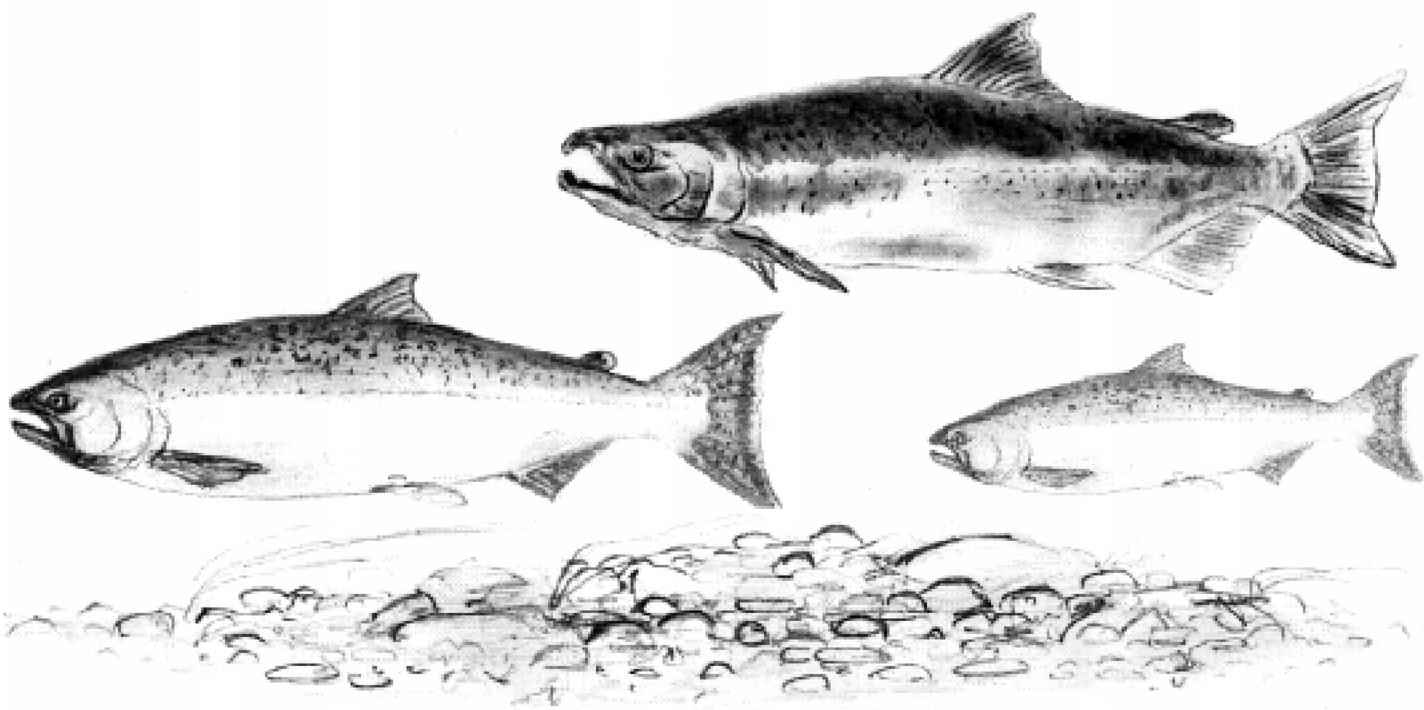
AUGUST 1999

IDAHO DEPARTMENT OF FISH AND GAME SNAKE RIVER CHINOOK CAPTIVE REARING PROGRAM

Preliminary Environmental Assessment

DOE/EA-1301



BONNEVILLE POWER ADMINISTRATION

Idaho Department of Fish and Game
Snake River Chinook Captive Rearing Program

Preliminary Environmental Assessment

DOE/EA-1301

Prepared for
Bonneville Power Administration

August 1999

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1. NEED AND PURPOSE FOR ACTION

1.1. Need for Action

The Bonneville Power Administration (**BPA**[1]) proposes to continue funding all elements of the Idaho Department of Fish and Game's (**IDFG**) ongoing Snake River Chinook **Captive-rearing** Program. The underlying need addressed by the program is to complete research on the captive-rearing of spring/summer chinook salmon *(Oncorhynchus tshawytscha)* of Snake River Evolutionarily Significant Units (**ESU**) at-risk local populations. This research could then be used to assist in the conservation and recovery of threatened and endangered stocks of anadromous salmonids.

In designing and managing the captive-rearing program, the IDFG is seeking to develop technologies and **protocols** for collecting wild/natural Snake River spring/summer chinook salmon from their natal streams. These juveniles are collected for in-hatchery rearing to **sexual maturity**, prior to **release** back to their streams of origin to spawn. The hypothesis being tested is that increased **juvenile-to-adult survival** of the wild fish reared in the hatchery would produce enough **spawners** to successfully enhance wild production. A secondary hypothesis is that, by using wild fish as captive-reared **broodstock**, the genetic viability of the wild populations would be maintained.

As part of its responsibilities under the **Pacific Northwest Electric Power Planning and Conservation Act of 1980** (Act), BPA must mitigate for fish, wildlife, and related **habitat** affected by the construction and operation of the Federal **hydroelectric dams** on the Columbia River and its tributaries. BPA also has responsibilities under the Endangered Species Act (**ESA**) of 1973 to conduct its activities in a way that does not jeopardize the continued existence of **listed** species, and to use its resources to conserve listed species.

The funding of this program is authorized under the Northwest Power Planning Council's (**Council**) Fish and Wildlife Program (**FWP**). Relevant measures of the FWP include: 7.4d.1, which calls for **scoping** to identify captive broodstock research needs; 7.4d.2, which calls for funding captive **broodstock** demonstration projects; and 7.4e.

1.2. Purposes

Consistent with the related actions and processes, BPA and the IDFG would fulfill the following purposes through implementation of the proposed program:

- Produce captive-reared adult chinook salmon with similar **morphological, physiological, and behavioral characteristics** to naturally produced fish;
- Minimize changes to the **genetic attributes** and **life history characteristics** of the naturally-spawning summer chinook populations in the Snake River Basin;

[1] Acronyms and words appearing in the glossary *(see Glossary)* are bolded the first time they appear in the document.

- Evaluate **spawning** behavior and success of released captive-reared adults;
- Assess **population viability** and develop a **conservation management plan**;
- Transfer information/technology;
- Mitigate in a manner consistent with the Council's FWP, and the *National Marine Fishery Service Draft Recovery Plan for Snake River Salmon*;
- Provide for administrative efficiency and cost-effectiveness.

1.3. Issues

Issues addressed in this Environmental Assessment (EA) are:

- Maintaining **metapopulation** structure by preventing local extinctions;
- Maintaining a minimum number of spawners in high risk populations;
- **Population dynamics** vs **population persistence**.

1.3.1. Decisions Based on This Environmental Assessment

Work funded by BPA to date *(see Past Program Activities)* has been categorically excluded under the National Environmental Policy Act (NEPA).

BPA Decision: Based on this document, and on public response to the document, the BPA must decide whether to issue a **Finding of No Significant Impact (FONSI),** allowing continued funding for the project. Issuance of the FONSI would be based on analytical answers to the question:

- Based on information generated by the program to date, the state of scientific certainty surrounding **hatchery supplementation** of wild stocks, and the **status of Snake River wild stock** target populations, is the IDFG program likely to fulfill its research goals without adding undue risk of extinction to threatened populations in a cost-effective manner?

IDFG Decision: Based on the results of their own research, and on this document, the IDFG must decide whether to continue the proposed action as written, modify the proposed action, or withdraw the proposed action from further consideration.

Council Decision: Based on this document, on public response to the document, and on its own expertise, the Council must decide whether the IDFG program meets its standards for continued funding.

National Marine Fisheries Service (NMFS)/United States Fish and Wildlife Service (USFWS): As required under the Endangered Species Act, NMFS and USFWS would review the EA and decide whether the document meets reporting, analytic, and scientific standards requisite for a favorable Biological Opinion on effects to endangered species.

1.4. Relationships to Other Projects

The Oregon Department of Fish and Wildlife (**ODFW**) initiated a **captive broodstock** program with broodyear 1994 Grande Ronde Basin chinook salmon *(reference document*

BPA 9604400). The program differs from the IDFG program in that it emphasizes captive broodstock rather than captive-rearing methods. Together, both programs aim at maintaining Snake River Basin chinook salmon metapopulation structure, while investigating two forms of captive **propagation** and determining their future utility.

The IDFG Snake River Chinook Captive-rearing Program for Salmon River Chinook Salmon operates in association with the Lower Snake River Compensation Plan (**LSRCP**)-funded Sawtooth Fish Hatchery (**SFH**) in Stanley, Idaho. Juvenile chinook collected from the Lemhi River, East Fork Salmon River (**EFSR**), and West Fork Yankee Fork Salmon River (**WFYF**) would be transferred to SFH for initial holding.

Cooperative **fish culture** activities conducted by NMFS at Washington State locations (*reference document BPA 9606700*) would be an integral component of the overall program. Duplicate chinook salmon cohorts would maintained in Idaho and Washington to guard against catastrophic loss at any one facility. In addition, culture activities at the NMFS' Manchester Marine Laboratory (**MML**) site would be carried out in seawater.

Guidance for the refinement and use of captive-broodstock technology for Pacific salmon is provided by NMFS and brings together information on **fish husbandry** techniques, genetic risks, physiology, nutrition, and pathology affecting captive broodstocks (*reference document BPA 9305600*).

Genetic investigations of Idaho and regional salmon populations (*reference document BPA 8909600*) provide essential information to the program. Conducted by NMFS, these studies generate baseline information on the genetic variability of target **subpopulations**. This information is an essential part of the Regional effort presently underway to maintain Snake River Basin chinook salmon metapopulation structure.

IDFG fish propagation activities associated with the chinook salmon captive-rearing initiative would be conducted at the Eagle Fish Hatchery (EFH), a facility presently in use to develop sockeye salmon captive broodstocks (*reference document BPA 9107200*). Although managed as separate projects, program responsibilities overlap and complement each other.

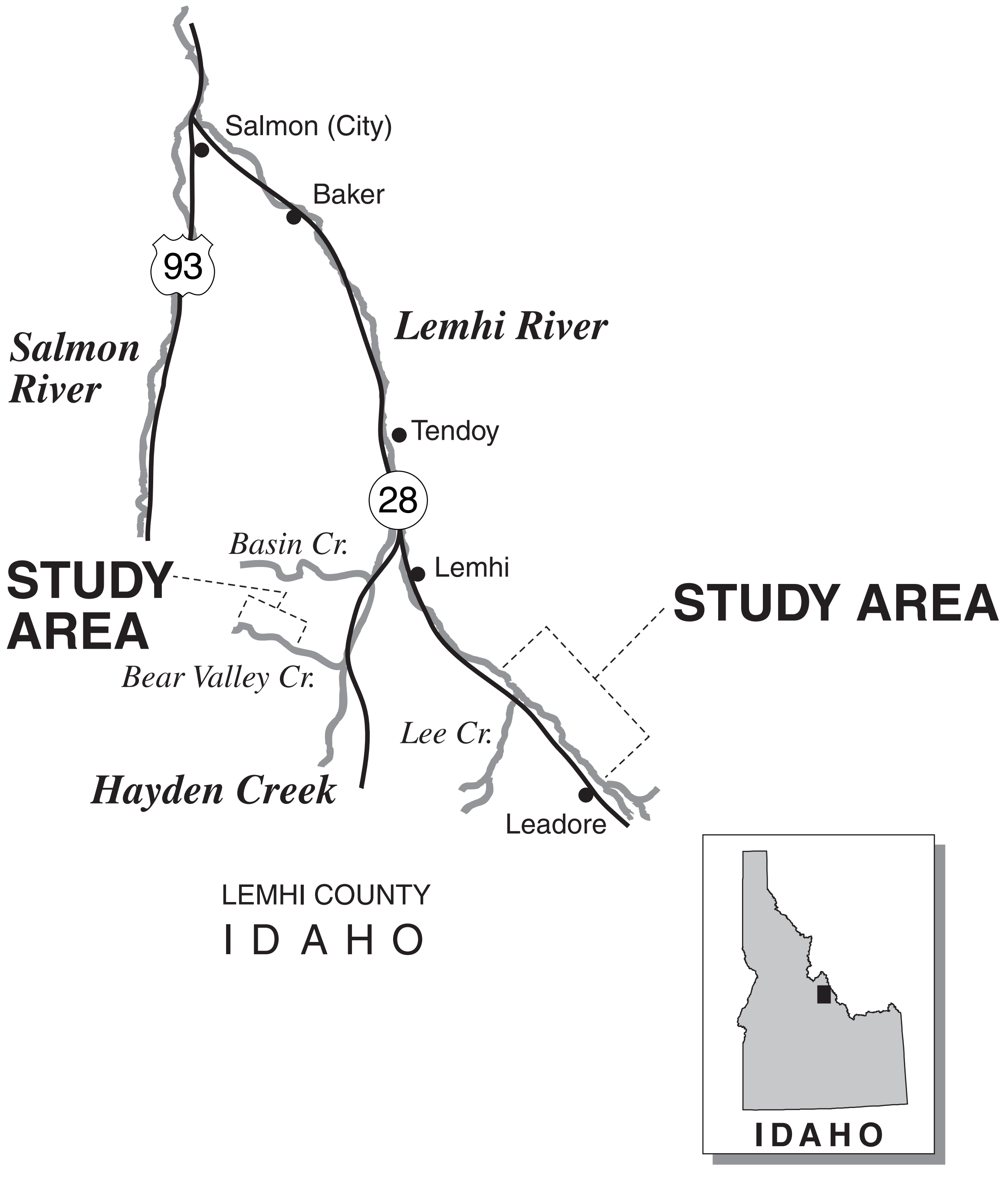

Figure 1-1. Map of Lemhi River Project Area

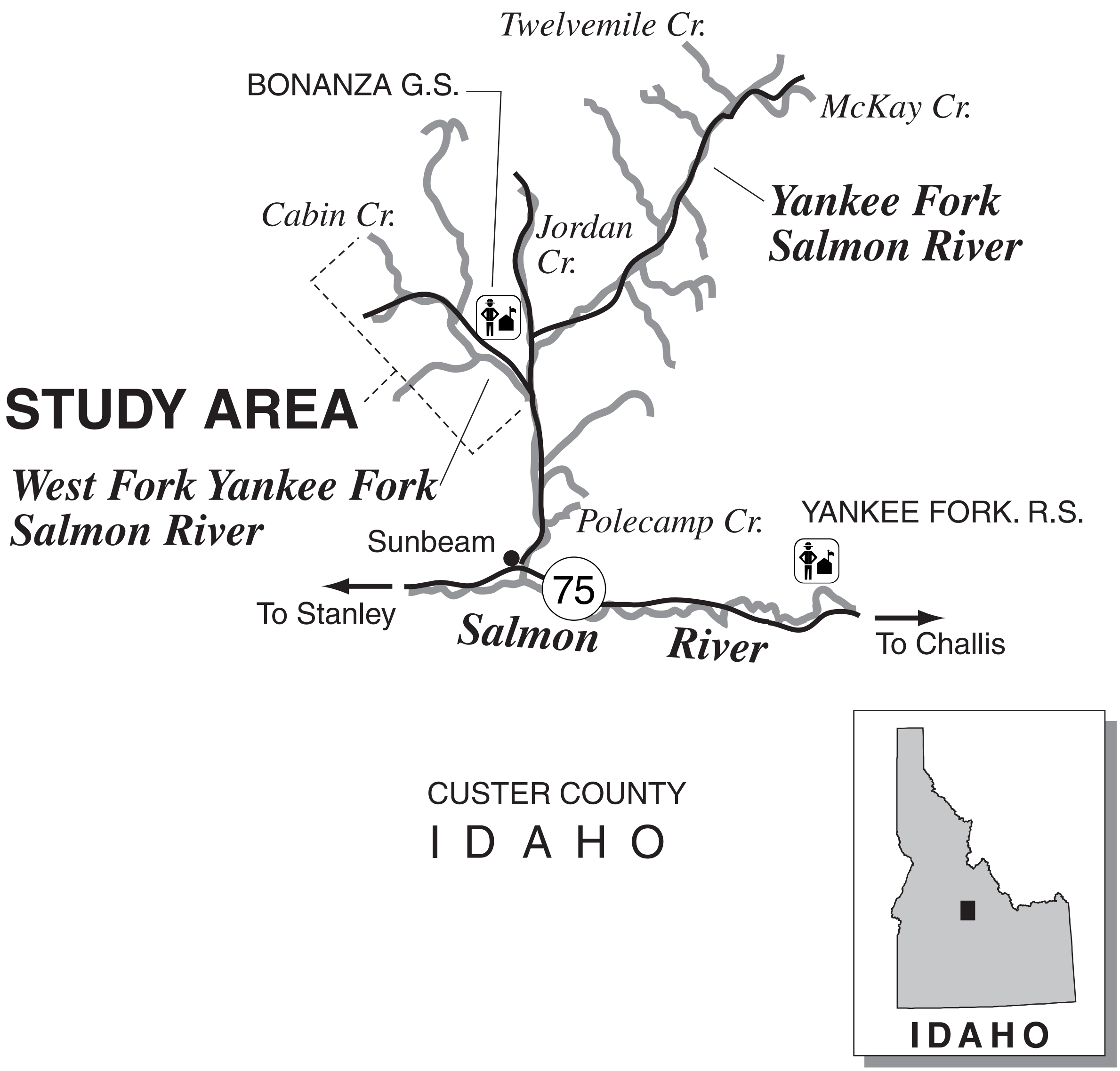

Figure 1-2. Map of West Fork Yankee Fork Salmon River Project Area

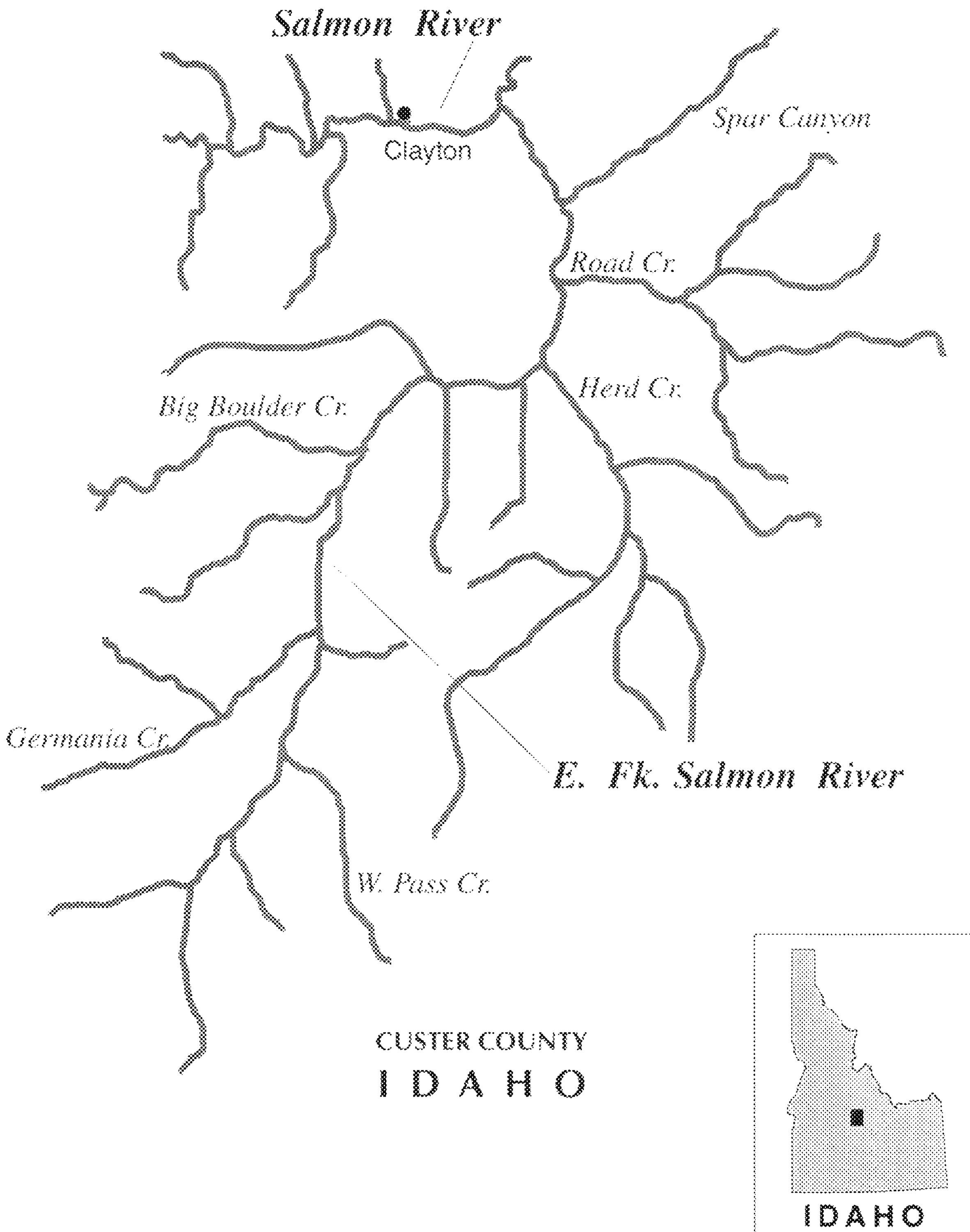

Figure 1-3. Map of East Fork Salmon River Project Area

2. ALTERNATIVES DESCRIPTION

2.1. Proposed Action

2.1.1. Overview

The IDFG Snake River Chinook Captive-rearing Program began in 1995 with the collection of **broodyear** 1994 juveniles, hatchery-rearing of these juveniles in freshwater and saltwater environments, and eventual release of sexually mature males and females back to **natal** streams for spawning in 1997 *(see Past Program Activities).* These program activities are ongoing, and include several program measures.

- Juvenile would be collected by screw trap and/or seine in the EFSR and WFYF, and the Lemhi River, in June, July, and August. At time of collection, the fish are summer **parr**, approximately six months past **swim-up.**
- These juveniles would then be transferred to SFH near Stanley, Idaho for initial rearing. Subsequently, the broodyear class would be transferred to Eagle Hatchery near Boise, Idaho, where they would be divided. A percentage of the broodyear class would then be reared in freshwater, and the rest in saltwater *(see 4.2.1.6).*
- Fish would be monitored for sexual maturity during rearing. As they mature, they would be **outplanted** to their streams of origin to spawn.
- Under permit from NMFS, IDFG may keep a small number of adult fish (approximately 22) from the Lemhi and WFYF populations to develop stock-specific understanding of **fecundity**, **gamete quality**, and **fertilization success**. Eggs from the retained adults would be outplanted to Bear Valley Creek, a tributary to the Lemhi River with no adults projected to return this year, and to WFYF.
- Monitoring and evaluation would be conducted, including **radio-tagging**, **marking**, observation, and tracking fish; **redd** counts; and placing of fish in enclosures to observe behavior and spawning.

<u>Past Program Activities</u>

1995: Juvenile chinook salmon born in 1994 (broodyear 1994) were collected from the Lemhi River, EFSR and WFYF to initiate the captive-rearing program. Following initial rearing at the SFH, the fish were transferred to IDFG's EFH for rearing to sexually mature adult stage.

1996: Broodyear 1995 juvenile fish were collected from the Lemhi River only, since too few adult summer chinook returned to the EFSR and WFYF to produce an adequate number of juveniles. Broodyear 1994 fish remained in culture at EFH.

1997: 1998 was the first year that the program was funded through the Columbia River Basin Fish and Wildlife Program. In 1997, broodyear 1996 juveniles were collected from the Lemhi River, and the EFSR and WFYF. Only five juveniles were collected from the EFSR as a result of the low numbers of adults returning to spawn.

In May, 1997, approximately ½ of the broodyear 1996 fish were transferred to the MFH in Washington State for saltwater rearing. The remaining half were reared in freshwater at the EFH.

Also in 1997, a small number of maturing male fish, known as '**jacks**,' from broodyear 1994 (up to four from the three collection site stocks) were returned to their streams of origin. Their movement and behavior on the spawning beds were monitored.

1998: Broodyear 1997 juveniles were collected from the Lemhi River and the WFYF. Low numbers of adults returning to the EFSR prevented collection at that site.

In September 1998, jacks from broodyear 1995 were released to the Lemhi River system and the WFYF with broodyear 1994 Lemhi River females. No adults were released to the EFSR in 1998 because of the projected low numbers of returning wild adults. Milt from 1997 and 1998 maturing males was **cryopreserved** (frozen).

Immature broodyear 1995, 1996, 1997, and 1998 fish remained in culture.

1999 and following: Broodyear 1996, 1997, and 1998, fish remain in culture, with expected maturation coming in years 1999, 2000, 2001, and 2002, respectively. Release of mature fish for spawning back to their streams of origin, and collection of broodyear 1998 juvenile fish is planned for fall 1999.

2.1.1.1. Tasks and Objectives - FY1999

Tasks can be organized into four work areas:

- Collection of juveniles for captive-rearing;
- Rearing, and monitoring and evaluation during the rearing phase;
- Planning outplanting schedules based on **forecasted adult returns**;
- Outplanting, and monitoring and evaluation of adult outplants.

2.1.2. Collection Protocols

Populations for hatchery preservation actions have been prioritized based on assumed relative importance to the Snake River spring/summer chinook salmon **Evolutionarily Significant Unit (ESU**), assumed retention of native population characteristics estimated, imminent extinction risk, and risk of exposure to experimental techniques. High priority populations would have:

- Annual **escapement** of less than 20 fish;
- Adequate habitat for successful spawning and rearing;
- Poor **resiliency** from the last bottleneck (1979 through 1984).

Juvenile chinook salmon would be collected over a broad range of stream distance using rotary screw traps (EG Solutions, Corvallis, OR) and beach seines. Rotary screw traps are passive capture devices generally positioned in the **thalweg** of the stream. Stream flow rotates the trap drum, which in turn funnels fish safely to a live well for temporary holding. IDFG personnel or their designated agents would tend traps on a daily basis. Captured juvenile chinook would be temporarily held in streamside live boxes until transferred to the SFH for initial rearing. Seine crews would work cooperatively with snorkel crews to locate juvenile chinook salmon. Following location, seine crew personnel would position the seine downstream of the targeted assemblage of fish.

Screw traps would be generally manned between 0800 and 1000 hours. Captured outmigrants would be anesthetized in buffered MS222 (Methane Tricaine Sulfonate), measured for fork length (nearest 1.0 mm) and weighed (nearest 0.1 g). Depending on location and study design, a portion of the captured outmigrants may be **PIT tagged** for evaluation purposes. PIT tagging procedures follow standard, accepted practices as described by Prentice et al. (1990). All captured juvenile chinook salmon would be held in flow-through, low velocity live boxes and released approximately one-half hour after sunset. A portion of PIT tagged juveniles may be released approximately 270 meters (m) (900 feet [ft]) upstream of the screw trap to develop estimates of trapping efficiency (based on the proportion recaptured).

Non-target species of concern (steelhead and bull trout) captured during efforts to collect juvenile chinook salmon would be released unharmed.

2.1.3. Rearing protocols

2.1.3.1. General Guidelines

These protocols apply to all rearing stages.

- All mortalities would be examined.
- Rearing densities would be maintained at or below 0.22 kilograms (kg)/0.03 cubic meters (cm) (0.5 pounds [lbs.]/1 cubic foot [cf]) of rearing space, and 4.5 kg/3.0 liters per minute (lpm) (10 lbs/11.4 gallons per minute [gpm]) of inflow.
- Strict **quarantine** practices would be maintained. Each pool has separate dip nets and brushes.
- Pools would be flushed and brushed weekly to maintain a clean environment.
- Each stock and broodyear would be maintained in individual 18 m (20 ft) tanks from smolt to adult.
- Fish would be observed daily for feed response and health condition.
- Emergency back-up systems and alarms would activated in case of power and/or water pump failures.
- Pools would be covered with jump netting.
- Natural photoperiod would be maintained.

- Fish health inspections and sampling would be routine, at the discretion of the IDFG pathologist. The IDFG Eagle Fish Hatchery Fish Health Laboratory would be the primary site for the chinook-rearing program. The IDFG Eagle Fish Hatchery Fish Health Laboratory is located adjacent to the EFH and provides space for all **necropsy work** associated with the program. Pathology investigations would be carried out as needed at this location.

2.1.3.2. Initial Rearing

- Juveniles would be transferred to SFH following collection.
- Juveniles would be held by stock in 0.9 m (three-ft) diameter pools.
- Juveniles would be transferred to EFH within two months of collection.
- Rearing densities would be maintained at or below 0.22 kg/per 0.03 cm (0.5 lbs/cf) fish of rearing space.
- Juveniles would be fed by hand seven days per week following growth program.

2.1.3.3. Seawater Rearing

- Approximately 80 percent of age 1+ smolts would be transferred in early May to MML for seawater rearing.
- All seawater for ESA programs would be filtered and treated with ultraviolet light (UV), and passed through a large packed column to maintain a high-quality rearing environment.
- A 3 m (20-foot) diameter pool would be filled to two-foot depth with freshwater.
- Smolts would be temperature-acclimated in transfer tank and placed into pool, one stock per pool.
- Seawater would be added slowly 26.6 to 38 lpm (seven to ten gpm) over two day period for acclimation, then increased to 76 lpm (20 gpm).
- 0.6 m (two-foot) water depth would be maintained for first four months after transfer. This would allow for quicker water turnover time and better inventory control while fish are small. Inflow is gradually increased to 133 lpm (35 gpm).
- Water depth would be increased to 1.5 m (five ft) for remaining 32 to 44 months, depending on age at maturation. Inflow would be increased to 190 to 266 lpm (50 to 70 gpm) depending on biomass.
- Natural water temperature regime would be maintained year round, with chillers used in the summer to keep water temperature from exceeding 13°C.
- Medicated feed treatments with Erythromycin would be applied as necessary under INAD 4333.

- Sampling for growth would be done no more than three times per year to minimize handling stress.

2.1.3.4. Adult Transfer to Freshwater

- Each stock is sorted for maturing adults beginning in June, at ages two, three, four, and five.
- Mature adults would be transferred back to IDFG facilities in July in transfer tanks containing 25 percent seawater and 75 percent freshwater to provide gradual acclimation back to a freshwater environment.

2.1.4. Outplant Design and Protocols

Outplant design and protocols are determined yearly by the Technical Oversight Committee based on predictions of wild/natural adult returns to target streams, and availability of program sexually-mature adults. The following protocols refer to only FY 1999.

2.1.4.1. Planning Outplanting

Rearing fish, both fresh- and saltwater-reared, would be monitored and evaluated for:

- growth;
- survival;
- the sex ratio of maturing fish; and
- disease and maturity profiles.

The number of outplanted adults to any particular study area would be based on forecasted wild/natural adult returns, carrying capacity and health of the stream environment, and program goals.

2.1.4.2. Outplanting - General

Adult chinook salmon would be transported to release locations in truck-mounted, insulated tanks with alarm and back-up oxygen systems on board. All vehicles would be equipped to provide the appropriate conditions for safe transfers. IDFG or cooperating or personnel would transport fish. Prior to release, transport and receiving water temperatures would be tempered to fall within a 2.0°C range.

Fish would be released into eddies and along stream margins to minimize initial energy expenditure.

East Fork Salmon River and WFYK enclosures would be constructed to monitor and evaluate the spawning success of captive-reared adults. Enclosures would consist of panels made of angle iron 3 m by 0.9 m (10 ft by 3 ft) with aluminum pickets 2.03 cm (13/16 inch) in diameter, spaced approximately 45 cm (1.5 inch) apart. The pickets would be pounded into the substrate and sandbagged to prevent fish from digging under and escaping. The IDFG would snorkel the bottom of the weir structure to ensure that it is sealed. Enclosures would be constructed on one side of the stream to provide easy passage around them.

Habitat types and the size of enclosures would be carefully selected to meet the needs of the fish. Stream sections with pools or slow-water resting areas, escape areas with cover, and suitable spawning substrate, would be selected. Enclosures would be carefully monitored several times per day.

The Bear Valley Creek enclosure in the Lemhi River drainage would be of a different design. Because of the relatively small stream channel size, partial channel enclosures would not be suitable. In this case, a lower blocking weir would be constructed to prevent captive-reared adult chinook salmon from emigrating downstream and out of the study section. The upper block on Bear Valley Creek is a natural, partial barrier. The lower block would be constructed of angle iron and picket material similar to that described above. However, this structure would include a trap to allow wild/natural chinook salmon and bull trout to pass the structure. Upstream and downstream migrating chinook salmon and bull trout would be collected and passed unharmed. This structure would be carefully monitored several times per day.

2.1.4.3. Outplanting - Lemhi River

In 1999, the IDFG proposes no releases of sexually mature females or males into the mainstem Lemhi River. Rather, the IDFG proposes releasing all sexually mature females and males into a two-mile section in Bear Valley Creek, a tributary to Hayden Creek (in the Lemhi drainage).

The temporary weir would be installed. The Idaho Department of Fish and Game estimates that less than two wild adults would return to Bear Valley Creek in 1999. Externally visible tags would be placed on all fish and some fish may be radio-tagged.

In addition, the Technical Oversight Committee may recommend holding some sexually mature males and females at EFH for artificial spawning and eyed-egg planting. Eyed-eggs would be placed into either Whitlock-Vibert **hatch boxes** or into streamside Jordan-Scotty boxes in Hayden Creek, near the Hayden Creek Hatchery site, which is 6.4-to-8 km (five miles) upstream from the mouth of the Lemhi River. Information would be collected on stock specific fecundity, gamete quality, and fertilization success during the brief hatchery incubation period.

The Shoshone-Bannock Tribe would be the designated IDFG Snake River Chinook Captive-rearing Program’s agent, responsible for planting and monitoring the eyed-eggs.

2.1.4.4. Outplanting - West Fork Yankee Fork Salmon River

The Idaho Department of Fish and Game proposes to release no mature adults on the WFYF for natural spawning in 1999. This decision is based on very low (less than two) projected numbers of returning wild/natural adults. Moreover, the program has fewer than 10 mature hatchery-reared WFYF adults. Therefore, IDFG program managers believe that holding and spawning adults in-hatchery, and outplanting progeny as eyed-eggs, would constitute the best use of program resources.

2.1.4.5. Outplanting - East Fork Salmon River

In the mainstem ESFR River, IDFG proposes to release all sexually mature females and males in 1999.

The temporary weir would be installed on the lower end and the upper end, acting as a natural barrier. Externally visible tags would be placed on all fish and some fish may be radio-tagged.

In addition, the Technical Oversight Committee may recommend holding some adult males and females at EFH for artificial spawning and eyed-egg planting. Eyed-eggs would be placed into either Whitlock-Vibert hatch boxes**,** or in streamside Jordan-Scotty boxes. Information would be collected on stock specific fecundity, gamete quality, and fertilization success during the brief hatchery incubation period.

The Shoshone-Bannock Tribe would be the designated IDFG captive-rearing program's agent, responsible for planting and monitoring the eyed-eggs.

2.1.4.6. Monitoring and Evaluation of Adult Outplants

Outplanting of sexually mature adults from the captive-rearing program is considered a form of supplementation. A detailed research plan for evaluating supplementation programs in Idaho is provided in Bowles and Leitzinger (1991).

The IDFG captive-rearing program would employ these same procedures to evaluate the success of outplanting sexually mature adult males. The evaluation would examine the overall effect of adult supplementation on natural production and productivity.

Production response variables that would be monitored include:

- number of redds constructed;
- mid-summer parr production from spawners;
- fall and spring emigrant (pre-smolt and smolt) production;
- total smolt production; and
- adult escapement resulting from adult outplants.

Productivity response variables that would be measured include:

- survival (egg-to-parr, parr-to-smolt, smolt-to-adult or redd counts);
- fecundity;
- age structure of the maturing captive population;
- spawning ratio (supplemented and unsupplemented adults);
- parr distribution and growth; and
- emigration timing.

2.2. No Action Alternative

Under the No Action Alternative, BPA would not fund ongoing program activities. Activities could proceed under a different funding source. However, no other funding sources have been identified.

Table 2-1: Decision Factors - Comparison of Alternatives

Purpose	Proposed Action	No Action Alternative
Mitigate in a manner consistent with the Council's FWP, and NMFS' Draft Recovery Plan for Snake River Salmon.	Consistent with NPPC Measure 7.3B for anadromous fish, and consistent with Task 4.1b of the Recovery Plan, as well as with the Biological Opinion for hatchery operations.	No mitigation under the No Action alternative.
Enhance natural production of summer chinook salmon in the Snake River Basin, and increase the probability of survival for the remaining native populations through the use of captive-reared local broodstock.	Yes	Uncertain
Maintain the genetic attributes and life history characteristics of the naturally-spawning summer chinook populations in the Snake River Basin.	Uncertain	Reduction of genetic attributes could be expected from reduced wild populations should no action be taken.
Utilize new knowledge on the use of captive-reared broodstock as a means to assist the recovery of endangered species.	Yes	No
Provide for administrative efficiency and cost-effectiveness.	Meets the biological objectives with minimal cost.	No

3. AFFECTED ENVIRONMENT

3.1. Study Areas

3.1.1. East Fork Salmon River

The East Fork Salmon River is located 552 river kilometers (RK) (345 river miles [RM]) upstream from the mouth of the Salmon River. The confluence of the EFSR is near the town of Clayton. The East Fork Salmon River is surrounded by private land from the mouth upstream to Big Boulder Creek, where land ownership transfers primarily to the US Forest Service (**USFS**). The Idaho Department of Fish and Game had operated a velocity barrier weir on the EFSR until 1998 when the decision was made to leave the barrier open and allow upstream passage of all adult chinook salmon. The study area is located from the velocity barrier weir site upstream to the headwaters of the EFSR.

3.1.2. West Fork Yankee Fork Salmon River

The Yankee Fork Salmon River is located 591 RK (369 RM) upstream from the mouth of the Salmon River. The confluence of the West Fork Yankee Fork is located upstream an additional 11 RK (6.8 RM) near the one-time mining community of Bonanza. Land ownership on the WFYF is primarily USFS property with several summer homes established near the mouth of the WFYF. Habitat consists of B and C channel types (Rosgen 19__). The majority of chinook salmon spawning occurs between the tributaries of Lightening, and Cabin creeks.

3.1.3. Lemhi River

The Lemhi River is located 416 RK (260 RM) upstream from the mouth of the Salmon River. The confluence is located near the town of Salmon. The mouth of Hayden Creek is located approximately 32 RK (20 RM) upstream from the mouth of the Lemhi River, and the confluence of Bear Valley Creek is an additional 12 RK (7.5 RM) upstream on Hayden Creek. Land ownership on the Lemhi River is private with several cooperating landowners residing in the study area near the town of Leadore. Most chinook spawning occurs near the town the Leadore. Land ownership is mixed in the Hayden Creek, Bear Valley Creek area with private landowners near the mouth of Hayden Creek, and USFS property throughout most of the drainage. Habitat types consist of B and C channel types on both Hayden Creek and Bear Valley Creek. The primary study area for evaluations of captive release spawning is in Bear Valley Creek where the fish would be restricted to a C channel meandering meadow of approximately 2.5 RK (1.5 RM) in distance.

3.2. Species Profiles for Study areas

In-stream fish species profiles are similar among study area streams.

- Anadromous fish include wild/natural and hatchery-produced spring/summer chinook salmon (*Oncorhynchus tshawytscha)* and steelhead (*O. mykiss)*.

- Resident fish include bull trout (*Salvelinus confluentus)*, cutthroat trout (*O. clarki)*, northern squawfish (*Ptychocheilus oregonensis)*, redside shiner (*Richardsonius balteatus)*, sculpin (*Cottus spp*.), dace (*Rhinichthys spp*.), suckers (*Catostomus spp*.), rainbow trout (*O. mykiss***),** mountain whitefish (*Prosopium williamsoni)*, and brook trout (*S. fontinalis)*.

3.3. Disease Profile of Study Areas

Three pathogens have been identified to originate in study area streams where parr were collected.

BACTERIAL KIDNEY DISEASE: *Rs* has been demonstrated to be present at relatively low prevalence in parr groups collected from both the Lemhi River and WFYF. Prevalence at collection has been estimated at about 2 percent of the parr. Subsequent transmission to other members of the group and development of clinical BKD and mortality has occurred in one of four Lehmi River and one of three WFYF groups. The severity of mortality in any one group is favored by early development of clinical BKD, conditions favoring horizontal transmission, culture and nutritional stress, and efficacy of Erythromycin therapy.

SALMINCOLA **INFESTATION:** Detection has been limited to chinook parr collected from the Lemhi River. This copepod successfully completes its life cycle under fresh water culture conditions. Infestation levels were estimated at 3 percent when the parr were collected. The parasite causes debilitation and poor growth when numbers of parasites per fish are sufficient to cause necrosis of gill tissues. Control of the parasite has been obtained at Eagle Fish Hatchery through administration of Ivermectin.

MYXOBOLUS CEREBRALIS: This parasite, which can cause clinical whirling disease does not complete its life cycle under hatchery conditions and consequently does not cause mortality. Each mortality from all cultured groups has been examined for Mc. Parr collected from the Lemhi River had a 33 percent prevalence, while EFSR and WFYF groups have had less than 1 percent prevalence. Some of the Lemhi River groups have had deformities typical of the disease.

VIRAL DISEASE AGENTS: There has been no evidence of viral disease agents from any group in this program.

3.4. Historical and Current Status of Anadromous and Resident Fish in the Sub-basin

3.4.1. Spring/summer Chinook Salmon

Historically, spring and summer chinook salmon were produced in numerous tributaries of the Snake River in both Oregon and Idaho. During the late 1800s, the Snake River probably produced in excess of 1.5 million juvenile spring and summer chinook salmon in some years (Matthews and Waples 1991).

Wild production in the Snake River Basin in the 1960s was returning 50,000 to 80,000 adult spring chinook annually (ODFW 1991). Returns of wild spring chinook in the Snake River Basin has declined to about ten to 20 percent of the estimated level of the

1960s (ODFW 1991) The estimated average annual escapement of wild adult spring chinook salmon at Lower Granite Dam was 6,100 from 1987 through 1991 (ODFW 1991). Escapement trends in Oregon streams indicate that there were relatively stable wild spring chinook escapements from the mid-1950s to early 1970s, and following the completion of the two uppermost dams on the Snake River, there was a sharp decline in escapement (ODFW 1991). The estimated average escapement of hatchery spring chinook over Lower Granite Dam during the same period was increasing annually and estimated to be an average of 12,900 fish (USFWS 1992).

The Snake River wild summer chinook run has declined substantially from an average run at Ice Harbor Dam in the 1960s of 22,000 fish to an average estimated run of 3,100 fish in the 1980s (ODFW 1991). Hatchery production of summer chinook began in the 1980s. The estimated hatchery summer chinook run at Lower Granite Dam has ranged from 671 in 1982 to 3,883 in 1988 (ODFW 1991).

The Salmon River, meanwhile, has been the single most important summer chinook salmon spawning stream in the Snake River basin, producing a substantial proportion of all Snake River summer chinook salmon (Mallet, 1974). Approximately 50 per cent of Idaho's summer chinook salmon redds were counted in the entire Salmon River. As recently as 1957, adult summer chinook salmon returns to the Salmon River were estimated to range between 10,000 and 15,000 fish.

Natural escapement declines in the Salmon River Basin have paralleled those of other Snake River stocks. Reduced spawner numbers combined with human manipulation have resulted in decreased spawning distribution and increased population fragmentation.

On December 28, 1993 (USGFR 1993; 58 FR 68543), critical habitat was designated for Snake River summer chinook salmon listed under the Endangered Species Act. This designation provides notice to Federal agencies and the public that these areas and features are vital to the conservation of the species.

3.4.2. Bull Trout

Resident **fluvial** life history forms are present within the project area watersheds. Tributaries of the watersheds function as spawning and rearing areas for fluvial bull trout. Densities tend to increase in small headwater tributaries

Resident fluvial bull trout complete their entire life cycle in the tributary (or nearby) streams in which they spawn and rear. Juvenile fish rear from one-to-four years before migrating to a river where maturity is reached. Resident and migratory forms may be found together; it is suspected that individual bull trout give rise to offspring exhibiting either resident or migratory behavior. Bull trout spawn from late August through late September in the project areas. Hatching may occur in winter or early spring, but **alevins** may stay in the gravel for an extended period after yolk absorption. (USFWS, Biological Opinion, 1998)

3.4.3. Steelhead

There are two races of steelhead: summer and winter. No winter steelhead occur in the Snake River drainage.

Two distinct stocks of summer steelhead have also been identified: A-run and B-run steelhead. A-run steelhead are a smaller, earlier-returning stock. B-run steelhead are a larger, later-returning stock. A-run fish are found in all study areas and are the species of concern due to possible species interactions. They mature at three to four years, and weigh up to 20 lbs. A-run females lay an average of 3,500 eggs in small to medium gravel during April to May. After emerging from the redds in April to June, juveniles remain in streams and rivers for one to two years before migrating to the ocean during March to June (Bell 1986).

Four distinct phases of life history characterize all races and stocks of steelhead: freshwater spawning and rearing; juvenile migration to the ocean; ocean residence; and adult upriver migration.

Additionally, The EFSR receives B-run steelhead. The B-run steelhead in the ESFR were introduced, and now are established.

Limited information is available on the historical size of summer steelhead runs in the Columbia River Basin. Escapement of wild/natural Snake River A-run steelhead at Lower Granite Dam have ranged from a low of 7,400 fish in 1974, to a high of 20,000 fish in 1986. Escapements have declined since 1986 (ODFW 1991).

The estimated Snake River B-run escapement at Lower Granite Dam was 2,900 fish in 1974, increasing to 7,000 fish in 1982. The escapement since 1982 has been variable, ranging from 5,100 fish to 8,900 fish (ODFW).

3.5. Aquaculture/Hatcheries

Over 200 wild stocks of Pacific salmon have recently been classified at risk of extinction by the American Fisheries Society, and US fisheries managers have become increasingly aware of the need to preserve and rebuild these stocks (Nehlson et al. 1991). In many cases, ecosystem preservation alone would not be adequate to rebuild wild stocks quickly enough to prevent extinction. Theoretically, the fastest way to increase population numbers is through supplementation releases of hatchery-propagated fish.

Unfortunately, techniques for producing hatchery-reared fish suitable for rebuilding wild runs have been poorly understood. Most attempts at supplementation that have used hatchery-reared fish to rebuild naturally spawning populations of Pacific salmon have yielded poor results (Moring 1986; Miller 1990; Cuenco et al. 1993). Although the protective hatchery environment does increase egg-to-smolt survival, post-release survival of cultured salmonids is often considerably lower than that of wild-reared fish (Greene 1952; Miller 1952; Salo and Bayliff 1958; Reimers 1963; Chilcote et al. 1986; Nickelson et al. 1986).

Conventional hatchery practices may induce domestication and anomalous behavioral characteristics, which are often considered prime factors in reducing the fitness of hatchery fish for survival in natural ecosystems (Reisenbichler and McIntyre 1977; Nickelson et al. 1986; Hillman and Mullan 1989; Goodman 1990; Waples 1991; Hilborn 1992).

When chinook salmon trapping began in 1981 as part of the LSRCP, it was assumed that enough chinook salmon adults would return to fill the needs of both **harvest** and continued hatchery production. It was also assumed that hatchery programs would not negatively impact the **productivity** (survival rates) or **genetic viability** (ability of wild salmon gene pools to adapt successfully to local habitats) of target or other populations. N**atural populations** would remain self-sustaining even with hydropower dams in place.

In reality, productivity of wild Snake River chinook salmon declined abruptly with completion of the Federal hydroelectric system by mid-decade of the 1970s (Petrosky and Schaller 1994). The combined counts of returning spring and summer chinook salmon to the Snake River Basin were the lowest on record in 1994 (4,475), and again in 1995 (2,787).

Most hatchery programs, as currently designed, have been unable to **mitigate** for the dams or stem the decline of target populations. Thus, salmon returns have been insufficient to meet artificial and natural **smolt** and adult production predictions, much less provide a consistent harvestable surplus of adults.

In the last few years, however, fish biologists, hatchery managers, and national and regional fish and wildlife agencies have begun to recognize that hatcheries can be constructed and managed for different goals. These goals may include augmentation, preservation, conservation, and recovery. Augmentation usually refers to mass-producing fish for harvest. Since these fish are expected to be harvested before reproduction, the cost associated with developing programs that produce long-term survival and breeding are not considered a good investment. These hatcheries may be expected to continue operating according to current hatchery standards.

Those hatchery programs associated with preservation, conservation, and recovery, however, aim at returning fish to the spawning grounds in order to sustain and grow depressed stocks. These hatchery programs run the gamut from high-cost, high-tech operations to low-cost, low-tech operations. They apply a range of generally unproven, yet promising, technologies and protocols to the task of producing genetically fit, well-adapted adult fish (Maynard et al. 1996). As these technologies and protocols are sorted out, and new ones come into the mix, long-term survival of hatchery fish should improve as a percentage of overall survival rates. Also, hatchery fish that emerge from new programs, to the extent that they resemble wild fish morphologically, physiologically, and behaviorally, should reduce the worst effects of mixing hatchery and wild fish in the wild.

3.5.1. Eagle Fish Hatchery

Eagle Fish Hatchery is the primary Idaho site for the chinook captive-rearing program. Artesian water from five wells is currently in use. Artesian flow is augmented through the use of four separate pump/motor systems. Water temperature remain a constant

13.3°C and total dissolved gas averages 100 percent after degassing. Water chilling capability was added in 1994. Backup and system redundancy is in place for degassing, pumping, and power generation.

Facility layout at EFH remains flexible to accommodate culture activities. Several fiberglass tank sizes would be used to culture chinook from pre-smolt to the adult stage.

3.5.2. Sawtooth Fish Hatchery

Sawtooth Fish Hatchery was completed in 1985 as part of the LSRCP, and is located on the Salmon River in the Stanley Basin. Sawtooth Fish Hatchery personnel and facilities have been used continuously since 1995 to depot pre-smolts prior to their transfer to the EFH. Following collection, pre-smolts would be held in six-foot semi-square fiberglass tanks by stream origin. All fish rearing occurs on well water. Water temperature varies during the year from approximately 2.5°C in January/February to 11.1°C in August/September. Backup and redundancy systems would be in place.

3.5.3. Manchester Marine Laboratory

4. IMPACTS OF THE ALTERNATIVES

4.1. Summary of Impacts

Table 4-1: Summary of Effects of Proposed Action and No Action

Effect/Resource	Aquaculture	No Action
Impacts from Program Activities		
Sp/su Snake River wild chinook salmon ESU/Extinction	Moderate potential to prevent extinction of Snake River sp/su chinook salmon populations and Snake River ESU by increasing number of captive-reared fish surviving to sexual maturity to spawn. Moderate positive impacts.	Declining escapement of target populations suggests high potential for extinction under the No Action alternative.
Genetic variation	High potential to maintain genetic variation by maintaining gene pool, using breeding plan to produce largest possible genetic variation with least risk to populations. Slight risk of negative impacts.	Risk to genetic variation to Snake River sp/su chinook salmon ESU from loss of target populations under the No Action alternative.
Domestication	Low potential for **domestication** to Snake River ESU due to short hatchery-rearing period, prudent hatchery practices, and relative low release numbers of captive-reared spawners. Slight risk of negative impacts.	No risk of domestication, because no interbreeding between captive- and hatchery-reared fish.

Effect/Resource	Aquaculture	No Action
Impacts from Program Activities (cont.)		
Fish health/disease	Disease profiles for collection sites show presence of **pathogens** *(Section 4.2.1.3).* Low risk of disease to captive-reared fish from high densities and low flows in hatchery; mitigated by proper hatchery practices, disease testing. Small risk of **horizontal transmission** to hatchery stocks due to strict quarantine protocols.	Risk to wild fish health from the No Action alternative would be from increased horizontal transmission of pathogens present in the wild environment, which could potentially be reduced by disease control for sample fish.
Experimental fish survival	Collection, handling, and transportation of wild parr may have a small impact on fish. Release of fish at sexual maturity should produce high potential for parr-to-adult survival. Positive impacts.	The No Action alternative would preclude collection of stock for captive-rearing, and thus there would be no impacts to hatchery fish survival.
Wild broodstock numbers/survival	Variable effect on natural spawning populations. Collection protocols would be indexed to total adult return when possible. However, high risk of target population extinction from nonintervention is outweighed by program goals. Positive impacts.	The No Action alternative, by precluding collection of juveniles for rearing to adult, would ultimately lead to high negative impacts to overall broodstock population due to decreased parr-to-adult survival of wild fish.
Intra-specific competition	Moderate risk for competition between captive-reared and wild/natural spawners for mates. However, this is desirable from the standpoint of maintaining genetic variation.	No release; no impacts.

Effect/Resource	Aquaculture	No Action
Impacts from Program Activities (cont.)		
Interspecific competition	Low potential for inter-specific competition due to co-evolvement of different species. Slight risk of negative impacts.	No release; no impacts.
Impacts from Construction Activities		
Water Quality/quantity	Non consumptive use of water at collection and release sites; carrying capacity at release sites should easily absorb byproducts of increased spawning. Temporary turbidity from erection of traps and enclosures. Slight impacts.	No collection or release; no impacts.
Floodplain & Wetland	Work crews passing through to streamside for collection and release activities would not disturb floodplain or wetland. No permanent structures would be erected on floodplain or wetlands. No impacts.	No collection or release; no impacts.

4.2. Impacts from the Proposed Action – Program Activities

4.2.1.1. Expected Impacts to Sp/su Snake River Wild Chinook Salmon Local Populations and Evolutionary Significant Unit: Extinction

Snake River spring/summer chinook salmon are listed under the Endangered Species Act as threatened, and has been in decline since the mid-1970s. The target species show a continued decline in the number of sexually mature adults returning to spawn, which in turn threatens the entire population structure.

The objective of the project is to supplement the wild/naturally spawning population with broodstock collected from the endemic population as juveniles and reared in the hatchery. This would increase the numbers of fish surviving to the spawning stage, to be outplanted in their natal streams. It is then hoped that the greater number of adult spawners would produce increased numbers of adults returning to the Salmon River.

The life stage during which mortality is highest for populations of wild salmon is the stage from juvenile to adult, during which time the fish would be subject to naturally occurring mortality from predation, inter- and intra-species competition, etc. At the same time, almost no information is available on mortality rates or mortality mechanisms during ocean rearing.

The Proposed Action would protect the potential spawners by removing most of the uncertainties associated with rearing in the wild. The small number of these fish released back to stream of origin could be expected to have no impact on the wild populations' ability to propagate.

4.2.1.2. Mitigation

None required for program design.

4.2.1.3. Expected Impacts to Genetic Variation/Fitness

Genetic variation/fitness refers to maintaining the integrity of the gene pool by reducing inbreeding and outbreeding, which can lead to a reduced genetic ability to adapt to local environments.

With the exception of domestication mechanisms *(see section 4.2.1.5)* potentially selecting sample fish, which then may introduce their genotype into the wild population, genetic variation/fitness in the collected juveniles would not be affected. Domestication impacts are theorized, but currently unproven, and the small number of outplanted adults would not be expected to impact the genetic variation or fitness of the ESU. Sample hatchery fish, rather, would be expected to retain their original wild/natural genetic structure, which in turn would be adapted to outplant streams.

However, hatchery protocols have been developed to take into account potential effects of domestication *(see Section 4.2.1.6*).

Rearing and spawning protocols (including spawning matrix) should reduce impacts to the genetic variation/fitness of the experimental population and wild/natural spawning populations on the target streams to slight.

Some wild/natural program adults would be held back and spawned in the hatchery to observe gamete viability. Progeny, in the form of eyed-eggs, would subsequently be outplanted to in-stream egg incubation systems to rear and spawn in the wild. These progeny also would retain their genetic structure.

4.2.1.4. Mitigation

Of the broodstock retained for in-hatchery breeding, genetic make-up would be identified at the individual fish level. Genetic diversity would be maintained through the use of a dissimilarity matrix during spawning. This matrix uses individual genetic identities and prioritizes specific crosses by genotype and haplotype.

Hatchery breeding also includes protocols for bridged generation breeding, e.g., three-year olds would be mated with four-year olds, five-year-olds mated with four-year-olds, etc. This should reduce the incidences of inbreeding.

Milt would be cryopreserved from each male chinook salmon selected for breeding in the hatchery. Cryopreserved milt can be incorporated into future spawning designs to increase program options. While cryopreserved milt produces lower fertilization rates than fresh milt, the benefit that it provides from a genetic variation perspective should outweigh this aspect of its use.

4.2.1.5. Expected Impacts from Domestication

Domestication refers to the mechanism of natural selection and its impact on the genetic fitness of interbreeding hatchery and wild populations. The theory is that the hatchery environments selects for fish best adapted to that domestic environment. Once these fish have been introduced into the wild, their genetic make-up is introduced into the wild population. However, that genetic make-up has been selected on the basis of its fitness match with the hatchery environment, not the wild environment. Thus, the wild population is less adapted to – less fit for – the wild environment, should genetic exchange occurs.

The domestication impacts on the genetic fitness of wild stocks remains a theory. However, this impact would be theoretically possible, since IDFG captive-reared adult have been raised in the hatchery, and experimental fish that reach sexual maturity may be those best adapted to the hatchery environment.

Also theoretically, the best way to mitigate for the effects of domestication on overall genetic fitness, is to produce hatchery fish whose morphology, physiology, and behaviors resemble those of wild fish as closely as possible. Differences in coloration, feeding habits, strength and size, lifestage timing, predation avoidance behaviors and other factors are all thought to reduce fitness of hatchery-reared stocks for successful adaptation to the wild environment.

Domestication impacts from interbreeding between naturally-reared wild stocks and hatchery-reared wild stocks are unknown. Because of the small number of hatchery-reared releases, impacts to the overall Snake River ESU would be expected to be very slight.

4.2.1.6. Mitigation

How close hatchery-reared fish need to **phenotypically** resemble wild fish to survive and retain their overall genetic integrity is a matter of conjecture. Some things are obvious. It has been observed in the captive-rearing program, for instance, that experimental fish raised in freshwater have been more susceptible to bacterial attacks on their fins than fish raised in saltwater. This may reduce their ability to compete and survive in the wild. Therefore, the ratio of fresh- to saltwater-reared fish has been decreased from 50:50 to 15:85.

Experimental fish may also be strengthened through fish exercise techniques. Coloration to ensure successful mate selection would be enhanced by increased amount of carotenoids in the fish feed, which mobilize to the skin and darken it at sexual maturity.

Human contact would be kept to a minimum to enhance predator avoidance behaviors.

As more of these domestication effects are recognized, rearing protocols would be modified to reduce their impacts.

4.2.1.7. Expected Impacts to Fish Health/Disease

The three project streams (Lemhi River, EFSR, WFYF) are tributaries to the Salmon River in central Idaho. Rearing of wild chinook from parr to maturity under hatchery conditions has given a unique opportunity to follow the role that several fish disease agents play in mortality events. Three pathogens have been identified to originate when the parr were collected. These were *Renibacterium salmoninarum (Rs)*, the causative agent of bacterial kidney disease (BKD), *Salmincola californiensis* (gill maggot copepod), and *Myxobolus cerebralis (Mc)*, the agent of whirling disease

Hatchery and Wild Juvenile Salmonids: Impacts to fish health refers to impacts from disease. Normally, this impact category refers to diseases contracted by hatchery-spawned and –reared juveniles, which would then be released into streams for acclimation and outmigration. The concern is that during these life stages - as well as during adult return and spawning - these fish may infect wild stocks.

In the case of the IDFG captive-rearing program, this is not the case. Since the program collects wild juveniles and brings them into the hatchery for rearing, the balance of pathogen/host/environment is shifted under culture conditions to favor disease transmission within a group in confinement. Rather than disease passing from hatchery to wild stocks, disease would more likely be brought into the hatchery and passed from infected wild fish to hatchery stocks. However, the confined conditions of hatchery-rearing present the risk that disease would be more readily transmitted among infected wild stocks as well.

Idaho Department of Fish and Game personnel collect juveniles for the captive-rearing program at parr stage. Agents of fish diseases occur in wild parr at relatively low levels. Detection of these disease agents and how they have persisted during subsequent rearing has illustrated that the disease agents that can be directly passed from fish-to-fish under hatchery conditions pose the greatest risk for survival. Each disease agent has operated differently between broodyear groups and under freshwater and saltwater rearing.

There is an undetermined risk of pathogen transmission between separate populations.

Adult Salmonids: Since these pathogens occur in the wild populations, the subsequent release of mature fish back into the stream of origin would not result in introducing a pathogen that is not already present. No impact is expected either to wild listed anadromous stocks from disease transmission, or to other in-stream species**.**

It is interesting to note that the stock that has the most varied of these disease agents, the Lemhi River stock, is also the one which has demonstrated the best resiliency during years when environmental conditions favor better migration survival.

4.2.1.8. Mitigation

The hatchery rearing systems have all been designed to segregate and quarantine small groups of experimental populations, thus limiting the potential for horizontal disease transmission among groups. Moreover, fish densities in rearing facilities would be designed to limit disease transmission.

Aggressive therapy would be instituted when needed. Parr would be injected with Erythromycin as soon as possible after collection. Fish collected from Lehmi River showing signs of *Salmincola* would be treated with Ivermectin. Prudent hatchery-rearing and disease control protocols would provide a positive impact over stream-rearing, and may reduce the total amount of pathogens in the project areas.

Experimental collection of eggs from in-stream redds would be begun shortly, to test the hypothesis that eggs would be less likely to carry disease than parr.

4.2.1.9. Fish survival

Collection, handling, and transportation of wild parr may have a small impact on fish.

Rearing of fish to sexual maturity should increase the potential for parr-to-adult survival. Positive impacts.

4.2.1.10. Mitigation

Collect, handle, and transport fish according to IHOT protocols.

4.2.1.11. Broodstock Numbers/survival

The effects on natural spawning populations are undetermined. Monitoring for such effects is an element of the IDFG captive-rearing research protocols. Program managers have determined that, given the high risk to target populations from extinction, current protocols for collecting, handling, transporting, and monitoring program fish would constitute the best use of the resource.

4.2.1.12. Mitigation

Collection protocols would be indexed to total adult return when possible. All program activities would be conducted according to established protocols.

4.2.1.13. Expected Impacts from Interspecific Competition

Steelhead and Bull Trout: There is no evidence to suggest that the release of adult chinook salmon from the captive-rearing program would have any negative impacts on listed steelhead and/or bull trout, particularly at ESU level. These species have co-evolved in the systems where these activities are planned, and life stages would be carried out in different stream levels, during different times of the year. Adult steelhead would not likely to be present in the areas where outplanting would occur.

It has been observed during collection of juveniles that steelhead fry inhabit the fringe of stream banks in headwater streams. Steelhead juveniles larger than fry would experience minimal impacts other than short-term displacement, such as operation of screw traps and weirs, and/or during snorkeling.

The USFWS announced a determination of Threatened Status for the Columbia River distinct population segments of bull trout effective July 10, 1998. Since no critical habitat has been designated for this species, designated critical habitat would not be affected. (USFWS, Biological Opinion, 1998).

4.2.1.14. Mitigation

No mitigation required.

4.2.1.15. Expected Impacts from Intra-specific Competition

Intra-species competition is related to various factors. Life stage at which fish are outplanted is one factor (e.g., pre-smolts compete for food and cover; smolts migrating to the saltwater environment do not feed, nor do they require much in the way of holding and cover areas, since they exit the system rapidly; and adult spawners are not in a feeding mode, although they compete for mates). Another factor would be in-stream conditions (e.g., availability of food and cover). The limiting factor for competition, however, may be the carrying capacity of the stream relative to population size, which takes into account aspects of the above two factors. If an indigenous population grows beyond its stream's space and resource production capabilities (production of food, cover, etc.), then competition would intensify. Conversely, if a stream's resources are underutilized, the number and intensity of competitive interactions would drop.

For the IDFG captive-rearing program, an undetermined but very slight impact would be expected from interaction and competition between experimental populations and wild stock. The purpose of the current project is to observe and evaluate interaction and competition between experimental populations and wild stock in the project streams. Sexually mature fish would be expected to compete for mates with wild stock. Normal behaviors in spawning salmon include competing for mates, and this is desirable from a natural selection standpoint. However, in this program, fish would in fact be outplanted to **underseeded** tributaries of the mainstem program areas, and/or segregated from other spawning populations. For instance, rather than returning sexually mature adults back into the mainstem Lemhi River, they would outplanted to the Bear Valley Creek tributary of the Lemhi River where, due to low adult returns, the likelihood for interspecies competition would be very slight. No such competition among adults has been observed to date in the project areas.

A small percentage of outplanted experimental populations have been observed wandering when no mates were available. However, this was due to a design flaw in the enclosures that has been corrected. No impacts from competition with wild stocks for mates would be expected from wandering experimental adults.

Some hatchery spawning has taken place, in order to test gamete viability. Eyed-eggs from hatchery spawning would be outplanted to egg incubation systems on the Lemhi, WFYF, and EFSR rivers. While this presents the possibility for interspecies competition between program juveniles and juvenile wild populations, the environments are severely underseeded, and the carrying capacity of the streams underutilized. No impacts from hatchery-spawned juveniles have been observed.

4.2.1.16. Mitigation

Spacially segregate adult outplants in underseeded, underutilized areas upstream of – or tributary to – collection areas.

Redesign stream enclosures with bars closer together.

4.2.1.17. Expected Impacts from Straying

Classic straying is considered movement of returning wild adults into stream systems other than their streams of origin. The main threat to wild stocks from straying is the potential for reduction of genetic fitness through the introduction of new genetic material non-adapted to local environments. However, if enough fish stray into a particular stream, impacts from inter- and intra-species competition, predation, and disease transmission would also be a possibility.

In the IDFG Snake River Chinook Captive-rearing Program, fish would be released to natal streams as adults. Typically, these adults are ready to spawn, and they stay where they are released. To date, a single fish has been observed moving from its release area into another stream system, which would fit the definition of straying. Therefore, the likelihood of impacts from straying would be considered very slight.

However, a less threatening form of 'wandering' has been observed for a small percentage of fish on the rare occasions when no female mate is available. These fish wander from release areas into other tributaries of the program mainstem river, or into the mainstems themselves. For instance, fish leaving the release area of the WFYF have been observed in the Yankee Fork Salmon River. A few releases to the Bear Creek Valley tributary to the Lemhi River have been observed moving into Hayden Creek, also within the Lemhi River basin. Due to their low numbers, and the fact that these wandering fish stay within their natal stream systems, no impacts from inter- or intra-species competition, predation, disease transmission, or reduction of genetic fitness of local populations would be expected.

Due to redesign of the in-stream enclosures, this small number of straying/wandering fish should be reduced to nearly zero, and no impacts from straying would be expected.

4.2.1.18. Mitigation

Movement of fish from release sites has been attributed to a design flaw in the enclosure. The design flaw (enclosure bars spaced too far apart) has been corrected.

While there is limited data on volitional movement away from the release site, a relationship is assumed to exist between the stage of sexual maturity of the released adult, and the likelihood of movement. The closer a released adult is to spawning, the less likely that fish is to move. Sexually mature adults would be released as close to spawning stage as possible, while still allowing ample time for acclimation.

4.2.1.19. Expected Impacts from Predation

Any change in the biomass of a stream presents the possibility of changes to predation patterns. Increases to the fish population could lead to more interspecies and intra-species in-stream predation. Also, an increase in fish could invite increased numbers of predatory mammals and/or birds into the area. Again, this would largely be a function of the numbers of released fish, their lifestage, and the carrying capacity of the stream.

IDFG captive-reared fish would be released in relatively small numbers to underutilized stream environments at a time when the released fish would not be feeding. To date, no predation has been observed, and impacts from predation – both interspecies and intra-species – would not be expected.

4.2.1.20. Mitigation

None required.

4.3. Impacts from the Proposed Action –Placement of Traps, Weirs, and Enclosures

4.3.1.1. Water Quality/quantity

Placement of the weir and associated monitoring activities could lead to streambed disturbances, mainly minor temporary increased turbidity.

4.3.1.2. Mitigation

Placement of traps and enclosures would be conducted in such a manner as to minimize turbidity and comply with State of Idaho water quality standards. No streambed material would be pushed or pulled across the flowing stream channel. Turbid water pumped from the site (if any) would not be returned directly to the stream.

4.3.1.3. Floodplain and Wetland

Work crews would be passing through any floodplains and/or wetlands without disturbing them. No permanent structures would be erected on any floodplain or wetland. No impacts to floodplain or wetland would be expected.

4.3.1.4. Mitigation

None required.

4.3.1.5. Threatened and Endangered Species

<u>Wild/natural Spring/summer Chinook Salmon</u>

Construction of the enclosures for adult spawners in-stream and/or screw traps for collection of juveniles would have no impacts on juvenile and/or adult wild spring/summer chinook. All work is completed before the arrival on-site of juvenile outmigrants and returning adults, and impacts would be short-term.

<u>Steelhead and Bull Trout</u>

Wading, construction of the enclosure, redd counts and snorkeling might cause short-term displacement of juvenile steelhead and bull trout, but overall the proposed activities should have little or no impact on listed species.

The presence of enclosures and screw traps should have little or no effect on juveniles on the WFYF, EFSR and Lemhi River. All juvenile wild smolts should have migrated past the sites prior to construction of the enclosures. Spacing between the pickets 3.75 cm

(1.5 inch) should allow free movement of the young-of-the-year chinook through or passed the enclosure.

The weirs placed in the EFSR and Lemhi River would not span the channels, and would be easily circumvented by adults returning to spawn in these study areas. The Bear Valley Creek weir would prevent passage of wild adults. However, this should not interfere with natural spawning because there is ample spawning habitat below the temporary weir for the forecasted number of returning spawners. Therefore, the weired off section would be expected to have little or no effect on returning wild adults.

4.3.1.6. Mitigation

Placement of traps and enclosures would be conducted in such a manner as to minimize turbidity and comply with State of Idaho water quality standards. No streambed material would be pushed or pulled across the flowing stream channel.

4.4. Cumulative Impacts of the Proposed Action

The Proposed Action (experimental, supplemental captive-rearing of Snake River wild spring/summer salmon), combined with other experimental supplemental aquaculture programs, could have cumulative impacts.

Because the IDFG Snake River Salmon Captive-rearing Program is experimental, cumulative impacts are not well-developed, and critical data on such impacts should emerge from the program itself. However, given the declining stock status of the target populations within the ESU, the risk/benefit ratio of imminent extinction to possible success of program goals and subsequent transfer of new technologies is assumed to be to their benefit.

Populations for hatchery preservation actions have been prioritized based on assumed relative importance to the Snake River spring/summer chinook salmon ESU, assumed retention of native population characteristics estimated, imminent extinction risk, and risk of exposure to experimental techniques. High priority populations would have:

- Annual **escapement** of less than 20 fish;
- Adequate habitat for successful spawning and rearing;
- Poor **resiliency** from the last bottleneck (1979 through 1984).

The single most important factor contributing to the decline of the target populations presently would be insufficient return of adult spawners to sustain those populations. This is due to many factors not discussed in this EA, including impacts from resource extraction, from hydroelectric projects that block the watersheds and change the character of migration corridors, to changing ocean conditions, etc. Whatever one might surmise about the impacts of these factors individually and cumulatively on wild salmon runs, increasing the amount of spawners and spawning activity within local declining populations remains a short-term solution to local extinctions.

Increasing parr-to-adult survival would provide cumulative benefits to target populations. Parr-to-adult survival is higher among hatchery-reared fish than among wild fish. As increasing numbers of hatchery-reared wild adults are returned to their natal streams to spawn, the rates of spawning success should rise, producing an increasing number of returning wild adult spawners as the program proceeds.

The concern with hatchery-rearing programs is that they are producing fish that are not equipped morphologically, physiologically, and behaviorally to survive in the wild and reproduce; and that they reduce the fitness of stream-reared wild fish by introducing their non-adapted genetic material into the wild population. Much of this remains theory. If true, however, there would be negative cumulative effects from rearing target fish in-hatchery and releasing them into the wild to reproduce.

However, this is an experimental program, and one of its goals is to develop exactly the kind of data to refine hatchery-rearing techniques and protocols in order to produce more fit spawners. In turn, as the program achieves its goals, more should become known about disease control, genetic variability the causes and effects of domestication, fish handling and spawning techniques and protocols, etc. Numbers of hatchery-reared spawners would continue to rise, as would their fitness. These new technologies would then be transferred; as they are picked up throughout the region (along with information from other experimental supplementation), they may enhance recovery of other ESUs.

4.5. Impacts from the No Action Alternative

If the No Action Alternative were selected, the current IDFG captive-rearing program would cease. Research on captive-rearing and release as a supplementation measure for Snake River wild spring/summer chinook salmon ESU would not be available from this source. As a result, supplementation from captive-rearing fish would be at least reduced, if not ended, and any benefits from such a supplementation approach would be lost.

5. MITIGATION ACTION PLAN

Table 5-1: Mitigation Action Plan

Impacts from Program Activities

Action	Mitigation	Responsible Party	Permits Needed
Existing Spring/summer Chinook Extinction	• No anticipated impacts. No mitigation is required	IDFG	NMFS Section 10 Direct Take Permit/IDFG
Fish Health/Disease	• Segregate and quarantine experimental fish from hatchery population. • Maintain low densities to reduce risk of horizontal transmission among experimental populations. • Inject parr with Erythromycin as soon as possible after collection. Treat fish from Lehmi River showing signs of *Salmincola* with Ivermectin. Prudent hatchery-rearing and disease control protocols would provide a positive impact over stream rearing, and may reduce the total amount of pathogens in the project areas. • Experimental collection of eggs from in-stream to test the hypothesis that eggs are less likely to carry disease than parr.	IDFG/EFH Fish Health Laboratory	NMFS Section 10 Direct Take Permit/IDFG
Hatchery Fish survival	• Collect, handle, and transport fish according to IHOT protocols.	IDFG	NMFS Section 10 Direct Take Permit/IDFG
Wild Broodstock numbers/survival	No mitigation. Best use of resource. Risk of extinction of target populations outweighs intervention.	IDFG	NMFS Section 10 Direct Take Permit/IDFG

Impacts from Program Activities (cont.)

Action	Mitigation	Responsible Party	Permits Needed
Intra-specific competition	• Redesign stream enclosures with bars closer together to prevent wandering of experimental adults. • Spacially segregate adult outplants in underseeded, underutilized areas upstream of – or tributary to – collection areas.	IDFG	NMFS Section 1010 Direct Take Permit/IDFG
Interspecific competition	• No anticipated impacts. No mitigation required.	IDFG	NMFS Section 1010 Direct Take Permit/IDFG
Straying	• Redesign stream enclosures with bars closer together to prevent wandering of experimental adults. • Release sexually mature adults as close to spawning stage as possible, while still allowing ample time for acclimation.	IDFG	NMFS Section 1010 Direct Take Permit/IDFG

Impacts from Program Activities (cont.)

Action	Mitigation	Responsible Party	Permits Needed
Domestication	• Produce fish with the morphology, physiology, and behaviors of wild fish. For instance, experimental fish raised in freshwater are more susceptible to bacterial attacks on their fins than fish raised in saltwater. This may reduce their ability to compete for mates and survive in the wild. Decrease the ratio of fresh- to saltwater-reared fish from 50:50 to 15:85. • Strengthen experimental populations through fish exercise techniques. Enhance natural coloration by increasing amount of carotenoids in the fish feed. • Keep human contact to a minimum to enhance predator avoidance behaviors. • Continue modifying rearing protocols to reduce the effects of domestication.	IDFG/EFH Fish Health Laboratory	NMFS Section 10 Direct Take Permit/IDFG
Genetic Fitness	• Use desirability matrix during spawning to minimize inbreeding. • Hatchery breeding includes protocols for bridged generation breeding, e.g.: three-year olds would be mated with four-year olds, five-year-olds mated with four-year-olds, etc. This reduces the incidence of inbreeding to zero. • Cryopreserved milt from male chinook salmon selected for breeding in-hatchery to provide a genetic variation benefit.	IDFG	NMFS Section 1010 Direct Take Permit/IDFG

Impacts from Placement and Operation of Weirs, Traps, and/or Enclosures

Action	Mitigation	Responsible Party	Permits Needed
Water quality/quantity	• Place all traps and enclosures in such a manner as to minimize turbidity and comply with State of Idaho water quality standards. No streambed material pushed or pulled across the flowing stream channel. Turbid water pumped from the site (if any) would not be returned directly to the stream.	IDFG	
Floodplain and wetland	• No impacts. Mitigation not Required.	IDFG	none
Threatened and Endangered Species *Natural/wild sp/su chinook salmon* *Steelhead* *Bull Trout*	• Place all traps and enclosures in such a manner as to minimize turbidity and comply with State of Idaho water quality standards. No streambed material pushed or pulled across the flowing stream channel. Turbid water pumped from the site (if any) would not be returned directly to the stream.		Section 1010

6. CONSULTATION, REVIEW, AND PERMIT REQUIREMENTS

6.1. National Environmental Policy Act

This Environmental Assessment (EA) was prepared pursuant to the National Environmental Policy Act (NEPA) (42 U.S.C. 4321 et. seq.) and the Council of Environmental Quality (CEQ) Implementing Regulations, which require Federal agencies to assess the impacts that their proposed actions may have on the environment. Based on information in the EA, BPA would determine whether the proposal significantly affects the quality of the human environment. If it does, an Environmental Impact Statement is required. If it is determined that the proposal would not have significant impacts, a Finding of No Significant Impact (FONSI) would be prepared.

6.2. USFS Special Use Permit

The USFS is required to issue Special Use Permits for activities on Forest Service land not specifically allowed under its Forest Management Plans. Application was made by the holder of the permit, James R. Lukens, IDFG Salmon Region (holder number 1000-09). Special Use Permit FS# 2700 – 4 was issued, and expires on 12/31/2002. Holder is authorized to use or occupy National Forest System lands, subject to the conditions set out on the Salmon-Challis National Forest.

6.3. Threatened and Endangered Species and Critical Habitat

The Endangered Species Act of 1973, as amended, requires that Federal agencies ensure that their actions do not jeopardize threatened or endangered species and their critical habitats; it also gives review authority to USFWS and NMFS. Sections 4.2.1.1 and 4.3.1.5 discuss impacts to threatened and endangered fish species in the project areas.

A Section 10 permit for direct take of all program area streams juvenile chinook salmon for captive-rearing has been issued by NMFS (NMFS, 1998). This would be updated to include the remaining actions described in this EA, including releasing adults. BPA and the IDFG would ensure that all necessary consultations and permits are obtained prior to undertaking the actions proposed in this EA, and that any permit conditions are followed.

6.4. Fish and Wildlife Conservation

Provisions of the Pacific Northwest Electric Power Planning and Conservation Act (16 U.S.C. et seq.) are intended to address system-wide fish and wildlife losses. This project is proposed as part of the Columbia River Basin Fish and Wildlife Program to fulfill these obligations.

The Fish and Wildlife Conservation Act of 1980 (16 USC 2901 et seq.) encourages Federal agencies to conserve and to promote conservation of non-game fish and wildlife species and their habitats. Measures proposed to mitigate potential impacts on vegetation and on fish and wildlife that are non-target species for this project do this to the maximum extent possible within BPA’s statutory responsibility.

The Fish and Wildlife Coordination Act (16 USC 661 et seq.) requires that Federal agencies consult with the USFWS whenever an agency plans to conduct, license, or permit an activity involving the impoundment, diversion, deepening, control, or modification of a stream or body of water. BPA would provide a copy of this EA to the USFWS for review to ensure species protection as required by this act.

6.5. Wetlands and Floodplains Protection

6.5.1. Floodplain/Wetlands Assessment and Mitigation

In accordance with the Department of Energy regulations on Compliance with Floodplain/Wetlands Environmental Review Requirements (10 CFR 1022.12), BPA has prepared the following assessment of the impacts of the IDFG Captive-rearing Program on floodplains and wetlands.

Alternatives for the project, including the No Action Alternative, are described in Chapter 2 of this EA. The No Action Alternative would have no effect on floodplains or wetlands.

6.5.1.1. Floodplain and Wetland Effects

Under Executive Order 11988, Federal agencies must avoid or minimize adverse impacts associated with short-term or long-term modification and occupancy of floodplains. Modification and destabilization of the floodplain could have potentially adverse effects, not only near the disturbance, but also in the stream channel and floodplain great distances downstream. Adverse impacts include the potential for flood damage to the facilities, increased flooding due to displacement of water from the normal floodplain by the construction of the facilities, and increased potential for erosion of floodplain soil and sediment near the construction sites. See Chapter 3 for a description of the floodplain wetland areas for proposed and alternative project sites.

6.6. Heritage Conservation

Federal historic and cultural preservation acts include the National Historic Preservation Act (16 USC 470-470w-6), the Archaeological Resources Protection Act (16 USC 470aa-470ll), the Archeological and Historic Preservation Act (16 USC 469-469c), the American Antiquities Act (16 USC 431-433), and the American Indian Religious Freedom Act (42 USC 1996).

An intensive archeological survey of all proposed sites conducted by the ? revealed ? significant cultural resources. Archaeological monitoring of any subsurface disturbance associated with the construction of facilities should be conducted. Monitoring should be undertaken by a qualified archaeologist, and be performed to insure that any unforeseen cultural resources are not disturbed by construction.

6.7. Permits for Work in Stream Beds

The Idaho Department of Water Resources administers the Idaho Stream Protection Act. The Act requires that before any activity can take place below the ordinary high water mark of a perennial stream, a Stream Channel Alteration permit must be obtained. BPA would ensure that this requirement is fulfilled for the construction of the water intakes and outfalls and any other regulated activities take place.

6.8. Permits for Discharges into Waters of the United States

A National Pollutant Discharge Elimination System Permit, if required, under the Clean Water Act, would be obtained before discharging treated effluent from the Eagle Fish Hatchery.

Permits are not required for the acclimation ponds or adult holding ponds because the amounts of wastes generated would fall below the threshold for these permits.

6.9. Requirements Not Applicable

6.9.1. Recreation Resources

No National Trails, Wilderness Areas, National Parks, or other specially designated recreational areas would be adversely affected by this proposed project.

6.9.2. Safe Drinking Water Act

The proposed action would not affect a sole source aquifer. No new injection wells would be required and no pollutants would be expected to reach drinking water supplies.

6.9.3. Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

No pesticides or herbicides would be used for this project.

6.9.4. Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)

BPA does not propose to acquire property for this project, so surveys to determine site contamination requiring cleanup would not be done.

6.9.5. Safe Drinking Water Act

The proposed action would not affect a sole source aquifer. No new injection wells would be required and no pollutants would be expected to reach drinking water supplies.

6.9.6. Resource Conservation and Recovery Act

No hazardous waste products would be used, discarded or produced by this project. Solid wastes would be disposed of at an approved landfill.

6.9.7. U.S. Army Corps of Engineers Permits for Structures or Work in Navigable Waters

This project does not affect waters classified as navigable waters according to the Corps definition in 33 CFR 329.

6.9.8. Farmland Protection Policy Act

The project would not affect any prime, unique or other important farmland as defined in the Farmland Protection Policy Act (U.S.C. 4201 et seq.).

6.9.9. The Executive Order on Environmental Justice

The project would not adversely affect minority or disadvantaged groups. No adverse effects on any human groups or individuals would be expected.

6.9.10. Clean Air Act

No facilities would be constructed that would require air quality permits under the Clean Air Act (42 USC 7401 et seq.). Construction equipment exhausts would meet regulatory requirements.

6.9.11. Noise Control Act

The proposed facilities would be constructed and operated within State of Idaho noise standards. Other activities would not create noise problems.

7. CONSULTING AGENCIES AND INTERESTED PARTIES

Idaho Department of Fish and Game	Peter Hassemer Steve Yundt Paul Kline
National Marine Fisheries Service	Conrad Mahnken Thomas Flagg Berry Berejikian
USFS	J. Richard Ward, District Forest Ranger

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9. GLOSSARY

Definitions are tailored to anadromous fish and the captive-rearing program, and may have different meanings in different contexts.

Act - Pacific Northwest Electric Power Planning and Conservation Act of 1980

Adfluvial - Life history that includes stream incubation and rearing, outmigration into a lake for additional rearing to maturity with spawning occurring in the tributary stream.

Alevin – The life stage of an fish at which the fish has hatched from egg, but remains attached to its egg sac.

Behavior (fish)/behavioral characteristics – Pertaining to behaviors of an individual or population of fish whose behaviors are adapted to a specific in-stream environment.

BPA - Bonneville Power Administration

Broodstock (wild/captive) – A stock of fish capable of reproducing, either in the wild, or in-hatchery.

Broodyear – The year that a year-class of fish are spawned as eggs.

Captive-rearing – Referring to a set of program techniques and scientific protocols with goals to remove juvenile wild fish from their stream of origin, rear them to sexually mature adults, and release them back to their stream of origin to breed.

Carrying capacity – Given the topological and biological profile of a particular habitat, its capacity as related to its ability to provide support (provide food, cover, etc.) for a particular population of fish.

Coded Wire Tag (CWT) – Devices for marking and tracking individual fish, coded wire tags are implanted in the snout using standard protocols and automatic injectors. These tags are used to differentiate hatchery-reared adults from naturally-produced adults.

Conservation management plan – A Federally-mandated plan demonstrating philosophies, theories, and techniques for managing ESA-listed species.

Council – The Northwest Power Planning Council. The Council was mandated under the Act to manage anadromous fish conservation and recovery, and power distribution in the region. Funded by the BPA.

Cryopreserved – Pertaining to the freezing of biological material for preservation and storage.

Culture (fish) – Pertaining to the artificial spawning and rearing of fish, usually in a hatchery, or the artificial management of any element of the life cycle of a fish.

Demonstration program – A program recognized by authorizing and funding agencies as an experimental program designed to prove or disprove its own hypotheses. Such programs usually have limited goals and small samples, and are held to less rigorous conservation standards than a full-scale program.

Diallel mating - A mating protocol employed when there are fewer than five returning broodstock pairs (male/female). Diallel mating maximizes the distribution of genetics in resulting progeny by mating each individual with every individual of the opposite sex. For example, if five males and five females return, gametes from each female would be separated into five aliquots, each of which would be fertilized using the milt of a different male.

DNA screening – Through the use of DNA screening technology, identifying and/or inventorying the genetic make-up of an individual.

Domestication – Referring to morphological, physiological, and behavior changes that issue from hatchery rearing when the changes are selected by that environment. Such changes, if genetically based, are theorized to enter the gene pool of a wild fish population when the hatchery-reared fish are allowed to spawn with that wild population.

EFH – Eagle Fish Hatchery.

E**ndemic summer chinook** - Populations of *Oncorhynchus tshawytscha* that are native to particular streams and rivers.

ESA - Endangered Species Act of 1973, which recognizes several levels of risk to species that are depressed due to human or natural actions. The ESA requires consultation among Federal agencies taking actions that may disturb the habitat of such species and the agencies with authority over different habitats.

Escapement - Referring to the percentage of a fish population that reaches the ocean rearing life stage, having reared and outmigrated successfully.

ESU – Evolutionary Significant Unit. Refers to a population that's continued existence is crucial to the preservation of the larger species.

Eyed-egg – A fertilized egg.

Fecundity – Refers to the numbers of eggs produced by an individual female of the species.

Fertilization success – The rate at which the males of a population are successful in fertilizing the female eggs.

Fluvial – Pertaining to a river.

Forecasted returns – The numbers of adult fish of a population predicted to return to their streams of origin to spawn, based on past returns, fertilization rates, escapement rates, known ocean conditions.

Founder effects - When the breeding population is reduced to a few individuals, the genetic material is limited, which may result in establishment of undesirable traits in a population.

Gamete quality – Referring to the condition of a fertilized egg.

Genetic - Referring to the genes, or basic functional units of inheritance of a species.

Genetic diversity/variability - All the genetic variation in an individual, population or species.

Genetic drift - Random changes in allelic frequencies due to natural sampling errors that occur in each generation; the rate of genetic drift increases as effective population size decreases.

Genotype – Refers to the genetic material and its structure in the individual that expresses itself in the phenotype of that individual.

Gpm – Gallons per minute.

Habitat – The physical/biological environment in which fish spend some or all of their life cycle, to which the fish are well-adapted.

Harvest – The removal of fish from the natural habitat for sport or commercial use (fishing), or for program requirements.

Hatch boxes – Boxes in which fertilized eggs are put prior to hatching. Hatchlings remain in the boxes as alevins. When the alevin loses its egg sac, it swims to the surface of the box and out as a fry. The boxes are designed to approximate natural conditions for hatching, such as allowing for water flow-through, etc.

Horizontal transmission (disease) – Referring to the spread of intra-species disease pathogens through populations due to fish densities and close proximity.

Husbandry (fish) - Pertaining to the artificial spawning and rearing of fish, usually in a hatchery, or the artificial management of any element of the life cycle of a fish.

Hydroelectric (dams) – Referring to energy produced by a flow of fluid water through or around turbines, which transform the energy from flow into electrical energy for generation and/or storage.

IDFG - Idaho Department of Fish and Game

Inter/intra-specific – Among species and within a species.

Jack – A sexually mature male anadromous fish that has spent a single year in the ocean environment prior to return to its stream of origin.

Life history characteristics - The physical appearance and/or social behavior of a population or individual of a species at each biologically differentiated phase of the life-cycle.

Listed species – A species listed through the ESA as threatened, endangered, or a species of special concern.

Locally-adapted broodstock – Broodstock population local to a habitat or series of habitats, and thus adapted to the habitats.

Loss of variability within-population - The reduction in quantity, variety and identity combinations of alleles in a population.

LSRCP – Lower Snake River Compensation Plan.

MML – Manchester Marine Laboratory.

Marking – Refers to some form of applying an identifying mark on an individual fish of an experimental population.

Metapopulation – The totality of subpopulations of a species in a region that can be considered genetically similar.

Mitigate – Measures to reduce impacts from actions taken, including: 1.) Not taking a certain action or parts of an action; 2.) limiting the degree or magnitude of an action and its implementation; 3.) repairing, rehabilitating, or restoring the affected environment; 4.) preservation and maintenance operations during the life of the action; and/or 5.) replacing or providing substitute resources or environments.

Morphology/morphological characteristics – Refers to physical characteristics of an individual fish, such as coloration, size, shape, etc.

Natal stream – Stream in which an individual fish is hatched. Stream of origin.

Native populations/Natural population - A species endemic to an area; species naturally reproducing in an area.

Natural production - Production of offspring by natural in-stream spawning of broodstock and birth, as opposed to artificial production.

Naturally-spawning - Fertilization of the wild female gamete by a wild male, unassisted, in the natural habitat.

NATURES concepts – A theory of aquaculture that aims to allow cultured fish to maintain their wild characteristics by decreasing rearing stress, reducing domestication, and better acclimating fish to their post-release environment.

Necropsy work – Development of data by researchers on a fish that has died through standard post-mortum scientific protocols.

NEPA – National Environmental Protection Act. This Act requires the production of various levels of analysis for any Federal activity. Levels of analysis include Categorical Exclusions (CX), a short document that demonstrates that the action would not impact the environment in which the activity takes place; Environmental Assessments (EA), which demonstrate that, which there may be impacts, they will not be significant; and Environmental Impact Statements (EIS), which demonstrate that impacts are uncertain.

NMFS - National Marine Fisheries Service

ODFW - Oregon Department of Fish and Wildlife

Outplanted – Release of an individual or population from the hatchery back to stream of origin to finish its life cycle in its natural habitat.

Parr – Life stage of an juvenile anadromous fish between swim-up and smoltification. Usually lasts about 18 months, at which point the fish begins the morphological, physiological, and behavioral adaptations to a saltwater environment and begins migration.

Pathogens – Disease-bearing agents, such as certain types of bacteria.

Phenotype – The appearance of an organism resulting from the interaction of that organism's genotype and environment.

Photoperiod – The daylight period of a day, to which certain behaviors are adapted, such as eating.

Physiology/physiological characteristics – The physical and chemical processes or functions in an organism.

PIT tag – Passive Integrated Transponder tag, a device for marking and tracking individual fish, PIT-tags are injected into the peritoneal cavity using a twelve-gauge needle and a modified hypodermic syringe. These tags are used to assess outmigration survival and smolt-to-adult survival rates.

Population dynamics – The description of interactions among individuals of a population.

Population persistence – The tendency of a population to continue to exist over time.

Population viability – The capacity of a population to persist, based on genetic variability, population threshold size, environmental conditions, etc.

Pre-smolt – The lifestage of a juvenile anadromous fish following the fry stage and prior to smolt stage. At this lifestage, the fish remains adapted to freshwater habitat, and continues feeding and rearing in its natal stream.

Productivity – The capacity of a population to reproduce.

Program - Referring to the Columbia River Fish and Wildlife Program.

Propagation, artificial/natural - Production of a species by means other than natural production, relating mainly to hatchery production. Such artificial propagation usually entails the capture of male and female broodstock; some manual/mechanical process for gamete retrieval and fertilization; and mechanical incubation of fertilized eggs; and rearing of fry.

Protocols – The plan for carrying out a scientific study.

Quarantine – The segregation of one fish population from another to prevent disease transmission, interbreeding, etc.

Recovery escapement level - The percentage or number of an anadromous fish population achieving successful outmigration from its natal river system to the ocean that is thought to increase population numbers above sustainable levels.

Redd – A bed of anadromous salmon eggs present within the natural substrate of a stream.

Release – Referring to the reintroduction of an individual or population of from to their natural habitat from an artificial environment.

Scoping – The sub-process within the NEPA process which seeks to identify pertinent issues to be analyzed within such NEPA documents as Environmental Assessments (EA) or Environmental Impact Statements (EIS).

SFH – Sawtooth Fish Hatchery

Single pair mating – A mating protocol used when there are 20 or more returning adult pairs (male/female). Females maturing on a given date are paired randomly with a mature mate of the opposite sex in a single-pair mating. Unlike the systematic mating scheme, excess males are held until the next spawning date. When there is an excess of females, mature males would be paired with a second female, until all females are spawned

Smolt – The lifestage of an anadromous salmon during which it migrates from its natal stream as a juvenile to its arrival in the marine environment. This stage is characterized by emerging physiological, morphological, and behavioral changes (called smoltification) that adapt the fish to its new environment.

Spawn/spawner – The production of male sperm and/or female eggs by fecund adult fish, called spawners.

Spawning matrix – A table of cross-referenced spawning criteria used to select proper spawning protocols given specific broodstock availability and/or genetic variability conditions.

Stock status – The number, condition, health, and viability of a particular genetically-related population of fish, relating to estimates of their ability to persist.

Supplementation - Adding to. In fisheries terms: Adding to the numbers of a naturally producing population through the introduction of artificially producing produced fish.

Swim-up – The period during which an alevin completes its development on the bottom of a river or hatchbox and subsequently swims to the surface as a fry.

Systematic mating – A mating protocol employed when between six and 19 broodstock pairs (male/female) return. Fish are numbered sequentially as they mature (each sex would be numbered independently). Single-pair matings are pursued, with the most mature female being mated with the most mature male following the sequential numbering schedule. If there is an excess of one sex, they are used in a second single-pair mating.

Thalweg – A line, as drawn on a map, connecting the lowest points of a riverbed.

Threshold escapement level - The level (in numbers) of juvenile anadromous fish successfully completing outmigration from their natal streams to the ocean necessary to sustain the fish population.

Underseeded – A body of water (in the case of anadromous salmon, a stream or river) that's carrying capacity exceeds the number of fish utilizing it.

USDOE - United States Department of Energy

USFS - United States Forest Service

USFWS - United States Fish and Wildlife Service

VIE (Visual Implant Elastomer) – Devices for marking and identifying individual fish, visual implant elastomer tags are implanted subcutaneously into the adipose tissue behind the eye using standard protocols and automatic injectors. They allow for monitoring of broodyear success and genetic evaluations.

WDFW - Washington Department of Fish and Wildlife

Wild fish, wild population - Genetically unique populations of fish that have maintained reproduction successfully without supplementation from hatcheries.

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