salmon	1995	11.6	0	0.00	11.6	0	0.000	
West Fork Yankee Fork Salmon River	Salmon	1994	11.6	9	0.78	11.6	9	0.776	
West Fork Yankee Fork Salmon River	Salmon	1993	11.6	14	1.21	11.6	14	1.207	
West Fork Yankee Fork Salmon River	Salmon	1992	11.6	6	0.52	11.6	6	0.517	

Notes:

[a] 125 adult pairs were outplanted from Rapid River Hatchery.

[b] Two additional redds occurred below the juvenile trap.

[c] 150 adult pairs were outplanted from Rapid River Hatchery.

[d] NC = No count (stream was not surveyed).

[e] Six additional redds occurred below the juvenile trap.

[f] Distance reported is for the IDFG trend area; number of redds is from Nemeth et al. (1996).

[g] Three additional redds occurred below the juvenile trap.

[h] A single adult chinook salmon was seen in Brushy Fork Creek during snorkeling activities.

[i] Moose Creek to Burnt Log Creek section (6.2 km) not surveyed 1991-1993; from 1994-present, Burnt Log Creek, from the mouth to 2.0 km above Buck Creek (4.0 km total), was included in the count.

[j] This number is conservative as one section of stream, Moose Creek to Burnt Log trail crossing, was not counted, but was known to have redds.
[k] Includes Knapp Creek.
[l] Section from Knapp Cr. to Dry Cr. was not surveyed in 1992.
[m] Aerial count.
[n] Seven of the redds counted were located in Colt Creek, a tributary of Colt Killed Creek.
[o] Nine additional redds were located between the mouth of Crooked Fk Cr and the juvenile screw trap.
[p] Nine additional redds located below the screw trap
[q] Nez Perce Tribe removed 149 adults for culture
[r] Nez Perce Tribe removed 73 adults for culture
[s] An estimated 408 adults escaped above weir in addition to the 90 known adults.

SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

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

Name, Title, and Signature of Applicant:

Certified by_____________________________ Date:_____________

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

Listed species affected: _________________________ ESU/Population:_________________________________ Activity:___________________

Location of hatchery activity:_____________________ Dates of activity:___________________ Hatchery program operator:_________________

Type of Take	**Annual Take of Listed Fish By Life Stage (*Number of Fish*)**			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)				
Capture, handle, tag/mark/tissue sample, and release d)			Entire run	
Removal (e.g. broodstock) e)			Section 7.2	
Intentional lethal take f)				
Unintentional lethal take g)			Pre-spawn mortality varies and may be as high as 15%.	
Other Take (specify) h) Carcass sampling				50

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

Instructions:

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

<u>SECTION 15. PROGRAM EFFECTS ON OTHER (NON-ANADROMOUS SALMONID) ESA-LISTED POPULATIONS.</u> Species List Attached (Anadromous salmonid effects are addressed in Section 2)

15.1) <u>List all ESA permits or authorizations for all non-anadromous salmonid programs associated with the hatchery program.</u>

Section 10 permits, 4(d) rules, etc. for other programs associated with hatchery program.
Section 7 biological opinions for other programs associated with hatchery program.

ESA Section 6 Cooperative Agreement for take bull trout associated with IDFG research activities.

ESA Section 7 Consultation and Biological Opinion through the U.S. Fish and Wildlife Service Lower Snake Compensation Program for take of bull trout associated with hatchery operations.

15.2) <u>Description of non-anadromous salmonid species and habitat that may be affected by hatchery program.</u>

General species description and habitat requirements (citations).
Local population status and habitat use (citations).
Site-specific inventories, surveys, etc. (citations).

The following passages are from the draft, 2001 Salmon Subbasin Summary (NPPC 2001).

Westslope cutthroat trout *Oncorhynchus clarki lewisi*:

The native westslope cutthroat subspecies occurs in watersheds throughout the Salmon Subbasin. Although the subspecies is still widely distributed and is estimated to occur in 85% of their historical range Rieman and Apperson (1989) contend viable populations exist in only 36% of their historic range. Most strong populations are associated with roadless and wilderness areas. Westslope cutthroat trout are currently listed as federal and state (Idaho) species of concern and sensitive species by the USFS and BLM, and were proposed for listing under the Endangered Species Act (ESA). On April 5, 2000, the United States Fish and Wildlife Service announced their 12-month finding regarding the petition it had received to list the westslope cutthroat trout as threatened throughout its range under ESA. The Service concluded after review of all available scientific and commercial information, that the listing of westslope cutthroat trout was not warranted.

Current distribution and abundance of westslope cutthroat trout are restricted compared to historical conditions (Liknes and Graham 1988, Rieman and Apperson

1989,
Behnke 1992). In Idaho, populations considered strong remain in 11% of historical range
and it has been suggested that genetically pure populations inhabit only 4% of this range
(Rieman and Apperson 1989), although genetic inventories that would support such a low
figure have not been conducted. Many populations have been isolated due to habitat fragmentation from barriers such as dams, diversions, roads, and culverts. Fragmentation
and isolation can lead to loss of persistence of some populations (Rieman and McIntyre 1993). Because of the high risk of these populations to chance events, conservation of the subspecies will likely require the maintenance and restoration of well-distributed, connected habitats. For the last several decades, IDFG has been stocking predominantly westslope cutthroat in their mountain lake program in lieu of non-native trout species. Because many of these lakes did not have trout present naturally, stocking may have resulted in a local range expansion, and possible compromising of genetic purity where subspecies other than westslope were placed. The current state fish management plan (IDFG 2001) notes that sterile fish will be stocked to eliminate potential interbreeding with native fish.

A high proportion of high lakes have received sterile trout in the past year. Westslope cutthroat trout in the Salmon Subbasin have been documented to exhibit fluvial and resident life histories (Bjornn and Mallet 1964, Bjornn, 1971 cited in Behnke
1992), and adfluvial behavior is suspected. Age at maturity ranges from 3-5 years (Simpson and Wallace, 1982). Westslope cutthroat trout are spring tributary spawners with spawning commencing in April and May depending on stream temperatures and elevation. Adult fluvial fish ascend into tributaries in the spring and typically return to mainstem rivers soon after spawning is complete (Behnke, 1992)
Overfishing has been identified by several researchers as a factor in the decline (Behnke 1992) of westslope cutthroat. This subspecies is extremely susceptible to angling pressure. Rieman and Apperson (1989) documented a depensatory effect in fishing (mortality increases as population size decreases) and speculated that uncontrolled harvest could lead to elimination of some populations. However, cutthroat populations have been protected via catch-and-release regulations in large portions of the Salmon Subbasin since the 1970s and no harvest of cutthroat has been permitted in mainstem rivers since 1996. Rieman and Apperson (1989) reported 400 to 1300% increases in westslope cutthroat populations following implementation of special fishing regulations.

Habitat loss and degradation are other important factors in the decline of westslope cutthroat. In an Idaho study, among depressed populations of cutthroat, habitat loss was the main cause of decline in 87% of the stream reaches evaluated based on a qualitative study of biologists' best judgements (Rieman and Apperson 1989). Land

management practices have contributed to disturbance of stream banks and riparian areas as well vegetation loss in upland areas which result in altered stream flows, increased erosion and sediment, and increased temperature.

Brook trout, and introduced rainbow trout, in combination with changes in water quality and quantity appear to have been deleterious to westslope cutthroat. Brook trout are thought to have replaced westslope cutthroat in some headwater streams (Behnke 1992). The mechanism is not known, but it is thought that brook trout may displace westslope cutthroat or take over when cutthroat have declined from some other cause. In drainages occupied by both westslope cutthroat and nonnative rainbow, segregation may occur with cutthroat confined to the upper reaches of the drainage.
Segregation does not always occur however and hybridization has been documented (Rieman and Apperson 1989).

Bull trout *Salveninus confluentus*:

All bull trout populations in the Salmon Subbasin were listed as Threatened under the
Endangered Species Act in 1998 (63 FR 31647), and are defined as one recovery unit of
the Columbia River distinct population segment. A recovery plan is under development by the USFWS, assisted by an interagency team (Lohr et al. 2000).

Historical abundance and distribution information throughout most of the subbasin is largely anecdotal. The best long-term population trend data exist for Rapid River, tributary to the Little Salmon River. Additional trend data for large fluvial bull trout are
available from the East Fork Salmon Chinook weir (Lamansky et al. 2001) Schill (1992) reported a declining bull trout density trend in 112 sites snorkeled within the Salmon River Subbasin from 1985 to 1990. However, a longer-term summary of those sites sampled for a longer time period indicated the opposite trend (D. Schill, IDFG, personal communication).

General life history and status information can be found in the Final Rule of the Federal Register and in the State of Idaho Bull Trout Conservation Plan (1996). A thorough discussion of habitat requirements and conservation issues is presented by Rieman and McIntyre (1993); and in respective Problem Assessments referred to for
specific fourth-code hydrologic units (major watersheds).

Rieman et al. (1997) used a basin-wide ecological assessment (Quigley and Arbelbide 1997) and current status knowledge regarding bull trout populations to predict distribution, strength, and future trends of populations in unsurveyed sub-watersheds. Bull trout display wide, yet patchy distribution throughout their range. Within the entire

Columbia Basin, the Central Idaho Mountains (more than half of which falls within the Salmon Subbasin) support the most secure populations of bull trout. Sport harvest of bull trout in the Salmon Subbasin has been prohibited since 1994.

In an effort to better understand the population structure of bull trout within the Salmon Subbasin, tissue samples are being taken for later genetic analysis whenever bull trout are captured by researchers operating adult or juvenile traps targeted on anadromous salmonids.

<u>Upper Salmon River</u>. Upstream migrating bull trout have been monitored in the mainstem Salmon River within this hydrologic unit since 1986, incidental to chinook salmon trapping operations (Lamansky et al. 2001). Numbers of bull trout intercepted annually have ranged from four to 38, with no evident trends. Bull trout have been documented in 54 streams within this unit (T. Curet, IDFG, pers comm.), including the mainstem and multiple tributaries of the East Fork Salmon River (BLM 1998). Upstream migrating bull trout have been partially monitored in the East Fork since 1984, incidental to chinook salmon trapping operations (Lamansky et al. 2001). Number of bull trout intercepted annually in the East Fork have ranged from 2 to 175, with no evident trends.

<u>Pahsimeroi River</u>. Bull trout are present in the Pahsimeroi River from the mouth to above Big Creek and in Little Morgan, Tater, Morse, Falls, Patterson, Big, Ditch, Goldburg, Big Gulch, Burnt, Inyo, and Mahogany creeks (T. Curet, IDFG, pers comm.).

Lemhi River. Bull trout are present in Big Eightmile, Big Timber, Eighteen Mile, Geertson, Hauley, Hayden, Kenney, Bohannon, Kirtley, Little Eightmile, Mill, Pattee, and Texas creeks, their tributaries, and in the Lemhi River. Hybridization with brook trout may occur in some tributary streams.

<u>Middle Salmon River – Panther Creek</u>. Bull trout are known present in 47 streams within this hydrologic unit (T. Curet, IDFG, pers comm.). These streams include Allison, Poison, McKim, Cow, Iron, Twelvemile, Lake, Williams, Carmen, Freeman, Moose Sheep, Twin Boulder, East Boulder, Pine, Spring, Indian, Corral, McConn, Squaw, Owl, multiple streams in the Panther Creek system, and the main Salmon and N.Fk. Salmon rivers.

<u>Middle Fork Salmon River</u>. Bull trout appear well distributed and abundant in all six identified key watersheds of the Middle Fork Salmon River (Middle Fork Salmon River Technical Advisory Team 1998). Key watersheds are: upper and lower Middle Fork Salmon River, Wilson / Camas creeks, Big, Marble, and Loon creeks. Bull trout and brook trout are known to be sympatric only in the headwaters of Big Creek. Bull

trout in the Middle Fork Salmon have been excluded from harvest for over three decades and this drainage is believed to contain one of the strongest bull trout populations in the Pacific Northwest (D Schill, IDFG, personal communication).

<u>Middle Salmon-Chamberlain Creek</u>. Spawning bull trout populations exist in the Chamberlain, Sabe, Bargamin, Warren, and Fall Creek watersheds. Spawning and early rearing is suspected to occur in the Crooked Creek, Sheep Creek, and Wind River watersheds (Clearwater Basin Bull Trout Technical Advisory Team 1998). South Fork Salmon (SFS). The East Fork of the South Fork Salmon River and the Secesh River support the strongest fluvial populations of bull trout in the South Fork watershed (IDFG GPM database). More recent research has documented specific distribution, seasonal migration, and spawn timing and locations of bull trout throughout the lower South Fork and East Fork of the South Fork Salmon River (Hogan 2001, in progress). From 1996 to 2000, bull trout captured incidental to salmon smolt trapping were tagged with PIT tags to gain life history information (K. Apperson, personal communication). Adams (1999) reported occasional sightings of brook trout x bull trout hybrids in tributaries.

<u>Lower Salmon River</u>. Slate, John Day, and Partridge creeks have been identified as key bull trout watersheds for spawning and rearing (Clearwater Basin Bull Trout Technical Advisory Team 1998). Race, Lake, and French creeks support limited bull trout spawning and rearing in their lower reaches. The mainstem Salmon River within this area provides for migration, adult and sub-adult foraging, rearing, and winter habitat. Rapid River and Boulder Creek have been identified as key bull trout watersheds (Clearwater Basin Bull Trout Technical Advisory Team 1998). Upstream migration of bull trout has been monitored in Rapid River since 1973 (Lamansky et al. 2001). Annual runs have ranged from 91 to 461 adult fluvial bull trout, with no evident trends. Radio telemetry studies on potential spawners initiated in 1992 documented timing of spawning migrations, spawning locations, spawning fidelity, spawning mortality, and range of wintering habitat (Schill et al. 1994; Elle and Thurow 1994; Elle 1998). The USFS is continuing to study use of headwater habitats for spawning and rearing (R. Thurow, personal communication). Age information has also been collected and analyzed by Elle (1998). Bull trout and brook trout are sympatric in some headwater reaches of Rapid River and Boulder Creek.

Redband trout *Oncorhynchus mykiss:*

The great majority of steelhead originally ascending the Columbia River are

believed to be descendants of redband trout (Behnke 1992). Redband trout are native to the Salmon Subbasin and continue to be widely distributed across their historical range within the subbasin. However, their population status and genetic connectivity are not well understood across large areas. It could be theorized the current distribution of wild redband trout is related to the historic distribution of summer steelhead. However, in the Middle Salmon-Chamberlain (MSC) and Lower Salmon (LOS) hydrologic units, suspected redband trout have been found above natural barriers in tributaries whose lower reaches are utilized by steelhead. Five populations of redband/rainbow trout have been genetically characterized in the MSC (Bargamin, Sheep, Chamberlain and Fivemile creeks) and LOS (Fish Creek, tributary to Whitebird Creek) hydrologic units. The Fivemile population was genetically distinct from all other rainbow (anadromous and non-anadromous) populations in the upper Columbia River drainage (Reingold 1985). The Fish Creek population was determined to be redband trout with the lowest amount of genetic variation of the five populations. All populations are genetically different among themselves (Letter from Robb Leary to Wayne Paradis, November 1, 2000). Unique populations may also be present in Rice, Little Slate, and French creeks in the Lower Salmon watershed.

To protect resident redband and steelhead trout within the upper portions of the Salmon Subbasin, hatchery catchable rainbow trout are released in only the mainstem Salmon River. Released fish are marked with an adipose fin clip so harvest is targeted only on hatchery stocks. In other areas of the subbasin, catchable hatchery trout are stocked only in areas where there is minimal or no risk to native fish. The Idaho Department of Fish and Game has adopted a policy where sterile resident salmonids will be stocked in waters accessible to wild/native salmonids unless there is a need to supplement the wild populations (IDFG 2001). All wild fish harvest is prohibited in all mainstem rivers in the upper portions of the drainage (MF to headwaters). No differentiation of resident redband trout from juvenile steelhead has been attempted in the Salmon Subbasin. Consequently, the distribution of the former remains poorly understood.

15.3) Analysis of effects.

Identify potential direct, indirect, and cumulative effects of hatchery program on species and habitat (immediate and future effects).
Identify potential level of take (past and projected future).

Hatchery operations - water withdrawals, effluent, trapping, releases, routine operations and maintenance activities, non-routine operations and maintenance activities (e.g. intake excavation, construction, emergency operations, etc.)

Hatchery operations (e.g., water supply, effluent discharge, fish health, facility maintenance) are not expected to adversely affect non-anadromous salmonids. Bull trout captured at adult chinook salmon trap sites are detained for a short period of time and released upstream.

Similarly, juvenile chinook salmon release and juvenile chinook salmon out-migrant trapping activities are not expected to negatively affect non-anadromous salmonids. Specific concerns are discussed below.

Fish health - pathogen transmission, therapeutics, chemicals.

Fish health monitoring occurs monthly, bi-monthly, or as requested by staff at the hatcheries covered in this HGMP. Diagnostic services are provided by the Idaho Department of Fish and Game Eagle Fish Health Laboratory.

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

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

To accommodate segregation incubation and rearing based on female parent ELISA optical density value associated with bacterial kidney disease monitoring. Specific bacterial pathogens identified during rearing cycles may be treated with therapeutics to prevent the spread of infections. The most common therapeutic used to control the spread of common bacterial pathogens (e.g., *Flavobacterium sp.*) is Oxytetracycline. This drug is administered under INAD 9332.

Ecological/biological - competition, behavioral, etc.

Spring chinook salmon fingerlings and smolts released in the upper South Fork Salmon River drainage could residualize and compete with non-anadromous salmonids for space and food and possibly modify the behavior of non-salmonids present in the system. However, the incidence of chinook salmon residualism is suspected to be an uncommon life history strategy.

Predation –

Spring chinook salmon fingerlings and smolts released in the upper South Fork Salmon River drainage could residualize and pose a predation risk to native non-anadromous salmonids. However, the incidence of this is suspected to be minor to non-occurring.

Monitoring and evaluations - surveys (trap, seine, electrofish, snorkel, spawning, carcass, boat, etc.).

No significant effects associated with the above research activities are expected. Adult and juvenile weir and trap activities may have a short-term impact to non-anadromous salmonid species through the alternation of migration routes, delays in movement, and from temporary handling. Snorkel, spawning, and carcass surveys may temporarily displace fish but are expected to have no long-term impacts.

Habitat - modifications, impacts, quality, blockage, de-watering, etc.

No adverse affects to habitat are anticipated.

15.4 Actions taken to mitigate for potential effects.

Identify actions taken to mitigate for potential effects to listed species and their habitat.

Actions taken to minimize adverse effects on listed fish include:

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

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

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

4. Continuing to reduce effect of the release of large numbers of hatchery chinook salmon at a single site by spreading the release over a number of days by trucking strategy or volitional release from ponds.

5. Attempting to program time of release to mimic natural fish for South Fork Salmon hatchery reserve releases.

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

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

8. Monitoring hatchery effluent to ensure compliance with National Pollutant Discharge

Elimination System permit.

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

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

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

12. Snorkel surveys conducted primarily to assess juvenile abundance and density are conducted in index sections only to minimize disturbance to target and not-target species. Displacement of fish is kept to a minimum.

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