

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:

Salmon River Basin, Spring Chinook Salmon
Sawtooth Fish Hatchery
East Fork Salmon River Satellite

**Species or
Hatchery Stock:**

Spring Chinook Salmon
Oncorhynchus tshawytscha.

Agency/Operator:

Idaho Department of Fish and Game

Watershed and Region:

Salmon River, Idaho.

Date Submitted:

September 30, 2002

Date Last Updated:

September 30, 2002

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Hatchery: Sawtooth Fish Hatchery
East Fork Salmon River Satellite

Program: Spring chinook salmon

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

Spring chinook salmon *Oncorhynchus tshawytscha*.

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

1.3) Responsible organization and individuals

Lead Contact

Name (and title): Sharon W. Kiefer, Anadromous Fish Manager.

Agency or Tribe: Idaho Department of Fish and Game.

Address: 600 S. Walnut, P.O. Box 25, Boise, ID 83707.

Telephone: (208) 334-3791.

Fax: (208) 334-2114.

Email: skiefer@idfg.state.id.us

On-site Operations Lead

Name (and title): Brent Snider, Fish Hatchery Manager II, Sawtooth Fish Hatchery.

Agency or Tribe: Idaho Department of Fish and Game.

Address: HC 64 Box 9905 Stanley, ID 83278.

Telephone: (208) 774-3684.

Fax: (208) 774-3413.

Email: bsinder@idfg.state.id.us

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

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

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

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

Sawtooth Fish Hatchery and East Fork Salmon River Satellite

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

Staffing level: 5 FTE.

Annual budget: \$850,000.

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

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

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

1.6) Type of program.

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

1.7) Purpose (Goal) of program.

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

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

1.8) Justification for the program.

The Lower Snake River Compensation Program has been in operation since 1983 to

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

Actions taken to minimize adverse effects on listed fish include:

1. Continuing fish health practices to minimize the incidence of infectious disease agents. Follow IHOT, AFS, and PNFHPC guidelines.
2. Marking hatchery-produced spring chinook salmon for broodstock management. Smolts released for supplementation research will be marked differentially from other fish.
3. Not releasing spring chinook salmon for supplementation research in the Salmon River in excess of estimated carrying capacity.
4. Continuing to reduce effect of the release of large numbers of hatchery chinook salmon at a single site by spreading the release over a number of days.
5. Attempting to program time of release to mimic natural fish for Salmon River smolt releases.
6. Evaluating natural rearing techniques for Salmon River spring chinook salmon at the Sawtooth Fish Hatchery.
7. Continuing to use broodstock for general production and supplementation research that exhibit life history characteristics similar to locally evolved stocks.
8. Continuing to segregate female spring chinook salmon broodstock for BKD via ELISA. We will incubate each female's progeny separately and also segregate progeny for rearing. We will continue development of culling and rearing segregation guidelines and practices, relative to BKD.
9. Monitoring hatchery effluent to ensure compliance with National Pollutant Discharge Elimination System permit.
10. Continuing Hatchery Evaluation Studies (HES) to provide comprehensive monitoring and evaluation for LSRCP chinook.

1.9) List of program “Performance Standards”.

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

- 3.5 Genetic Characteristics.
- 3.6 Research Activities.
- 3.7 Operation of Artificial Production Facilities.

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

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

- 3.1.2 Standard: Program contributes to mitigation requirements.

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

- 3.1.3 Standard: Program addresses ESA responsibilities.

Indicator 1: ESA Section 7 Consultation completed.

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

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

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

Indicator 1: Annual number of spawners on spawning grounds estimated in specific locations.

Indicator 2: Spawner-recruit ratios estimated in specific locations.

Indicator 3: Number of redds in natural production index areas documented in specific locations.

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

Indicator 1: Marking rates and type of mark documented.

Indicator 2: Number of marks identified in juvenile and adult groups documented.

1.10.2) “Performance Indicators” addressing risks.

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

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

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

Indicator 1: Number of natural-origin spawners removed for broodstock determined annually and documented.

Indicator 2: Natural origin spawners released to migrate to natural spawning areas documented.

Indicator 3: Number of adults, eggs or juveniles placed in natural rearing areas managed.

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

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

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

Indicator 1: Annual release numbers, life-stage, size at release, length of acclimation documented.

Indicator 2: Location of releases documented.

Indicator 3: Timing of hatchery releases documented.

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

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

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

Indicator 1: Total number of natural spawners reaching collection facilities documented.

Indicator 2: Total number of natural spawners estimated passing collection facilities documented.

Indicator 3: Timing of collection compared to overall run timing.

- 3.5.3 Standard: Artificially produced adults in natural production areas do not exceed

appropriate proportion.

Indicator 1: Ratio of natural to hatchery-produced adults monitored.

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

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

Indicator 1: Location of juvenile releases documented.

Indicator 2: Length of acclimation period documented.

Indicator 3: Release type (e.g., volitional or forced) documented.

Indicator 4: Adult straying documented.

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

Indicator 1: Level of smoltification at release documented.

Indicator 1: Release type (e.g., forced or volitional) documented.

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

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

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

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

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

Indicator 1: Monitoring and evaluation framework including detailed time line.

Indicator 2: Annual and final reports.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1.11) Expected size of program.

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

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

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

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

Note: the following abbreviations are used in the table:

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

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

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

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

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

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

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

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

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

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

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

| | | | | | | | |
|------|---------|------|----|----|-----|----|-------|
| 1987 | 305,300 | 1989 | 12 | 23 | 23 | 58 | 0.019 |
| 1988 | 514,600 | 1990 | 7 | 27 | 65 | 99 | 0.019 |
| 1989 | 98,300 | 1991 | 15 | 18 | 13 | 46 | 0.046 |
| 1990 | 79,300 | 1992 | 6 | 2 | 0 | 8 | 0.010 |
| 1991 | 35,172 | 1993 | 0 | 0 | 0 | 0 | 0.000 |
| 1992 | 12,368 | 1994 | 0 | 7 | 0 | 7 | 0.056 |
| 1993 | 48,845 | 1995 | 3 | 7 | n/a | 10 | 0.020 |

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

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

Sawtooth Fish Hatchery – In operation since 1985.

East Fork Salmon River Satellite - In operation since 1984.

1.14) Expected duration of program.

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

1.15) Watersheds targeted by program.

Listed by hydrologic unit code –

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

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

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

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

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

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

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

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

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

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

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

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

produced fish.

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

Ongoing since the mid-1980s, annual standard surveys continue to provide trends in abundance and distribution of summer parr (Hall-Griswold and Petrosky 1997). Resultant data show an erratic trend toward lower abundance of juvenile chinook salmon in their preferred habitat (Rosgen C-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 (λ) 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 directly affected by the program

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

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

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

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

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

Bull trout (T – 6/98)

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

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

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

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

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

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

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

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

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

extinction.

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

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

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

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

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

| Brood Year | 1990 | | 1991 | | 1992 | |
|------------|--------|--------|--------|--------|--------|--------|
| | Spring | Summer | Spring | Summer | Spring | Summer |
| Run | | | | | | |
| Dam Counts | 17,315 | 5,093 | 6,623 | 3,809 | 21,391 | 3,014 |
| % Females | 48 | 44 | 44 | 52 | 49 | 43 |

| | | | | | | |
|------------------------------------|---------|-------|---------|-------|---------|-------|
| # of Females | 8,368 | 2,246 | 2,906 | 1,961 | 10,482 | 1,294 |
| # of Females in Hatcheries | 3,395 | 421 | 1,330 | 252 | 2,747 | 462 |
| Adjustment for Migration Mortality | 4,244 | 526 | 1,663 | 350 | 3,434 | 578 |
| # of Females in Harvest | 796 | 10 | 1 | 0 | 897 | 43 |
| Female Escapement | 3,328 | 1,710 | 1,292 | 1,611 | 6,151 | 673 |
| Combined Female Escapement | 5,038 | | 2,853 | | 6,824 | |
| Combined W/N Smolts | 527,000 | | 627,037 | | 627,942 | |
| # of Smolts/Female | 105 | | 220 | | 92 | |

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

| Brood Year | 1996 | | 1997 | | 1998 | |
|------------------------------------|---------|--------|-----------|--------|-----------|--------|
| Run | Spring | Summer | Spring | Summer | Spring | Summer |
| Dam Counts | 4,215 | 2,608 | 33,855 | 10,709 | 9,854 | 4,355 |
| % Females | 38 | 40 | 55 | 44 | 54 | 54 |
| # of Females | 2,023 | 1,032 | 18,620 | 4,766 | 5,333 | 2,346 |
| # of Females in Hatcheries | 1,036 | 148 | 5,503 | 894 | 2,229 | 365 |
| Adjustment for Migration Mortality | 1,295 | 185 | 6,879 | 1,118 | 2,786 | 456 |
| # of Females in Harvest | 20 | 0 | 3,183 | 322 | 643 | 67 |
| Female Escapement | 708 | 847 | 8,558 | 3,326 | 1,904 | 1,823 |
| Combined Female Escapement | 1,555 | | 11,884 | | 3,727 | |
| Combined W/N Smolts | 599,159 | | 1,560,298 | | 1,344,382 | |
| # of Smolts/Female | 385 | | 131 | | 361 | |

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

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

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

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

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

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

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

See below.

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

ESA-listed, spring chinook salmon are trapped during broodstock collections periods at

the Sawtooth Fish Hatchery and the East Fork Salmon River Satellite. However, the chinook salmon trap on the East Fork Salmon River has not been operated since 1998.

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

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

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

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

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

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

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

It is unlikely that take levels for natural-origin spring chinook salmon will exceed projected take levels presented in Table 1 (attached). The Idaho Supplementation Studies project is beginning to phase out of developing new supplementation broodstocks. As such, beginning in 2003, we anticipate that all natural-origin chinook salmon will be released upstream for natural spawning. However, in the unlikely event that stated levels of take are exceeded, the IDFG will consult with NMFS Sustainable Fisheries Division or

Protected Resource Division staff and agree to an action plan. We assume that any contingency plan will include a provision to discontinue hatchery-origin, steelhead trapping activities.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

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

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

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

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

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

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

- 3.3) Relationship to harvest objectives.**

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

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

- 3.3.1) Describe fisheries benefiting from the program, and indicate harvest levels**

and rates for program-origin fish for the last twelve years (1988-99), if available.

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

3.4) Relationship to habitat protection and recovery strategies.

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

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

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

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

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

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

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

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

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

The literature suggests that the effects of behavioral or competitive interactions between hatchery-produced and natural chinook salmon juveniles would be difficult to evaluate or quantify (Cannamela 1992b; USFWS 1992, 1993). There is limited information describing adverse behavioral effects of summer releases of hatchery-produced chinook salmon fingerlings (age 0) on natural chinook salmon fingerlings. Hillman and Mullan (1989) reported that larger hatchery-produced fingerlings apparently “pulled” smaller chinook salmon from their stream margin stations as the hatchery fish drifted downstream. The hatchery-produced fish were approximately twice as large as the natural juveniles. In this study, spring releases of steelhead smolts had no observable effect on natural chinook fry or smolts. However, effects of emigrating yearling, hatchery-produced chinook salmon on natural chinook salmon fry or yearlings is unknown. There may be potential for the larger hatchery-produced fish, presumably migrating in large schools, to “pull” natural chinook salmon juveniles with them as they

migrate. If this occurs, effects of large, single-site releases on natural survival may be adverse. We do not know if this occurs, or the magnitude of the potential effect. In the upper Salmon River, IDFG biologists observed chinook salmon fry in typical areas during steelhead sampling in April – June, 1992 even though 1.27 million spring chinook salmon smolts had been released in mid-March (IDFG 1993c).

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

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

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

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

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

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

Bacterial kidney disease and other diseases can be horizontally transmitted from hatchery fish to natural, listed species. However, in a review of the literature, Steward and Bjornn (1990) stated that there was little evidence to suggest that horizontal transmission of

disease from hatchery-produced smolts to natural fish is widespread in the production area or free-flowing migration corridor. However, little additional research has occurred in this area. Hauck and Munson (IDFG, unpublished) stated that hatcheries with open water supplies (river water) may derive pathogen problems from natural populations. The hatchery often promotes environmental conditions favorable for the spread of specific pathogens. When liberated, infected hatchery-produced fish have the potential to perpetuate and carry pathogens into the wild population.

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

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

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

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

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

SECTION 4. WATER SOURCE

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

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

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

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

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

SECTION 5. FACILITIES

- 5.1) Broodstock collection facilities (or methods).**

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

East Fork Salmon River Satellite - The East Fork Salmon River Satellite was constructed

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

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

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

5.3) Broodstock holding and spawning facilities.

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

5.4) Incubation facilities.

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

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

5.5) Rearing facilities.

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

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

5.6) Acclimation/release facilities.

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

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

Brood year 1992 spring chinook salmon experienced an epizootic of apparent mycotic

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

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

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

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

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

6.1) Source.

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

6.2) Supporting information.

6.2.1) History.

See Section 6.1 above.

6.2.2) Annual size.

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

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

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

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

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

6.2.4) Genetic or ecological differences.

The following excerpt was taken from:

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

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

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

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

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

In a status review of Snake River fall chinook salmon, Waples et al. (1991b) examined genetic relationships among fall-run chinook salmon in the Columbia and Snake Rivers (Group 3 of Waples et al. 1991a) in more detail. A UPGMA cluster analysis of Nei's unbiased genetic distance, based on 21 polymorphic loci, indicated that "bright" fall-run

chinook salmon in the upper Columbia River were genetically distinct from those in the Snake River. Populations in the two groups were characterized by allele-frequency differences of about 10-20% at several loci, and these differences remained relatively constant from year to year in the late 1970s and early 1980s. However, allele-frequency shifts from 1985 to 1990 for samples of fall-run chinook salmon at Lyons Ferry Hatchery in the Snake River suggested that mixing with upper Columbia River fish had occurred. This is consistent with reports that stray hatchery fish from the upper Columbia River were inadvertently used as brood stock at the Lyons Ferry Hatchery. Samples of "bright" fall-run chinook salmon from the Deschutes River and the Marion Drain irrigation channel in the Yakima River Basin also appeared in the same cluster with samples of fall-run chinook salmon from the Snake River.

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

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

Some studies have indicated that Snake River spring- and summer-run chinook salmon have reduced levels of genetic variability. Utter et al. (1989) estimated gene diversities with 25 polymorphic loci for 65 population units and found that gene diversities in the Snake River were lower than those in the Columbia River. Winans (1989) estimated levels of gene diversity with 33 loci for spring-, summer-, and fall-run chinook salmon at

28 localities in the Columbia River Basin. Fall-run chinook salmon tended to have significantly greater levels of gene diversity ($N=12$, mean $H=0.081$) than both spring- ($N=17$, $H=0.065$) and summer-run ($N=3$, mean $H=0.053$) chinook salmon. Spring-run fish in the Snake River had the lowest gene diversities ($N=4$, mean $H=0.044$). However, Waples et al. (1991a) found that, with a larger sample of 65 loci, gene diversities in Snake River spring-run and summer-run chinook salmon were not as low as that suggested by earlier studies.

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

- 1) Populations of chinook salmon in the Columbia and Snake Rivers are genetically discrete from populations along the coasts of Washington and Oregon.
- 2) Strong genetic differences exist between populations of spring-run and fall-run fish in the upper Columbia and Snake Rivers. In the lower Columbia River, however, spring-run fish are genetically more closely allied with nearby fall-run fish in the lower Columbia River than with spring-run fish in the Snake and upper Columbia Rivers.
- 3) Summer-run fish are genetically related to spring-run fish in some areas (e.g., Snake River), but to fall-run fish in other areas (e.g., upper Columbia River).
- 4) Populations of fall-run fish are subdivided into several genetically discrete geographical groups in the Columbia and Snake Rivers (these populations will be discussed in detail in the next section).
- 5) Hatchery populations of chinook salmon tend to be genetically similar to the respective source populations used to found or augment the hatchery populations.

6.2.5) Reasons for choosing.

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

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

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

SECTION 7. BROODSTOCK COLLECTION

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

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

7.2) Collection or sampling design.

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

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

7.3) Identity.

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

7.4) Proposed number to be collected:

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

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

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

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

Sawtooth Fish Hatchery broodstock collection history.

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

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

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

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

7.6) Fish transportation and holding methods.

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

7.7) Describe fish health maintenance and sanitation procedures applied.

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

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

7.8) Disposition of carcasses.

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

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

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

SECTION 8. MATING

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

8.1) Selection method.

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

Spawning protocols will typically follow existing hatchery practices. Sexes will be

spawned 1:1 as they ripen, and follow a spawning plan (developed by the IDFG) to develop supplementation and hatchery reserve broodstocks. Spawn timing will be dependent on ripeness, which is assumed to correspond with run timing. If adult escapement is low (e.g., < 100 females), factorial or modified diallele crosses may be utilized to minimize genetic drift and maintain genetic diversity, (Kapuscinski et al. 1991).

8.2) Males.

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

8.3) Fertilization.

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

8.4) Cryopreserved gametes.

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

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

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

SECTION 9. INCUBATION AND REARING -

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

9.1) Incubation:

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

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

Sawtooth Fish Hatchery spring chinook salmon egg information.

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

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

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

| | | | |
|------|--------|--------|------|
| 1992 | 30,500 | 28,200 | 92.5 |
| 1993 | 50,939 | 43,399 | 85.2 |

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

Surplus eggs have not been generated in this program.

9.1.3) Loading densities applied during incubation.

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

9.1.4) Incubation conditions.

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

9.1.5) Ponding.

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

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

9.1.6) Fish health maintenance and monitoring.

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

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

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

9.2) Rearing:

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

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

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

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

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

9.2.3) Fish rearing conditions

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

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

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

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

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

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

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

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

See Section 9.2.4 above.

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

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

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

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

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

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

No smolt development indices are developed in this program.

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

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

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

At spawning, ELISA optical density values for female spawners are used to establish criteria for egg culling and isolation incubation needs. Fish may receive prophylactic

antibiotic treatments to control the spread of infectious disease agents. Fish are maintained at conservative density and flow indices (< 0.3 and < 1.5, respectively). Fish are fed by hand and observed several times daily. Proper disinfection protocols are in place. Rearing vats and raceways are swept on a regular basis.

SECTION 10. RELEASE

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

10.1) Proposed fish release levels.

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

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

¹ Releases associated with the Idaho Supplementation Studies program.

² General production (mitigation) releases.

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

Stream, river, or watercourse:

Release point: Upper Salmon River at Sawtooth Fish Hatchery 17060201 HUC.

Major watershed: Salmon River.

Basin or Region: Salmon River Basin.

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

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

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

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

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

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

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

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

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

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

10.5) Fish transportation procedures, if applicable.

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

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

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

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

Fish intended for potential harvest interception are generally marked with an adipose fin clip. To evaluate emigration success and timing to main stem dams and to evaluate

specific survival studies, PIT tags are inserted in production release groups annually. Coded wire tags may be used as a mark for various evaluation.

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

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

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

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

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

10.9) Fish health certification procedures applied pre-release.

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

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

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

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

Actions taken to minimize adverse effects on listed fish include:

1. Continuing fish health practices to minimize the incidence of infectious disease agents. Follow IHOT, AFS, and PNFHPC guidelines.
2. Marking hatchery-produced spring chinook salmon for broodstock management. Smolts released for supplementation research will be marked differentially from other fish.
3. Not releasing spring chinook salmon for supplementation research in the Salmon River in excess of estimated carrying capacity.
4. Continuing to reduce effect of the release of large numbers of hatchery chinook salmon at a single site by spreading the release over a number of days.
5. Attempting to program time of release to mimic natural fish for Salmon River smolt releases.
6. Evaluating natural rearing techniques for Salmon River spring chinook salmon at the Sawtooth Fish Hatchery.
7. Continuing to use broodstock for general production and supplementation research that exhibit life history characteristics similar to locally evolved stocks.
8. Continuing to segregate female spring chinook salmon broodstock for BKD via ELISA. We will incubate each female's progeny separately and also segregate progeny for rearing. We will continue development of culling and rearing segregation guidelines and practices, relative to BKD.
9. Monitoring hatchery effluent to ensure compliance with National Pollutant Discharge Elimination System permit.
10. Continuing Hatchery Evaluation Studies (HES) to provide comprehensive monitoring and evaluation for LSRCP chinook.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

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

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

Document LSRCP fish rearing and release practices.

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

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

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

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

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

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

Performance Standards and Indicators: 3.6.1, 3.6.2

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

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

Yes, funding, staffing and support logistics are dedicated to the existing monitoring and

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

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

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

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

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

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

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

SECTION 12. RESEARCH

12.1) Objective or purpose.

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

To properly evaluate this compensation effort, adult returns to facilities, spawning areas,

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

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

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

12.2) Cooperating and funding agencies.

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

12.3) Principle investigator or project supervisor and staff.

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

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

N/A

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

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

Hatchery staff routinely investigate hatchery variables (e.g., diet used, ration fed, vat or

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

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

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

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

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

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

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

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

Fish health monitoring occurs year round.

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

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

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

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

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

See Table 1.

12.10) Alternative methods to achieve project objectives.

Alternative methods to achieve research objectives have not been developed.

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

N/A.

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

See Section 11.2 above.

SECTION 13. ATTACHMENTS AND CITATIONS

Literature Cited:

Achord, S.A., M.B. Eppard, E.E. Hockersmith, B.P. Sanford, G.A. Axel, and G.M. Mathews. 2000. Monitoring the migrations of wild Snake River spring/summer chinook salmon smolts, 1998. Prepared for the Bonneville Power Administration. Project 9102800, Contract DE-AI79-91BP18800. Portland, OR.

Bachman, R.A. 1984. foraging behavior of free-ranging wild and hatchery brown trout in a stream. T. Amer. Fish. Soc. 113: 1-32.

Berggren, T.J. and L.R. Basham. 2000. Comparative survival rate study (CSS) of hatchery PIT tagged chinook. Status Report for migration years 1996 – 1998 mark/recapture activities.

Prepared for the Bonneville Power Administration. Contract No. 8712702. Portland, OR.

Bowles, E. and E. Leitzinger. 1991. Salmon supplementation studies in Idaho rivers, experimental design. Submitted to the Bonneville Power Administration. Project No. 89-098, Contract No. DE-BI79-89BP01466. Idaho Department of Fish and Game, Boise, ID.

Busack, C. 1990. Yakima/Klickitat production project genetic risk assessment. YKPP Preliminary Design Report, Appendix A. Washington Department of Fisheries. Prepared for the Bonneville Power Administration. Portland, OR.

Chapman D., A. Giorgi, M. Hill, A. Maule, S. McCutcheon, D. Park, W. Platts, K. Prat, J. Seeb, L. Seeb and others. 1991. Status of Snake River chinook salmon. Pacific Northwest Utilities Conference Committee, 531 p. D. Chapman Consultants, Boise, ID.

Chilcote, M.W., S.A. Leider, and J.J. Loch. 1986. Differential reproductive success of hatchery and wild summer-run steelhead under natural conditions. *T. Amer. Fish. Soc.* 115: 726-735.

Currens, K.P., C.A. Busack, G.K. Meffe, D.P. Philipp, E.P. Pister, F.M. Utter, and S.P. Yundt. 1991. A hierarchical approach to conservation genetics and production of anadromous salmonids in the Columbia river Basin. Product of the 1990 Sustainability Workshop, Northwest Power Planning Council, Portland, OR.

Dennis, B., P.L. Munholland and J.M. Scott. 1991. Estimation of growth and extinction parameters for endangered species. *Ecol. Mon.* 61:115-144.

Emlen, J.M., et al. 1991. Genetic variability and population viability. Product of the 1990 Sustainability Workshop, Northwest Power Planning Council. Portland, OR.

Everest, F.E. 1969. Habitat selection and spatial interaction of juvenile chinook salmon and steelhead trout in two Idaho streams. Ph.D. Dissertation. University of Idaho, Moscow, ID.

Fulton, L.A. and R.E. Pearson. 1981. Transplantation and homing experiments on salmon and steelhead trout in the Columbia River system: fish of the 1939 – 44 broods. U.S. Department of Commerce, NOAA Technical Memorandum, NMFS F/NWC-12.

Hall-Griswold, J.A. and C.E. Petrosky. 1997. Idaho habitat/natural production monitoring, part 1. Annual Report 1996. Prepared for the Bonneville Power Administration. Project No. 91-73, Contract DE-BI79-91BP21182. Idaho Department of Fish and Game. Boise, ID.

Hampton, M. 1988. Development of habitat preference criteria for anadromous salmonids of the Trinity River. U.S. Fish and Wildlife Service. Sacramento, CA.

Hansen, J.M. and J. Lockhart. 2001. Salmon supplementation studies in Idaho rivers. Annual Report 1997 (brood years 1995 and 1996). Prepared for the Bonneville Power Administration. Project 8909802. Portland, OR.

- Healey, M.C. 1991. Life history of chinook salmon. Pages 311-393 In Croot, C. and L. Margolis, ed: Pacific Salmon Life Histories. University of British Columbia Press, Vancouver, B.C. Canada.
- Hillman, T.W. and J.W. Mullan. 1989. Effect of hatchery releases on the abundance and behavior of wild juvenile salmonids. In Summer and winter juvenile chinook and steelhead trout in the Wenatchee River, Washington. A final report to Chelan County PUD, Washington. D. Chapman Consultants. Boise, ID.
- Idaho Department of Fish and Game (IDFG). 1998. Idaho's anadromous fish stocks: their status and recovery options. Report to the Director. May 1, 1998. Idaho Department of Fish and Game. Boise, ID.
- Idaho Department of Fish and Game (IDFG). 1993. Hatchery steelhead smolt predation of wild and natural juvenile chinook salmon fry in the upper Salmon River, Idaho. D.A. Cannamela preparer, Idaho Department of Fish and Game, Fisheries Research. Boise, ID.
- Idaho Department of Fish and Game. 1992. Anadromous Fish Management Plan, 1992-1996. Boise, ID.
- Idaho Department of Fish and Game (IDFG), Nez Perce Tribe, Shoshone-Bannock Tribes. 1990. Salmon River Subbasin salmon and steelhead production plan. Columbia Basin System Planning.
- Idaho Fisheries Resource Office (IFRO). 1992. Dworshak/Kooskia SCS program biological assessment. Unpublished report submitted to the Lower Snake River Compensation Plan office, U.S. Fish and Wildlife Service. Boise, ID.
- Kapuscinski, A.R. and L.D. Jacobson. 1987. Genetic guidelines for fisheries management. Department of Fisheries and Wildlife, University of Minnesota, St. Paul, MN.
- Kapuscinski, A.R., C.R. Steward, M.L. Goodman, C.C. Krueger, J.H. Williamson, E.C. Bowles, and R. Carmichael. 1991. Genetic conservation guidelines for salmon and steelhead supplementation. Product of the 1990 Sustainability Workshop, Northwest Power Planning Council. Portland, OR.
- Kiefer, S.W. 1993. A biological assessment of the effects of the release of summer chinook into the South Fork of the Salmon River from the LSRCP McCall Fish Hatchery on Snake River listed salmon. Unpublished report submitted to the USFWS, LSRCP office for Section 7 consultation. Idaho Department of Fish and Game. Boise, ID.
- Kiefer, S.W. 1987. An annotated bibliography on recent information concerning chinook salmon in Idaho. The Idaho Chapter of the American Fisheries Society.
- Kiefer, R.B., J. Johnson, and D. Anderson. 2001. Natural production monitoring and evaluation: monitoring age composition of wild adult spring and summer chinook salmon

returning to the Snake River Basin. Prepared for the Bonneville Power Administration. Project No. 91-73, Contract No. BP-94402-5. Idaho Department of Fish and Game. Boise, ID.

Kiefer, R.B. and K. Forster. 1990. Intensive evaluation and monitoring of chinook salmon and steelhead trout production, Crooked River and upper Salmon River sites, Idaho. Annual Report. Prepared for the Bonneville Power Administration. Project No. 83-7, Contract DE-AI79-84BP13381. Portland, OR.

Kiefer, R.B. and K. Forster. 1991. Intensive evaluation and monitoring of chinook salmon and steelhead trout production, Crooked River and upper Salmon River sites, Idaho. Annual Report. Prepared for the Bonneville Power Administration. Project No. 83-7, Contract DE-AI79-84BP13381. Portland, OR.

Krisiansson, A.C. and J.D. McIntyre. 1976. Genetic variation in chinook salmon (*Oncorhynchus tshawytscha*) from the Columbia River and three Oregon coastal rivers. Trans. Amer. Fish. Soc. 105: 620-623.

Kucera, P.A. and M.L. Blenden. 1999. Chinook salmon spawning ground survey in Big Creek, and tributary streams of the South Fork Salmon River, Idaho 1992-1995. Assessment of the status of salmon spawning aggregates in the Middle Fork Salmon River and South Fork Salmon river. Technical Report 99-7. Nez Perce Tribe Department of Fisheries Resources Management. Lapwai, ID.

LaPatra, S.W., W.J. Groberg, J.S. Rohovec, and J.L. Fryer. 1990. Size related susceptibility of salmonids to two strains of infectious hematopoietic necrosis virus. T. Amer. Fish. Soc. 119: 25-30.

Lee, E.G.H. and T.P.T. Evelyn. 1989. Effect of Renibacterium salmoninarum levels in the ovarian fluid of spawning chinook salmon on the prevalence of the pathogen in their eggs and progeny. Diseases of Aquatic Organisms 7: 179-184.

Marnell, L.F. 1986. Impacts of hatchery stocks on wild fish populations. Fisheries Culture in fisheries management, pages 339-351.

Matthews, G.M. and R.S. Waples. 1991. Status review for Snake River spring and summer chinook salmon. NOAA tech. Memo. NMFS F/NWC-200, 75p. National Marine Fisheries Service, Northwest Fisheries Science Center, Montlake, WA.

Myers, J.M., R.G. Kope, G.J. Bryant, D. Teel, L.J. Lieberheimer, T.C. Wainwright, W.S. Grant, F.W. Waknitz, K. Neely, S.T. Lindley, and R.S. Waples. 1998. Status review of chinook salmon from Washington, Idaho, Oregon, and California. National Marine Fisheries Service, NOAA Technical Memorandum NMFS-NWFSC-35. Northwest Fisheries Science Center, Montlake, WA.

National Marine Fisheries Service (NMFS). 2000. Endangered Species Act Section 7 Consultation. Biological Opinion. Reinitiation of consultation on the operation of the federal

Columbia River power system, including the juvenile fish transportation program, and 19 Bureau of Reclamation projects in the Columbia Basin.

Nehlsen, W., J.E. Williams, and J. Lichatowich. 1991. Pacific salmon at the crossroads: stocks at risk from California, Oregon, Idaho and Washington. *Fisheries* 16: 4-21.

Nei, M. 1978. Estimation of average heterozygosity and genetic distance from a small number of individuals. *Genetics* 89: 583-590.

Nei, M. 1972. Genetic distance between populations. *Am. Nat.* 106: 283-292.

Nelson, D.D. and J.L. Vogel. 2001. Monitoring and evaluation activities of juvenile and adult fishes in Johnson Creek. Annual Progress Report. Period Covered: January 1, 1998 to December 31, 1998. Nez Perce Tribe Department of Fisheries Resource Management. Lapwai, ID.

Northwest Power Planning Council (NPPC). 2001. Draft Subbasin Summary for the Salmon Subbasin of the Mountain Snake Province.

Oosterhout, G.R. and P.R. Mundy. 2001. The doomsday clock 2001: an update on the status and projected time to extinction for Snake River wild spring/summer chinook stocks. Prepared for Trout Unlimited. Portland, OR.

Peery, C.A. and T.C. Bjornn. 1992. Examination of the extent and factors affecting downstream emigration of chinook salmon fry from spawning grounds in the upper Salmon River. Unpublished report, Idaho Cooperative Fish and Wildlife Research Unit, University of Idaho, Moscow, ID.

Petrosky, C.E. 1984. Competitive effects from stocked catchable-size rainbow trout on wild population dynamics. Ph.D. Dissertation. University of Idaho, Moscow, ID.

Phinney, L. 1990. True story of Snake River fall chinook not a pleasing tale. Washington Department of Fisheries. Planning, Research, and Harvest Management Newsletter 1 (2): 1-5.

Pilcher, K.S. and J.L. Fryer. 1980. The viral diseases of fish: A review through 1978. In Part I: Diseases of proven viral etiology. CRC Press.

Piper, G.R., I.B. McElwain, L.E. Orme, J.P. McCraren, L.G. Gowler, and J.R. Leonard. 1982. Fish Hatchery Management. U.S. Fish and Wildlife Service, Washington D.C.

Quinn, T.P. and K. Fresh. 1984. Homing and straying in chinook salmon, *Oncorhynchus tshawytscha*, from the Cowlitz River Hatchery, Washington. *Can. J. Fish. Aquat. Sci.* 41: 1078-1082.

Regional Assessment of Supplementation Project (RASP). 1991. Draft status report for review and comment. Prepared for the Bonneville Power Administration. Portland, OR.

- Reisenbichler, R.R. 1983. Outplanting: potential for harmful genetic change in naturally spawning salmonids. In J.M. Walton and D.B Houston, eds: Proceedings of the Olympic Wild Fish Conference. Port Angeles, WA.
- Reisenbichler, R.R. and J.D. McIntyre. 1977. Genetic differences in growth and survival of juvenile hatchery and wild steelhead trout, *Salmo gairdneri*. J. Fish. Res. Bd. Canada. 34: 123-128.
- Riggs, L. 1990. Principles for genetic conservation and production quality. report to the Northwest Power Planning Council. Portland, OR.
- Sankovich, P. 1990. Distribution and spawning behavior of adults and survival of offspring of wild and hatchery chinook salmon. Summary Annual Report. Idaho Department of Fish and Game. Boise, ID.
- Shreck, C.B., H.W. Li, C.S. Sharpe, K.P. Currens, P.L. Hulett, S.L. Stone, and S.B. Yamada. 1986. Stock identification of Columbia River chinook salmon and steelhead trout. U.S. Dep. Energy, Bonneville Power Administration. Project No. 83-45. Bonneville Power Administration, Portland, OR.
- Steward, C.R. and T.C. Bjornn. 1990. Supplementation of salmon and steelhead stocks with hatchery fish: a synthesis of published literature. In W. Miller, ed: Analysis of salmon and steelhead supplementation.
- U.S. Fish and Wildlife Service (USFWS). 1992. Biological assessment of proposed 1992 LSRCP steelhead and rainbow trout releases. Unpublished report, Lower Snake River Compensation Plan Office. Boise, ID.
- U.S. Fish and Wildlife Service (USFWS). 1993. Programmatic biological assessment of the proposed 1993 LSRCP program. Unpublished report, Lower Snake River Compensation Plan Office. Boise, ID.
- Utter, F.M., D.W. Chapman, and A.R. Marshall. 1995. Genetic population structure and history of chinook salmon in the upper Columbia River. Am. Fish. Soc. Symp. 17: 149-165.
- Utter, F., G. Milner, G. Stahl, and D. Teel. 1989. Genetic population structure of chinook salmon (*Oncorhynchus tshawytscha*), in the Pacific Northwest. Fish. Bull. 87: 239-264.
- Walters, J., J. Hansen, J. Lockhart, C. Reighn, R. Keith, and J. Olson. 2001. Idaho supplementation studies five year report 1992 – 1996. Project Report, Idaho Department of Fish and Game. Prepared for the Bonneville Power Administration. Report No. 99-14, Contract DE-BI19-89BP01466. Portland, OR.
- Waples R.S., D.J. Teel, and P.B. Aebersold. 1991a. A genetic monitoring and evaluation program for supplemented populations of salmon and steelhead in the Snake River Basin.

Annual report. Bonneville Power Administration, 50 p.

Waples, R.S., J. Robert, P. Jones, B.R. Beckman, and G.A. Swan. 1991b. Status review for Snake River fall chinook salmon. NOAA Tech. Memo. NMFS F/NWC-201, 73p. National Marine Fisheries Service, Northwest Fisheries Science Center, Coastal Zone and Estuarine Studies Division, Montlake, WA.

Waples, R.S., O.W. Johnson, P.B. Aebersold, C.K. Shiflett, D.M. VanDoornik, D.J. Teel, and A.E. Cook. 1993. A genetic monitoring and evaluation program for supplemented populations of salmon and steelhead in the Snake Rive Basin. Annual Report. Prepared for the Bonneville Power Administration. Contract DE-AI79-89BP0091. Portland, OR.

Ware, D.M. 1971. Predation by rainbow trout (Salmo gairdneri): the effect of experience. J. Fish. Res. Bd. Canada. 28: 1847-1852.

Utter, F.M., W.J. Ebel, G.B. Milner, and D.J. Teel. 1982. Population structures of fall chinook salmon, *Oncorhynchus tshawytscha*, of the mid-Columbia and Snake River. U.S. Dep. Commer., NOAA, Northwest and Alaska Fisheries Center, Processed Report 82-10, 14p.

Winans, G.A. 1989. Genetic variability in chinook salmon stocks from the Columbia River Basin. N. Am. J. Fish. Manage. 9: 47-52.

Attachment 1.

The following excerpts were taken from:

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

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

Study Streams

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

General Criteria

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

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

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

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

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

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

Supplementation Protocols

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

Existing Programs

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

Existing programs in areas with viable natural populations typically include a weir to trap adults for broodstock and a hatchery facility nearby or in an adjacent sub-basin. Broodstock is collected systematically from adult returns comprised of an unknown proportion of hatchery and natural fish. Typically, one out of every three (33%) females and males is passed over the weir to spawn naturally and the remaining two out of three (67%) are brought into the hatchery for broodstock. Fish are spawned non-selectively throughout the run at a 1:1 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 1:1 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_e), factorial crosses or diallele crosses will be utilized to increase allelic diversity and N_e (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. >5°C 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 quotas will be regulated to maintain minimal exploitation (e.g. no more than 10%) on natural and supplementation fish. In all instances, terminal fisheries on study stocks will require precise and accurate creel survey data.

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

Risk Assessment

Our risk assessment of supplementation is based primarily on genetic concerns and follows guidelines currently being developed in the Basin (Busack 1990; Currens et al. 1991; Emlen et al. 1991; Kapuscinski et al. 1991). All upriver stocks of chinook salmon are currently

experiencing severe genetic risks to long-term stock viability (Riggs 1990; Mathews and Waples 1991; Nehlsen et al. 1991). We believe the major contributors to this genetic "bottlenecking" are system modifications (e.g. harvest, flows, and passage) which exert tremendous mortality and artificial selection pressures. These system constraints have forced many upriver stocks into a genetically vulnerable status warranting probable protection under the Endangered Species Act.

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

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

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

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

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

As discussed previously, we are not proposing dramatic modifications to hatchery

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

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

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

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

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

Potential Harvest Opportunities

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

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

| Stream | Basin | Year | Stream Length | Number of | | New Length | New Redds | New Redds/km | Comments |
|------------------------------|------------|------|-----------------|----------------|---------------------|------------|-----------|--------------------|--|
| | | | | Redds Counted | Redds per kilometer | | | | |
| 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 | |
| | | | | | | | | | 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 | 1997 | 20.7 | 75 | 3.62 | 12.1 | 74 | 6.116 | |
| 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 | |
| | | | | | | | | | 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 | 1993 | 18.1 | 25 | 1.38 | 12.1 | 25 | 2.066 | |
| 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. 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 | 1995 | 19 | 4 | 0.21 | 16.5 | 4 | 0.242 | |
| 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 (<i>Number of Fish</i>) | | | |
| | Egg/Fry | Juvenile/Smolt | Adult | Carcass |
| Observe or harass a) | | | | |
| Collect for transport b) | | | | |
| Capture, handle, and release c) | | | | |
| Capture, handle, tag/mark/tissue sample, and release d) | | | Entire run | |
| Removal (e.g. broodstock) e) | | | Section 7.2 | |
| Intentional lethal take f) | | | | |
| Unintentional lethal take g) | | | Pre-spawn mortality varies and may be as high as 8%. | |
| Other Take (specify) h) Carcass sampling | | | | 50 |

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

Instructions:

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

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

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

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) Description of non-anadromous salmonid species and habitat that may be affected by hatchery program.

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 compensatory 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.

Upper Salmon River. 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.

Pahsimeroi River. 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, Goldberg, 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.

Middle Salmon River – Panther Creek. 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.

Middle Fork Salmon River. 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).

Middle Salmon-Chamberlain Creek. 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.

Lower Salmon River. 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 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 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. Moving release sites for hatchery-produced, mitigation steelhead released in the East Fork Salmon River downstream to reduce the potential for negative interaction with natural anadromous and resident species.

3. Minimizing the number of smolts in the release population which are larger than 225 mm (or about 4 fpp).

4. Programming time of release to mimic natural fish for releases, given the constraints of transportation.

5. Continuing to apply evaluation tags (100%) to East Fork Salmon River steelhead to facilitate identification.

6. Manage adult collection levels to maintain natural spawning and to provide fish for supplementation research.

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

8. Continuing research to improve post-release survival of steelhead to potentially reduce numbers released to meet management objectives.

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

Elimination System permit.

10. Continuing to externally mark hatchery chinook released for harvest purposes with an adipose fin clip.

11. 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.

12. 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.

13. 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.

15.5 References

- Adams, S.B. 1999. Mechanisms limiting a vertebrate invasion: brook trout in mountain streams of the northwestern USA. Doctoral dissertation, University of Montana.
- Behnke, R.J. 1992. Native trout of Western North America. American Fisheries Society, Monograph 6.
- Bjornn, T. C. and Mallett, J. (1964). Movements of Planted and Wild Trout in an Idaho River System. Transactions of the American Fisheries Society 93(1): 70-76.*
- Cannamela, D.A. 1992. Potential impacts of releases of hatchery steelhead trout “smolts” on wild and natural juvenile chinook and sockeye salmon. A white paper. Idaho Department of Fish and Game, Boise, ID.
- Elle, S. 1998. Bull trout investigations. Project 6, Subproject 1, Annual Performance Report, Project F-73-R-18. Idaho Department of Fish and Game, Boise.
- Elle, S. and R. Thurow. 1994. Rapid River bull trout movement and mortality studies. Job 1, Job Performance Report, Project F-73-R-16. Idaho Department of Fish and Game, Boise.
- Hogan, D.M. 2001 (draft). Spatial and temporal distribution of bull trout (*Salvelinus confluentus*) in the upper East Fork South Fork Salmon River and its tributaries. M.S.

Thesis, University of Idaho, Moscow.

IDFG 2001. Fisheries management plan 2001 – 2006. Idaho Department of Fish and Game, Boise.

Lamansky, J.A., F.S. Elle, and D.J. Schill. 2001. Wild trout investigations. Project 2: Subproject 2, Grant F-73-22. Idaho Department of Fish and Game, Boise.

Liknes, G.A., and P.J. Graham. (1988). Westslope cutthroat trout in Montana: life history, status, and management. American Fisheries Society Symposium 4:53-60.

Lohr, S., T. Cummings, W. Fredenberg, S. Duke. 2000. Listing and recovery planning for bull trout. USFWS internal report.

Quigley, T.M. and S.J. Arbelbide, editors. 1997. An assessment of ecosystem components in the interior Columbia basin and portions of the Klamath and Great basins. U.S. Forest Service General Technical Report PNW-405 (volumes 1-4).

Reingold, M. 1985. Fivemile Creek Isolated Rainbow Trout. Region 6 Salmon Subregion

Salmon River and Stream Investigations. Project F-17-R-10 Job 6(SAL)-C2. Idaho

Department of Fish and Game, Boise, ID.

Rieman, B.E., D.C. Lee, and R.F. Thurow. 1997. Distribution, status, and likely future trends of bull trout within the Columbia River and Klamath River basins. North American Journal of Fisheries Management 17:1111-1125.

Rieman, B. E. and McIntyre, J. D. (1993). Demographic and Habitat Requirements for Conservation of Bull Trout. Ogden, UT: U.S. Forest Service, Intermountain Research Station.

Rieman, B. E. and Apperson, K. A. (1989). Status and Analysis of Salmonid Fisheries: Westslope Cutthroat Trout Synopsis and Analysis of Fishery Information. Idaho Department of Fish and Game.

Schill, D., R. Thurow, and P. Kline. 1994. Seasonal movement and spawning mortality of fluvial bull trout in Rapid River, Idaho. Job Performance Report, Project F-73-R-15. Idaho Department of Fish and Game, Boise.

Simpson, J. C. and Wallace, R. L. (1982). Fishes of Idaho. Moscow: University of Idaho Press.