State of Washington
Department of Fish and Wildlife
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Main Office Location: Natural Resources Building, 1111 Washington Street SE, Olympia WA

May 11, 2011

Mr. Robert P. Jones
Salmon Management Division
National Marine Fisheries Service
1201 NE Lloyd Blvd., Suite 1100
Portland, Oregon 97232

Dear Mr. Jones,

The Washington Department of Fish and Wildlife submits this Hatchery and Genetic Management Plan (HGMP) and Addendum 1 for the Snake River fall Chinook salmon propagated at Lyons Ferry Hatchery. This HGMP and the Addendum were completed in consultation and coordination with program co-managers and is consistent with provision of 2008 – 2017 U.S. v Oregon Management Agreement.

This HGMP is being submitted for ESA consultation for a Section 10(a)(1)(A) permit for artificial propagation purposes to enhance the survival of ESA listed Snake River fall Chinook salmon. Some of the activities associated with this HGMP were previously permitted through Section 10 Permit 1530.

Please contact Mark Schuck at (509) 382-1004, or myself at (360) 902-2662, if you have any questions regarding this request. We appreciate the coordination and collaboration that has gone in to our final product.

Sincerely,

Heather Bartlett
Hatcheries Division Manager

cc: Colleen Fagan, Oregon Department Fish and Wildlife
Pete Hassemer, Idaho Fish and Game
Becky Johnson, Nez Perce Tribe
Joe Krakker, United States Fish and Wildlife Service
Scott Marshall, United States Fish and Wildlife Service
Stuart Rosenberger, Idaho Power Company
Brian Zimmerman, Confederated Tribe Umatilla Indian Reservation
Mark Schuck
John Whalen

Snake River Stock Fall Chinook
Lyons Ferry Hatchery, Fall Chinook Acclimation Program, and Idaho Power Company

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Programs:	**Lyons Ferry Complex – Lyons Ferry Hatchery** **Idaho Power Company-Oxbow and Umatilla Hatcheries** **Fall Chinook Acclimation Program Facilities**
Species or Hatchery Stock:	**Fall Chinook salmon (*Oncorhynchus tshawytscha*) Snake River Hatchery and Natural**
Agency/Operator:	**Washington Department of Fish and Wildlife, Nez Perce Tribe, Idaho Department of Fish and Game, and Oregon Department of fish and Wildlife.**
Watershed and Region:	**Primarily Snake River / Snake River Basin, but includes releases into the Clearwater Subbasin, Mountain Snake Province and Grande Ronde Subbasin, Blue Mountain Province**
Date Submitted:	**September 16, 2002**
Date Last Updated:	**May 9, 2011**

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Hatchery: Lyons Ferry Complex (LFH).
Program: Snake River Fall Chinook Salmon – Snake River Stock Program for Lower Snake River Compensation Plan (LSRCP)

Hatchery: Irrigon Fish Hatchery
Program: Snake River Fall Chinook Salmon – Incubation/rearing/release for LSRCP

Hatchery: Oxbow Fish Hatchery
Program: Snake River Fall Chinook Salmon-Incubation/rearing/release for Idaho Power Company (IPC)

Hatchery: Umatilla Fish Hatchery
Program: Snake River Fall Chinook Salmon-Incubation/rearing/release for IPC

Program: Fall Chinook Acclimation Project (FCAP), rearing/release for LSRCP by the Nez Perce Tribe (NPT)

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

Fall Chinook salmon *(O. tshawytscha),* Snake River Stock (threatened) including hatchery and natural origins

1.3) Responsible organization and individuals

WDFW Hatchery Evaluations Staff Lead Contact

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IDFG On-site Operations Lead

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(ODFW) On-site Operations Lead

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

1. U. S. Fish and Wildlife Service (USFWS) –LSRCP - Program funding/oversight
2. NPT – Co-manager – Operates acclimation facilities above Lower Granite (LGR) Dam
3. Confederated Tribes of the Umatilla Indian Reservation(CTUIR) – Co-manager
4. National Marine Fisheries Service (NMFS) – Co-operator operates adult trap at LGR Dam.
5. IPC – Co-operator – Mitigation for Hells Canyon Dam. Facility owner and sole funding source for operation and maintenance of Oxbow Fish Hatchery.
6. IDFG – Co-operator – Rears IPC mitigation fish
7. ODFW - Co-operator- Rears IPC mitigation and LSRCP mitigation fish at Irrigon and Umatilla hatcheries.
8. Unites States of America Corp of Engineers (USACE)- Co-operator-currently involved in research using Snake River hatchery fish and signatories to the FERC approved Memorandum of Understanding (MOU) outlining IPC's commitment to fund a portion of the USACE's construction costs for the WDFW's LFH in exchange for sufficient capacity within the new Lyons Ferry facility to ensure availability of approximately 1.3 million eyed fall Chinook salmon eggs annually.
9. Bonneville Power Administration (BPA)-Funding agency for fall Chinook FCAP operated by the NPT.
10. Hells Canyon Settlement Agreement (HCSA) Parties – signatories to the Federal

Energy Regulation Commission (FERC) approved agreement defining mitigation requirements for Idaho Power Company associated with construction and continuing operation of the Hells Canyon Dam Complex. Parties include the IPC, NMFS, IDFG, ODFW, the Washington Department of Fisheries (WDF), and the Washington Department of Game (WDG) (now collectively WDFW).

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

The LSRCP presently funds production of these mitigation fish (Snake River stock fall Chinook). The program was established as mitigation for lost fish resources resulting from construction and operation of hydroelectric facilities in the Snake River. Currently, fall Chinook management for LSRCP mitigation in the Washington portion of the Snake River is mandated to provide 18,300 returning adult hatchery fall Chinook, in addition to providing 98,000 fish in commercial and 32,000 fish in sport fisheries. Both operational and evaluation costs described in this HGMP are presently covered by LSRCP.

The LFH staff includes the Hatchery Complex Manager, and 11 permanent fish hatchery specialists, one plant mechanic, and two seasonal fish hatchery workers. Not all hatchery staff is needed for the Snake River Stock program on an annual basis, although other programs require additional staff. Annual operation and maintenance costs for the program are estimated at $1,014,000. Evaluations also occur for each species produced at LFH and are conducted by a staff of 8-10 permanent biologists and technicians. Three additional temporary technicians are hired yearly to cover fall Chinook trapping and data entry. The Snake River Stock program represents a major portion of the annual evaluation budget. The estimated evaluations budget for 2010 includes approximately $293,000 for duties associated with fall Chinook.

<u>Irrigon Fish Hatchery</u>
Incubating and rearing of fall Chinook at Irrigon fish hatchery for WDFW costs approximately $37,000 including staffing for 4 months of Technician time. Monitoring and evaluation costs are included in the WDFW evaluations budget and are funded through LSRCP.

<u>Oxbow Fish Hatchery</u>
Funded by IPC
Staffing level: 1 FTE plus 2,740 hours of seasonal labor
Annual budget: $213,000 as of FY10

<u>Umatilla Fish Hatchery</u>
Funded by IPC
Staffing level: 1 Technician for 3 ½ months
Annual budget: $136,395 as of FY10

<u>FCAP Facilities</u>
A two person crew works an 8-day on and 6-day off schedule. Crew members work 10 hours each day but are required to remain on site 24 hours to monitor the pumps and alarm system. Staff members live in an on-site travel trailer and receive a per diem allowance for food and personal items. Staff members are supervised by a project

foreman who makes periodic visits to the site and have a radio-telephone for communications. Written schedules, manuals and oral instructions guide staff members. Some employees work 6 months on the project to assist in assembly, operations and disassembly while others work from 6 to 12 weeks during fish acclimation. Employees move to other projects immediately following the completion of operations. Annual fall Chinook fish acclimation project operational costs are $729,631. Annual monitoring and evaluation project costs are: $307,176.

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

Incubation, rearing, and marking – 1) LFH – along the Snake River (River kilometer (Rkm) 95), below the Palouse River, in Franklin County, Washington, 2) Oxbow Fish Hatchery – along the Snake River (Rkm 434) upstream of the confluence of Pine Creek and the Snake River in Baker County, Oregon, HUC17050201, and, 3) Umatilla and Irrigon hatcheries- along the south side of the Columbia River (Rkm449), below McNary Dam, in Umatilla county, Oregon (for rearing Idaho Power mitigation, USACOE research, and LSRCP mitigation fish from eggs provided by LFH), HUC 17070101.

Juvenile Acclimation – The three fish acclimation sites that were identified and developed through the FCAP project were selected due to their location and proximity to historic fall Chinook salmon spawning habitat: Pittsburg Landing on the Snake River below Hells Canyon Dam, Captain John Rapids (CJR) on the Snake River near the confluence with the Grande Ronde River, and Big Canyon site on the lower Clearwater River (Figure 1).

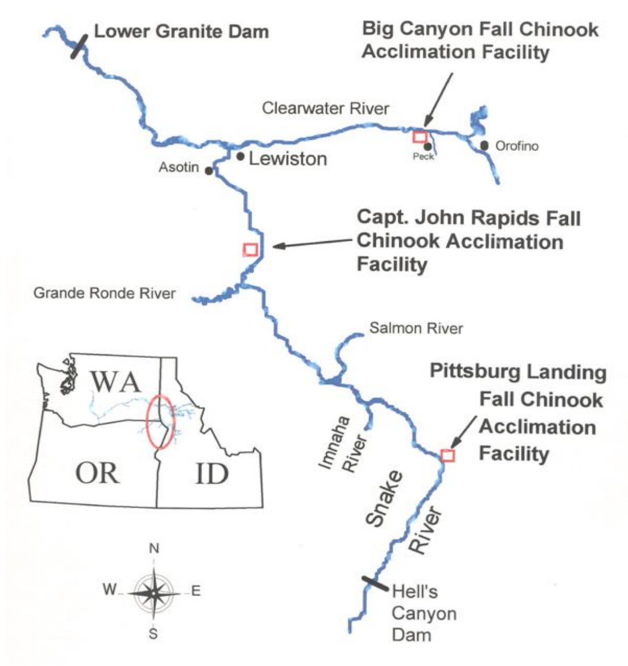

Figure 1. Locations of FCAP facilities.

Pittsburg Landing

Pittsburg Landing is located in the Hells Canyon National Recreation Area (HCNRA) near Whitebird, Idaho. The site is located on the Idaho side of the Snake River at River Mile (RM)

215 (Rkm 346), about 31 miles downstream of Hells Canyon Dam in Idaho County. Pittsburg Landing has the only road access to the Snake River on the Idaho side of the HCNRA suitable for passenger vehicles. Access to the site is by Deer Creek Road (U.S. Forest Service Road 433), 18 miles from US Highway 95.

This site was chosen because of its location near suitable spawning and rearing habitat and good road access, which is necessary for delivery of equipment and fish.

Big Canyon

Big Canyon acclimation site is located on the lower Clearwater River adjacent to US Highway 12 near Peck, Idaho. The site is 4 miles below the confluence of the North Fork and Middle Fork of the Clearwater River at RM 35 (Rkm 57) in Nez Perce County. It is located on Nez Perce Tribal allotment 992 and the site of a Clearwater River boat launch facility that was previously leased to the IDFG.

The site was selected because it is located within the designated critical habitat area for Snake River fall Chinook and has good road access. Listed fall Chinook are known to successfully spawn in the Clearwater River: both immediately upstream and downstream of the facility.

Captain John Rapids

This site is located at CJR on the Snake River between Asotin, Washington and the mouth of the Grand Ronde River at RM 164 (Rkm 263). The site is on the Washington side of the river in Asotin County, 20 miles upstream of Asotin, with vehicle access provided by the Snake River Road.

The site has favorable characteristics for fish acclimation that includes proximity to adult spawning habitats, has a good release point into an eddy instead of into the river current and is isolated from residences which reduces the possibility of conflicts with local citizens.

Juvenile Release– 1) LFH – along the Snake River (Rkm 95), below the Palouse River, in Franklin County, Washington, 2) Captain John Rapids Acclimation Facility (CJR AF) – along the Snake River (Rkm 263), below the Grande Ronde River, in Asotin County, Washington, 3) Couse Creek boat launch – along the Snake River (Rkm 254), downstream from CJR AF and the Grande Ronde River, in Asotin County, Washington, 4) Pittsburg Landing Acclimation Facility – along the Snake River (Rkm 346), above the Salmon River, in Idaho County, Idaho, 5) Below Hells Canyon Dam - along the Snake River (Rkm 395) in Wallowa County, Oregon, and 6) Big Canyon Acclimation Facility – along the Clearwater River (Rkm 57) in Nez Perce County, Idaho, and 8) Grande Ronde River-near Cougar Creek (Rkm 254), in Asotin county, Washington.

Adult Collection – 1) LFH – along the Snake River (Rkm 95), below the Palouse River, in Franklin County, Washington, 2) Lower Granite Dam Adult Trap - Snake River (Rkm 173) in Garfield County, Washington.

Adult Holding and Spawning - LFH – along the Snake River (Rkm 95), below the Palouse River, in Franklin County, Washington.

1.6) Type of program. Integrated Recovery/Mitigation.

The Snake River fall Chinook program is managed to supplement and sustain the natural spawning population of Snake River fall Chinook population in the Snake River while providing tribal and non-tribal harvest opportunities.

The LSRCP fall Chinook goal was to include 54,900 fish for commercial harvest and 18,300 fish for sport harvest. Those numbers are far larger than the Snake River escapement goal of 18,300 hatchery fish; therefore our program is an integrated harvest program. Production goals are consistent with the current *US vs. Oregon* Management Agreement.

IPC's fall Chinook salmon program at OFH and Umatilla FH functions as mitigation for the construction and ongoing operation of the Hells Canyon Dam Complex (HCC).

1.7) Purpose (Goal) of program (based on priority).

This hatchery program is part of the Lower Snake River Compensation Plan (LSRCP). The purpose of the LSRCP is to replace adult salmon, steelhead and rainbow trout lost by construction and operation of four hydroelectric dams on the Lower Snake River in Washington. Specifically, the stated purpose of the plan when authorized in 1976 was:

> ***"…[to]….. provide the number of salmon and steelhead trout needed in the Snake River system to help maintain commercial and sport fisheries for anadromous species on a sustaining basis in the Columbia River system and Pacific Ocean" (NMFS & FWS 1972 pg 14.)***

Subsequently in 1994, additional authorization was provided (PL 103-316) to construct juvenile acclimation facilities for fall Chinook salmon that would

" … protect, maintain or enhance biological diversity of existing wild stocks."

Numeric mitigation goals for the LSRCP were established in a three step process (COE 1974). First the adult escapement that occurred prior to construction of the four dams was estimated. Second an estimate was made of the reduction in adult escapement (loss) caused by construction and operation of the dams (e.g. direct mortality of smolt). Last, a catch to escapement ratio was used to estimate the future production that was forgone in commercial and recreational fisheries as result of the reduced spawning escapement. Assuming that the fisheries below the project area would continue to be prosecuted into the future as they had in the past, LSRCP adult return goals were expressed in terms of the adult escapement back to, or above the project area.

For fall Chinook salmon, the escapement above Lower Granite Dam prior to construction of these dams was estimated to be 34,400. Construction and operation of the dams were expected to cause a reduction in the spawning escapement in two ways. First, the slack water reservoirs created behind the dams was expected to eliminate spawning grounds for 5,000 adults. Second, 15% of the smolts migrating past each dam were expected to die (48% cumulative mortality).

These factors were expected to reduce the adult spawning escapement by 18,300. This number established the LSRCP escapement mitigation goal back to the project area. This reduction in natural spawning escapement was estimated to result in a reduction in the coast-wide commercial/tribal harvest of 54,900 adults, and a reduction in the recreational fishery harvest of 18,300 adults below the project area. In summary the expected total number of adults that would be produced as part of the LSRCP mitigation program was 91,500 (Table 1).

Table 1. Fall Chinook goals as stated in the LSRCP Mitigation document.

Component	Number of Adults
Escapement to Project Area	18,300
Commercial Harvest	54,900
Recreational Harvest	18,300
Total	91,500

Since 1976 when the LSRCP was authorized, many of the parameters and assumptions used to size the hatchery program and estimate the magnitude of benefits have changed.

- The survival rate required to deliver a 4:1 catch to escapement ratio has been less than expected and this has resulted in fewer adults being produced.
- The listing of Snake River fall Chinook and Snake River Steelhead under the Endangered Species Act has resulted in significant curtailment of commercial, recreational and tribal fisheries throughout the ocean and mainstem Columbia River. This has resulted in a higher percentage of the annual run returning to the project area than was expected.

The LFH fall Chinook program was designed to escape 18,300 adults back to the project area after a harvest of 73,200. While recognizing the overarching purpose and goals established for the LSRCP, and realities' regarding changes since the program was authorized, the following objectives for the beneficial uses of adult returns have been established for the period through 2017:

1. To contribute to the coast-wide ocean fisheries in accordance with Pacific Salmon Treaty.
2. To contribute to the recreational, commercial and/or tribal fisheries in the mainstem Columbia River consistent with agreed abundance-based harvest rate schedules established in the 2008 – 2017 *US vs. Oregon* Management Agreement.
3. To spawn enough fish to retain 4.75 million eggs (Lyons Ferry AOP 2009-2010) to assure that production goals as stated in *US vs. Oregon* are met. Fecundities vary depending upon return age classes and run composition, but generally 1,400-2,000 females would need to be spawned to make production goals. In order to produce enough fish to meet harvest goals, many more fish would need to be trapped, spawned, and reared. Major construction additions would need to occur at LFH and changes to the production tables would need to occur in order to meet harvest mitigation goals.

4. To estimate the numbers of returns of LSRCP, FCAP, and IPC fish to the basin, the run composition must be estimated. For this task, an additional 1,300-2,000 fish must be recovered so coded wire tag information can be decoded.

5. To provide tribal and non-tribal fisheries in the Snake River consistent with co-manager goals.

6. To contribute to hatchery and natural-origin return goals identified in the Snake River Fall Chinook Management Plan.

Hatchery-Origin Return Goals

- Interim total return target based on current production levels and survival is 15,484 hatchery-origin fish above Lower Monumental Dam, which is comprised of 9,988 from LSRCP, 3,206 from Nez Perce Tribal Hatchery (NPTH), and 2,290 from IPC.

- The long-term goal is for a total return 24,750 hatchery-origin fish above Lower Monumental Dam, which is comprised of 18,300 from LSRCP, 3,750 from NPTH, and 2,700 for IPC.

Natural-Origin Return Goals

- Achieve ESA delisting by attaining interim population abundance in the Snake River ESU of at least 3,000 natural-origin spawners, with no fewer than 2,500 distributed in the mainstem Snake River (as recommended by the Interior Columbia Technical Recovery Team).

- Interim goal is to achieve a population of 7,500 natural-origin fall Chinook (adults and jacks) above Lower Monumental Dam.

- Long term goal is to achieve a population of 14,360 natural-origin fall Chinook (adults and jacks) above Lower Monumental Dam.

Three hatchery programs artificially propagate endemic Snake River fall Chinook. Two ((LSRCP (includes LFH and FCAP), and Nez Perce Tribal Hatchery)) of the programs are integrated programs aimed to increase harvest and natural-origin abundance via supplementation. The third (Idaho Power Company) is primarily mitigation for lost production. Fish are released at two different life stages (sub-yearling and yearling smolts). Releases occur at 10 release locations. The three programs are highly coordinated in their operations, including broodstock collection at Lower Granite Dam and fish transfers between facilities. Several out of basin hatchery facilities are utilized (Irrigon and Umatilla) in addition to the in basin facilities and acclimation sites. Marking of hatchery-origin fish is guided by a Snake River Basin Fall Chinook Salmon Production Program Marking Justification white paper. Mark types and quantities have been adopted under the 2008 - 2017 *US vs. Oregon* Management Agreement. At full production levels, 76% of the hatchery-produced fish are marked in some manner, 47% are marked with an adipose fin clip.

1. The goal of the LSRCP program is to mitigate for decreased numbers of fall Chinook harvested and returning to the Snake River due to the construction of the lower Snake River Dams. Production goals are consistent with *US vs. Oregon* Agreements.

2. The goal of the IPC program is to replace adult fall Chinook salmon lost to the construction and ongoing operation of the HCC by releasing 1,000,000 smolts annually.

3. The immediate goal of the FCAP is a concerted effort to ensure that the Snake River fall Chinook salmon above Lower Granite Dam are not extirpated. Long-term goals of the project are

    3.1 Increase the natural population of Snake River fall Chinook spawning above Lower Granite Dam.

    3.2 Sustain long-term preservation and genetic integrity of this population.

    3.3 Keep the ecological and genetic impacts of non-target fish populations within acceptable limits.

    3.4 Assist with the recovery of Snake River fall Chinook for removal from ESA listing.

    3.5 Provide harvest opportunities for both tribal and non-tribal anglers.

1.8) Justification for the program.

Lyons Ferry Program-LSRCP: The LSRCP is a congressionally mandated program pursuant to PL 99-662 and PL 103-316. Congress authorized the Lower Snake River Project on March 2, 1945 by Public Law 14, 79th Congress, First Session. The project was authorized under the Rivers and Harbors Act of 1945. It consists of Ice Harbor Dam (IHR), completed in 1962; Lower Monumental Dam, 1969; Little Goose Dam, 1970 and Lower Granite Dam, 1975. The project affected over 140 miles of the Snake River and tributaries from Pasco, Washington to upstream of Lewiston, Idaho. The authorized purposes of the project were primarily navigation and hydroelectric power production. The original authorizing legislation for the project made no mention of fish and wildlife measures needed to avoid or otherwise compensate for the losses or damage to these important resources.

The Fish and Wildlife Coordination Act (FWCAR) of 1958 (48 Stat. 401, 16 U.S.C. 661 et seq. as amended) requires an analysis of fish and wildlife impacts associated with federal water projects as well as compensation measures to avoid and/or mitigate for loss of or damage to wildlife resources (refer to Section 662 (b) of the Act). The USFWS and NMFS provided the USACE with a FWCAR on the LSRCP in 1972. Using the FWCAR, the USACE wrote a report to Congress in 1975 (USACE 1975) detailing losses of fish and wildlife attributable to the Project. Congress authorized the LSRCP as part of the Water Resources Development Act of 1976 (Public Law 94-587).

The LSRCP is funded by the USFWS through the LSRCP Office with power production revenues provided by the BPA. The WDFW administers and implements Washington's portion of the program. Specific mitigation goals include "in-place" and "in-kind" replacement of adult salmon and steelhead. The LSRCP program for steelhead and trout in Washington was begun in 1982 and for salmon in 1984. The LSRCP program in Washington has been guided by the following objectives: 1) Establish broodstock(s) capable of meeting egg needs, 2) Maintain and enhance natural populations of native salmonids, 3) Return adults to the LSRCP area which meet designated goals, and 4) Improve or re-establish sport and tribal fisheries. The production program is consistent with *US vs. Oregon* Agreements.

IPC and the HCC Program: The 1980 HCSA is a FERC approved agreement defining mitigation requirements for IPC associated with construction and continuing operation of the HCC. Parties include IPC, NOAA Fisheries, IDFG, ODFW, and WDFW. Section IV.A.2 of the HCSA required IPC to "contract with appropriate state and federal agencies or otherwise provide for the trapping of sufficient fall Chinook salmon and the fertilizing and eyeing-up of sufficient eggs to raise up to 1,000,000 fall Chinook salmon smolts" (FERC, 1980). IPC also entered into an agreement with the USACE for sufficient capacity within LFH to ensure availability of approximately 1.3 million eyed fall Chinook salmon eggs annually.

FCAP Facilities: During 1994, through *US vs. Oregon*, an agreement was made between the four Columbia River Treaty Tribes, States and Federal agencies to replace the natural production losses from adults trapped and removed at Lower Granite Dam with about 150,000 LFH yearlings to be acclimated and released upstream of the dam in 1996. Further agreements were reached to release 450,000 yearlings at acclimation facilities above Lower Granite Dam in future years as long as 450,000 are available for on-station releases at LFH. In addition, the agreement states that if additional LFH fall Chinook brood production is available above the full yearling program of 900,000, then these fish shall be released off-station as sub-yearlings. The fall Chinook acclimation project is designed to incorporate sub-yearling fall Chinook salmon into the existing program.

The fisheries co-managers (*US vs. Oregon* parties) had agreed that they should take a more active role in rebuilding the Snake River fall Chinook populations within its critical habitat. Because the *US vs. Oregon* parties largely control harvest and production issues, they revised the existing harvest agreements and production strategy to protect and encourage an increase in natural fish production.

The U.S. Congress secured funding for construction of acclimation facilities during deliberations over the FY95 budget. Congress instructed the USACE through the LSRCP to construct final rearing and acclimation facilities for fall Chinook in the Snake River basin to complement their activities and efforts in compensating for fish lost due to construction of the lower Snake River dams. The NPT along with State and Federal agencies selected three acclimation sites. Two acclimation facilities were located on the Snake River, at Capt. John Rapids and Pittsburg Landing, and one acclimation site was located on the Clearwater River at Big Canyon (see descriptions above). The sites were selected because of the proximity of spawning habitat for returning adults and because of good road access. ESA consultation by both NMFS and USFWS determined that the rearing, acclimation, and release of LFH fall Chinook salmon at acclimation sites on the Snake and Clearwater Rivers was not likely to affect listed Snake River sockeye salmon, Snake River spring/summer Chinook salmon, Snake River fall Chinook salmon, or their critical habitat (Stelle 1996). The NPT assumed responsibility for operation and maintenance of the facilities. The LSRCP was to fund the operations and maintenance of facilities constructed under the plan; however, in 1997 the decision was changed and BPA was directed to fund operations and maintenance (O&M) and monitoring and evaluation (M&E) of the facilities.

In 2001 the first release of sub-yearlings from the IPC program occurred to increase spatial diversity and encourage homing to the Snake River below Hells Canyon Dam. In 2005 the first release of sub-yearlings in the Grande Ronde River occurred. This release was funded by LSRCP and was consistent with the *US vs. Oregon* production table.

Indicate how the hatchery program will enhance or benefit the survival of the listed natural population (integrated or isolated recovery programs).

The Snake River Fall Chinook Program began as an egg bank program (1976) to maintain and increase the stock until the mitigation program could be initiated. The egg bank converted to a mitigation program after 1984 that continued to increase population size and maintain stock integrity while building towards future harvest. From 1976-1984, adults were trapped from the Snake River and their progeny were marked and reared separately at several locations. This stock was then transferred to LFH in 1984.

The incidence of stray fish in the broodstock at LFH increased until 1989 when it was determined <u>after</u> spawning that 41% of fish used for broodstock were stray non-Snake River origin, hatchery fish. WDFW was concerned that spawning with hatchery strays was compromising the natural Snake River stock. Trapping at IHR Dam was terminated and broodstock management was modified in an effort to maintain the genetic integrity of the stock. The 1989 brood year was not used for broodstock when they returned as adults.

By 1990, coded wire tags were read to determine origin of fish prior to spawning. Also, to benefit the integrity of natural populations, since 1990 any fish of unknown origin were removed at LGR Dam and excluded from the broodstock used for supplementation. Through selection at LFH, only known Snake River stock Chinook were used as broodstock during 1990-2002. Genetic sampling and analyses indicate that Snake River stock reared at LFH are closer to the natural population spawning in the Snake River, than the Columbia River stocks (Marshall et al, 2000).

The ESA listing of Snake River fall Chinook in the early 1990s slightly changed the program focus towards stock recovery. By the mid to late 1990s, acclimation facilities above LGR Dam were included and the program changed to a supplementation program to enhance fall Chinook production in the Snake River using Snake River stock.

Currently, Snake River origin fish reared in the hatchery are trapped at LFH and LGR Dam. In 2003, the program began including unmarked/ untagged hatchery females in production in an effort to integrate natural origin fish into the hatchery program. Any Snake River origin fish not needed for production or run reconstruction estimates are returned to the Snake River to "supplement" the natural population. The majority of unmarked fish in the Snake River are allowed to spawn naturally in the Snake River each year. The majority of smolts released by WDFW for the program have imprinted on the unique Lyons Ferry water during rearing so returning adults are less likely to stray into other rivers. To decrease densities of fish reared at LFH and improve fish health, it was determined that some of the fish originally slated for WDFW release would be reared at Irrigon FH before release into the Grande Ronde River. In addition, acclimation sites above LGR Dam have been used by the Nez Perce Tribe to encourage returning adults to spawn near the areas of release, thus encouraging spawning of Snake River stock raised at LFH with natural Snake River stock. Radio telemetry studies in the Snake River Basin (Garcia et al 2004) have shown that acclimation of juveniles does in fact return fish to the area of the river they were acclimated. Further, the program releases yearling smolts at 10 fish per pound (fpp) in order to increase smolt to adult returns and quicken progress towards meeting recovery and mitigation goals. However, we also attempt to mimic the lifecycle of natural fish and maximize production at LFH by rearing and releasing sub-yearling smolts at 50 fpp. Production goals for LFH are consistent with *US vs. Oregon* Agreements.

1.9) List of program "Performance Standards".

A Northwest Power and Conservation Council (NPCC) "Artificial Production Review" document (2001) provides categories of standards for evaluating the effectiveness of hatchery programs and the risks they pose to associated natural populations. The categories are as follows: 1) legal mandates, 2) harvest, 3) conservation of wild/naturally produced spawning populations, 4) life history characteristics, 5) genetic characteristics, 6) quality of research activities, 7) artificial production facilities operations, and 8) socio-economic effectiveness. The NPCC standards represent the common knowledge up to 2001. Utilization of more recent reviews on the standardized methods for evaluation of hatcheries and supplementation at a basin-wide ESU scale is warranted.

In a report prepared for NWPCC, the Independent Scientific Review Panel (ISRP) and the Independent Scientific Advisory Board (ISAB) reviewed the nature of the demographic, genetic and ecological risks that could be associated with supplementation, and concluded that the current information available was insufficient to provide an adequate assessment of the magnitude of these effects under alternative management scenarios (ISRP and ISAB 2005). The ISRP and ISAB recommended that an interagency working group be formed to produce a design(s) for an evaluation of hatchery supplementation applicable at a basin-wide scale. Following on this recommendation, the *Ad Hoc* Supplementation Workgroup (AHSWG) was created and produced a guiding document (Beasley et al. 2008) that describes a framework for integrated hatchery research, monitoring, and evaluation to be evaluated at a basin-wide ESU scale.

The AHSWG framework is structured around three categories of research monitoring and evaluation: 1) implementation and compliance monitoring, 2) hatchery effectiveness monitoring, and 3) uncertainty research. The hatchery effectiveness category addresses regional questions relative to both harvest augmentation and supplementation hatchery programs and defines a set of management objectives specific to supplementation projects. The framework utilizes a common set of standardized performance measures as established by the Collaborative System wide Monitoring and Evaluation Project (CSMEP). Adoption of this suite of performance measures and definitions across multiple study designs will facilitate coordinated analysis of findings from regional monitoring and evaluation efforts. This is needed to address management questions and critical uncertainties associated with the relationships between harvest augmentation and supplementation hatchery production, and ESA listed stock status/recovery.

The NPCC (2006) has called for integration of individual hatchery evaluations into a regional plan. While the RM&E framework in AHSWG document represents our current knowledge relative to monitoring hatchery programs to assess effects that they have on population and ESU productivity, it represents only a portion of the activities needed for how hatcheries are operated throughout the region. A union of the NPCC (2001) hatchery monitoring and evaluation standards and the AHSWG framework likely represents a larger scale more comprehensive set of assessment standards, legal mandates, production and harvest management processes, hatchery operations, and socio-economic standards addressed in the 2001 NPCC document (sections 3.1, 3.2, 3.7, and 3.8 respectively). These are not addressed in the AHSWG framework and should be included in this document. NWPCC standards for conservation of wild/natural populations, life history characteristics, genetic characteristics and research activities (sections 3.3, 3.4, 3.5, and 3.6 respectively) are more thoroughly developed by the AHSWG, and the later standards should apply to this document. Table 1 represents the union of performance standards described by the NWPCC in 2001, regional questions for monitoring and evaluation for harvest and supplementation programs, and performance standards and testable assumptions as described by the AHSWG (Galbreath et al. 2008).

Table 2. Compilation of performance standards described by the Northwest Power and Conservation Council (NWPCC 2001), regional questions for monitoring and evaluation for harvest and supplementation programs, and performance standards and testable assumptions as described by the Ad Hoc Supplementation Work Group (Beasley et al. 2008).

Category	Standards	Indicators
1. LEGAL MANDATES	1.1. Program contributes to fulfilling tribal trust responsibility mandates and treaty rights, as described in applicable agreements such as under U.S. v. OR and U.S. v. Washington.	1.1.1. Total number of fish harvested in Tribal fisheries targeting this program. 1.1.2. Total fisher days or proportion of harvestable returns taken in Tribal resident fisheries, by fishery. 1.1.3. Tribal acknowledgement regarding fulfillment of tribal treaty rights.
	1.2. Program contributes to mitigation requirements.	1.2.1. Number of fish released by program, returning, or caught, as applicable to given mitigation requirements.
	1.3. Program addresses ESA responsibilities.	1.3.1. Section 7, Section 10, 4d rule and annual consultation
2. IMPLEMENTATION AND COMPLIANCE	2.1. Program contributes to mitigation requirements.	2.1.1.Hatchery is operated as a segregated program. 2.1.2.Hatchery is operated as an integrated program 2.1.3.Hatchery is operated as a conservation program
	2.2. Program addresses ESA responsibilities.	2.2.1. Hatchery fish can be distinguished from natural fish in the hatchery broodstock and among spawners in supplemented or hatchery influenced population(s)
	2.3. Restore and maintain treaty-reserved tribal and non-treaty fisheries.	2.3.1. Hatchery and natural-origin adult returns can be adequately forecasted to guide harvest opportunities. 2.3.2. Hatchery adult returns are produced at a level of abundance adequate to support fisheries in most years with an acceptably limited impact to natural-spawner escapement.
	2.4. Fish for harvest are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while avoiding over-harvest of non-target species.	2.4.1. Number of fish release by location estimated and in compliance with AOPs and US vs. OR Management Agreement. 2.4.2. Number if adult returns by release group harvested 2.4.3. Number of non-target species encountered in fisheries for targeted release group.
	2.5. Hatchery incubation, rearing, and release practices are consistent with current best management practices for the program type.	2.5.1. Juvenile rearing densities and growth rates are monitored and reported. 2.5.2. Numbers of fish per release group are known and reported. 2.5.3. Average size, weight and condition of fish per release group are known and reported. 2.5.4. Date, acclimation period, and release location of each release group are known and reported.

Category	Standards	Indicators
	2.6. Hatchery production, harvest management, and monitoring and evaluation of hatchery production are coordinated among affected co-managers.	2.6.1. Production adheres to plans, documents developed by regional co-managers (e.g. US vs. OR Management agreement, AOPs etc.). 2.6.2. Harvest management, harvest sharing agreements, broodstock collection schedules, and disposition of fish trapped at hatcheries in excess of broodstock needs are coordinated among co-management agencies. 2.6.3. Co-managers react adaptively by consensus to monitoring and evaluation results. 2.6.4. Monitoring and evaluation results are reported to co-managers and regionally in a timely fashion.
3. HATCHERY EFFECTIVENESS MONITORING REGIONAL FOR AUGMENTATION AND SUPPLEMENTATION PROGRAMS	3.1. Release groups are marked in a manner consistent with information needs and protocols for monitoring impacts to natural- and hatchery-origin fish at the targeted life stage(s) (e.g. in juvenile migration corridor, in fisheries, etc.).	3.1.1. All hatchery origin fish recognizable by mark or tag and representative known fraction of each release group marked or tagged uniquely. 3.1.2. Number of unique marks recovered per monitoring stratum sufficient to estimate number of unmarked fish from each release group with desired accuracy and precision.
	3.2. The current status and trends of natural origin populations likely to be impacted by hatchery production are monitored.	3.2.1. Abundance of fish by life stage is monitored annually. 3.2.2. Adult to adult or juvenile to adult survivals are estimated. 3.2.3. Temporal and spatial distribution of adult spawners and rearing juveniles in the freshwater spawning and rearing areas are monitored. 3.2.4. Timing of juvenile outmigration from rearing areas and adult returns to spawning areas are monitored. 3.2.5. Ne and patterns of genetic variability are frequently enough to detect changes across generations.
	3.3. Fish for harvest are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while avoiding over-harvest of non-target species.	3.3.1. Number of fish release by location estimated and in compliance with AOPs and US vs. OR Management Agreement. 3.3.2. Number if adult returns by release group harvested 3.3.3. Number of non-target species encountered in fisheries for targeted release group.
	3.4. Effects of strays from hatchery programs on non-target (unsupplemented and same species) populations remain within acceptable limits.	3.4.1. Strays from a hatchery program (alone, or aggregated with strays from other hatcheries) do not comprise more than 10% of the naturally spawning fish in non-target populations. 3.4.2. Hatchery strays in non-target populations are predominately from in-subbasin releases. 3.4.3. Hatchery strays do not exceed 10% of the abundance of any out-of-basin natural population.
	3.5. Habitat is not a limiting factor for the affected supplemented population at the targeted level of supplementation.	3.5.1. Temporal and spatial trends in habitat capacity relative to spawning and rearing for target population. 3.5.2. Spatial and temporal trends among adult spawners and rearing juvenile fish in the available habitat.

Category	Standards	Indicators
	3.6. Supplementation of natural population with hatchery origin production does not negatively impact the viability of the target population.	3.6.1. Pre- and post-supplementation trend in abundance of fish by life stage is monitored annually. 3.6.2. Pre- and post-supplementation trends in adult-to-adult or juvenile to adult survivals are estimated. 3.6.3. Temporal and spatial distribution of natural origin and hatchery origin adult spawners and rearing juveniles in the freshwater spawning and rearing areas are monitored. 3.6.4. Timing of juvenile outmigration from rearing area and adult returns to spawning areas are monitored.
	3.7. Natural production of target population is maintained or enhanced by supplementation.	3.7.1. Adult progeny per parent (P:P) ratios for hatchery-produced fish significantly exceed those of natural-origin fish. 3.7.2. Natural spawning success of hatchery-origin fish must be similar to that of natural-origin fish. 3.7.3. Temporal and spatial distribution of hatchery-origin spawners in nature is similar to that of natural-origin fish. 3.7.4. Productivity of a supplemented population is similar to the natural productivity of the population had it not been supplemented (adjusted for density dependence). 3.7.5. Post-release life stage-specific survival is similar between hatchery and natural-origin population components.
	3.8. Life history characteristics and patterns of genetic diversity and variation within and among natural populations are similar and do not change significantly as a result of hatchery augmentation or supplementation programs.	3.8.1. Adult life history characteristics in supplemented or hatchery influenced populations remain similar to characteristics observed in the natural population prior to hatchery influence. 3.8.2. Juvenile life history characteristics in supplemented or hatchery influenced populations remain similar to characteristics in the natural population those prior to hatchery influence. 3.8.3. Genetic characteristics of the supplemented population remain similar (or improved) to the unsupplemented populations.
	3.9. Operate hatchery programs so that life history characteristics and genetic diversity of hatchery fish mimic natural fish.	3.9.1. Genetic characteristics of hatchery-origin fish are indistinguishable from natural-origin fish. 3.9.2. Life history characteristics of hatchery-origin adult fish are indistinguishable from natural-origin fish. 3.9.3. Juvenile emigration timing and survival differences between hatchery and natural-origin fish must be minimal.
	3.10. The distribution and incidence of diseases, parasites and pathogens in natural populations and hatchery populations are known and releases of hatchery fish are designed to minimize potential spread or amplification of diseases, parasites, or pathogens among natural populations.	3.10. Detectable changes in rate of occurrence and spatial distribution of disease, parasite or pathogen between the affected hatchery and natural populations.

Category	Standards	Indicators
4. OPERATION OF ARTIFICIAL PRODUCTION FACILITIES	4.1. Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols such as those described by IHOT, PNFHPC, the Co-Managers of Washington Fish Health Policy, INAD, and MDFWP.	4.1.1. Annual reports indicating level of compliance with applicable standards and criteria. 4.1.2. Periodic audits indicating level of compliance with applicable standards and criteria.
	4.2. Effluent from artificial production facility will not detrimentally affect natural populations.	4.2.1. Discharge water quality compared to applicable water quality standards and guidelines, such as those described or required by NPDES, IHOT, PNFHPC, and Co-Managers of Washington Fish Health Policy tribal water quality plans, including those relating to temperature, nutrient loading, chemicals, etc.
	4.3. Water withdrawals and instream water diversion structures for artificial production facility operation will not prevent access to natural spawning areas, affect spawning behavior of natural populations, or impact juvenile rearing environment.	4.3.1. Water withdrawals compared to applicable passage criteria. 4.3.2. Water withdrawals compared to NMFS, USFWS, and WDFW juvenile screening criteria. 4.3.3. Number of adult fish aggregating and/or spawning immediately below water intake point. 4.3.4. Number of adult fish passing water intake point. 4.3.5. Proportion of diversion of total stream flow between intake and outfall.
	4.4. Releases do not introduce pathogens not already existing in the local populations, and do not significantly increase the levels of existing pathogens.	4.4.1. Certification of juvenile fish health immediately prior to release, including pathogens present and their virulence. 4.4.2. Juvenile densities during artificial rearing. 4.4.3. Samples of natural populations for disease occurrence before and after artificial production releases.
	4.5. Any distribution of carcasses or other products for nutrient enhancement is accomplished in compliance with appropriate disease control regulations and guidelines, including state, tribal, and federal carcass distribution guidelines.	4.5.1. Number and location(s) of carcasses or other products distributed for nutrient enrichment. 4.5.2. Statement of compliance with applicable regulations and guidelines.
	4.6. Adult broodstock collection operation does not significantly alter spatial and temporal distribution of any naturally produced population.	4.6.1. Spatial and temporal spawning distribution of natural population above and below weir/trap, currently and compared to historic distribution.
	4.7. Weir/trap operations do not result in significant stress, injury, or mortality in natural populations.	4.7.1. Mortality rates in trap. 4.7.2. Prespawning mortality rates of trapped fish in hatchery or after release.
	4.8. Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of natural fish.	4.8.1. Size at, and time of, release of juvenile fish, compared to size and timing of natural fish present. 4.8.2. Number of fish in stomachs of sampled artificially produced fish, with estimate of natural fish composition.

Category	Standards	Indicators
5. SOCIO-ECONOMIC EFFECTIVENESS	5.1. Cost of program operation does not exceed the net economic value of fisheries in dollars per fish for all fisheries targeting this population.	5.1.1. Total cost of program operation. 5.1.2. Sum of ex-vessel value of commercial catch adjusted appropriately, appropriate monetary value of recreational effort, and other fishery related financial benefits.
	5.2. Juvenile production costs are comparable to or less than other regional programs designed for similar objectives.	5.2.1. Total cost of program operation. 5.2.2. Average total cost of activities with similar objectives.
	5.3. Non-monetary societal benefits for which the program is designed are achieved.	5.3.1. Number of adult fish available for tribal ceremonial use. 5.3.2. Recreational fishery angler days, length of seasons, and number of licenses purchased.

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

See Table 2. This program is consistent with the goals stated in the Viability Criteria for Application to Interior Columbia Basin Salmonid ESUs Draft Report (ICTRT 2007), although it only represents one of the three populations that used to exist in the ESU. It was determined that the Snake River fall Chinook are currently restricted to a single extant population which cannot meet the minimum ESU biological viability criteria established by the Interior Columbia River Basin Technical Recovery Team (ICTRT) because we would need two out of three populations existing. In efforts to increase the spatial distribution of this population, fish are released into the Grande Ronde and Clearwater rivers, and Snake River up to Hells Canyon Dam. The ICTRT also stated that the probability of long-term persistence of the ESU would be greatly enhanced with additional populations. They recognize that there are significant difficulties in re-establishing fall Chinook populations above the Hells Canyon complex, and suggested that initial effort be placed on recovery for the extant population, concurrently with scoping efforts for re-introduction. Ongoing discussions are occurring in-basin regarding this recommendation.

The ICTRT also established a minimum abundance threshold for the extant fall Chinook production consistent with the general abundance/productivity objectives summarized in the July 2003 ICTRT Viability Draft Report. They adapted the recommendations summarized in NMFS Biological Opinion for Hatchery Operations (1995) to assign a minimum long term average spawning abundance threshold for the extant population. They recommend a minimum abundance threshold of 3,000 natural origin spawners for the extant Snake River fall Chinook population. No fewer than 2,500 of those natural origin spawners should be distributed in mainstem Snake River habitat.

Response to Hatchery Review Recommendations:

Recent reviews[1] of hatchery programs throughout the Columbia basin were initiated to address concerns regarding hatchery performance, operations, and effects on ESA listed target and non-

[1] Hatchery Scientific Review Group and the U.S. Fish and Wildlife Service Hatchery Review Team

target populations. Following are responses to general and specific recommendations generated during those reviews for Snake River fall Chinook.

Hatchery Scientific Review Group

The Hatchery Scientific Review Group (HSRG) completed their review of Snake River fall Chinook in 2009. Following are excerpts from their observations, and their full list of recommendations. The full document can be viewed on line at: http://www.hatcheryreform.us/hrp_downloads/reports/columbia_river/system-wide/4_appendix_e_population_reports/blue-lower_snake_river_fall_chinook_01-31-09.pdf

Managers have not assigned a population designation for Snake River Fall Chinook although conservation and harvest objectives have been identified. Snake and Clearwater River fall Chinook salmon are managed as one population for recovery purposes.

The current hatchery program releases 5.8 million smolts into the Snake River at various locations. Currently, this program is not meeting the standards for a Contributing or Primary population (currently proportion of natural origin fish in broodstock (pNOB) = 5%, proportion of hatchery origin fish on spawning grounds (pHOS) = 77%). The hatchery program is providing some conservation benefit to the natural population. The HSRG was unable to develop a solution that achieved the standards of either a primary or contributing population under the existing conditions.

Adults are collected at Lower Granite Dam, the LFH and the NPTH. Adult holding, spawning, incubation, and juvenile rearing occur at LFH and NPTH. Incubation and rearing may also occur at Oxbow, Irrigon, Umatilla and Dworshak hatcheries.

The increase in Snake River fall Chinook returns over the last several years is the result of a number of habitat, fish passage, marine survival and hatchery actions together with harvest management. As currently operated, there is little opportunity for local adaptation and spatial structure in the ESU.

Recommendations: The HSRG looked at various hatchery scenarios that could improve productivity while meeting the standards for a Primary or Contributing population, but could not significantly increase natural-origin spawning under current habitat conditions. To promote spatial structure, local adaptation and to improve productivity, the HSRG recommends that managers pursue development of broodstock collection capabilities for releases into the Clearwater River. Due to the lack of adult capture facilities, the HSRG recommends that managers develop, test and deploy live capture selective fishing gears to collect local Clearwater brood to accomplish this end, provide additional harvest opportunity, and manage pHOS. Managers should avoid removing Clearwater-origin fish at Lower Granite Dam. Managers should also develop similar broodstock collection capabilities within the Snake River upstream of the confluence of the Clearwater River (e.g., CJR, PBL, and Hells Canyon Dam).

The HSRG recommends that managers implement a BKD control strategy for their spring and summer/fall Chinook hatchery programs where BKD has proved a recurring problem. Ideally, the strategy should include culling (destroying) eggs/progeny from hatchery- and natural-origin brood that are found to be infected with the BKD agent. However, because brood fish with high levels of the BKD agent are more likely to transmit the agent to their progeny than brood with lesser levels of the agent, the culling of eggs/progeny from infected brood fish, should, at the very least, be applied to those with high levels of the BKD agent (e.g., ELISA OD value of 0.4 and above when broodstock are not in short supply and ELISA OD value of 0.6 and above when broodstock are in short supply). In addition, in programs using ESA-listed natural-origin brood fish, the culling of their eggs/progeny may, at the managers' discretion, be dispensed with. However, the ESA-listed broodstock should be injected, pre-spawning, with an appropriate antibiotic (preferably, erythromycin at 40 mg/kg fish), and the resulting eggs should be surface-disinfected with an iodophor. All pre-spawning brood injections may be limited to females, ESA-listed or otherwise.

Finally, eggs and hatchlings derived from broodstock found to be heavily infected with the BKD agent should be incubated and reared in isolation from those obtained from broodstock with no or lesser levels of the BKD agent. In addition, the hatchlings should be reared at the lowest possible densities (below current standards), and, at the first signs of infection with the BKD agent, they should be treated with orally administered erythromycin (100 mg/kg fish) for 28 days. The treatment should be repeated if there is evidence that the BKD agent has persisted in the hatchlings. **Response: The co-managers have discussed the issues of broodstock collection and spatial distribution at length. There is currently no evidence that broodstock collection practices are hindering the behavior or performance of fall Chinook released within the basin from any location. Because natural origin fish typically do not enter hatchery ladders and traps or return in concentrated numbers to hatchery release locations neither LFH, NPTH or Hells Canyon Dam can effectively collect fall Chinook other than returning hatchery origin adults, collecting broodstock completely from those locations does not promote integration with the natural population. In the co-managers view, local adaptation should encourage some level of spawning to facilitate natural selection processes, and utilizing fish returning to a specific hatchery release would seem less beneficial than selecting broodstock at random from a mixture of releases as they pass LGR dam. Further, while local adaptation may occur by collecting broodstock at hatchery facilities, domestication effects from continuous cycling through the hatchery would not be consistent with the supplementation goal for the upper Snake River.**

Collecting natural fish for broodstock with the development and deployment of in-river adult collection facilities for the Clearwater would be expensive and a fairly intrusive means to collect broodstock. Co-managers question whether the cost and impact to natural fish is warranted especially when there is no indication from adult spawning behavior within the basin that there has been a significant change in relative spawning distribution since supplementation began. Redd counts and surveys do not suggest that the systematic random collection of broodstock from LGR Dam is changing spawning behavior. The co-managers understand the HSRG's contention of a possible benefit for adaptation by separating collection between the Snake and Clearwater. However, Snake River fall Chinook were listed under ESA as a single population and the co-managers continue to view this as a single remnant population occupying approximately 13% of from the historical habitat. We believe attempts to artificially create diversity in the population or partition habitat to attempt to artificially increase spatial diversity and local adaptation is not a viable or defensible management scheme and seems a difficult task for questionable benefit.

Co-managers are planning to develop a local broodstock for reintroduction of fall Chinook salmon in the upper Clearwater River as part of the NPTH program (see NPTH HGMP). Fall Chinook in the Clearwater were extirpated by Lewiston Dam in 1927. Supplementation efforts as part of the NPTH program includes releasing fall Chinook juveniles in from acclimation facilities on the South Fork Clearwater and Selway rivers. The Nez Perce Tribe plans to operate a weir on the South Fork Clearwater to collect returning fall Chinook adults and use them as the broodstock source for releases from these two upriver acclimation facilities.

U.S. Fish and Wildlife Service HRT Review

Program goals and objectives

Issue LF-FC1: At the present time, fall Chinook in the accessible portions of the Snake River are managed as one single stock or population. In the long term, this will inhibit the development of spatial structure and diversity for naturally spawning populations (aggregations) of fall Chinook in the Snake River. *The Snake River fall Chinook ESU was reduced to a single remnant population, largely maintained by Lyons Ferry FH. As a result of the successes of the current program, the abundance of Snake River fall Chinook in recent years has increased substantially from a few hundred fish in the mid 1990's to close to 20,000 fish in recent years. The increased abundance has increased the abundance of fish representing, but the current management strategy does not address the viability parameters of spatial structure and diversity.*

Recommendation LF-FC1: Establish natural spawning escapement goals the Clearwater River and the stretch between Lewiston and Hells Canyon reach of the Snake River upstream from Lewiston, Idaho. Correlate the number of fish released from each remote acclimation facility with the natural spawning escapement goals for each of those stream reaches and/or regions. Consider establishing a sliding scale that would reduce the number of fish released at each particular release site as a function of the number of naturally spawning adults within each of those regions. **Response: The NPT has identified specific management goals, including population goals for the Clearwater, and there have been several attempts to calculate the productive capacity of the remnant fall Chinook habitat in the mainstem Snake River below Hells Canyon Dam. Although no agreed upon capacity has currently been adopted for management purposes, numbers of natural fall Chinook continue to increase in the rivers above Lower Granite dam. Spatial structure is expanding, based on annual redd surveys conducted by the co-managers, which has shown a steady increase in core area abundance and increased use of tributary habitat (Clearwater, Grande Ronde, Salmon and Imnaha) for spawning. The managers are not currently willing to decrease hatchery releases in the upper basin until the relative reproductive success of hatchery and natural fish is better understood, and no further expansion of spatial distribution is occurring.**

Issue LF–FC2: The purpose of the current fall Chinook program is to provide mitigation as specified under the LSRCP program while meeting the interim conservation and

recovery criteria established for the Snake River fall Chinook ESU. *The mitigation goal is to return 18,300 fish to the project area. Co-managers have identified general short-term and long-term natural-origin spawning goals for the entire ESU (7,500 and 14,360, respectively*[1]*). However, short and long term adult escapement goals have not been established for specific natural spawning areas associated with current release locations. Additionally, specific harvest goals have not been established for each release location.*

Recommendation LF-FC2a: Establish specific natural-origin spawning escapement goals consistent with release strategies (numbers and locations) and conservation and recovery criteria developed for Snake River fall Chinook. **Response: Snake River fall Chinook are currently managed as a single population above LGR, and partitioning habitat to attempt to artificially increase spatial diversity and local adaptation is not considered a viable or defensible management scheme. The recovery criteria developed by the ICTRT should be applied to the population as a whole.**

Recommendation LF-FC2b: Establish specific harvest goals that are associated with current release strategies and consistent with natural-origin spawning escapement goals for conservation and recovery. **Response: All managers within the basin have identified harvest as a high priority. However, large returns of fall Chinook have only recently been consistent to the Snake River and harvest plans are not fully implemented. Development of harvest scenarios and implementation of annual seasons will be necessary to assess the effectiveness of fisheries at removing Chinook from these areas. Only after those preliminary seasons have been evaluated, including their impact on the abundance and distribution of spawning, can more specific harvest goals be established.**

Issue LF-FC3 There is not an established Snake River fall Chinook ESU recovery plan that provides guidance for the existing Lyons Ferry FH fall Chinook program*. Co-managers have developed a draft Snake River Fall Chinook Management Plan; however, an official, agreed-to management document does not currently exist.*

Recommendation LF-FC3: Co-managers should complete a recovery plan that identifies how recovery should be achieved. **Response: A draft recovery plan is being developed but has not been approved under *U.S. vs. Oregon*.**

Broodstock Choice and Collection

Issue LF-FC4: The current management goal that natural-origin fall Chinook compose 30% of the broodstock (pNOB = 0.30), provided that this number does not exceed 20% of the natural-origin spawning population, is not achievable in most years under current conditions (2,273-6,607 natural-origin returns 2002-2007). *Approximately 3,500 adult fall Chinook must be retained for broodstock of which approximately 1,050 are necessary to achieve pNOB equal to 0.3. The number of natural-origin fish required for broodstock would exceed 20% of the natural-origin adults passing Lower Granite Dam in most years under current conditions.*

[1] Draft Snake River Fall Chinook Management Plan.

Recommendation LF-FC4a: Broodstock management should focus on collecting broodstock at a rate that does not exceed 20% of the natural-origin spawning population and allow the pNOB value to vary among brood year depending upon the abundance of natural-origin adults available for broodstock**. Response: It is generally not possible to trap 20% of the fall Chinook population at LGR because of the numbers of hatchery and wild steelhead passing the dam at the same time would overwhelm the trap. The recommendation is therefore consistent with our current trapping criteria whereby pNOB is a function of the available wild fish.**

Recommendation LF-FC4b: The Review Team supports co-manager efforts to achieve a pNOB value = 30%, which is expected to reduce domestication risks, by trapping natural-origin fall Chinook adults at Lower Granite Dam. The likelihood of achieving this target could be increased by improving the broodstock collection and sorting capabilities at Lower Granite Dam (issue/recommendation #). **Response: The managers agree with the HRT that completion of improvements at the trap facility at LGR Dam were necessary and those underway during this review were completed. However it is unlikely that a 30% pNOB can ever be achieved, regardless of improvements. The physical handling of sufficient salmon and steelhead to collect enough brood to reach a 30% pNOB would be extremely invasive on the fish during the late summer and early fall when water temperatures are at the upper end of tolerance for salmonids. A 100% external mark of hatchery fish would be required for there to be any chance to reach such a pNOB and the marking strategy for Snake River fall Chinook is currently agreed to under the *U.S. vs. Oregon* Management Agreement.**

Issue LF-FC5a: Managing the proportion of natural-origin fall Chinook to be incorporated in the broodstock pNOB is complicated because not all hatchery fish are identified by marks or tags. *Only 70% to 80% of the Lyons Ferry FH Chinook receives marks and/or tags. This poses a domestication risk to the propagated stock since those hatchery-origin fall Chinook that don't receive a mark or tag cannot be distinguished from natural-origin fall Chinook.*

Issue LF-FC5b: Managing the proportion of hatchery origin recruits (pHOS) on natural spawning and rearing areas above Lower Granite Dam requires the ability to trap, identify, and live sort migrating adults. *The proportion of hatchery fall Chinook marked by methods identifiable in live fish and the limited proportion of returning adults that can be examined and sorted at Lower Granite and other existing traps precludes effective sorting.*

Recommendation LF-FC5: Mark or tag all hatchery-origin fish in some manner so that they can be distinguished from natural-origin fish during broodstock collection. Consider using a marking method or methods which can be distinguished while the fish are alive to allow monitoring and sorting for passage to natural spawning areas as well as broodstock collection (see recommendation LF-FC14 regarding improvements to the Lower Granite trap). **Response: The co-managers have established an agreed to marking strategy through the *US vs. Oregon* Management Agreement and cannot increase external marking of hatchery fall Chinook to reach this recommendation without a renegotiation of the 2008-17 Columbia River Management Agreement.**

Issue LF-FC6: Fall Chinook released on station at LFH do not represent all spawn takes. *Progeny from two egg takes are used in each release group. The egg takes are rotated through release groups annually. This is performed because tagging across all egg takes for each release group is difficult due to the high variability in fish size. This activity results in an effective number of breeders that is less than 50% of the total number of adults spawned for the on station release. Restricting on station releases to fall Chinook representing a narrow temporal portion of the egg takes each year is a form of artificial selection and poses genetic risks to the Lyons Ferry fall Chinook stock.*

Recommendation LF-FC6: Utilize eggs from adults across the entire run and spawn takes for the on-station release. Consider chilling eggs to equal out temperature units among egg takes and ultimately reduce size variability at the time of marking and tagging. **Response: Such an action would seriously hamper WDFW's attempts to rear sub-yearling smolt releases to an appropriate size at release by artificially delaying most of the early egg takes by chilling. We do not agree that current brood and egg management impose artificial selection on the population. A significant proportion (up to 70%) of broodstock are currently collected at LGR Dam, and the adults being spawned represent the entire range of egg takes and releases into the Snake River basin. We have documented that run timing and spawn timing are not correlated thus using progeny from two egg takes of fish actually incorporate fish returning over multiple weeks.**

Hatchery and Natural Spawning, Adult Returns

Issue LF-FC7a: The current management strategy of collecting broodstock at Lower Granite Dam and LFH, and then releasing the progeny of those fish in the Clearwater River and Snake River below Hells Canyon, prevents the development of spatial structure, diversity, and local adaptations of both hatchery and naturalized populations in the upstream release areas. *Ideally, broodstock should be collected from returning adults at the same locations where they were released as juveniles and where natural spawning supplementation is desired. The development of locally adapted broodstocks and naturally spawning populations for the Clearwater River and the Hells Canyon reach of the Snake River could contribute to increased spatial structure and diversity, thereby assisting with recovery of the Snake River fall Chinook ESU. Local adaptations that maximize productivity can only develop if adult fish are allowed to return to the areas where they were released as juveniles, and then successfully reproduce and produce progeny in the same areas where their parents reproduced successfully.*

Issue LF-FC7b: The collection and development of fall Chinook brood stocks at locations where locally adapted populations can potentially be developed are not given high priority. *For example, co-manager agreements under the US vs. Oregon process assigns low priority of egg transfers to Oxbow FH, although Oxbow FH is a location where a local broodstock for the Hells Canyon reach of the Snake River could be developed. The current practice of capturing broodstock at Lower Granite Dam, and then releasing the progeny of those fish at upstream locations (i.e., Clearwater River and lower Hells Canyon) with different temperature profiles and hydrology, results in no natural selection or selective advantage for adult Chinook that do return to the specific areas of their release. In the long run, this strategy is expected to reduce smolt-to-adult return rates*

(SARs) back to the release locations, increase stray rates between the two subbasins, and reduce the mean productivity (recruit per spawner) of fish that do reproduce naturally in the two respective regions.

Recommendation LF-FC7: Explore opportunities for recapturing adult fall Chinook at Nez Perce Tribal Hatchery and Oxbow FH for developing local brood stocks for the Clearwater River and the Hells Canyon reach of the Snake River, respectively. Continue to maintain an integrated program utilizing adult returns to LFH and Lower Granite Dam for release of juveniles at LFH to help meet LSRCP mitigation goals and harvest goals for the lower Snake River, to serve as a genetic reserve for Snake River fall Chinook, and to provide a source of fish for developing two localized stocks for the Clearwater River and the Hells Canyon reach of the Snake River, respectively. In particular, the Nez Perce Tribal Hatchery may be the appropriate place for developing an "early-run" fall Chinook population for the Clearwater River. Developing such a population is a long-term goal of the Nez Perce Tribe. **Response: There is no current evidence that broodstock collection practices are hindering the behavior or performance of fall Chinook released within the basin either at FCAP facilities or from NPTH. A study completed several years ago (Garcia et al. 2004) showed strong fidelity of adult returns from smolts released from the FCAP facilities to spawning areas near their point of release. These fish are spawning in these reaches of rivers and are presumed to be contributing to the increasing number of natural fish returning annually. Moreover, since Snake River fall Chinook are considered a single population, attempts to artificially create diversity in the population seems a difficult task for questionable benefit. Further, the suggestion of trapping fish at NPTH or Oxbow hatcheries (concrete to concrete) seems directly contrary to the goal of encouraging local adaptation as proposed for other salmon populations in the Columbia. Local adaptation should encourage some level of spawning to facilitate natural selection processes, and utilizing fish returning to a specific hatchery release would seem less beneficial than selecting broodstock at random from a mixture of releases as they pass LGR dam.**

Issue LF-FC8: The current management strategy is to pass hatchery-origin fall Chinook adults upstream with the intent to reestablish naturally spawning populations, irrespective of the number being passed. *This may be desirable as the initial phase of restoring naturally spawning populations as a first step toward recovery of the ESU.*

Recommendation LF-FC8: As the number of natural-origin adult recruits increases over time, the number of hatchery-origin fish spawning naturally should decrease to allow the establishment of viable, self-sustaining naturally spawning populations. Ultimately, this might require the development of a sliding scale for the number of hatchery-origin fish allowed to pass upstream of Lower Granite Dam**.** Modifications to the Lower Granite Dam collection and sorting facility (see recommendation LF-FC14) and/or improvements to mainstem collection sites downstream of Lower Granite (e.g. Ice Harbor) may be required to achieve this objective**. Response: The level of fish handling at LGR to achieve this recommendation would be completely contrary to the best management practices (BMP) of fish culture and fish management. LGR Dam is simply not a weir that can effectively be used as a management tool to control pHOS.**

Issue LF-FC9: The current practice is to return any LFH-origin adults not needed for broodstock, monitoring, or run reconstruction to the Snake River to "supplement" the natural population

Recommendation LF-FC9: Concurrent with the future objective of establishing viable, self-sustaining naturally spawning populations, discontinue returning hatchery-origin adults to the Snake River. **Response: This is inconsistent with the *US vs. Oregon* Management Agreement and contrary to the desire to have fish spawning in the natural environment; especially those of endemic origin like Snake River fall Chinook. This is also inconsistent with the mitigation and harvest goals for the Snake River.**

Issue LF-FC10: Lyons Ferry FH fall Chinook are periodically used to backfill other fall Chinook programs.

Recommendation LF-FC10: Discontinue backfilling other fall Chinook programs. If backfilling does occur, ensure that Lyons Ferry FH fall Chinook are differentially marked so that they are not included in the backfilled program's broodstock. **Response: We agree that the use of Snake River fall Chinook to backfill Columbia River programs should not occur. The marking of those fish, should they be used elsewhere, is extremely important so they can be identified as strays if they return to the Snake and are trapped as broodstock.**

Incubation and Rearing

Issue LF-FC11: The fall Chinook reared at Lyons Ferry FH periodically experience outbreaks of Bacterial Gill Disease which can result in substantial losses to a brood year. *Reductions in rearing densities achieved by utilizing the adult holding ponds have reduced outbreaks; however, mortalities have still reached 3.5% since the rearing modification was made. Therapeutic treatment is required. Most of the bacterial gill disease occurs in the raceways although it can occur in the lakes. Fish size (less than 35 fpp) at time of movement between the raceways and the lakes and manganese in the water supply are hypothesized to increase susceptibility to the disease. Rearing densities are currently low and not thought to be a contributing factor, but the complexity of the program and fish distribution practices at the hatchery may favor bacterial infections when fish are most susceptible.*

Recommendation LF-FC11: Investigate modifying hatchery practices to reduce or eliminate the incidence of Bacterial Gill Disease. Consider adjusting feed frequency or amounts, investigating flow patterns and turnover in lakes for modifications of water flow, increasing aeration in the lakes, and improving cleaning methods in the raceways. May need to consider resizing the yearling and sub-yearling programs. **Response: We agree that actions to reduce the effects of bacterial gill disease on the Chinook program would be beneficial. In 2009 adult ponds were modified by splitting the vessels lengthwise to increase flexibility of rearing juvenile Chinook and to accommodate adult Chinook. We reared sub-yearlings in those vessels in 2010 and did not observe any bacterial gill disease. We suspect that the change of the vessel size increased flow and decreased densities, making it a better rearing environment. Any resizing of the program would need *US vs. Oregon* concurrence, which could occur**

if a direct relationship to a hatchery practice and BKD could be established. A density index of .08 has been established to reduce the occurrence of BGD (standard index for Chinook is .12).

Issue LF-FC12: Juvenile fall Chinook that are released as yearlings are given a medicated feed to help control bacterial kidney disease. *These treatments are given prophylactically (i.e. when the fish do not show clinical signs of disease). The U.S. Department of Agriculture and other federal agencies have published warnings and advisories regarding the biological risks and potential overuse of antibiotics. However, BKD is annually detected in the fall Chinook juveniles at Lyons Ferry and the acclimation sites, indicating that antibiotic treatment may be necessary to control this disease if the fish are reared to the yearling stage. At release, the yearling fish show descaling and a loss of parr marks, indicators of physiological maturity/stress. Propagation of fall Chinook beyond the stage of smoltification increases their susceptibility to BKD.*

Recommendation LF-FC12: Re-evaluate the need for regularly scheduled prophylactic use of erythromycin feed with the goal of phasing out its use. Included in this phase-out could be a study that evaluates adult returns from erythromycin treated and untreated juvenile groups. **Response: Beginning in spring 2011, only fall Chinook fry to be released as yearlings from the NPT acclimation facilities (FCAP) will receive a 28 day Aquamycin feeding. The yearling fall Chinook treatment for the on-station release at LFH will be discontinued. It is determined that the adult sampling protocols are controlling the risk of an outbreak of BKD, along with the concerns of post treatment stress, and an increase in the number of drop-outs occurring in the fry. This practice is under constant evaluation and Washington has concluded that the beneficial effects of prophylactic erythromycin treatment out weights the risks and will be continued. This recommendation is not consistent for other stock HGMP's in the Snake River (i.e. Tucannon spring Chinook).**

<u>**Release and Outmigration**</u>

Issue LF-FC13a The natural life history of fall Chinook in the Snake River includes the outmigration of juveniles to the ocean as sub-yearlings or as yearlings after over-wintering in fresh water or the Columbia River estuary. *Currently, natural-origin Chinook from the Snake River commonly enter the ocean as sub-yearlings, whereas juveniles from the Clearwater River commonly enter the ocean as yearlings. The majority of hatchery-origin fall Chinook are currently released as sub-yearlings; however, fall Chinook are released into the Snake River as yearlings at three locations: Lyons Ferry FH (200,000 fish), Pittsburg Landing (150,000 fish), and Captain John Rapids (150,000 fish). In addition, fall Chinook are released as yearlings at one location in the Clearwater River: the Big Canyon facility (150,000 fish).It is unclear whether the current strategy of releasing a proportion of each brood year as yearlings confers any net benefits with respect to meeting the stated goals of the program.*

Issue LF-FC13b: Fall Chinook salmon released as yearlings are held in the hatchery and acclimation sites beyond the natural physiological stages of smoltification and outmigration for this species. *Signs of stress and maturation are detected by descaling* *and loss of parr marks during fish health pre-release exams done at Lyons Ferry FH and the three acclimations sites. At the acclimation sites, the yearlings are held for several months and can be infected by pathogens such as IHNV and enteric redmouth disease, transmitted from migrating adult salmonids in the river water supply. When water conditions become less favorable at the acclimation sites, the fish can show increased mortality due to pathogens. Prior to 2005, bacterial kidney disease (BKD) was significantly worse among pre-release yearling juveniles sub-yearling juveniles until stringent BKD prevention techniques (erythromycin injections of adults, use of progeny from low BKD female parents, and use of medicated feed) and improved fish culture (low densities) reduced disease progression. However, low levels of BKD have been detected since 2005 in 4 to 42% of the yearling fish during the five-month rearing period prior to release.*

Issue LF-FC13c: Adult return rates for fall Chinook released as yearlings are, at the present time, approximately twice (2x) return rates of fish released as sub-yearlings. *This ratio was > 10x during the early 1990's when return rates were much lower. Substantially more fish could be reared if all fish were released as sub-yearlings.*

Issue LF-FC13d: The acclimation facilities (Captain John's, Pittsburg Landing, and Big Canyon) have problems with intake water supplies and back-up power generation that require highly trained personnel during emergency situations*. Fish in the yearling program are on site for 2.5 –3 months, just before the sub-yearling program Chinook which are on site for 6-8 weeks.*

Recommendation LF-FC13: Assess the overall benefits and risks of releasing a proportion of each brood year as yearlings versus releasing all fish as sub-yearlings. These evaluations should include considerations of the natural life history strategies of fall Chinook in areas where hatchery fish are released to determine if current yearling release levels and locations are consistent with program goals and the current life history strategies of natural-origin fall Chinook in the Snake and Clearwater rivers. If the benefits of releasing fall Chinook as yearlings do not significantly outweigh the risks, consider terminating the yearling program and increase the number of sub-yearlings released to achieve the LSRCP mitigation goal of the program. Determine if increases in the sub-yearling program would continue to meet the necessary densities and/or environmental conditions required for healthy production at Lyons Ferry FH and the acclimation sites. Use of a lake for rearing sub-yearlings could be investigated to reduce densities. The goal would be to establish acclimations of 6-8 weeks so that time in the acclimation sites is reduced, thereby decreasing exposure to pathogens, reducing operational time and exposure to limiting water conditions at the acclimation sites.
Response: The co-managers constantly scrutinize the relative merit of yearling and sub-yearling production. The managers believe that the current allocation of yearlings and sub-yearlings throughout the basin is the best to ensure adequate survivals for mitigation, while providing for continuation of natural life history strategies without undue selection from the hatchery program. In general the survival of yearling over sub-yearling releases exceed the 2x figure referenced by the HRT, thus making cost benefits strongly positive with this hatchery strategy. For instance, the survival benefits of yearlings released on-station at LFH over sub-yearlings released at LFH (brood years 99-03 through the 2008 Snake River returns) occurs for each age of

return through the 3 salt age for returns to the Snake River. Survivals of age two salt yearlings are 5 times greater than sub-yearling survivals. Survivals of age three salt yearlings are 1.2 times greater than sub-yearling survivals. In addition, more fish are harvested per yearling released than sub-yearling released. The LSRCP mitigation was based on 54,900 commercial, 18,300 sport, and 18,300 escapement.

Regarding BKD, beginning in spring 2011, only the yearling fall Chinook fry for the NPT acclimation facilities (FCAP) will receive a 28 day Aquamycin feeding. The yearling fall Chinook treatment for the on-station release at LFH will be discontinued. It is determined that the adult sampling protocols are controlling the risk of an outbreak of BKD, along with the concerns of post treatment stress, and an increase in the number of drop-outs occurring in the fry.

Acclimation of both yearling and sub-yearling releases has been identified and instituted as a preferred release method for fall Chinook above LGR Dam. The HRT has expressed concern regarding the length of acclimation for yearling releases based on water quality and fish pathogen concerns. Lengthy acclimation allows for decreased numbers of fish at LFH in the spring, thus reducing densities of sub-yearlings in raceways and reducing the probability of BKD or other disease epizootics. We disagree that the extended acclimation period could be detrimental for the yearling releases as this occurs during early spring (February – April) when water quantity and quality are high. Later use of the acclimation facilities for sub-yearlings is subject to poor water conditions, although acclimation periods are much shorter; which is consistent with the HRT's fish health concerns. Further, yearlings are acclimated for 6 weeks at Big Canyon and Pittsburg Landing. Yearlings are acclimated at CJR AF for approximately 10 weeks because there is a need to move fish off station at LFH to make room for marking and sub-yearling production. Sub-yearlings are acclimated 3-4 weeks at all three facilities.

The managers conduct biannual coordination meetings to discuss monitoring, evaluation, research and production issues. As previously mentioned, program performance is carefully scrutinized and if results indicate the need for program changes, those will be discussed in a timely manner. If improved hatchery practices were to shift benefits toward a full sub-yearling rearing strategy, there is a process outlined in *US vs. Oregon* to institute such a change. In addition, a yearling component should continue in the event that smolt to adult return rates decline to low rates as seen in the late 1980s.

Facilities/Operations

Issue LF-FC14: The sorting facility at Lower Granite Dam is inadequate as a broodstock collection site for the fall Chinook program. *Large numbers of steelhead and hatchery-origin fall Chinook returning to Lower Granite Dam during the same time period combined with an inadequate broodstock collection facility limit managers ability to collect and sort broodstock. As a result, only 15% of the fish ascending the ladders at Lower Granite Dam can be intercepted and sorted.*

Recommendation LF-FC14: Consult with the Army Corps of Engineers and co-managers to modify the collection facilities at Lower Granite Dam to allow sorting a high proportion of fall Chinook in the presence of large numbers of steelhead passing at the same time. Facility modifications would also allow for the future management of hatchery-origin fish passage upstream of Lower Granite Dam (pHOS). **Response: We have serious reservations about such an invasive recommendation. We do not believe that the LGR trap can reasonably be used as a tool to regulate pHOS in the upper basin. The required levels of fish handling are unacceptable and completely unrealistic.**

Issue LF-FC16: The accumulation of manganese precipitate in the water supply lines restricts flow and water conveyance, reducing the rearing capabilities of the facility over time*. Manganese accumulation in the main water line reduces overall water availability. Accumulation in the smaller pipes can constrict water flow to individual rearing units. High concentrations of dissolved manganese in the well water also poses a fish health risk to fall Chinook and may contribute to the incidence of Bacterial Gill Disease. The shallowest well (number 4) is considered the largest contributor of manganese.*

Recommendation LF-FC16: Consult with Service engineers to investigate modification of water chemistry to preclude formation of precipitate. In addition, consider deepening well number 4. Determine whether accumulated manganese precipitate can be removed from the main water line or if sections must be replaced, and remove or replace smaller pipes that are constricted. **Response: There is no evidence that manganese and iron precipitates are restricting water flow in any hatchery water supply lines. High concentrations of manganese and iron have only been suspected to contribute to bacterial gill disease. In fact, many groups of fish are reared at LFH without bacterial gill disease. While this assumption/concern may have merit, many stocks reared at LFH do not break with Bacterial Gill Disease, despite the presence of manganese. In fact, epizootic occurrence has been strictly random for instances of BGD in fall Chinook. Evidence has shown that adjacent raceways populated identically with fall Chinook juveniles, have reacted differently to the water source: one breaks while another does not. Density index has been managed not to exceed 0.08 DI, although generally the recommended maximum DI for fall Chinook is 0.13. While potential restrictions in the manifold systems or higher precipitates are possible in some raceways, water flows are consistent from one rearing vessel to another. Close monitoring of flows during the rearing season is standard operating procedure to ensure a healthy rearing environment.**

Issue LF-FC17: Although the hatchery has a sophisticated alarm system, the alarm does not function properly and at times provides false or erroneous information which could lead to fish loss.

Recommendation LF-FC17: Service the alarm system and/or consider upgrading the system so that it functions properly**. Response: With the expansion of the adult rearing ponds in 2009, all alarm probes have been upgraded, with exception of the Lakes. Service technicians from Technical Systems Incorporated monitor our alarm system,**

routinely upgrading the software when applicable. Redundancy is built into our system for monitoring power, flows, and water levels.

Issue LF-FC18: Pumped well water from the Marmes pump station is the exclusive water source for the facility, increasing the risk of catastrophic loss to fish reared on station.

Recommendation LF-FC18: Investigate the possibility of installing a backup pump system that would draw water from the mainstem Snake River. **Response: Many hatcheries throughout the region and state depend on one water supply. Provisions to minimize risk are employed (i.e. standby generator). The use of Snake River water would present extreme risk to fish health with high water temperatures and high fish pathogen loads.**

Issue LF-FC19: The Lower Snake River Compensation Plan office is reviewing the ownership status of water rights associated with all co-manager-operated facilities which divert water for fish culture. *In the case of Lyons Ferry, the water right is currently held by the Army Corps of Engineers. The appropriate documentation to transfer the water rights to the Service may not have been filed in the respective state agency which administers water rights. Moreover, facility staff may not consistently or adequately record water use to ensure documentation of beneficial use in support of its water right(s) and as required by state law. Adequate documentation and reporting are required to maintain the right to divert water.*

Recommendation LF-FC19: Complete transfer of the water right from the Army Corps of Engineers to the U.S. Fish and Wildlife Service. WDFW should work with the Lower Snake River Compensation Plan office to ensure water diverted for fish culture is measured and reported correctly. Water use information needs to be maintained by the Service's, Region 1 Engineering, Division of Water Resources. **Response: No transfer is needed for the water rights associated with LFH. The name of the original applicant stays on the certificate in perpetuity, unless there is a change of some sort, such as in use or quantity. The water right is attached to the land and since the land was transferred to USFWS, so did the water right. Water flows are measured quarterly and reported as part of the National Pollutant Discharge Elimination System (NPDES) permit.**

Issue LF-FC20: The roof of the fall Chinook spawning building leaks.

Recommendation LF-FC20: Repair the roof of the fall Chinook spawning building. **Response: This recommendation was accomplished during the summer of 2009.**

Issue LF-FC21: A number of safety issues were identified at Lyons Ferry FH during a Service safety review but have yet to be corrected), posing a human safety risk to hatchery staff. *The Service performed a safety review of Lyons Ferry FH in 2006. Issues that were identified and not yet corrected include catwalks and railings for the fall Chinook adult trap and collection facility.*

Recommendation LF-FC21: Contract or hire temporary maintenance staff to correct safety issues. **Response: Safety corrections are ongoing.**

Research, Monitoring, and Accountability

Issue LF-FC22: A consistent mechanism for dealing with contingencies that are not covered in management documents or through the Annual Operation Plan process appears to be lacking*.* *The co-managers meet on an annual basis to agree upon program actions; however, if contingencies arise, there is no apparent, agreed upon process to discuss and reach agreement. Additionally, management documents designed to facilitate contingency planning, such as HGMPs or Statement of Works (SOWs), are not updated on a regular basis, and, in the case of HGMPs, have not been approved which means a formal ESA consultation process has not been completed for salmon and steelhead.*

Recommendation LF-FC22: Continue to work with the co-managers to establish such a consistent mechanism, such as within the AOP process and including the finalization and approval of all HGMPs. **Response: WDFW, the NPT and IPC continue working toward a final Snake River fall Chinook HGMP. Snake River fall Chinook production and management is a sensitive subject in the Columbia Basin and elsewhere and approval of an HGMP must be approved through the *US vs. Oregon* review process. Along with two coordination meetings each year we have weekly teleconferences during fall Chinook trapping season where the status of the run and accounting of numbers of fish hauled to the hatcheries are discussed. These teleconferences continue through the season and weekly estimated inventories of eggs collected and an updates on the current level of the production goals met are discussed. After incubated eggs are picked for loss, another update is distributed to co-managers. If there is a shortage at one hatchery the other hatchery is contacted to determine if they can help the other hatchery out with an egg transfer. We are currently incorporating contingency plans for in-season program adjustments (e.g. Fish inventories above or below program goals, marking strategies, release numbers and locations, etc.).**

Issue LF-FC23a: Information is limited regarding the proportion of hatchery and natural-origin fall Chinook spawning naturally. Proportions of hatchery versus natural origin fall Chinook migrating upstream are monitored at Lower Granite Dam; however, spawning ground surveys in natural production areas have been difficult.*.*

Issue LF-FC23b: Little is known regarding differential reproductive success of natural-origin versus hatchery-origin recruits in natural spawning and rearing areas.

Issue LF-FC23c: Juvenile hatchery-origin fall Chinook may pose competition and predation risks to natural-origin fall Chinook, but little or no information is presently available to evaluate this.

Recommendation LF-FC23: Increase monitoring of adult hatchery and natural interactions on the spawning grounds and juvenile interactions in the rearing habitat. Consider a structured evaluation of differential reproductive success of hatchery and natural origin recruits spawning in the Snake River above Lower Granite Dam. **Response: WDFW has been investigating methods to measure relative reproductive**

success (RRS) above LGR for the last four years in response to a request for proposals (RFP) by BPA. The managers agree that understanding the RRS of hatchery and natural fish is a highly desirable RME goal. The managers are committed to pursuing a RRS study by altering the methods recently used but unsuccessful. It is important to understand that there exist significant sampling challenges in the upper main stem Snake River to recover confirmed hatchery and wild Chinook from the spawning grounds. These limitations may impose significant variation in study results, complicating the analysis and precision of the study data and limit its usefulness to managers trying to assess the risk of hatchery fish spawning in the wild. A technical conference/symposium was convened by BPA to address RPAs 64 and 65 from the FCRPS BiOp and to attempt to identify research actions that would answer RRS questions for Snake River fall Chinook that arose in the recent basin wide RM&E review undertaken by BPA and CBFWA. The results of that effort are now available (Peven 2010), but no decision has been made on which research approach into RRS would be most likely to succeed.

Issue LF-FC24: The evaluation and dissemination of sampling data for LSRCP programs is inadequate, inhibiting the ability for managers to make decisions based on current information. *There exists a backlog of annual reports. The LSRCP office has increased staff and has begun reducing the backlog. However, reporting is not yet timely enough.*

Recommendation LF-FC24: Continue work through the backlog of annual reports. Complete annual reports in a timely fashion (e.g. within one year of the previous year's work). **Response: Bringing annual reports up to date is a high priority for LSRCP. A schedule has been put in place which will assure that annual reports are completed before December 31 of the year after the data was collected.**

Issue LF-FC25: The evaluation and dissemination of sampling data are inadequate, inhibiting the ability for managers to make decisions based on current information. *Data reporting does not meet the specified standards of the Pacific Salmon Commission.*[1] *Those standards require preliminary reporting of data for the current calendar year no later than January 31 of the following year" reference.*

Recommendation LF-FC25: The Service should work with LSRCP co-managers to develop a data management plan that incorporates tagging goals and objectives, data management, and reporting requirements of coded-wire tag data at both the program and regional levels. The Service should incorporate reporting requirements of coded-wire tag data into the cooperative agreement between the LSRCP office and co-managers (WDFW and tribes). **Response: This issue is being addressed**

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[1] Pacific Salmon Commission's Data Standard Work Group. December 2005. Specifications and Definitions for the Exchange of Coded-Wire Tag Data for the North American Pacific Coast. PSC Format Version 4. Regional Mark Processing Center, Portland, OR. www.rmpc.org.

Education and Outreach

Issue LF26: The Lyons Ferry Hatchery displays and handouts are outdated. *The existing Lyons Ferry Hatchery displays were installed in the 1980's-early 90's when the facility was constructed.*

Recommendation LF26: Update the displays and handouts so that they accurately reflect the present state of salmon and steelhead and the associated programs at Lyons Ferry Hatchery. **Response: This is currently the maintenance list and has been submitted to LSRCP.**

Issue LF27: The information available to the public in regards to the Lyons Ferry Hatchery and its associated programs is inadequate. *The LSRCP web site lacks information for public consumption. Additionally, WDFW does not currently manage a web page for Lyons Ferry Hatchery.*

Recommendation LF27: Information in regards to the harvest and conservation benefits the programs provide should be made available by the Service and WDFW in a format for public consumption (e.g. simple brochures, interactive web pages, etc.). For example, fishery benefits provided by the program for each hatchery could be updated annually on the LSRCP web site and provided in a brochure at the hatchery. This information should include contribution of hatchery-origin Snake River fall Chinook to marine fisheries in Canada and Alaska. If the LSRCP web site is the primary source of information for the program, any WDFW page for *Lyons Ferry Hatchery* should be linked to this site. **Response: Annual reports are available on both the LSRCP and WDFW websites. This information will be available on the agency websites in upcoming annual reports. In addition, WDFW is participating in the development of a Salmon Conservation Reporting Engine, a web-based database, as an alternative way to get the data to the public. The LSRCP is currently developing a web-based data engine to provide the information to the public as well.**

1.10.1) "Performance Indicators" addressing benefits.

WDFW will use a standard set of indicators to determine whether the population has declined, remained stable, or has been recovered to sustainable levels, and whether the program has provided the expected benefits (see **1.10.2** below). The ability to estimate hatchery and natural proportions will be determined by implementing plans, budgets, and assessment priorities.

1.10.2) "Performance Indicators" addressing risks.

The suite of performance measures developed by the CSMEP represents a crosswalk mechanism that is needed to quantitatively monitor and evaluate the standards and indicators listed in **Error! Reference source not found.** 3. The CSMEP measures have been adopted by the AHSWG (Galbreath et. al. 2008). The adoption of this regionally applied means of assessment will facilitate coordinated analysis of findings from basin-wide M&E efforts and will provide the scientifically based foundation to address the management questions and critical uncertainties associated with supplementation and

ESA listed stock status/recovery.

Listed below are the suite of Performance Measures (modified from the management objectives listed in Galbreath et al. (2008)), and the assumptions that need to be tested for each standard.

Table 3. Standardized performance measures and definitions for status and trends and hatchery effectiveness monitoring and the associated performance indicator that it addresses. (Taken from Galbreath et al. 2008).

Performance Measure		Definition	Related Indicator
Abundance	Adult Escapement to Tributary	Number of adults (including jacks) that have escaped to a certain point (i.e. - mouth of stream). Population based measure. Calculated with mark recapture methods from weir data adjusted for redds located downstream of weirs and in tributaries, and maximum net upstream approach for DIDSON and underwater video monitoring. Provides total escapement and wild only escapement. [Assumes tributary harvest is accounted for]. Uses TRT population definition where available	2.3.2, 3.1.2, 3.2.1, 3.2.2, 3.2.4, 3.6.1, 3.7.1, 3.7.4, 5.3.1
	Fish per Redd	Number of fish divided by the total number of redds. Applied by: The population estimate at a weir site, minus broodstock and mortalities and harvest, divided by the total number of redds located upstream of the weir.	3.2.1, 3.2.3, 3.2.4, 3.6.3, 3.7.3
	Female Spawner per Redd	Number of female spawners divided by the total number of redds above weir. Applied in 2 ways: 1) The population estimate at a weir site multiplied by the weir derived proportion of females, minus the number of female prespawn mortalities, divided by the total number of redds located upstream of the weir, and 2) DIDSON application calculated as in 1 above but with proportion females from carcass recoveries. Correct for mis-sexed fish at weir for 1 above.	3.2.1, 3.2.3, 3.2.4, 3.6.3, 3.7.3
	Index of Spawner Abundance - redd counts	Counts of redds in spawning areas in index area(s) (trend), extensive areas, and supplemental areas. Reported as redds and/or redds/km.	3.2.3, 3.2.4, 3.6.3, 3.7.3, 4.6.1
	Spawner Abundance	In-river: Estimated number of total spawners on the spawning ground. Calculated as the number of fish that return to an adult monitoring site, minus broodstock removals and weir mortalities and harvest if any, subtracts the number of female pre-spawning mortalities and expanded for redds located below weirs. Calculated in two ways: 1) total spawner abundance, and 2) wild spawner abundance which multiplies by the proportion of natural origin (wild) fish. Calculations include jack salmon. In-hatchery: Total number of fish actually used in hatchery production. Partitioned by gender and origin.	3.2.1, 3.2.3, 3.2.4, 3.6.3, 3.7.3
	Hatchery Fraction	Percent of fish on the spawning ground that originated from a hatchery. Applied in two ways: 1) Number of hatchery carcasses divided by the total number of known origin carcasses sampled. Uses carcasses above and below weirs, 2) Uses weir data to determine number of fish released above weir and calculate as in 1 above, and 3) Use 2 above and carcasses above and below weir.	2.2.1, 3.1.1, 3.4.1, 3.4.2, 3.4.3, 3.7.2, 3.7.4
	Ocean/Mainstem Harvest	Number of fish caught in ocean and mainstem (tribal, sport, or commercial) by hatchery and natural origin.	1.1.1, 1.1.2, 2.3.1, 2.4.2, 2.6.2, 3.3.2, 3.3.3
	Harvest Abundance in Tributary	Number of fish caught in ocean and mainstem (tribal, sport, or commercial) by hatchery and natural origin.	1.1.1, 1.1.2, 2.3.1, 2.4.2, 2.6.2, 3.3.2, 3.3.3
	Index of Juvenile Abundance (Density)	Parr abundance estimates using underwater survey methodology are made at pre-established transects. Densities (number per 100 m2) are recorded using protocol described in Thurow (1994). Hanken & Reeves estimator.	3.2.1, 3.5.1, 3.5.2
	Juvenile Emigrant Abundance	Gauss software is (Aptech Systems, Maple Valley, Washington) issued to estimate emigration estimates. Estimates are given for parr, pre-smolts, smolts and the entire migration year. Calculations are completed using a Modified Bailey Method and bootstrapping for 95% CIs. Gauss program developed by the University of Idaho (Steinhorst 2000).	3.2.1, 3.6.1, 3.7.4

Performance Measure		Definition	Related Indicator
	Smolts	Smolt estimates, which result from juvenile emigrant trapping and PIT tagging, are derived by estimating the proportion of the total juvenile abundance estimate at the tributary comprised of each juvenile life stage (parr, pre-smolt, smolt) that survive to first mainstem dam. It is calculated by multiplying the life stage specific abundance estimate (with standard error) by the life stage specific survival estimate to first mainstem dam (with standard error). The standard error around the smolt equivalent estimate is calculated using the following formula; where X = life stage specific juvenile abundance estimate and Y = life stage specific juvenile survival estimate: $Var(X \cdot Y) = E(X)^2 \cdot Var(Y) + E(Y)^2 \cdot Var(X) + Var(X) \cdot Var(Y)$	3.2.1, 3.6.1, 3.7.4
	Run Prediction	This will not be in the raw or summarized performance database.	2.3.1,
Survival – Productivity	Smolt-to-Adult Return Rate	The number of adult returns from a given brood year returning to a point (stream mouth, weir) divided by the number of smolts that left this point 1-5 years prior. Calculated for wild and hatchery origin conventional and captive brood fish separately. Adult data applied in two ways: 1) SAR estimate to stream using population estimate to stream, 2) adult PIT tag SAR estimate to escapement monitoring site (weirs, LGR), and 3) SAR estimate with harvest. Accounts for all harvest below stream. *Smolt-to-adult return rates* are generated for four performance periods; tributary to tributary, tributary to first mainstem dam, first mainstem dam to first mainstem dam, and first mainstem dam to tributary. *First mainstem dam to first mainstem dam* SAR estimates are calculated by dividing the number of PIT tagged adults returning to first mainstem dam by the estimated number of PIT tagged juveniles at first mainstem dam. Variances around the point estimates are calculated as described above. *Tributary to tributary* SAR estimates for natural and hatchery origin fish are calculated using PIT tag technology as well as direct counts of fish returning to the drainage. PIT tag SAR estimates are calculated by dividing the number of PIT tag adults returning to the tributary (by life stage and origin type) by the number of PIT tagged juvenile fish migrating from the tributary (by life stage and origin type). Overall PIT tag SAR estimates for natural fish are then calculated by averaging the individual life stage specific SARs. Direct counts are calculated by dividing the estimated number of natural and hatchery-origin adults returning to the tributary (by length break-out for natural fish) by the estimated number of natural-origin fish and the known number of hatchery-origin fish leaving the tributary. *Tributary to first mainstem dam* SAR estimates are calculated by dividing the number of PIT tagged adults returning to first mainstem dam by the number of PIT tagged juveniles tagged in the tributary. There is no associated variance around this estimate. The adult detection probabilities at first mainstem dam are near 100 percent. *First mainstem dam to tributary* SAR estimates are calculated by dividing the number of PIT tagged adults returning to the tributary by the estimated number of PIT tagged juveniles at first mainstem dam. The estimated number of PIT tagged juveniles at first mainstem dam is calculated by multiplying life stage specific survival estimates (with standard errors) by the number of juveniles PIT tagged in the tributary. The variance for the estimated number of PIT tagged juveniles at first mainstem dam is calculated as follows, where X = the number of PIT tagged fish in the tributary and Y = the variance of the life stage specific survival estimate: $Var(X \cdot Y) = X^2 \cdot Var(Y)$ The variance around the SAR estimate is calculated as follows, where X = the number of adult PIT tagged fish returning to the tributary and Y = the estimated number of juvenile PIT tagged fish at first mainstem dam: $Var\left(\frac{X}{Y}\right) = \left(\frac{EX}{EY}\right)^2 \cdot \left(\frac{Var(Y)}{(EY)^2}\right)$	3.2.1, 3.2.2, 3.7.4

	Performance Measure	Definition	Related Indicator
	Progeny-per- Parent Ratio	Adult to adult calculated for naturally spawning fish and hatchery fish separately as the brood year ratio of return adult to parent spawner abundance using data above weir. Estimates of this ratio for fish spawning and produced by the natural environment must be adjusted to account for the confounding effect of spawner density on this metric. Two variants calculated: 1) escapement, and 2) spawners.	3.2.1, 3.2.2, 3.7.4
	Recruit/spawner (R/S)(Smolt Equivalents per Redd or female)	Juvenile production to some life stage divided by adult spawner abundance adjusted for the confounding effects of spawner density. Derive adult escapement above juvenile trap multiplied by the pre-spawning mortality estimate. Adjusted for redds above juvenile Trap. *Recruit per spawner* estimates, or *juvenile abundance (can be various life stages or locations) per redd/female*, is used to index population productivity, since it represents the quantity of juvenile fish resulting from an average redd (total smolts divided by total redds) or female. Several forms of juvenile life stages are applicable. We utilize two measures: 1) juvenile abundance (parr, pre-smolt, smolt, total abundance) at the tributary mouth, and 2) smolt abundance at first mainstem dam .	3.2.1, 3.2.2, 3.7.4
	Pre-spawn Mortality	Percent of female adults that die after reaching the spawning grounds but before spawning. Calculated as the proportion of "25% spawned" females among the total number of female carcasses sampled. ("25% spawned" = a female that contains 75% of her egg compliment].	3.2.3, 4.5.1
	Juvenile Survival to first mainstem dam	Life stage survival (parr, pre-smolt, smolt, sub-yearling) calculated by CJS Estimate (SURPH) produced by PITPRO 4.8+ (recapture file included), CI estimated as 1.96*SE. Apply survival by life stage to first mainstem dam to estimate of abundance by life stage at the tributary and the sum of those is total smolt abundance surviving to first mainstem dam . Juvenile survival to first mainstem dam = total estimated smolts surviving to first mainstem dam divided by the total estimated juveniles leaving tributary.	3.2.2, 3.6.2, 3.7.5, 3.9.3,
	Juvenile Survival to all Mainstem Dams	*Juvenile survival to first mainstem dam and subsequent Mainstem Dam(s)*, which is estimated using PIT tag technology. Survival by life stage to and through the hydrosystem is possible if enough PIT tags are available from the stream. Using tags from all life stages combined we will calculate (SURPH) the survival to all mainstem dams.	3.2.2, 3.6.2, 3.7.5, 3.9.3,
	Post-release Survival	Post-release survival of natural and hatchery-origin fish are calculated as described above in the performance measure "Survival to first mainstem dam and Mainstem Dams". No additional points of detection (i.e. screw traps) are used to calculate survival estimates.	3.2.2, 3.6.2, 3.7.5, 3.9.3,
Distribution	Adult Spawner Spatial Distribution	Extensive area tributary spawner distribution. Target GPS red locations or reach specific summaries, with information from carcass recoveries to identify hatchery-origin vs. natural-origin spawners across spawning areas within populations.	3.2.3, 3.2.4, 3.6.3, 3.7.3, 4.3.3, 4.6.1
	Stray Rate (percentage)	Estimate of the number and percent of hatchery origin fish on the spawning grounds, as the percent within MPG, and percent out of ESU. Calculated from 1) total known origin carcasses, and 2) uses fish released above weir. Data adjusted for unmarked carcasses above and below weir.	3.4.1, 3.4.2, 3.4.3
	Juvenile Rearing Distribution	Chinook rearing distribution observations are recorded using multiple divers who follow protocol described in Thurow (1994).	
	Disease Frequency	Natural fish mortalities are provided to certified fish health lab for routine disease testing protocols. Hatcheries routinely samples fish for disease and will defer to then for sampling numbers and periodicity	3.10, 4.4.3
Genetic	Genetic Diversity	Indices of genetic diversity – measured within a tributary) heterozygosity – allozymes, microsatellites), or among tributaries across population aggregates (e.g., FST).	3.2.5, 3.8.3, 3.9.1
	Reproductive Success (Nb/N)	Derived measure: determining hatchery: wild proportions, effective population size is modeled.	3.7.2
	Relative Reproductive Success (Parentage)	Derived measure: the relative production of offspring by a particular genotype. Parentage analyses using multilocus genotypes are used to assess reproductive success, mating patterns, kinship, and fitness in natural populations and are gaining widespread use of with the development of highly polymorphic molecular markers.	3.2.1, 3.2.2, 3.2.4, 3.6.1, 3.7.1, 3.7.2 3.7.4, 5.3.1
	Effective Population Size (Ne)	Derived measure: the number of breeding individuals in an idealized population that would show the same amount of dispersion of allele frequencies under random genetic drift or the same amount of inbreeding as the population under consideration.	3.2.5

Performance Measure		Definition	Related Indicator
Life History	Age Structure	Proportion of escapement composed of adult individuals of different brood years. Calculated for wild and hatchery origin conventional and captive brood adult returns. Accessed via scale method, dorsal fin ray ageing, or mark recoveries. Juvenile Age is determined by brood year (year when eggs are placed in the gravel) Then Age is determined by life stage of that year. Methods to age Chinook captured in screw trap are by dates; fry – prior to July 1; parr – July 1-August 31; pre-smolt – September 1 – December 31; smolt – January 1 – June 30; yearlings – July 1 – with no migration until following spring. The age class structure of juveniles is determined using length frequency breakouts for natural-origin fish. Scales have been collected from natural-origin juveniles, however, analysis of the scales have never been completed. The age of hatchery-origin fish is determined through a VIE marking program which identifies fish by brood year. For steelhead we attempt to use length frequency but typically age of juvenile steelhead is not calculated.	3.8.1, 3.8.2, 3.9.2
	Age–at–Return	Age distribution of spawners on spawning ground. Calculated for wild and hatchery conventional and captive brood adult returns. Accessed via scale method, dorsal fin ray ageing, or mark recoveries.	3.8.1, 3.8.2, 3.9.2
	Age–at-Emigration	Juvenile Age is determined by brood year (year when eggs are placed in the gravel) Then Age is determined by life stage of that year. Methods to age Chinook captured in screw trap are by dates; fry – prior to July 1; parr – July 1-August 31; pre-smolt – September 1 – December 31; smolt – January 1 – June 30; yearlings – July 1 – with no migration until following spring. The age class structure of juveniles is determined using length frequency breakouts for natural-origin fish. Scales have been collected from natural-origin juveniles, however, analysis of the scales have never been completed. The age of hatchery-origin fish is determined through a VIE marking program which identifies fish by brood year. For steelhead we attempt to use length frequency but typically age of juvenile steelhead is not calculated.	3.8.1, 3.8.2, 3.9.2
	Size-at-Return	Size distribution of spawners using fork length and mid-eye hypural length. Raw database measure only.	3.8.1, 3.9.2
	Size-at-Emigration	Fork length (mm) and weight (g) are representatively collected weekly from natural juveniles captured in emigration traps. Mean fork length and variance for all samples within a life stage-specific emigration period are generated (mean length by week then averaged by life stage). For entire juvenile abundance leaving a weighted mean (by life stage) is calculated. Size-at-emigration for hatchery production is generated from pre release sampling of juveniles at the hatchery.	3.8.2, 3.9.2
	Condition of Juveniles at Emigration	Condition factor by life stage of juveniles is generated using the formula: $K = (w/l^3)(10^4)$ where K is the condition factor, w is the weight in grams (g), and l is the length in millimeters (Everhart and Youngs 1992).	3.8.2, 3.9.2
	Percent Females (adults)	The percentage of females in the spawning population. Calculated using 1) weir data, 2) total known origin carcass recoveries, and 3) weir data and unmarked carcasses above and below weir. Calculated for wild, hatchery, and total fish.	3.8.1, 3.9.2
	Adult Run-timing	Arrival timing of adults at adult monitoring sites (weir, DIDSON, video) calculated as range, 10%, median, 90% percentiles. Calculated for wild and hatchery origin fish separately, and total.	3.2.4, 3.6.4, 3.8.1, 3.9.2
	Spawn-timing	This will be a raw database measure only.	3.2.4, 3.6.4, 3.8.1, 3.9.2
	Juvenile Emigration Timing	Juvenile emigration timing is characterized by individual life stages at the rotary screw trap and Lower Granite Dam. Emigration timing at the rotary screw trap is expressed as the percent of total abundance over time while the median, 0%, 10, 50%, 90% and 100% detection dates are calculated for fish at first mainstem dam .	3.2.4, 3.6.4, 3.8.2, 3.9.2, 3.9.3, 4.8.1
	Mainstem Arrival Timing (Lower Granite)	Unique detections of juvenile PIT-tagged fish at first mainstem dam are used to estimate migration timing for natural and hatchery origin tag groups by life stage. The actual Median, 0, 10%, 50%, 90% and 100% detection dates are reported for each tag group. Weighted detection dates are also calculated by multiplying unique PIT tag detection by a life stage specific correction factor (number fish PIT tagged by life stage divided by tributary abundance estimate by life stage). Daily products are added and rounded to the nearest integer to determine weighted median, 0%, 50%, 90% and 100% detection dates.	3.2.4, 3.6.4, 3.8.2, 3.9.2, 3.9.3, 4.8.1
Habitat	Physical Habitat	TBD	
	Stream Network	TBD	
	Passage Barriers/Diversions	TBD	
	Instream Flow	USGS gauges and also staff gauges	

Performance Measure		Definition	Related Indicator
	Water Temperature	Various, mainly Hobo and other temp loggers at screw trap sights and spread out throughout the streams	
	Chemical Water Quality	TBD	
	Macroinvertebrate Assemblage	TBD	
	Fish and Amphibian Assemblage	Observations through rotary screw trap catch and while conducting snorkel surveys.	2.4.3, 3.3.3, 3.4.1
In-Hatchery Measures	Hatchery Production Abundance	The number of hatchery juveniles of one cohort released into the receiving stream per year. Derived from census count minus prerelease mortalities or from sample fish- per-pound calculations minus mortalities. Method dependent upon marking program (census obtained when 100% are marked).	2.5.2, 2.5.3, 2.6.1, 4.4.2
	In-hatchery Life Stage Survival	In-hatchery survival is calculated during early life history stages of hatchery-origin juvenile Chinook. Enumeration of individual female's live and dead eggs occurs when the eggs are picked. These numbers create the inventory with subsequent mortality subtracted. This inventory can be changed to the physical count of fish obtained during CWT or VIE tagging. These physical fish counts are the most accurate inventory method available. The inventory is checked throughout the year using 'fish-per-pound' counts. Estimated survival of various in-hatchery juvenile stages (green egg to eyed egg, eyed egg to ponded fry, fry to parr, parr to smolt and overall green egg to release) Derived from census count minus prerelease mortalities or from sample fish- per-pound calculations minus mortalities. Life stage at release varies (smolt, pre-smolt, parr, etc.).	
	Size-at-Release	Mean fork length measured in millimeters and mean weight measured in grams of a hatchery release group. Measured during prerelease sampling. Sample size determined by individual facility and M&E staff. Life stage at release varies (smolt, pre-smolt, parr, etc.).	2.5.1, 2.5.3
	Juvenile Condition Factor	Condition Factor (K) relating length to weight expressed as a ratio. Condition factor by life stage of juveniles is generated using the formula: $K = (w/l^3)(10^4)$ where K is the condition factor, w is the weight in grams (g), and l is the length in millimeters (Everhart and Youngs 1992).	2.5.3,3.8.2, 3.9.2
	Fecundity by Age	The reproductive potential of an individual female. Estimated as the number of eggs in the ovaries of the individual female. Measured as the number of eggs per female calculated by weight or enumerated by egg counter.	3.8.1, 3.8.2, 3.9.2
	Spawn Timing	Spawn date of broodstock spawners by age, sex and origin, Also reported as cumulative timing and median dates.	3.2.4, 3.6.4, 3.8.1, 3.9.2
	Hatchery Broodstock Fraction	Percent of hatchery broodstock actually used to spawn the next generation of hatchery F1s. Does not include pre-spawning mortality.	2.2.1
	Hatchery Broodstock Pre-spawning Mortality	Percent of adults that die while retained in the hatchery, but before spawning.	4.7.2
	Female Spawner ELISA Values	Screening procedure for diagnosis and detection of BKD in adult female ovarian fluids. The enzyme linked immunosorbent assay (ELISA) detects antigen of *R. salmoninarum.*	3.10, 4.4.3
	In-Hatchery Juvenile Disease Monitoring	Screening procedure for bacterial, viral and other diseases common to juvenile salmonids. Gill/skin/ kidney /spleen/skin/blood culture smears conducted monthly on 10 mortalities per stock	3.10, 4.4.3
	Length of Broodstock Spawner	Mean fork length by age measured in millimeters of male and female broodstock spawners. Measured at spawning and/or at weir collection. Is used in conjunction with scale reading for aging.	3.9.2
	Prerelease Mark Retention	Percentage of a hatchery group that have retained a mark up until release from the hatchery. Estimated from a sample of fish visually calculated as either "present" or "absent"	3.1.1, 3.1.2
	Prerelease Tag Retention	Percentage of a hatchery group that have retained a tag up until release from the hatchery - estimated from a sample of fish passed as either "present" or "absent". ("Marks" refer to adipose fin clips or VIE batch marks).	3.1.1, 3.1.2
	Hatchery Release Timing	Date and time of volitional or forced departure from the hatchery. Normally determined through PIT tag detections at facility exit (not all programs monitor volitional releases).	2.5.4, 4.8.1
	Chemical Water Quality	Hatchery operational measures included: dissolved oxygen (DO) - measured with DO meters, continuously at the hatchery, and manually 3 times daily at acclimation facilities; ammonia (NH_3) nitrite (NO_2), -measured weekly only at reuse facilities	4.2.1

Performance Measure		Definition	Related Indicator
	Water Temperature	Hatchery operational measure (Celsius) - measured continuously at the hatchery with thermographs and 3 times daily at acclimation facilities with hand-held devices.	

The performance measures listed and described above should allow adequate monitoring of populations during supplementation; however, they do not necessarily describe the potential benefits, or lack of negative effects of the program that might prevent the natural population from moving toward viability and eventual delisting under the ESA. Snake River fall Chinook monitoring presents some significant sampling challenges in answering these questions. The ICTRT provided an assessment of the viability of Columbia basin ESUs (ICTRT 2007) and in that document stated:

"The viability of an ESU cannot be evaluated without first understanding the viability of these component building blocks. Thus our primary goal under this hierarchy has been to describe ESU viability through assessment of <u>population</u> extinction risks which consider abundance, productivity, spatial structure and diversity."

Three populations of Snake River fall Chinook salmon were identified by the ICTRT. Two of the populations (Marsing Reach and Salmon Falls) were extirpated with the construction the Hells Canyon Dam Complex. Access to those areas remains blocked. The extant population (Lower mainstem) consists of two primary spawning aggregates (mainstem Snake River and Clearwater River) and six minor spawning aggregates (Tucannon River, Grande Ronde River, Imnaha River, Salmon River, South Fork Clearwater River, and Selway River). The loss of two populations and continued loss of access to their original habitat significantly reduces opportunities to recover the ESU. While this is not a unique circumstance within the Columbia basin it poses substantial challenges to recovering the population and meeting mitigation goals that are in place and important to the managers.

Three hatchery programs artificially propagate endemic Snake River fall Chinook. Two (Lyons Ferry Hatchery and Idaho Power Company) of the programs are mitigation for lost production. The third (Nez Perce Tribal Hatchery) is an integrated program aimed to increase harvest and natural origin abundance via supplementation. Fish are released at two different life stages (sub-yearling and yearling smolts). Releases occur at 10 release locations. The three programs are highly coordinated in their operations, including broodstock collection at Lower Granite dam and fish transfers between facilities. Several out of basin hatchery facilities are utilized (Irrigon and Umatilla) in addition to the in basin facilities and acclimation sites. Marking of hatchery-origin fish is guided by a Snake River Basin Fall Chinook Salmon Production Program Marking Justification white paper. Mark types and quantities have been adopted under the 2008 - 2017 *US vs. Oregon* Management Agreement. At full production levels, 76% of the hatchery produced fish are marked in some manner, 47% are marked with an adipose fin clip. Monitoring efforts funded by the LSRCP or directly through the NPCC's Fish and Wildlife Program provide the data to monitor and evaluation hatchery performance and assess risks and benefits of that program to the natural population.

Adult abundance is estimated via window counts at Ice Harbor, Little Goose, and Lower

Granite Dams, trapping at Lower Granite Dam, redd counts in all spawning aggregate areas, and direct counts at fish ladders. Window counts are not a census. Counts are typically for 16 hours sampling periods. It is assumed that very little fish passage occurs during night hours. Counts are reported without any associate accuracy and precision; they are commonly perceived and utilized as census. Adult trapping at Lower Granite Dam supports collection broodstock (both hatchery and natural origin) and estimates of age and origin via run-reconstruction efforts. Run-reconstruction estimates were substantially modified in 2003 to increase the accuracy and precision of estimated returns of both hatchery and natural fish. A static stratified trapping rate is established pre-season annually, typically in the range of 8-20%. Some in-season adjustments may occur to accommodate fish handling limitations. It should be noted that Lower Granite Dam estimates do not encompass the entire mainstem Snake River population of fall Chinook salmon. Multiple pass extensive area aerial redd count surveys were initiated in 1988. Underwater camera observation of deepwater redds supplements aerial counts in the mainstem Snake spawning aggregate. Carcass recovery is limited due to the large river size and only occurs in the Clearwater River portion of the population. Redd counts characterize spatial distribution, however differences or similarities between hatchery and natural origin fish (NOF) spawning distribution is not possible from these counts.

Determination of wild and hatchery origin of unmarked fall Chinook relies on scale analysis. Using scale analysis and run reconstruction and estimates of the proportion of wild and hatchery spawners is available for the entire ESU through adult sampling at Lower Granite Dam and from carcass recoveries in the Tucannon River. Age-structure of spawners estimated from scale samples and known marks of hatchery releases are obtained from sub-samples at Lower Granite Dam and from carcass recoveries in the Tucannon River for the entire ESU. Sex ratio of spawners estimated the same as for age-structure data.

Harvest of Snake River fall Chinook salmon occurs in ocean, mainstem, and in limited tributary fisheries. Ocean and mainstem Columbia River fisheries have been mostly non-selective, although efforts are underway to move to selective sport fisheries in mainstem and tributary areas. As fisheries expand, the management agencies coordinate appropriate sampling programs to document hatchery fish harvest and estimate natural population impacts.

Abundance and distribution information of juveniles is limited. Abundance information of wild juveniles is not available for any spawning aggregate. Collection of juveniles does occur at three of the four Snake River dams and fish guidance efficiencies are estimated. However, Snake River fall Chinook exhibit diverse juvenile life history patterns with prolonged emigration (May through April) and smoltification as both sub-yearlings and yearlings. This diversity combined with inability to run hydro-facility fish collection systems during the winter precludes estimation of juvenile abundance and absolute juvenile survival. PIT tags implanted in hatchery release groups can provide survival information for general production sub-yearling and yearling releases. Survival information for PIT tagged wild is limited to the Clearwater River and the upper and lower Snake River spawning aggregates. However, estimates of survival for wild, surrogate hatchery production, and Nez Perce Tribal Hatchery sub-yearling production must be characterized as combine probability of emigration and survival. Distribution information is available for the Clearwater River and for the upper and lower Snake River through beach seining.

Following is a summation of actions or information for key data gaps that will result from implementation of this program that the managers believe will benefit, or have not detrimental effect on Snake River fall Chinook:

Abundance is the number of fish produced by natural processes that have spent their entire life cycle in nature (i.e., natural-origin fish). This is often referred to as gravel-to-gravel survival or fish originating from naturally spawning parents that hatch in a stream's gravel and that survive to spawn naturally themselves years later. The ICTRT concluded that in general in the Columbia: "*A majority of populations had inadequate hatchery fraction information. We used MPG aggregate hatchery fraction for most populations. Abundance and productivity assessments would improve with more detailed population level hatchery fraction data. A majority of populations had inadequate age structure information. Typically, average MPG aggregate age structure from a few years of data was used in most cases for the population level.*" The effect of a hatchery program on salmon and abundance should be determined.

<u>*Run Reconstruction:*</u> Snake River fall Chinook have been identified in *U.S. v Oregon* agreements as an indicator of upriver bright fall Chinook (URB) population health, and are an important factor used by *U.S. v Oregon* parties in establishing Columbia River fisheries and allocating harvest to various user groups. Key to this process is an accurate annual description of the makeup of the fall Chinook population passing above LGR Dam to spawning areas ("Run Reconstruction"). Further, as efforts expand to recover fall Chinook in the Snake River, NOAA Fisheries must track population abundance and productivity toward a future recovery of the population when protection under the ESA would no longer be necessary (de-listing).

To accomplish these multiple tasks, a sample of the fall Chinook population at LGR Dam is collected annually, and transferred to LFH. During the spawning process, salmon are identified by marks and tags, scale patterns and genetic markers. Natural origin fish are infused into the hatchery population, and data collected during spawning is used to "reconstruct" the structure of the population at LGR Dam for managers. Reconstruction data includes estimating population age structure from tags and scale pattern analysis, estimating abundance and trend data for the natural population, and estimating returns and SARs for both hatchery and wild fish. Run reconstruction provides substantial information to the agencies, which is used to make informed management decisions for the population.

Further, the proportion of natural-origin fish (NOF) removed from the population (spawning aggregate) to provide hatchery broodstock is clearly defined during a process whereby sampling at Lower Granite Dam for run reconstruction also provides broodstock for both LFH and NPTH. Hatchery accountability also reports the number of NOF killed or injured by hatchery facilities that would otherwise have provided either natural or hatchery production to the Snake.

> Finally, increases in NOF attributable to hatchery supplementation can be accounted as part of the run reconstruction/hatchery operation process. Juveniles planted into streams and adult returns from these plants, serve to seed freshwater spawning and rearing areas. Although only the progeny of naturally spawning fish (natural-origin and hatchery-origin) count in determining abundance for viability purposes, the managers maintain that recent increases in natural fish abundance are the direct result of supplementation actions of the programs.

Productivity is the survival rate of natural-origin fish as related to parent run size. It is a measure that directly relates to the potential ability for a population or spawning aggregate to be self sustaining. For example, the productivity measure used by the ICTRT is expressed in terms of recruits per spawner or the degree to which natural spawning adults in one generation are replaced by natural-origin natural spawning adults in the next generation. This measure of life-cycle productivity is affected by mortality and survival at all life stages taken together. In general, if productivity is limited by the number of natural spawners (e.g., fish have difficulty finding mates or habitat is being re-colonized), then naturally spawning hatchery fish potentially can increase natural productivity. The effect of a hatchery program on salmon and steelhead productivity (Araki et al. 2007 and 2008) should be determined.

> <u>*Relative reproductive success of hatchery and wild fall Chinook:*</u> Fall Chinook salmon passing LGR Dam and accessing upper Snake River spawning grounds have greatly increased in abundance since 1995, including the numbers of natural origin fish. During this period, relative proportions of LFH reared fish in escapements have also increased; from approximately 0% in 1995 to as high as 64% in 1998. It is unknown what contribution hatchery-origin fish have provided to the increase in natural origin spawner abundance. Fall Chinook from LFH continue to be used in supplementation and rebuilding efforts, such as releases from the Nez Perce Tribe acclimation facilities (FCAP), and throughout the remaining fall Chinook habitat in the Snake River Basin.
>
> Productivity of Snake River Basin fall Chinook is currently estimated from trends in redd counts for the mainstem and several sub-basins. Redds often are under-counted because of difficulties in detecting redds due to water clarity, depth of water at redd location and weather conditions, however counts have increased and continue to increase in many historical spawning areas and in newly utilized (or possibly discovered) sites. Unfortunately, natural- and hatchery-origin fish productivity cannot be estimated separately, thus the contribution of naturally spawning hatchery fish to increased population abundance is unknown. Determining the reproductive success of naturally spawning hatchery and natural fish has been identified as a priority (RPA 64, 65) in the most recent FCRPS BiOp (NMFS 2008).
>
> Again the ICTRT identified the serious need for productivity in their viability analysis (ICTRT 2007) stating: *"…adequate estimates of the relative levels of hatchery fish contributing to natural spawning for a particular population would allow for more representative estimates of current and potential natural productivity levels*." The managers agreed with the ICTRT on this issue, understanding that if the proportion of LFH reared natural spawners continues to increase and their reproductive success is high, we expect the genetic profile of natural origin fall Chinook in future years will become indistinguishable from LFH brood stock. It was theorized that a time-series of brood

year-based genetic data for Snake River fall Chinook would permit effective monitoring of the genetic change in the wild population as supplementation efforts continue. However, recent results by Marshall and Small (2011) indicate that the current genetic differences between hatchery and natural fish are too small to allow for an accurate or precise measurement of relative reproductive success using genetic change over time as the indicator. In response to the FCRPS RPA's 64 and 65 an Ad Hoc group of researchers was assembled by NOAA Fisheries and BPA to examine what other possibilities exist for measuring RRS in the supplemented Snake River fall Chinook population. A guidance document has been completed (Peven et al. 2010) which lays out research possibilities, but no further action has been taken. The managers are committed to implementing such a study if the theoretical approach can be agreed upon and funds made available. If a reproductive success study can accurately determine LFH fall Chinook relative reproductive success, the results have the potential to change management in the Snake River basin, resulting in a biological benefit to the Snake River Fall Chinook ESU.

Competition for food or habitat between NOF and planted HOF: Connor et al. (2002, 2005) investigated the growth and behavior of natural origin fall Chinook in the Snake basin. With the advent of supplementation their investigations expanded to look for interactions or effects of the program on natural fish (Connor et al. 2010). Their work continues and represents part of an integral piece of RM&E within the Snake.

Refer to Addendum 1 for further discussion.

HOF nutrient contribution to freshwater rearing areas
The potential value of marine derived nutrients to the ecological health of watersheds and population health of salmon has been broadly well recognized (References?). The hatchery program has increased the flow of those nutrients into the Snake through the return of hatchery jack and adult fall Chinook. Many tons of carcasses fuel the ecosystem annually, which has steadily increased in the system since 2000 (See Table 16 below).

SARs and juvenile productivity estimates for fall Chinook: Improve or collect information on SARs and juvenile productivity (i.e. smolts per spawner). SARs are essential for taking into account variability in survival during smolt outmigration and marine life stages in evaluating A&P criteria. The goal is to estimate SARs that are representative at the population level. A number of approaches to accomplish estimating these SARs (e.g. marking wild or hatchery smolts, estimating natural origin smolts and adult production) have been pursued within the Snake. A comprehensive marking program utilizing CWTs and PIT tags is currently in place to estimate hatchery SARs. PIT tags and small size sub-yearling releases (see Attachment 6) that are used as a surrogate for naturally produced have been used to evaluate transportation actions in the basin to improve survivals.

Spatial structure is the range or distribution of NOF. Any viability evaluation must consider spatial structure within a population (or group of populations) because spatial structure affects extinction risk (McElhany et al. 2000). The effect of hatchery programs on salmon and steelhead spatial structure should be determined by:

1. Whether hatchery facilities (i.e., weirs, ladders, diversions, etc.) affect escapement back to the area of origin, rates of natural straying, or dispersal of fish (adults and juveniles) into under-used habitats, especially when adult returns are large, and

2. Competition for prime spawning areas and redd superimposition. (Refer to Addendum 1 for further discussion)

Release strategies include both direct and acclimated approaches to disperse hatchery juveniles across the available habitat and to encourage increased survival and homing through acclimation. These actions have been evaluated and found to successfully return hatchery supplementation fish to their intended areas (Garcia et al. 2001). These efforts have resulted in steadily increasing numbers of redds in prime spawning areas (Table 16: Garcia et al. 2001, 2004 and 2005; Groves 2002) and colonization/utilization of new spawning areas in most recent years (Hesse et al. 2010).

3. Competition between planted HOF juveniles and NOF for rearing areas. (Refer to Addendum 1 for further discussion)

4. Spawning between HOF and NOF that reduces productivity and affects spatial distribution. (Refer to Addendum 1 for further discussion)

There is no current indication that HOF are displacing NOF on the spawning grounds to less desirable or productive spawning habitat. Garcia et al. (2001, 2004 and 2005) have found apparent sympatric spawning of the two populations, although putative NOF spawners are difficult to confirm because of the small number of carcasses collected from the Snake. (Refer to Addendum 1 for further discussion)

Diversity refers to the distribution of traits within and among populations of salmon and steelhead. These traits include anadromy, morphology, fecundity, run timing, spawn timing, juvenile behavior, age at smolting, age at maturity, egg size, developmental rate, ocean distribution patterns, physiology and molecular genetic characteristics. A combination of genetic and environmental factors largely causes phenotypic diversity. Variation or diversity in these and other traits is important to viability because a) it allows fish to take advantage of a wider array of environments; b) it spreads the risk (e.g., different ocean distribution patterns mean not all fish are at risk from local or regional varying ocean conditions); and c) genetic diversity allows fish to adapt to changing environmental conditions. Habitat, harvest, and hatchery factors can all affect diversity. In the case of hatchery programs, gene flow strongly influences patterns of diversity within and among salmon populations. The effect of hatchery programs on salmon and steelhead diversity should be determined by:

1. The similarity of HOF life history characteristics and traits relative to NOF traits and the rate of gene flow of HOF into a natural population or spawning aggregate. Natural rates of gene flow have helped salmon and steelhead to persist and adapt to local conditions and the natural or background level between spawning aggregates, between populations, between Distinct Population Segments and between Evolutionarily Significant Units should be maintained.

Phenotypic characteristics for natural and hatchery populations: Little information was available to assess phenotypic changes because natural origin fish have been systematically excluded from hatchery broodstock and sampling. Representative estimates of current morphological, life history or behavioral traits are becoming available for both segments of the population as efforts to include natural fish in the brood provide access to sample those fish. Additional analysis of relationships between habitat characteristics and phenotypic traits (Connor et al. 2010) would improve the ability to assess changes from historical patterns at the population level; however it is not currently clear if such an effort could be achieved for the Snake River.

2. Maintenance of within population substructure (e.g., multiple spawning aggregates): Extensive and intensive spawning ground surveys are conducted annually by a collaborative co-manager effort. The surveys result in an enumeration of total redds observed throughout the Snake River basin, as well as documentation of site specific usage (Dauble et al. 1999; Dauble and Geist 2000) and colonization of new spawning sites each year.

3. The extent to which a hatchery program preserves or builds salmon or steelhead genetic resources: Snake River Fall Chinook genetics sampling information allowing evaluation of population substructure has been ongoing since the inception of the program (Bugert et al. 1991; Bugert et al. 1995). An established baseline can be coupled with periodic future follow-up efforts to evaluate the impacts of management strategies on population substructure.

4. Selective mortality effects: Little information was or is currently available to assess selective mortality resulting from differential impacts of human induced mortality. Additional information is needed to better assess human induced mortality effects in each of the four Hs (habitat, hatcheries, harvest and hydropower).

Currently we cannot determine hatchery from natural origin Chinook by scale or DNA analysis. Once a method is identified to do so, we will use the above indicators to determine whether the program has or is, causing measurable impacts, or poses unacceptable risks to the listed natural populations within the Snake River Basin. (Refer to Addendum 1 for further discussion)

1.11) Expected size of program.

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

Pre-season total egg take goal of Snake River hatchery or natural origin fish during 2010 was 4.78 million eggs to cover priorities 1-17 as listed in the 2008-2017 Management Agreement. This goal was estimated using the last five years of in-hatchery survival rates from green egg to eye up.

For broodstock alone we need 1,400- 2,000 females based on the range of fecundities we have documented in the past and in-hatchery survivals from green egg to eye up. Overall we anticipate trapping and retaining 3,500-5,000 fish (females and males) at LGR to accommodate broodstock and run reconstruction needs. Beginning in 2003, trapping at LGR Dam was modified to systematically collect 11% of the total run to the dam. This procedure allowed most of the unmarked/untagged fall Chinook (now considered to be of Snake River origin) to pass the dam unhindered. Since then trapping rates have been adjusted annually and within years to accommodate handling limitations at the trap, to provide sufficient broodstock, and to inform run reconstruction. In 2010 the trapping rate was initially set at 12% and was based on the estimated returns of fall Chinook and steelhead to the basin. It was reduced to 10% due to the larger than estimated run size. The trapping rate will be modified in-season as needed.

Any of the LFH fish not needed for broodstock or evaluation needs will be returned to the Snake River. Any of the LGR trapped fish that are untagged and not used for broodstock will be returned to the Snake River above LGR Dam. Any fish retained then released above LGR Dam will receive an upper caudal clip to prevent re-counting of these fish at the trap.

Scales are no longer considered reliable to distinguish in-basin from out of basin hatchery fish. Therefore matings will remain separated in trays until the end of the season when an estimate is made on the number of strays returning to the basin. If the estimated number of untagged strays has contributed greater than 5% of the gametes, unknown origin hatchery fish may be culled to reduce the proportion of potential stays in the brood. Eggs may also be shipped out-of-basin if they are needed elsewhere. Additional known origin fish may be spawned to fulfill egg take needs.

In past years jills (a 1-salt female) were included in broodstock. In an effort to reduce the contribution and potential negative effect these fish would have on future returns (increased jacks and overall decreased mean age at spawning), the co-managers have agreed to cull eggs from jills if there were enough older aged females trapped to meet egg take needs.

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

The current production level for on-station releases at LFH is 450,000 yearling smolts and 200,000 sub-yearling smolts (Table 4). Production for releases above LGR Dam is 450,000 yearling smolts and 3,528,000 sub-yearling smolts (Table 4). Additionally, there are always requests for research fish. Managers consider existing agreements and the potential benefits from proposed research requests on a case-by-case basis. The original LSRCP production goal was 9,160,000 sub-yearling smolts at a density index of 0.53. To increase returns, the program was switched to some yearling production to yield a benefit for smolt-to-adult returns. Current plans are to continue rearing yearlings until population abundance and sub-yearling survival increases. Total production has been reduced due to reflect rearing constraints at LFH. Loading densities have been lowered in an attempt to improve fish health and the quality of fish released from the hatchery.

Table 4. Production table B4B from the 2008-2017 *US vs. Oregon* Management Agreement. Snake River fall Chinook production for Brood Years 2008-2017 for the Lower Snake River Compensation Program (LSRCP) at LFH, the Fall Chinook Acclimation Program (FCAP), the Idaho Power Program (IPC) and the Nez Perce Tribal Hatchery (NPTH)

Production Priority	Rearing Facility [2]	Release Number	Release Location	Life stage	Mark
Tier One assumes rearing of 2.2 million sub-yearlings at LFH and 1.0 million eggs for IPC program.[7]					
1	Lyons Ferry	450,000	On-station	yearling	225K CWT, AD, VIE 225K CWT, VIE
2	Lyons Ferry	150,000	Pittsburg Landing	yearling	70K CWT, AD 80K CWT
3	Lyons Ferry	150,000	Big Canyon	yearling	70K CWT, AD 80K CWT
4	Lyons Ferry	150,000	Captain John Rapids	yearling	70K CWT, AD 80K CWT
5	Lyons Ferry	200,000	On-station	sub-yearling	200K CWT, AD
6	Lyons Ferry	500,000	Captain John Rapids	sub-yearling	100K CWT, AD 100K CWT 300K Unmarked
7	Lyons Ferry	500,000	Big Canyon	Sub-yearling	100K CWT, AD 100K CWT 300K Unmarked
8	Lyons Ferry	200,000	Pittsburg Landing	sub-yearling	100K CWT, AD 100K CWT
9	IPC [2] (Oxbow)	200,000	Hells Canyon Dam	sub-yearling	200K CWT, AD
10	Lyons Ferry	200,000	Pittsburg Landing	sub-yearling	200K Unmarked
11	Lyons Ferry	200,000	Direct stream evaluation Near Captain John Rapids	sub-yearling	200k CWT, AD
12	DNFH/Umatil la	250,000	Transportation Study [b c]	sub-yearling	250K PIT tag only
13	Irrigon FH	200,000	Grande Ronde River	sub-yearling	200K CWT, AD
14	DNFH/Umatil la	78,000	Transportation Study [b c]	sub-yearling	78K PIT tag
15	IPC (Umatilla)	200,000	Hells Canyon Dam	sub-yearling	200K CWT
16	Irrigon FH	200,000	Grande Ronde	sub-yearling	200K unmarked
17	IPC (Umatilla)	600,000	Hells Canyon Dam	sub-yearling	600K AD only
TOTAL	Yearlings		900,000		
	Sub-yearlings		3,528,000 (of which 328,000 are for Transportation Study)		

[a/] The Parties expect that fisheries conducted in accordance with the harvest provisions of this agreement will not compromise broodstock acquisition. If broodstock acquisition is nevertheless compromised by the current mark strategy and as a result of implementation of mark selective fisheries for fall Chinook in the ocean or Columbia/Snake River mainstem, the Parties will revisit the marking strategy during the course of this Agreement.

[b/] Production of transportation study surrogates is in effect for five brood years. After this group of fish has been provided for five years the transportation study group will be removed from the table and the groups of fish below will move u pone step in priority. If eggs available for sub-yearling production are 1.2 M or less, production of the transportation study surrogate group will be reduced to 250K or be deferred for that year. The PAC will review broodstock collected and projected egg take and make a recommendation to the policy group on whether to provide 250,000 fish or defer by November 1.

[c/] For logistical purposes, fish may be reared at Irrigon (LSRCP)

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

Do this for the most recent 12 years or for the years available and dependable info. Indicate program goals for the parameters

Under the original LSCRP goals, production returns of 0.2% back to the LSRCP area (above Ice Harbor Dam) would satisfy Washington's mitigation responsibilities in the Snake River. However, production was reduced from 9.16 M and ultimately adult returns (18,300) are the measure of mitigation success; not meeting original smolt-to-adult return (SAR) rates to the Snake River basin. Sub-yearlings released at LFH generally met the survival goal (Table 5), but yearlings released at LFH far exceeded the goal (Table 8). Data presented in tables 5 and 8 were derived from the LFH Evaluation Fall Chinook Salmon Annual report 2007/2008 (Milks et al. 2010) and include estimated numbers of live fish escaping above LGR Dam. Detailed SAS data for fall Chinook released in the Snake River basin can be found in Attachment 2.

Table 5. Estimated average percent smolt-to-adult return survivals to the Snake River basin through return year 2008 for CWT tagged sub-yearlings released by WDFW.

Release site	Brood year	Fin clip	Average % SAR	STD % SAR	min % SAR	max % SAR
Completed Returns						
LFH	BY98	AD	0.747			
LFH	BY99-03	AD	0.194	0.109	0.085	0.321
LFH	BY04-06	AD	0.384	0.482	0.077	0.940
Col R below Bonn	BY00	AD	0.072			
CCD	BY02	AD	0.074			
Incomplete returns through return year 2008						
CCD	BY04-05	AD	0.278	0.343	0.032	0.670
GRR	BY04-05	AD	0.132	0.104	0.059	0.205

Table 6. Estimated average percent smolt-to-adult return survivals to the Snake River basin through return year 2008 for CWT tagged sub-yearlings released by NPT.

Release site	Brood year	Fin clip	Average % SAR	STD % SAR	min % SAR	max % SAR
Completed Returns						
Big Canyon	BY98	No clip	1.209			
Big Canyon	BY00-03	No clip	0.220	0.133	0.113	0.396
Captain John Rapids	BY99-03	No clip	0.316	0.265	0.060	0.691
Pittsburg Landing	BY00-02	No clip	0.101	0.061	0.042	0.163
Pittsburg Landing	BY03	AD	0.047			
Nez Perce Tribal Hatchery (NPTH)	BY02-03	No clip	0.118	0.135	0.024	0.273
Incomplete returns through return year 2008						
Big Canyon	BY04-06	AD	0.248	0.176	0.071	0.544
Big Canyon	BY05-06	No clip	0.704	0.884	0.079	1.329
Captain John Rapids	BY04-06	AD	0.316	0.388	0.040	0.760
Captain John Rapids	BY05-06	No clip	0.658	0.864	0.047	1.270
Pittsburg Landing	BY04-06	AD	0.032	0.032	0.009	0.055
Pittsburg Landing	BY06	No clip	0.035			
Nez Perce Tribal Hatchery (NPTH)	BY04-06	AD	0.104	0.100	0.011	0.232
NPTH	BY04-06	No clip	0.327	0.467	0.015	0.864
NPTH-North Lapwai Valley	BY05-06	AD	0.194	0.223	0.036	0.351
NPTH-North Lapwai	BY05	No clip	0.377			

Valley						
NPTH-Cedar Flats Acclimation	BY05-06	No clip	0.730	0.609	0.119	1.337
NPTH-Lukes Gulch Acclimation	BY05-06	No clip	0.345	0.417	0.050	0.640

Table 7. Estimated average percent smolt-to-adult return survivals to the Snake River basin through return year 2008 for CWT tagged sub-yearlings released as part of IPC mitigation.

Release site	Brood year	Fin clip	Average % SAR	STD % SAR	min % SAR	max % SAR
Incomplete returns through return year 2008						
HCD	BY04-05	AD	0.221	0.171	0.066	0.49

Table 8. Estimated average percent smolt-to-adult return survivals to the Snake River basin through return year 2008 for CWT tagged yearlings released by WDFW.

Release site	Brood year	Fin clip	Average % SAR	STD % SAR	min % SAR	max % SAR
Completed Returns						
LFH	BY94-98	AD	0.793	0.377	0.382	1.166
	BY99-03	AD	1.032	0.409	0.385	1.499
	BY03	No clip	1.021		0.077	0.940
Incomplete returns through return year 2008						
LFH	BY04-06	AD	1.061	0.571	0.532	1.666
	BY04-06	No clip	1.250	0.545	0.630	1.656

Table 9. Estimated average percent smolt-to-adult return survivals to the Snake River basin through return year 2008 for CWT tagged yearlings released by FCAP.

Release site	Brood year	Fin clip	Average % SAR	STD % SAR	min % SAR	max % SAR
Completed Returns						
PL	BY94-98	AD	0.302	0.146	0.055	0.477
PL	BY99-03	AD	0.367	0.259	0.110	0.775
BC	BY95-98	AD	0.333	0.205	0.092	0.702
BC	BY99-03	AD	0.303	0.136	0.108	0.454
CJ	BY96-98	AD	0.454	0.379	0.070	0.992
CJ	BY99-02	AD	0.424	0.216	0.134	0.657
Incomplete returns through return year 2008						
PL	BY04-06	AD	0.718	0.604	0.203	1.368
PL	BY04-06	No clip	0.734	0.483	0.186	1.095
BC	BY04-06	AD	0.675	0.395	0.267	1.057
BC	BY04-06	No clip	0.872	0.483	0.175	1.345
CJ	BY04-06	AD	1.837	1.590	0.120	3.259
CJ	BY04-06	No clip	1.597	1.253	0.155	2.415

Original mitigation requirements were developed using lengths of fall Chinook seen at dams to designate adults, but ocean conditions are highly variable among years and can affect estimates of the number of returning adults (e.g. - larger fish returning at younger ages during productive ocean environment years). Average percent SARs to the Snake

River by salt water age are presented in Tables 10 and 11 for sub-yearling and yearling fall Chinook. Generally, returns have been below the mitigation goal of 18,300 fall Chinook (Table 6).

Table 10. Estimated average percent smolt-to-adult return survivals to the Snake River basin through return year 2008 of sub-yearlings released by WDFW by salt water age.

Release site	Brood year	Fin clip		1 salt	2 salt	3 salt	4 salt	5 salt
Completed Returns								
LFH	BY98	AD		**0.208**	**0.347**	**0.173**	**0.018**	
	BY99-03	AD	average	**0.065**	**0.075**	**0.045**	**0.011**	**0.001**
			std	0.033	0.046	0.035	0.009	
			min	0.034	0.034	0.012	0.001	
			max	0.111	0.126	0.090	0.018	
Col R barged below Bonn	BY00	AD		**0.033**	**0.025**	**0.013**	**0.002**	
CCD	BY02	AD		**0.031**	**0.034**	**0.008**		
Incomplete returns through return year 2008								
LFH	BY04-06	AD	average	**0.187**	**0.293**	**0.006**		
			std	0.177	0.373			
			min	0.041	0.029			
			max	0.384	0.556			
CCD	BY04-05	AD	average	**0.105**	**0.173**	**0.001**		
			std	0.110	0.233			
			min	0.023	0.009			
			max	0.230	0.440			
GRR	BY04-05	AD	average	**0.093**	**0.038**	**0.003**		
			std	0.081	0.024			
			min	0.036	0.020			
			max	0.150	0.055			

Table 11. Estimated average percent smolt-to-adult return survivals to the Snake River basin through return year 2008 of sub-yearlings released by FCAP and NPTH by salt water age.

Release site	Brood year	Fin clip		1 salt	2 salt	3 salt	4 salt	5 salt
Completed Returns								
BC	BY98	No clip		**0.493**	**0.437**	**0.244**	**0.031**	**0.003**
	BY00-03	No clip	average	**0.078**	**0.088**	**0.045**	**0.011**	**0.004**
			std	0.038	0.062	0.037	0.003	
			min	0.038	0.042	0.010	0.009	
			max	0.112	0.178	0.097	0.014	
CJ	BY99-03	No clip	average	**0.085**	**0.095**	**0.074**	**0.007**	
			std	0.097	0.096	0.067	0.004	
			min	0.023	0.037	0.010	0.003	
			max	0.254	0.265	0.162	0.010	
PL	BY00-02	No clip	average	**0.039**	**0.037**	**0.020**	**0.005**	**0.004**
			std	0.029	0.017	0.021	0.001	
			min	0.005	0.026	0.004	0.004	
			max	0.058	0.057	0.045	0.006	
PL	BY03	AD	average	**0.032**	**0.030**	**0.013**		
NPTH	BY02-03	No clip	average	**0.053**	**0.039**	**0.022**	**0.005**	
			std	0.058	0.047	0.027	0.003	
			min	0.015	0.004	0.004	0.003	
			max	0.120	0.092	0.053	0.007	
Incomplete returns through return year 2008								
BC	BY04-06	AD	average	**0.090**	**0.153**	**0.073**	**0.019**	
			std	0.095	0.096	0.008	0.002	
			min	0.028	0.081	0.067	0.018	
			max	0.256	0.288	0.078	0.020	
BC	BY05-06	No clip	average	**0.481**	**0.445**			
			std	0.569				
			min	0.079				
			max	0.884				
CJ	BY04-06	AD	average	**0.131**	**0.254**	**0.049**		
			std	0.170	0.253			
			min	0.025	0.075			
			max	0.327	0.433			
CJ	BY05-06	No clip	average	**0.467**	**0.383**			
			std	0.594				
			min	0.047				
			max	0.887				
PL	BY04-06	AD	average	**0.030**	**0.005**			
			std	0.036				
			min	0.004				
			max	0.055				
PL	BY06	No clip	average	**0.035**				
NPTH	BY04-06	AD	average	**0.099**	**0.037**	**0.010**		
			std	0.070	0.044			
			min	0.018	0.011			
			max	0.144	0.088			

NPTH	BY04-06	No clip	average	**0.209**	**0.177**
			std	0.274	0.235
			min	0.004	0.011
			max	0.521	0.343
NPTH-NLV	BY05-06	AD	average	**0.169**	**0.196**
			std	0.007	0.012
			min	0.164	0.187
			max	0.173	0.204
NPTH-NLV	BY05	No clip	average	**0.036**	
NPTH-CFA	BY05-06	No clip	average	**0.454**	**0.415**
			std	0.426	0.015
			min	0.119	0.404
			max	0.933	0.426
NPTH-LGA	BY05-06	No clip	average	**0.186**	**0.317**
			std	0.193	
			min	0.050	
			max	0.323	

Table 12. Estimated average percent smolt-to-adult return survivals to the Snake River basin through return year 2008 of sub-yearlings released as part of IPC mitigation by salt water age.

Release site	Brood year	Fin clip		1 salt	2 salt	3 salt	4 salt	5 salt
Incomplete returns through return year 2008								
HCD	BY04-05	AD	average	**0.107**	**0.113**	**0.041**		
			std	0.081	0.106	0.022		
			min	0.032	0.024	0.019		
			max	0.239	0.254	0.063		

Table 13. Estimated average percent smolt-to-adult return survivals to the Snake River basin through return year 2008 of yearlings released by WDFW by salt water age.

Release site	Brood year	Fin clip		0salt	1salt	2salt	3salt	4salt
Completed Returns								
LFH	BY94-98	AD	average	**0.092**	**0.294**	**0.298**	**0.105**	**0.005**
			std	0.046	0.192	0.146	0.033	0.005
			min	0.029	0.083	0.139	0.055	0.001
			max	0.167	0.562	0.490	0.140	0.016
	BY99-03	AD	average	**0.151**	**0.438**	**0.385**	**0.056**	**0.006**
			std	0.113	0.203	0.155	0.045	0.004
			min	0.005	0.156	0.126	0.013	0.001
			max	0.298	0.755	0.576	0.127	0.009
	BY03	No clip	SAR	**0.196**	**0.414**	**0.384**	**0.026**	
Incomplete returns through return year 2008								
LFH	BY04-06	AD	average	**0.489**	**0.671**	**0.375**		
			std	0.451	0.350			
			min	0.108	0.424			
			max	0.986	0.918			
	BY04-06	No clip	average	**0.662**	**0.684**	**0.397**		
			std	0.706	0.275			

min	0.140	0.490
max	1.465	0.879

Table 14. Estimated average percent smolt-to-adult return survivals to the Snake River basin through return year 2008 of yearlings released by FCAP by salt water age.

Release site	Brood year	Fin clip		0salt	1salt	2salt	3salt	4salt
Completed Returns								
PL	BY94-98	AD	average	**0.023**	**0.083**	**0.096**	**0.097**	**0.005**
			std	0.016	0.084	0.048	0.094	0.003
			min	0.011	0.008	0.029	0.004	0.003
			max	0.058	0.238	0.150	0.293	0.009
PL	BY99-03	AD	average	**0.123**	**0.168**	**0.085**	**0.014**	
			std	0.138	0.067	0.076	0.018	
			min	0.021	0.079	0.028	0.001	
			max	0.327	0.257	0.214	0.045	
BC	BY95-98	AD	average	**0.019**	**0.067**	**0.223**	**0.076**	**0.010**
			std	0.022	0.071	0.242	0.051	0.005
			min	0.001	0.007	0.014	0.001	0.007
			max	0.060	0.214	0.702	0.139	0.014
BC	BY99-03	AD	average	**0.097**	**0.144**	**0.069**	**0.012**	
			std	0.055	0.065	0.031	0.007	
			min	0.042	0.054	0.042	0.002	
			max	0.145	0.219	0.107	0.022	
CJ	BY96-98	AD	average	**0.045**	**0.208**	**0.189**	**0.059**	**0.006**
			std	0.071	0.310	0.065	0.028	0.000
			min	0.015	0.015	0.015	0.020	0.006
			max	0.159	0.574	0.327	0.103	0.006
CJ	BY99-02	AD	average	**0.119**	**0.206**	**0.117**	**0.011**	
			std	0.065	0.092	0.051	0.008	
			min	0.061	0.091	0.042	0.001	
			max	0.189	0.299	0.157	0.017	
Incomplete returns through return year 2008								
PL	BY04-06	AD	average	**0.453**	**0.262**	**0.275**		
			std	0.621	0.215			
			min	0.058	0.132			
			max	1.368	0.511			
PL	BY04-06	No clip	average	**0.460**	**0.331**	**0.160**		
			std	0.435	0.284			
			min	0.056	0.130			
			max	0.921	0.532			
BC	BY04-06	AD	average	**0.406**	**0.299**	**0.207**		
			std	0.348	0.077			
			min	0.022	0.245			
			max	0.700	0.354			
BC	BY04-06	No clip	average	**0.592**	**0.300**	**0.240**		
			std	0.675	0.232			
			min	0.039	0.136			
			max	1.345	0.464			
CJ	BY04-06	AD	average	**1.501**	**0.310**	**0.389**		

			std	1.626	0.343	
			min	0.052	0.068	
			max	3.259	0.553	
CJ	BY04-06	No clip	average	**1.233**	**0.369**	**0.354**
			std	1.178	0.386	
			min	0.059	0.096	
			max	2.415	0.642	

Table 15. Estimated returns of fall Chinook from LSRCP program including FCAP to the Snake River basin.

	Saltwater age					A/J determined by fork length			
	0 salt	1 salt		2-5 salt					
Return year	**Mini Jack [a]**	**Jack [b]**	**Jill [c]**	**Adult F**	**Adult M**	**Adult F+M ≥ 53**	**Jack ≤ 53cm**	**Total (A+J)**	**% of LSRCP goal**
1995						1,274	2,071	3,345	18.3
1996						1,227	548	1,775	9.7
1997						1,227	711	1,938	10.6
1998						3,586	1,227	4,813	26.3
1999						4,091	1,209	5,300	29.0
2000						4,441	4,474	8,915	48.7
2001						9,398	4,777	14,175	77.5
2002						11,355	5,157	16,512	90.2
2003						10,788	6,775	17,555	95.9
2004						12,247	2,194	14,641	80.0
2005						8,521	3,123	11,644	63.6
2006						7,014	6,040	13,054	71.3
2007[e]	1,090	10,507	1,355	3,473	2,049			17,384	95.0
2008	14,272	3,956	222	6,478	7,820			18,476	101.0

[a] Minijacks are males that did not spend a year in salt water. Not considered part of mitigation.
[b] Jacks are males that spent 1 year in salt water.
[c] Jills are females that spent 1 year in salt water.
[d] Estimated run to LGR Dam (includes fish hauled to LFH and NPTH for processing as well as fish released from the dam).
[e] Estimates prior to 2007 do not include numbers of fish left in the reservoir between LMO and LGR not accounted for in other calculations.

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

The egg bank program began in 1976. Releases of fall Chinook into the Washington portion of the Snake River from LFH first occurred in 1985.

Oxbow FH was constructed and began operation in 1961 as an experimental facility for fall Chinook salmon spawning and rearing. Due to poor success the program was discontinued in 1973. Following implementation of the HCSA in 1980, production of fall Chinook salmon at OFH was reinstated utilizing eyed eggs received from WDFW's LFH. The first eggs were received from Lyons Ferry FH in brood year 2000. Egg availability remains variable and brood year 2004 was the first year since the inception of the HCSA that IPC received sufficient eyed eggs from Lyons Ferry FH to rear the one million smolts required by the HCSA.

The FCAP program began in 1994 with the first releases of fall Chinook into the Idaho portion of the Snake River near Pittsburg Landing in 1996. In 1997 the program was increased and included releases of fish into the Idaho portion of the Clearwater River near Big Canyon Creek. In 1998 the program grew and the first release of fish into the Washington portion of the Snake River near CJR occurred.

1.14) Expected duration of program.

The LSRCP fall Chinook program (Lyons Ferry and FCAP is ongoing as part of the Lower Snake River Compensation Plan program which is congressionally authorized to mitigate for the development and operation of the four lower Snake River dams. This program will operate indefinitely.

The fall Chinook salmon program associated with IPC is expected to continue indefinitely to mitigate for losses of anadromous fish associated with the construction and operation of the HCC.

1.15) Watersheds targeted by program.

Snake River basin including the Snake River, Clearwater, and Grande Ronde (Wallowa sub-basin, HUC-17060105) rivers. Snake River at Oxbow Fish Hatchery is HUC 17050201 and the Snake River at Hells Canyon Dam is HUC 17060101

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

1.16.1) Potential Alternatives to the Current Program

Alternatives listed in the 2005 HGMP that have been addressed since 2005:

Alternative 1: Evaluate direct stream releases of sub-yearlings.
Under new low density rearing strategies at LFH, there will be production constraints that limit the size of the program. Direct releases would allow us to release fish at optimal size, health and release time to match river flow; potentially optimizing survival. Because of capacity constraints at acclimation sites, fish scheduled for the late (second) release are held back at LFH until the acclimation pond has completed its first release. This delay in timing of releases may subject these fish to higher water temperatures and lower river flow. Although handling of Chinook smolts by trucking has been shown to decrease their survival rate in some cases this would be a very cost effective approach versus construction and O&M costs associated with new acclimation facilities. Direct stream releases are currently being discussed as an option. (Note: a study began in 2005 to address this alternative, which will compare direct releases near CJR AF with an acclimated release at the same site) **Response: This alternative is being evaluated through implementation of a consensus study developed by USFWS, NPT and WDFW. The 2010 release will be year 5 of this study. Preliminary results from the first four years of study showed a consistent performance advantage (travel time, probability of survival to and between dams) for acclimated sub-yearling fall Chinook (Connor et al.**

2010). Although adult returns from the releases will be used as the ultimate measure of comparison between study groups, the juvenile performance results are interesting.

Alternative 4: Implement broodstock trapping for the Snake River fall Chinook program at NPTH and Hells Canyon Dam for IPC and NPTH program needs.
Broodstock collection at LFH to cover all programs is difficult. Variable trapping rates can limit LFH's ability to meet broodstock needs in some years. Conversely, during large run years adult holding capacity could be exceeded, causing unnecessary stress on broodstock. Moreover, facility limitations at Lower Granite Dam have been identified and managers began a new sampling protocol to improve data quality for run reconstruction and management decision making. This protocol limits the ability of LGR to provide fall Chinook broodstock to any facility. This alternative would reduce pressure on LGR and LFH by diversifying collection to other locations, and meet a similar goal identified in the Draft Snake River Fall Chinook Management Plan. By diversifying collection sites to include NPTH and a trap at HC Dam, trapping at LFH and LGR could decrease to the level needed for run reconstruction purposes and the monitoring of the natural population above LGR Dam. It would also allow WDFW to focus on meeting LSRCP needs at LFH. Additional discussion is needed under the fall Chinook management plan. **Response: Broodstock trapping at NPTH has occurred. Trapping at Hells Canyon Dam is being tested.**

Alternative 5: Modify the adult trap at LFH to facilitate broodstock selection and handling.
Modifying the adult trap at LFH by attaching an anesthetic tank and handling chute would allow fish to be sampled immediately and released to the river or retained for broodstock. This would benefit natural origin fish by allowing them to return to the river the same day they are captured. In addition, we would be able to target an exact number of females to retain. Currently, any fish trapped is retained up to 45 days until sorting. At that time, with our current broodstock constraints, unmarked/untagged fish (possibly natural origin) are sampled and hauled back to the Snake River and excess females are returned to the river. By handling and sorting fish immediately, we could reduce the number of fish on hand in the broodstock ponds, which may help address concerns raised in Alternative 4. **Response: The trap at LGR has been modified so several more holding tanks are in place and water supply has increased.**

Alternatives listed in the 2005 HGMP that have not been accomplished

Alternative 2: Build more acclimation facilities above LGR Dam.
This would allow more fish to be released in better condition because of timing and densities. This option could produce better survival and homing from fall Chinook than using Alternative 1, but is a very expensive alternative and should not be pursued until completion of a study to measure the efficacy of direct releases is completed. Acceptable acclimation sites are limited in the basin. Additional discussion is needed before this can move forward. **Response: We are committed to releases and release sites as described in the *US vs. Oregon* document and the production table B4B, listed here as**

Table 1.

Alternative 3: Use Cottonwood acclimation pond for fall Chinook acclimation. Cottonwood pond is located on the lower Grande Ronde River, a tributary to the Snake River, and is currently used for steelhead but could be modified for fall Chinook use by providing a new intake system. These modifications have already been identified as part of the NEOH process and would be considerably more cost effective then new construction. Acclimation would return adults to an area of the Grande Ronde with relatively poor fall Chinook habitat, but could improve juvenile survival and provide flexible release timing options. Additional discussion is needed before this alternative can proceed. Discussions may benefit from results from direct stream releases in Alternative 1. **Response: A direct release of fish into the Grande Ronde began in 2005. Returns of these fish will provide an idea of what to expect from releases into the Grande Ronde River. We are committed to releases and release sites as described in the *US vs. Oregon* document and the production table B4B, listed here as Table 1.**

Alternative 6: Convert Umatilla River fall Chinook production to Snake River stock. Fish released in the Umatilla River are consistently the number one contributor to strays in the Snake River and at LFH. Lyons Ferry is presently the sole distributor of Snake River stock fall Chinook eggs to the Snake River basin. This alternative would decrease the effect these fish have on the natural spawning populations in the Snake River and simplify spawning protocol at LFH. The conversion would require difficult decisions by managers about allocation of eggs for production, and LFH would not be able to provide all the eggs needed for changing of stock for the Umatilla River without a reduction in egg requests by other agencies. It is unknown if this stock change would exacerbate straying from the Columbia River to the Snake River, or if it would present a problem to other Columbia River stocks if they strayed elsewhere. Mixed genetic parentage during the conversion to a new stock in the Umatilla could pose significant tagging or identification problems, especially if the progeny then strayed into the Snake River. This option will be discussed further, but it may cause more straying problems than it alleviates and it may reduce the LSRCP production in the Snake River basin from LFH. **Response: U.S. v. Oregon parties have considered this alternative and decided against it, in large part because of the complexities described above. In addition, recent run reconstruction information indicates that returns of Umatilla fall Chinook to the Snake River have substantially declined to in recent years (0.5 – 3.1% for 2006-08).**

Alternative 7: Release additional 200 K sub-yearlings at LFH.
Pros: This would allow for studies to compare size and time of release to maximize SAR from sub-yearling production. This would also increase the abundance of fish for broodstock at LFH to meet increasing demands, but may not be possible without increased rearing space at LFH. This option is still under discussion. **Response: This has not occurred because it is not consistent with the *US vs. Oregon* Management Agreement production table B4B.**

1.16.2) Potential Reforms and Investments

Reform/Investment 1: Complete a comprehensive Snake River Fall Chinook Hatchery

Management Plan. This plan has been in the works for many years. Because of the diversity of players in the Snake Basin, conflicting goals listed in *US vs. Oregon* and LSRCP documents, and differing opinions on ranking of release sites and production needs, crafting of the Plan has been delayed. The returning adult goals for fall Chinook as listed in the *US vs. Oregon* documents and the LSRCP goal need to be aligned. By using an escapement goal at McNary that is less than originally used in the LSRCP, Snake River fish can be harvested at a greater rate in the lower Columbia R., thus decreasing the number of fall Chinook available to spawn or for harvest in the Snake River. This process is currently underway and is expected to be completed by late 2005 at a cost of <$50,000. **Response: This document has not been finalized, and no completion date has been agreed upon by the co-managers.**

Reform/Investment 2: The current need for multiple release groups and sizes of groups to meet *US vs. Oregon*, LSRCP and IPC production has over taxed the facility at LFH. Increased rearing space (raceways or rearing ponds) with additional water supply would provide for increased production and flexibility to meet the growing demand for Snake River stock fall Chinook in the basin, while not crowding out (competing for space with) other programs at LFH. Encouraging more self-reliance by the NPTH and IPC programs will help alleviate this problem as well. New construction is very costly but may be the only answer for the basin. $1,000,000- <$5,000,000 **Response: Although additional rearing ponds have not been built, the adult holding ponds have been divided to allow for more vessels that can hold different mark or release groups.**

Reform/Investment 3: Fund increased evaluation marking. Mark more fish in the basin so that all release groups can be evaluated upon return. The use of PIT tags for hatchery release groups could be cost effective compared to modifying the trap at LGR (**R/I-5**), but natural production probably could not be tagged representatively. Increased costs could be $100,000-$250,000. **Response: An ongoing transportation evaluation study funded by the Corps of Engineers is currently underway that utilizes PIT tags in all major hatchery releases within the basin. Evaluation of the results of this study should inform the managers about the efficacy and costs of PIT tagging for evaluating the program as a whole.**

Reform/Investment 4: Construct or modify alternate release sites like Cottonwood Pond on the Grande Ronde River. Cost would be highly variable. Modifying Cottonwood could be in the $100,000-$250,000 range, while building new sites could range from $1,000,000-<$5,000,000. **Response: Not completed.**

Reform/Investment 5: Modify the adult trap at LGR Dam to provide a facility capable of handling more fish during peak run periods. The present facility was constructed as a research trap and was never intended to be used for management of runs (stray fall Chinook removal) or to sample all fish passing the dam. Run reconstruction for management and as required by *US vs. Oregon* needs to attain greater confidence in the estimates of hatchery and wild fish to the Snake River. This will be very costly and will require close coordination with COE, but is an extremely critical area for overall Columbia basin management decisions $1,000,000-<$5,000,000. **Response: Some modifications were done to increase the throughput capacity of the trap. During fall**

2009 the long standing water supply problem was substantially alleviated by the Corps of Engineers, which will allow more of the expanded facility holding tanks to be used during the peak of the run. These changes are neither adequate to handle the large numbers of fish crossing the dam so that it could serve to control stray escapement into the upper basin, nor for sampling enough fish to ensure 20% of hatchery broodstock is derived from wild fish under the current marking strategy. Sampling for run reconstruction is currently considered adequate with the existing trap.

Reform/Investment 6: Management might be enhanced if an alternative dam were chosen as the site of fall Chinook management. The Snake River Fall Chinook Hatchery Management Plan (currently in draft) identifies Lower Monumental Dam as that site. McNary Dam, located on the Columbia River below the mouth of the Snake River, enumerates, and has an escapement goal, for all upriver bright fall Chinook. To better estimate Snake River bright fall Chinook, we suggest establishing return goals and enumerating at Lower Monumental Dam, the second dam on the Snake River. Lower Monumental Dam is preferred over Ice Harbor because of the occurrence of Hanford/Columbia River fish dipping into the Snake River, which can elevate the estimate of fall Chinook in the Snake River. The error rate in ladder counts at IHR Dam was documented to be as high as 64% in 1993, during a telemetry study done by Mendel and Milks (1997). These fish have been documented as dipping into the Snake River, crossing IHR Dam and eventually being detected on spawning grounds in the Yakima or Columbia rivers above the confluence to the Snake River. If additional costs would be incurred at Lower Monumental Dam for adult counts they may be in the range of $50,000-<$100,000. **Response: This has not yet occurred. It would be useful to install PIT tag detection arrays at LMO for adults returning to the basin. This would address the fallback problem that is noted at IHR and give better in season estimates of returning fish that will remain in the basin.**

Reform/Investment 7: The co-managers have identified the need to include natural origin recruit (NOR) adults into the broodstock at LFH to prevent genetic separation of the hatchery and wild populations. Presently, unmarked strays and untagged/unmarked Snake River stock fall Chinook released above LGR are difficult or impossible to identify in a timely manner during the spawning process at LFH. This has prevented inclusion of NORs in the broodstock since 1990. A uniform marking strategy within the basin is needed to be able to monitor straying into the Snake River. Utilizing scale analysis to determine NORs from hatchery origin recruits could be an interim solution that would allow NORs to be included. This reform could be instituted with adoption of **R/I #3** above. Additional genetic or scale sampling should cost <$50,000. **Response: In 2004 we began including NOR adults (based on scale determinations) in broodstock at LFH. At that time it was believed that wild fish could be distinguished from hatchery fish using scale analysis. Each year since 2004 the differences between hatchery and wild fish scales have been increasingly more difficult to detect. In 2010 it became apparent that scales were no longer reliable to differentiate hatchery from wild Chinook in the Snake River. This limits our ability to actively select them for use in broodstock. We include untagged fish in our broodstock in an effort to include wild fish. Neither genetics nor scales are currently able to differentiate hatchery from wild fish in broodstock.**

IPC:

Reform/Investment 1: Upon issuance of a new FERC license for the HCC, IPC proposes to modify the adult fish trap at Hells Canyon Dam. Modifications will include expansion of current holding facilities as well as provide the ability to sort fish at the adult trap. These modifications will provide the potential to collect localized fall Chinook salmon for broodstock at Oxbow Hatchery. Because fall Chinook salmon have not successfully been targeted at the Hells Canyon adult trap for brood collection, it is unclear whether the proposed modifications will provide adequate numbers of fall Chinook salmon for broodstock needs. $1,000,000-<$5,000,000. **Response: A new FERC license for the Hells Canyon Complex is currently pending 401 Certification under the Clean Water Act and ESA consultation.**

Reform/Investment 2: Upon issuance of a new FERC license, IPC proposes to upgrade and expand Oxbow Hatchery to provide for adult holding, spawning, incubation, and rearing facilities capable of accommodating the production of 1 million fall Chinook salmon smolts. This action would potentially allow hatchery fall Chinook salmon broodstock to be held at Oxbow Hatchery. The upgrades address some of the HSRG/HRT/TRT concerns for Snake River fall Chinook salmon as well as reduce some of the reliance on LFH for eggs to meet IPC mitigation requirements identified in the 1980 Hells Canyon Settlement Agreement. Over $5,000,000. **Response: A new FERC license for the Hells Canyon Complex is currently pending 401 Certification under the Clean Water Act and ESA consultation.**

SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS.

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

WDFW, IDFG, and Bureau of Indian Affairs had Section 10 Permit #1530 for the operation of Lower Granite Trap (expired 12/31/10), however a letter of determination for research at LGR Dam has been provided to the managers and will be in effect through December 2013; Section 4(d) coverage through a USFWS Consultation with NMFS for LSRCP actions and the NMFS Biological Opinion; and a statewide Section 6 Consultation with USFWS (Bull Trout).

Currently, because IPC contracts with the Umatilla Hatchery for up to 80 percent of its smolt production and because Oxbow Hatchery is not a broodstock collection station, there are no ESA permits issued other than annual transport permits from the states of Oregon, Idaho, and Washington and annual release permits issued by NOAA. This HGMP will serve as both the biological opinion and ESA permit for future operations related to Oxbow Hatchery.

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

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

Include information describing: adult age class structure, sex ratio, size range, migration timing, spawning range, and spawn timing; and juvenile life history strategy, including smolt emigration timing. Emphasize spatial and temporal distribution relative to hatchery fish release locations and weir sites

- Snake River fall Chinook (threatened)
- Snake River spring/summer Chinook (threatened)
- Snake River steelhead (threatened)
- Salmon River Sockeye (endangered)

are within Snake River Basin areas that may be affected by this program. The habitat associated with the Snake River fall Chinook has been listed as Critical.

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

(Includes listed fish used in supplementation programs or other programs that involve integration of a listed natural population. Identify the natural population targeted for integration).

<u>Snake River Fall Chinook</u> –Fall Chinook are generally considered an 'ocean-type' (after sea-type, in Gilbert, 1913) run of salmon which migrate to the Pacific Ocean during their first year of life, normally within 3 months of emergence from spawning substrate. Adults enter the mouth of the Columbia River in the early fall and spawn during October and November (Rondorf and Miller, 1993; Dauble and Watson, 1997). Adult Snake River fall Chinook enter the Columbia River in August and migrate into the Snake River from late August through November. There is also a 'stream-type', which rears in the reservoirs and migrate to the Pacific Ocean during the second year of life.

Fall Chinook in the Snake River primarily spawn in the Hells Canyon reach between Hells Canyon Dam and the Clearwater River. Fall Chinook in the Clearwater, Grande Ronde, Imnaha, and Salmon Rivers are considered segments of the Snake River population. Nez Perce Tribe and WDFW biologists have documented the number of fall Chinook redds in the Grande Ronde since 1986 (Glen Mendel, WDFW pers. comm. 2002). Redd counts have ranged from 0-197 since 1986 in the area between the mouth and Troy, Oregon (Rkm 73). The ten-year most recent (1995-2004) average is 70 (SD=67.7). Approximately 87.6% of redds observed in 2004 and 78.0% of redds observed in 2003 were located between the Grande Ronde River mouth and Cottonwood Creek (Garcia et al. 2005). Spawning occurs from late October through early December, with fry emergence during April. Most out-migration occurs within several months following emergence with peak migration past Lower Granite Dam in late June. Some migrate out through fall and some over-winter before migrating (Connor et al. 2005). Competition for food and space is possible.

Hatchery-origin fall Chinook (from this program) are intended to spawn upstream of

LGR Dam in the main stem Snake River or other tributaries where natural origin fall Chinook spawn. Spawning with hatchery origin fish may reduce the reproductive success of natural spawners, but at this time it is unknown to what extent, if any.

The Lower Granite trap was built and has been used primarily for research, with tag detectors and diversion gates to selectively sample Passive Integrated Transponder (PIT) and coded-wire tag (CWT) marked adult salmon and steelhead. More recently, the trap has been used for management purposes including collection of fall Chinook broodstock for LFH and NPTH. The trap and crew are currently sampling 9-20% of the fall Chinook and steelhead runs passing LGR to gather data for reconstruction of the fall Chinook run. This sampling entails handling 25,000-35,000 fish out of a total run of about 200,000+ steelhead and 20,000-30,000 fall Chinook.

Fish enter the south shore ladder and ascend to the trap facility. Electronic controls direct fish passing through the ladder into a trap holding facility 9-20% of each hour, 24 hours a day. When not directed into the trap, most fish pass the ladder unimpeded. Other studies currently underway at the facility use electronic PIT tag detectors to select specific fish by code to be directed into the trap. Trapped fall Chinook salmon are anesthetized, examined, tagged and sampled (scales or tissue), injected with Oxytetracycline (if destined for a hatchery), and placed in a recovery tank. Once partially recovered, the salmon are placed in larger holding tanks to await transportation to LFH or NPTH, or returned immediately to the ladder to continue their upstream migration. The trap operation and layout is as described by Harmon (2003). All steelhead are trapped, anesthetized, handled, scale and DNA sampled if required, and immediately released to the ladder to resume their upstream travel.

Juvenile hatchery fall Chinook released as smolts may compete for food and space with naturally reared fall Chinook during the migration period. It has also been documented that reservoir rearing is also occurring in the Snake River, which would increase the chance that these fish are competing for food and space with the naturally reared fall Chinook. In 2004, scale samples were taken on unmarked/untagged returning adults. Of 443 fish that were determined to be of natural Snake River Origin, 257 (58.0%) showed yearling out-migrant patterns indicating they reservoir reared. Reservoir rearing is also occurring in unmarked/untagged Snake River origin hatchery fish at a rate of 55.9%, based upon scale sampling of 463 fish during spawning activities at LFH. This phenomenon is occurring in sub-yearlings released above LGR Dam. Competition by our traditional hatchery fish with reservoir-reared fish, however, is generally minimized because of release size (yearlings and larger-than-natural sub-yearlings), and condition of fish at release (smolts). Further, hatchery-origin fall Chinook from this program have the chance to spread diseases to natural ESA listed populations during the migration period. Regional protocols are followed to ensure healthy fish upon release.

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

(Includes ESA-listed fish in target hatchery fish release, adult return, and broodstock collection areas).

The hatchery production program may incidentally affect listed Snake River summer steelhead, Snake River spring Chinook, and Columbia Basin bull trout. Potential affects are organized by hatchery activity below.

Trapping for program needs:

ESA listed Snake River spring/summer Chinook, and summer steelhead are incidentally trapped at LFH and LGR Dam while fall Chinook are being targeted. Trapping begins August 18 at LGR Dam to avoid trapping most summer Chinook run. Similarly, the LFH adult trap does not open until September 1 to avoid trapping spring/summer Chinook. At that time it is still possible that listed Snake River spring/summer Chinook may be captured. When trapped, the fish are immediately shunted into a raceway and not sorted again until the first week of October. Spring/summer Chinook are documented at the traps through CWT recoveries. The average number of CWT spring/summer Chinook incidentally caught over the last five years during fall Chinook trapping is six fish.

Natural-origin adult steelhead can be incidentally collected during the trapping for fall Chinook broodstock at LFH, although it is very rare (Snake River Steelhead HGMP). These fish are sorted out at spawning and returned to the river. Under the new trapping protocol at LGR Dam, generally 10-20% of natural origin steelhead may be handled and released during the fall Chinook trapping period. Fish are examined for marks and released immediately back into the fish ladder.

ESA listed Columbia Basin bull trout are also present in the lower Snake River Basin, although they have never been documented as being trapped at LFH or LGR Dam during fall Chinook trapping. Therefore, Columbia Basin bull trout have not been indirectly affected by the trapping portion of the mitigation program as described. For more information regarding bull trout, please refer to the USFWS Lower Snake River bull trout recovery plan.

In-river concerns regarding fish released or returning from this program:

Summer steelhead – Snake River basin summer steelhead are comprised both of A-run and B-run components. Most A-run adults (60%) return to the basin after one year of ocean rearing. The remainder is 2-ocean age adults with an occasional 3-ocean age fish. Females generally predominate with a 60/40 sex ratio on average. Returning adults range in size from 54 to 85 cm and 1.4 to 6.8 kg. Adults generally enter the Columbia River from May through August, subsequently entering the Snake River from July through the following March. Adults in the lower Snake River basin (Washington State) may utilize tributaries to the mainstem. Most B-run adults (60 %+) return as 2-ocean age fish, with less returning as 3-ocean, and the least as 1-ocean age. Adults generally return in size from 70-100 cm and 3.0-10.0 kg. B-run fish enter the Columbia beginning in August and continue through early October. The extent of mainstem spawning for both runs is not well documented, but the interaction with fall Chinook is expected to be minimal because of the disparate spawning times for the two species.

Spawning begins in March in the tributaries and continues until May. Juveniles utilize a wide range of habitats throughout the basin including areas adjacent to smolt release locations. Most naturally produced smolts migrate after rearing for two years. A much lower percentage migrates after one or three years. Smolt out-migration through the lower Grande Ronde Basin extends from late winter until late spring, thereby overlapping with hatchery fall Chinook smolts releases as described for this program. Peak smolt movement is associated with increased flow events between mid-April and mid-May (Ann Setter – ODFW, pers. comm.).

Spring Chinook –Spring Chinook adults utilize the Snake River primarily as a migration corridor to reach to the headwater streams in the Tucannon, Clearwater, Grande Ronde, Imnaha, and Salmon River basins. Spawning in the mainstem has not been well documented. Juvenile utilization in the Snake River is minimal due to high summer water temperatures. Natural origin spring Chinook juveniles in the mainstem Snake River would likely rear for one year and smolt the following spring. However, due to growth potential, it may be possible to produce a sub-yearling smolt. Smolt migration from the basin begins in November (earlier in the Tucannon) and extends through early July, thereby overlapping with the hatchery fall Chinook production from this program (Mensik et al. 2010).

Juvenile hatchery fall Chinook released as smolts may compete for food and space with naturally reared spring Chinook following release. However, this is generally minimized because of release size, condition of fish at release (smolts), and migration timing. Predation by Chinook smolts is unlikely due to size constraints (See Section 3.5). As with the other species, hatchery-origin fall Chinook from this program have the chance to spread diseases to natural ESA listed populations during the migration period. Regional protocols are followed to ensure healthy fish upon release.

Sockeye - Sockeye adults utilize the Snake River primarily as a migration corridor to reach Redfish Lake in Idaho. Juvenile utilization in the Snake River is minimal due to high summer water temperatures. Smolt migration from the basin begins in November and extends through early July, thereby overlapping with the hatchery fall Chinook production from this program (Fish Passage Center).

Juvenile hatchery fall Chinook released as smolts may compete for food and space with naturally reared sockeye following release. However, this is generally minimized because of release size, condition of fish at release (smolts), and migration timing. As with the other species, hatchery-origin fall Chinook from this program have the chance to spread diseases to natural ESA listed populations during the migration period. Regional protocols are followed to ensure healthy fish upon release.

Bull trout – Both fluvial and ad-fluvial life history forms of bull trout inhabit a number of tributaries to the lower Snake River. The lower mainstem in Washington State is likely utilized as a migration or over-wintering corridor. Fluvial adults migrate into tributary headwater areas during summer and early fall. Spawning for both resident and fluvial adults occurs in late August through October. Fry emerge during the spring or summer. Juvenile rearing is restricted to headwater areas by higher water temperatures downstream, and therefore bull trout juveniles will not be located in areas of hatchery fall Chinook juveniles from this program.

However, juvenile hatchery fall Chinook released as smolts may compete for food and space with the fluvial and resident forms of bull trout as some degree of extended rearing by hatchery fall Chinook following release is expected. Time spent together may be limited because of release size, condition of fish at release (smolts), and time of release. Predation of hatchery fall Chinook on bull trout in the migration corridor is not likely limited due to size (See Section 3.5). Bull trout associated with areas influenced by migrating or residual hatchery fall Chinook are generally fluvial adults and are more likely to out-compete or prey on hatchery fall Chinook due to a significant size advantage. As with the other species, hatchery-origin fall Chinook from this program have the chance to spread diseases to natural ESA listed populations during the migration period. Regional protocols will be followed to ensure healthy fall Chinook at release.

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

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

Fall Chinook – The Hatchery Effects Report for Protected Salmon & Steelhead of the Interior Columbia Basin working paper of the FCRPS Remand Hatcheries and Harvest working Group (2006) states that there is good reason to believe that the Snake River fall Chinook programs have increased spatial structure, genetic resources and probably abundance. Hatchery programs have helped jumpstart the ESU, and natural-origin fall Chinook returns have increased from <100 in 1990 to between 2,000 and 5, 000 from 2001-2004 (Table 16). Spatial distribution has expanded into the Clearwater and lower Grande Ronde River sub-basins and changes of the Umatilla hatchery program has reduced straying from outside the basin and threats to fall Chinook diversity. It was documented in the NOAA Fisheries USBR Upper Snake Actions (2008) that under the current conditions the available area below Hells Canyon Dam has demonstrated the capacity to support at least 5,000 spawners. The ICTRT has set a recovery abundance threshold of 3,000 spawners to meet viability goals for abundance at <5% risk of extinction (ICTRT 2007).

Table 16. Natural and hatchery origin (includes all hatcheries) adult fall Chinook passed above LGR Dam to continue migration to spawning areas. Data compiled using LSRCP annual reports, IDFG harvest data, NPTH spawning data. (Mendel et al. 1993, 1994, 1995; Wargo et al. 1999; Milks and Varney 2000; Milks et al. 2003, 2006, 2007, 2009, 2010; Sands 2001)

Year	Natural Adults [a]	Hatchery adults	Snake River redds	Asotin Creek redds	Clearwater River basin redds	Grande Ronde River basin redds	Imnaha River basin redds	Salmon River basin redds
1988	368	259	64	0	21	1	1	0
1989	295	411	58	0	10	0	1	0
1990	78	258	37	0	4	1	3	0
1991	316	274	46	0	4	0	4	0
1992	549	119	47	-	26	5	3	1
1993	742	210	127	-	36	49	4	3
1994	406	201	67	-	37	15	0	1
1995	350	285	65	-	20[a]	18	4	2
1996	639	280	104	-	69	20	3	1
1997	796	211	58	-	72	55	3	1
1998	304	658	185	-	78	24	13	3
1999	905	957	373	-	191	13	9	0
2000	1171	1497	346	-	173	8	9	0
2001	5216	5291	709	-	336	197	38	22
2002	2235	8155	1113	-	527	111	72	31
2003	3856	9649	1512	3	572	93	43	18
2004	4756	9870	1709	4	631	162	35	21
2005	2704	7421	1442	6	487	129	36	27
2006	2433	5351	1025	1	514[b]	42	36	9
2007	1762	8565	1117	0	718	81	17	18
2008	1853	15413	1819	3	965	186	68	14

[a] Adult criteria was ≥ 56 cm total length (≥53cm fork length) to match criteria used at the fish counting window at LGR Dam.

[b] Not full counts. No surveys after 11/21 in 1995 and 10/30 in 2006 due to rains and turbid water conditions.

The Biological Review Team (Good et al. 2005) characterizes the risk of the distribution VSP factor as "moderately high" because approximately 85% of historical habitat is inaccessible and the distribution of the extant population makes it relatively vulnerable to variable environmental conditions and large disturbances. In addition, the BRT characterizes the risk for diversity VSP factor as "moderately high" because of the loss of diversity associated with extinct populations and the significant hatchery influence on the extant population. A draft ICTRT Current Status Summary (ICTRT 2007) characterizes the long-term (100 year) extinction risk, calculated from productivity and natural origin abundance estimates of SR fall Chinook during the 1977-1999 brood year "base period" for recruit/spawner productivity estimates, as "High" (>25% 100 year extinction risk). In these analyses, the ICTRT defines the quasi-extinction threshold (QET) for 100-year extinction risk as fewer than 50 spawners in four consecutive years (QET=50). The ICTRT also calculated the extinction risk based on the 1990-1999 time period and determined that it was "moderate" (6-25% 100-year extinction risk). The ICTRT indicates that the extinction risk is likely between these estimates ("moderate" to "high"). The ICTRT assessments are framed in terms of long-term viability and do not directly incorporate short-term (24-year) extinction risk or specify a particular QET for use in analyzing short-term risk. If hatchery supplementation is assumed to continue at current levels for Snake River fall Chinook, the short-term extinction risk is 0% at all QETs (Hinrichsen 2008). Designated critical habitat for Snake River fall Chinook includes all Columbia River estuarine areas and river reaches proceeding upstream to the confluence of the Columbia and Snake Rivers; all Snake River reaches from the confluence of the Columbia River upstream to Hells Canyon Dam; the Palouse River upstream to Palouse falls; the Clearwater River upstream to its confluence with Lolo Creek; and the North Fork Clearwater river upstream to Dworshak Dam. Critical habitat also includes river reaches presently or historically accessible in the following subbasins: Clearwater, Hells Canyon-Imnaha, Lower Grande Ronde, Lower North Fork Clearwater, Lower Salmon, Lower Snake, Lower Snake-Asotin, Lower Snake-Tucannon, and Lower Snake-Palouse.

The SCA (NOAA et al. 2008) identified that the Snake River (SR) fall Chinook is a threatened species composed of one extant population in one major population group (MPG). Two historical populations have been extirpated. This population must be highly viable to achieve the ICTRT's suggested viability scenario (ICTRT 2007a). Key statistics associated with the current status of SR fall Chinook salmon are summarized in Tables 8.2.2-1 through 8.2.2-4 of the SCA.

The key limiting factors and threats for the Snake River fall Chinook include hydropower projects, predation, harvest, degraded estuary habitat, and degraded mainstem and tributary habitat. Ocean conditions have also affected the status of this ESU. Ocean conditions affecting the survival of Snake River fall Chinook were generally poor during the early part of the last 20 years.

The ICTRT recommends that no fewer than 2,500 of the 3,000 natural-origin fish be mainstem Snake River spawners. Total returns of fall Chinook over Lower Granite Dam increased steadily from the mid-1990s to the present. Natural returns increased at roughly the same rate as hatchery origin returns (through run year 2000), since then hatchery returns have increased disproportionately to natural-origin returns (Figure 2). The median proportion of natural-origin has been approximately 32% over the past two brood cycles (Cooney and Ford 2007). The spawning populations in the lower Grande Ronde, Clearwater, Imnaha, and Salmon rivers are considered part of the larger composite population for the entire Snake River Basin. Spawners consist of natural- and hatchery-origin fish (LFH and NPTH– which rears Snake River stock fall Chinook). LFH fall Chinook hatchery releases occur throughout the Snake River Basin from LFH and Idaho Power Company (IPC) facilities, acclimation facilities operated by the NPT, in the Clearwater Basin from an acclimation facility operated by the NPT, and in the Grande Ronde River as a direct release.

The driving factors for the recent increase may include reduced harvest rates, improved in-river rearing and migration conditions, the development of life history adaptations to current conditions, improved ocean conditions benefiting the relatively northern migration pattern, the supplementation program, or other factors. At this time, there is insufficient information to estimate the relative contributions of these factors (Cooney and Ford 2007).

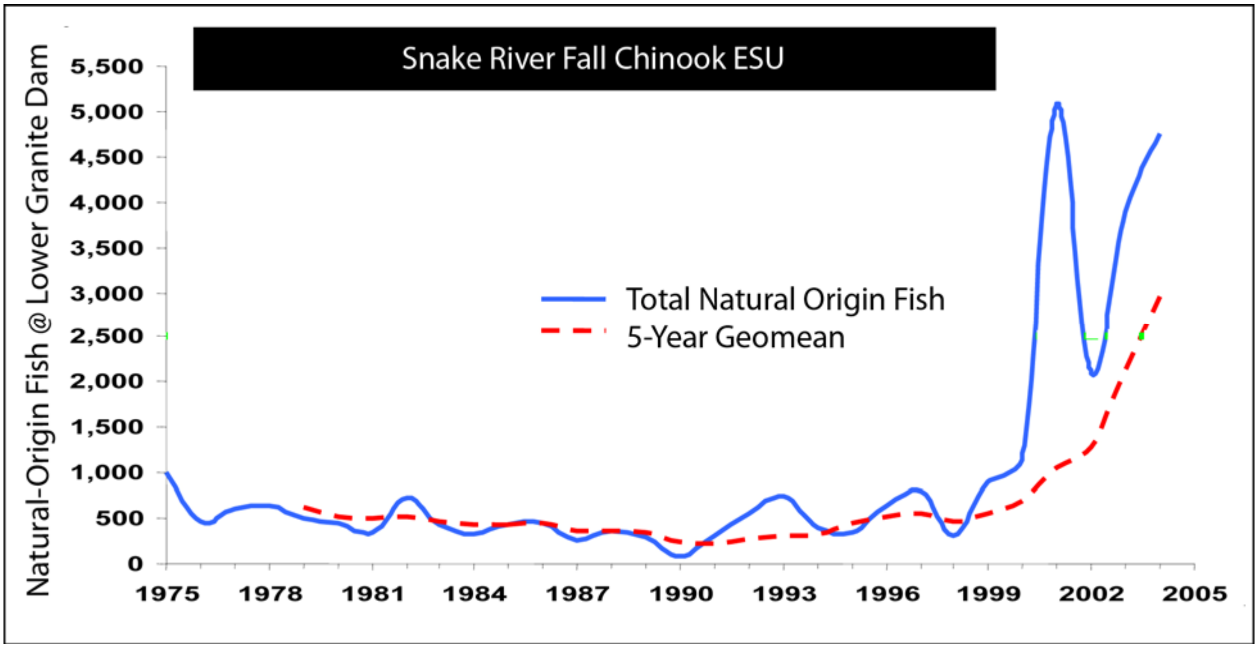


Figure 2. Figure 8.2.2.1-1 in the SCA - Snake River Fall Chinook Salmon Abundance Trends (adopted from Fisher and Hinrichsen 2006)

Snake River Spring/summer Chinook – is a threatened species composed of 28 extant populations in five major population groups (MPGs) in the Snake Basin. Key statistics associated with the current status of Snake River spring/summer Chinook salmon are summarized in Tables 8.3.2-1 through 8.3.2-4 of the SCA (NOAA et al. 2008). Following is a short summary of population status from the SCA.

The key limiting factors and threats for the Snake River spring/summer Chinook include hydropower projects, predation, harvest, degraded estuary habitat, and degraded tributary habitat. Ocean conditions generally have been poor for this ESU over the last 20 years, improving only in the last few years. Eleven populations spawn in wilderness areas, where the habitat is considered functional.

For all populations, average abundance over the most recent 10-year period is below the average abundance thresholds that the Interior Columbia Technical Recovery Team identifies as a minimum for low risk (See SCA Table 8.3.2-1 (NOAA et al. 2008).

Abundance for most Snake River spring Chinook populations declined to extremely low levels in the mid-1990s, increased in the early 2000s, and are now at levels intermediate to those of the mid-1990s and early 2000s (Figure 3).

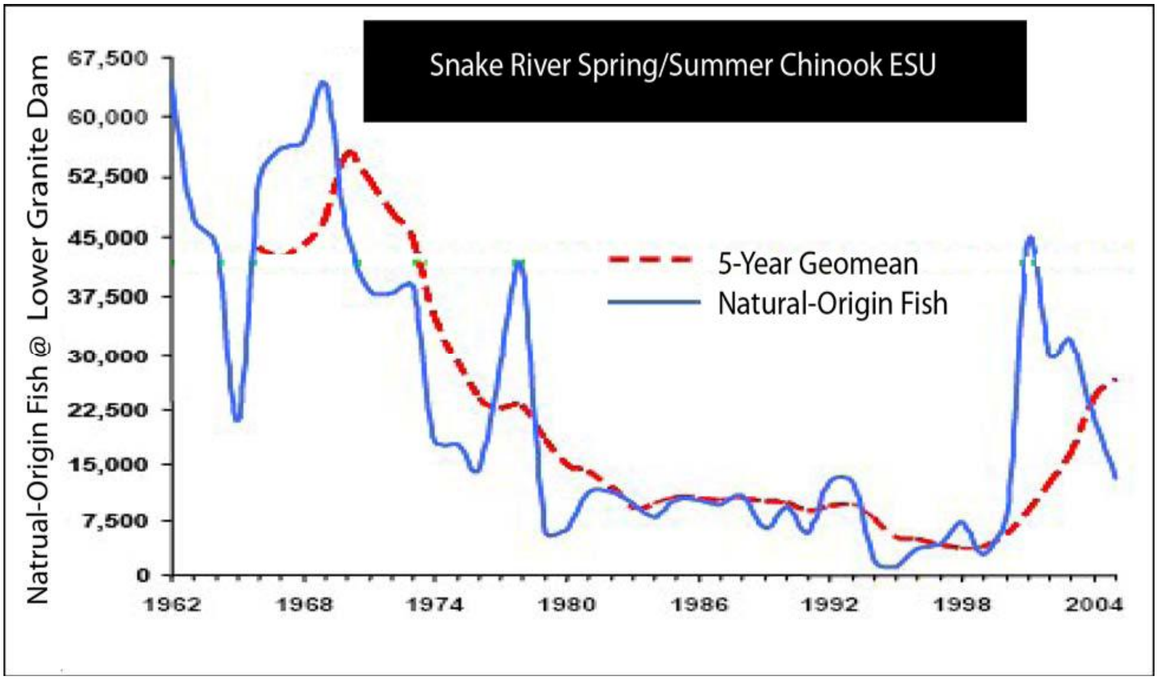


Figure 3. Figure 8.3.2-1 in the SCA - Snake River Spring Summer Chinook Abundance Trends (adopted from Fisher and Hinrichsen 2006).

Tucannon River spring Chinook is listed as "threatened' under the ESA as part of the Snake River spring/summer Chinook ESU. Substantial use occurs in the mainstem of the Tucannon above Rkm 25. Spawning and rearing does not generally overlap with fall Chinook in the Tucannon, which utilize the lowest reaches of the drainage.

Snake River Summer Steelhead- The Snake River steelhead DPS includes all anadromous populations that spawn and rear in the mainstem Snake River and its tributaries between Ice Harbor and the Hells Canyon hydro complex, and were. There are five major population groups (MPG) with 24 populations. Inland steelhead in the Columbia River Basin are commonly referred to as either A-run or B-run based on migration timing and differences in age and size at return. A-run steelhead are believed to occur throughout the steelhead streams in the Snake River Basin, and B-run are thought to be produced only in the Clearwater and Salmon rivers. This DPS was listed under the ESA as threatened in 1997 and reaffirmed in 2006.

Key statistics associated with the current status of Snake River steelhead are summarized in Tables 8.5.2-1 through 8.5.2-4 of the SCA (NOAA et al. 2008). Following are excerpts that summarize the population status from the SCA.

Historically, the key limiting factors for the Snake River steelhead included hydropower projects, predation, harvest, hatchery effects (NMFS 1999; NPPC 1999), and tributary habitat. Ocean conditions have also affected the status of this DPS. These generally have been poor over at least the last 20 years, improving only in the last few years.

The abundance of Snake River steelhead has been stable or increasing for most A-run and B-run populations during the last 20 brood cycles. On average, the natural-origin components of the A-run populations have replaced themselves whereas the natural-origin components of the B-run populations have not.

Population-specific adult population abundance is generally not available for SR steelhead due to difficulties conducting surveys in much of their range. To supplement the few population-specific estimates, the ICTRT used Lower Granite Dam counts of A-run and B-run steelhead and apportioned those to A- and B-run populations proportional to intrinsic potential habitat (Appendix A of ICTRT 2007c). The ICTRT generated 10-year geometric mean abundance estimates for two populations in the Grande Ronde MPG and reported average A-run and average B-run abundance as an indicator for the other populations. For the two Grande Ronde MPG populations, one recent average abundance exceeds the ICTRT abundance threshold and the second is below the threshold (Table 8.5.2-1). Both the A- and B-run averages are below the average abundance thresholds that the ICTRT identifies as a minimum for low risk. Abundance for Grande Ronde populations and the average A- and B-run populations, declined to low levels in the mid-1990s, increased to levels at or above the recovery ICTRT abundance thresholds in a few years in the early 2000s, and are now at levels intermediate to those of the mid-1990s and early 2000s. Figure 4 shows the 1980 to most recent abundance and 5-year geometric mean trends for the aggregate of all populations above Lower Granite Dam. The 5-year geometric mean increased from 1980, peaking in 1989 and decreasing throughout the 1990s. Aggregate abundance of natural-origin fish peaked in 2002 and the 5-year geometric mean has been increasing since 2000.

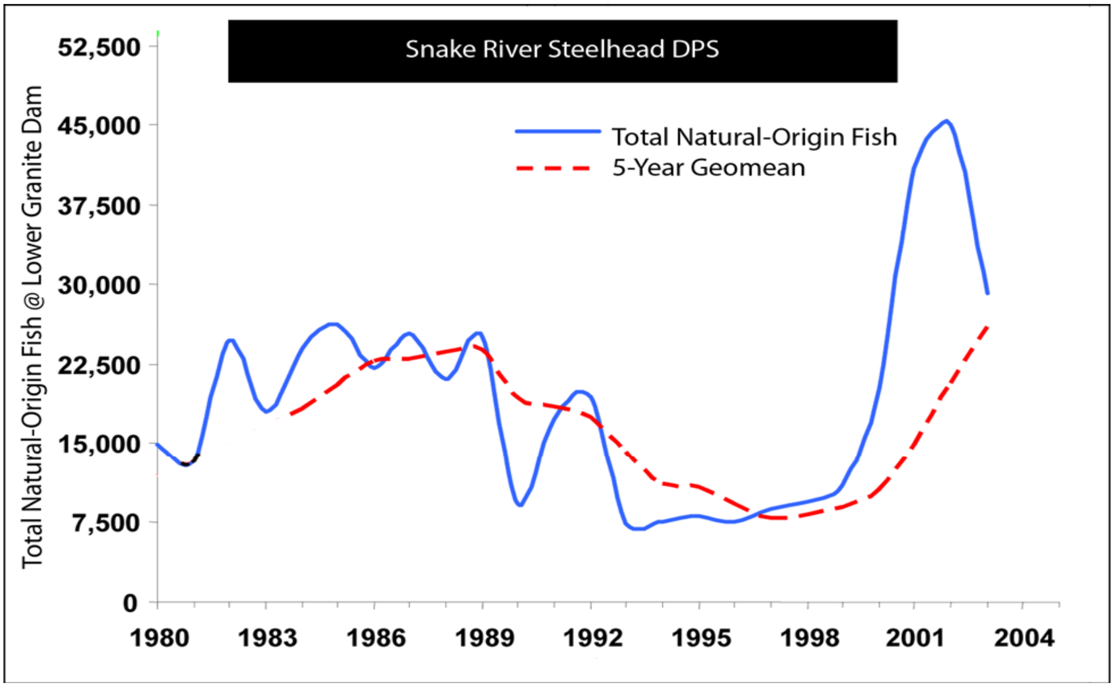


Figure 4. Figure 8.5.2.1-1 in the FCRPS BiOp Supplemental Comprehensive Analysis - Snake River Steelhead DPS Abundance and 5-Year Geometric Mean (adopted from Fisher and Hinrichsen 2006).

Snake River Sockeye – The Snake River sockeye salmon ESU includes all anadromous and residual sockeye from the Snake River basin, Idaho, as well as artificially propagated sockeye salmon from the Redfish Lake Captive Broodstock Program. Snake River sockeye are currently listed as "endangered" under the ESA.

Statistics associated with the current status of Snake River sockeye are summarized in Chapter 8.4 of the SCA (NOAA et al. 2008). Following are excerpts that summarize the population status from the SCA.

Sockeye salmon were historically numerous in many areas of the Snake River basin prior to the European westward expansion. However, intense commercial harvest of sockeye along with other salmon species beginning in the mid-1880s; the existence of Sunbeam Dam as a migration barrier between 1910 and the early 1930s; the eradication of sockeye from Sawtooth Valley lakes in the 1950s and 1960s; the development of mainstem hydropower projects on the lower Snake and Columbia Rivers in the 1970s and 1980s; and poor ocean conditions in 1977 through the late 1990s probably combined to reduce the stock to a very small remnant population. Snake River sockeye salmon are now found predominantly in a captive broodstock program associated with Redfish and the other Sawtooth Valley lakes (NMFS 1991a). At the time of listing, one, one, and zero fish had returned to Redfish Lake in the three preceding years, respectively.

This species has a very high risk of extinction. Between 1991 and 1998, all 16 of the natural-origin adult sockeye salmon that returned to the weir at Redfish Lake were incorporated into the captive broodstock program. Between 1999 and 2007, more that

355 adults returned from the ocean from captive broodstock releases—almost 20 times the number of wild fish that returned in the 1990s.

Bull Trout – Natural origin fluvial and ad fluvial bull trout in the Snake River are listed as "threatened" under the ESA as part of the Columbia basin bull trout distinct population segment (DPS). In the Washington portion of the Snake River, sub-populations of bull trout exist only in tributaries of the Snake River because of habitat requirements for spawning and rearing.

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

Data are not available at this time. It is noted that the interpretation of annual variations in progeny to parent ratios of naturally reproducing fish is difficult because the confounding effect of spawner density needs to be removed as one step of the analysis. The progeny to parent ratio observed when the parental numbers are many, will invariably be lower than when the parental numbers are few. Without means for standardizing this density dependent dynamic, the comparison of progeny to parent ratios among different years can easily lead to erroneous conclusions about population status. In addition, this population is exposed to large variations in downstream passage and ocean survival. These variations also can seriously confound the interpretation of progeny to parent ratios, unless standardization is developed for this factor as well. In the case of this population, over all smolt to adult survival estimates are not available, which could be used as a tool for this standardization. Since Snake River fall Chinook are mainstem spawners, it is difficult to determine productivity or survival data by life stage. There is a smolt trap operated by the IDFG on the Snake River just above the confluence with the Clearwater River. The smolt trap only monitors fish using the Snake River corridor between Hells Canyon Dam and Lewiston and does not function for fall Chinook. There are also smolt traps in the lower Tucannon, Clearwater, and Grande Ronde rivers.

The measure of productivity for Snake River Basin fall Chinook is currently estimated by trends in redd counts for several basins including the Clearwater, Grande Ronde, Imnaha, and Salmon rivers. Also, redd counts have fluctuated over the years and often are underestimated due to water clarity and weather conditions on the day the river is surveyed. Unfortunately natural fish productivity cannot be determined (separated) from the mixed natural/hatchery population. Currently, broodstock trapping at LGR Dam provides some indication of the abundance of natural and hatchery spawners returning to the Snake River and spawning grounds above LGR Dam.

- Provide the most recent 21 year (e.g. 1988-2008) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

See Table 16 and explanation under section 2.2.2 above.

- Provide the most recent 21 year (e.g. 1988-2008) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if

known.
See Table 16 and explanation under section 2.2.2. We are not able to evaluate spawning success of natural-origin fall Chinook that passed LGR Dam.

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

<u>Trapping activities</u>: ESA listed Snake River spring/summer Chinook, Snake River steelhead (Snake River ESU), and Sockeye are incidentally trapped at LGR Dam, while fall Chinook are being targeted. ESA listed Snake River spring/summer Chinook, and Snake River steelhead (Snake River ESU) are incidentally trapped at LFH, while fall Chinook are being targeted. Duration of trapping at LGR Dam is generally August 18-November 27. Trapping may end earlier if we have attained our full production needs. Take at LGR Dam has been addressed under Section 10 Permit #1530 until the end of 2010, however the managers have identified the intent to replace Section 10 permit #1530 with a Section 10 permit resulting from this HGMP. Occasionally, spring/summer Chinook are misidentified and shipped to LFH. It isn't until the fish dies or is seen at spawning that the fish is identified as a spring/summer Chinook. By then the fish is in too poor of condition to be returned to the spawning grounds and thus is kept from spawning in the wild. The LFH adult trap does not open until September 1 to avoid trapping spring/summer Chinook. At that time it is possible that listed Snake River spring/summer Chinook may be captured. When the fish are being trapped it is difficult to differentiate spring/summer Chinook from fall Chinook when they are coming down the sorting chute. Early in the season when fish are trapped, the fish are immediately shunted into a raceway and not sorted again until the last week of September. Spring/summer Chinook are confirmed at the traps through CWT recoveries. The average number of CWT spring/summer Chinook incidentally caught between 2005-2008 during fall Chinook trapping was five fish from LFH and seven fish from LGR Dam. Over the same years, approximately 6,300 fish annually have been trapped for the fall Chinook program and associated management needs.

Listed summer steelhead adults (Snake River ESU) will be incidentally trapped from August 18 through November at the LGR adult trap (Take Table 1). Under a new fall Chinook trapping protocol for the LGR Dam adult trap; 10-20% of fish passing the dam will be handled. As a result, a similar percentage of wild steelhead passing the dam at that time will be incidentally handled, and up to 3% of the total sample may be directly sampled for steelhead run composition information by Idaho Fish and Game Personnel. Those fish will be released back to the fishway to continue upstream to spawning areas. At LFH, all steelhead incidentally trapped will be placed in a holding pond with the fall Chinook. It is possible for these fish to be held up to 24 days before they are initially sorted. After sorting, they will be moved to the steelhead raceways, held an additional 21 days (chemical withdrawal period), then released into the Snake River. For estimated take, see Snake River Steelhead HGMP.

<u>Spawning, Rearing and Releases:</u> Once spawning begins, fish will be checked weekly, but fish to be released will still require a 21-day holding period because

of chemical withdrawal requirements. Rearing/release of fall Chinook from LFH has a potential for indirect take of listed fall Chinook that may be present in the mainstem of the Snake River. The release of Snake River Stock fall Chinook may incidentally affect (take) other listed salmonids (spring/summer Chinook, steelhead, bull trout) in the Snake River by displacement or competition. In addition, smolts that might residualize or over-winter will also compete for food and space, though we believe this is minimized because released fish are generally fully smolted to maximize emigration. An estimate of the annual take level to each of these species is not possible.

IPC Releases: Release of fall Chinook from Oxbow and Umatilla hatcheries has a potential for indirect take of listed fall Chinook that may be present in the mainstem of the Snake River. The release of Snake River Stock fall Chinook may incidentally affect (take) other listed salmonids (spring/summer Chinook, steelhead, bull trout) in the Snake River by displacement or competition. In addition, smolts that might residualize or over-winter will also compete for food and space, though we believe this is minimized because released fish are generally fully smolted to maximize emigration. An estimate of the annual take level to each of these species is not possible

Smolt Trapping**:** Takes of out-migrating fall Chinook (natural and hatchery-origin) will occur at WDFW's smolt trap (Table 30) located on the mainstem Tucannon River (RKM 3) and from NPT's smolt trap located on the mainstem Clearwater River (N46.451358, W116.808117). The NPT is currently working under a Section 10 Permit #1134 that covers juvenile trapping activities. The traps will be operated from October to early July each year to capture natural-origin fall Chinook, natural- and hatchery-origin spring Chinook, and natural- and hatchery-origin summer steelhead. Smolt trapping enables WDFW and NPT staffs to estimate natural smolt production from the basin, and evaluate performance of hatchery releases. Some of the natural- and hatchery-origin fish captured will be measured, weighed and released. Small groups of captured fish (natural-origin) will receive a partial caudal fin clip for identification and transported back upstream about one kilometer and released to calculate trap efficiency. Most fish will be counted and released immediately back to the stream to continue their out-migration. During peak out-migration, fish may be held in live boxes for two to three hours before release (mark/recapture trial, or PIT tagged). At other times of year the trap may be checked only once a day. Delayed migration will result for fish captured in the trap, and delayed mortality as a result of injury may also result. Mortality of natural fall Chinook is expected to remain below 0.5% (based on previous records of smolt trapping in the Tucannon River from 1997-present).

Table 17. Requested take from the Nez Perce Tribe Section 10 Permit # 1134 application**.** Estimated number of adult and juvenile spring/summer and fall Chinook salmon to be captured in rotary screw traps, number to be PIT tagged, and estimated mortalities associated with these activities in the Imnaha River, South Fork Salmon River, Secesh River, Lake Creek, Johnson Creek, and Clearwater River.

ESU/Species and Population Group	**Life Stage**	Origin	**Take Activity**	Authorized Take	**Authorized Mortality**	Research Location	Research Period	Details
Fall Chinook Salmon	Juvenile	Natural	Capture, handle, release[1]	20,000	100	Clearwater River	May 1-Oct 1	Screw Trap
Fall Chinook Salmon	Juvenile	Hatchery Non-ad clipped	Capture, handle, release[1]	50,000	250	Clearwater River	May 1-Oct 1	Screw Trap
Fall Chinook Salmon	Juvenile	Natural	Capture, handle, tag, mark[2]	8,000	80	Clearwater River	May 1-Oct 1	Screw Trap
Fall Chinook Salmon	Juvenile	Natural	Capture, handle, tag, mark[2]	2,000	20	Clearwater River	May 1-Oct 1	Screw Trap

Netting Methods

Nez Perce Tribe in the Clearwater also utilizes beach seines, fyke nets, trawling, purse seining and minnow traps to sample juvenile fish for length, weight, scale samples, and other biological information and to mark fish with Passive Integrated Transponders for survival estimates. These activities are covered under Permit #1134. Fish are anaesthetized in a MS-222 bath (3 ml MS-222 stock solution (100 g/L) per 19 L of water) buffered with propolyaqua (PRO-NOVAQUA). Age groups will be determined through use of the scale method (Borgerson et al 1995, Carlander 1986, Davis and Light 1985, Hooton et al 1987, Jearld 1983, Schwartzberg and Fryer 1990, Seelbach and Beyerle 1984). Tissue samples from a fin clip will be used for genetic analysis. These surveys will allow collection of baseline information on existing fish densities, fish sizes, age structure, and genetic makeup in selected streams of naturally reproducing fish populations and populations supplemented with hatchery fish. Work plans are coordinated with appropriate management agencies prior to implementation of the project.

Beach seining will be accomplished with the use of a jet boat where appropriate and/or by wading in predetermined sampling sites. Beach seines are 100' x 6' x 3/16" mesh and 50' x 4' x 3/16" mesh in the Clearwater River and 20' x 6' (with a 4' inner bag) x 3/16" mesh, 15' x 6' (with a 4' inner bag) x 3/16" mesh, or 10' x 6' (with a 4' inner bag) x 3/16" mesh in the S.F. Salmon River. Fyke nets will have 4' square openings x 50' wings x 3/16" mesh and minnow traps are 16" long x 8" in diameter x 3/32" mesh. The latter two will be used overnight along reduced flow areas and checked and pulled out of the river the following morning. Trawling (10’X10’X30’) and purse seining (500’X 30’) will be conducted in the lower Clearwater River reservoir area (mouth to Rkm 4) using prop boats. Fish used for PIT tagging and/or for biological data collection will be held in 5 to 15 gallon containers, perforated/in-river or aerated, until released, depending on the project and length of time to be held.

Age 0+ Chinook salmon will be captured by beach seines and fyke nets along shoreline areas and in slack water areas with trawls and purse seines. All age 0+ fall Chinook salmon 60 mm and greater will be placed in 5 gallon holding buckets and transferred to a pan of anesthetic water (MS 222 at 60-70 ppm). All fish will be measured, weighed, and scanned for PIT tags. Previously PIT tagged fish will be allowed to recover (at least 15 min) and returned to the place of capture. Remaining fish will be PIT tagged as described by Prentice et al. (1990) and a sub-sample (up to 120/stream per sampling duration) will be caudal fin clipped (small portion of top lobe). The tissue sample will be placed in a buffer solution for DNA analysis. Scales will be taken from fish sub-sampled for genetic analysis and sent to the Columbia River Inter-Tribal Fish Commission (CRITFC) for establishing baseline growth and scale pattern data on the wild population. Genetic analysis (DNA) will also be conducted by CRITFC to determine stock (spring/summer or fall) and genetic profiles.

Table 18. Authorized take from the Nez Perce Tribe Section 10 Permit # 1134. Authorized number of fall Chinook salmon to be observed, collected using seines or fyke nets, trawls, purse seines, and estimated mortality due to observe/harass, capture/handle/release, and capture/handle/tag/mark (numbers in bold are totals for each sample method or take activity).

ESU/Species and Population Group	**Life Stage**	Origin	**Take Activity**	Authorized Take	**Authorized Mortality**	Research Location	Research Period	Details
Fall Chinook Salmon	Juvenile	Natural	Capture, handle, release[1]	5,000	20	Clearwater River	May 1-Oct 1	Beach Seine/ Fyke Net/Trawl/Purse Seine/Minnow Trap
Fall Chinook Salmon	Juvenile	Hatchery Non-ad clipped	Capture, handle, release[1]	8,300	32	Clearwater River	May 1-Oct 1	Beach Seine/ Fyke Net/Trawl/Purse Seine/Minnow Trap
Fall Chinook Salmon	Juvenile	Natural	Capture, handle, tag, mark[2]	10,000	100	Clearwater River	May 1-Oct 1	Beach Seine/ Fyke Net/Trawl/Purse Seine/Minnow Trap
Fall Chinook Salmon	Juvenile	Natural	Capture, handle, tag, mark[2]	10,800	156	Clearwater River	May 1-Oct 1	Beach Seine/ Fyke Net/Trawl/Purse Seine/Minnow Trap
				20,000	**200**			

[1] Estimated indirect mortality rate of 0.4%
[2] Estimated indirect mortality rate of 1.0%

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

Operation of the adult trap at LFH, during early fall, to collect hatchery broodstock will indirectly take spring/summer Chinook, and summer steelhead and will directly take listed Snake River ESU fall Chinook (both natural and hatchery origin). Current trap operations may prevent or delay upstream migration of a small number of summer steelhead and spring/summer Chinook that enter LFH. Fish entering the trap are processed daily, allowing non-targeted fish to be passed within 24 hours of trapping. In years of large numbers of returning fish, the trap at LFH will be operated intermittently, which may encourage the fish to swim upstream on the days we are not trapping. This will help decrease the stress associated with running the trap and shunting the fish back to the river.

Fall Chinook at LGR Dam are trapped by NMFS personnel, transferred to WDFW, transported to LFH, and subsequently used for broodstock at LFH. Beginning in 2004, the NPT began hauling fish from LGR Dam to NPTH. Listed Snake River fall Chinook will be collected and transported to LFH and NPTH in proportion to their presence in the ladder at the dam. This action is being taken as a consensus management action of the Managers to minimize the genetic difference between hatchery and wild components of the Snake River fall Chinook population

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

Table 19 shows the numbers of natural origin fish that contributed to broodstock at LFH since 2003. Pre-spawning mortality (Table 21) for natural origin fish was estimated at 6.3% for females and 1.7% for males in 2007 and 0% for females and 6.3% for males in 2008. These estimates are minimums because we do not know if the fish hauled back to the river early in the season would have survived to spawn if they had remained at the hatchery.

Full estimates of take as reported for the 1530 permit are included in tables 19-22 below for return years 2003-2008.

Table 19. Estimated numbers of natural origin fish used in broodstock at LFH.

Return year	Trapping location	Natural Females	Natural Males [a]	Natural Jacks [a] (≤53cm)	Naturals in Broodstock (%)	Total number of fish spawned [a] (LGR+LFH)	Mating protocol
2003	LFH	2	0	0	0.1	1560	Unknown x LF
2004	LGR LFH	118 9[b]	2 0	1 0	4.9	2645	Unknown x LF
2005	LGR LFH	110 1	122 2	6 0	9.1	2634	Unknown x LF
2006	LGR LFH	115 2	71 3	0 0	12.2	1567	Unknown x unknown and Unknown x LF
2007	LGR LFH	43 1	49 3	0 0	3.3	2915	Unknown x unknown
2008	LGR	110	54 0	0	6.4	2575	Unknown x unknown

[a] Fish that were used multiple times are only counted once.
[b] Includes one female that was a true jill (1 salt).

Table 20. Estimated numbers of natural origin fish used in broodstock at NPTH.

Return year	Trapping Location	Natural Females	Natural Males	Natural Jacks	Naturals in Broodstock (%)	Total number of fish spawned	Mating protocol
2003	NPTH	1	0	0	1.0	104	Random
2004	LGR NPTH	76 3	33 1	4 0	17.0	688	Random
2005	LGR NPTH	30 0	37 3	2 0	14.4	494	Random
2006	LGR NPTH	51 0	40 1	0 0	21.8	418	Random
2007	LGR NPTH	57 1	20 0	0 0	13.6	574	Random
2008	LGR NPTH	48 2	30 0	1 0	7.6	1064	Random

Table 21. Estimated mortality of natural origin fish at LFH that were intended for broodstock and numbers of fish returned to the Snake River alive.

Return year	Trapping location	Mortality Natural female	Mortality Natural male	Killed outright Natural female	Killed outright Natural male	LIVE fish Hauled back to river Natural female	LIVE fish Hauled back to river Natural male
2003	LFH	1	1	0	0	1	4M/2J
2004	LGR LFH	28 0	9M/10J 0	4 1	2M/4J 0	0 0	0 0
2005	LGR LFH	2 0	4M/1J 1	2 0	41M/2J 0	1 0	37 0
2006	LGR LFH	6 3	8 4	0 0	10M/1J 1J	0 0	0 0
2007	LGR	4	2	0	15	15	63
2008	LGR	5	15	1	2	9	26

Table 22. Estimated mortality of natural origin fish at NPTH that were intended for broodstock and numbers of fish returned to the Clearwater River alive.

Return year	Trapping location	Mortality Natural female	Mortality Natural male	Killed outright Natural female	Killed outright Natural male	LIVE fish Hauled back to river Natural female	LIVE fish Hauled back to river Natural male
2003	NPTH	0	0	0	0	0	0
2004	LGR NPTH	10 0	2 3	2 0	3 0	11[a] 9[a]	57[a] 41[a]
2005	LGR NPTH	1 0	2 1	0 0	7 1	0 0	0 0
2006	LGR	0	2	2	8	0	0

	NPTH	0	0	0	0	0	0
2007	LGR	2	3	1	14	0	0
	NPTH	0	0	0	0	0	0
2008	LGR	4	3	0	3	7	5
	NPTH	0	0	0	0	0	0

[a] Potential natural (no marks/tags, scales not taken).

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

See "Take" Table 29 at back of document.

Table 23. Summary take information from Nez Perce Tribe Permit #1134 for years 2002 to 2010 for, Seine, Fyke Net, Trawls, Purse Seines, and Minnow Traps, and Collection for Juvenile Chinook salmon.

ESU/Species and Population Group	**Life Stage**	**Take Activity**	Sample Year	Number of Fish Authorized for Take	Actual Number of Fish Taken	**Number Authorized for Unintentional Mortality**	**Actual Number of Unintentional Mortality**	Details
Fall Chinook Salmon	Juvenile	Observe	2002	2,000	1,294	0	0	Snorkel Surveys,
			2003	2,000	551		0	
Fall Chinook Salmon	Juvenile	Capture,Handle, Release	2002	2,000	160	100	0	Seines, Fyke nets, Minnow Trapping
			2003	2,000	240	100	21	
			2004	2,000	1,043	100	2	
			2005	2,000	**2,616[a]**	100	7	
			2006	2,000	1,983	100	30	
			2007	5,000	2,560	20	3	
			2008	5,000	926	20	0	
			2009	5,000	187	20	4	
			2010	5,000	13	20	7	
Fall Chinook Salmon	Juvenile	Capture,Handle, Mark, Release	2004	10,000	2,029	100	29	Seines, Fyke nets, Minnow Trapping
			2005	10,000	1,991	100	2	
			2006	10,000	1,290	100	9	
			2007	10,000	1,608	100	8	
			2008	10,000	851	100	9	
			2009	10,000	893	100	11	
			2010	10,000	2,803	100	8	

Table 24. Summary take information from Nez Perce Tribe Permit #1134 for years 2005to 2010 for, screwtraping for juvenile Chinook salmon.

ESU/Species and Population Group	**Life Stage**	**Take Activity**	**Sample Year**	**Number of Fish Authorized for Take**	**Actual Number of Fish Taken**	**Number Authorized for Unintentional Mortality**	**Actual Number of Unintentional Mortality**	**Details**
Fall Chinook Salmon	Juvenile	Capture,Handle, Release	2005	20,000	251	100	1	Screw trapping
			2006	20,000	900	100	2	
			2007	20,000	145	100	0	
			2008	20,000	262	100	0	
			2009	20,000	35	100	2	
			2010	20,000	98	100	52	
Fall Chinook Salmon	Juvenile	Capture,Handle, Mark, Release	2005	8,000	208	80	0	Screw trapping
			2006	8,000	312	80	1	
			2007	8,000	82	80	0	
			2008	8,000	246	80	0	
			2009	8,000	89	80	2	
			2010	8,000	172	80	3	

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

Take of natural adult and jack fall Chinook will not exceed 20% of the natural return because the trap at LGR Dam will not be set above that rate. At the LGR Dam Adult Trap, most (80-90%) fish pass unhindered above the trap to spawn naturally. Fish collected as part of systematic sampling are hauled to LFH or NPTH and held until spawning. Since NOAA's final determination to include Snake River Origin hatchery fish as threatened, we could exceed take levels and have to return fish to the river. Trapping at LFH would cease immediately, but trapping at LGR Dam would have to continue to sample CWTs from hatchery fish for run reconstruction purposes. Untagged fish at Lower Granite Dam in excess of broodstock needs will be scale-sampled and released above LGR Dam. Also, Fish are sorted on a daily basis by trap operators, or during the hatchery broodstock spawning operations at LFH that would allow excess listed fish to be returned to the river immediately.

Operation of the program described in this document is permitted based on the available information and population status at time of consultation. Significant changes in the population status may warrant re-initiation of consultation to assess the program. We propose the following criteria (or thresholds of change) as cause for re-consultation:

- If estimated natural population levels decrease to 50% of minimum abundance threshold (MAT),
- Programs are incapable of incorporating at least 10% NOF (3 year average) into the brood stock spawned at either LFH or NPTH by 2015,
- If significant disease or rearing problems arise at either hatchery causing >30% juvenile mortality.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery or other regionally accepted policies. Explain any proposed deviations from the plan or policies.

(e.g. "The hatchery program will be operated consistent with the ESU-wide plan, with the exception of age class at release. Fish will be released as yearlings rather than as sub-yearlings as specified in the ESU-wide plan, to maximize smolt-to-adult survival rates given extremely low run sizes the past four years.").

The Snake River fall Chinook program at LFH and the resulting production of fall Chinook is part of legally required mitigation under the LSRCP Program.

This program is consistent with:

- Northwest Power and Conservation Council's Artificial Production Review (APR-1999) According to the Artificial Production Review, the Council stated, "Management objectives such as for harvest opportunities, or for in-kind, in-place mitigation, or for protection of specific natural populations are all equally important."
- Middle Snake, Clearwater, Grande Ronde Subbasin plans
- Washington's Fish and Wildlife Commission adopted their "Policy on Hatchery Reform (2009)". Its purpose was: To advance the conservation and recovery of wild salmon and steelhead by promoting and guiding the implementation of hatchery reform. Hatchery reform is the scientific and systematic redesign of hatchery programs to help recover wild salmon and steelhead and support sustainable fisheries. The intent of hatchery reform is to improve hatchery effectiveness, ensure compatibility between hatchery production and salmon recovery plans and rebuilding programs, and support sustainable fisheries. Washington Fish and Wildlife Commission Policy: POL-C3619

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

Indicate whether this HGMP is consistent with these plans and commitments, and explain any discrepancies.

This HGMP is consistent with the following cooperative and legal management agreements. Where changes to agreements are likely to occur over the life of this HGMP, WDFW is committed to amending this plan to be consistent with the prevailing legal mandates.

– *Lower Snake River Compensation Plan* – LSRCP goals as authorized by Congress direct actions to mitigate for losses that resulted from construction of the four Lower Snake River hydropower projects. The program is not consistent with smolt production levels as outlined in original LSRCP. The proposed program will continue to support a substantial tribal and sport harvest level. WDFW is still attempting to reach adult return goals to support harvest.

– *US vs. Oregon* - The hatchery program outlined within this HGMP is consistent with the current 2008-2017 Management Agreement for salmon, steelhead and other species pursuant to United States of America v. State of Oregon, U.S. District Court, District of Oregon. Appendix B4B provides hatchery smolt production agreements of the *US vs. Oregon* negotiations and the intent to provide fish for harvest in tribal and sport fisheries into the future.

- *Fisheries Management and Evaluation Plan (FMEP).* – FMEPs for Snake River fisheries are currently being drafted by WDFW, which will describe in detail the current fisheries management within the Snake River Basin (including the Grande Ronde). Fishery management objectives within the FMEP and this HGMP are consistent.

- *WDFW Wild Salmonid Policy.* Washington Department of Fish and Wildlife is directed by State and Departmental management guidelines to conserve and protect native fish and wildlife populations.

- *Snake River Salmon Recovery Plan* – The Governor of the State of Washington committed WDFW to cooperate and partner with regional governments to develop a science based and community supported strategy for salmon recovery. A draft plan was completed in December 2006. WDFW will continue to work with regional governments to recover salmon and steelhead populations in the Snake River Basin.
- *Tribal Resource Management Plan (TRMP) –* the Nez Perce Tribe has developed a TRMP to describe fisheries implemented by the Tribe for fall Chinook in the Snake Basin.
- *Hells Canyon Settlement Agreement –* IPC will "contract with appropriate state and federal agencies or otherwise provide for the trapping of sufficient fall Chinook salmon and the fertilizing and eyeing up of sufficient eggs to permit raising up to 1,000,000 fall Chinook salmon smolts." (FERC 1980). Refer to section 1.8
- *Idaho Power Company/US Army Corps of Engineers MOU –* When available, LFH will provide for trapping, holding, and spawning of sufficient adult fall Chinook salmon to provide for the production of 1,300,000 eyed eggs annually. Refer to section 1.8
- *Nez Perce Tribal Hatchery Memorandum of Agreement (MOA)* – a 25-year plan (2000-2025) for operation of Nez Perce Tribal Hatchery between Bonneville Power Administration and the Nez Perce Tribe. When needed, LFH will help provide broodstock for NPTH. Annual Operating Plans (AOP) are prepared and reviewed to guide the production each year in conjunction with periodic reviews and recommendations and are consistent with the NPTH AOP.
- *Draft Snake River Fall Chinook Recovery Plan -* The program goal to restore a viable natural population of fall Chinook in the Snake River will be guided in part by the recovery plan currently under development for the Snake River ESU. The primary units of the recovery plan are Major Population Groups (MPGs). The fall Chinook that exist in the Tucannon, Clearwater, Asotin, Grande Ronde, Salmon and Imnaha basins collectively represent one of these MPGs which the ICTRT refers to as the Lower Snake MPG. The remaining two MPGs that existed above Hells Canyon Dam have been identified as extirpated. For the ESU to achieve recovery all MPGs would have to be viable or the remaining one achieve Highly Viable status. A determination of whether or not a MPG is viable is dependent on the status of the constituent populations. In the case of the Snake River fall Chinook, the remaining population must achieve highly viable status for the MPG to be judged viable. As described in the draft recovery plan, the general strategy is to use hatchery fish to help speed the recovery of Snake River fall Chinook. Therefore, within the Snake River basin, the recovery strategy includes the implementation of a conservation hatchery program with the intent to balance the adverse short-term impacts on diversity versus the long-term risk of population extirpation.

  Recovery Plan Strategy The abundance of natural origin spawners in the Snake population was critically low, having a mean of 520 passing Lower Granite Dam during the years 1975-2000. This represents only 0.208 of the level necessary to meet the Minimum Abundance Threshold (MAT) of 2,500 established by the ICTRT for this population. Recent years have seen natural origin spawners estimated at over 4,300 and average nearly 3,000. As such, this population has responded to conservation and supplementation efforts and is not likely to suffer demographic collapse which could lead to extirpation. The ongoing strategy for this population was developed to address the immediate concern and relies on the use of hatchery fish to do so. A hatchery broodstock, initiated from natural adults returning to the population and maintained at LFH through concerted efforts to exclude Columbia River strays, will be used to supplement the natural population and reduce its chances of demographic extinction. In the long term, the hatchery program will provide for gene banking and fishery benefits and efforts will be expanded to increase the annual contribution of natural-origin fish into the brood stock. Monitoring and future management of returning adults will also be used to achieve the balance between demographic risk of extinction and the genetic and ecological risks associated with hatchery fish consistent with the long-term goal of population recovery and achievement of a demographically independent naturally reproducing population. Specific actions to achieve this goal will be developed in a manner that is acceptable to the co-managers and consistent with obligations under the US v Oregon agreement.

3.3) Relationship to harvest objectives.

Explain whether artificial production and harvest management have been integrated to provide as many benefits and as few biological risks as possible to the listed species. Reference any harvest plan that describes measures applied to integrate the program with harvest management.

As an Integrated Recovery Program, and Mitigation program, the production of Snake River fall Chinook at LFH is intended to fulfill mitigation goals as outlined under the LSRCP, which called for in-place and in-kind replacement. Harvest would occur on this stock as part of the mitigation goal.

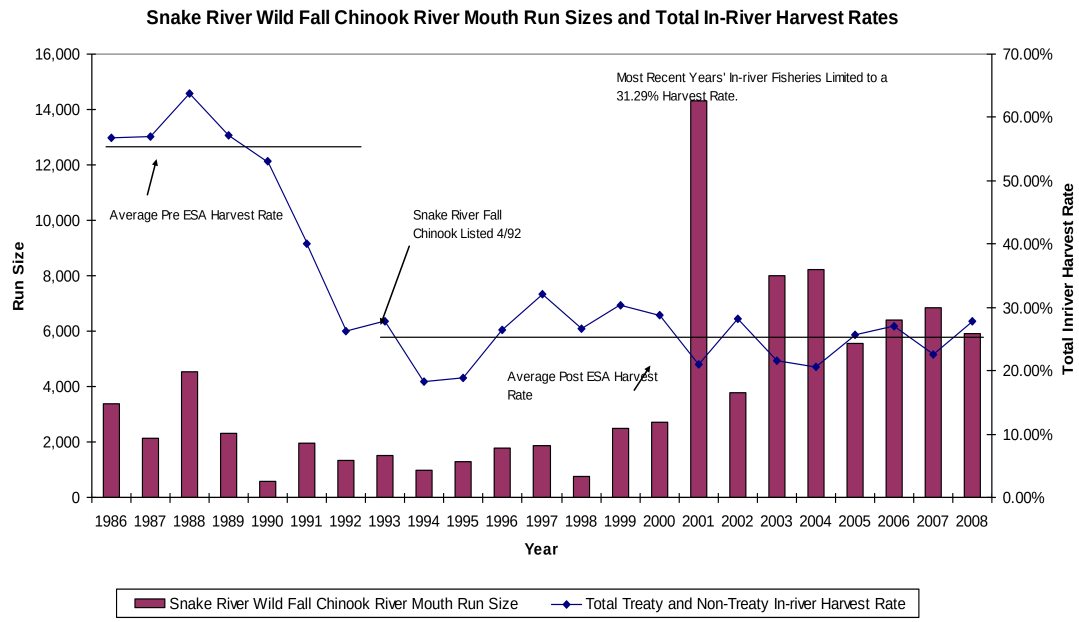
Harvest occurs on this stock in the ocean from Alaska to California and in the Columbia and Snake River basins. Snake Basin fisheries are promulgated by ID, WA, and NPT and most likely future fisheries by ODFW and CTUIR.

Describe fisheries benefiting from the program, and indicate harvest levels and rates for program-origin fish for six brood years (1988-97).

Snake River fall Chinook are present throughout ocean fisheries from Alaska to California, and in fall season fisheries in the mainstem Columbia River. Incidental catch occurs in fisheries that target harvestable hatchery- and natural-origin fish. The total ocean fishery exploitation rate averaged 46% from 1986 to 1991, and 31% from 1992 to 2006. Ocean fisheries have been required since 1996, through ESA consultation, to achieve a 30% reduction in the average exploitation rate observed during the 1988 to 1993 base period. In recent years, about 14% of the incidental take has occurred in the Southeast Alaska fishery, about 23% in the Canadian fishery (primarily off the west coast of Vancouver Island), about 20% in the coastal fishery (primarily off Washington, and to a lesser degree off Oregon and Northern California:, about 11% in the non-treaty fishery in the Columbia River, and about 30% in the Columbia River tribal treaty fishery. The presence of large numbers of harvestable natural-origin fish in the fishing locations from other sources, and unclipped hatchery fish makes it infeasible to distinguish Snake River fall Chinook through means of mark-selective fishing techniques.

Snake River fall Chinook are also caught in fall season fisheries In the Columbia River with most impact occurring in Non-treaty and treaty Indian fisheries from the river mouth to McNary Dam. Fisheries affecting Snake River fall Chinook have been subject to ESA constraints since 1992. Since 1996, Columbia River fisheries have been subject to a total harvest rate limit of 31.29%. This represents a 30% reduction in the 1988 to 1993 base period harvest rate.

Figure 5.



Total harvest mortality for the combined ocean and in river fisheries can be expressed in terms of exploitation rates which provide a common currency for comparing ocean and in-river fishery impacts (Fisheries in the Columbia River are generally managed subject to harvest rate limits). Harvest rates are expressed as a proportion of the run returning to the river that is killed in river fisheries. The total exploitation rate had declined significantly since the ESA listing. Total exploitation rate averaged 75% from 1986 to 1991, and 45% from 1992 to 2006.

Multiple fisheries benefit from the fall Chinook mitigation program in the ocean and the Columbia River. Ocean and mainstem Columbia River fisheries have been mostly non-selective, although efforts are underway to move to selective sport fisheries in mainstem and tributary areas.

Snake Basin Harvest Forum

Nez Perce Tribal Fishery for Fall Chinook

The Tribe is in the process of preparing a long-term harvest plan for Snake River steelhead and fall Chinook. The objective of this long-term tributary harvest plan is to describe the Nez Perce Tribe's treaty fishery regime for Snake River steelhead and fall Chinook salmon in the Snake Basin and its tributaries. The Nez Perce Tribe will use the harvest framework as specified in the plan to determine its harvest share of fish in the basin.

At the basin scale, this Nez Perce tributary harvest plan:

1) provides a reasonable exercise of Nez Perce federally-secured treaty reserved fishing rights in the Snake River basin;
2) specifies annual Nez Perce fishing opportunities while acknowledging non-tribal fishing opportunities consistent with U.S. v. Oregon;
3) describes hatchery production that is covered by the *U.S. vs. Oregon* 2008-2017 Management agreement, including associated hatchery operations designed to benefit listed anadromous fish; and
4) establishes a framework to determine harvestable fish and to allocate harvest between Nez Perce treaty and non-treaty fisheries.

The foundation for the Nez Perce Tribe's treaty fisheries set forth in this Plan is the Tribe's 1855 Treaty with the United States. The Nez Perce Tribe's treaty-reserved fishing rights and fisheries in the Snake Basin continue to be critically important to the Tribe in maintaining and practicing its culture and ways of life.

Due to the Nez Perce Tribe's treaty fishing rights and geography in the Snake Basin, the Tribe's treaty harvest objectives and artificial propagation strategies are sensitive to and compatible with conserving and rebuilding local steelhead and salmon populations. The Tribe structures annual fisheries to ensure adequate fish distribution between harvest, hatchery and natural escapement objectives. Wild fish harvest impacts under this plan will be shared with non-treaty sport fishers. The Tribe expects to manage its fisheries consistent with this harvest plan once it is completed.

Each year, the Tribe will work cooperatively with the appropriate co-managers in developing annual fishery plans and harvest management. Proposed harvest rates are to be applied to total aggregate run of wild/natural fall Chinook projected to return to Snake River to determine Nez Perce treaty fishery harvest levels on an annual basis. The Tribe will provide to appropriate co-managers and NOAA Fisheries its annual fishery expectations based on predicted run forecast. Additional details regarding the Tribe's treaty harvest of Snake River fall Chinook will be provided in its long-term harvest plan.

IDFG Recreational Fishery for Fall Chinook

Listed SR fall Chinook and SR steelhead may be affected by recreational fisheries targeting adipose clipped hatchery fall Chinook. The current fall Chinook fishery was initiated in 2008. ESA coverage for the fishery is currently associated with the incidental encounters and take of fall Chinook in the steelhead fishery authorized in Permit 1481. IDFG will submit a new FMEP in 2010 that includes specific authorization for harvest of adipose fin clipped fall Chinook and incidental mortalities of unclipped fall Chinook associated with that harvest. The current fishery is confined to the Snake River from the mouth of the Clearwater River upstream to Halls Canyon Dam. The new FMEP will also include provisions for a fishery in the mainstem and Middle Fork of the Clearwater fishery in the event that future returns there include sufficient clipped hatchery origin fish for harvest.

No additional incidental mortality impacts are expected beyond those accounted for in the existing steelhead fishery because the fall Chinook fishery is incidental to the steelhead fishery. The recreational fall Chinook fishery occurs during a portion of the steelhead fishery fall season. Anglers are required to have a Salmon Permit to fish for and retain adipose clipped hatchery fall Chinook and a Steelhead Permit to fish for and retain adipose clipped hatchery steelhead. Department staff observed that the fall Chinook fishery in 2008 was low-key and incidental to the traditional recreational steelhead fishery. The Department found in 2008 that all anglers with a Salmon Permit interviewed in 2008 were targeting steelhead; retention of fall Chinook was essentially a bonus (J. DuPont, IDFG, personal communication). The Department anticipates that fall Chinook fishery will continue to be incidental to the steelhead fishery during the term of the FMEP, and few, if any, anglers will target fall Chinook without also targeting steelhead.

Fisheries target adipose-clipped hatchery populations in excess of broodstock needs, consistent with hatchery mitigation goals, Treaty and non-Treaty harvest sharing and ESA limitations on allowable incidental mortality from natural origin SR steelhead and fall Chinook. Only fall Chinook with a clipped adipose fin (as evidenced by a healed scar) may be kept. Only barbless hooks may be used when fishing for fall Chinook in the Clearwater River and the Snake River below Hells Canyon. All fall Chinook (and steelhead) with an intact adipose fin must be immediately released unharmed back to the water. The fall Chinook recreational fishery is incidental to the steelhead fishery, and not likely result in additional incidental mortality to listed species.

We compared the areas that sub-yearlings and yearlings released by WDFW (on-station at LFH, at CCD, or the GRR), NPT (FCAP), and IPC (HCD and PBL) were intercepted during 2008 as well as the saltwater age-at-interception. Comparisons were only done using ADCWT releases of both groups so any differences occurring because of mark selective fisheries would occur to both groups. Sub-yearlings (Tables 25-27) were taken primarily in ocean fisheries whereas yearlings (Tables 28 and 29) were taken nearly equally in ocean and freshwater fisheries. Harvest of yearlings occurred mostly in the Columbia River then in BC and WA ocean fisheries to a lesser extent. Sub-yearlings were harvested mainly in ocean fisheries in BC, WA and the Columbia River. The tables below underestimate total catch because they do not contain information from yearling and sub-yearling releases that were not adipose clipped. Although yearlings return or are intercepted at a higher rate than sub-yearlings at a saltwater age less than two, they also return at a higher rate for older salt water ages.

Table 25. Final locations of ADCWT sub-yearling fall Chinook released by WDFW to freshwater and ocean areas in 2008 by saltwater age.

Area	1-salt	2-salt	3-salt	4-salt	Total	% of total
Freshwater	264	2,453	31	3	2,751	75%
COL		216	12	2	229	6%
SN	264	2,238	19	1	2,521	69%
Ocean		875	22		898	25%
AK		9	9		17	0%

BC		507	12		518	14%
COL		32			32	1%
OR		40			40	1%
WA		288	2		290	8%
Grand Total	264	3,329	53	3	3,648	

Table 26. Final locations of ADCWT sub-yearling fall Chinook released by FCAP to freshwater and ocean areas in 2007 by salt water age.

Area	1-salt	2-salt	Total	% of Total
Freshwater	164	768	931	83%
COL		59	59	5%
SN	164	708	872	78%
Ocean		187	187	17%
AK		8	8	1%
BC		54	54	5%
COL		4	4	0%
OR		9	9	1%
WA		112	112	10%
Grand Total	164	955	1,118	

Table 27. Final locations of ADCWT sub-yearling fall Chinook released as part of IPC mitigation to freshwater and ocean areas in 2008 by saltwater age.

Area	1-salt	2-salt	Total	% of Total
Freshwater	106	593	699	73%
COL		94	94	10%
SN	106	499	605	63%
Ocean		258	258	27%
AK		5	5	1%
BC		130	130	14%
COL		8	8	1%
HS		26	26	3%
OR		10	10	1%
WA		79	79	8%
Grand Total	106	851	958	

Table 28. Final locations of ADCWT yearling fall Chinook released by WDFW to freshwater and ocean areas in 2008 by saltwater age.

Area	0-salt	1-salt	2-salt	3-salt	4-salt	Total	% of total
Freshwater	2,288	960	1,047	82	1	4,378	92%
COL			204	32	1	237	5%
OR			1			1	0%
SN	2,288	960	842	50		4,140	87%
Ocean			361	35	7	404	8%
AK			2	11		12	0%
BC			148	18	7	173	4%
COL			6			6	0%

OR			73			73	2%
WA			133	7		140	3%
Grand Total	2,288	960	1,409	117	8	4,782	

Table 29. Final locations of ADCWT yearling fall Chinook released by FCAP to freshwater and ocean areas in 2008 by saltwater age.

Area	0-salt	1-salt	2-salt	3-salt	4-salt	Total	% of Total
Freshwater	3,660	315	834	28	1	4,838	95%
COL			239	7	1	247	5%
SN	3,660	315	595	20		4,590	90%
Ocean			266	3		269	5%
AK			7	3		10	0%
BC			103			103	2%
COL			4			4	0%
OR			45			45	1%
WA			107			107	2%
Grand Total	3,660	315	1,100	30	1	5,107	

All of these fisheries are not necessarily consistent with LSRCP goals (returning fish to the Snake River), although they are consistent with *US vs. Oregon* management plans and principles for tribal and sport fisheries. All sport fisheries within the region are selective for hatchery-reared fish and require release of natural-origin fall Chinook (See WDFW and ODFW Snake River FMEP – in progress). Fisheries have occurred in the Snake River in 2008 and 2009, although very few fish were harvested. WDFW intends to continue to have fisheries in the Snake River when the run size is large enough to warrant it.

3.4) Relationship to habitat protection and recovery strategies.

Describe the major factors affecting natural production (if known). Describe any habitat protection efforts, and expected natural production benefits over the short- and long-term. For Columbia Basin programs, use NPPC document 99-15, section II.C. as guidance in indicating program linkage with assumptions regarding habitat conditions

Human development and land management impacts, consistent with those identified across the Columbia and Snake River basins, affect natural fall Chinook production in the Snake River. Loss of channel diversity, increased sedimentation, reduced stream flows, habitat constriction due to effects of irrigation withdrawn, water temperature, and inundation and loss of spawning/rearing habitat through dam construction, and fragmentation of habitat all affect productivity of natural fall Chinook populations within the watershed. No comprehensive review of the ecological health of the Snake River in Washington in relation to salmonid population status and recovery has been completed at this time. Limiting factors such as water temperature, channel stability, sediment load, and instream habitat (in tributaries to the mainstem) are known to exist in the basin, but the extent of these problems are un-quantified to date. State programs in place provide standards for activities on private land that might otherwise contribute to the problems listed above. Activities on public lands or federally funded actions must additionally meet Endangered Species Act listed species protection criteria developed through consultation with US Fish and Wildlife Service and National Marine Fisheries Service as well as National Environmental Policy Act (NEPA) review.

3.5) Ecological interactions.

Describe salmonid and non-salmonid fishes or other species that could (1) negatively impact program; (2) be negatively impacted by program; (3) positively impact program; and (4) be positively impacted by program. Give most attention to interactions between listed and "candidate" salmonids and program fish.

Predation **-** Predation requires opportunity, physical ability and predilection on the part of the predator. Opportunity only occurs when temporal and spatial distribution of predator and prey species overlaps. This overlap must occur not only in a broad sense but at a microhabitat level as well.

As hatchery fall Chinook smolts migrate downstream, avian (i.e. kingfishers, mergansers, gulls, terns) and mammalian (i.e. river otters, mink, etc.) predators will likely prey on them. While not always desired from a production standpoint, these hatchery fish provide an additional food source to natural predators that might otherwise consume listed fish.

Predation by hatchery fish on natural-origin smolts is less likely to occur than predation on fry (NMFS 1995). Salmonid predators are generally thought to prey on fish 1/3 or less their length (Horner 1978; Hillman and Mullan 1989; Beauchamp 1990; Canamela 1992; CBFWA 1996). However, Witty et al. (1995) concluded that predation by hatchery production on wild salmonids does not significantly impact naturally produced fish survival in the Columbia River migration corridor.

Relative size of proposed hatchery fall Chinook smolts released as sub-yearling smolts (75-95 mm) and yearling smolts (130-180 mm) are unlikely to prey on wild fall Chinook (35-95mm). Also, spring Chinook smolts (90-110 mm) and wild steelhead smolts (130-200 mm) should preclude any substantial predator/prey interaction among the migrating fish.

Timing and location of hatchery fall Chinook smolt releases at LFH, the FCAP satellites and releases from Oxbow Hatchery and Hells Canyon Dam and the distribution of listed species fry limit potential interaction. Yearling releases from LFH occur before most natural fall Chinook out-migration begins, while sub-yearling releases substantially overlay natural migration and similarity in size likely precludes any predation. In addition, spring/summer Chinook and summer steelhead spawn in upper reaches of tributaries which would limit potential interaction at the fry stage. Bull trout fry tend to maintain themselves in headwater spawning areas, and thus avoid interaction with hatchery fall Chinook smolts.

A varying percentage of hatchery fall Chinook releases do not migrate from the system and some have been documented as reservoir rearing (personal communication, John

Sneva, WDFW 2002). These fish, by remaining in the lower Snake River have an increased opportunity to interact with juvenile listed fish. At this time, it is not known at what level this is occurring in the Snake River.

Competition **-** Hatchery fall Chinook smolts have the potential to compete with natural spring/summer and fall Chinook, natural steelhead and bull trout juveniles for food, space, and habitat. The Species Interaction Work Group (SIWG, 1984) reported that potential impacts from competition between hatchery and natural fish are assumed to be greatest in the spawning and nursery areas and at release locations where fish densities are highest (NMFS 1995). These impacts likely diminish as hatchery smolts disperse, but resource competition may continue to occur at some unknown, but lower, level as smolts move downstream through the migration corridor. Canamela (1992) concluded that effects of behavioral and competitive interactions would be difficult to evaluate or quantify.

Steward and Bjornn (1990), however, concluded that hatchery fish kept in the hatchery for extended periods before release as smolts may have different food and habitat preferences than natural fish, and that hatchery fish will be unlikely be able to out-compete natural fish. Further, hatchery produced smolts emigrate seaward soon after liberation, minimizing the potential for competition with natural fish. Competition between hatchery-origin salmonids with wild salmonids, in the mainstem corridor was judged not to be a significant factor (Witty et al. 1995). All production fish described in this program are released as smolts to minimize the likelihood for interaction and adverse ecological effects to listed natural Chinook salmon juveniles, bull trout, and steelhead.

Bull trout associated with areas influenced by residual hatchery fall Chinook are generally fluvial adults and are more likely to out-compete and prey on hatchery fall Chinook because of a significant size advantage.

Disease - Hatchery operations potentially amplify and concentrate fish pathogens that could affect listed Chinook, steelhead, and bull trout growth and survival. LFH is supplied with constant temperature well water; as a result disease occurrence and the presence of pathogens and parasites is infrequent, although BKD and bacterial gill disease are common. When infestations or infections have occurred, they have been treated. Further evidence for the relative disease-free status of this stock at Lyons Ferry is the low mortality during rearing following typical early life stage losses. Documentation of disease in these stocks is accomplished through monthly, and pre-liberation, fish health examinations.

Returning adult fall Chinook held for spawning at the LFH potentially create a concentrated source of pathogens and parasites that they carry. The increase in risk posed to natural Chinook, steelhead and bull trout by these fish is considered minimal for several reasons. First, it is unlikely that the hatchery fall Chinook adults that return to the production facilities harbor any agents that naturally spawning steelhead and salmon do not also carry. Second, cold water temperatures during the winter for fall Chinook adults are not conducive to infectious disease processes. This reduces the potential for transmission between adults in holding ponds and from fish-to-fish in the natural habitat. Documentation of the disease status of the adult fall Chinook stocks is accomplished through annual fish health examinations of spawning adults. Results of these examinations over the past years indicate a low prevalence and incidence of serious fish pathogens and parasites in this stock. For the Snake River Stock program described here, bacterial kidney disease (BKD) has been most prevalent. Procedures described later (See Section 8 and Section 9) reduce the possibility of outbreaks in the hatchery.

Nutrient flow-Increased hatchery fish in the spawning grounds increase basin level marine nutrients available that have been shown to significantly benefit watershed health , excavate and loosen gravels to make it more useful on a continual basis through the process of redd construction, and provide a food source for direct consumption of carcasses by other fish.

SECTION 4. WATER SOURCE

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

For integrated programs, identify any differences between hatchery water and source, and "natal" water used by the naturally spawning population. Also, describe any methods applied in the hatchery that affect water temperature regimes or quality. Include information on water withdrawal permits, National Pollutant Discharge Elimination System (NPDES) permits, and compliance with NMFS screening criteria

WDFW

LFH- The hatchery has eight deep wells that produce nearly constant 52^0 F, fish pathogen-free water. The hatchery is permitted to pump up to 53,000 gpm (118.1 cfs). Presently, LFH is the main rearing site for Snake River stock fall Chinook. Adult fall Chinook are collected at the LFH adult trap and the LGR adult trap, and transported to LFH. Eggs are fertilized, incubated and hatched, and juveniles reared to the pre-smolt and smolt stages on well water. High concentrations of dissolved Manganese (variable among the eight wells), and particulate Manganese Oxide, is strongly suspected of limiting the density at which fall Chinook can be reared in raceways at LFH. While the water also has higher concentrations of other minerals (common in deep wells), no negative impacts on eggs or fish from these are known. Discharge from LFH complies with all NPDES standards where it enters the Snake River.

By Mid December, some eyed eggs are transported to the IDFG for incubation, rearing at Oxbow Hatchery facility, and release at Pittsburg Landing Acclimation facility or just below HC Dam Likewise, eyed eggs are transported to the ODFW for incubation, rearing at Umatilla Hatchery facility, and release below HC Dam and at Pittsburg Landing Acclimation facility

Fish reared at Irrigon hatchery for WDFW-Incubation from eye-up on occurs at Irrigon Hatchery using 5 cfs of temperature controlled well water (49 degrees Fahrenheit). Rearing at Irrigon is accomplished in 2 raceways and 6 circular starter tanks with an approximate total water supply of 46.6 cfs of well water. Combined program smolt production is limited by ground water available for rearing at Irrigon Hatchery.

IPC

Oxbow Fish Hatchery – OFH is supplied with both surface water pumped from the Snake River and groundwater pumped from two wells. Surface water from the Snake River supplies the adult holding ponds (for steelhead production and temporary ponding of spring Chinook salmon) and the juvenile raceways (for fall Chinook salmon rearing). Water is pumped from the Snake River by two 100-horsepower production pumps that each produce 8,000 gallons per minute (gpm) of water and have separate power sources. Only one pump operates at a time, so the second pump acts as an emergency backup. After river water passes over a wedge-wire screen to filter out organic matter, it flows through two aeration pump platforms before entering the four adult ponds. Surface water supplying the fall Chinook salmon juvenile raceways also passes over the wedge-wire screen before flowing into the river water head-box, through a flow control valve and entering the head-box for the juvenile raceways. At this point, raw surface water can be mixed with groundwater from the wells to adjust the water temperature before it enters the juvenile raceways. Water discharges from the raceways to Pine Creek, a tributary to the Snake River located on the west side of the OFH. Snake River water temperatures at this site vary throughout the year from seasonal lows of 34 degrees F in the winter to seasonal highs of 72 degrees F in the late summer.

The two groundwater wells are capable of providing a total of 550 gallons per minute (gpm) of constant temperature, pathogen-free water. One well (well #1) serves as the primary water source for egg incubation and is equipped with a 3-horsepower pump capable of producing 125 gpm. The other well (well #2) is equipped with a 10-horsepower pump capable of producing 425 gpm and has a separate power source from well #1. Water from well #2 is used primarily for fall Chinook salmon production in the juvenile raceways, but also serves as a backup water supply for egg incubation. Groundwater temperature is a constant 54 degrees F in well #1 and a constant 56 degrees F in well #2. Furthermore, a 70-horsepower water chiller capable of chilling water to 40 degrees F is available should hatchery personnel need to manipulate incubation water temperatures between 54 degrees F and 40 degrees F. Groundwater supplying fall Chinook salmon egg incubation is pumped from well #1 into an elevated surge tank in the hatchery building before distribution through two 4-inch PVC water lines to the 28 incubator stacks. Water discharges from the incubation room to the Snake River. OFH withdraws water per IPC's water rights granted in permit #G 15440 by the Oregon Water Resources Department (OWRD). Because OFH produces less than 20,000 pounds of fish per year and feeds less than 5,000 pounds of feed at any one time, no NPDES wastewater permit is required for this facility.

Umatilla Fish Hatchery – During years when the number of eyed fall Chinook salmon eggs available to IPC exceeded OFH's rearing capacity, IPC has contracted with ODFW's Umatilla FH to raise the remaining portion of eyed eggs received from Lyons Ferry FH. The Umatilla FH receives water from the Columbia River through a Ranney well system and four separate wells. The system was initially designed and constructed to produce a maximum of 15,000 gpm of water. However, several wells have been subject to failure, therefore actual water capacity at Umatilla FH is 5,500 gpm (Jack Hurst, ODFW, Umatilla FH). Water from the well system averages 54 degrees F. Umatilla FH withdraws water per the Bonneville Power Administration's (BPA) water rights granted in permit #G 10870 (certificate #72181) and permit #G 11210 (certificate #72182) by OWRD. Water discharged from Umatilla FH is monitored under the National Pollutant Discharge Elimination System (NPDES) general permit # 0300 J.

<u>*FCAP facilities*</u>

Pittsburg Landing acclimation site- The site has water pumped directly from the Snake River to the acclimation tanks by four, 4-inch diesel pumps. Water pumps are rented from a contractor because leasing appeared to offer the least cost over a ten-year life cycle. Each pump has a portable water intake screen that is placed into the river each year and connected to the pump by 120 ft of 6-inch plastic hose. The pumps provide 500 gpm of water and operate 24 hours each day throughout the 6-week acclimation period except for oil checks and servicing. A 1,000 gallon tank, placed within a spill containment barrier, supplies fuel for the pumps. The water is pumped to one of two12 ft. high water distribution boxes, containing degassing towers to remove nitrogen gas, before flowing through a series of downsizing pipes to the rearing units.

Big Canyon acclimation site-The site uses similar equipment to that of Pittsburg Landing.

Captain John acclimation site- The site is supplied with Snake River water by two independent 1,250 gpm submersible electric pumps. The pumps and intake screens were designed to be placed into the river and then removed following fish acclimation each year but were replaced in 2001 with permanent intake screens located in the main Snake River channel. The pump intake screens are provided with an air back flush system to remove debris and an alarm system is available to monitor flows.

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

(e.g. "Hatchery intake screens conform to NMFS screening guidelines to minimize the risk of entrainment of juvenile listed fish.").

<u>*WDFW*</u>

Water withdrawal at LFH is through wells, and effluent is discharged to the Snake River, in compliance with NPDES standards.

Irrigon

Water used at Irrigon FH for fall Chinook salmon production originates from the Columbia River via a Ranney well system. Effluent water is discharged under NPDES general permit # 300 J. Irrigon hatchery operates solely on pumped well water. No listed fish are subject to take from this water source.

<u>*IPC*</u>

Oxbow Fish Hatchery – Water utilized for hatchery production at OFH is pumped either from the Snake River or from two groundwater wells. Effluent water is discharged into Pine Creek or the Snake River in compliance with U.S. Environmental Protection Agency (USEPA) discharge. OFH is located upstream of Hells Canyon Dam, therefore no listed stocks are present in the vicinity of the hatchery water withdrawal structures.

Umatilla Fish Hatchery – Water used at Umatilla FH for fall Chinook salmon production originates from the Columbia River via a Ranney well system. Effluent water is discharged under NPDES general permit # 300 J. Umatilla Hatchery operates solely on pumped well water. No listed fish are subject to take from this water source.

FCAP facilities

Water supply intakes for the three acclimation sites are screened with NOAA compliant sized screens. Production from the acclimation sites does not exceed 20,000 lbs. of biomass and therefore does not require an NPDES permit.

SECTION 5. FACILITIES

Provide descriptions of the hatchery facilities that are to be included in this plan (see "Guidelines for Providing Responses" Item E), including dimensions of trapping, holding incubation, and rearing facilities. Indicate the fish life stage held or reared in each. Also describe any instance where operation of the hatchery facilities, or new construction, results in destruction or adverse modification of critical habitat designated for listed salmonid species.

5.1) Broodstock collection facilities (or methods).

WDFW

LFH - Adult salmonids enter a ladder at LFH that terminates in a trap. The trap will be checked daily, possibly more often, depending upon expected return. Fish are directed by an automated crowder to a chute where they are identified by species and directed to the appropriate pond where they are to be held until spawning, or returned to the river.

NMFS personnel with assistance from WDFW and NPT personnel, obtain additional broodstock for LFH through the operation of LGR Dam adult trap. Ten to 20 percent of the run passing LGR Dam is trapped daily starting in late August and continuing through November. Fall Chinook are anesthetized and some retained in holding ponds on site. Regular transportation of fish from the Dam to LFH is coordinated between NMFS/LFH/NPTH staffs. For more details on operational criteria and takes associated with the LGR trap, refer to Section 10 permit #1530 and 2011 NOAA Letter of Determination for ISEMP Research..

IPC

No broodstock are collected for IPC's fall Chinook salmon program at Oxbow Fish Hatchery. All broodstock are collected at WDFW's Lyons Ferry FH or at Lower Granite Dam under the direction of WDFW. IPC receives eyed fall Chinook salmon eggs from WDFW's Lyons Ferry FH per the MOU between IPC and COE dated May 31, 1984. However, if IPC's fall Chinook salmon program be expanded to include the collection of broodstock, the Hells Canyon Trap (HC) used for trapping adult steelhead and spring Chinook salmon for OFH could be used for trapping fall Chinook salmon as well. The HC Trap consists of an attraction channel with approximately 150 feet of ladder, the holding area (trap), and a loading hopper. During trapping, fish move from the trap into the loading hopper and are hoisted up 80 feet to a transport truck. Fish are then transported approximately 23 miles to OFH for processing. Because steelhead are also returning to the Snake River in the fall, the trapping of fall Chinook salmon at the HC Trap would require considerable handling of steelhead.

FCAP facilities

No broodstock are collected at the FCAP acclimation facilities.

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

WDFW

Transportation from LGR Dam to LFH

Captured adult fall Chinook are hauled from LGR Dam to LFH by WDFW personnel in a 5,578 L aerated, un-refrigerated tank truck, filled with water from LFH.

Transportation from LFH to Irrigon FH

Fingerlings and smolts are transported in tanker trucks ranging in size from 2400 to 5000 gallon capacity.

Loading density, dissolved oxygen and temperature criteria for transported adults will follow those outlined in the Oregon State Liberation Manual, section 7.

IPC

No adults are collected for IPC's fall Chinook salmon program; thus adult transportation at OFH is unnecessary. However, in the event that IPC's fall Chinook salmon program changes to include the collection of broodstock, an adult transportation vehicle (equipped with oxygen and a fresh flow agitator system) is available to transfer fish from the HC Trap to the adult holding ponds at OFH. IPC currently uses a 1,200-gallon capacity fish transportation vehicle to move adult steelhead from the HC Trap to Oxbow FH. This same vehicle could be used to transport adult fall Chinook salmon.

Sub-yearling fall Chinook salmon smolts are transported to their release sites in two 5,000-gallon, fully insulated smolt tankers owned by IPC. Each smolt tanker has three compartments (2,000-gallon front, 1,000-gallon middle, 2,000-gallon rear) and is equipped with liquid oxygen, five mechanical aerators (2 in front, 1 in middle, 2 in rear), eight micro-bubble oxygen diffusers (3 in front, 2 in middle, 3 in rear), six oxygen flow meters, and a low pressure liquid oxygen regulator.

FCAP facilities

Up to 150,000 fall Chinook salmon yearlings are transferred from LFH to each facility on or about 01 March, at a size of approximately 12 fish per pound. If sub-yearlings are available, up to 500,000 are transferred to each facility at 100 fpp in late April-early May. WDFW and NPT fish distribution vehicles share fish transport to all the acclimation facilities. LFH personnel provide schedules and facilitate loading and enumeration of the fish. Fish transport permits are requested and received before fish are distributed.

The Fall Chinook Acclimation Project (FCAP) transports both yearling and sub-yearling juveniles from LFH to the fall Chinook fish acclimation facilities. Transportation of the fish to the fall Chinook fish acclimation facilities is shared between LFH and the Nez Perce Tribe Fisheries Department.

Transportation: Prior to transport the truck and transport tanks are checked to be sure they are fully operational; including, fuel and oil levels, oxygen quantity, gauge function, meter operation and accuracy, tires and spares, and other operational and maintenance requirements are met, including vehicle licenses and permits

Coordination: Personnel from LFH and the Fall Chinook Acclimation Project (FCAP) coordinate a transport schedule for fish based upon the Annual Operating Plan. Transport may be changed due to weather, fish health, fish size and availability of transport vehicles.

- Personnel are briefed on destinations, purpose, contact persons and schedules that must be met to avoid errors in transport. Emergency release sites for fish being transported are the Snake, Clearwater or Salmon rivers.
- Trucks and tanks are cleaned and disinfected prior to use as a health and safety routine to avoid inception or dissemination of potential pathogens associated with fish transport.
- Prior to each new transport exercise, the truck and tanks are cleaned and disinfected.
- Tanks are not filled with water until arrival at the site where the fish are to be transported.
- At loading, care is taken to mix water sources to achieve an ambient temperature that will allow for directly releasing the fish into the receiving water without tempering. This procedure reduces the time fish are held in the transport tanks up to two hours. Ice may be added to the tanks if additional temperature moderation is needed.
- When needed, physiological support is given to transported fish by adding Poly-aqua (5ml (1 teaspoon) per 10 gallons of water) or salt (NaCl) at 1% is added to reduce transport stress and aid in wound healing.
- Loading density is always kept as low as possible. The Nez Perce Transport Vehicle has 8- 500 gallon tanks. The density during yearling transport does not exceed 0.75 pounds and 0.50 pounds during sub-yearling transfer for each tank.

5.3) Broodstock holding and spawning facilities.

WDFW

LFH - Fall Chinook collected at LGR Dam are held separately from those that voluntarily enter the LFH. All fish are held in concrete raceways (8.5 or 10 ft wide x 150 ft long x 4.3 ft deep). Each of the four 10 ft raceways holds 6,450 cubic feet (ft^3) of water, while the 8.5 ft. raceways hold 5,483 ft^3 of water. Fish are distributed among the ponds according to trapping origin (LGR or LFH), and whether they have been sorted and vaccinated.

During weekly spawning activities, fish are crowded into a channel, enter an elevator, are hoisted into the building and submerged in anesthetic, and then placed on the sorting table. Ripe Snake River origin fish (H&W) are killed and spawned.

IPC

No broodstock are collected for IPC's fall Chinook salmon program at OFH. All fall

Chinook salmon released as part of IPC's mitigation for the HCC are reared from eyed eggs that are received from Lyons Ferry FH. However, in the event that IPC's fall Chinook salmon program changes to include the holding and spawning of fall Chinook salmon broodstock, four adult holding raceways currently exist at OFH for steelhead and spring Chinook salmon. These same raceways could be used to hold adult fall Chinook salmon. The two largest raceways measure 105-ft long x 35-ft wide x 5-ft deep, providing 36,750 $ft^3$of holding area. The two smaller raceways measure 55-ft long x 35-ft wide x 5-ft deep, providing 19,250 $ft^3$of holding area. A center raceway measuring 70-ft long x 4-½-ft wide x 5-ft deep and is used to move fish into the spawning building. The spawning building is located adjacent to the holding ponds and consists of holding and sorting areas and a spawning table where eggs are collected and fertilized. Although broodstock facilities are presently on site at OFH, it should be noted that attempts to hold and spawn fall Chinook salmon broodstock at this facility in the late 1960s through mid 1970s were unsuccessful. Irresolvable water quality and disease issues at OFH limited IPC's ability to adequately sustain fall Chinook salmon production. If these facilities at OFH are used for fall Chinook salmon broodstock in the future, it is likely that water quality and disease issues similar to those experienced in the late 1960s would arise.

IPC plans to renovate the Oxbow FH following issuance of a new FERC operating license for the HCC. The primary focus of this renovation will be to improve spring Chinook salmon broodstock holding, summer steelhead broodstock holding, spawning and egg incubation, and fall Chinook salmon egg incubation and juvenile rearing. Consideration will also be given to the feasibility of holding fall Chinook salmon broodstock for spawning purposes.

5.4) **Incubation facilities**.

LFH- The incubation room at LFH is designed to accept and incubate eggs from individual females through the eyed stage. The south side incubation room holds four banks of 28 stacks, which hold 1,568 usable Heath trays. Each stack has its own water source. Water is single use flow through. Each female will be kept separate until eye-up. After eyeing is complete and ELISA and virus sample results are received, eggs will be combined, according to sample results, and placed in trays with substrate. Each tray will hold 5,000 eggs. Eggs with positive ELISA results will be kept separate or destroyed, according to fish health/production protocol. Eggs will hatch in the incubation trays and fry will be ponded in raceways at LFH.

Irrigon Fish Hatchery- Incubation at Irrigon FH occurs in 82 vertical trays with 5,000 eggs per tray. Eggs are incubated from the eyed to emerging fry in the incubation trays.

Oxbow Fish Hatchery – OFH's incubation room is located within a 28-ft x 60-ft single story, hatchery building that also contains the office and shop. The incubation room consists of twenty-eight 16-tray stacks of Marisource vertical flow incubators supplied by pumped pathogen-free well water, allowing for a total incubation capacity of 1.6 million eggs. A 70-horsepower water chiller capable of chilling water to 40 degrees F is available should hatchery personnel need to manipulate incubation water temperatures between 54 degrees F and 40 degrees F

Umatilla Fish Hatchery – Umatilla FH incubation equipment consists of four separate units of Marisource vertical flow incubator stacks. The number of incubator stacks and trays varies by unit, but provide a total of 552 individual incubation trays for fall Chinook salmon incubation. Water used for incubation can be supplied directly from the wells to the incubators or can be mixed with chilled water prior to entering the incubators. In addition to the 54 degrees F well water, three of the vertical flow incubator units can be supplied with well water mixed with 45 degrees F chilled water to supply a range of temperatures between 45 and 54 degrees F, provided that a flow of 300 gpm of chilled water is not exceeded. The fourth incubator unit can also be supplied with well water mixed with 38 degrees F chilled water to provide a temperature range between 38 and 54 degrees F, provided that the chilled water flow does not exceed 60 gpm.

5.5) Rearing facilities.

LFH- Initial rearing will occur in outside raceways, 10ft wide x 100 ft long x 2.8 ft deep, which run 600 gpm of well water per raceway. There are 37 outdoor raceways available for rearing at LFH. All fish will be feed a commercial dry or semi moist salmon diet by hand.

After fish reach fingerling size, the on-station yearling production group will be marked and placed into one of three 2.1-acre rearing lakes at LFH. Each lake is supplied with up to 4,200 gpm of well water. Fish rearing density at this point is very low. A pneumatic feeder mounted on a truck is used to present feed.

Beginning in 2003, large raceways 18 ft wide x 150 ft long x 4.3 ft deep were used to rear sub-yearling fish destined for transfer to the NPT. These raceways are supplied with well water at 3,000 gpm. Fish rearing densities will be very low ($\leq$0.10 lbs/ft^3). In 2009, the four large raceways were further divided to create eight smaller raceways for adult holding and rearing. This modification will provide greater flexibility for holding separate release groups at uniform densities, and for marking.

Irrigon Fish Hatchery- Rearing at Irrigon FH occurs in 6-ft diameter circular tanks for initial rearing, and the fish are moved to two raceways, 20-ft wide x 100-ft long x 4-ft deep each, after initial rearing to smolt size.

Oxbow Fish Hatchery – OFH presently has facilities to rear 200,000 fall Chinook salmon to release as sub-yearling smolts at approximately 45 fish per pound (fpp). Rearing facilities consist of two concrete raceways that measure 130-ft long x 6-ft wide x 4-ft deep each. A cement wall divides the first 30 feet of each raceway into two smaller nursery sections. The head-box and outlet end of the raceways reduce the usable length of rearing space to approximately 107.5 feet, providing approximately 1,415 ft^3 of rearing space. Well water and river water are plumbed to the raceways in order to achieve required flows and to aid in controlling water temperatures. Fish are moved from the incubators to the juvenile raceways as swim-up fry and remain in the raceways until their release as sub-yearling smolts. Due to space and water supply constraints, the balance of IPC's fall Chinook salmon mitigation program is reared at Umatilla FH. IPC plans to reconstruct Oxbow FH following issuance of a new FERC operating license for the HCC. This renovation will include rearing space for one million sub-yearling fall Chinook salmon smolts.

Umatilla Fish Hatchery – Umatilla FH uses two different types of rearing units for rearing fall Chinook salmon: Oregon style raceways and Michigan style raceways. Umatilla FH has ten Oregon style raceways with rearing dimensions of 91-ft long x 18.75-ft wide x 3.67-ft deep providing 6,262 ft^3 of rearing space per raceway. These raceways are designed for serial reuse in groups of two ponds; an upper and a lower pond. They also can be supplied with fresh water individually, if necessary. The twenty-four Michigan style raceways have dimensions of 91-ft. long x 9-ft wide x 2.75-ft deep totaling 2,252 ft^3 of rearing space per raceways. In these raceways, water is supplied in reuse groups of three ponds each. Each raceway has a submersible pump that supplies 950 gpm of water to oxygen contact columns, located at the head of each raceway. Oxygen is introduced and unwanted saturated gas is removed from incoming water at this point. Each raceway has its own oxygen supply line. Supplemental oxygen is either delivered from oxygen generators (pressure swing absorption units) or from a bulk liquid oxygen tank on site. Fall Chinook salmon are reared in the Oregon or Michigan raceways depending on the available water supply.

5.6) Acclimation/release facilities.

LFH- Sub-yearling production at LFH will be reared in raceways until release. At release, these fish will be pumped from the raceway using a four or six inch diameter Magic Valley® pump. The fish will be directed through an irrigation pipe to the Snake River. Yearling production at LFH will be reared in raceways until marking. At that time they will be transferred to one of the lakes. The fish will remain in the lake until release. Screens and stop logs will be pulled around April 1 to allow fish to volitionally move to the outlet structure. The outlet structure is a concrete raceway approximately 11 ft wide x 59 ft long x 4 ft deep (total depth without water). Fish move out of this channel to the Snake River.

Oxbow fish hatchery- Fall Chinook salmon are reared in the concrete juvenile raceways from swim-up fry until release as sub-yearling smolts. At release, all fish at OFH are netted and loaded from the raceways into the smolt transport tankers described in section 5.2. Fall Chinook salmon reared at Umatilla FH are reared in Oregon or Michigan style raceways until their release. At Umatilla FH, fish are pumped into the smolt transport tankers instead of being netted. Release sites for IPC fall Chinook salmon vary depending on directives from IDFG (through consultation with NOAA Fisheries). Typically, sub-yearling smolts reared at OFH and Umatilla FH are direct released into the Snake River at the Forest Service boat ramp one mile below HC Dam on the Oregon shore. However, in some years, a portion of the sub-yearling smolts reared as part of IPC's mitigation program have been transported to the Nez Perce Tribe's (NPT) Pittsburg Landing Acclimation Ponds (PLAP) for acclimation and later release. Please see section 10.3 for specific release locations by year.

<u>*FCAP facilities*</u>

Pittsburg FCAP site- The site is a temporary acclimation facility consisting of: sixteen (16) 20ft diameter aluminum circular tanks; two (2) aluminum distribution boxes; four

(4) river intake screens; ring lock flexible hose: 4" = 1,260 ft, 6" = 1,780 ft, 8" = 3,110 ft; camlock flexible hose: 6" = 2,080 ft; one (1) 500 gallon diesel storage tank; one (1) 20 ft storage container; two (2) 30ft camp trailers; one (1) 1996 Chevy S-10 pickup; micro-diffusers and regulators (1 per tank); one (1) trailer mounted 4,000 watt generator light plant; one (1) utility storage trailer; sixteen (16) camouflage nets; two (2) trailer mounted hydro cyclones; miscellaneous bolts, seals, camlock fittings, etc. Equipment used at Pittsburg Landing and the other two facilities was purchased by USACE, Walla Walla District, under the FY95 Congressional Add-on (Senate Report, 103-672, p7).

The rearing units consist of 16 circular aluminum tanks, each 20 ft in diameter and 4 feet deep. The tanks are transported from the storage area by a 20 ft flatbed lift-truck and placed on leveled 6-inch by 6-inch wood timbers. The tanks, made in two pieces and bolted together, drain water from the center of the tank through an 8-inch diameter pipe placed in a plywood manhole running under the tank. The tank is fitted with vertical 12-inch circular perforated aluminum screen and the water depth controlled by a 6-inch center PVC standpipe. The rearing water enters the tank through a 4-inch pipe located on the edge of the tank and is directed in a manner to facilitate a circular motion to aid the movement of fish waste and mortality to the center screen. Water flow is controlled by a 4-inch gate valve located on the incoming line and maintains flows at l00 gpm. The water discharge line is connected from the tank to the river by an 8-inch flexible plastic pipe, which is also used to release the fish.

Big Canyon FCAP site- The Big Canyon site is a temporary facility with fish rearing tanks and aeration towers remaining on site while water pumps and related equipment are disassembled and stored offsite each year (Figure 4).

The Big Canyon facility uses identical or similar equipment to that of Pittsburg Landing. The rearing tank assembly has been changed over the years to include a single row of tanks that sit flat on the gravel surface. The center drain line is located in a trench dug under the tank, thus eliminating the need for 12-inch deep gravel pad that was previously used. This method can only be used where the proper elevation is available to facilitate water discharge to the river.

The USACE agreed to furnish electric pumps to replace the diesel units that were rented each year. Electric pumps were installed and tested before the 2002 acclimation season.

Captain John site- The CJR AF is a single 150’x 50’ in-ground, lined pond that is supplied with Snake River water by two independent 1,250 gpm submersible electric pumps. Other facility equipment and capital construction consists of: two (2) river intake screens; one (1) camp trailer; one (1) standby propane generator; one (1) water well (domestic water); septic system; commercial electric service; alarm system; telephone service. The pumps and intake screens were designed to be placed into the river and then removed following fish acclimation each year, but were replaced in 2001 with permanent intake screens located in the main Snake River channel. The pump intake screens are provided with an air back flush system to remove debris and an alarm system is available to monitor flows.

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

LFH- In 2000, the estimated loss due to bird predation was 25% for the 1998 brood year fall Chinook juveniles. These fish were being reared in one of the lakes at LFH for yearling production. Wires over the pond and limited hazing were insufficient to deter birds.

In 2001 there was a power outage that led to dewatering of the holding area at the adult trap at LFH. Twenty-three fall Chinook died that were unmarked/untagged and could have been Snake River origin, naturally produced fish. An additional 172 Snake River origin, hatchery produced fall Chinook also died. At that time an automatic pump restart system was not in place. The system has been updated and a similar occurrence is not anticipated.

Irrigon, Oxbow and Umatilla fish hatcheries- No operational difficulties or disasters have led to significant fall Chinook salmon mortality at Irrigon, Oxbow, nor Umatilla FH.

Pittsburg, Big Canyon and Captain John Rapids FCAP facilities- Despite frequent operational difficulties and challenges there have been no significant fish mortalities at the FCAP sites in their 15 years of operation. Operations are a challenge because these facilities are temporary in nature, located in remote locations and operated during the spring of the year under extreme and widely fluctuating environmental conditions. Water supply at all three sites is pumped directly from the river by either diesel or electric pumps to rearing tanks or pond. Events caused by electrical power or equipment failures that disrupt the normal flow of water are frequent. Staff also deals regularly with water pump failures, faulty pump VFD starter drives, and other equipment repairs. During spring run-off turbid water, debris, algae mats, and high fluctuations in water levels result in plugged intake screens, relocating intake pumps and screens, and fish culture challenges. In addition, all three of the FCAP facilities are located downstream from hydropower dams with fluctuating flows resulting in sometimes very large differences in river elevation in a 24 hour time period. These fluctuations in water elevations require moving intake screens and pumps so they are not dewatered or not swept away.

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

LFH- the hatchery follows strict operational procedures set forth by the Integrated Hatchery Optimization Team (IHOT 1993). Staff is available to respond to critical operational problems at all times. Water flow and low water alarm systems, and emergency generator power supply systems to provide incubation and rearing water to the facilities are installed at LFH. All pumps are now fitted with automatic restart systems in case of power outages. Fish health monitoring occurs monthly, or more often, as required in cases of disease epizootics. All rearing lakes at LFH were covered with netting in 2003-2004 to prevent excessive bird predation. Fish health practices follow PNWFHPC (1989) protocol.

An emergency plan was developed by LFH and will be implemented in case of emergencies. The following is a list of vessels used to hold/rear fish at LFH with their respective emergency release protocols:

> North raceways-Fish will be released by removing the discharge screens, pulling the wooden stop logs, and forcing the fish over the short concrete stop log wall. The fish will then be flushed with the discharge water to the river.
>
> South raceways- Fish will be released by removing the discharge screens and lowering the adjustable sump pipe into the discharge channel. The fish will then be flushed with the discharge water to the river.
>
> Rearing lakes-Fish will be released by lifting the flush gate and pulling the discharge stop logs. The fish will then be flushed with the discharge water to the river.
>
> Adult salmon/fingerling ponds- Fish will be released by lifting the flush gate and pulling the discharge stop logs. The fish will then be flushed with the discharge water to the river.
>
> Adult trap holding pond-The adult exclusion bar/screen located at the base of the fish ladder will be removed to prevent injury to fish during an emergency release. In addition, the water supply pump, which supplies ladder water to the adult trap, will be turned off to avoid pulling released fish into the pump and causing mortality. After these measures are taken, fish will be released by pulling the discharge stop logs. The fish will then be flushed with the discharge water to the river.

Irrigon Fish Hatchery-Generators are all on site, and in the event of a power failure automatically start to run the pumps in order to keep the water flowing. Screens are maintained in working order. Densities are adjusted to maintain the quality of facility out flow.

Oxbow Fish Hatchery – OFH has one full-time employee residing at the facility. The juvenile raceways are supplied with surface water pumped from the Snake River. These pumps are powered by separate power sources with only one pump operating at a time, allowing the second pump to act as a backup for the first pump in case of a pump or power failure. The incubation room is supplied with pumped well water from well #1. Well #2 remains as an emergency backup with a separate power source to help prevent catastrophic egg loss resulting from power or water system failure. The rearing raceways and incubation head tank are equipped with low water level alarms and all pumps are equipped with power failure alarms, which are tied to the hatchery office, employee residence and in IPC's Oxbow Power Plant control room. If the hatchery staff is absent from the site, the power plant staff will respond to any alarms at OFH. Protocols are also in place to guide the disinfection of equipment and gear to minimize risks associated with the transfer of potential disease agents.

Umatilla Fish Hatchery – The temperature, mechanical systems, electrical systems, and flow are continually monitored and have alarms to indicate system issues or failures. An emergency gas powered pump installed in the aeration tower structure supplies water for incubation in the event of aeration lift pump failure. All rearing raceways have a high-low water level alarm. In addition to the water level alarms, the Michigan ponds also have pump failure and oxygen flow alarms. All eggs and fish are reared on pathogen-free water to minimize the risk of introducing pathogens into the hatchery program. In the event of total system failure resulting in total loss of water, eggs or fish may be transported to nearby Irrigon Fish Hatchery, provided that it is still operational, has the necessary space and all logistics were in place prior to the time of failure. Fish health and sanitation programs are also in place to monitor and evaluate the health status of fall Chinook salmon juveniles reared at Umatilla FH and to prevent the transmission of pathogens from one stock to another.

<u>*FCAP facilities*</u>

*Pittsburg Landing***:** A 24-volt alarm system constantly monitors water levels in each rearing tank and each of the two water distribution towers. A panel that provides a visual and audio alarm when a low water level is detected monitors the alarm system. The alarm control box and panel is located near the staff-housing trailer. The facility has two alarm systems and 16 emergency oxygen systems – hoses

Big Canyon FCAP site: The electric pumps provide the same performance as the diesel pumps while reducing rental and maintenance costs, allowing onsite staff reduction and eliminates the risk of a major fuel spill.

CJR FCAP site: The pumps deposit large amounts of sand in the acclimation pond, which must be removed by hand tools between each group of fish. The alarm system does not provide accurate data, if working at all. Negotiations are ongoing with the USACE to provide the necessary changes to meet the standards required at the facility.

FCAP emergency release procedures in response to mechanical or water system failure:

- The Fall Chinook Fish Acclimation Facilities are staffed with personnel on site 24/7 – including weekends and holidays.
- River water for acclimation is pumped at all three sites and is monitored by electronic water flow and water level alarms. The alarms are manually tested daily to prevent water system failures. Commercial electrical power failure at Big Canyon and Capt. John Rapids facilities are backed up with diesel generators that are tested each week.
- Standby pumps are available at all three facilities for backup.
- An emergency oxygen system is available at all three facilities and can be used for short durations to prevent fish loss.
- Land line telephones are available at Big Canyon and Capt. John Rapids and a radiophone at the Pittsburg Landing site to call for backup help in case of an emergency situation. Staff members have a list of emergency numbers and backup staff are available on a 24/7 basis.
- The fish acclimation sites are located in remote areas that cannot be reached quickly by backup personnel. This requires onsite staff members to correct the emergency situation or initiate temporary backup systems until help can arrive.
- A procedure manual is available at each acclimation site.

- Each acclimation site is unique and there are no special adaptations that can be made to support an emergency release of the fish.
- Emergency releases can only be made in the same manner that normal releases are made from the acclimation units
- Emergency release of fish requires a minimum of two staff members and would occur under the guidance of the manager responsible for the project.
- Record events of release and discuss with supervisor.
- Notify upper management, policy and co-managers of event.

5.9) Facilities Maintenance

LFH

Annual Maintenance –

- Annual water supply pump rehabilitation. ($30,000)
    a. Well column shafting, spiders, and impellers need to be pulled, inspected and repaired or replaced every six to eight years. There are eight (8) supply pumps for the LFH.
    b. Pump seals and bearings replaced every eight years or less.
    c. Pump columns replaced every eight years. This is an additional cost of $3,500 per 15' section. There is an average of six columns per well casing. ($168,000 total for all eight well column replacements) These columns deteriorate via electrolysis and by the turbidity and velocity of flow up the casing, creating erosion in the steel, especially near the couplings.
    d. Pump parts on hand for expediting repairs when needed – an additional cost from above pump maintenance estimate ($5,984).
- Rotating drum screen maintenance for rearing lake ($500).
- Chemicals for egg disinfection and fungus control ($7,500)
- Vehicle maintenance ($1,000).
- Annual fish transportation; a total of 59,500 lbs. yearlings and sub-yearlings hauled from Lyons Ferry to FCAP facilities and direct release at Couse Creek. ($10,500)
- Fire safety and maintenance service. ($1,500)

Non-recurring Maintenance (next 5 years)

- Stop log replacement for Lake # 2 ($1,500).
- New fish culture equipment. ($1,000).
- Cover existing intermediate rearing area on north side of facility ($100,000)
    a. ESA listed steelhead and Chinook juveniles are reared in these units, currently exposed to all the elements and predators.
- Install jump screens above manifolds on south side raceways ($14,000)
- Increase intermediate rearing capacity ($250,000)
    a. Install permanent rearing containers in the intermediate rearing area on north side of facility to accommodate initial or expanded juvenile rearing.

- Develop increased water supply to meet program diversity requirements for "stepping stone" approach. ($5 million)
    a. New water supply (i.e. Wells), backup generator and raceways could potentially be constructed on North east end of facility in the open field area.

- Replace formalin treatment pumps ($1,200).
- Replace venturi pump and hoses ($5,000)
- Replace adult pond valve actuators ($2,000)

Oxbow Hatchery

Programmatic Maintenance -The Hells Canyon Trap is situated on the Oregon shore of the Snake River immediately below Hells Canyon Dam. Discharge from the dam greater than 50,000 CFS has the potential to inundate the trap with water. Any woody debris present in the water during such high flow events has the potential to be deposited in the trap. Extreme high flows of this nature can also deposit cobble/rubble sized substrate within the fish ladder, hampering trap operation. Immediate removal of all such debris is necessary to restore normal trapping operation. Rock and woody debris removal is accomplished with a crane and clamshell bucket operated from the embankment above the Hells Canyon Trap. No take of NMFS listed species is anticipated for any of the maintenance activities at Oxbow Fish Hatchery and Hells Canyon Trap.

The Hells Canyon Trap is located within the migration corridor of ESA listed spring Chinook salmon, steelhead and bull trout. Direct effects to individual adult or juvenile spring Chinook salmon, steelhead and bull trout are a concern during such maintenance activities. Effects could include disturbance and displacement of fish as a result of personnel or heavy equipment working near the river channel. Suitable spawning habitat does not exist in the vicinity of the Hells Canyon Trap; therefore, effects to embryonic life stages will not occur as a result of these actions. No machinery is placed in or near the river channel, thus eliminating any risk of fuel or oil contamination. Woody debris and rock removed from the trap may be loaded onto trucks for offsite disposal or may be returned to the river channel for natural redistribution downstream. Due to the large size of the substrate removed from the trap and the high water velocity in the area, the likelihood of transporting fine sediments downstream is minimal. High flow events of this nature and the associated need to remove debris from the trap occur on average, once every five years.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

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

6.1) Source.

LFH and FCAP facilities - Currently, ESA listed Snake River origin, hatchery (stock essential for recovery) and naturally produced fall Chinook are used for broodstock. Fish are trapped at LFH and LGR Dam.

IPC- No adults are collected for IPC's fall Chinook salmon program at OFH. Snake River origin, hatchery produced fall Chinook salmon (stock essential for recovery of the Snake River fall Chinook salmon ESU). Lyons Ferry FH broodstock are trapped primarily at Lyons Ferry FH, but can be supplemented by fall Chinook salmon trapped at Lower Granite Dam by NOAA Fisheries.

6.2) Supporting information.

6.2.1) History.

Provide a brief narrative history of the broodstock sources. For listed natural populations, specify its status relative to critical and viable population thresholds (use section 2.2.2 if appropriate). For existing hatchery stocks, include information on how and when they were founded, sources of broodstock since founding, and any purposeful or inadvertent selection applied that changed characteristics of the founding broodstock.

See section 2.2.2.

The Snake River fall Chinook ESU consists of fall Chinook which spawn in the Snake, Clearwater, Salmon, Imnaha, and Grande Ronde river basins. ESA-listed fall Chinook in the Clearwater subbasin were eradicated as native stocks by Lewiston dam (Rm 4.0) built in 1927 without passage for a period of 14 years, 1927 thru 1940 (Fulton 1970). The dam was removed in 1973 and the Snake River stock re-colonized the Clearwater River.

After adoption of the LSRCP program in 1976, WDFW initiated a fall Chinook egg bank development program for the Snake River. WDFW initiated adult trapping at IHR Dam between 1977 and 1993. In addition, fish have been trapped on-site at LFH since 1984. Over time the program has changed to a supplementation program to enhance fall Chinook production in the Snake River using Snake River stock. The incidence of stray fish in the broodstock at Lyons Ferry began increasing until 1989 when it was determined after spawning that 41% of fish used for broodstock were strays. It was decided that maintaining the genetic integrity of Snake River fall Chinook was paramount. Moreover, the management agencies were concerned that strays were spawning in the wild with natural Snake River stock and the integrity of the natural population was being compromised. The 1989 brood year was not used as broodstock. In 1990, trapping also began at LGR Dam to monitor and remove strays from the Snake River and to supplement broodstock for LFH. As of 1990 WDFW began reading coded wire tags to determine origin of fish prior to spawning. To benefit the integrity of the natural populations, all fall Chinook with a CWT was removed from the run at Lower Granite Dam. At the hatchery only Snake River origin fish, confirmed by CWT decoding, were used in broodstock. Genetic sampling and characterization has been done and results indicate that Snake River stock reared at LFH are indeed closer to the original natural spawning population in the Snake River, than the Columbia River stocks or the Snake River population during high stray rate years. In 1993 trapping ceased at Ice Harbor dam because of the high number of strays from the Columbia River that were detected during a three year radio telemetry project. In 2003, WDFW changed the trapping protocol and began sub-sampling the whole run (tagged and untagged fish), although only wire tagged fish were retained for broodstock. In addition, also in 2003 the program began including unmarked/untagged Snake River origin hatchery females trapped at LFH in production. In 2004 unmarked/untagged Snake River hatchery females and natural Snake River origin females from both trapping locations were used for broodstock. Based on scale analysis of unmarked/untagged fish, only Snake River hatchery or natural origin fish were used. With changes in rearing sites (Oxbow fish hatchery in 2001, Umatilla and Nez Perce Tribal fish hatcheries in 2003, and Irrigon fish hatchery in 2008) and river

flow/spill patterns (Flow augmentation, and spill) scale pattern analysis became unusable to discern in basin hatchery fish from out of basin hatchery fish. The Draft Snake River Fall Chinook Management Plan states that naturally produced Snake River stock fall Chinook would be included up to 30% of the fish used for broodstock as long as the numbers of wild fish trapped do not exceed 20% of the run. It is fortunate that the percentage of fish in the run to LGR Dam has not exceeded 5% for the last several years; otherwise untagged fish used in spawning might end up being out of basin strays. Any Snake River origin hatchery fish not needed for production are returned to the Snake River to "supplement" the natural population. The majority of unmarked fish are allowed to spawn naturally in the Snake River each year.
The Nez Perce Tribe, Confederated Tribes of the Umatilla Indian Reservation, Washington Department of Fish and Wildlife, Oregon Department of Fish and Wildlife and NOAA Fisheries technical staff has drafted a Snake River Fall Chinook Hatchery Management Plan (Zimmerman et al. 2005). This entire document has not been adopted by co-managers and *US vs. Oregon* parties as an official management plan, but it was utilized in developing *US vs. Oregon* production agreements, marking strategies, and annual operation plan strategies for hatchery operation. For brood year 2006, the production priority plan identified in the Snake River Fall Chinook Hatchery Management Plan has been adopted by *US vs. Oregon* parties, with a "pending" decision on the fall Chinook transportation evaluation production.

The Snake River Fall Chinook Hatchery Management Plan has identified biological objectives for adult escapement. Objectives were developed by co-managers NPT, CTUIR, WDFW, IDFG, ODFW, USFWS, and NOAA, but have not been adopted by *US vs. Oregon* and are presented below.

<u>Hatchery-Origin Snake River Fall Chinook Adult Return Goals</u>

- Interim goal is to return 14,568 hatchery-origin adults above Lower Monumental Dam – comprised of 9,988 from Lower Snake River Compensation Plan (LSRCP), 2,290 from NPTH, and 2,290 from IPC.
- Long-term goal is to return 24,340 hatchery-origin adults above Lower Monumental Dam – comprised of 18,300 from LSRCP, 3,750 from NPTHC, and 2,290 from Idaho Power Company (IPC).
- Provide approximately 5,000 adults annually to meet the interim hatchery production broodstock requirements. This total is comprised of 4,000 adults needed for LFH and 1,000 for Nez Perce Tribal Hatchery Complex.

<u>Natural-Origin Snake River Fall Chinook Adult Return Goals</u>

- Maintain genetic attributes and life history characteristics of the naturally spawning Chinook aggregate by sustaining a minimum adult spawner (hatchery- and/or natural-origin) abundance threshold of 7,500 adults.
- Achieve ESA delisting by attaining interim population abundance in the Snake River of at least 3,000 naturally produced spawners and an eight year geometric mean cohort replacement rate exceeding 1.0 during the eight years.
- Interim goal is to achieve a self-sustaining population of 8,250 natural-origin adult fall Chinook above Lower Monumental Dam. This is comprised of a natural spawning

population of 6,500 for the Snake River mainstem and its tributaries, 1,250 for the Clearwater River, and 500 for the Grande Ronde River.

- Long term goal is to achieve a self-sustaining population of 14,360 natural-origin adult fall Chinook above Lower Monumental Dam.
- Maintain out-of-basin hatchery-origin straying above Lower Granite Dam at levels of 5% or less

6.2.2) Annual size.

Provide estimates of the proportion of the natural population that will be collected for broodstock. Specify number of each sex, or total number and sex ratio, if known. For broodstocks originating from natural populations, explain how their use will affect their population status relative to critical and viable thresholds.

LFH
Natural-origin fish trapped for broodstock will not exceed 20% of the run.

IPC
No adults are collected for IPC's fall Chinook salmon program at OFH. Please refer to Lyons Ferry FH Hatchery section for estimates of annual run size and the proportion of the natural population that will be collected for broodstock.

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

If using an existing hatchery stock, include specific information on how many natural fish were incorporated into the broodstock annually.

The Snake River Stock was likely derived from a genetically distinct population of fall Chinook in the Snake River Basin. During 1990-2002, unmarked/untagged fish were not included in broodstock because of the possibility of encountering unmarked strays. In 2003, the program began including unmarked/untagged Snake River origin hatchery females trapped at LFH for production. Table 19 lists the estimated number of natural origin fish included in broodstock over the last several years. Managers have identified the goal of having up to 30% of the LFH broodstock consist of naturally produced salmon.

IPC
No adults are collected for IPC's fall Chinook salmon program at OFH. Please refer to Lyons Ferry Hatchery section for past and proposed levels of natural fish incorporated into broodstock.

6.2.4) Genetic or ecological differences.

Describe any known genotypic, phenotypic, or behavioral differences between current or proposed hatchery stocks and natural stocks in the target area.

Genetic relationship between Snake River origin, hatchery produced fall Chinook and natural spawners above LGR Dam is unanswerable at present (Marshall et al. 2000). The ecological differences are also unknown at present. Phase 1 of a Reproductive Success Study began in 2004 to examine the applicability of new technology (ad-mixture stock analysis procedure using DNA samples) in understanding hatchery/wild relative reproductive success in a large river system where traditional intensive DNA pedigree sampling is not practical.

IPC
No adults are collected for IPC's fall Chinook salmon program at OFH. Please refer to Lyons Ferry Hatchery section for genetic or ecological differences between hatchery and natural stocks.

6.2.5) Reasons for choosing.

Describe any special traits or characteristics for which broodstock was selected

The Snake River Stock fall Chinook is an endemic population and has been shown to be genetically different from the Columbia River stocks. An egg bank program was initiated in 1976 to save this stock. The LSRCP requires "in-place" and "in-kind" mitigation.

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

(e.g. "*The risk of among population genetic diversity loss will be reduced by selecting the indigenous Chinook salmon population for use as broodstock in the supplementation program*.").
The exclusion of non-Snake River fall Chinook from the broodstock has kept the LFH fall Chinook production genetically intact. WDFW will continue to exclude non-Snake River origin fall Chinook from its broodstock based on CWT information. Unmarked/untagged fish will be included in broodstock in an effort to include wild fish. It is suggested that unmarked/untagged fish from LGR Dam be used preferentially over unmarked fish at LFH as they are more likely to be of Snake River origin. This action will be examined on an annual basis. Broodstock (i.e. eggs) for the LFH Snake River fall Chinook program will be collected over the entire run timing. Spawning will occur weekly to cover the run and spawn timing.

SECTION 7. BROODSTOCK COLLECTION

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

Adults

7.2) Collection or sampling design.

Include information on the location, time, and method of capture (e.g. weir trap, beach seine, etc.) Describe capture efficiency and measures to reduce sources of bias that *could lead to a non-representative sample of the desired broodstock source*

Trapping protocols for LFH and LGR Dam are attached (Appendix B). These protocols change yearly depending upon expected run size and sex composition of the return, but the general intent is to systematically sample and collect brood stock from across the full extent of the run at Lower Granite Dam. However, there may be implementation uncertainties that in some years will make sampling of the entire return period infeasible. Records will be maintained that document the broodstock collection dates for each year and will be periodically reviewed to assess whether or not the long-term multiyear pattern of broodstock collection shows a chronic bias to one segment of the return period.

The primary broodstock source for the production described in this document has been identified as LGR Dam. Additional broodstock will be collected at LFH and NPTH hatcheries as needed to reach production goals. Trapping at LGR Dam also occurs to estimate the run composition to LGR Dam.

Hauling of fish from the LGR adult trap begins after August 18 and generally ends the third week in November. Very few fall Chinook adults pass LGR after November 20. Broodstock will be collected at the adult trap at LFH starting on September 1 to limit the number of spring/summer Chinook encountered. The trap will be checked daily, possibly more, depending upon expected return. Fish are directed to a chute where they are identified by species and directed to the appropriate pond where they are to be held until spawning. Trapping at LFH will be adjusted to assure that fish are trapped throughout the run.

Known strays are removed in accordance with the guidelines in the Snake River Fall Chinook Hatchery Management Plan (Zimmerman et al. 2005).

7.3) Identity.

Describe method for identifying (a) target population if more than one population may be present; and (b) hatchery origin fish from naturally spawned fish.

Adult fall Chinook will be 100% electronically sampled before spawning. Origin of fish used for spawning will be determined by CWT, BWT, PIT tag, fin-clip, and visual implant elastomer (VIE) tag detections prior to spawning. Unmarked/untagged fish that are spawned will be scale-sampled to determine age and juvenile rearing patterns. Natural-origin fish will be estimated at season's end after CWTs are expanded to account for associated untagged hatchery releases. Untagged fish remaining after the associated hatchery fish are removed will be assigned to natural-origin category.

7.4) Proposed number to be collected:

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

The goal changes yearly based on run size and negotiations of the Fall agreement for *US vs. Oregon*. Total number collected is also dictated by NMFS request for removal of stray fish at LGR Dam and run reconstruction needs.

Short Term: An estimated 4,000 adult fall Chinook of Snake River origin would need to be collected to meet production goals through priority 17 as listed in the 2008-2017 *US vs. Oregon* Management Agreement.

Long Term: Unknown, will depend on future run sizes, fall agreements, and completion of the Comprehensive Snake River Fall Chinook Hatchery Management Plan.

IPC
No adults are collected for IPC's fall Chinook salmon program at OFH. Please refer to Lyons Ferry Hatchery section for broodstock collection goals. Broodstock collection goals must be sufficient to supply 1.3 million eggs for the IPC fall Chinook salmon program. Based on the average fecundity (3,578) of fall Chinook salmon females spawned at Lyons Ferry FH for IPC's program from 2000 to 2008, approximately 363 females are needed at spawning to produce 1.3 million eggs for IPC's program. This number does not reflect losses of females associated with trap or pre-spawning mortality and egg culling after spawning.

7.4.2) Broodstock collection levels for the last ten years (e.g. 1992-2008): See Table 9.

Table 30. Collected, spawned, and eggs collected from fall Chinook, Snake River Stock, trapping in 1991-2008. Based on CWT and elastomer recoveries processed at LFH. Jacks measure <53 cm to be consistent with current run reconstruction and window counts.

Brood Year	Collected Adults Female	Male	Jack	Spawned Adults Female	Male	Jack	Eggs Collected
1991	269	238	148	260	183	118	906,411
1992	293	185	154	276	161	1	901,232
1993	126	125	140	115	102	24	400,490
1994	168	243	510	164	164	47	583,871
1995	349	505	1,884	333	371	81	1,056,700
1996	499	609	501	464	465	60	1,433,862
1997	485	381	769	375	255	206	1,184,141
1998	815	1,274	1,201	663	518	228	2,085,155
1999	1,448	1,371	934	1,305	874	528	3,980,455
2000	1,112	1,757	1,332	1,037	729	369	3,576,956
2001	1,519	2,200	455	1,338	1150	188	4,734,234
2002	1,856	1,858	811	1,322	1,089	171	4,910,467
2003	1,164	1,428	1,596	794	619	234	2,812,751
2004	1,681	2,298	710	1,331	1,178	156	4,625,638

2005	1783	1468	7014	1518	1099	96	4,929,630
2006	882	1331	1690	786	693	88	2,819,004
2007	1867	2518	2328	1569	1432	125	5,143,459
2008	1607	2782	2042	1345	1264	17	4957300

Anticipated broodstock collection levels for IPC. Currently these fish are listed in the LFH Broodstock collection table.

Table 31. Broodstock collection levels and eyed eggs produced for IPC's fall Chinook salmon program at OFH and Umatilla FH (2000-2008).

Return Year	No. of Females Spawned	No. of Males Spawned	Total No. of Adults Spawned	Average Fecundity	Total No. of Green Eggs	% Eye Up	Total No. of Eyed Eggs
2000	34	34	68	3,511	119,611	96.9%	115,891
2001	55	55	110	3,744	206,167	97.0%	200,064
2002	154	154	308	3,798	583,171	97.3%	566,967
2003	62	62	124	3,328	207,598	96.3%	200,000
2004	310	310	620	3,510	1,090,882	96.7%	1,053,278
2005	348	348	696	3,297	1,188,791	96.8%	1,150,750
2006	37	37	74	3,466	130,969	95.4%	125,000
2007	315	315	630	3,240	1,042,094	97.4%	1,015,000
2008	265	265	530	3,943	1,069,358	96.6%	1,033,000
Average=	176	176	351	3,537	626,516	96.7%	606,661

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

Describe procedures for remaining within programmed broodstock collection or allowable upstream hatchery fish escapement levels, including culling.

Because of run reconstruction data needs, wire tagged fish trapped at LGR will be killed and buried. These fish cannot be distributed to food banks because they are treated with chemicals that are potentially hazardous to human consumption.

Untagged fish in excess of broodstock needs will either be returned to the river or will be spawned and resulting progeny distributed according to the Management agreement and/or decisions made by co-managers based upon rearing space and release location. Untagged fish will be scale-sampled to determine hatchery/wild origin. All non-Snake River origin hatchery fall Chinook will be killed unless an identified need, outside of the Snake River Basin, is found for the gametes.

7.6) Fish transportation and holding methods.

Describe procedures for the transportation (if necessary) and holding of fish, especially *if captured unripe or as juveniles. Include length of time in transit and care before and during transit and holding, including application of anesthetics, salves, and antibiotics.*

Refer to Sections 5.2 and 5.3.
The 2009-2010 LFH AOP is Attachment 6.

7.7) Describe fish health maintenance and sanitation procedures applied.

Broodstock collected at LGR adult trap: All fall Chinook collected are injected at capture with Erythromycin 200 (20mg/kg of fish) to reduce infection levels of *Renibacterium salmonarum* [causative agent of Bacterial Kidney Disease (BKD)]. While at LFH, salmon are treated with a formalin flush (167ppm) every other day as prophylaxis for *Saprolegnia sp*. (Fungus).

Broodstock collected at LFH: Females will have their first injection of Erythromycin 200 (20mg/kg of fish), at sorting which is up to 25 days after collection. Once spawning begins, newly trapped fish will be injected at the next spawn day (up to seven days after trapping) to reduce infection levels of *Renibacterium salmonarum* (causative agent of Bacterial Kidney Disease [BKD]). While at LFH, salmon are treated with formalin flush (167ppm) every other day as prophylaxis for *Saprolegnia sp*. (Fungus).

Prior to spawning, all personnel will disinfect raingear and boots prior to entering the spawning building.

All females contributing to yearling production will be examined for BKD using the Enzyme Linked Immunosorbent Assay (ELISA) technique. In addition, all eggs destined for Nez Perce Tribal Hatchery will be examined for BKD. Fish will be sampled across the run.

A sample of 60 females used for broodstock will be sampled annually to detect viral pathogens.

Oxbow FH
No adults are collected for IPC's fall Chinook salmon program at OFH. Please refer to the Lyons Ferry Hatchery description in this section for fish health maintenance and sanitation procedures applied at Lyons Ferry FH.

7.8) Disposition of carcasses.

All carcasses will be buried onsite due to fish health treatments, permitting, and storage constraints.

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

(e.g. "The risk of fish disease amplification will be minimized by following Co-manager

Fish Health Policy sanitation and fish health maintenance and monitoring guidelines").

Natural fish are systematically sub-sampled at the trap at LGR Dam (10-20% rate depending on year) along with hatchery-origin fish. The remaining fish are allowed to continue upstream to their spawning grounds un-delayed, which provides substantial numbers of natural- and hatchery-origin Snake River stock fish for the up-river spawning grounds. LFH and LGR trapped fish that are determined to be stray based on scale analysis will be excluded from the broodstock. Otherwise, natural-origin Snake River fall Chinook will be included into the broodstock at LFH to minimize digression of the hatchery-origin fish from the genetic makeup of the naturally spawning population.

The trap is checked multiple times daily at LGR Dam when in operation. The goal is to pass fish within minutes or a few hours of being caught. Fish are not generally held more than 8-12 hours (over-night) at LGR Dam before being passed or transported to a holding facility. Fish trapped at LFH are generally not held longer than 24 hours before they are shunted to the hatchery or returned to the river. Returning hatchery fish from the hatchery programs will be allowed to enter the natural spawning population with the exception of those fish removed for hatchery broodstock.

Disease control efforts at LFH and NPTH follow standards described and adopted by the Pacific Northwest Fish Health Protection Committee (PNWFHPC 1989) and standards for the best management of Columbia Basin hatcheries (IHOT 1993) will effectively control expansion of species specific or general salmonid diseases.

SECTION 8. MATING

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

8.1) Selection method.

Specify how spawners are chosen (e.g. randomly over whole run, randomly from ripe fish on a certain day, selectively chosen, or prioritized based on hatchery or natural origin).

All males and females that have been collected for broodstock will be examined weekly during the spawning season to determine ripeness. All ripe fish of potentially Snake River origin from LFH will be spawned. Hatchery reared males of Snake River stock will be randomly selected and spawned.
Refer to: LFH Annual Operation Plan 2009-2010 (Attachment 6)

8.2) Matings. (new version had this listed as Males)

Specify expected use of backup males, precocious males (jacks), and repeat spawners

Mating will occur in a 1x1 cross (1 female to 1 male). Because the spawning population is large (>1000), increasing genetic diversity is not presently a concern. An additional step will be taken to minimize the potential affect of stray Chinook on the population

genetics.
LFH Annual Operation Plan 2009-2010 is attached.

8.3) Fertilization.

Describe spawning protocols applied, including the fertilization scheme used (such as equal sex ratios and 1:1 individual matings; equal sex ratios and pooled gametes; or factorial matings). Explain any fish health and sanitation procedures used for disease prevention.

During fertilization, each female's eggs will be spawned into a plastic bag lining a bucket. Semen from one male will be added and the mixture stirred. See section 7.7 for specific fish health maintenance procedures.
Refer to LFH Annual Operation Plan 2009-2010 (Attachment 6).

8.4) Cryo-preserved gametes.

If used, describe number of donors, year of collection, number of times donors were used in the past, and expected and observed viability

Semen from hatchery-origin males has been collected in the past but is not currently needed for spawning because of the large spawning population. The cryo-preserved semen will be archived for possible future uses including genetic investigations or use if limited males are available for spawning.

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

(*e.g. "A factorial mating scheme will be applied to reduce the risk of loss of within population genetic diversity for the small chum salmon population that is the subject of this supplementation program".*).

A 1x1 cross was used to simulate natural spawning and increases the chance of high reproductive genetic diversity for several years. Also, attempts were made to limit jacks in broodstock to prevent undesirable contribution by younger age fish to the stock. Refer to LFH Annual Operation Plan 2009-2010 (Attachment 6) for a more detailed discussion of spawning protocols. However, the protocol for selecting older age fish was not entirely responsive to changes in ocean productivity and the resulting size at age for younger fish. This protocol often resulted in the inclusion of a significant proportion (15-45%) of 1-ocean age males (jacks) and even 1-ocean age females (jills) in broodstock, raising concerns about the long-term effect on population age structure (Hankin et al. 2009). Starting in 2009 older age fish were selected for broodstock whenever possible based on CWT information, or by establishing a size selection criteria to exclude jacks and jills from broodstock by using within year length at age data from CWT tagged fish. Moreover, recent research within the Columbia Basin (Schroeder et al. 2008) has shown that large adult males contribute disproportionately to spawning, presumably due to competitive dominance. Following these results, older age males (3- and 4-ocean) at LFH were utilized multiple times (up to 3) in place of jacks to more closely mimic a natural spawning assemblage. This action did not overly reduce the effective breeding population (Busack and Knudsen 2007; Busack 2007) because of the large production program (>1,400 females).

SECTION 9. INCUBATION AND REARING

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

9.1) Incubation:

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

Provide data for the most recent twelve years (1988-99), or for years dependable data are available

Following is the egg survival information at LFH for the seventeen most recent brood years (Table 32). In 2003, nets were erected over the earthen pond at LFH to reduce avian predation and to increase survivals of yearlings released on-station. In 2005, nets were placed over the south raceways; and in 2006, nets were placed over the north raceways. These modifications were done to reduce predation on sub-yearlings and increase survivals prior to transfer and release. Original LSRCP hatchery protocol called for 80% survival from green egg to smolt stage for sub-yearlings. Since this program was originally designed for sub-yearling production, yearling protocols were not identified. Data presented in Table 32 indicate that these goals have generally been met for the Snake River Stock reared at LFH.

(**Note**: Bacterial Kidney Disease (BKD) control measures at LFH may require the disposal of eggs from females that test positive for the disease. Years with low returns may leave us broodstock limited. To meet Fall agreement requests there may be a need to rear high titer ELISA fish to transfer and release. In other years, we may discard these eggs-fish. Discarded eggs are included in percent loss figures. Figures may not represent true egg survival, but correctly depict survival under existing hatchery management protocol.)

Table 32. History of egg loss for the Snake River Stock fall Chinook at WDFW's LFH from 1991-2007 brood years.

Brood year	Green eggs	Eyed eggs retained	Fry ponded	Release type	Survival of retained production		
					green egg-ponding	ponding-smolt	green egg-smolt
1991	906,411	828,514	807,685	yearling	89.1	94.1	83.8

1992	901,232	855,577	835,171	yearling sub-yearling	92.7 92.7	96.5 98.4	89.5 91.2
1993	400,4980	363,129	352,574	yearling	88.0	99.0	87.1
1994	583,871	553,189	542,461	yearling	92.7	99.3	92.1
1995	1,056,700	1,022,700	959,773	yearling sub-yearling	90.8 90.8	94.8 99.0	86.1 89.9
1996	1,433,862	1,377,202	1,361,577	yearling sub-yearling	95.0 95.0	76.6 89.5	72.8 85.0
1997	1,184,141	1,134,641	1,101,070	yearling sub-yearling	93.0 93.0	92.5 97.6	86.0 90.8
1998	2,085,155	1,978,704	1,926,605	yearling sub-yearling	92.4 92.4	94.8 95.1	87.6 87.9
1999	3,980,455	3,605,482	3,869,707	yearling sub-yearling	92.4 92.4	66.3 95.2	61.3 87.9
2000	3,576,956	3,249,377	3,158,689	yearling sub-yearling	92.8 92.8	91.3 94.9	84.8 88.1
2001	4,734,234	4,230,432	4,103,521	yearling sub-yearling	93.6 93.6	79.5 97.7	74.5 95.8
2002	4,910,467	3,540,000	3,481,685	yearling sub-yearling	95.3 95.3	86.8 94.8	82.8 90.3
2003	2,812,751	2,476,825	2,441,771	Yearling sub-yearling	95.5 95.5	75.7 95.1	72.3 90.8
2004	4,625,638	3,413,437	3,290,378	Yearling sub-yearling	93.0 93.0	96.8 97.6	90.1 90.8
2005	4,929,630	3,378,600	3,275,563	Yearling sub-yearling	92.2 92.2	99.3 104.9	91.5 96.7
2006	2,819,004	2,601,679	2,603,679	Yearling sub-yearling	95.7 95.7	95.4 100.2	91.3 95.5
2007	5,143,459	2,847,917	2,828,436	Yearling sub-yearling	95.8 95.8	95.4 100.3	91.4 95.5

Irrigon Hatchery
At Irrigon Hatchery survival from eye to ponding is 99%. Survival from ponding to release is 98%.

Oxbow and Umatilla Hatcheries
Survival rates for fall Chinook salmon reared at Oxbow FH and Umatilla FH are presented in Table 33.

Table 33. IPC fall Chinook survival rates from eyed egg to ponding (fry) and release (smolts) by brood year (2000-2008).

Brood Year	Rearing Facility	Eyed Eggs Received	# of Fry Ponded	% Survival to Ponding as Fry	# of Smolts Released	% Survival to Release as Smolts	Release Location
2000	Oxbow FH	122,514	121,032	98.8%	115,220	94.0%	HC Dam
2001	Oxbow FH	178,409	175,408	98.3%	171,463	96.1%	HC Dam
2002	Oxbow FH	230,000	226,392	98.4%	209,246	91.0%	HC Dam
	Umatilla FH	336,967	334,544	99.3%	332,226	98.6%	HC Dam
2003	Oxbow FH	200,000	197,669	98.8%	9,957	87.7%	HC Dam
					165,438		PLAP
2004	Oxbow FH	211,000	207,387	98.3%	189,119	89.6%	HC Dam
	Umatilla FH	842,278	826,916	98.2%	394,055	93.6%	HC Dam
					397,704	94.4%	PLAP
2005	Oxbow FH	210,000	206,760	98.5%	191,135	91.0%	HC Dam
	Umatilla FH	378,064	351,726	93.0%	332,165	87.9%	HC Dam
		451,532	421,808	93.4%	397,085	87.9%	PLAP
2006	Oxbow FH	127,564	126,664	99.3%	124,539	97.6%	HC Dam
2007	Oxbow FH	205,000	202,668	98.9%	192,471	93.9%	HC Dam
	Umatilla FH	810,000	792,793	97.9%	770,350	95.1%	HC Dam
2008	Oxbow FH	210,000	206,154	98.2%	202,839	96.6%	HC Dam
	Umatilla FH	823,000	805,966	97.9%	803,485	97.6%	HC Dam

Data Source: OFH Fall Chinook Salmon Brood Year Reports (2000-2006), OFH Monthly Narrative Reports and ODFW's Umatilla Fish Hatchery

HC Dam - Snake River at Hells Canyon Dam

PLAP - Snake River at NPT Pittsburg Landing Acclimation Ponds

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

Describe circumstances where extra eggs may be taken (e.g. as a safeguard against potential incubation losses), and the disposition of surplus fish safely carried through to the eyed eggs or fry stage to prevent exceeding of programmed levels.

Females trapped at LGR tend to have a higher fecundity than that of females trapped at LFH. This is because the fish trapped at LGR are primarily sub-yearlings and wild fish, whereas the fish trapped at LFH are primarily from yearling releases, which produce less fecund adults. Causes for surplus eggs include: 1) using a fecundity that underestimates the average fecundity of fish in the return, resulting in more trapped and spawned fish to meet egg take goals than were actually needed; 2) spawning more fish anticipating a high stray rate when actually fish were all in-basin; 3) not knowing the actual number of eggs on hand until eye up; 4) changes in survival rates of the gametes; and 5) requesting additional eggs to backfill production at NPTH.

Surplus eggs of Snake River origin from hatchery releases may be folded into production groups as listed in the fall agreement, if density and flow parameters allow. (Refer to LFH Annual Operation Plan 2009-2010, Attachment 6). Jills (1 salt) may be culled if excess eggs are taken.

Per IPC's MOU with the COE, IPC will receive up to 1.3 million eyed eggs from Lyons Ferry FH when eggs are available; therefore there is no cause for IPC to receive surplus eggs.

9.1.3) Loading densities applied during incubation.

Provide egg size data, standard incubator flows, standard loading per Heath tray (or other incubation density parameters).

LFH - Currently there are no management goals regarding incubation loading densities. Protocol restricts loading of incubation trays after eye-up to no more than 5,000 eggs per tray.

Irrigon Hatchery - Incubation at Irrigon Hatchery is set at 5gpm per tray and less than 10,000 eggs per tray.

Oxbow Fish Hatchery – Eyed eggs are transported from Lyons Ferry FH in 75 quart coolers containing chilled water and ice. Upon receipt from Lyons Ferry FH, eyed eggs are disinfected for approximately one half hour in a 100 parts per million (ppm) solution of well water and Argentyne (buffered iodine). After disinfection, eyed eggs are loaded into Marisource 16-tray vertical flow incubator stacks. Loading densities vary from year to year, however incubator trays are typically loaded with approximately 3,000 eggs each. Eggs are incubated with 54 degree F well water at 5 gpm per IHOT recommendations. Dead eggs are picked at approximately 800 Fahrenheit temperature units (FTUs), at 1,000 FTUs and at 1,500 FTUs.

Umatilla Fish Hatchery – Eyed eggs are transported from Lyons Ferry FH in mesh bags submerged in five-gallon buckets containing chilled water and ice. Upon arrival at Umatilla FH, eggs are disinfected for approximately 15 minutes in a 75 ppm solution of Argentyne and well water. Hatchery incubation consists of four isolated units of Marisource vertical flow incubators. Incubator tray loading densities do not exceed 7,300 eyed eggs per tray. Eggs are incubated with 54 degrees F well water at 4 gpm. Well water can be supplemented with chilled water to decrease water temperatures down to 45 degrees F in three units and 38 degrees F in one unit.

9.1.4) Incubation conditions.

Describe monitoring methods, temperature regimes, minimum dissolved oxygen criteria *(influent/effluent), and silt management procedures (if applicable), and any other parameters monitored.*

LFH - See section 7.7 for specific incubation techniques including fish health maintenance. There are currently no management goals relating to incubation conditions. LFH Annual Operation Plan 2009-2010 is attached (Attachment 6).

Irrigon Hatchery - Water used during incubation at Irrigon FH is well water with dissolved oxygen (D.O.) of 10.0 and temperature of 42-55 degrees Fahrenheit, and is clear and free of silt. Water temperature is continuously monitored via recording thermograph or set via chillers. Dissolved oxygen is monitored, but has never presented a problem for egg survival.

Oxbow Fish Hatchery – Eggs are reared on well water, which is pumped from one of two wells to a surge tank in the hatchery building before being distributed to the incubator stacks. Well #1 can provide up to 125 gpm of 54 degree F water, and well #2 can produce 425 gpm of 56 degree F water. A 70-horsepower water chiller capable of chilling water to 40 degrees F is also available if hatchery personnel need to manipulate incubation water temperatures between 54 degrees F and 40 degrees F. Incubation stacks utilize catch basins to prevent silt and fine sand from circulating through incubation trays. Oxygen levels average 9.8 ppm for influent water and 9.2 ppm for effluent discharge.

Umatilla Fish Hatchery – Water is supplied to the Umatilla FH from the Columbia River through a Ranney well system. Water flows are regulated to a minimum of 4 gpm with individual egg tray temperatures ranging from 38 degrees F to 54 degrees F. Oxygen saturation levels average 10 ppm for influent water and 9 ppm for effluent discharge.

9.1.5) Ponding.

Describe degree of button up, cumulative temperature units, and mean length and weight (and distribution around the mean) at ponding. State dates of ponding, and whether swim up and ponding are volitional or forced.

LFH – Fry hatch after 955 thermal units. After a total of 1,774 thermal units are recorded, the fry are buttoned up; then ponded at 1,000 fish per pound by hatchery staff. Fry are moved directly to the outside raceways. An ideal ponding density index (DI) goal for Snake River origin fall Chinook produced at LFH is not specified by LSRCP. Management objectives for fall Chinook ponding in raceways is dependent upon fall Chinook agreements and rearing capacity, and can change yearly. Density indices were reduced beginning in 2001, to address bacterial gill problems encountered since 1984. These indices are now evaluated annually to minimize disease outbreaks while targeting maximum production and SAR. However, declining occurrence of both BKD and Bacterial Gill disease (BGD) since reducing densities warrants a maximum DI of 0.08 lbs/ft^3 at ponding and until fish are larger than 100 FPP (4.5 g/fish). Water turnover rates are also being evaluated. Please refer to section 5.5 for more information regarding ponding and subsequent rearing.

Irrigon Hatchery - At Irrigon fish hatchery fish are moved to the circular raceways at swim up. Then the fish are transferred to the concrete raceways when they reach 400fpp.

Oxbow Fish Hatchery – Following hatching, fall Chinook salmon sac-fry button up at approximately 1,700 to 1,750 FTUs at which point they are moved outside to the juvenile raceways (usually in early February). Fry are ponded directly into the concrete juvenile raceways, but are initially restricted to a small section of the raceways with a water flow of 70 gpm. Approximately every 30 days, rearing space is increased by moving the screens further down the raceways and flows are increased to maintain target flows. Density and flow indices are maintained to not exceed 0.30 lbs/ft^3/in and 1.00 lbs/gpm/in, respectively. Fish are reared in these raceways until their release as sub-yearling smolts.

Umatilla Fish Hatchery – Fall Chinook salmon fry are ponded in the Oregon raceways in early February at approximately 1,850 FTUs, 1,000 fpp, and 100% button-up. These raceways are designed for serial reuse in groups of two raceways, an upper and a lower raceway; however, they also can be supplied with fresh water individually, if necessary. Final rearing occurs in the Michigan style raceways where water is supplied in reuse groups of three raceways each. The size at which fish are transferred to the Michigan style raceways varies depending on how many fish are in each Oregon raceway; however, fingerlings are transferred when their total weight is approximately 2,800 pounds. Each raceway has a submersible pump that supplies 950 gpm of water to oxygen contact columns, located at the head of each pond. Oxygen is introduced and unwanted saturated gas is removed from incoming water at this point. Current production goals at Umatilla FH are to rear fall Chinook salmon in Michigan style raceways with a final density index of approximately 0.64 lbs/ft^3/in, a flow index of 1.5 lbs/gpm/in, and a water exchange rate of 3.4 times per hour.

FCAP sites – Pittsburg Landing and Big Canyon sites rear yearlings to a density of 0.12 lbs/ft^{3}and sub-yearlings to a density of 0.14 lbs/ft^3. The CJR AF rears yearlings to a density of 0.04 lbs/ft^3 and sub-yearlings to a density of 0.05 lbs/ft^3. Yearlings are programmed to be released at 10 fpp and sub-yearlings are released at 50 fpp.

9.1.6) Fish health maintenance and monitoring.

Describe fungus control methods, disease monitoring and treatment procedures, incidence of yolk-sac malformation, and egg mortality removal methods.

LFH

Eggs will be initially disinfected and water hardened for one hour in iodophor (1:100 or 10,000 ppm). During incubation, formalin (1:600 or 1,667 ppm) will be added every other day for 15 minutes to control fungus on the eggs.

Flow monitors will sound an alarm if flow through the incubation troughs is interrupted. IHOT incubation protocols will be followed where practical.

Footbaths will be present in the incubation room at each door. Staff will disinfect boots each time that they enter or exit the area.

Dead eggs will be picked and removed at the eyed stage

All sampling equipment for fish evaluations will be disinfected with iodophor if equipment was used in any other location prior to coming onsite. Disinfections will occur between sampling of raceways, and after completion of tasks.

After fish are ponded, a WDFW fish health specialist visits the hatchery monthly or more often as requested by hatchery personnel. On monthly visits, fish are examined for abnormal behavior and characteristics. In cases of sickness and/or mortality, fish are sacrificed to determine the cause of the problem.

Irrigon FH

- These monitoring plans are consistent with monitoring plans developed by the Integrated Hatchery Operations Team for the Columbia Basin anadromous salmonid hatcheries (see Policies and Procedures for the Columbia Basin anadromous Salmonid Hatcheries, Annual Report 1994. Bonneville Power Administration).
- A qualified fish health specialist will conduct all fish health monitoring.
- Conduct examinations of juvenile fish at least monthly and more often as necessary. A representative sample of healthy and moribund fish from each lot of fish will be examined. The number of fish examined will be at the discretion of the fish health specialist.
- Investigate abnormal levels of fish loss when they occur.
- Determine fish health status prior to release or transfer to another facility. The exam may occur during the regular monthly monitoring visit, i.e. within 1 month of release.
- Appropriate actions including drug or chemical treatments will be recommended as necessary. If a bacterial pathogen requires treatment with antibiotics a drug sensitivity profile will be generated when possible. Incoming eggs are disinfected with iodine but no other disease treatments occur unless it is necessary.
- Findings and results of fish health monitoring will be recorded on a standard fish health reporting form and maintained in a fish health database.

\- Fish culture practices will be modified if deemed necessary after reviewing with facility personnel. Pertinent discussion items are as follows: nutrition, water flow and chemistry, loading and density indices, handling, disinfection procedures, and disease treatments.

Umatilla FH

Oxbow FH

FCAP sites

Staff performs daily scheduled fish culture duties that includes: checking and recording oxygen levels in the rearing units three times each day, feeding the rearing units three times each day and picking fish mortality twice each day. Staff also observes fish behavior for abnormalities, and assists in fish health checks and the fish-marking program. The fish are fed a semi-moist pellet manufactured by Bio-Oregon of Warrenton, Oregon. Fish culture methods are the same as per Integrated Hatchery Operations Team (IHOT) guidelines and consistent with WDFW fish culture techniques at LFH. The NPT-DFRM

Production Division Director reviews any changes to standard procedures, and other agencies are consulted if necessary. Environmental precautions are necessary to handle diesel and oil for the portable water pumps.

Yearling fish are reared and acclimated in the temporary facilities for six weeks (10 weeks at Capt. John Rapids) before release into the Snake and Clearwater Rivers during April, at a size of approximately 10 fpp, or 160-170 mm fork length. Sub-yearling fish are reared and acclimated approximately four weeks for group 1, and two to four weeks for group 2 before release into the river during June, at 60 fpp. Release typically occurs during rising water conditions, at the same time or slightly preceding fall Chinook salmon releases at LFH, and at night to minimize predation by birds or other fish.

Fish health services are provided by contract with the USFWS, Dworshak Fish Health Center (DFHC). The contract provides diagnostic and pathogen survey services for all fall Chinook juveniles and smolts transported to the fish acclimation facilities. The services include a fish health check before transfer, bi-weekly exams during acclimation and a pre-release exam. Other health checks are performed as requested. Fish health protocols are as per AFS Blue Book, IHOT and Nez Perce Tribe fish health protocols.

LFH - See section 7.7 for fish health maintenance and monitoring. LFH Annual Operation Plan 2009-2010 (Attachment 6).

Irrigon Hatchery - Eyed eggs are transferred to Irrigon Hatchery and upon arrival are disinfected in 75 ppm iodophore (buffered iodine) for 10 minutes. Formalin treatments @ 1,667 ppm are continued three times per week until hatch, which is usually no more than two weeks after arrival at Irrigon Hatchery.

Oxbow Fish Hatchery – Upon receipt from LFH, eyed eggs are typically disinfected in a 100-ppm solution of well water and Argentyne for 30 minutes. Dead eggs are picked at approximately 800, 1,000 and 1,500 FTUs. Formalin treatments are not needed to control fungus on incubating eggs. Once fry are ponded in the juvenile raceways, pathologists from IDFG's Eagle Fish Health Laboratory travel to OFH on a monthly basis to evaluate fish health. Evaluations include necropsies performed on fry to detect bacterial and viral rates of infection and assessments of organ development and fish conformation. A final pre-liberation assessment is performed within 45 days of release from the hatchery.

Umatilla Fish Hatchery – At Umatilla FH, eyed fall Chinook salmon eggs are disinfected in 75 ppm Argentyne for 15 minutes upon receipt from Lyons Ferry FH. Fungus is controlled with formalin treatments at a concentration of 1,667 ppm (1:600). Formalin treatments are scheduled seven times per week for 15 minute intervals. ODFW pathology staff monitors fish health on a monthly basis until transfer or release, at which time a pre-liberation exam is completed.

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

(*e.g. "Eggs will be incubated using well water only to minimize the risk of catastrophic loss due to siltation.")*

LFH - Refer to section 8.5 for discussion about mating protocol. Flows to the incubator stacks are checked daily, as is head box water level, by utilizing a simple visual monitoring system installed on each head box. Head boxes are physically checked periodically and cleaned as needed, although typically no cleaning is required. All four head boxes have water level alarms, set to sound well before water would be lost to incubation trays. Pathogen free well water reduces the likelihood of disease outbreaks that could affect survival.

Irrigon Hatchery - Eggs are incubated solely using pathogen-free well water to minimize the risk of catastrophic loss due to siltation. Utilizing pathogen-free well water for incubation and rearing will reduce exposure of fry and fingerlings to any potential pathogens in the Snake River.

Oxbow Fish Hatchery – Eggs are incubated solely using pathogen-free well water to minimize the risk of catastrophic loss due to siltation. Utilizing pathogen-free well water for incubation and a portion of early rearing will reduce exposure of fry and fingerlings to any potential pathogens in the Snake River.

Umatilla Fish Hatchery – Eggs are incubated solely using pathogen-free well water to minimize the risk of catastrophic loss due to siltation. Utilizing pathogen-free well water for incubation and rearing will reduce exposure of fry and fingerlings to any potential pathogens in the Snake River.

9.2) Rearing:

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

LFH - Refer to Table 9 Above.

Idaho Power Program – Refer to Table 10 above.

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

Include density targets (lbs fish/gpm, lbs fish/ft3 rearing volume, etc).

LFH - When production at LFH began increasing in the late 1990s, disease outbreaks also increased. Density indices were evaluated in 2001-2004 to address bacterial gill disease (BGD) problems and the potential effect on BKD outbreaks encountered since 1984. The ideal density indices for Snake River origin fall Chinook produced at LFH, according to rearing vessel, are not known at this time and likely depend on various within-hatchery factors (water quality, vessel type, feed type, etc); but trials keeping the

DI between 0.08 and 0.14 (depending on fish size), consistently produced fish with lower incidence of both BKD and BGD. Therefore, density for any fall Chinook group reared at the LFH should generally not exceed 0.14 lbs/ft^3. Fall Chinook densities in any rearing vessel should not exceed 0.09 lbs/ft^3 until fish reach 100 fish per pound. At that point, densities can increase on a sliding scale to 0.14 lbs/ft^3 at yearling size [10-12 FPP (38-45 g/fish)]. Fish destined for transfer to other facilities for final rearing (historically at around 70 FPP) should generally not exceed a density of 0.11 lbs/ft^3. In the past, flow indices rarely exceeded 80% of maximum for any rearing vessel (Table 34). Water turnover rates are also being evaluated. Please see section 5.5 for more information regarding rearing.

Table 34. Rearing density and flow indexes at LFH for brood years 2005-2008.

Brood Year	Rearing Facility	Density Index (lbs/ft^3/in)		Flow Index (lbs/gpm/in)	
		At Ponding	At Release	At Ponding	At Release
2005 subs	LFH	.05	.08	.28	.31
2006 subs	LFH	.05	.08	.28	.32
2007 subs	LFH	.05	.07	.28	.30
2008 subs	LFH	.05	.09	.35	.35
2005 yrls	LFH	.03	.14	.16	.50
2006 yrls	LFH	.03	.14	.16	.50
2007 yrls	LFH	.03	.14	.16	.45
2008 yrls	LFH	.03	.14	.17	.45

Oxbow Fish Hatchery – During final rearing in the juvenile raceways, the target density index in the concrete raceways at OFH is 0.3 lbs/ft^3/in. The target flow index is 1.0 lbs/gpm/in. Actual density and flow indices achieved at OFH are summarized in the following table.

Table 35. Density and loading criteria for Oxbow FH fall Chinook salmon by brood year (2000-2008).

Brood Year	Rearing Facility	Density Index (lbs/ft^3/in)		Flow Index (lbs/gpm/in)		Volume in Raceways (ft^3)		Flow in Raceways (gpm)	
		At Ponding	At Release	At Ponding	At Release	At Ponding	At Release	At Ponding	At Release
2000	Oxbow FH	0.25	0.25	1.1	1.01	308	2,538	70	619
2001	Oxbow FH	0.18	0.36	0.69	1.03	616	2,671	160	925
2002	Oxbow FH	0.21	0.42	0.81	1.13	616	2,671	160	990
2003[1]	Oxbow FH	0.19	0.27	0.98	1.24	616	2,671	120	575

2004	Oxbow FH	0.20	0.31	0.81	1.73	616	2,671	150	485
2005	Oxbow FH	0.21	0.28	0.62	0.88	455	2,671	150	841
2006	Oxbow FH	0.07	0.20	0.24	1.05	582	2,836	160	525
2007	Oxbow FH	0.25	0.21	0.53	1.11	584	2,785	274	525
2008	Oxbow FH	0.24	0.33	2.16	1.2	585	2,856	63	785

[1] Density and loading criteria at release are through May 3, 2004 only, when 166,623 sub-yearling smolts were transported to the NPT Pittsburg Landing Acclimation Pond.
Data Source: OFH Fall Chinook Salmon Brood Year Reports (2000-2006) and OFH Monthly Production Summaries

Umatilla Fish Hatchery – Current production goals at Umatilla FH are to rear fall Chinook salmon in Michigan style ponds with a final density index of 0.64 lbs/ft^3/inch, a flow index of 1.5 lbs/gpm/inch, and an exchange rate of 3.4 times per hour. Actual density and flow indices achieved at Umatilla FH are summarized in the following table.

Table 36. Density and loading criteria for Umatilla FH fall Chinook salmon by brood year and rearing pond (2002-2008).

Brood Year	Rearing Pond	Density Index (lbs/ft^3/in)		Flow Index (lbs/gpm/in)		Volume in Ponds (ft^3)		Flow in Ponds (gpm)	
		At Ponding	At Release	At Ponding	At Release	At Ponding	At Release	At Ponding	At Release
2002	Oregon	0.04	0.64	0.315	0.302	6,260	6,260	800	1,250
	Michigan	-	-	-	-	-	-	-	-
2004	Oregon	0.12	-	0.96	-	6,260	-	800	-
	Michigan	-	1.85	-	4.39	-	2,250	-	950
2005	Oregon	0.08	-	0.63	-	6,260	-	800	-
	Michigan	-	0.51	-	3.65	-	6,750	-	950
2007	Oregon	0.08	-	0.65	-	6,260	-	800	-
	Michigan	-	0.69	-	4.90	-	6,750	-	950
2008	Oregon	0.08	-	0.65	-	6,260	-	800	-
	Michigan	-	0.58	-	4.12	-	6,750	-	950

Data Source: Data provided by ODFW's Umatilla Fish Hatchery

9.2.3) Fish rearing conditions

(Describe monitoring methods, temperature regimes, minimum dissolved oxygen, carbon dioxide, total gas pressure criteria (influent/effluent if available), and standard pond management procedures applied to rear fish).

LFH - Refer to section 5.5. Raceways are supplied with oxygenated water from the hatchery's central degassing building. Approximately 800-1,000 gpm of water enters each raceway. Oxygen levels range between 10-12 ppm entering and 8-10 ppm leaving the raceway, depending on ambient air temperature and number of fish in the raceway.

Flow index (FLI) is monitored monthly at all facilities and rarely exceeds 80% of the allowable loading. Raceways are cleaned by vacuuming weekly to remove accumulated feed and fecal material. Fall Chinook in raceways are fed by hand, whereas those held in the lake are fed using a feed blower. LFH Annual Operation Plan 2009-2010 is attached (Attachment 6).

Irrigon FH - Fish are reared in well water (seasonal temperature variations 50°F to 62°F). Dissolved oxygen levels are monitored during peak production and maintained above 6 ppm. Raceways are cleaned weekly and mortalities are picked daily.

Oxbow Fish Hatchery – Initial flows in the juvenile raceways are typically set at approximately 70 gpm of constant 56 degree F well water. As fish grow, flows are increased to maintain density and flow indices not exceeding 0.30 lbs/ft^3/in and 1.00 lbs/gpm/in, respectively, up to approximately 200 gpm. When fish reach roughly 100 fpp, river water is added to the raceways to increase flows. Cooler river water temperatures at that time (generally the end of March) can reduce raceway temperatures up to 10 degrees F. During the rearing period, water temperatures are monitored at the head-box for river water temperatures, at the raceway head box for mixed water temperatures, and at the well for groundwater temperatures. Fish are reared in the juvenile raceways until their release as sub-yearling smolts. Fish are fed using mechanical belt feeders with some supplemental hand feeding. Raceways are cleaned and mortalities removed and recorded daily. Snake River water temperatures at this site can range between seasonal lows of 34 degrees F and highs of 72 degrees F. Dissolved oxygen is monitored in the raceways on a weekly basis from ponding to release, and averages 9.8 ppm for influent well water. No dissolved oxygen data is available for effluent well water or influent and effluent water once well and river water are mixed in the raceways. Total water chemistry is measured at the start of parr rearing and again when river water is introduced and mixed with the well water in the raceways.

Umatilla Fish Hatchery – Fall Chinook salmon are initially reared in Oregon raceways from swim-up to a maximum size of 285 fpp as fingerlings. The size at which fish are transferred depends on the number of fish in the Oregon raceways. Final rearing for fall Chinook salmon at Umatilla FH occurs exclusively in the Michigan style raceways. Fish are fed a minimum of once every hour via mechanical feeders. Ponds are cleaned daily and waste is flushed to settling ponds, which discharge to the Columbia River. Effluent water quality is monitored under NPDES guidelines. Mortalities are removed once per day. Water flows are monitored weekly to maintain a target flow rate of 950 gpm. Water temperatures average 54 degrees F, but range between 52 and 61 degrees F. Dissolved oxygen is monitored daily and levels are maintained at or above 8 ppm. Ammonia and total gas saturation levels have not been a problem. Records are kept of all water quality monitoring done at the hatchery.

9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available. See Table 16 -18.

LFH – Refer to Table 37 below. .

Table 37. Monthly growth of Snake River Fall Chinook sub-yearlings at LFH.

Brood Year	Date	Average Fish Per Pound (fpp)	Average Length (inches)	Condition Factor (K)
2005	Jan	967	1.48	
	Feb	727	1.62	1.016
	March	345	2.08	1.076
	April	128	2.89	
	May	75	3.46	
	June	56	3.81	
	July			
	Aug			
	Sept			
	Oct			
	Nov			
	Dec			
2006	Jan	891	1.52	
	Feb	608	1.72	1.24
	March	313	2.15	1.14
	April	143	2.79	
	May	83	3.34	
	June			
	July			
	Aug			
	Sept			
	Oct			
	Nov			
	Dec			
2007	Jan			
	Feb	701	1.64	1.086
	March	285	2.22	
	April	118	2.97	
	May	63	3.67	
	June			
	July			
	Aug			
	Sept			
	Oct			
	Nov			
	Dec			
2008	Jan	866	1.53	
	Feb	513	1.81	1.135
	March	212	2.44	1.152
	April	100	3.14	
	May	63	3.67	

Monthly growth of Snake River Fall Chinook yearlings at LFH

Brood Year	Date	Average Fish Per Pound (fpp)	Average Length (inches)	Condition Factor (K)
2005	Jan	962/14	34.5/153.5	

	Feb	703/13	41.7/157.4	
	March	350/11	52.6/166.4	
	April	179/10	65.7/171.7	
	May	116	75.9	
	June	78	86.7	
	July	58	95.6	1.004
	Aug	44	104.9	
	Sept	33	115.4	
	Oct	28	121.9	
	Nov	22	132.1	
	Dec	17	143.9	
2006	Jan	947/15	37.7/150	
	Feb	622/13	43.4/157.4	
	March	270/11	57.3/166.4	
	April	158/10	68.5/171.7	
	May	106	78.2	1.044
	June	71	89.4	
	July	50	100.5	1.08
	Aug	41	107.4	1.037
	Sept	35	113.2	
	Oct	29	120.5	
	Nov	23	130.1	
	Dec	19	138.7	
2007	Jan	17	143.9	
	Feb	670/15	42.3/150	1.036
	March	254/13	58.5/157.4	
	April	158/10	68.5/171.7	
	May	106	78.2	
	June	61	94	1.067
	July	49	101.2	1.062
	Aug	40	108.2	
	Sept	34	114.3	1.062
	Oct	28	121.9	
	Nov	22	132.1	1.101
	Dec	19	138.7	
2008	Jan	882	38.6	
	Feb	608	43.7	
	March	346	52.8	1.055
	April	182	65.4	1.074
	May	109	77.5	1.121
	June	77	87	
	July	53	98.6	1.110
	Aug	42	106.5	
	Sept	35	113.2	1.113
	Oct			
	Nov			
	Dec			

Oxbow Fish Hatchery – Juvenile fall Chinook salmon are reared for approximately 5 months before being released as sub-yearling smolts into the Snake River. After button up, all fish are reared in the juvenile raceways until their release. Growth is tracked each week and pound counts and lengths are recorded throughout the rearing period at OFH. A condition factor of 0.00035 is assumed when making these calculations. Monthly fish growth information is summarized in the Table 38 below.

Table 38. Monthly growth of IPC fall Chinook at Oxbow Fish Hatchery.

Brood Year	Date	Average Fish Per Pound (fpp)	Average Length (inches)	Avg. Length Increase by Month (inches)	Average Monthly Mortality
2000	Feb-01	373.0	2.10	-	2,326
	Mar-01	100.0	3.22	1.12	329
	Apr-01	52.0	3.78	0.56	70
	May-01	42.0	4.35	0.57	29
	Jun-01[1]	23.0	4.94	0.59	0
2001	Feb-02	322.0	2.09	-	2,716
	Mar-02	99.0	2.87	0.78	914
	Apr-02	57.4	3.92	1.05	217
	May-02	42.0	4.24	0.32	98
2002	Feb-03	410.0	1.94	-	5,352
	Mar-03	116.0	2.89	0.95	881
	Apr-03	77.0	3.40	0.51	1,107
	May-03	46.6	4.03	0.63	345
2003	Feb-04	452.4	1.89	-	10,520
	Mar-04	122.6	2.80	0.91	2,230
	Apr-04	88.6	3.55	0.75	305
	May-04[2]	48.0	3.81	0.26	14
2004	Jan-05	1102.0	1.52	-	4,822
	Feb-05	320.7	2.16	0.64	10,330
	Mar-05	98.5	3.09	0.93	2,061
	Apr-05	61.5	3.66	0.57	1,055
2005	Jan-06	1800.0	1.23	-	757
	Feb-06	408.7	1.97	0.74	7,963
	Mar-06	124.3	2.63	0.66	3,236
	Apr-06	80.3	3.22	0.59	1,421
2006	Feb-07	348.4	2.10	-	2,469
	Mar-07	103.5	3.03	0.93	149
	Apr-07	63.4	3.73	0.70	368
	May-07	55.0	3.87	0.14	23

2007	Jan-08	895.0	1.55	-	1,174
	Feb-08	233.6	2.37	0.82	2,443
	Mar-08	88.9	3.26	0.89	163
	Apr-08	55.3	3.71	0.45	413
	May-08	55.0	3.87	0.16	23
2008	Jan-09	972.6	1.51	-	1,219
	Feb-09	296.9	2.26	0.75	3,100
	Mar-09	98.8	3.09	0.83	364
	Apr-09	62.7	3.75	0.66	289
	May-09	54.8	3.93	0.18	143

Data Source: OFH Fall Chinook Salmon Brood Year Reports (2000-2006) and OFH Monthly Production Summaries

[1] 113,770 smolts were released on May 16, 2001. June numbers are for the 1,450 smolts that remained at OFH until their release on June 19, 2001.

[2] 166,623 sub-yearling smolts were transported to the NPT Pittsburg Landing Acclimation Pond on May 3, 2004. May numbers are for the 9,957 smolts that remained at OFH until their release on May 28 2004.

Umatilla Fish Hatchery – Fall Chinook salmon are reared for approximately 5 months after being received as eyed eggs from Lyons Ferry FH. After button up, all fish are reared in the Oregon style rearing ponds until their transfer to the Michigan style ponds for final rearing.

Table 39. Monthly growth of IPC fall Chinook at Umatilla Fish Hatchery.

Brood Year	Date	Average Fish Per Pound (fpp)	Average Length (inches)	Avg. Length Increase by Month (inches)	Average Monthly Mortality
2002	Feb-03	297.0	2.13	-	1,489
	Mar-03	126.7	2.81	0.68	353
	Apr-03	55.9	3.71	0.89	415
	May-03	41.4	4.10	0.40	61
2004	Feb-05	375.0	1.97	-	15,775
	Mar-05	168.0	2.55	0.58	3,290
	Apr-05	65.9	3.50	0.95	3,940
	May-05	63.4	3.56	0.06	236
2005	Feb-06	387.0	1.89	-	38,177
	Mar-06	136.2	2.63	0.74	3,396
	Apr-06	62.5	3.37	0.74	1,708

	May-06	62.5	3.37	0.00	323
2007	Feb-08	373.2	1.92	-	4,515
	Mar-08	106.3	2.85	0.93	949
	Apr-08	63.1	3.36	0.51	1,096
	May-08	44.0	3.76	0.40	699
2008	Feb-09	615.6	1.63	-	6,990
	Mar-09	164.5	2.48	0.85	3,487
	Apr-09	77.2	3.15	0.67	2,319
	May-09	60.2	3.41	0.26	328

Data Source: Data provided by ODFW's Umatilla Fish Hatchery

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

Contrast fall and spring growth rates for yearling smolt programs. If available, indicate hepatosomatic index (liver weight/body weight) and body moisture content as an estimate of body fat concentration data collected during rearing.

LFH - For fish growth data, refer to Table 37 in Section 9.2.4 above.

Irrigon Hatchery - Hepatosomatic indexes have not been scheduled as a portion of the evaluation program. It is probable that they could be used to evaluate fall Chinook prior to release.

Oxbow Fish Hatchery – For fish growth data, refer to Table 38 in Section 9.2.4 above.

Umatilla Fish Hatchery – For fish growth data, refer to Table 39 in Section 9.2.4 above.

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

LFH - Fry/fingerling will be fed an appropriate commercial dry or semi-moist trout/salmon diet. Feeding frequency, percent body weight per day, and feed size are adjusted as fish increase in size in accordance with good fish culture practices and program goals.

Table 40. Feeding schedules and conversions for fall Chinook reared at LFH.

Rearing Period	Food Type (Bio-Oregon)	Application Schedule *(# feedings/day)*	Feeding Rate *(% B.W./day)*	Average Monthly Food Conversion
January	Yrls-BDS #1, BCF 2.5 Subs-BVS #0	Yrls-1/day by hand & blower Subs-4-5 per/day by hand	Yrls-1-2.5% Subs-2.5%	Yrls-.7-.8 Subs-.6
February	Yrls-BDS #1, BCF 2.5 Subs-BVS #0 & #1	Yrls-1/day by hand & blower Subs-2-3 per/day by hand	Yrls-1-2.5% Subs-2.5%	Yrls-.7-.8 Subs-.6

March	Yrls-BDS #2, BCF 2.5 Subs-BVS #1 & #2	Yrls-1/day by hand & blower Subs-1-2 per/day by hand	Yrls-1-2.25% Subs-2.25%	Yrls-.7-.8 Subs-.6
April	Yrls-BDG 1.2, BCF 2.5 Subs-BVS #2, BVF 1.2	Yrls-1/day by hand & blower Subs-1-2 per/day by hand	Yrls-1-1.5% Subs-1.5%	Yrls-.7-.8 Subs-.7
May	Yrls-Bio medicated 1.2 Subs-BVF 1.5	Yrls-1/day by hand Subs-1-2 per/day by hand	Yrls-1.5% Subs-1.25%	Yrls-.7 Subs-.7
June	Yrls-BCF 1.2	Yrls-1/day by hand	Yrls-.75%	Yrls-.8
July	Yrls-BCF 1.5	Yrls-1/day by hand	Yrls-.65%	Yrls-.8
August	Yrls-BCF 1.5 & 2.0	Yrls-1/day by hand	Yrls-.65%	Yrls-.8
September	Yrls-BCF 2.0	Yrls-1/day by hand	Yrls-.55%	Yrls-.8
October	Yrls-BCF 2.0	Yrls-1/day by hand & blower	Yrls-.65%	Yrls-.8
November	Yrls-BCF 2.0 & 2.5	Yrls-1/day by hand & blower	Yrls-.50%	Yrls-.8
December	Yrls-BCF 2.5	Yrls-1/day by hand & blower	Yrls-.45%	Yrls-.8

Irrigon FH - Fall Chinook salmon are fed Bio-Oregon feed starter (BDS), Bio-moist grower (BMG), and Bio-moist feed (BMF). Fish are fed hourly up to 12 times per day by mechanical feeders at rates of 2.8%-6% body weight.

Oxbow Fish Hatchery – Juvenile fall Chinook salmon are fed Bio-Oregon feed from button-up to release (starter diet, pelleted diet, and pelleted diet with beta glucan). The beta glucan feed is fed two weeks prior to marking to promote immune system function. Fish are fed via mechanical belt feeders supplemented with periodic hand feeding. Food types used from button-up to sub-yearling smolt release are presented below.

Table 41. Oxbow Fish Hatchery feeding schedule for fall Chinook.

Rearing Period	Food Type (Bio-Oregon)	Application Schedule *(# feedings/day)*	Feeding Rate *(% B.W./day)*	Average Monthly Food Conversion
February	#0 and #1 starter diet	8+ hand feedings/day	2.30%	0.84
March	#1 and #2 starter diet, 1.2 mm pelleted diet (beta glucan)	12 hour belt (continuous)	1.40%	0.70
April	1.2 mm pelleted diet (beta glucan & regular)	12 hour belt (continuous)	1.20%	0.97
May	1.2 mm and 1.5 mm pelleted diet	12 hour belt (continuous)	1.50%	0.72

Data Source: OFH Fall Chinook Salmon Brood Year Reports (2000-2006) and OFH Monthly Production Summaries

Umatilla Fish Hatchery – Fall Chinook salmon are fed Bio-Oregon feed starter (BDS), Bio-moist grower (BMG), and Bio-moist feed (BMF). Fish are fed hourly up to 12 times per day by mechanical feeders at rates of 2.8%-6% body weight.

Table 42. Umatilla hatchery feeding schedule for fall Chinook.

Rearing Period	Food Type (Bio-Oregon)	Application Schedule (# feedings/day)[1]	Feeding Rate[2] (% B.W./day)	Average Monthly Food Conversion
February	#0 BVS	23 times per day by mechanical feeders	3.6%-3.3%	0.72
March	#0, #1, #2 BVS	27 times per day by mechanical feeders	3.3%-3.1%	0.61
April	#2 BVS, 1.2 and 1.5 mm BVF	29 times per day by mechanical feeders	3.1%-2.9%	0.76
May	1.5 and 2.0 mm BVF	32 times per day by mechanical feeders	2.9%-2.6%	0.94

[1] # feedings/day based on feeding 1/2 hour before sunrise to 1/2 hour after sunset

[2] Feeding rates are starting and ending for the month.
Data Source: Data provided by ODFW's Umatilla Fish Hatchery

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

LFH - A WDFW fish health specialist monitors fish health monthly. More frequent care is provided as needed if disease is noted. Treatment for disease is provided by Hatchery Specialists under the direction of the Fish Health Specialist. Sanitation consists of raceway cleaning, and disinfecting equipment between raceways and/or between species on the hatchery site. The 2009-2010 Annual Operation Plan for LFH is presented in the Appendices, and more fully describes fish health monitoring efforts and protocols.

Irrigon FH - Juvenile fish are treated for bacterial infections if necessary with florfenicol under a veterinarian prescription.

Oxbow Fish Hatchery – IDFG Eagle Fish Health Laboratory staff conducts routine fish health inspections on a monthly basis at OFH. This includes necropsies performed on sample fry to detect bacterial and viral rates of infection, to assess organ development, and to evaluate fish conformation. More frequent inspections occur if needed. Although not needed for IPC's fall Chinook salmon program thus far, therapeutics may be used to treat specific disease agents either via a medicated feed treatment (i.e. Oxytetracycline) or an external bath (i.e. formalin). Disinfection protocols are in place for equipment, trucks and nets. After fish are released each year, the raceways are power washed and then air-dried for approximately eight months between brood years.

Umatilla Fish Hatchery – Fish health is monitored monthly per specific protocols in the Umatilla Fish Health Monitoring and Evaluation work statement. All raceways are monitored monthly for pathogens and parasites. Five moribund or dead fish per raceway are tested for systemic and gill bacteria and five fish per raceway are examined for *Renibacterium salmoninarum* using DFAT or ELISA. If necessary, juvenile fish are treated for bacterial infections with oxytetracycline under an Investigational New Animal Drug (INAD) permit. A statewide fish health management policy (September 12, 2003) provides guidelines for preventative and therapeutic fish health strategies that are followed in this program.

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

LFH - Program goal for the Snake River Stock program will be to release yearling fall Chinook between April 1 and April 15 at 10 fpp. Sub-yearling releases are targeted for release in June at 50 fpp. Pre-liberation samples will note smolt development visually based on degree of silvering, presence/absence of parr marks, fin clarity and banding of the caudal fin. No gill ATPase activity or blood chemistry samples will be used to determine degree of smoltification, or to guide fish release timing, are anticipated.

Irrigon Hatchery – No smolt development indices are developed at Irrigon Hatchery.

IPC program - No smolt development indices are developed in IPC's fall Chinook salmon program at OFH or Umatilla FH.

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

"NATURES" rearing concepts will not directly be applied to the Snake River stock program. However, certain aspects of the "NATURES" techniques are used by default at LFH. For instance, the concrete rearing raceways are old enough that the walls and bottoms are of nearly natural coloration and texture, and promote natural looking fish. Once the yearling program fish are removed from the raceways, they are placed in a large earthen rearing pond with a concrete bottom at LFH, which greatly reduces density, producing more natural looking fish (i.e. less erosion on fins).

No natural or semi-natural rearing methods are applied at Irrigon, Oxbow or Umatilla FHs.

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

(*e.g. "Fish will be reared to sub-yearling smolt size to mimic the natural fish emigration strategy and to minimize the risk of domestication effects that may be imparted through rearing to yearling size.")*

LFH - Professional personnel trained in fish cultural procedures operate LFH facilities. Facilities are state-of-the-art to provide a safe and secure rearing environment through the use of alarm systems, backup generators, and water re-use pumping systems to prevent catastrophic fish losses. In 2003, a net to deter bird predation on the fish was installed over the lake in which fall Chinook are reared. Netting over the south raceways occurred in 2005, and netting over the north raceways occurred in 2006.

Irrigon Hatchery **-** Strict health monitoring, prevention, and treatment protocols are used.

Oxbow Fish Hatchery – Hatchery staff strive to rear fish at conservative density and flow indices (not to exceed 0.30 lbs/ft^3/in and 1.00 lbs/gpm/in, respectively). The IDFG Eagle

Fish Health Laboratory establishes fish health monitoring, disease treatment, and sanitation procedures. Fish are reared to sub-yearling smolt size and released into the Snake River to mimic the natural fish emigration strategy.

Umatilla Fish Hatchery – Strict health monitoring, prevention, and treatment protocols are used. Fish are reared to sub-yearling smolt size and released into the Snake River to mimic the natural fish emigration strategy and encourage outmigration.

SECTION 10. RELEASE

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

10.1) Proposed fish release levels

The following (Table 43) shows proposed WDFW Snake River Stock smolt releases into the Snake River from LFH. (Refer also to *US vs. Oregon* Production Priority Table B4.b)

Table 43. Proposed BY2009 Snake River fall Chinook tagging, transfers and releases.

Site	Transfer Goal	Release Goal	Size (fpp)	Age	Mark/CWT/ Elastomer	PIT Tags	Transfer/Release Date
Oxbow (IPC)	211,000	200,000	Eyed Eggs	0+	100% AD CWT	10,000	Jan – Feb 2009 (transfer)
Umatilla (IPC)	842,000	800,000	Eyed Eggs	0+	200K AD CWT 600K AD Only	NA	Jan – Feb 2009 (transfer)
DNFH/research	345,200	328,000	Eyed Eggs	0+	Unknown	328,000	Jan – Feb 2009 (transfer)
LFH	200,000	200,000	50	0+	100% AD CWT	-0-	May – Jun 2009
Grande Ronde Direct - Irrigon	421,000	400,000	Eyed Eggs	0+	200K ADCWT 200K Unmarked	-0-	Jan – Feb 2009 (transfer)
Capt. John	500,000	100,000 100,000 300,000	50 50 50	0+ 0+ 0+	CWT Only AD CWT Unmarked	3,500	Mar – Jun 2009
Big Canyon	500,000	100,000 100,000 300,000	50 50 50	0+ 0+ 0+	CWT Only AD CWT Unmarked	3,500	Mar – Jun 2009
Pittsburg Landing	400,000	100,000 100,000 200,000	50 50 50	0+ 0+ 0+	CWT Only AD CWT Unmarked	3,500	Mar – Jun 2009
Direct near Capt. John	200,000	200,000	50	0+	100% AD CWT	3,500	June 2009
LFH	450,000	450,000	10	1+	225K AD CWT 225K CWT Only	27,778	April 2010
Capt. John	155,000	150,000	12	1+	70K AD CWT 80K CWT Only	5,000	Feb - 2010 (transfer)
Pittsburg Landing	155,000	150,000	12	1+	70K AD CWT 80K CWT Only	5,000	Mar - 2010 (transfer)
Big Canyon	155,000	150,000	12	1+	70K AD CWT 80K CWT Only	5,000	Mar - 2010 (transfer)

IPC fall Chinook salmon program release goal (combined OFH and Umatilla FH releases):

Table 44. Proposed BY2009 releases of fall Chinook for IPC.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Fingerling	1,000,000	42.0	May	Snake River

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

Stream, river, or watercourse: Snake River
Release point: RKM 95.1 (LFH)
GPS: **N** 46.5986969 / W –118.2324069
HUC: 17060107
WRIA: **35**
Major watershed: Snake River
Basin or Region: Snake River Basin

Stream, river, or watercourse: Snake River
Release point: RKM 253.7 (near Couse Creek)
GPS: **N** 46.2048509 / W –116.9666427
HUC: 17060103
WRIA: **35**
Major watershed: Snake River
Basin or Region: Snake River Basin

Stream, river, or watercourse: Grande Ronde River
Release point: RKM 49.4 (near Cougar Creek)
GPS: **N** 46.0325972 / W –117.3191495
HUC: 17060106
WRIA: **35**
Major watershed: Grande Ronde River
Basin or Region: Grande Ronde

IPC releases
Stream, river, or watercourse: Snake River
Release point: RKM 395 (below Hells Canyon Dam)
GPS: N 45.25222 / W –116.70667
HUC: 17060101
Major watershed: Snake River
Basin or Region: Snake River Basin

FCAP:
Stream, river, or watercourse: Snake River
Release point: RKM 346 (Pittsburg Landing)
GPS: N 45.6175 / W -116.46945

HUC: 17060101

Major watershed: Snake River
Basin or Region: Snake River Basin

Stream, river, or watercourse: Snake River
Release point: RKM 263 (Captain John)
GPS: **N** 46.1385781 / W –116.9354294
HUC: 17060103
WRIA: **35**
Major watershed: Snake River
Basin or Region: Snake River Basin

Stream, river, or watercourse: Clearwater
Release point: RKM 57 (Big Canyon)
GPS: N46.4976764 / W –116.4345891
HUC: 170603060801
Major watershed: Clearwater River
Basin or Region: Clearwater River Basin

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

For existing programs, provide fish release number and size data for the past three fish generations, or approximately the past 12 years, if available. Use standardized life stage definitions by species presented in ***Attachment 2****. Cite the data source for this information*

The number of Snake River Stock fall Chinook released into the Snake River by WDFW has varied since program inception (Tables 45 and 46).

Table 45. Sub-yearling releases of fall Chinook that were part of LSRCP and FCAP programs for BY96-08.

Brood Year	Release Year	Begin Release	End Release	Total Released	fpp at release	Release site
1996	1997	06/10/1997	06/13/1997	252,705	63.9	Big Canyon
1998	1999	05/30/1999	06/05/1999	322,928	82.2	Captain John
1998	1999	06/02/1999	06/03/1999	347,105	83.8	Big Canyon
1998	1999	06/15/1999	06/15/1999	204,194	50.1	LFH on-station
1999	2000	05/20/2000	05/31/2000	491,033	45.4	Captain John
1999	2000	05/24/2000	05/26/2000	400,156	55.6	Pittsburg Landing
1999	2000	05/26/2000	05/26/2000	196,643	45.5	LFH on-station
1999	2000	05/30/2000	06/01/2000	497,790	40.2	Big Canyon
1999	2000	06/15/2000	06/23/2000	401,814	52.0	Captain John
1999	2000	06/20/2000	06/26/2000	392,684	45.0	Big Canyon
2000	2001	05/26/2001	05/26/2001	501,129	49.5	Captain John
2000	2001	05/28/2001	05/28/2001	374,070	84.1	Pittsburg Landing
2000	2001	05/29/2001	05/29/2001	499,606	53.3	Big Canyon
2000	2001	06/01/2001	06/01/2001	199,976	45.7	Col. R.-below BONN Dam
2000	2001	06/13/2001	06/13/2001	357,362	78.2	Big Canyon

2000	2001	07/03/2001	07/03/2001	3,994	52.2	LFH on-station
2001	2002	05/27/2002	05/28/2002	495,215	193.0	Big Canyon
2001	2002	05/27/2002	05/29/2002	399,315	166.0	Pittsburg Landing
2001	2002	05/28/2002	05/28/2002	498,927	215.0	Captain John
2001	2002	06/18/2002	06/19/2002	505,674	178.0	Big Canyon
2001	2002	06/20/2002	06/20/2002	498,948	152.0	Captain John
2001	2002	06/24/2002	06/24/2002	194,582	52.0	LFH on-station
2001	2002	10/16/2002	10/16/2002	29,059	24.6	Near Couse Creek
2001	2002	12/02/2002	12/02/2002	24,573	26.0	Snake R at Roosters Landing
2002	2003	03/04/2003	03/04/2003	33,500	1200.0	Snake R at Roosters Landing
2002	2003	05/28/2003	05/28/2003	512,685	81.3	Captain John
2002	2003	06/03/2003	06/03/2003	506,488	94.5	Big Canyon
2002	2003	06/04/2003	06/04/2003	390,183	129.6	Pittsburg Landing
2002	2003	06/06/2003	06/06/2003	200,092	50.0	LFH on-station
2002	2003	06/09/2003	06/09/2003	100,019	40.4	Near Couse Creek
2002	2003	06/12/2003	06/12/2003	291,402	74.4	Captain John
2003	2004	05/24/2004	05/24/2004	165,438	54.0	Pittsburg Landing
2003	2004	05/29/2004	06/01/2004	500,739	55.3	Captain John
2003	2004	05/31/2004	05/31/2004	197,687	51.5	Pittsburg Landing
2003	2004	06/03/2004	06/03/2004	473,556	79.6	Big Canyon
2003	2004	06/21/2004	06/21/2004	201,534	51.1	LFH on-station
2004	2005	05/23/2005	05/23/2005	234,030	59.0	Near Couse Creek
2004	2005	05/24/2005	05/24/2005	482,460	66.0	Grande Ronde
2004	2005	05/25/2005	05/26/2005	397,704	50.4	Pittsburg Landing
2004	2005	05/26/2005	05/26/2005	200,191	49.0	Near Couse Creek
2004	2005	05/27/2005	05/27/2005	200,171	51.0	LFH on-station
2004	2005	05/28/2005	05/31/2005	505,087	46.8	Captain John
2004	2005	05/30/2005	05/31/2005	510,226	55.3	Big Canyon
2005	2006	04/04/2006	04/04/2006	71,000	181.0	LFH on-station
2005	2006	05/22/2006	05/24/2006	397,067	52.5	Pittsburg Landing
2005	2006	05/25/2006	05/26/2006	504,706	56.7	Big Canyon
2005	2006	05/25/2006	05/29/2006	506,972	45.6	Captain John
2005	2006	05/30/2006	05/31/2006	200,820	55.6	Near Couse Creek
2005	2006	06/01/2006	06/01/2006	202,210	52.3	LFH on-station
2005	2006	06/19/2006	06/21/2006	409,165	50.6	Grande Ronde
2005	2006	06/22/2006	06/22/2006	211,508	50.0	Near Couse Creek
2006	2007	05/23/2007	05/23/2007	200,692	62.0	LFH on-station
2006	2007	05/26/2007	05/26/2007	400,924	56.3	Pittsburg Landing
2006	2007	05/28/2007	05/29/2007	506,706	57.0	Big Canyon
2006	2007	05/29/2007	05/29/2007	514,483	50.0	Captain John
2007	2008	05/26/2008	05/26/2008	520,035	55.0	Big Canyon
2007	2008	05/27/2008	05/27/2008	402,207	60.0	Pittsburg Landing
2007	2008	05/28/2008	05/28/2008	512,745	65.0	Captain John
2007	2008	05/28/2008	05/28/2008	230,401	59.1	Near Couse Creek
2007	2008	05/29/2008	05/29/2008	303,270	46.2	Grande Ronde
2007	2008	06/02/2008	06/02/2008	200,733	48.7	LFH on-station
2008	2009	05/24/2009	05/24/2009	415,991	59.3	Pittsburg Landing
2008	2009	05/26/2009	05/26/2009	474,868	62.5	Big Canyon

2008	2009	05/26/2009	05/26/2009	524,910	57.0	Captain John
2008	2009	05/26/2009	05/26/2009	200,743	46.5	Near Couse Creek
2008	2009	05/28/2009	05/29/2009	441,050	67.1	Grande Ronde
2008	2009	06/02/2009	06/03/2009	181,400	50.0	Grande Ronde
2008	2009	06/02/2009	06/02/2009	200,695	51.7	LFH on-station

Table 46. Yearling releases of fall Chinook that were part of LSRCP and FCAP programs for BY96-08.

Brood Year	Release Year	Begin Release	End Release	Total Released	fpp at release	Release site
1996	1998	04/03/1998	04/16/1998	418,992	10.1	LFH on-station
1996	1998	04/13/1998	04/16/1998	48,065	9.5	Big Canyon
1996	1998	04/13/1998	04/16/1998	13,107	30.0	Big Canyon
1996	1998	04/13/1998	04/15/1998	133,205	10.9	Captain John
1996	1998	04/13/1998	04/16/1998	141,814	9.9	Pittsburg Landing
1997	1999	04/01/1999	04/13/1999	432,166	8.3	LFH on-station
1997	1999	04/12/1999	04/15/1999	153,222	10.4	Big Canyon
1997	1999	04/12/1999	04/15/1999	142,885	10.0	Pittsburg Landing
1997	1999	04/12/1999	04/15/1999	157,010	11.8	Captain John
1997	1999	04/26/1999	04/28/1999	76,386	11.1	Big Canyon
1998	2000	03/24/2000	04/14/2000	456,401	9.4	LFH on-station
1998	2000	04/01/2000	04/12/2000	131,324	8.2	Captain John
1998	2000	04/11/2000	04/13/2000	131,306	10.5	Big Canyon
1998	2000	04/11/2000	04/13/2000	134,709	9.6	Pittsburg Landing
1999	2001	04/01/2001	04/20/2001	338,757	8.7	LFH on-station
1999	2001	04/04/2001	04/13/2001	101,976	10.1	Captain John
1999	2001	04/09/2001	04/11/2001	113,215	10.2	Big Canyon
1999	2001	04/10/2001	04/12/2001	103,741	10.4	Pittsburg Landing
2000	2002	04/01/2002	04/11/2002	432,511	9.3	LFH on-station
2000	2002	04/10/2002	04/12/2002	159,472	12.9	Big Canyon
2000	2002	04/15/2002	04/17/2002	159,731	13.4	Pittsburg Landing
2000	2002	04/16/2002	04/16/2002	160,155	16.6	Captain John
2001	2003	03/30/2003	04/07/2003	151,919	10.0	Captain John
2001	2003	04/01/2003	04/09/2003	518,436	9.7	LFH on-station
2001	2003	04/13/2003	04/14/2003	140,383	9.1	Pittsburg Landing
2001	2003	04/14/2003	04/15/2003	145,331	10.6	Big Canyon
2002	2004	04/02/2004	04/07/2004	150,761	9.1	Captain John
2002	2004	04/12/2004	04/14/2004	446,355	9.9	LFH on-station
2002	2004	04/12/2004	04/13/2004	145,117	9.9	Pittsburg Landing
2002	2004	04/14/2004	04/15/2004	106,927	9.4	Big Canyon
2003	2005	03/28/2005	03/30/2005	453,200	9.4	LFH on-station
2003	2005	04/04/2005	04/05/2005	139,509	10.4	Big Canyon
2003	2005	04/13/2005	04/14/2005	150,706	9.9	Pittsburg Landing
2004	2006	04/05/2006	04/10/2006	450,000	9.8	LFH on-station
2004	2006	04/05/2006	04/05/2006	149,557	10.3	Pittsburg Landing
2004	2006	04/11/2006	04/14/2006	151,122	8.9	Captain John
2004	2006	04/12/2006	04/13/2006	129,798	9.3	Big Canyon

2005	2007	04/02/2007	04/06/2007	503,161	11.0	LFH on-station
2005	2007	04/13/2007	04/13/2007	158,499	10.0	Captain John
2005	2007	04/16/2007	04/17/2007	146,683	10.0	Pittsburg Landing
2005	2007	04/18/2007	04/19/2007	155,480	10.0	Big Canyon
2006	2008	04/07/2008	04/10/2008	459,634	10.3	LFH on-station
2006	2008	04/14/2008	04/14/2008	153,680	8.4	Captain John
2006	2008	04/14/2008	04/14/2008	150,357	9.8	Pittsburg Landing
2006	2008	04/15/2008	04/15/2008	147,832	9.3	Big Canyon
2007	2009	04/03/2009	04/03/2009	140,784	9.1	Captain John
2007	2009	04/06/2009	04/08/2009	455,153	9.1	LFH on-station
2007	2009	04/14/2009	04/14/2009	152,275	9.5	Pittsburg Landing
2007	2009	04/15/2009	04/15/2009	154,350	10.6	Big Canyon

IPC program - Releases include fish reared at OFH and Umatilla FH (Table 47).

Table 47. Sub-yearling releases of fall Chinook that were part of IPC program since its inception in 2000.

Brood Year	Release year	Release Dates	Total No. Smolts (Fingerlings) Released	Average Size (fpp)	Release Location
2000	2001	May 16	113,770	42.0	HC Dam
		June 19	1,450	23.0	HC Dam
2001	2002	May 21	171,463	42.0	HC Dam
2002	2003	May 15 & 16	332,226	41.4	HC Dam
		May 22	209,246	46.6	HC Dam
2003	2004	May 24	165,438	54.0	PLAP
		May 28	9,957	48.0	HC Dam
2004	2005	April 28	189,119	61.5	HC Dam
		May 10 & 12	394,055	59.4	HC Dam
		May 25 & 26	397,704	50.4	PLAP
2005	2006	May 2	191,135	80.3	HC Dam
		May 9 &10	332,165	57.9	HC Dam
		May 1, 3, 5	397,085	52.5	PLAP
2006	2007	May 8	124,539	55.0	HC Dam
2007	2008	May 6	192,471	51.4	HC Dam
		May 20 & 22	770,350	44.0	HC Dam
2008	2009	May 8	202,839	54.8	HC Dam
		May 12 & 14	803,485	60.2	HC Dam
Averages			**555,389**	**51.4**	

Data Source: OFH Fall Chinook Salmon Brood Year Reports (2000-2006), OFH Monthly Narrative Reports and ODFW's Umatilla Fish Hatchery

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

Provide the recent five year release date ranges by life stage produced (mo/day/yr). Also indicate the rationale for choosing release dates, how fish are released (volitionally, forced, volitionally then forced) and any culling procedures applied for non-migrants.

LFH - Refer to Tables 45 and 46 for specific release data. Volitional releases will begin 1 April, and can continue through 15 April for yearlings released from LFH. Yearly adjustments may occur based on water conditions, smolt size, and other environmental conditions. Sub-yearling releases may occur in May and June.

Irrigon Hatchery – Fish are off feed two days prior to release. Water is tempered to the trucks using mechanical chillers. Fish are pumped onto liberation trucks and hauled to the Grande Ronde River for release.

IPC- Refer to Table 47 in section 10.3 for specific release data. Fall Chinook salmon sub-yearling smolts are generally loaded onto transport trucks and released into the Snake River during the month of May (Refer to section 5.2 for transport truck descriptions). Releases are planned to occur ahead of rising water temperatures and decreasing river flows in the Snake River. Annual adjustments to release dates may occur based on water conditions, smolt size, and other environmental conditions.

10.5) Fish transportation procedures, if applicable.

Describe fish transportation procedures for off-station release. Include length of time in transit, fish loading densities, and temperature control and oxygenation methods.

LFH - Yearling and sub-yearling smolts are transported to acclimation facilities operated by the NPT in a variety of transport tankers. Each tanker uses re-circulation, aeration, and O_2 supplementation to maintain water qualities optimal for fish. Fish are hauled for approximately 2.5 hours to BCC AF, 2 hours to CJR AF, and 10 hours to PBL AF. Loading densities, temperatures, and oxygenation methods are described in the annual operations plan in Attachment 5.

Irrigon Hatchery - Fish released by ODFW from Irrigon FH are transported via tanker trucks ranging in size from 2,000 to 5,000 gallon capacity from Irrigon Hatchery to acclimation facilities. Transportation criteria are described in the Oregon State Liberation Manual. Maximum loading is 1 pound of fish per gallon.

Oxbow Fish Hatchery – Sub-yearlings are crowded to the end of the raceways, netted, and transferred into the 5,000-gallon transport trucks as described in section 5.2. Transport trucks are filled with water from the Snake River, which averages 55 to 60 degrees F. Approximately 3,800 pounds of fish (at 45 fpp) are loaded into each truck. Transport duration to the release site below HC Dam is approximately one hour. Trucks are equipped with oxygen and fresh flow agitator systems. Fish are kept off of feed for a minimum of 48 hours prior to loading and transporting.

Umatilla Hatchery – Fall Chinook salmon sub-yearlings are loaded from the ponds to 5,000 gallon fish tankers using a fish pump. Fish are loaded at maximum rate of 1.0 lbs/gallon. Transport time from Umatilla FH to release sites varies with release locations. Fish released below HC Dam are transported for approximately 5 to 6 hours. Fish transported to Pittsburg Landing for either acclimation or direct release are transported for approximately 6 to 7 hours. Supplemental oxygen and aeration are provided and water temperature is monitored during transport.

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

LFH - Fish released at LFH are not acclimated on river water. The pond exit is screened so that fish cannot escape. Refer to section 4.0 regarding water sources for fish rearing at LFH and section 5.5 for details on rearing. During release, evaluation staff sample fish to document size, weight, condition factor, degree of visual smoltification, and the number of precocious male fish present in the release population.

Irrigon Hatchery – No acclimation occurs at Irrigon Hatchery.

IPC program - No acclimation occurs for fall Chinook salmon at OFH or Umatilla FH. Fish are transported to release sites and directly released into the Snake River. Occasionally, some fish from IPC's fall Chinook salmon program are transferred to the PLAP for acclimation prior to release; and when that occurs, fish acclimate for approximately 20 to 30 days before release into the Snake River.

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

Refer to *US vs. Oregon* table B4.b

All sub-yearling smolts released as part of IPC's fall Chinook salmon program are marked with an adipose fin clip for identification. A portion of these fish also receive PIT tags annually to evaluate emigration success and timing to main stem dams. In recent years, fish in some release groups have received CWTs for additional evaluations.

The marking history for IPC fall Chinook salmon is summarized in Table 48:

Table 48. IPC Fall Chinook Fish Marking Summary for OFH and Umatilla FH by Brood Year (2000-2008).

Brood Year	Release Year	Total No. Smolts Released	Hatchery	Release Location	AD fin clips	CWT tags	PIT tags
2000	2001	115,220	Oxbow FH	HC Dam	100.0%	0	0
2001	2002	171,463	Oxbow FH	HC Dam	98.4%	0	1,000
2002	2003	209,246	Oxbow FH	HC Dam	99.4%	0	9,900
		332,226	Umatilla FH	HC Dam	100.0%	0	3,000

2003	2004	9,957	Oxbow FH	HC Dam	99.2%	0	9,957
		165,438	Oxbow FH	PLAP	99.2%	165,438	0
2004	2005	189,119	Oxbow FH	HC Dam	94.4%	170,189	9,973
		394,055	Umatilla FH	HC Dam	100.0%	0	0
		397,704	Umatilla FH	PLAP	100.0%	212,546	0
2005	2006	191,135	Oxbow FH	HC Dam	99.8%	176,185	12,083
		397,085	Umatilla FH	PLAP	99.4%	222,083	24,369
		332,165	Umatilla FH	HC Dam	99.4%	0	23,969
2006	2007	124,539	Oxbow FH	HC Dam	74.6%	114,585	9,954
2007	2008	192,471	Oxbow FH	HC Dam	99.6%	174,357	15,472
		770,350	Umatilla FH	HC Dam	100.0%	223,250	64,463
2008	2009	202,839	Oxbow FH	HC Dam	97.4%	186,374	14,962
		803,485	Umatilla FH	HC Dam	98.8%	232,772	55,488

Data Source: OFH Fall Chinook Salmon Brood Year Reports (2000-2006), OFH Monthly Narrative Reports and ODFW's Umatilla Fish Hatchery

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

Snake River Stock, hatchery reared fish would be folded back into production groups as listed in the fall agreement. Any deviations from standard release areas and production will be discussed and agreed upon by co-managers (Refer to section 9.1.2).

There are no plans for surplus smolt production. IPC's mitigation goal established in the HCSA is to release 1 million fall Chinook salmon smolts annually.

10.9) Fish health certification procedures applied pre-release.

LFH - Fish will be examined by a WDFW and USFWS fish health specialists and certified for release as required under the PNWFHPC (1989) guidelines.

Irrigon FH- Refer to section 7.7 for fish reared at Irrigon FH.

Oxbow Fish Hatchery – Approximately 30 to 45 days prior to release, a 60 fish pre-liberation sample is taken from the raceways to assess fish health prior to release. In addition, an Organo-somatic index is developed for the group. Diagnostic services are provided by the IDFG Eagle Fish Health Laboratory.

Umatilla Fish Hatchery – All health monitoring is consistent with the ODFW fish health policy. Within four weeks prior to release, a random sample of fish are collected and examined for culturable viruses.

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

LFH **-** Under conditions requiring release of fish, actions will be taken that are suitable for the incident occurrence. At LFH, direct release into the Snake River is the preferred alternative.

Irrigon Hatchery –No release would occur in the case of a system failure at Irrigon during rearing. If any of the fish could be salvaged, hatchery staff would contact the North East Regional Office and request direction about what would need to be done next.

Oxbow Fish Hatchery – A specific protocol for responding to emergency conditions does not currently exist. If a water system failure occur, hatchery personnel would likely remove juvenile raceway screens and allow fish to exit to Pine Creek and thus to the Snake River.

Umatilla Fish Hatchery – In the event of complete system failure resulting in total loss of water, either eggs and/or fish may be transported to nearby Irrigon Fish Hatchery, provided that it is still operational, has the necessary space and all logistics were in place prior to the time of failure.

FCAP **-** Emergency release of fish requires a minimum of two staff members and would occur under the guidance of the manager responsible for the project. Fish would be released directly in the Snake River at CJR AF and into the Clearwater River at the BCC AF.

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

(*e.g. "All yearling Coho salmon will be released in early June in the lower mainstem of the Green River to minimize the likelihood for interaction, and adverse ecological effects, to listed natural Chinook salmon juveniles, which rear in up-river areas and migrate seaward as sub-yearling smolts predominately in May").*

Actions taken to minimize adverse effects on listed fish include:

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

2. Marking hatchery-produced fall Chinook salmon for harvest management in downstream fisheries.

3. Not releasing fall Chinook salmon in the Snake River in excess of estimated carrying capacity.

4. Continuing to reduce the effect of releasing large numbers of hatchery fall Chinook salmon at a single site by spreading annual releases over a number of days.

5. Attempting to program time of release to mimic natural fish emigration for Snake River smolt releases.

6. Continuing to use eyed eggs from broodstock that exhibit life history characteristics similar to locally evolved stocks.

7. Continuing to release fish that are fully smolted to promote rapid emigration to reduce interactions with natural fish.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

This section describes how "Performance Indicators" listed in Section 1.10 will be monitored. Results of "Performance Indicator" monitoring will be evaluated annually and used to adaptively manage the hatchery program, as needed, to meet "Performance Standards".

Monitoring and Evaluation Statements of work are provided in Attachments 3 and 4.

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

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

Table 49. Monitoring and Evaluation performance measures and their status for Snake fall Chinook.

Performance Measure		Definition	Performance Measures Currently Completed (Yes, No, Partial)
Abundance	Adult Escapement to Tributary	Number of adults that have escaped to a certain point (i.e. - mouth of stream). Population based measure. Calculated with mark recapture methods from weir data adjusted for redds located downstream of weirs and in tributaries. Provides total escapement and wild only escapement. [Assumes tributary harvest is accounted for]. Uses TRT population definition where available	PARTIAL
	Fish per Redd	Number of fish divided by the total number of redds. Applied by: The population estimate at a weir site, minus broodstock and mortalities and harvest, divided by the total number of redds located upstream of the weir.	YES
	Female Spawner per Redd	Number of female spawners divided by the total number of redds above weir. Applied in 2 ways: 1) The population estimate at a weir site multiplied by the weir derived proportion of females, minus the number of female pre-spawn mortalities, divided by the total number of redds located upstream of the weir, and 2) DIDSON application calculated as in 1 above but with proportion females from carcass recoveries. Correct for mis-sexed fish at weir for 1 above.	PARTIAL
	Index of Spawner Abundance - redd counts	Counts of redds in spawning areas in index area(s) (trend), extensive areas, and supplemental areas. Reported as redds and/or redds/km.	YES
	Spawner Abundance	In-river: Estimated number of total spawners on the spawning ground. Calculated as the number of fish that return to an adult monitoring site, minus broodstock removals and weir mortalities and harvest if any, subtracts the number of female prespawning mortalities and expanded for redds located below weirs. Calculated as hatchery spawner abundance, and 2) wild spawner abundance which multiplies by the proportion of natural origin (wild) fish. In-hatchery: Total number of fish actually used in hatchery production. Partitioned by gender and origin.	YES

	Hatchery Fraction	Percent of fish on the spawning ground that originated from a hatchery. Applied in two ways: 1) Number of hatchery carcasses divided by the total number of known origin carcasses sampled. Uses carcasses above and below weirs, 2) Uses weir data to determine number of fish released above weir and calculate as in 1 above, and 3) Use 2 above and carcasses above and below weir.	PARTIAL
	Ocean/Mainstem Harvest	Number of fish caught in ocean and mainstem (tribal, sport, or commercial) by hatchery and natural origin.	YES
	Harvest Abundance in Tributary	Number of fish caught in ocean and mainstem (tribal, sport, or commercial) by hatchery and natural origin.	YES
	Index of Juvenile Abundance (Density)	Parr abundance estimates using underwater survey methodology are made at pre-established transects. Densities (number per 100 m2) are recorded using protocol described in Thurow (1994). Hanken & Reeves estimator.	NO
	Juvenile Emigrant Abundance	Gauss software is (Aptech Systems, Maple Valley, Washington) is used to estimate emigration estimates. Estimates are given for parr pre-smolts, smolts and the entire migration year. Calculations are completed using the Bailey Method and bootstrapping for 95% CIs. Gauss program developed by the University of Idaho (Steinhorst 2000).	NO
	Smolts	Smolt estimates, which result from juvenile emigrant trapping and PIT tagging, are derived by estimating the proportion of the total juvenile abundance estimate at the tributary comprised of each juvenile life stage (parr, pre-smolt, smolt) that survive to first mainstem dam. It is calculated by multiplying the life stage specific abundance estimate (with standard error) by the life stage specific survival estimate to first mainstem dam (with standard error). The standard error around the smolt equivalent estimate is calculated using the following formula; where X = life stage specific juvenile abundance estimate and Y = life stage specific juvenile survival estimate: $Var(X \cdot Y)$ $= E(X)^2 \cdot Var(Y) + E(Y)^2 \cdot Var(X) + Var(X) \cdot Var(Y)$	NO
	Run Prediction	This will not be in the raw or summarized performance database.	YES
Survival – Productivity	Smolt-to-Adult Return Rate	The number of adult returns from a given brood year returning to a point (stream mouth, weir) divided by the number of smolts that left this point 1-5 years prior. Calculated for wild and hatchery origin conventional and captive brood fish separately. Adult data applied in two ways: 1) SAR estimate to stream using population estimate to stream, 2) adult PIT tag SAR estimate to escapement monitoring site (weirs, LGR), and 3) SAR estimate with harvest. Accounts for all harvest below stream. *Smolt-to-adult return rates* are generated for four performance periods; tributary to tributary, tributary to tributary, tributary to first mainstem dam, first mainstem dam to first mainstem dam, and first mainstem dam to tributary. *Tributary to tributary SAR* estimates for natural and hatchery origin fish are calculated using PIT tag technology as well as direct counts of fish returning to the drainage. PIT tag SAR estimates are calculated by dividing the number of PIT tag adults returning to the tributary (by life stage and origin type) by the number of PIT tagged juvenile fish migrating from the tributary (by life stage and origin type). Overall PIT tag SAR estimates for natural fish are then calculated by averaging the individual life stage specific SARs. Direct counts are calculated by dividing the estimated number of natural and hatchery-origin adults returning to the tributary (by length break-out for natural fish) by the estimated number of natural-origin fish and the known number of hatchery-origin fish leaving the tributary. The variance around the SAR estimate is calculated as follows, where X = the number of adult PIT tagged fish returning to the tributary and Y = the estimated number of juvenile PIT tagged fish at first mainstem dam: $Var\left(\frac{X}{Y}\right) = \left(\frac{EX}{EY}\right)^2 \cdot \left(\frac{Var(Y)}{(EY)^2}\right)$	PARTIAL
	Progeny-per- Parent Ratio	Adult to adult calculated for naturally spawning fish and hatchery fish separately as the brood year ratio of return adult to parent spawner abundance using data above weir. Estimates of this ratio for fish spawning and produced by the natural environment must be adjusted to account for the confounding effect of spawner density on this metric. Two variants calculated: 1) escapement, and 2) spawners.	PARTIAL

	Recruit/spawner (R/S)(Smolt Equivalents per Redd or female)	Juvenile production to some life stage divided by adult spawner abundance, adjusted for the confounding effects of spawner density. Derive adult escapement above juvenile trap multiplied by the pre-spawning mortality estimate. Adjusted for redds above juvenile Trap. *Recruit per spawner* estimates, or *juvenile abundance (can be various life stages or locations) per redd/female*, is used to index population productivity, since it represents the quantity of juvenile fish resulting from an average redd (total smolts divided by total redds) or female. Several forms of juvenile life stages are applicable. We utilize two measures: 1) juvenile abundance (parr, pre-smolt, smolt, total abundance) at the tributary mouth, and 2) smolt abundance at first mainstem dam.	PARTIAL
	Juvenile Survival to first mainstem dam	Life stage survival (parr, pre-smolt, smolt, sub-yearling) calculated by CJS Estimate (SURPH) produced by PITPRO 4.8+ (recapture file included), CI estimated as 1.96*SE. Apply survival by life stage to first mainstem dam to estimate of abundance by life stage at the tributary and the sum of those is total smolt abundance surviving to first mainstem dam. Juvenile survival to first mainstem dam = total estimated smolts surviving to first mainstem dam divided by the total estimated juveniles leaving tributary.	YES
	Juvenile Survival to all Mainstem Dams	*Juvenile survival to first mainstem dam and subsequent Mainstem Dam(s)*, which is estimated using PIT tag technology. Survival by life stage to and through the hydrosystem is possible if enough PIT tags are available from the stream. Using tags from all life stages combined we will calculate (SURPH) the survival to all mainstem dams.	PARTIAL
	Post-release Survival	Post-release survival of natural and hatchery-origin fish are calculated as described above in the performance measure "Survival to first mainstem dam and Mainstem Dams". No additional points of detection (i.e. screw traps) are used to calculate survival estimates.	PARTIAL
Distribution	Adult Spawner Spatial Distribution	Extensive area tributary spawner distribution. Target GPS redd locations or reach specific summaries, with information from carcass recoveries to identify hatchery-origin vs. natural-origin spawners across spawning areas within populations.	YES
	Stray Rate (percentage)	Estimate of the number and percent of hatchery origin fish on the spawning grounds, as the percent within MPG, and percent out of ESU. Calculated from 1) total known origin carcasses, and 2) uses fish released above weir. Data adjusted for unmarked carcasses above and below weir.	PARTIAL
	Juvenile Rearing Distribution		PARTIAL
	Disease Frequency	Natural fish mortalities are provided to certified fish health lab for routine disease testing protocols. Hatcheries routinely samples fish for disease and will defer to then for sampling numbers and periodicity	NO
Genetic	Genetic Diversity	Indices of genetic diversity – measured within a tributary) heterozygosity – allozymes, microsatellites), or among tributaries across population aggregates (e.g., FST).	PARTIAL
	Reproductive Success (Nb/N)	Derived measure: determining hatchery: wild proportions, effective population size is modeled.	NO
	Relative Reproductive Success (Parentage)	Derived measure: the relative production of offspring by a particular genotype. Parentage analyses using multi-locus genotypes are used to assess reproductive success, mating patterns, kinship, and fitness in natural pop8ulations and are gaining widespread use of with the development of highly polymorphic molecular markers.	NO
	Effective Population Size (Ne)	Derived measure: the number of breeding individuals in an idealized population that would show the same amount of dispersion of allele frequencies under random genetic drift or the same amount of inbreeding as the population under consideration.	PARTIAL
Life History	Age Structure	Proportion of escapement composed of adult individuals of different brood years. Calculated for wild and hatchery origin conventional and captive brood adult returns. Accessed via scale method, dorsal fin ray ageing, or mark recoveries. Juvenile Age is determined by brood year (year when eggs are placed in the gravel) Then Age is determined by life stage of that year. Scales have been collected from natural-origin juveniles.	YES
	Age–at–Return	Age distribution of spawners on spawning ground. Calculated for wild and hatchery conventional and captive brood adult returns. Accessed via scale method, dorsal fin ray ageing, or mark recoveries.	YES
	Age–at-Emigration	Juvenile Age is determined by brood year (year when eggs are placed in the gravel) Then Age is determined by life stage of that year. Scales have been collected from natural-origin juveniles. The age of hatchery-origin fish is determined through a VIE marking program which identifies fish by brood year.	YES
	Size-at-Return	Size distribution of spawners using fork length. Raw database measure only.	YES
	Size-at-Emigration	Fork length (mm) and weight (g) are representatively collected weekly from natural juveniles captured in emigration traps. Mean fork length and variance for all samples within a life stage-specific emigration period are generated (mean length by week then averaged by life stage). For entire juvenile abundance leaving a weighted mean (by life stage) is calculated. Size-at-emigration for hatchery production is generated from pre release sampling of juveniles at the hatchery.	PARTIAL

	Condition of Juveniles at Emigration	Condition factor by life stage of juveniles is generated using the formula: $K = (w/l^3)(10^4)$ where K is the condition factor, w is the weight in grams (g), and l is the length in millimeters (Everhart and Youngs 1992).	PARTIAL
	Percent Females (adults)	The percentage of females in the spawning population. Calculated using 1) weir data, 2) total known origin carcass recoveries, and 3) weir data and unmarked carcasses above and below weir. Calculated for wild, hatchery, and total fish.	YES
	Adult Run-timing	Arrival timing of adults at adult monitoring sites (weir, PIT array) calculated as range, 10%, median, 90% percentiles. Calculated for wild and hatchery origin fish separately, and total.	YES
	Spawn-timing	This will be a raw database measure only.	YES
	Juvenile Emigration Timing	Juvenile emigration timing is characterized by individual life stages at the rotary screw trap and Lower Granite Dam. Emigration timing at the rotary screw trap is expressed as the percent of total abundance over time while the median, 0%, 10, 50%, 90% and 100% detection dates are calculated for fish at first mainstem dam.	PARTIAL
	Mainstem Arrival Timing (Lower Monumental)	Unique detections of juvenile PIT-tagged fish at first mainstem dam are used to estimate migration timing for natural and hatchery origin tag groups by life stage. The actual Median, 0, 10%, 50%, 90% and 100% detection dates are reported for each tag group. Weighted detection dates are also calculated by multiplying unique PIT tag detection by a life stage specific correction factor (number fish PIT tagged by life stage divided by tributary abundance estimate by life stage). Daily products are added and rounded to the nearest integer to determine weighted median, 0%, 50%, 90% and 100% detection dates.	PARTIAL
Habitat	Physical Habitat		NO
	Fish and Amphibian Assemblage	Observations through rotary screw trap catch and while conducting snorkel surveys.	NO
In-Hatchery Measures	Hatchery Production Abundance	The number of hatchery juveniles of one cohort released into the receiving stream per year. Derived from census count minus prerelease mortalities or from sample fish-per-pound calculations minus mortalities. Method dependent upon marking program (census obtained when 100% are marked).	YES
	In-hatchery Life Stage Survival	In-hatchery survival is calculated during early life history stages of hatchery-origin juvenile Chinook. Enumeration of individual female's live and dead eggs occurs when the eggs are picked. These numbers create the inventory with subsequent mortality subtracted. This inventory can be changed to the physical count of fish obtained during CWT or VIE tagging. These physical fish counts are the most accurate inventory method available. The inventory is checked throughout the year using 'fish-per-pound' counts. Estimated survival of various in-hatchery juvenile stages (green egg to eyed egg, eyed egg to ponded fry, fry to parr, parr to smolt and overall green egg to release) Derived from census count minus prerelease mortalities or from sample fish- per-pound calculations minus mortalities. Life stage at release varies (smolt, pre-smolt, parr, etc.).	YES
	Size-at-Release	Mean fork length measured in millimeters and mean weight measured in grams of a hatchery release group. Measured during prerelease sampling. Sample size determined by individual facility and M&E staff. Life stage at release varies (smolt, pre-smolt, parr, etc.).	YES
	Juvenile Condition Factor	Condition Factor (K) relating length to weight expressed as a ratio. Condition factor by life stage of juveniles is generated using the formula: $K = (w/l^3)(10^4)$ where K is the condition factor, w is the weight in grams (g), and l is the length in millimeters (Everhart and Youngs 1992).	YES
	Fecundity by Age	The reproductive potential of an individual female. Estimated as the number of eggs in the ovaries of the individual female. Measured as the number of eggs per female calculated by weight or enumerated by egg counter.	YES
	Spawn Timing	Spawn date of broodstock spawners by age, sex and origin, Also reported as cumulative timing and median dates.	YES
	Hatchery Broodstock Fraction	Percent of hatchery broodstock actually used to spawn the next generation of hatchery F1s. Does not include pre-spawn mortality.	YES
	Hatchery Broodstock Prespawn Mortality	Percent of adults that die while retained in the hatchery, but before spawning.	YES
	Female Spawner ELISA Values	Screening procedure for diagnosis and detection of BKD in adult female ovarian fluids. The enzyme linked immunosorbent assay (ELISA) detects antigen of *R. salmoninarum*.	YES
	In-Hatchery Juvenile Disease Monitoring	Screening procedure for bacterial, viral and other diseases common to juvenile salmonids. Gill/skin/ kidney /spleen/skin/blood culture smears conducted monthly on 10 mortalities per stock	PARTIAL
	Length of Broodstock Spawner	Mean fork length by age measured in millimeters of male and female broodstock spawners. Measured at spawning and/or at weir collection. Is used in conjunction with scale reading for aging.	YES

	Prerelease Mark Retention	Percentage of a hatchery group that have retained a mark up until release from the hatchery. Estimated from a sample of fish visually calculated as either "present" or "absent"	YES
	Prerelease Tag Retention	Percentage of a hatchery group that have retained a tag up until release from the hatchery - estimated from a sample of fish passed as either "present" or "absent". ("Marks" refer to adipose fin clips or VIE batch marks).	YES
	Hatchery Release Timing	Date and time of volitional or forced departure from the hatchery. Normally determined through PIT tag detections at facility exit (not all programs monitor volitional releases).	YES
	Chemical Water Quality	Hatchery operational measures included: dissolved oxygen (DO) - measured with DO meters, continuously at the hatchery, and manually 3 times daily at acclimation facilities.	PARTIAL
	Water Temperature	Hatchery operational measure (Celsius) - measured continuously at the hatchery with thermographs and 3 times daily at acclimation facilities with hand-held devices.	YES

Use the above information to determine whether the population has declined, remained stable, or has been recovered to sustainable levels. The ability to estimate hatchery and natural proportions will be determined by implementation plans, budgets, and applicable methods to discriminate between the fish and assessment priorities.

***Estimate the contribution of conservation / mitigation program-origin fall Chinook to the basin and compare performance to the natural population*.**

1. Differentially tag (CWT) all or a portion of hatchery-reared fall Chinook to allow for distinction from natural-origin fish upon return as adults at area adult traps, or that might be recovered in downriver fisheries. Mark and tag rates have been determined as part of the 2008-17 Columbia River Management Plan; although deviations or changes will be determined through discussions/agreements with the co-managers during the Annual Operations Plan for Lyons Ferry Complex and subsequently approved or denied in the *US vs. OR* process. In addition, a portion of each brood year will be PIT tagged for total contribution estimation at adult return, monitoring straying into other local rivers, and relative downstream migration success.

2. Conduct adult trapping at Lower Granite Dam throughout the fall Chinook return to collect broodstock for the hatchery conservation/mitigation program, to enumerate overall returns, and to collect information regarding fish origin for the spawning escapement, and age class composition. Utilize PIT detection array(s) to independently estimate overall returns and calculate relative performance among natural fish and the hatchery stock. Use the PIT tag array at the Tucannon River mouth to help determine the number of hatchery fish (Snake River and stray) on the spawning grounds.

3. Conduct spawning ground surveys to estimate spawners, and use in conjunction with adult traps and PIT tag detection data to estimate the proportions of natural and hatchery fall Chinook in the spawning population.

4. Operate a smolt trap on the Tucannon River and Clearwater River to: 1) Estimate the number, timing, and age composition of natural origin fall Chinook smolts from the river, 2) PIT tag as many natural origin smolts as possible to estimate smolt-to-adult survival and to continue documentation of natural origin smolts that migrate above Lower Granite Dam.

5. Calculate Smolt-to-Adult and Adult-to-Adult survival of hatchery fish by brood year to determine if fish are surviving at expected program levels. Estimate escapement to the Snake, Tucannon, Grande Ronde, Clearwater, Salmon and Imnaha Rivers spawning grounds, and harvest (when applicable).

6. Use the above activities to evaluate the status of the Snake River fall Chinook population for Viable Salmonid Population (VSP) and ESA recovery monitoring. VSP monitoring is essential under the ESA to determine population and status and compare with de-listing criteria and de-listing levels for identified population groups, and for local salmon recovery planning efforts, as well as for mitigation fishery planning. Currently, some of the parameters needed for VSP monitoring are inconsistent or lacking. The population level viability guidelines provided in McElhany et al. (2000) are organized around four major parameters: abundance, productivity, spatial structure and diversity. These biological viability measures are intended to inform long-term regional recovery planning efforts, including the establishment of delisting criteria for each population. Monitoring activities as described in #'s 1-6 above will allow estimation of the four parameters needed for VSP monitoring in the Snake River.

Monitor and evaluate any changes in the genetic, phenotypic, or ecological characteristics of the populations potentially affected by the program.

1. Collect DNA-based genetic samples from the Snake River fall Chinook population at periodic intervals to determine the degree to which discrete populations persist in the individual watersheds.

2. Collect length and scale samples from natural origin adults returning to traps as available. Assess age structure of returning natural fish, and use this data for Smolt-to-Adult and Adult-to-Adult survival estimates.

Assess the need and methods for improvement of conservation / mitigation activities in order to meet program objectives, or the need to discontinue the program because of failure to meet objectives.

1. Determine the pre-spawning and green egg to released smolt survivals for the program.
   a. Monitor growth and feed conversion.
   b. Determine green-egg to eyed-egg, eyed-egg to fry, and fry to released-smolt survival rates.
   c. Maintain and compile records of cultural techniques used for each life stage, such as: collection and handling procedures, and trap holding durations for broodstock; fish and egg condition at time of spawning; fertilization procedures, incubation methods/densities, temperature unit records by developmental stage, shocking methods, and fungus treatment methods for eggs; ponding methods, rearing/pond loading densities, feeding schedules and rates for juveniles; and release methods.
   d. Summarize results of tasks for presentation in annual reports.

e. Identify where the propagation program is falling short of objectives, and make recommendations for improved production as needed.

2. Determine if broodstock procurement methods are collecting the required number of adults that represent the demographics of the donor population with minimal injuries and stress to the fish.
    a. Monitor operation of adult trapping operations to ensure compliance with established broodstock collection protocols.
    b. Monitor timing, duration, composition, and magnitude of run at each adult collection site.
    c. Collect biological information on collection-related mortalities. Determine causes of mortality.
    d. Summarize results for presentation in annual reports. Provide recommendations on means to improve broodstock collection, and refine protocols if needed for application in subsequent seasons.

3. Monitor fish health, specifically as related to cultural practices that can be adapted to prevent fish health problems. Professional fish health specialists supplied by WDFW will monitor fish health.
    a. A fish health specialist will conduct fish health monitoring. Significant fish mortality to unknown causes will be sampled for histopathological study.
    b. The incidence of viral pathogens in broodstock will be determined by sampling fish at spawning in accordance with procedures set forth in PNWFHPC. Recommendations on fish cultural practices will be provided on a monthly basis based upon the fish health condition of juveniles.
    c. Fish health monitoring results will be summarized as part of an annual report.

Collect and evaluate information on adult returns.

This element will be addressed through consideration of the results of previous elements, and through the collection of information required under adaptive criteria. All will be used as the basis for determining the success of progress toward program goals and whether the program should continue.

1. Monitor the directed or incidental harvest of fall Chinook in recreational and treaty fisheries. Document trends in abundance.
2. Collect age, sex, length, average egg size, and fecundity data from a representative sample of broodstock used in the supplementation program for use as baseline data to document any phenotypic changes in the populations.
3. Compare newly acquired electrophoretic and SNP analysis data reporting allele frequency variation of returning hatchery and natural fish with baseline genetic data. Determine if there is evidence of a loss in genetic variation (not expected from random drift) that may have resulted from the supplementation program.
4. Evaluate results of spawning ground surveys and age class data collections to:
    a. Estimate the abundance and trends in abundance of spawners;
    b. Estimate the proportion of the escapement comprised by steelhead of hatchery lineage, and of natural lineage;
    c. Through CWT and PIT tag recoveries, estimate brood year contribution for

hatchery lineage and natural-origin fish.

5. Monitor the abundance of stray hatchery fish from this program that enter other waters in the Snake River basin where monitoring is ongoing, or is expected to begin soon. Stray fish from this program may be considered a risk to other listed populations within the Columbia Basin.

Use the above information and additional RM&E discussed and proposed in Addendum 1, to determine whether the population has declined, remained stable, or has been recovered to sustainable levels. The ability to estimate hatchery and natural proportions will be determined by implementation plans, budgets, and assessment priorities. Once natural populations have attained the ability to replace themselves, the focus of the program will shift from conservation and recovery of the population, to achieving mitigation goals defined under LSRCP and in the Snake River Salmon Recovery Plan.

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

Current monitoring and evaluation funding covers most activities listed above. However, funding to monitor potential hatchery/wild interaction, including ratios of hatchery and wild fish in natural spawning areas, and annual production estimates in the Snake River, and genetic monitoring will require commitment of additional resources. Following are RM&E tasks that will require additional time and investment to address:

- Relative reproductive success – The managers and BPA have assembled to assess the available methodologies for measuring reproductive success. The challenges for such a task with Snake River fall Chinook are substantial due to the size of the river and limitations on obtaining samples of the fish. The results of that effort are finalized (Peven et al. 2010) although no decision has been made on how to proceed with a study at this time.
- The productivity and capacity of remaining fall Chinook habitat in the lower Snake River is not well understood. Current recovery goals were described by the ICTRT as part of their status review and need to be revisited with recently updated run reconstruction estimates of hatchery and wild escapement at Lower Granite Dam. Estimates of smolt production from the basin and expanded understanding of the mechanisms behind altered early life history pathways (reservoir rearing and emigration as yearling smolts) need further investigation to understand productive capacities of the altered habitat.

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

(*e.g. "The Wenatchee River smolt trap will be continuously monitored, and checked every eight hours, to minimize the duration of holding and risk of harm to listed spring Chinook and steelhead that may be incidentally captured during the sockeye smolt emigration period.)"*

1. Utilize recognized fish handling and anesthetization procedures to minimize the

effects on juvenile and adult fall Chinook handled for RM&E activities.

2. Adhere to accepted fish marking standards for size at marking for the mark or tag used (CWT, PIT, VIE, etc)
3. Adult trapping facilities will be monitored daily, or more often as necessary to prevent injury and unnecessary delay.
4. Fish seining, trawling, and fyk netting will use specific fish capture, fish handling, fish anesthesia, fish marking and fish PIT tagging protocols are followed explicitly and all staff are trained in their use and application before working under field conditions. To the extent possible, we will use snorkeling to obtain relative abundance estimates and seining to collect specimens. We estimate no mortalities will occur due to observing juvenile or adult Chinook salmon, steelhead, and bull trout underwater. Seines will be the major gear type used to collect juvenile salmonids to minimize adverse effects due to fish collection.
5. There is a potential for mortalities to occur through screw trapping and handling. We believe that this potential can be minimized through project planning and implementation by experienced research biologists where survival of the fish is the number one priority. Fish trapping, trap maintenance, fish handling, fish anesthesia, and fish PIT tagging protocols are followed explicitly and all staff are trained in their use and application before working under field conditions. We are exploring approaches that will still maintain study design requirements by sub-sampling or reducing trap efficiency if emigrating juveniles become too numerous because of increased run size. Maintaining comparable methods across years is desired and we are seeking adequate take approval in the absence of a restructured sampling approach.
6. Stress and mortality associated with emigration studies are minimized by four methods:
    - Over sized live-boxes are fitted to two of the three traps available for use in the Imnaha River. These live-boxes are roughly twice as large as the standard live-box fitted to a rotary screw trap. The increased volume in the live-box allows for a lower density, better ability for juveniles to avoid predators (e.g. bull trout), and will help to keep debris from crushing fish. If densities in the live-box become high enough to produce signs of stress, sub-sampling will occur by netting fish out of the live-box and passing them through a PIT tag detector. A portion of each net full will be sub-sampled for species composition. A biologist will determine the exact portion of the catch to be sub-sampled, with the health of the fish given first priority. (Imnaha River Only)
    - A baffle has been fitted to the live box to dissipate water velocity. This will reduce potential fish injury/impingement during high runoff conditions. (Imnaha River Only)
    - Field-staff conduct regular checks of the traps and live boxes throughout the day and night to ensure that traps are maintained and that no mortalities occur. Cones and debris drums are also regularly checked to ensure that traps are not causing fish impingement or descaling and that fine debris is removed from the traps. Water temperatures and stream discharge are regularly monitored to ensure safe capture and handling of all fish.
    - A bypass tube has been attached to the live-box of one trap with a sampling chamber fitted with a Destron racquet antenna tuned for underwater use by

Biomark. If the biologist anticipates a large number of fish and/or debris this trap may be used to subsample the catch on an hourly basis by directing fish from the bypass tube into the sampling chamber where they can be scanned for PIT tags with no handling. Otherwise all fish can escape through the bypass tube directly into the river

IPC - Adhere to accepted fish marking standards for size at marking for the mark or tag used (CWT, PIT, etc).

SECTION 12. RESEARCH

Provide the following information for any research programs conducted in ***direct association with the hatchery program described in this HGMP. Provide sufficient detail to allow for the independent assessment of the effects of the research program on listed fish****. If applicable, correlate with research indicated as needed in any ESU hatchery plan approved by the co-managers and NMFS. Attach a copy of any formal research proposal addressing activities covered in this section. Include estimated take levels for the research program with take levels provided for the associated hatchery program in* ***Table 53****.*

12.1) Objective or purpose.

Indicate why the research is needed, its benefit or effect on listed natural fish populations, and broad significance of the proposed project

The ongoing LSRCP program research is designed to:

- Document hatchery rearing and release activities and subsequent adult returns.
- Determine success of the program in meeting mitigation and conservation goals and adult returns to the Snake River Basin; namely contribution to fisheries, and counts of hatchery and wild Chinook at LFH, Tucannon River, and Lower Granite Dam.
- Provide management recommendations aimed at improving program effectiveness and efficiency,
- Provide management recommendations aimed at reducing program impacts on ESA listed populations.

12.2) Cooperating and funding agencies.

Lower Snake River Compensation Program
Nez Perce Tribe
Confederated Tribes of the Umatilla Indian Reservation
National Marine Fisheries Service
Idaho Power Company
U.S. Fish and Wildlife Service

12.3) Principle investigator or project supervisor and staff.

WDFW:	Mark Schuck, Debbie Milks, Afton Grider, Temporary field technicians
NPT (FCAP):	Bill Arnsberg, Bill Young
IPC:	Stuart Rosenberger, Phil Groves

USFWS: Billy Connor, Howard Burge
NMFS: Doug Marsh, Darren Ogden

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

Same as described in Section 2.

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

1) <u>*Monitoring hatchery/wild ratios in natural spawning streams*</u> - Adult fall Chinook will be captured and enumerated at the existing LGR adult trap. In addition, redd counts and carcass surveys will be performed on the Tucannon River and hatchery/wild ratios calculated. Fish that are systematically sampled and collected for broodstock are hauled to LFH for future spawning. Scale samples collected from unmarked/untagged fish were used to estimate number of hatchery and wild fish passing LGR dam until 2009. The method for determining wild origin was dropped because of inaccuracies. An annual run reconstruction will be built from CWT and PIT tag data, and will be used to track H/W ratios at LFH and LGR dam. Similar samples will be collected from carcasses during spawning ground surveys of the Tucannon River, and will be used to monitor the H/W ratio there. See section 2.2.3.

2) <u>*Genetic monitoring*</u> – Wild juvenile fall Chinook may be sampled periodically from various natural production areas in the course of genetic monitoring. Samples will be collected using a smolt trap located on the lower Tucannon River. Juvenile Chinook sampled will be captured and anesthetized with MS-222, measured, weighed, and scale sample removed. Non-lethal tissue samples will be removed for genetic analysis and the fish will be allowed to recover before release. Snake River Stock hatchery produced juveniles will also be sampled for comparison to natural fish. Juvenile fall Chinook may also be PIT tagged to assess emigration behavior.

   During spawning at LFH and on the spawning grounds in the Tucannon River, unmarked/untagged fall Chinook will have scale samples and fin tissue removed, which can be used for DNA analysis. Fish encountered during spawning surveys are likely to be dead when sampled. In addition, Snake River origin, hatchery reared fall Chinook will be sampled for comparison to historically sampled natural fish and present-day natural fish. Results of this data should tell us if we are maintaining genetic integrity of the stock reared at LFH or producing a divergent population. Fish sampled in the hatchery will be anesthetized with MS-222 prior sampling.

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

1. Broodstock/Adult Trapping: August-December
2. Spawning and Spawning Ground Surveys: October-December
3. Fecundity estimates: November-January
4. Juvenile Rearing: Year round because of yearling and sub-yearling production at LFH.
5. Tagging/marking at the hatchery-April-October (based on regular tagging activities)

6. PIT tagging: August and April (based on other PIT tagging activities at the hatchery)
7. Smolt trapping-October through June (on the Tucannon and Clearwater rivers)
8. Seining, fyke netting, and trawling - July – October.

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

At LFH, all adult fall Chinook sorted will be anesthetized with MS-222 before they are handled.

Smolt trapping - Most fish will be counted and released immediately back to the stream to continue their out-migration. During peak out-migration, fish may be held in live boxes for two to three hours before release (mark/recapture trial, or PIT tagged). At other times of year the trap may be checked only once a day. Fish will be hauled upstream in buckets to estimate trapping efficiency and population size. In addition, a portion of the naturally spawned fish may be PIT tagged to monitor downstream migration timing. Any juvenile fall Chinook handled will be anesthetized with MS222 prior to any handling. Delayed migration will result for fish captured in the trap, and delayed mortality as a result of injury may also result. Mortality of natural fall Chinook is expected to remain below 0.5% (based on previous records of smolt trapping in the Tucannon River from 1997-present).

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

Injury due to capture, marking and tissue sampling is inevitable. There may be an occasional direct loss due to capture and handling account for the lethal take estimates that may occur during monitoring and evaluation activities. Precautions will be taken during all activities to make sure the mortalities are kept to a minimum.

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

Refer to "Take" Table 54.

12.10) Alternative methods to achieve project objectives.

The nature of our genetic sampling strategy is to monitor genetic integrity of the fish used for broodstock at LFH. One of our goals is population recovery and thus the maintenance of the genetic profile seen in the past. We may need to change our spawning protocols if shifts have occurred regarding the genetic integrity of the hatchery produced Snake River stock. Alternate techniques such as adult or smolt trapping on the mainstem Snake River and recovering fish off of redds for genetic analysis are too labor intensive to consider feasible.

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

Due to our inability to differentiate between listed anadromous and non-listed forms of *O. tshawytscha*, take estimates include both. During smolt trapping, we expect to encounter spring/summer/fall Chinook juveniles and bull trout during sampling. However the number of encounters and as a result the level of mortality, is expected to be on the order of <50 fish/species for the season.

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

(*e.g. "Listed coastal cutthroat trout sampled for the predation study will be collected in compliance with NMFS Electrofishing Guidelines to minimize the risk of injury or immediate mortality.").*

Every effort will be made to insure that adult trapping facilities do not delay movement of listed fish by checking the trap daily or more often as needed. Juvenile fish that are handled and/or tagged are anesthetized to reduce stress and held in recovery buckets before being released. Handling and tagging are kept to the minimum needed to provide valid estimates of abundance or survivals.

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

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

Name, Title, and Signature of Applicant:

Certified by_____________________________ Date:_____________

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

As of August 5, 2009, there are 44 separate listings of Federal Status endangered/threatened species within the State of Washington (http://ecos.fws.gov), 58 listings in Oregon, and 22 listings in Idaho. In the lists below (Tables 29-31), are all non-salmonid listed species and their current status ratings. Of the following species listed only the plant species Spalding's Catchfly is confirmed to be found in the area where the Snake River Stock production program occurs (i.e. Snake River, Grande Ronde River, LFH). Species such as the Gray Wolf, the Grizzly Bear, the Canadian Lynx, and the northern spotted owl were once likely found in the Grande Ronde River basin, but their current existence is not verified. The geographic distributions of the other listed species were generally limited to the Cascade Mountain Range, the Selkirk Mountains in NE Washington, the Willamette Valley (Oregon), Puget Sound and Coastal areas.

Table 50. List of current ESA listed species (animal and plant) within the State of Washington.

Status Rating	Species
ANIMALS	
Endangered	Albatross, short-tailed (*Phoebastria (=Diomedea) albatrus*)
Threatened	Bear, grizzly (*Ursus arctos horribilis*)
Threatened	Butterfly, Oregon silverspot (*Speyeria zerene hippolyta*)
Endangered	Caribou, woodland (ID, WA, B.C.) (*Rangifer tarandus caribou*)
Endangered	Curlew, Eskimo (*Numenius borealis*)
Endangered	Deer, Columbian white-tailed (*Odocoileus virginianus leucurus*)
Threatened	Lynx, Canada (lower 48 States DPS) (*Lynx canadensis*)
Threatened	Murrelet, marbled (CA, OR, WA) (*Brachyramphus marmoratus marmoratus*)
Threatened	Otter, southern sea except where EXPN (*Enhydra lutris nereis*)
Threatened	Owl, northern spotted (*Strix occidentalis caurina*)
Endangered	Pelican, brown (*Pelecanus occidentalis*)
Threatened	Plover, western snowy (Pacific coastal pop.) (*Charadrius alexandrinus nivosus*)
Endangered	Rabbit, pygmy Columbia Basin DPS (*Brachylagus idahoensis*)
Threatened	Sea turtle, green (*Chelonia mydas*)
Endangered	Sea turtle, leatherback (*Dermochelys coriacea*)
Threatened	Sea-lion, Steller eastern pop. (*Eumetopias jubatus*)
Endangered	Sea-lion, Steller western pop. (*Eumetopias jubatus*)
Endangered	Whale, humpback (*Megaptera novaeangliae*)
Endangered	Whale, killer Southern Resident DPS (*Orchinus orca*)
Endangered	Wolf, gray (lower 48 states, except where delisted and where EXPN) (*Canis lupus*)
PLANTS	
Threatened	Paintbrush, golden (*Castilleja levisecta*)
Endangered	Stickseed, showy (*Hackelia venusta*)
Threatened	Howellia, water (*Howellia aquatilis*)
Endangered	Desert-parsley, Bradshaw's (*Lomatium bradshawii*)
Threatened	Lupine, Kincaid's (*Lupinus sulphureus (=oreganus) ssp. Kincaidii (=var. kincaidii*))
Threatened	Checker-mallow, Nelson's (*Sidalcea nelsoniana*)
Endangered	Checkermallow, Wenatchee Mountains (*Sidalcea oregana var. calva*)
Threatened	Catchfly, Spalding's (*Silene spaldingii*)
Threatened	Ladies'-tresses, Ute (*Spiranthes diluvialis*)

Table 51. List of current ESA listed species (animal and plant) listed and occurring in the State of Oregon.

Status Rating	Species
ANIMALS	
Endangered	Albatross, short-tailed (*Phoebastria (=Diomedea) albatrus*)
Threatened	Bear, grizzly (*Ursus arctos horribilis*)
Endangered	Butterfly, Fender's blue (*Icaricia icarioides fenderi*)
Threatened	Butterfly, Oregon silverspot (*Speyeria zerene hippolyta*)
Endangered	Condor, California U.S.A. only (*Gymnogyps californianus*)
Endangered	Curlew, Eskimo (*Numenius borealis*)
Threatened	Lynx, Canada (lower 48 States DPS) (*Lynx canadensis*)
Threatened	Murrelet, marbled (CA, OR, WA) (*Brachyramphus marmoratus marmoratus*)
Threatened	Otter, southern sea except where EXPN (*Enhydra lutris nereis*)
Threatened	Owl, northern spotted (*Strix occidentalis caurina*)
Endangered	Pelican, brown (*Pelecanus occidentalis*)
Threatened	Plover, western snowy (Pacific coastal pop.) (*Charadrius alexandrinus nivosus*)
Endangered	Rabbit, pygmy Columbia Basin DPS (*Brachylagus idahoensis*)
Threatened	Sea turtle, green (*Chelonia mydas*)
Endangered	Sea turtle, leatherback (*Dermochelys coriacea*)
Threatened	Sea turtle, loggerhead (*Caretta caretta*)
Threatened	Sea-lion, Steller eastern pop. (*Eumetopias jubatus*)
Endangered	Sea-lion, Steller western pop. (*Eumetopias jubatus*)
Endangered	Whale, humpback (*Megaptera novaeangliae*)
Endangered	Whale, killer Southern Resident DPS (*Orchinus orca*)
Endangered	Wolf, gray (lower 48 states, except where delisted and where EXPN) (*Canis lupus*)
PLANTS	
Threatened	Paintbrush, golden (*Castilleja levisecta*)
Endangered	Rock-cress, McDonald's (*Arabis macdonaldiana*)
Threatened	Howellia, water (*Howellia aquatilis*)
Endangered	Desert-parsley, Bradshaw's (*Lomatium bradshawii*)
Threatened	Lupine, Kincaid's (*Lupinus sulphureus (=oreganus) ssp. Kincaidii (=var. kincaidii*))
Threatened	Checker-mallow, Nelson's (*Sidalcea nelsoniana*)
Threatened	Catchfly, Spalding's (*Silene spaldingii*)
Endangered	Daisy, Willamette (*Erigeron decumbens var.decumbens*)
Threatened	Four-o'clock, MacFarlane's (*Mirabilis macfarlanei*)
Endangered	Fritillary, Gentner's (*Fritillaria gentneri*)
Endangered	Lily, Western (*Lilium occidentale*)
Endangered	Lomatium, Cook's (*Lomatium cookii*)
Endangered	Meadowfoam, large-flowered woolly (*Limnanthes floccosa ssp. Grandiflora*)
Endangered	Milk-vetch, Applegate's (*Astragalus applegatei*)
Endangered	Popcornflower, rough (*Plagiobothrys hirtus*)
Threatened	Thelypody, Howell's spectacular (*Thelypodium howellii spectabilis*)
Endangered	Wire-lettuce, Malheur (*Stephanomeria malheurensis*)

Table 52. List of current ESA listed species (animal and plant) listed and occurring within the State of Idaho.

Status Rating	Species
ANIMALS	
Threatened	Bear, grizzly (*Ursus arctos horribilis*)
Endangered	Caribou, woodland (ID, WA, B.C.) (*Rangifer tarandus caribou*)
Endangered	Curlew, Eskimo (*Numenius borealis*)Limpet, Banbury Springs (*Lanx sp.*)
Threatened	Lynx, Canada (lower 48 States DPS) (*Lynx canadensis*)
Endangered	Rabbit, pygmy Columbia Basin DPS (*Brachylagus idahoensis*)
Threatened	Snail, Bliss Rapids (*Taylorconcha serpenticola*)
Endangered	Snail, Snake River physa (*Physa natricina*)

Endangered	Snail, Utah valvata (*Valvata utahensis*)
Endangered	Springsnail, Bruneau Hot (*Pyrgulopsis bruneauensis*)
Threatened	Squirrel, northern Idaho ground (*Spermophilus brunneus brunneus*)
Endangered	Wolf, gray (lower 48 states, except where delisted and where EXPN) (*Canis lupus*)
PLANTS	
Threatened	Howellia, water (*Howellia aquatilis*)
Threatened	Catchfly, Spalding's (*Silene spaldingii*)
Threatened	Four-o'clock, MacFarlane's (*Mirabilis macfarlanei*)
Threatened	Ladies'-tresses, Ute (*Spiranthes diluvialis*)

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

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

Refer to Section 2.1

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

Spalding's Catchfly

General species description and habitat requirements (citations).

Citation: Hitchcock, C.L., A. Cronquist, M. Ownbey, and J.W. Thompson. 1964. Vascular Plants of the Pacific Northwest, Part 2: *Salicaceae to Saxifragaceae*. University of Washington Press, Seattle. 597 pp.

The Spalding's Catchfly is a long-lived, herbaceous perennial, 8-24 inches tall, typically with one stem, but can have several. Each stem bears 4-7 pairs of lance shaped leaves 2 to 3 inches in length. The light green foliage and stem are lightly to more typically densely covered with sticky hairs. The cream-colored flowers are arranged in a spiral at that top of the stem. The outer, green portion of the flower forms a tube, ~1/2 inch long with ten distinct veins running its length. The flower consists of 5 petals, each with a long narrow "claw" that is largely concealed by the calyx tube and a very short "blade", or flared portion at the summit of the claw. Four (sometimes as many as 6) short petal-like appendages are attached inside and just below each blade.

The species begins to flower in mid- to late July, with some individuals still flowering by early September. Most other forbs within its habitat have finished flowering when *S. spaldingii* is just hitting its peak. A majority of individuals have developed young fruits by mid- to late August.

S. spaldingii occurs primarily within open grasslands with a minor shrub component and occasionally with in a mosaic of grassland and ponderosa pines. It is most commonly found at elevations of 1900-3050 feet, near the lower tree line, with a preference for northerly-facing aspects. The species is primarily restricted to mesic (not extremely wet or extremely dry) prairie or steppe vegetation that makes up the Palouse Region in SE Washington.

Local population status and habitat use (citations).

Within the State of Washington, S. spaldingii, is found in Asotin, Lincoln, Spokane and Whitman counties, with a status listing of 'threatened". A total of 28 populations have been identified (FR# 1018-AF79, Vol 66, No. 196, p. 51598). This plant is threatened by a variety of factors including habitat destruction and fragmentation resulting from agricultural and urban development, grazing and trampling by domestic livestock and native herbivores, herbicide treatment and competition from nonnative plant species (Gamon 1991; Schassberger 1988). It is currently estimated that 98% of the original Palouse prairie habitat has been lost to the mentioned activities (Gamon 1991). Each of the populations documented are generally very small, and are currently quite fragmented, raising questions about their long-term viability.

Site-specific inventories, surveys, etc. (citations).

Site-specific findings in Franklin County not available.

15.3) <u>Analysis of effects.</u>

Spalding's Catchfly

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

To the best of our knowledge, the program as described in this HGMP will not have direct, indirect, or cumulative effects on the listed species. The surrounding habitat associated with this hatchery mitigation program will not be altered, which would be the only source of "take" possible to the listed species. Interactions with the fall Chinook will not occur.

Identify potential level of take (past and projected future).

None (past or projected future)

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

Operation of the Adult Trap or incubation/rearing areas at Lyons Ferry will not affect (directly or indirectly) the existence of the listed species in the area. Habitat requirements for the species do not apply at the Lyons Ferry adult trap or hatchery facility. Activities at Lyons Ferry all take place on existing hatchery grounds. No new construction activities are planned for the program that could impact the listed species. Effluent from the hatchery falls below state water quality standards guidelines, and is therefore not a concern.

<u>Fish health</u> - *pathogen transmission, therapeutics, chemicals.*

Not Applicable – Pathogens would not be transmitted between the species.

<u>Ecological/biological</u> - competition, behavioral, etc.

Not Applicable - Non-overlapping habitats between the fall Chinook and the flower.

<u>Predation</u> -

Not Applicable

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

When/if electrofishing surveys occur to collect genetic samples, little to no impact should be expected as survey areas will likely be out of the range of the listed species.

<u>Habitat</u> - modifications, impacts, quality, blockage, de-watering, etc.

Modifications to the surrounding hatchery areas are not planned at this time, so no loss of potential habitat to the listed species is expected.

15.4 Actions taken to mitigate for potential effects.

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

No actions are considered necessary at this time. Disturbance to Bald Eagles will be minimal in the area, and land disturbance where Spalding's Catchfly may habitat will not occur over the course of the program.

15.5 References

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Table 53. Estimated listed salmonid take levels of by hatchery activity

Listed species affected: Fall Chinook ESU/Population: Snake Activity: Broodstock Collection, spawning, rearing and releases Location of hatchery activity: Lyons Ferry Complex Dates of activity: Year Round Hatchery program operator: Jon Lovrak					
Type of Take	**Origin**	**Annual Take of Listed Fish By Life Stage (Number of Fish)**			
		Egg/Fry	***Juvenile or Smolt***	***Adult*** [h]	***Carcass***
Observe or harass [a]	No fin clip	0	0	0	0
	Ad clip	0	0	0	0
Collect for transport [b]	No fin clip	0	0	0	0
	Ad clip	0	0	0	0
Capture, handle, and release [c]	No fin clip	0	0	1,500	0
	Ad clip	0	0	2,000	0
Capture, handle, tag/mark/tissue sample, and release [d]	No fin clip	0	765,000	3,000	0
	Ad clip	0	2,560,000	775	0
Removal (e.g. broodstock) [e]	No fin clip	0	0	1,500	0
	Ad clip	0	0	4,000	0
Intentional lethal take [f]	No fin clip	0	0	1,500	0
	Ad clip	0	0	4,000	0
Unintentional lethal take [g]	No fin clip	7.5%	7.5%	25	0
	Ad clip	7.5%	7.5%	50	0
Other Take (specify)	No fin clip	0	0	0	0
	Ad clip	0	0	0	0

a. Contact with listed fish that could occur from migration delay at dam or traps.
b. Take associated with weir or trapping operations where listed fish are captured and transported for brood.
c. Take associated with weir or trapping operations where listed fish are captured handled and released upstream or downstream.
d. Take occurring due to PIT tagging prior to release. The number shown assumes full production. This number could vary depending on annual egg takes and survival in the hatchery. Adults could be captured throughout the Snake basin, with some samples collected for scales and genetics.
e. Listed fish removed from the Snake River and collected for use as hatchery broodstock.
f. Intentional mortality of listed fish as a result of spawning as broodstock. Same fish as shown in E.
g. Unintentional mortality of listed fish from operation of adult traps, including loss of fish during transport or holding prior to spawning or prior to release back into the wild following broodstock spawning. Also provided are estimates of egg loss or fry/juvenile loss to the smolt stage as a percent of the total population. Adult mortalities are based on a % of mortality due to trapping/collection of fish from the listed activities.
h. Estimates of adult takes are based on sampling rate at LGR trap not to exceed 20%

Table 54. Estimated listed salmonid take levels of by Research, Monitoring and Evaluation activities that occur outside the realm of standard hatchery operations.

Listed species affected: Fall Chinook ESU/Population: Snake

Monitoring and Evaluation Activities: Spawning Ground Surveys; Smolt Trapping, fyke netting and seining; etc…

Location of hatchery activity: Snake River and associated Streams and rivers in Washington, Oregon and Idaho.

Dates of activity: Year Round Research/Monitoring/Evaluation program operator: Deborah Milks, Darren Ogden, Doug Marsh, Jay Hesse, Jason Vogel, Stuart Rosenberger, Phil Groves, Billy Connor, Howard Burge, Ken Tiffan, Pete Hassemer and numerous other researchers.

Type of Take	Origin	Annual Take of Listed Fish By Life Stage (*Number of Fish*)			
		Egg/Fry	*Juvenile or Smolt*	*Adult*	*Carcass*
Observe or harass [a]	No fin clip	0	2,500 [h]	200	0
	Ad clip	0	2,500 [h]	600	0
Collect for transport [b]	No fin clip	0	0	0	0
	Ad clip	0	0	0	0
Capture, handle, and release [c]	No fin clip	0	5,000 25,000 [h,i]	70 [h,i]	10
	Ad clip	0	58,300 [h,i]	20 [h,i]	10
Capture, handle, tag/mark/tissue sample, and release [d]	No fin clip	0	2,685 12,800 [h,i]	300	500
	Ad clip	0	1,000	100	1,000
Removal (e.g. broodstock) [e]	No fin clip	0	0	0	0
	Ad clip	0	0	0	0
Intentional lethal take [f]	No fin clip	0	0	0	0
	Ad clip	0	0	0	0
Unintentional lethal take [g]	No fin clip	0	268 300 [h,i]	0	0
	Ad clip	0	100 458 [h,i]	30	0
Other Take (specify)	No fin clip	0	0	0	0
	Ad clip	0	0	0	0

a. Contact with listed fish through spawning surveys.
b. Take (non-lethal) of listed fish for transportation only (i.e. smolt trapping).
c. Take associated with smolt trapping operations where listed fish are captured, handled and released.
d. Take occurring due to PIT tagging and/or bio-sampling (length/weight and scales) of fish collected through smolt trapping operations prior to release. Also includes natural origin adults that may be captured at adult traps
e. Broodstock collection activities do not take place under the Research Section.
f. Intentional mortality of listed natural origin fish during smolt trapping.
g. Unintentional mortality of listed fish, including loss of fish during transport during smolt trapping.
h. Nez Perce Tribe activities associated with snorkeling, seines, fyke nets, trawls, and purse seines, Take listed here is consistent with the current Section10 #1334 Permit.
i. Nez Perce Tribe activities associated with emigrant studies using rotary screw traps. Take listed here is consistent with the current Section10 #1334 Permit.

Attachment 1. Definition of terms referenced in the HGMP template.

Augmentation - The use of artificial production to increase harvestable numbers of fish in areas where the natural freshwater production capacity is limited, but the capacity of other salmonid habitat areas will support increased production. Also referred to as “fishery enhancement”.

Critical population threshold - An abundance level for an independent Pacific salmonid population below which: depensatory processes are likely to reduce it below replacement; short-term effects of inbreeding depression or loss of rare alleles cannot be avoided; and productivity variation due to demographic stochasticity becomes a substantial source of risk.

Direct take - The intentional take of a listed species. Direct takes may be authorized under the ESA for the purpose of propagation to enhance the species or research.

Evolutionarily Significant Unit (ESU) - NMFS definition of a distinct population segment (the smallest biological unit that will be considered to be a species under the Endangered Species Act). A population will be/is considered to be an ESU if 1) it is substantially reproductively isolated from other conspecific population units, and 2) it represents an important component in the evolutionary legacy of the species.

Harvest project - Projects designed for the production of fish that are primarily intended to be caught in fisheries.

Hatchery fish - A fish that has spent some part of its life-cycle in an artificial environment and whose parents were spawned in an artificial environment.

Hatchery population - A population that depends on spawning, incubation, hatching or rearing in a hatchery or other artificial propagation facility.

Hazard - Hazards are undesirable events that a hatchery program is attempting to avoid.

Incidental take - The unintentional take of a listed species as a result of the conduct of an otherwise lawful activity.

Integrated harvest program - Project in which artificially propagated fish produced primarily for harvest are intended to spawn in the wild and are fully reproductively integrated with a particular natural population.

Integrated recovery program - An artificial propagation project primarily designed to aid in the recovery, conservation or reintroduction of particular natural population(s), and fish produced are intended to spawn in the wild or be genetically integrated with the targeted natural population(s). Sometimes referred to as “supplementation”.
Isolated harvest program - Project in which artificially propagated fish produced primarily for harvest are not intended to spawn in the wild or be genetically integrated with any specific natural population.

Isolated recovery program - An artificial propagation project primarily designed to aid in the recovery, conservation or reintroduction of particular natural population(s), but the fish produced are not intended to spawn in the wild or be genetically integrated with any specific natural population.

Mitigation - The use of artificial propagation to produce fish to replace or compensate for loss of fish or fish production capacity resulting from the permanent blockage or alteration of habitat by human activities.

Natural-orign fish - A fish that has spent essentially all of its life-cycle in the wild and whose parents spawned in the wild. Synonymous with *natural origin recruit (NOR).*

Natural-origin recruit (NOR) - See *natura-originl fish* .

Natural population - A population that is sustained by natural spawning and rearing in the natural habitat.

Population - A group of historically interbreeding salmonids of the same species of hatchery, natural, or unknown parentage that have developed a unique gene pool that breed in approximately the same place and time, and whose progeny tend to return and breed in approximately the same place and time. They often, but not always, can be separated from another population by genotypic or demographic characteristics. This term is synonymous with stock.

Preservation (Conservation) - The use of artificial propagation to conserve genetic resources of a fish population at extremely low population abundance, and potential for extinction, using methods such as captive propagation and cryopreservation.

Research - The study of critical uncertainties regarding the application and effectiveness of artificial propagation for augmentation, mitigation, conservation, and restoration purposes, and identification of how to effectively use artificial propagation to address those purposes.

Restoration - The use of artificial propagation to hasten rebuilding or reintroduction of a fish population to harvestable levels in areas where there is low, or no natural production, but potential for increase or reintroduction exists because sufficient habitat for sustainable natural production exists or is being restored.

Stock - (see "Population").

Take - To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

Viable population threshold - An abundance level above which an independent Pacific salmonid population has a negligible risk of extinction due to threats from demographic variation (random or directional), local environmental variation, and genetic diversity changes (random or directional) over a 100-year time frame.

Attachement 2: Smolt-to-adult survival estimates of fall Chinook released in the Snake River basin.

Attachment 2.Table 1. Percent smolt-to-adult survivals of adipose clipped and unclipped wire tagged sub-yearlings released in the Snake River Basin by salt water age.

Brood Year	Site	CWT	Date	fpp	1-salt	2-salt	3-salt	4-salt	5-salt	Total
Incomplete Returns										
2004	BC	612504	30-May	55	0.060	0.180	0.004			0.244
					118	351	7			476
	CJ [vs. CCD]	610154	28-May	47	0.027	0.082	0.050			0.159
					50	149	90			289
2006	NPT-North Lapwai Valley	612710	22-May	51	0.036					0.036
					52					52

Attachment 2.Table 2. Percent Smolt-to-adult-survials of adipose clipped and wire tagged sub-yearlings released in the Snake River Basin by salt water age.

Brood Year	Site	CWT	Date	fpp	1-salt	2-salt	3-salt	4-salt	5-salt	Total
Completed Returns										
1996	BC	635120	10-Jun	64	0.061	0.193	0.205	0.042	0.003	0.503
					73	231	246	50	3	602
		635316	10-Jun	64	0.054	0.214	0.190	0.036		0.493
					62	244	216	41		562
1998	LFH	631026	15-Jun	50	0.239	0.544	0.374	0.041		1.198
					484	1104	759	84		2431
1999	LFH	630167	26-May	46	0.120	0.172	0.159	0.032	0.001	0.483
					234	334	308	62	1	939
2000	Col. R.-below BONN Dam	630270	1-Jun	46	0.040	0.060	0.083	0.006		0.189
					80	119	166	11		375
2001	LFH	630890	24-Jun	52	0.053	0.152	0.098	0.029	0.005	0.337
					101	292	189	55	9	647
2002	LFH	631545	6-Jun	50	0.067	0.057	0.032	0.001		0.158
					134	113	63	3		313
	CCD	631391	9-Jun	40	0.031	0.052	0.016	0.002		0.102
					31	51	16	2		100
2003	LFH	631786	21-Jun	51	0.039	0.068	0.027	0.001		0.136
					78	135	54	3		269
	PL-IPC	106973	24-May	54		0.075	0.025			0.100
						27	9			36
		107976	24-May	54	0.031	0.026	0.019			0.077
					20	16	12			49
		108076	24-May	54	0.033	0.027	0.003			0.063
					20	17	2			39
Incomplete Returns										
2004	CCD [vs. CJ]	610155	26-May	49	0.025	0.034	0.010			0.069

					47	62	18		128
	GRR Direct	632782	25-May	56	0.036	0.040	0.009		0.085
					69	77	18		163
	HC Dam-IPC	100471	28-Apr	62	0.039	0.067	0.041		0.146
					8	14	8		30
		106676	28-Apr	62	0.039	0.064	0.063		0.166
					21	34	34		89
		106776	28-Apr	62	0.055	0.031	0.029		0.116
					30	17	16		62
		107176	28-Apr	62	0.105	0.038			0.143
					26	9			35
		109370	28-Apr	62	0.038	0.042			0.080
					8	9			17
	LFH	632787	27-May	51	0.042	0.036	0.009		0.087
					83	71	17		171
	NPTH	612670	17-May	115		0.015	0.002		0.017
						15	2		17
		612672	17-May	121	0.018	0.014	0.010		0.042
					25	20	14		58
	PL-IPC	073336	25-May	50	0.004	0.008			0.012
					9	16			25
2005	BC	610174	25-May	57	0.261	0.353			0.614
					255	345			601
	CJ [vs. CCD]	610176	25-May	46	0.369	0.618			0.987
					364	610			974
	CCD [vs. CJ]	633583	30-May	56	0.259	0.643			0.902
					508	1260			1768
	CCD	610178	22-Jun	50	0.068	0.112			0.180
					142	234			376
	GRR Direct	633584	19-Jun	51	0.155	0.099			0.254
					304	196			500
	HC Dam	108977	2-May	80	0.181	0.486			0.667
					75	200			275
		109477	2-May	80	0.265	0.331			0.596
					177	221			398
		109577	2-May	80	0.232	0.304			0.537
					158	207			365
	LFH	633582	1-Jun	52	0.416	0.815			1.231
					837	1640			2476
	NPT-North Lapwai Valley	612671	17-May	72	0.167	0.219			0.386
					166	218			384
	NPTH	612698	8-Jun	59	0.149	0.149			0.297
					148	147			295
	PL1-IPC	094419	22-May	53	0.243	0.120			0.363
					451	223			673
2006	BC	612729	28-May	50	0.071				0.071
					70				70
	CJ	612727	29-May	50	0.040				0.040
					40				40
	HC Dam-IPC	101273	8-May	55	0.009				0.009
					10				10

		103880	8-May	55	0.032					0.032
					37					37
		104480	8-May	55	0.052					0.052
					60					60
	LFH	633986	23-May	62	0.136					0.136
					264					264
	NPTH	612699	11-Jun	38	0.135					0.135
					133					133
	PL	612732	26-May	50	0.055					0.055
					54					54

Attachment 2.Table 3. Percent Smolt-to-adult-survials of wire tagged (not adipose clipped) sub-yearlings released in the Snake River Basin by salt water age.

Brood Year	Site	CWT	Date	fpp	1-salt	2-salt	3-salt	4-salt	5-salt	Total
Completed Returns										
1998	BC	631025	2-Jun	84	0.494	0.506	0.344	0.036	0.003	1.383
					965	987	671	71	6	2700
1999	CJ	630168	20-May	45	0.111	0.133	0.126	0.007	0.005	0.382
					214	258	245	14	9	739
	CJ	630169	15-Jun	52	0.269	0.253	0.232	0.012		0.766
					523	492	452	23		1491
2000	BC	630271	29-May	53	0.112	0.094	0.053	0.011	0.004	0.275
					221	186	105	21	8	540
	PL	630272	28-May	84	0.054	0.026	0.020	0.001	0.004	0.105
					106	52	39	2	8	207
2001	BC	612639	27-May	193	0.107	0.214	0.121	0.024		0.467
					212	424	240	47		923
	CJ	610106	28-May	215	0.078	0.093	0.099	0.014	0.001	0.285
					144	173	183	26	3	528
	CJ	610105	20-Jun	152	0.254	0.289	0.191	0.027		0.761
					464	526	348	50		1388
	PL	612501	27-May	166	0.058	0.060	0.058	0.009		0.185
					115	119	117	18		369
2002	BC	610122	3-Jun	95	0.053	0.049	0.030	0.009		0.141
					102	94	59	17		272
	CJ	610121	28-May	81	0.025	0.043	0.005			0.073
					49	85	9			142
	CJ	612654	12-Jun	74	0.035	0.057	0.018			0.109
					65	106	33			204
	NPT-North Lapwai Valley	610109	28-May	61	0.030	0.022	0.018	0.003		0.072
					23	17	14	2		56
		612648	28-May	61	0.086					0.086
					8					8
		612657	28-May	61			0.015			0.015
							11			11
	NPTH	610107	2-Jun	38	0.015	0.007	0.005			0.028
					30	14	10			54
	NPTH	610110	19-Jun	81	0.122	0.115	0.083	0.007		0.328
					119	113	82	7		321

	PL	610123	4-Jun	130	0.005	0.027	0.011	0.006	0.049
					9	52	21	11	93
2003	BC	612500	3-Jun	80	0.038	0.054	0.045		0.137
					76	106	89		271
	CJ	612600	29-May	55	0.034	0.055	0.051	0.003	0.142
					66	105	98	5	274
	NPTH	612675	4-Jun	55	0.024	0.024	0.011	0.003	0.062
					40	39	18	5	102
Incomplete Returns									
2004	NPTH	610108	17-May	115	0.004	0.011	0.001		0.016
					8	21	2		31
		612669	17-May	121	0.018	0.010	0.001		0.029
					19	11	1		31
2005	BC	610175	25-May	57	0.884	0.508			1.392
					875	503			1378
	CJ	610177	25-May	46	0.891	0.469			1.361
					886	466			1352
	NPT-Cedar Flats	612653	13-Jun	33	0.933	0.536			1.469
					150	86			236
		612660	13-Jun	33	0.308	0.485			0.794
					29	46			75
	NPT-Lukes Gulch	612655	13-Jun	37	0.327	0.353			0.680
					82	89			171
	NPT-North Lapwai Valley	612707	17-May	72	0.173	0.234			0.408
					171	231			402
	NPTH	612709	8-Jun	59	0.523	0.422			0.945
					1034	834			1868
2006	BC	612730	28-May	50	0.079				0.079
					79				79
	CJ	612728	29-May	50	0.047				0.047
					47				47
	NPT-Cedar Flats	612734	11-Jun	47	0.119				0.119
					30				30
	NPT-Lukes Gulch	612733	4-Jun	37	0.050				0.050
					12				12
	NPTH	612696	11-Jun	38	0.102				0.102
					199				199
	PL	612731	26-May	50	0.035				0.035
					34				34

Attachment 2.Table 4. Percent Smolt-to-adult-survials of adipose clipped and wire tagged yearlings released in the Snake River Basin by salt water age.

Brood Year	Site	CWT	Date	fpp	0-salt	1-salt	2-salt	3-salt	4-salt	5-salt	Total
Completed Returns											
1994	LFH	635844	9-Apr	10.7	0.100	0.138	0.257	0.132	0.003		0.631
					198	274	510	261	7		1250
		635845	9-Apr	10.7	0.106	0.104	0.229	0.107	0.004	0.001	0.551
					221	216	478	222	9	2	1148
	PL	635712	12-Apr	10.3	0.022	0.024	0.084	0.029	0.003		0.162
					25	27	96	33	3		185
1995	BC	635959	14-Apr	10.3	0.022	0.105	0.261	0.162	0.023		0.574
					16	75	187	116	17		412
		635960	14-Apr	10.3	0.018	0.096	0.287	0.122	0.003		0.526
					13	70	210	89	2		384
	BC	635953	14-May	11.6		0.007	0.025	0.072			0.103
						2	7	21			30
		636024	14-May	11.6			0.438				0.438
							3				3
		636025	14-May	11.6	0.014	0.032	0.096	0.219	0.007		0.368
					2	5	14	32	1		53
	LFH	636320	4-Apr	9.3	0.080	0.524	0.916	0.233	0.017		1.770
					175	1140	1995	508	37		3856
		636321	4-Apr	9.3	0.098	0.561	0.936	0.260	0.010		1.865
					213	1221	2040	567	21		4061
	PL	635957	14-Apr	10.7	0.026	0.133	0.279	0.260	0.020	0.010	0.727
					17	89	188	175	13	7	489
		635958	14-Apr	10.7	0.021	0.134	0.293	0.172	0.011		0.631
					14	91	197	116	7		425
1996	BC	630110	13-Apr	30		0.008		0.019			0.027
						1		2			3
		636126	13-Apr	9.5			0.100	0.197			0.297
							15	30			46
		636343	13-Apr	9.5			0.880				0.880
							70				70
		636347	13-Apr	9.5	0.004	0.057	0.581	0.030			0.673
					1	14	138	7			160
	CJ	630363	13-Apr	10.9	0.015	0.015	0.104	0.193			0.327
					1	1	7	13			22
		630401	13-Apr	10.9		0.070	0.253				0.323
						1	4				5
		636345	13-Apr	10.9	0.020	0.060	0.435	0.080	0.011		0.607
					12	36	263	49	7		367
		636346	13-Apr	10.9	0.016	0.042	0.336	0.134			0.528
					10	26	209	83			327
	LFH	630163	3-Apr	10.1	0.032	0.192	0.400	0.189	0.021		0.834
					64	385	800	378	42		1670
		636318	3-Apr	10.1	0.030	0.168	0.348	0.152	0.003		0.700
					62	350	725	317	5		1460
	PL	630446	13-Apr	9.9	0.028	0.072	0.280	0.178	0.007		0.565

					19	49	189	121	4	382
		630448	13-Apr	9.9	0.021	0.067	0.276	0.333	0.004	0.701
					14	46	188	227	3	478
1997	BC	630454	12-Apr	10.4	0.005	0.211	0.320	0.043		0.580
					8	321	486	65		881
	BC	630938	26-Apr	11.1	0.005	0.123	0.442	0.015		0.584
					3	93	335	12		443
	CJ	630453	12-Apr	11.8	0.037	0.694	0.626	0.055	0.006	1.418
					58	1084	978	86	10	2215
	LFH	630860	1-Apr	8.3	0.151	0.669	1.343	0.192	0.006	2.361
					649	2879	5779	824	26	10157
	PL	630451	12-Apr	10	0.024	0.321	0.398	0.077	0.002	0.822
					34	448	555	107	2	1147
1998	BC	631012	11-Apr	10.5	0.078	0.290	0.541	0.095	0.001	1.005
					102	378	706	125	2	1313
	CJ	631013	1-Apr	8.2	0.216	0.729	0.849	0.169	0.013	1.977
					283	957	1114	221	17	2593
	LFH	631213	24-Mar	9.41	0.176	0.752	0.948	0.240	0.008	2.124
					798	3409	4296	1090	38	9631
	PL	631212	11-Apr	9.6	0.080	0.274	0.470	0.073	0.004	0.900
					106	366	627	97	5	1201
1999	BC	630477	9-Apr	10.2	0.050	0.237	0.082	0.024	0.003	0.395
					57	268	93	27	3	447
	CJ	630478	4-Apr	10.1	0.085	0.318	0.247	0.059	0.002	0.710
					86	323	251	59	2	721
	LFH	630476	1-Apr	8.7	0.014	0.453	0.852	0.241	0.012	1.571
					47	1525	2872	812	41	5297
	PL	630479	10-Apr	10.4	0.026	0.158	0.158	0.027		0.369
					27	164	164	28		383
2000	BC	630677	10-Apr	12.9	0.151	0.185	0.227	0.077	0.001	0.641
					236	289	355	121	1	1002
	CJ	630183	16-Apr	16.6	0.112	0.253	0.304	0.074		0.743
					179	405	487	119		1191
	LFH	631273	1-Apr	9.3	0.193	0.657	0.923	0.273	0.011	2.057
					824	2813	3949	1169	48	8804
	PL	630678	15-Apr	13.4	0.334	0.279	0.464	0.135	0.001	1.214
					531	444	739	215	2	1931
2001	BC	610119	14-Apr	10.6	0.057	0.159	0.142	0.020		0.378
					82	228	204	28		542
	CJ	610118	30-Mar	10	0.197	0.414	0.408	0.066		1.085
					297	623	614	99		1632
	LFH	631585	1-Apr	9.7	0.303	0.989	0.878	0.092	0.003	2.266
					1558	5083	4512	475	17	11645
	PL	610120	13-Apr	9.1	0.072	0.237	0.151	0.014		0.475
					100	329	210	19		658
2002	BC	612659	14-Apr	9.41	0.003	0.082	0.133	0.014	0.001	0.232
					3	87	142	15	1	248
	CJ	612503	2-Apr	9.07	0.012	0.122	0.166	0.022		0.323
					18	184	250	33		486
	LFH	632167	12-Apr	9.89	0.104	0.232	0.346	0.056	0.002	0.740
					446	990	1482	239	8	3166
	PL	612502	12-Apr	9.948	0.006	0.112	0.095	0.012		0.225

					9	163	137	17			326
2003	BC	610147	4-Apr	10.4	0.147	0.258	0.268	0.018			0.691
					93	163	169	12			437
	LFH	631769	28-Mar	9.4	0.262	0.696	0.934	0.042			1.934
					571	1515	2033	92			4211
		632368	28-Mar	9.4	0.080	0.857	1.357	0.152			2.446
					13	140	223	25			401
	PL	610149	13-Apr	9.9	0.077	0.288	0.245	0.027			0.636
					54	201	171	19			445
Incomplete Returns											
2004	BC	610148	12-Apr	9.3	0.496	0.553	0.408				1.457
					331	369	272				972
	CJ	610151	11-Apr	8.9	1.203	0.772	0.744				2.719
					844	542	522				1908
	LFH	633283	5-Apr	9.7947	0.376	1.191	0.627				2.194
					845	2676	1409				4930
	PL	610150	5-Apr	10.29	0.316	0.676	0.456				1.448
					212	452	306				970
2005	BC	612507	18-Apr	10	0.022	0.245					0.267
					15	166					181
	CJ	612506	13-Apr	10	0.052	0.068					0.120
					36	47					83
	LFH	633598	2-Apr	11.02	0.108	0.424					0.532
					244	960					1204
	PL	612505	16-Apr	10	0.058	0.145					0.203
					37	93					130
		612661	16-Apr	10	0.073	0.132					0.205
					5	9					14
2006	BC	612513	15-Apr	(blank)	0.700						0.700
					478						478
	CJ	612511	14-Apr	(blank)	3.259						3.259
					2250						2250
	LFH	633987	7-Apr	10.31	0.986						0.986
					2288						2288
	PL	612512	14-Apr	(blank)	1.368						1.368
					932						932

Attachment 2.Table 5. Percent smolt-to-adult-survials of wire tagged (not adipose clipped) yearlings released in the Snake River Basin by salt water age.

Brood Year	Site	CWT	Date	fpp	0-salt	1-salt	2-salt	3-salt	4-salt	5-salt	Total
Completed Returns											
2003	BC	610145	4-Apr	10.4	0.167	0.196	0.172	0.020			0.556
					121	143	125	15			404
	LFH	631770	28-Mar	9.4	0.202	0.484	0.575	0.032			1.293
					441	1056	1254	69			2820
	PL	610146	13-Apr	9.9	0.057	0.182	0.204				0.443
					45	145	162				351
Incomplete Returns											
2004	BC	610144	12-Apr	9.29	0.394	0.531	0.332				1.257

					234	316	198	747
	CJ	610152	11-Apr	8.89	1.224	0.763	0.434	2.422
					957	596	340	1893
	LFH	633284	5-Apr	10.29	0.380	0.968	0.488	1.835
					840	2138	1077	4055
	PL	610153	5-Apr	10.29	0.403	0.642	0.215	1.260
					313	498	167	978
2005	BC	612508	18-Apr	10	0.039	0.136		0.175
					30	105		135
	CJ	612509	13-Apr	10	0.059	0.096		0.155
					46	76		122
	LFH	633597	2-Apr	10.06	0.140	0.490		0.630
					310	1082		1392
	PL	612510	16-Apr	10	0.056	0.130		0.186
					41	94		135
2006	BC	612516	15-Apr	(blank)	1.345			1.345
					1045			1045
	CJ	612514	14-Apr	(blank)	2.415			2.415
					2003			2003
	LFH	634092	7-Apr	10.09	1.465			1.465
					3228			3228
	PL	612515	14-Apr	(blank)	0.921			0.921
					751			751

Attachment 3. Age class designations by fish size and species for salmonids released from hatchery facilities. (Washington Department of Fish and Wildlife, November, 1999).

		SIZE CRITERIA	
	SPECIES/AGE CLASS	Number of fish/pound	Grams/fish
X	Chinook Yearling	<=20	>=23
X	Chinook (Zero) Fingerling	>20 to 150	3 to <23
X	Chinook Fry	>150 to 900	0.5 to <3
X	Chinook Unfed Fry	>900	<0.5
X	Coho Yearling 1/	<20	>=23
X	Coho Fingerling	>20 to 200	2.3 to <23
X	Coho Fry	>200 to 900	0.5 to <2.3
X	Coho Unfed Fry	>900	<0.5
X	Chum Fed Fry	<=1000	>=0.45
X	Chum Unfed Fry	>1000	<0.45
X	Sockeye Yearling 2/	<=20	>=23
X	Sockeye Fingerling	>20 to 800	0.6 to <23
X	Sockeye Fall Releases	<150	>2.9
X	Sockeye Fry	> 800 to 1500	0.3 to <0.6
X	Sockeye Unfed Fry	>1500	<0.3
X	Pink Fed Fry	<=1000	>=0.45
X	Pink Unfed Fry	>1000	<0.45
X	Steelhead Smolt	<=10	>=45
X	Steelhead Yearling	<=20	>=23
X	Steelhead Fingerling	>20 to 150	3 to <23
X	Steelhead Fry	>150	<3
X	Cutthroat Trout Yearling	<=20	>=23
X	Cutthroat Trout Fingerling	>20 to 150	3 to <23
X	Cutthroat Trout Fry	>150	<3
X	Trout Legals	<=10	>=45
X	Trout Fry	>10	<45

1/ Coho yearlings defined as meeting size criteria and 1 year old at release, and released prior to June 1st.
2/ Sockeye yearlings defined as meeting size criteria and 1 year old.

Attachment 4

2010 Monitoring and Evaluation Statement of Work for the WDFW - Lower Snake River Compensation Plan Hatchery Program

Category 1. Fish Culture and Production Activities

Project 1a – Production Monitoring

Objective 1a.1. Monitor and evaluate the quality and release of hatchery spring and fall Chinook salmon and summer steelhead produced at LFC.

Approach: Evaluation staff will analyze marking data and releases of juvenile salmon and steelhead to determine survival rates between life stages and examine potential variables that may influence observed survivals. To document the percent precocious male fish in all of our release groups, visual sampling of spring and fall Chinook salmon and steelhead juveniles will occur. To document PIT tag loss that occurs between tagging and release of fall Chinook, we will install a PIT tag array in the outlet channel.

Task 1a.1.1. Evaluate mark quality (adipose/ventral fin) and tag retention [coded-wire tag (CWT), and visual implant elastomer tag (VIE)] before release.

Task 1a.1.2. Document and report release size, general condition, and percent sexual precocity of juvenile salmonids prior to release.

Task 1a.1.3. Summarize hatchery records for each brood year to document and report green egg-to-fry, fry-to-smolt, and green egg-to-smolt survival rates for each species, and for each release strategy where appropriate (e.g. - yearling/sub-yearling fall Chinook releases) at LFC.

Task 1a.1.4. Recommend/suggest changes in rearing, marking, and/or tagging based on above monitoring to hatchery/fish management staffs to maximize production.

Task 1a.1.5. Install PIT tag antenna array in the outlet of LFH Lake 2.

Task 1a.1.6. Document the number of PIT tagged fish in the release and calculate the number of PIT tags shed between tagging and release.

Objective 1a.2. Assist in the planning, spawning, record keeping, and summarizing data for spawned spring and fall Chinook salmon and summer steelhead at LFC.

Approach: WDFW evaluation staff annually assists in the spawning operations of spring and fall Chinook salmon and summer steelhead at LFC. The role of the evaluation staff has been and will be to collect the biological data (date of spawning, sex, length, scales, marks/tags, extraction of CWTs, DNA and scale sampling, fecundity estimation, etc.) from all fish retained/spawned for broodstock from each of the species. This collaborative role has been critical for optimizing production strategies (See Category 1c below) since program inception. In addition, evaluation staff has worked closely with the hatchery staff to provide weekly/monthly/yearly summaries of the data for hatchery reports and ESA compliance.

Task 1a.2.1. Develop or update spawning protocols as needed for review and approval by LFC and Fish Management staffs prior to the onset of spawning for all species.

Task 1a.2.2. Assist LFC in the spawning of spring and fall Chinook salmon and summer steelhead at LFC.

Task 1a.2.3. Collect biological data from all (or representative sample) spawned fish at LFC (sex, length, scales, DNA, marks/tags, CWT extraction and verification, fecundity estimation)

Task 1a.2.4. Where applicable, assist or provide LFC with the necessary data summaries for completion of hatchery records from spawning activities.

Objective 1a.3. Assist in estimating composition of fall Chinook returned to the river, marking (caudal fin clip) for documentation of survival of fish released, and Snake River run reconstruction efforts.

Approach: It is necessary to trap more fall Chinook than are needed for spawning to assure fish are randomly collected across the run. At the end of the season fish in excess of broodstock needs are returned to the river. Fish are marked with a partial caudal fin clip to allow Evaluation staff to document the effect of their release (site and date of release) on redd counts and run size to the Tucannon River. The mark is also used to track these fish to upstream locations, which may affect Snake River run size estimation at LGR Dam (run reconstruction).

Task 1a.3.1 Collect biological data from all fall Chinook returned to the river at the end of the season at LFC (sex, adult or jack, scales, marks/tags).

Task 1a.3.2. Caudal clip LFC trapped fish with a bottom caudal fin clip and LGR trapped fish with a top caudal fin clip, and document recapture and recovery events.

Objective 1a.4. Operate adult traps on the Touchet and Tucannon rivers for steelhead broodstocks.

Approach: WDFW evaluation staff will operate adult fish traps on the Touchet and Tucannon rivers for endemic broodstock development for the LFC summer steelhead program. To date, evaluation staff has taken the lead on operation and evaluation of adult trapping for the endemic broodstocks in the Tucannon and Touchet rivers. Factors such as weir/trap impedance/avoidance, run timing, spawn timing, population demographics, phenotypic and genetic characteristics, and return rates are part of the necessary evaluation that should be conducted before these programs are expanded. Evaluation staff is responsible for daily record keeping of all species captured, passed, or hauled for broodstock, along with any biological samples collected. These adult traps are also used for estimating adult returns (Category 2).

Trapping Protocols for Endemic Steelhead:

Touchet River: WDFW evaluation staff will operate the Touchet River adult trap year round. The primary purpose will be for trapping adult summer steelhead for the endemic stock program currently under development, but other local species (bull trout, whitefish, brown trout, spring Chinook) will be captured and enumerated as well. Data collected from summer steelhead from the Touchet River adult trap will include length, sex, and scales from all passed natural-origin summer steelhead. These data, in conjunction with those collected from the endemic broodstock collected will be used for ***Sub-objective 1c.1*** (see below).

Tucannon River: WDFW will begin trapping for Tucannon River endemic steelhead in fall 2009, and will trap/count summer steelhead and other species (hatchery steelhead, fall Chinook, Coho, and bull trout) into May 2010. The trap may be disabled (open trap doors) and the PVC floating weir panels will be partially sunk to allow unrestricted passage of adult steelhead and other species when staff time is limited, or during extreme cold periods when little fish movement occurs. Data collected from summer steelhead from the Tucannon River adult trap will include length, sex, scales, and DNA punches (when needed) from all passed natural-origin summer steelhead. These data, in conjunction with those collected from the endemic broodstock collected will be used for ***Sub-objective 1c.1*** (see below).

Task 1a.4.1. Operate adult traps on the Tucannon and Touchet rivers, and collect and transport natural origin steelhead broodstock for the LFC summer steelhead hatchery program.

Task 1a.4.2. Compile all data from trapping and spawning, and calculate return rates for program evaluation.

Project 1b – Fish Health Monitoring – N/A

Project 1c – Optimum Production Strategies

Objective 1c.1. Maintain, and evaluate changes in, the phenotypic and genotypic characteristics of salmon and steelhead stocks used at LFC.

Approach: WDFW uses an assortment of endemic and non-endemic stocks of salmon and steelhead for production at LFC. Both the spring and fall Chinook salmon stocks were developed from endemic sources, while the two original steelhead programs (Lyons Ferry and Wallowa) were not. WDFW, Tribal co-managers and NMFS desire to maintain the integrity of the salmon stocks for use in the program and to minimize the potential negative effects of hatchery operations on ESA listed populations. Likewise, recent efforts to develop endemic steelhead broodstocks on the Touchet and Tucannon rivers have similar goals of protecting the health of natural populations while using Lyons Ferry and Wallowa stocks for harvest mitigation production. To achieve these goals of production, broodstock genetic integrity and population genetic integrity and health, requires WDFW to manage their broodstocks carefully and monitor and evaluate the genetic health of hatchery and wild populations.

Broodstock Management
To maintain the phenotypic and genotypic integrity of populations cultured for the LSRCP program, WDFW staff strives to collect and mate adults for broodstock to maintain stock

demographics (e.g. run/spawn timing, age structure, sex ratios and size of fish) and genetic integrity of gametes retained for production. Ideally this would be accomplished by selecting broodstock from throughout the run/spawning season. However, because of juvenile rearing time constraints (endemic steelhead - 1 year rearing cycle), or adult holding capacity (Lyons Ferry steelhead and fall Chinook), exceptions to this rule have been made.

WDFW currently uses CWTs and/or fin clips and scale readings to identify and remove stray hatchery fish from spring Chinook broodstock. Likewise, CWTs from fall Chinook are used to exclude strays from broodstock at the hatchery before spawning (see objective 1a.2). Scales were used in the past for stray determination but changes in rearing and release locations of sub-yearlings have compromised the reliability of scale pattern analysis for identifying strays. In 2009, scales will be collected from 30 CWT returning fall Chinook adults and jacks from IPC sub-yearling releases and Grande Ronde releases. Scale patterns from these samples will be used to increase the accuracy of origin determinations made by WDFW staff for untagged in-basin (Snake) releases, and to document reservoir rearing of hatchery released fish.

Similar actions are followed to maintain the genetic integrity of local endemic steelhead broodstocks being developed and evaluated. Since all endemic stock fish are from unmarked/untagged natural origin fish, any external or internal marks that identify them as hatchery origin fish can quickly be identified and enable them to be removed from the broodstock. Stock integrity of the Lyons Ferry and Wallowa steelhead is not a current concern. Coded-wire tag recoveries during broodstock spawning of these two stocks over the years shows <0.5% stray inclusion from any given year.

Sub-Objective 1c.1.1: Determine the origin and stock of fall Chinook salmon used as broodstock at LFC.

Background: From 1990-2002, LFH broodstock consisted solely of known LFH origin fish based on CWTs and visible implant elastomer (VIE) tags. Beginning in 2003 unmarked/untagged in-basin hatchery sub-yearling fall Chinook trapped at LGR were included in broodstock at LFH. DNA comparisons between broodstock collected in 2002 and 2003 and unmarked/untagged hatchery sub-yearlings collected in 2002 or 2003 indicated the fish were significantly similar (Kassler et al. 2004). In 2004, both natural origin and unmarked/ untagged fish trapped at LFH and LGR were included in broodstock. In 2005 and 2006, out-of-basin unmarked/untagged sub-yearlings (based on scale analysis) were included in LFH brood stock at a rate less than 5%. In 2006, scales were collected on CWT tagged Umatilla Hatchery adults (by the NPT) and a blind test was done to assess the accuracy of origin determinations. Only 29% of those fish were correctly identified as coming from out-of-basin. Scales were also collected on returning in-basin CWT tagged fish (LFH/Snake River hatchery origin fish). Approximately 85% of those fish were correctly identified as in-basin releases. In 2007, all untagged fish were DNA sampled to determine origins as part of a parentage study by NOAA. Further, untagged sub-yearling "stray based on scales" fish were DNA sampled to determine origin using microsatellite DNA analysis. Results from DNA analysis were not as useful as we had hoped as only 30% of the results provided clear origin assignments.

Approach: In 2009, scale analysis will be used to determine which fish are wild. We will estimate the numbers of untagged stray fish associated with decoded CWTs to derive the stray component of fish that were processed. The stray component in the brood will be calculated for fish whose gametes are retained for production. In the future thermal marking of otoliths, if adopted, would allow nearly 100% identification of inbasin hatchery fish.

Task 1c.1.1.1. Collect scale samples on all untagged fish processed at LFH. Scales from each fish will be used to differentiate hatchery from naturally produced fish.

Task 1c.1.1.2. Examine all fall Chinook for marks (AD fin clip or VIE) and scan with a hand held or "V" tag detector and PIT tag scanner, and determine sex. Recover and decode all tags.

Task 1c.1.1.3. Calculate the rate at which natural origin Fall Chinook are included in broodstock so as not to exceed 20% of the broodstock.

Task 1c.1.1.4. Estimate the rate at which unmarked/untagged hatchery strays were included in broodstock (goal = not exceed 5% of the broodstock) (fall Chinook).

Task 1c.1.1.5. Estimate stock composition of fish retained for broodstock.

Sub-Objective 1c.1.2: Document changes in the phenotypic characteristics of salmon and steelhead stocks used at LFC.

Task 1c.1.2.1. Examine spring Chinook for marks, wire (CWT), sex, and collect scales to determine age composition after spawning.

Task 1c.1.2.2. Examine all steelhead for marks (i.e., Ad or ventral fin clip, or VIE), scan for CWT and PIT tags, and determine sex. Collect scales from natural origin fish to document age and life history pattern of each stock (see Sub-Objective 1c.1.4).

Task 1c.1.2.3. Collect length and weight samples from hatchery and natural origin spawned female spring Chinook and summer steelhead, and from a sub-sample of spawned female fall Chinook. Estimate fecundity for each and create relationships with body size information to track for long-term changes.

Task 1c.1.2.4. Determine length frequency ranges for age 2 mini- and age 3 jack fall Chinook based on CWTs. Provide recommended minimum length to managers to exclude age 2 mini-jacks from the broodstock.

Task 1c.1.2.5. Enumerate jacks retained in broodstock each week to assist LFC with reporting and to assure jacks are incorporated in broodstock within the spawning protocol guideline (fall Chinook).

Task 1c.1.2.6. Document brood year specific phenotypic characteristics for salmon and steelhead stocks used at LFC (endemic, conventional production/supplementation, captive brood), and compare and report changes that have occurred over time.

Genetics Monitoring and Evaluation

Prior to 1983, there was no artificial production of fall Chinook in southeast Washington and steelhead and spring Chinook production had been nearly nonexistent. The WDFW therefore believes that Chinook and steelhead populations were substantially wild in genetic character. Since the mid 1990's WDFW has actively pursued genetic sampling and characterization utilizing microsatellite DNA technology. Substantial effort has been expended on these characterizations for all the cultured species at the LFC. We will continue in this fiscal year to archive tissue samples from spring and fall Chinook, but plan no genetic sampling of steelhead.

We anticipate future steelhead sampling on a systematic basis to satisfy ongoing concern regarding the effects of hatchery programs on ESA listed populations, or if programs significantly change as a result of hatchery reform.

Sub-Objective 1c.1.3: Determine the genotypic character of natural and hatchery spring Chinook in the Tucannon River.

Background: In 1985, WDFW began the hatchery spring Chinook production program by trapping wild (unmarked) adults for the hatchery broodstock. Hatchery-origin fish have been returning to the Tucannon since 1988. The hatchery broodstock has consisted of both natural and hatchery-origin fish since 1989. The Tucannon River spring Chinook population was listed as "Endangered" in 1992, and then subsequently upgraded to "Threatened" in 1995 under the ESA. The supplementation program is part of the LSRCP mitigation program, and will continue as long as mitigation is required under the LSRCP. In 1994, the adult escapement declined severely to less than 150 fish, and the run in 1995 was estimated at 54 fish. WDFW and the co-managers believed the risk of extinction was high enough that aggressive intervention beyond the current supplementation program, in the form of a captive broodstock program, was warranted. The captive broodstock program collected fish from the 1997-2002 brood years supplementation program to be raised to adults and spawned.

Both of the hatchery programs are being conducted with the recognition that artificial propagation may have potentially deleterious direct and indirect effects on the listed fish. These effects may include genetic and ecological hazards that cause maladaptive genetic, physiological, or behavioral changes in the donor or target populations, with attendant losses in natural productivity.

Both marked and unmarked Umatilla River hatchery fish are known to stray into the Tucannon River and managers would like to know to what degree they are impacting the endemic Tucannon stock. Large returns during 2001 may have been comprised of large numbers of these unmarked stray Umatilla River origin fish.

Approach: We will collect and archive tissue samples from broodstock and in-river spawners for future genetic analysis if warranted. Carcasses sampled during spring or fall Chinook salmon spawning ground surveys provide the genetic (DNA) data to define stock characteristics, monitor possible introgression of hatchery stock genes into these populations, and evaluate our success at maintaining stock integrity.

Some tasks for 2009 include collection of appropriate samples for future analysis.

> Task 1c.1.3.1. Collect and archive genetic samples (broodstock and carcass surveys) for genetic drift analysis and compare to other Snake River and Columbia River spring Chinook stocks. [This is a continuation of work that began with the allozyme study/report (Busack and Marshall 2002 Draft WDFW Report)].

> Task 1c.1.3.2. Archive samples from known Umatilla strays for analysis and identification of a genetic marker that can be used to differentiate Umatilla origin strays from Tucannon River spring Chinook. If a genetic marker is identified it will be used to adjust the historical dataset to reflect the actual stock composition of the run.

Sub-Objective 1c.1.4: Collect tissue samples for future genotypic characterization of natural and hatchery fall Chinook salmon in the Snake River.

Approach: In 2009, we will collect and archive tissue samples by sub-sampling untagged fish to profile the origins of contributors to our broodstock. We will also continue to archive tissue samples randomly collected from LFH fall Chinook broodstock for future genetic comparisons.

> Task 1c.1.4.1. Collect 200 tissue samples from spawned fish, from which 100 samples will be randomly selected as representative of the broodstock once origin is determined. The 100 samples will be archived for future comparisons between hatchery broodstock and naturally produced salmon. (See Task 1c.1.1.)
>
> Task 1c.1.4.2. Collect DNA samples on 100 additional untagged fish to increase the sample size for natural origin fish.

Objective 1c.2. Evaluate hatchery release strategies (downstream survival rates).

Sub-objective 1c.2.1: Conduct a size at release experiment with Tucannon River Spring Chinook.

Background: Zabel and Achord (2004) suggested that increased size and earlier emigration from Idaho rivers improved survival in one life stage (juveniles) and seemed to improve survival in subsequent life stages (adults). Studies have shown that hatchery-reared fish have lower juvenile survival rates during emigration and provide lower adult returns than wild fish. Releasing hatchery fish at a larger size has been shown to increase survival and adult returns in some hatcheries, but this may also increase the number of precocious males. Tucannon River hatchery spring Chinook have had chronic low returns throughout the program's history. Current size at release is 15 fish per pound (fpp), but in order to release fish at that size, hatchery staff must hold back growth of the fish, which may compromise their emigration success. Recent studies on growth modulation in hatcheries have shown the potential to decrease the rate of precocialism (Larsen et al. 2006) while attaining a larger smolt size. Current rearing strategies for spring Chinook at LFH/TFH are similar to the growth modulation protocol described by Larsen et al. (2006), and are substantially different from rearing protocols used during the 1980's and 1990's production studies where high numbers of jacks resulted from releasing larger smolts. Modifying size at release could allow production emphasis to shift from quantity to quality in an attempt to improve hatchery efficiency where it counts most, the improvement of post-release survival and adult returns without inducing high precocialism.

Approach: We will compare differences in survival and size and age at return between smolts reared to 9 fpp and the current release goal of 15 fpp for the 2006-2008 brood years. All fish in the two groups of approximately 65,000 fish will receive a CWT and a VIE tag, which will be used to analyze survival to adult returns (SARs), and size and age of returns between treatments. Each of the groups will also be marked with 2,500 PIT tags before release to compare smolt-to-smolt survival within the system (Tucannon River PIT tag array), and detections of PIT tags for the groups will be analyzed using the SURPH model to calculate relative survival through the Federal Columbia River Power System (FCRPS).

> Task 1c.2.1.1. Coordinate with LFC staff to randomly segregate spring Chinook

production into two groups for rearing to 9 fpp and 15 fpp at release for the 2006-2008 brood years.

Task 1c.2.1.2. Mark both groups with CWT and VIE.

Task 1c.2.1.3. Tag each group with 2,500 PIT tags before placement in Curl Lake for final rearing, acclimation and volitional release.

Task 1c.2.1.4. Summarize PIT tag detections from the PTAGIS database at the end of each migration year, and collect adults within the Tucannon following standard recovery protocols currently in place for the Hatchery and M&E programs.

Task 1c.2.1.5. Analyze PIT tag and adult recovery data for statistically significant differences using an appropriate test to examine juvenile survival through the system (Tucannon PIT tag array), survival through the FCRPS (SURPH model), survival to adult returns (CWT), and size and age of returns among treatments.

Sub-objective 1c.2.2: Evaluate fall Chinook release strategies, release sites, and smolt out-migration timing from LFH releases to downstream collection sites.

Background: Production at LFH began with yearling releases as a way to boost returns of fall Chinook into the Snake River. As returns of fall Chinook increased, sub-yearling production was reinitiated in the program as a way to retain the natural ocean-type life history of fall Chinook. Despite the proven survival advantage provided by a yearling release strategy, at some point the fish managers may request the shift to all sub-yearling production. We will continue to monitor the relative survival success of each program to assist the managers with data necessary to inform that decision.

Approach: Acclimation facilities are located throughout the Snake River basin to promote homing of fall Chinook to their historical spawning grounds. Out-migration timing is monitored at smolt monitoring facilities in the Columbia basin by PIT tag detections. Our primary evaluations will be performed on sub-yearling fish released from LFH, directly into the Snake River near Captain John Rapids, and into the Grande Ronde River (Table 1). PIT tags will be used to document arrival, duration, and travel times between dams. These data along with size at release data, projected flow data, projected spill data, and the sampling schedule at LMO dam will be used to determine the optimal release date. Marks/tags applied for the yearling program are used for adult return calculations and for spawning procedures. Complementary evaluations of releases made above LGR are done by the NPT, the USFWS or IDFG/IPC. Specific details of the monitoring and evaluation of LFH origin fall Chinook that are released upstream of LGR are included in interagency/tribal cooperative project descriptions. Calculated SARs for the releases will be used to compare and contrast performance, and will be the primary metric for determining relative success of sub-yearling and yearling releases.

Table 53. Proposed marking/tagging of fall Chinook salmon released by WDFW in 2010.

Location	Life Stage	Total Number Released	Marked Release	Marks	PIT tags
Lyons Ferry Hatchery	Yearling	225,000	225,000	AD/CWT/VIE	13,500
Lyons Ferry Hatchery	Yearling	225,000	225,000	CWT/VIE	13,500
Snake River near Couse Creek (direct release)	Sub-yearling	200,000	200,000	AD/CWT	3,500[b]
Grande Ronde River	Sub-yearling	400,000	200,000	AD/CWT	3,500[b]
				Total	**27,000**

a. Proposed tagging for 2009 subject to US vs Oregon review and approval
b. These fish will be part of the COE transportation study, they are not additional tags required by LSRCP.

Task 1c.2.2.1. Continue to coordinate and participate in cooperative study plans with the USFWS Fisheries Resource Office, National Marine Fisheries Service, Idaho Power, Idaho Department of Fish and Game, and the NPT for evaluating off-station releases in 2009/10.

Task 1c.2.2.2. PIT tag 27,000 yearlings from the onstation release, and 3,500 sub-yearlings each from the direct release near Couse Creek and the direct release into the Grande Ronde River.

Task 1c.2.2.3. Document migration timing and survival for sub-yearling fall Chinook using PIT tag detections at Snake River dams.

Task 1c.2.2.4. Document survival (SAR) differences between yearling and sub-yearling fall Chinook released by WDFW.

Task 1c.2.2.5. Document survival (SAR) based on PIT tag detections and SARs derived from CWTs to determine if post-release CWT loss is occurring and to what extent.

Task 1c.2.2.6. Continue coordinating releases of fish directly released into the Snake River near Couse Creek with the NPT acclimated release of sub-yearlings released from Captain John Rapids Acclimation facility and fish released by ODFW into the Grande Ronde River.

Sub-objective 1c.2.3: Evaluate and monitor summer steelhead (LFH, Wallowa, and Endemic stock) release strategies, release sites, smolt out-migration timing and relative survivals from LFC releases.

Approach: All LFH and Wallowa stock fish will be 100% AD-clip production marked for harvest purposes. In addition, a portion of the LFH and Wallowa stocks will be CWT and LV clipped for continued mitigation program contribution. Both endemic stocks will be coded wire tagged for identification upon adult return should they be recovered post-spawning at area traps (dead kelts) or from spawning ground surveys. Currently, endemic stocks are not marked for sport harvest. For both endemic stocks, PIT tags will be used to monitor relative out-migration timing and performance, but the primary purpose will be for determining smolt-to-adult returns rates. In addition, PIT tag groups have been added to all tributary release groups of Lyons Ferry or Wallowa stocks in the Snake, Tucannon, Walla Walla, Touchet, and Grande Ronde rivers. Many of these have been added since we will no longer conduct creel surveys on the Tucannon, Walla Walla or Touchet rivers and will rely on historical CWT data and catch record card estimates to determine contribution from LSRCP fish to these locations (See objective 2.3a).

The listed PIT tagging rates are designed to return 25-60 adults for each brood year (over 1-2 years), and should provide reliable estimates of total survival that can be used with CWT harvest records and adult trap recoveries to estimate total contribution from each release location. Results from the adult PIT tag interrogations will be used to evaluate the success of the endemic program before they are expanded, and recommendations are made about the LFH stock program. PIT tags released into the Tucannon River (endemic and LFH stock) will also be used to assist in our evaluation of bias in our smolt trap efficiency estimates. Table 2 lists proposed marks/tags for the 2010 release year.

It has been a challenge each year to rear Touchet endemic stock fish to a 1-year smolt at 4.5 fish/lb, with many fish being release much smaller than the goal. Because of that failure, we strongly believe it has affected their overall post-release survival. Beginning in January 2009, a small study was initiated at Lyons Ferry to compare survival of 1-year and 2-year smolts from the Touchet River endemic stock program. Fish were hand sorted during coded-wire tagging, with approximately 6,000 fish removed from the population to begin their 2-year smolt-rearing program. An additional 5,000 PIT tags are requested to evaluate the post-releases survival of these 2-year smolts. We plan to conduct this study for at least two years, with subsequent years dependant on program changes that may occur as a result of Hatchery Reform reviews.

Table 2. Proposed marking/tagging of summer steelhead from LFH Complex in 2009/10. (All fish released of LFH or Wallowa stocks of origin receive adipose (AD) fin clips.)

Stock	Release Location	Total Number Released	Marks released (Number)	Tagged (PIT)
LFH	On Station	60,000	LV/CWT (20,000)	1,500
LFH	Touchet R. @ Dayton AP	85,000	LV/CWT (20,000)	3,500
LFH	Lower Tucannon R.	100,000	LV/CWT (20,000)	3,500
LFH	Walla Walla R.	100,000	LV/CWT (20,000)	3,500
Wallowa	Grande Ronde R. @ Cottonwood AP	160,000	LV/CWT (20,000)	4,000 + 2000 [a]
Tucannon	Upper Tucannon R.	50,000	CWT (50,000)	8,000
Touchet	NF Touchet R. (1-year smolt)	50,000	CWT (50,000)	8,000
Touchet	NF Touchet R. (2-year smolt)	6,000	CWT (6,000)	5,000 [b]
			Total	**37,000**

[a] An additional 2,000 tags will be added the Cottonwood AP release. These PIT Tags will be provided by the Fish Passage Center as part of the Comparative Survival Study (CSS) for steelhead above Lower Granite Dam.

[b] These fish were CWT in January of 2009 when they were split out from the 1-year smolts released in 2009. An additional 5,000 PIT tags will be required to evaluate the success of the 2-year program in relation to the 1-year program.

Task 1c.2.3.1. Implant PIT tags in fish from the Tucannon and Touchet rivers endemic programs, and the LFH and Wallowa stocks of hatchery fish.

Task 1c.2.3.2. Summarize adult return detections to estimate smolt-to-adult survival.

Task 1c.2.3.3. Compare adult PIT tag detections with expanded CWT recovery based on harvest estimates and adult trapping records for each study group. Estimate total contribution from each group (Section 2) and determine if unaccounted steelhead in CWT groups represent a significant underestimation bias.

Category 2. Estimating Adult Returns

Project 2a – Catch Accounting

Sub-Project 2a.1: Marking and Tagging

Objective 2a.1.1: Coordinate marking/tagging needs with hatchery and fish management staff.

Approach: The LFC has three species programs for mitigation within the Snake River Basin (spring and fall Chinook salmon and summer steelhead). Each has a specified mitigation goal under the LSRCP program. WDFW considers it essential that the programs evaluate success in meeting their goals, or take appropriate actions based on adult returns to modify programs so that they are successful. Each State's program has used marks (fin clips) and/or tags (CWT, VIE, PIT) to document successes/ failures from various releases of each of the species. The ESA listings of all anadromous species in the Snake River Basin, and concerns about the effects that hatchery fish may have on listed populations have brought forth suggested tagging protocols by NOAA fisheries. They strongly suggest a representative mark/tag group(s) within each distinct release of hatchery fish to better document the distribution of returning hatchery fish on the spawning grounds. While certainly relevant to protecting ESA listed fish species, space limitations at the hatcheries, species release size and timing, and cost of tagging limit the number of representative groups available each year. As such, evaluation, fish management, and hatchery staffs (along with US v. OR technical input) work closely in developing yearly marking programs that will satisfy most needs and be adequate in size to document 1) smolt-to-adult survivals, 2) harvest in ocean fisheries, and mainstem Columbia commercial, recreational and tribal fisheries, and 3) recreational fisheries in the project area.

Task 2a.1.1. Recommend marks (fin clips, CWT, VIE, PIT) for all 2010 release year fish for determination of smolt-to-adult survival, fishery contribution, and annual adult returns (i.e. mitigation goals).

Note: Table of tagging costs will be provided by LFC.

Sub-project 2a.2: CWT Laboratory:

Objective 2a.2.1: Recover and process CWT's recovered from hatchery sampling, creel surveys, adult trap sampling, and spawning ground surveys.

Approach: The Snake River Lab (SRL) LSRCP evaluation office is remote from the main CWT extraction and processing lab in Olympia, where the vast majority of tag reading occurs for the State of Washington. Many of our spawning protocols require real-time extraction and processing of CWTs to remove any stray fish that might be in the broodstock (spring and fall Chinook programs). As such, over the years the SRL has become self-reliant and efficient in CWT extraction and processing (5,000-6,000 CWTs annually). All CWTs processed are eventually shipped to Olympia, re-read, and the data are submitted by Olympia staff to the regional CWT database.

Task 2a.2.1.1. Recover snouts from CWT identified fish from hatchery sampling during routine spawning activities (Objective 1a.2), adult traps (Objective 2b.1), creel (Objective 2a.3) and spawning ground surveys (Objective 2b.2).

Task 2a.2.1.2. Extract and read CWTs from snouts. Use appropriate forms to record relevant biological data as required for each fish.

Task 2a.2.1.3. Enter CWT codes to appropriate databases/spreadsheets for real-time data analysis (if appropriate). Submit tags and data/databases to Olympia CWT Lab for tag re-reading (Quality control), and submission to the regional (RMIS) CWT database.

Sub-project 2a.3: Fishery Catch Estimation and Sampling:

Objective 2a.3.1: Conduct summer steelhead fishery sampling to recover CWTs, determine impacts of fisheries to wild stocks, and estimate contribution of LSRCP fish to the sport fishery for mitigation evaluation.

<u>Approach</u>: WDFW personnel have annually surveyed steelhead sport anglers within the LSRCP area of Washington [Snake River (in cooperation with IDFG), Columbia River, Walla Walla River, Touchet River, Tucannon River and the Lower Grande Ronde River (in cooperation with ODFW)]. Sport fishing for summer steelhead is open yearly on the Snake and Columbia rivers and most of their tributaries from 1 September through 31 March, and on Grande Ronde River from 1 September through 15 April. Anglers can keep only AD clipped fish, some of which are also LV clipped indicating the presence of a CWT. When possible, catch rates from each week's surveys are summarized during the season and provided to the local news media to assist anglers. However, the primary purpose of the creel surveys is to recover CWT tagged fish and to document incidence of wild fish captured in the fishery (Category 3). Estimates of the total number of CWT fish harvested (WDFW, IDFG, ODFW or USFWS origin tags) are calculated by expanding our CWT recoveries with a sample rate (CWTs are expanded only if we achieve a minimum of 5% sample, although a sample rate of 20% is the goal) based on total estimated harvest obtained from statewide steelhead catch record card estimates. Using the mark rate and total releases, total contribution to the fishery for mitigation evaluation can then be calculated and hatchery production levels can be adjusted as needed. All estimates of CWTs harvested are provided to the Region Mark Information System (RMIS) coded-wire tag database maintained by Pacific States Marine Fisheries Commission (PSMFC).

In addition to our standard CWT recovery/creel census surveys, we also cooperate with ODFW by conducting a joint survey of anglers on the lower Grande Ronde River (sections of which are in both Washington and Oregon). The ODFW samples the lower Grande Ronde River (Bogan's Oasis Resort in Washington to Wildcat Creek in Oregon) from September through January. The WDFW samples this area from February to mid-April. Angler effort, catch rates, and harvest are calculated by ODFW as described in Carmichael et al. (1988).

Historically, it has been difficult to sample the steelhead fishery at a high rate in all areas because of the large, relatively remote area. Beginning in the 2007 run year, we changed our creel efforts to increase our sampling rate. To achieve the increased sample rate in high harvest areas, creel surveys are no longer conducted in the Tucannon, Walla Walla, or Touchet Rivers. All creel efforts are concentrated on the mainstem Snake River, the Columbia River near Wallula, and the

Grande Ronde River. In addition to more focused creel surveys, in 2008/09 we enlisted the help of local guides (Heller Bar area of the mid-Snake River), and a local fishing group (Tri-State Steelheaders), to collect additional steelhead snouts to increase our sample rate. This effort was patterned after the Idaho Dept of Fish and Game incentive program (1-3$/fish snout) using local guides in 2006 and 2007 to increase their sample rates. Participation and results were varied from the different regions where this was attempted, but overall IDFG increased their sample rate in all areas. Similarly to results in Idaho, participation in our program in 2008 was limited, but we anticipate an increase in guide participation in 2009, and in our sample rate as well.

Task 2a.3.1.1. Conduct creel/CWT recovery surveys on the Snake, Columbia and Grande Ronde rivers to collect information on harvested untagged and CWT tagged LFC origin adult steelhead.

Task 2a.3.1.2. Coordinate boundary water sampling with IDFG on the mainstem Snake River. Share catch and angler data, and exchange recovered CWTs as necessary.

Task 2a.3.1.3. Enlist the help of local fishing guides and a local fishing group to collect snouts from harvested fish to increase sample rates in various river sections. Explore other alternatives (sporting good stores, gas stations, etc.) for volunteer collections in the future.

Task 2a.3.1.4. Coordinate with ODFW in joint creel surveys on the lower Grande Ronde River. Share data, data files, and exchange CWTs as necessary to calculate angler effort, catch rates, and harvest.

Task 2a.3.1.5. Process recovered CWTs from summer steelhead creel surveys (Objective 2a.2).

Task 2a.3.1.6. Enter in all catch data (date, anglers, hours fished, river section, fish kept or released (Category 3), angler origin where appropriate (WA, OR, ID), and biological data from fish kept (sex, length, marks, CWT codes, etc.) into a database. Submit final annual database to appropriate staff in Olympia for submission to RMIS database.

Task 2a.3.1.7. Obtain commercial and sport harvest estimates of LFC summer steelhead from downriver fisheries as reported in the Regional CWT database. Use catch record card data and make preliminary calculations for the number of LFC origin steelhead that were present in the sport catch on each river within the LSRCP area for which creel survey results are available.

Task 2a3.1.8. Compile all CWT data from area adult traps (Section 2.b.1) and/or spawning ground survey data (Section 2.b.2), and add to the creel survey information for a minimum contribution of LFC fish back to the project area..

Task 2a.3.1.9. Compare/contrast and adjust if needed the results from 2a.3.7 and 2a.3.8 with estimates of return from PIT tagged groups (See objective 1c.2.3) for total contribution of LSCRP fish released into Washington.

Project 2b - Estimating Project Area Escapement

Objective 2b.1. Monitor, evaluate and/or conduct adult trapping/collection of spring and fall Chinook and summer steelhead for broodstock and run reconstruction (fall Chinook).

Approach: SRL staff will continue to monitor, conduct, and/or evaluate broodstock collection of spring and fall Chinook salmon and summer steelhead at adult traps that are currently funded under the LSRCP. Duties shared between LFH hatchery staff and the evaluation staffs differ at each trapping facility. As an example, evaluation staff will generally provide a broodstock collection schedule/goal, while the hatchery has responsibility to transport fish to the hatchery. However, both staffs work together (in conjunction with WDFW Fish Management goals and objectives) to optimize performance and reach established goals for the program. Sampling protocols are designed for each location according to site, personnel and ESA limitations to provide the greatest accuracy and precision possible for estimating escapement. Sampling capabilities range from a systematic sub-sample (10-20%) of the fish at Lower Granite Dam for fall Chinook to near 100% capture and enumeration of spring Chinook at the Tucannon Fish Hatchery trap. A PIT tag array will be installed in the adult fish sorting flume at LFH to allow detection of PIT tagged adults upon return. Trapping at LFH recycles many fish back to the river. Because broodstock needs may sometimes be met through trapping at LGR for fall Chinook, only some of the fish arriving at LFH are trapped. We suspect that fish returned to the river from the trap are returning to be re-trapped multiple times. We will use PIT tag data from fish detected in the flume to determine the magnitude of re-trapping events for fall Chinook and steelhead.

Sub-objective 2b.1.1: Monitor and evaluate adult trapping/collection of spring Chinook on the Tucannon River.

Task 2b.1.1.1. Coordinate adult spring Chinook trapping and collection with LFC staff. Provide recommendations for broodstock collection rates annually prior to trapping. Use trapping data in conjunction with redd counts and carcass surveys to estimate spawning escapement into the Tucannon River.

Task 2b.1.1.2. Sacrifice all marked (ad-clipped) spring Chinook at the TFH to obtain CWTs for location of release. All fin clipped spring Chinook in the Tucannon are considered stray fish from outside the basin because none of the WDFW spring Chinook in the basin are fin clipped.

Sub-objective 2b.1.2: Monitor, evaluate, and/or conduct adult trapping/collection of summer steelhead at LFC adult traps or at temporary traps on the Tucannon and Touchet rivers.

Task 2b.1.2.1. Coordinate adult summer steelhead trapping and collection with LFC staff (LFH adult trap, Cottonwood Trap, Lower Tucannon River Adult Trap, Touchet River Adult Trap, and Tucannon Hatchery Trap). Provide recommendations or annual trapping protocols for annual broodstock collection rates prior to initiation of trapping.

Task 2b.1.2.2. Operate adult traps on the Tucannon and Touchet rivers to document natural and hatchery origin steelhead and other species. Record the origin of all fish captured in steelhead traps, document mortalities, and collect biological samples on natural origin steelhead for stock profile and genetic characterization.

Task 2b.1.2.3. Sacrifice all marked (ADLV clipped) hatchery origin summer steelhead at all adult traps to obtain CWTs for location of release.

Sub-objective 2b.1.3: Monitor and evaluate adult trapping/collection of fall Chinook at LFH and Lower Granite Dam Adult traps.

Task 2b.1.3.1. Coordinate fall Chinook trapping and collection with LFC and NPTH staffs, and collaborate with US vs Oregon parties on trapping protocols to reach regional production goals (LFH adult trap, Lower Granite Dam Adult Trap).

Task 2b.1.3.2. Install PIT tag array in flume of adult trap at LFH.

Task 2b.1.3.3. Document recapture events of PIT tagged fish trapped at LFH.

Objective 2b.2. Estimate adult returns, collect life history characteristics, and document distribution of adult spring and fall Chinook salmon, and summer steelhead to southeast Washington streams and facilities.

Approach: Adult return goals were used to define the LSRCP program; therefore measuring adult returns to the point of release and to other intermediate areas is necessary to determine program success. WDFW monitors the returns of spring and fall Chinook salmon and summer steelhead throughout southeast Washington through adult trapping (Lower Tucannon River adult trap, TFH adult trap, LFH adult trap, Lower Granite Dam adult trap, Touchet River adult trap, and Cottonwood Creek adult trap), and spawning ground and creel surveys. Sport harvest, and CWT expansions from surveys can be used to estimate the number of adults that would have returned to the project area. Trapped and/or spawned broodstock fish and carcasses provide data concerning origin, stray rates, sex ratios, and composition of each year's run. Spawning surveys provide numbers of redds, spawn timing, and distribution of fish in each of the surveyed rivers. These are primary actions to track program performance and progress toward meeting goals. Another factor that can affect the success of the LSRCP program is downriver and within-area harvest of adults. This primarily affects fall Chinook and steelhead in downriver fisheries. Few Tucannon River spring Chinook have been documented in downriver fisheries. Fisheries are directly sampled or CWT recoveries gathered from regional databases.

The substantial numbers of stray hatchery origin salmonids has become a broad regional concern in the Columbia and Snake River basins over the last 10-15 years. Numerous studies have shown or suggested the negative effects of stray salmonids on native populations. For the LSRCP program, strays have become an issue in two ways, 1) numerous strays from outside the Snake River basin have been documented in area rivers (i.e. Umatilla fall Chinook in the Snake River Basin, Umatilla spring Chinook in the Tucannon River Sub-basin), and 2) some LSCRP fish have been found in relatively high numbers in the Columbia River Basin (i.e. Wallowa stock summer steelhead in the Deschutes River, Oregon). As such, we believe it prudent to compile and evaluate all relevant data on stray LSRCP fish in other basins, and non-LSRCP fish into the Snake River Basin and its tributaries.

Species-specific approaches to document straying.

Spring Chinook: WDFW adult trapping and broodstock collection activities are used to gather return data for representative CWT releases. These actions also will result in substantial data annually on stray fish from other watersheds entering the Tucannon River. We will summarize and report LSRCP origin and stray information from our adult trapping (Tucannon Hatchery trap) and carcass recovery during spawning surveys. Because Tucannon River Chinook and steelhead have been documented in Asotin Creek, limited carcass recovery surveys will be conducted there, and data from a BPA/IMW monitoring project will be retrieved and included in our assessment of adult returns as appropriate.

Fall Chinook: We will trap fall Chinook at LFH as well as LGR Dam to determine the return fidelity of fish to the hatchery, and to above LGR Dam where the majority of in-basin spawning occurs. We will also document straying of LFH origin fall Chinook to out-of-basin areas and interception in fisheries. The fidelity and abundance of fish from LFH production groups will be assessed by documenting returns to 1) point of release, 2) in-basin hatchery racks 3) in-basin spawning areas, and 4) out of basin (stray) hatchery racks. Although not considered straying, recoveries of tagged fish from fisheries affects the overall return of fish to the spawning grounds, and potentially the success of our program. We will document freshwater and saltwater fishery recoveries for sport, commercial, and tribal fisheries, and sum recoveries by the state (or Country) in which they were recovered. Straying of out-of-basin fish to points within our study area must also be addressed. The impact of non-endemic stocks on ESA listed Snake River stock in the LSRCP study area can affect the integrity of the natural population. We will document the extent and the composition of strays into these areas. Run composition will be estimated at LGR Dam, and on spawning grounds of the Tucannon River. Members from the US vs Oregon Technical Advisory Committee (TAC) and our staff will cooperate to develop the run reconstruction at LGR Dam. The run reconstruction of fall Chinook at LGR Dam will be used to estimate LSRCP returns for evaluation and to monitor wild returns to meet ESA goals.

It is unknown to what extent hatchery returns, both Snake River and stray origin, affect natural production and the reproductive success of naturally spawning fish. Broodstock trapping activities at LGR Dam provide an indication of natural and hatchery adult fall Chinook abundance in the Snake River and potential spawners above LGR Dam. The data collected by WDFW's evaluations are closely linked to the BPA funded study; *Evaluating Relative Reproductive Success of Natural and Hatchery Origin Snake River Fall Chinook Spawners Upstream of Lower Granite Dam* (Anne Marshall, personal communication). This study is an outgrowth of concerns about stray fall Chinook in the Snake River, as well as increasing numbers of Snake River stock hatchery adults from the LFH program. It dovetails with LSRCP studies by attempting to assess and quantify the effects of reproductive interactions between hatchery (primarily LSRCP production) and wild fall Chinook in the Snake River through genetic mixture analysis. The last collects of adults (BY 2008) and the resultant juveniles have been made and analysis is underway of the adult samples. Continuation of this BPA project (or another to address reproductive success) depends on analysis of samples collected during the last four years.

Steelhead: The assessment of summer steelhead straying is difficult due to the extended time that they spend in freshwater migrating to their final destination. The majority of WDFW LSRCP summer steelhead in the Snake River may spend 9-12 months in the system before spawning, during that time they may be captured in numerous sport/commercial fisheries. While sport/commercial fisheries are useful in the overall assessment of returns, they may give a skewed view of straying depending on the time of year and location in which the harvest occurred. Steelhead are also periodically recovered in adult traps or from spawning ground surveys. SRL and Lyons Ferry Hatchery staffs operate four adult steelhead traps in SE Washington that are directly associated with the LSRCP program. WDFW Fish Management or Science staffs operate other adult traps in SE Washington. These traps capture many tagged hatchery fish, of which the origin can be determined should the fish be sacrificed and a CWT recovered. In recent years, the number of PIT tagged steelhead of both hatchery and wild origin has increased dramatically. The prevalence of these tags greatly facilitates the tracking of steelhead behavior without sacrificing fish. Numerous detections of tagged fish can more fully explain wandering/straying behavior, and WDFW evaluations studies have adopted sampling protocols for recovering PIT tags wherever traps are operated or sampling is conducted. All extracted CWTs from traps or spawning ground surveys, and PIT tag detections are eventually submitted to the regional CWT or PIT tags databases in Portland, OR.

We will use recoveries of hatchery steelhead CWTs as reported to RMIS from fisheries (depending on time and location of recovery), adult fish traps, and spawning ground surveys, to assess straying in summer steelhead (both within-program and out-of-program).

Sub-objective 2b.2.1: Estimate adult returns, collect life history characteristics, and document distribution of adult spring Chinook to the Tucannon River and Asotin Creek.

Task 2b.2.1.1. Summarize adult trap and broodstock spawning for spring Chinook (See Objective 1a.2, and sub-objective 2b.1.1)

Task 2b.2.1.2. Conduct spawning ground surveys to count redds, determine distribution of spawners, and sample carcasses (sex, length, scales for age composition, and tissue for genetic typing) to document life history characteristics of spring Chinook in the Tucannon River and Asotin Creek.

Task 2b.2.1.3. Process scales and CWTs for age composition.

Task 2b.2.1.4. Obtain estimates of down river harvest of Tucannon River spring Chinook from the RMIS coded-wire tag database.

Sub-objective 2b.2.2: Estimate adult returns, collect life history characteristics, and document distribution of adult fall Chinook to southeast Washington streams and facilities.

Task 2b.2.2.1. Document the magnitude; return distribution; and fish size, age, and sex of the fall Chinook returning to LFH. Document the same information for fish hauled from Lower Granite Dam (LGR) to LFH for spawning.

Task 2b.2.2.2. Recover and process CWTs and scales to determine origin and composition of hatchery fall Chinook returning to LFH or hauled from LGR.

Task 2b.2.2.3. Conduct spawning ground surveys to count redds of coho and fall Chinook, determine distribution of spawners, and sample carcasses (sex, length, scales for age composition, and tissue for genetic typing) to document life history characteristics of fall Chinook in the Tucannon River.

Task 2b.2.2.4. Estimate adult returns to the Tucannon for fall Chinook and coho based on redd counts.

Task 2b.2.2.5. Process scales and recovered CWTs from the Tucannon River for age composition.

Task 2b.2.2.6. Obtain estimates of LFH origin fall Chinook present in down-river harvest, returning to racks and rivers, and released above LGR, which contribute to the LSRCP goal and document progress toward reaching that goal.

Task 2b.2.2.7. Coordinate with NMFS staff at LGR to collect approximately 750 scale samples from unmarked/untagged fall Chinook across the run at LGR in 2009. WDFW Olympia staff will examine the scales. Results will be used to differentiate hatchery from naturally produced fish for run reconstruction efforts.

Task 2b.2.2.8. Provide CWT and trapping databases to the Columbia River TAC and assist in run reconstruction efforts at LGR.

Sub-objective 2b.2.3: Estimate adult returns, collect life history characteristics, and document distribution of adult summer steelhead to southeast Washington streams and to LSRCP facilities.

Task 2b.2.3.1. Summarize hatchery returns to LFH, TFH, Cottonwood Creek adult trap, and the temporary adult traps on the Tucannon and Touchet rivers (See Objective1a.2, and sub-objective 2b.1.2). Retrieve all hatchery summer steelhead data from a BPA funded project on Asotin Creek that conducts adult steelhead trapping.

Task 2b.2.3.2. Conduct spawning ground surveys to count redds, determine distribution of spawners, and collect carcasses (where possible) to document life history characteristics of summer steelhead in the Tucannon and Touchet rivers, and Asotin Creek.

Task 2b.2.3.3. Estimate the spawning escapement of LFH origin steelhead into the Touchet and Tucannon rivers, and Asotin Creek based on spawning ground surveys and adult trap records.

Task 2b.2.3.4. Process recovered CWTs and scales for age composition from all summer steelhead sampled (hatchery and natural origin).

Sub-objective 2b.2.4. Assess the nature and extent of straying of LFC spring and fall Chinook salmon and summer steelhead.

Task 2b.2.4.1. Summarize and report the capture and identification of tagged spring and fall Chinook salmon and summer steelhead to LSRCP facilities and traps.

Task 2b.2.4.2. Summarize and report the capture and identification of WDFW-LSRCP produced spring and fall Chinook salmon and summer steelhead to other basin (Columbia River or within Snake River) facilities and traps.

Project 2c- Smolt Production and Adult Survival

Objective 2c.1. Assess and quantify the juvenile out-migration of natural and hatchery-origin spring Chinook salmon, naturally reared fall Chinook salmon, and naturally and hatchery-origin (endemic broodstock only) summer steelhead from the Tucannon River.

Approach: WDFW operates a juvenile migrant trap in the lower Tucannon River. Information about naturally produced spring and fall Chinook salmon, and summer steelhead migrants obtained from this trap includes: 1) smolt out-migration timing, 2) duration, 3) magnitude, and 4) smolt age. WDFW uses data from the trap to calculate survival between life stages for both natural and hatchery-origin fish to assist in the evaluation of the hatchery program. The smolt trap also allows us to capture and PIT tag natural and hatchery origin smolts (all species) to describe migration timing, relative survival through downstream dams, and if applicable, estimate smolt-to-adult survival in natural origin salmonids. These factors are recognized metrics for understanding the viability of populations, and understanding the ecological relationship of the population to its habitat (capacity and density dependent population response). These ecological relationships can have a significant bearing on the ability of hatchery supplementation programs to positively affect depressed salmon populations.

Task 2c.1.1. Operate a juvenile migrant trap on the Tucannon River to collect downstream migrating spring and fall Chinook, and summer steelhead. Determine duration and peak migration of all smolts.

Task 2c.1.2. Collect length, weight, and scale samples on a representative sample of naturally produced salmonids. Process scales (Olympia Scale Lab) to determine ages of different smolts for brood year estimates, and differentiate species, race and hatchery or wild origins.

Task 2c.1.3. Estimate trap efficiency using partial fin clips and/or PIT Tags (Objective 2c.2) on wild and hatchery fish (except LFH stock steelhead). Use estimated trap efficiencies to estimate total smolt production (endemic stock hatchery origin and natural origin) for target salmonid species.

Task 2c.1.4. Estimate natural origin downstream migrant success and timing, and smolt-to-adult survival by PIT tagging natural origin salmonids captured at the Tucannon River smolt trap. Use these estimates for comparison against standard hatchery survivals by species for better information to optimize hatchery production and release strategies.

Task 2c.1.5. For Tucannon spring Chinook examine the relationship between smolts/redd (female) and the proportion of hatchery origin (and natural origin) fish on the spawning grounds to see if natural production increased or decreased as more hatchery fish (and natural fish) spawned in the Tucannon River. Examine the data set for evidence of density dependent population growth and habitat capacity and productivity.

Task 2c.1.6. Document smolt health through an index of condition factor and observations of external signs of physical anomalies and disease.

Objective 2c.2. Estimate the nature, degree and variance of juvenile population sampling methodology bias; and calculate corrections for Tucannon River smolt trap estimates.

Background: Accurate, precise juvenile population abundance estimates (Task 2c.1.3) are crucial for describing survival trends of populations over time, and to measure response to management actions such as hatchery supplementation and habitat manipulation/restoration. Studies (Thedinga et al. 1994; Peterson et al. 2004) have identified bias, and resulting error, associated with traditional sampling methodologies, some of which have been used on this project. Correctly, those studies have called for researchers to carefully evaluate bias and error associated with their study data by conducting separate population estimates with methods having demonstrated accuracy and precision. Further, it has been strongly suggested (Peterson et al. 2004; Rosenberger and Dunham 2005) that researchers test the assumptions of population estimators being used. Other researchers within WDFW have recently identified bias in smolt trap efficiency estimates that were conducted similarly to Tucannon trap efficiency tests. While the evidence for estimator bias and error seem consistent in the literature, our methods differ from those, and thus must be tested to estimate the level of error, and confirm compliance of the methods with underlying assumptions. If bias in our methods has been consistent over the term of the data, data could be adjusted as appropriate once bias is measured. These corrections could be important in understanding ecological and population response relationships that might be masked by error resulting from methodology bias.

Approach: We reviewed releases of PIT tagged steelhead from the Tucannon River, and compared survival estimates from point of release to our smolt trap (based on smolt trap efficiency tests) and to Lower Monumental Dam on the Snake River (using the SURPH survival model). Results estimated on average a 30% survival to the smolt trap based on fin clip capture efficiency, but 70% survival to Lower Monumental Dam based on PIT tags. It has been suggested that the marked fish release location for efficiency tests may be too close to our trap, thereby overestimating efficiency, and underestimating smolt out-migration. Other factors (e.g. - trap avoidance by large size smolts, positive or negative bias in recapture probability from previously captured fish used for mark efficiency tests) could also be involved and may contribute to the discrepancies observed.

We will attempt estimating the efficiency bias over the next two or three field seasons through the use of PIT tags and a new PIT tag array that has been deployed in the lower Tucannon River about 100 yards below the smolt trap. WDFW will work with Biomark to estimate/calibrate the array efficiency in detecting PIT tags. We will then be able to use array detections in conjunction with our estimated smolt trap efficiency based on the same PIT tagged fish to determine if our efficiency estimates are biased. If we can determine a consistent relationship exists (likely species specific), a correction factor could be applied to previous years' smolt estimates. Representative mark groups of spring Chinook (wild origin), fall Chinook, and summer steelhead (wild origin) will be PIT tagged during the outmigration. In 2008 there were not enough total fall Chinook of sufficient size to tag. The small size of fall Chinook leaving the Tucannon limits our use of standard 12 mm PIT tags. We may use 8.5mm tags in 2009/10 to increase sample size for trapping estimates if the PIT tag array can be shown to effectively detect the smaller tag.

Task 2c.2.1. Fin clip (top or bottom caudal) and PIT tag representative groups of spring and fall Chinook and summer steelhead to determine smolt trap efficiency based on either recaptures in the smolt trap or detections by the PIT tag array in the Tucannon River.

Task 2c.2.2. Determine efficiencies and calculate population estimates based on standard efficiency tests using fin clips.

Task 2c.2.3. Determine efficiencies and calculate population estimates based on correction of efficiency from PIT tag array detections.

Task 2c.2.4. Calculate bias and provide results with 95% C.I.

Objective 2c.3. Estimate and compare smolt-to-adult and parent-to-progeny survival rates for LFC hatchery origin (WDFW released) and natural origin spring and fall Chinook salmon, and summer steelhead.

Approach: WDFW will use data from the smolt trap to determine natural smolt yield, and to determine smolt-to-adult (SAR) survival rates for naturally produced spring and fall Chinook salmon in the Tucannon River (see Objective 2c.1 above).

Task 2c.3.1. Utilize age composition data, smolt trap estimates, hatchery release numbers, and annual adult escapement estimates to calculate smolt-to-adult and parent-to-progeny survival rates of hatchery and natural origin spring Chinook salmon from the Tucannon River.

Task 2c.3.2. Utilize age composition data, adult escapement estimates, and CWT recovery data to calculate smolt-to-adult survival rates and recruit/spawner ratios for hatchery fall Chinook produced at LFC and released by WDFW.

Task 2c.3.3. Estimate female-to-progeny survival rates for naturally spawning fall Chinook salmon (H + W) from the Tucannon River.

Task 2c.3.4. Coordinate with the NPT so that methods used in calculating smolt-to-adult survival rates for hatchery fall Chinook are similar, so comparisons can be made between release sites by agency.

Task 2c.3.5. PIT tag natural origin steelhead smolts at the Tucannon smolt trap, and PIT tag hatchery endemic and LFH stock hatchery fish prior to release in the Tucannon River. Query PIT tag database upon adult return of these groups. Calculate smolt-to-adult return rates based on adult PIT tag detections from these three groups and compare smolt-to-adult performance. Recommend changes to hatchery production/rearing as needed.

Category 3. Legal Obligations

Project 3a – ESA compliance

Objective 3a.1. Assess LSRCP hatchery evaluation actions to determine potential effects on species listed under the Endangered Species Act; represent WDFW during formal ESA consultation between NMFS and the USFWS; coordinate and integrate Washington's anadromous fish management and research with the Section 7 LSRCP Biological Assessment, subsequent Biological Opinions and Management Plans, NMFS' Recovery Plan, and develop and submit Hatchery and Genetic Management Plans (HGMPs) for stocks produced at LFC.

Approach: Operation of the LSRCP program in Washington requires close cooperation between WDFW and USFWS personnel to ensure that production and evaluation actions conform to guidelines established by NMFS under the ESA. Moreover, it is the responsibility of evaluation staff to integrate production and evaluation research with existing state management goals and principles. These actions are expressed in the completion of Sections 7 and 10 Biological Assessments, or Section 4(d) Hatchery and Genetic Management Plans (HGMP) that must be submitted to NMFS for approval and ESA operational coverage for production and evaluation actions. WDFW will ensure that pertinent state and federal management policies are considered and that recommendations to minimize deleterious effects of programs on listed species are provided.

WDFW will help the USFWS-LSRCP Office ensure that the Section 7 Biological Assessments, Section 10 permit applications, and HGMP documents are coordinated. Further, WDFW will continue to provide data for ESA concerns to other agencies, and program tasks and objectives will be modified as necessary to minimize adverse impacts to listed species. WDFW will be involved in the USFWS/NMFS consultations for the LSRCP Program under the ESA.

Sub-objective 3a.1.1: Assess LSRCP hatchery evaluation actions to determine potential effects on species listed under the Endangered Species Act.

Task 3a.1.1.1. Obtain quantitative data necessary to evaluate LSRCP funded programs.

Task 3a.1.1.2. Assist USFWS-LSRCP staff with quantitative analysis for the development or modifications of Biological Assessments and HGMPs.

Task 3a.1.1.3. Assess effects of all proposed actions and estimate direct and indirect takes of listed species using tasks and results listed in this SOW.

Task 3a.1.1.4. Develop and recommend alternatives to reduce deleterious effects of the program on all listed species.

Task 3a.1.1.5. Provide a copy of the LSRCP annual Spring Chinook Evaluation report to NOAA Fisheries to comply with ESA reporting requirements for takes resulting from evaluation actions.

Task 3a.1.1.6. Provide an annual Take report to NOAA Fisheries for fall Chinook actions taken at LGR Dam under Permit #1530.

Sub-objective 3a.1.2: Represent WDFW during formal ESA consultation between NMFS and the USFWS.

Task 3a.1.2.1. Act as the liaison between the USFWS and WDFW during the formal consultation period to fulfill the cooperator's role in the process.

Task 3a.1.2.2. Provide additional documentation, as requested, for the LSRCP formal consultation between NMFS and the USFWS-LSRCP Office.

Sub-objective 3a.1.3: Coordinate and integrate Washington's anadromous fish research with the Section 7 LSRCP Biological Assessment, subsequent Biological Opinions and Management Plans, HGMPs, and NMFS' Recovery Plans.

Task 3a.1.3.1. Recommend changes in Washington's fish management and research plans to ensure compliance with decisions made during consultations between NMFS and FWS.

Task 3a.1.3.2. Review special conditions of Section 10 permits, special conditions of Section 7 consultations, and special requirements for Section 4(d) HGMPs and coordinate with WDFW personnel who will implement the actions to ensure that all actions are permitted and consistent with permit requirements.

Task 3a.1.3.3. Where appropriate, provide input to WDFW responses to the NMFS Biological Assessments, Opinions, and Recovery Plans.

Project 3b – Hatchery/Wild interactions

Objective 3b.1. Determine natural production and estimate freshwater survival rates for spring Chinook salmon in the Tucannon River.

Approach: Natural and hatchery origin adult spring Chinook salmon from Washington's LSRCP program are known to utilize overlapping spawning areas. It is currently unknown to what extent natural and hatchery origin fish interbreed, and what effects interbreeding of hatchery and wild fish, and natural production from hatchery x hatchery spawning (whether intended or defacto supplementation) may have on natural production. The spring Chinook program was developed with endemic fish. However, research has documented that hatchery origin fish may not be as successful in reproducing in the wild, and may lower overall fitness of the natural population.

Spawning ground estimates are available for Tucannon spring Chinook (both in total number and by origin) and we consider these accurate and precise, and useful for describing relative reproductive success. Survival information for natural origin spring Chinook is collected through estimated egg deposition from redd counts, and smolt trapping (Objective 2c.2). Part of the work was completed in 2007 but high flows damaged the PIT tag detection array in 2008 and 2009. We plan to conduct the study again in 2010 for an additional year's data, after which we will examine bias and error in these estimation techniques, and apply a bias correction to the estimates as necessary.

Task 3b.1.1. Estimate egg deposition in the Tucannon River based on redds and fecundity estimates from the supplementation program. (Spring Chinook only)

Task 3b.1.2. Estimate the number of natural smolts emigrating from the Tucannon River using the Tucannon River smolt trap (Objective 2c.2). Utilize the Biomark PIT tag array to examine bias and error in our trapping efficiencies by PIT tagging known quantities of representative groups of fish. (Spring Chinook and steelhead)

Task 3b.1.3. Relate proportion of hatchery spawners in the Tucannon River to smolt production to estimate their relative reproductive success. (Spring Chinook only)

Objective 3b.2. Investigate effects of the LSRCP hatchery production program on non-target taxa of concern.

Background: Recent studies have suggested that hatchery programs that produce increasingly higher numbers of fish may hinder the recovery of depleted wild populations (Levin et al. 2001). Furthermore, Levin and Williams (2002) have demonstrated that the survival of wild Chinook salmon is negatively associated with releases of hatchery steelhead. Such studies prompted the Independent Scientific Advisory Board to call for a Columbia Basin wide evaluation of the efficacy of hatchery supplementation in the recovery of wild populations, and evaluate other broad ecological effects of hatchery programs (ISRP & ISAB, 2005). The potential for detrimental effects of hatchery programs on non-target taxa was identified as a serious concern of the ISRP/ISAB as those effects are currently not widely being evaluated on species of concern such as bull trout.

Approach: Beginning in 2007, evaluation staff began a retrospective review and analysis of existing data sets to examine possible negative effects of the hatchery spring Chinook and steelhead programs on the abundance and growth of the native bull trout, spring Chinook and Tucannon summer-run steelhead populations. Those analyses were completed in 2007 but no strong correlations were found. However, data limitations likely limited the sensitivity of those analyses to detect correlations. We will continue collection of data on species of concern that are encountered at our traps and during field sampling (species, relative abundance, presence/absence over time, and where applicable, lengths and weights of a sample of fish)

> Task 3b.2.1. Record the presence, abundance, sizes and general condition of sympatric species within rivers where LSRCP supplementation and evaluation actions occur. Monitor the status of these species over time to help determine whether supplementation is affecting the status of these populations.
>
> Task 3b.2.2. Report findings.

Objective 3b.3. Utilize reference streams within the Snake and Columbia basins to evaluate the effects of LSRCP hatchery production supplementation on ESA listed target mitigation populations.

Background: Direct and de facto supplementation, of spring Chinook and steelhead respectively, under the LSRCP has been ongoing in the Tucannon and Touchet Rivers of Washington since the program's inception. More recently, direct supplementation of Snake River fall Chinook has been actively pursued by WDFW and NPT programs funded jointly by the LSRCP and BPA. The Independent Scientific Review Panel (ISRP) and the Independent Scientific Advisory Board (ISAB) have stated the need for a comprehensive evaluation of the use of supplementation as a recovery tool for depressed salmon populations in the Columbia River basin (ISRP and ISAB 2005). Development of a comprehensive supplementation evaluation plan was undertaken in 2006-2008 by fisheries researchers and managers. They concluded that there is an "insufficient effort within the basin" to obtain estimates for relative reproductive success (RRS) from non-supplemented (reference) streams, against which RRS values for natural origin fish in supplemented populations can be compared (Galbreath, et al., 2007). This evaluation would partially meet the regional desire to address programmatic concerns regarding hatchery production and the ESA.

In order to assess the effects of supplementation, comparisons of a number of treated versus untreated streams may be the best method of detecting differences in long-term fitness attributable to supplementation programs (Galbreath, et al., 2006). One approach is to analyze data for parameters collected from a number of treated (supplemented) and reference (i.e., non-supplemented) streams across the basin. Galbreath, et al. (2006) noted that one of the difficulties in evaluating monitoring data for supplementation programs is the limited availability of reference streams. These reference streams provide the best opportunity to determine if there is a change in reproductive success or productivity as a result of supplementation.

Within this context, data from ongoing LSRCP funded evaluations are available to populate comparisons between LSRCP supplemented streams and appropriate reference streams, if and when they can be found. Asotin Creek was identified as an important steelhead reference stream that is ecologically and geologically similar to the Tucannon and Touchet rivers, and has recently expanded intensive monitoring under BPA's Fish and Wildlife Program (adult and smolt trapping). As such, we believe that Asotin Creek represents an excellent for comparison of the RRS and population demographics of steelhead from LSRCP supplemented streams. Possible reference streams were identified for Tucannon spring Chinook in 2009 (Yakima, Salmon and Upper Columbia river basin tributaries) but the data must be analyzed to determine which of the rivers can serve as reliable references. Reference rivers for Snake River fall Chinook have yet to be identified.

Approach: We will use data sets from the Tucannon River and Asotin Creek steelhead to compare and contrast metrics defined as part of the supplementation M&E program developed through the CSMEP. Some of these metrics are: adult age structure, adult sex ratio, spawn timing, % hatchery fish in the spawning population, genetic indices (heterozygosity, hatchery genetic introgression, etc.), fecundity and change in fecundity over time, and smolt age structure. We expect to collaborate with other managers and utilize the data for the CSMEP effort to describe and evaluate the impacts of hatchery supplementation as developed in the study protocol. We intend to complete an analysis of potential reference streams for Tucannon spring Chinook and present the results.

Task 3b.3.1. Summarize available Tucannon River steelhead population data into a format consistent with CSMEP supplementation data to enable comparisons with Asotin Creek data (to be provided by separate BPA Project #2003-5300).

Task 3b.3.2. Complete data summarizations, analysis and comparisons using CSMEP protocols for the evaluation of supplementation monitoring project.

Task 3b.3.3. Analyze reference streams/populations for Tucannon spring Chinook, and Snake River fall Chinook if possible.

Task 3b.3.4. Report preliminary results of the Tucannon/Asotin supplementation comparison with LSRCP office, and cooperating CSMEP agencies and evaluate the applicability of the tool to measure supplementation effects within an ESA framework.

Category 4. Electronic Database Systems

Upload PIT tag data to PTAGIS after PIT tagging, and tag recovery data from fish spawned at LFH or recovered at traps. Estimates of returns of hatchery and wild fish sampled on the project are provided to Washington's Salmonid Stock Inventory (SaSI) database, which functions to assess stock status. Coded wire tag recoveries and expansion estimates are provided to the Regional Mark Information System (RMIS) by WDFW Olympia staff, after SRL evaluation personnel finalize the data. No databases are directly funded by LSRCP, only the data are provided.

Category 5. Peer Review, Biometric Review, Analysis and Reporting

Project 5a – Annual progress reports

Objective 5a.1. Complete annual reports to summarize results of all LSRCP funded work conducted during the FFY07 contract periods.

Task 5a.1.1. Submit a draft report on Tucannon River spring Chinook research and activities to the U.S. Fish and Wildlife Service (1 August of each year). Submit a final report within 120 days after formal review.

Task 5a.1.2. Submit a draft report on Lyons Ferry fall Chinook research and activities to the U.S. Fish and Wildlife Service (1 August of each year). Submit a final report within 120 days after formal review.

Task 5a.1.3. Submit a draft report on Lyons Ferry summer steelhead research and activities to the U.S. Fish and Wildlife Service (1 October of each year). Submit a final report within 120 days after formal review.

Project 5b – Peer reviewed publications

Evaluation studies may produce regionally significant results pertaining to the use and efficacy of hatchery programs to provide fisheries and maintain natural populations. Where applicable, publish results of studies in peer-reviewed journals to make results available in the broadest possible manner.

Category 6. Participation in External Forums

Not Anticipated for FFY2010.

Category 7. Regionally Significant Research

Objective 7a: Conduct and Evaluate the Tucannon River Spring Chinook Captive Broodstock Program.

<u>*Approach*</u>: WDFW utilized a captive broodstock program to provide a quick “boost” to the Tucannon River spring Chinook population due to low returns in the mid-90s. The final release of smolts occurred in 2008, but returns will continue to be assessed through the LSRCP M&E program until the last captive brood progeny return in 2011. The program was primarily funded by BPA but the LSRCP program provides additional support through its ongoing M&E and hatchery O&M programs. Captive broodstock programs are experimental and the information gathered from this program will be shared with other interested parties in the Snake River Basin that conduct, or are considering conducting, captive broodstock programs for recovery of ESA-listed populations.

Task 7a.1. Assess the Tucannon River Spring Chinook Captive Broodstock Program in conjunction with ongoing LSRCP supplementation activities.

Task 7a.2. Act as a source of information to other programs that conduct, or are interested in conducting, captive broodstock programs.

Task 7a.3. Report captive broodstock/LSRCP supplementation comparative performance results in reports to BPA, and in journal publications where applicable.

Category 8. Data Gaps

Ongoing monitoring and evaluations conducted within the LSRCP generate questions that may not be answered as part of the work through which they were identified. These questions, or data gaps, can have both a direct and indirect relevancy to LSRCP programs. Some of these are identified and studied as part of regionally significant research (Category 7) where their applicability to LSRCP programs is inferential rather than directly applicable to its success. The remainder represents studies that can and should be addressed as part of the LSRCP monitoring and evaluation program. Following are data gaps identified for future studies within Washington. A brief description of each unknown and its relevancy to the program is provided. Data gaps are not listed in priority order.

1. Unaccounted steelhead – steelhead are particularly difficult to enumerate because of their protracted pre-spawning migration period, the extensive nature of their distribution, their predilection to wander into far reaching streams where they may or may not eventually spawn, their long spawning season and difficult environmental and river conditions during spawning which makes surveys very difficult and accuracy questionable, and the difficulties associated with trying to effectively trap steelhead. A combination of expanded PIT tagging and adult trapping may be required to accurately account for hatchery origin fish returning to the Snake basin and then subsequently to their intended river.

2. Stray steelhead – stray steelhead are really a subset of unaccounted fish. However their potential impact to ESA listed populations has been identified as a jeopardy issue for the LSRCP program. A LSRCP collaborative study to further define the problem fish will depend on ESA consultation with NMFS.

3. Relative reproductive success of LSRCP salmon and steelhead stocks – hatchery stocks used for direct supplementation (developed from endemic populations), and the affects of defacto supplementation of other hatchery stocks on ESA listed populations is not completely understood. LSRCP cooperators should engage where possible with regional actions to assess the productivity of hatchery and wild populations. Data mining from long term data sets, and/or changes to data collection protocols within the LSRCP program may be necessary.

4. Use of kelts to increase the effective population size when developing endemic steelhead broodstocks – work done in the Columbia and Yakima basins have identified kelt reconditioning as a potential action to minimize the effect of broodstock collection on naturally spawning populations, and a way to increase production in the natural

environment. This action along with partial spawning of wild broodstock (currently being investigated) may assist with broodstock development for LSRCP hatchery steelhead.

5. Hooking mortality – significant fisheries are currently in place for LSRCP spring Chinook salmon and steelhead in the Snake Basin. Harsh environmental conditions may negatively affect a fishes' recovery after being hooked and released. The delayed hooking mortality rates associated with fisheries in the Columbia basin east of the Cascades is currently not well understood. A study similar to one conducted by ODFW in the Willamette River (Lindsay et al. 2004) should be conducted within the Snake River for steelhead, and the applicability Oregon's study results for Chinook examined.

6. Evaluate the ecological status of LSRCP rivers in relation to the Mitigation goals – mitigation goals were established within the context of historical productivity and capacity. Those capacities may now be substantially more limiting than in the past because of a lack of marine derived nutrients and other ecological changes. These changes may prevent the LSRCP program from succeeding (e.g. high within tributary mortalities of smolts) if systems are not ecologically capable of supporting mitigation numbers of fish. An evaluation of this unknown and the potential actions to increase productivity (e.g. carcass analogs) and capacity, or to reduce the LSRCP goal, may be appropriate.

7. Review current fishery sampling coverage and protocols – a substantial proportion of the original LSRCP mitigation goal was designated to downriver and ocean fisheries. Certain fisheries downriver or in the ocean are known to not electronically sample fish that are not externally marked (i.e. fin clips). This lack of consistent sampling protocols among the agencies makes using the CWT database suspect, and greatly limits our ability to adequately monitor/assess the LSRCP salmon and steelhead program.

8. Identifying untagged stray fall Chinook in the Snake River is becoming more complex. Development of a benign mark that would accurately identify Snake River hatchery fish has been a high priority within the LSRCP program. Thermal manipulation of salmon eggs at the eyed stage provides a distinctive otolith mark that is being used on Pacific salmon in the Northwest. If all of the Snake River basin hatchery fish were otolith marked, any untagged fish that did not have the same identifier would either be stray or wild. Wilds could be subtracted out based on scale data and the remaining numbers of fish could be assigned to strays. The benefits of using this mark would be nearly 100% identification of inbasin fish resulting in a more accurate estimate of stock compensation of the run as well as broodstock. Pursuing a discussion of this marking technique should be a high priority for fall Chinook.

9. Fall Chinook run reconstruction estimates the composition of returning adults and jacks primarily based on CWTs. Occasionally, large groups of juvenile hatchery fish are released as unassociated (not represented by a CWT). To estimate returns of these groups, SARs of fish released at similar times and from similar locations are used. However, run reconstruction is not able to assign all returning hatchery fish to a release location (In 2007 approximately 13.7% of the in-basin hatchery fish were unassignable to release locations). Possible reasons include incorrect SAR estimates used to estimate

unassociated component, inaccurate pre-release quality control checks that do not sufficiently cover tag loss, or unaccounted post-release tag loss. To address pre-release tag loss, increased sample sizes and/or standardized waiting periods before quality control checks are needed to reduce error in tag loss estimates. To address post-release tag loss, an examination of CWT retention in PIT tagged release groups when they return as adults may provide accurate estimates of this loss.

10. The use of PIT tags to expand our knowledge of fish behavior and survival within the Snake and Columbia Rivers has increased dramatically in recent years. There is sufficient information within the basin and in published literature to caution researchers about the potential decrease in survival (SAR) for PIT tagged fish. We believe PIT tagging will continue to play a significant role in hatchery and wild fish research. As such we also believe that a comprehensive study to assess the effect of a PIT tag on fish survival is needed. There exists within the LSRCP program sufficient facilities and use of multiple species for mitigation that would support the development and conduction of a comprehensive PIT tag survival study, and strongly suggest that the LSRCP cooperators work toward such a study.

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Attachment 5

Monitor and Evaluate Juvenile Snake River Fall Chinook Salmon Outplanted Upstream of Lower Granite Dam

2010 STATEMENT OF WORK

BPA Project Number 199801004

A: ADMINISTRATIVE SUMMARY:

Organization:	Nez Perce Tribe
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Project Period:	January 1, 2010 through December 31, 2010

B. PROJECT SUMMARY:

This project will evaluate the success of fall Chinook salmon supplementation above Lower Granite Dam and facilitate management decisions for future conservation and perpetuation of naturally spawning populations of fall Chinook salmon in the Snake and Clearwater Rivers above Lower Granite Dam specifically addressing RPA 184 in the FCRPS 2000 Biological Opinion and as recommended in the FWP, Snake Hell's Canyon and Clearwater Subbasin Summaries and Wy-Kan-Ush-Mi Wa-Kish-Wit.

C: COORDINATION:

This project complements and collaborates with several other Bonneville Power Administration (BPA) projects as recommended in the *Snake Hell's Canyon* and *Clearwater Subbasin Summaries*. Foremost is the Fall Chinook Acclimation Project (FCAP), which consists of BPA projects 199801005, 199801007 and 199801008. These projects are the operations of the Pittsburg Landing, Captain John Rapids, and Big Canyon Fall Chinook acclimation facilities, respectively. This project conducts monitoring and evaluation on the supplementation yearling and sub-yearling fall Chinook that are reared at Lyons Ferry Hatchery (LFH) and transferred for acclimation and release from these facilities.

This project shares personnel, equipment and vehicles with the fall Chinook portion of the Nez Perce Tribal Hatchery M&E (NPTH M&E) Project (198335003).

Beginning in 2003 we took the lead for conducting fall Chinook salmon spawning ground surveys on the Grande Ronde, Imnaha and Salmon Rivers. The National Marine Fisheries Service (NMFS) and Washington Department of Fish and Wildlife (WDFW) complement this project by sampling adult fall Chinook returns to LFH and Lower Granite Dam. The Idaho

Power Company (IPC) and U.S. Fish and Wildlife Service (USFWS) (project 199801003) conduct spawning ground survey activities on the Snake River and the NPTH M&E project (198335003) leads spawning ground surveys in the Clearwater River subbasin.

All PIT tagging operations at the acclimation facilities are led by the NPT and may be assisted by WDFW. PIT tagging activities at Pittsburg Landing in 1996 were conducted cooperatively between the USFWS and NPT. The USFWS led PIT tagging operations at Pittsburg Landing in 1997 and 1998. The NPT has led PIT tagging operations at Pittsburg Landing in 1999. The NPT has led all PIT tagging activities at the Big Canyon Creek facility since 1997 and will continue to do so in the future. The NPT has led PIT tagging activities at the Captain John Rapids facility since 1998 in close coordination with WDFW. Beginning in 2005, the Corps of Engineers began funding a Transportation/In-river study to look at differences in adult return rates of fall Chinook transported below Bonneville Dam and those left in-river to migrate through the Snake and Columbia River corridor. We cooperate with this project in PIT tagging additional production fish at and monitor tag loss and mortalities after tagging.

We coordinate with USFWS Idaho Fish Health Laboratory personnel on the transfer of the fish health sampling data, which we analyze and report on a yearly basis.

We coordinate with co-managers (USFWS, WDFW, IDFG, NMFS, IPC, ODFW, etc.) and TAC to develop fall Chinook management and monitoring and evaluation planning documents through the *US vs. Oregon* proceedings.

D: BACKGROUND:

Agreements were reached through *US vs. Oregon* to release 450,000 yearling fall Chinook salmon on-station at Lyons Ferry Hatchery as well as and additional 450,000 (total) yearlings from three acclimation facilities above Lower Granite Dam. The USFWS Lower Snake River Compensation Plan (LSRCP) funded the first two years (1996 and 1997) of this project, through the BPA. Direct BPA funding began in 1998. Supplementation of LFH fall Chinook yearlings and monitoring and evaluation studies were initiated with the commencement of operations of the Pittsburg Landing acclimation facility on the Snake River in 1996. The Big Canyon facility on the Clearwater River and the Captain John Rapids facility on the Snake River began operating in 1997 and 1998, respectively. The three acclimation facilities have also accommodated annual releases of up to 2.4 million sub-yearling fall Chinook in all but one year since 1997 due to ample broodstock availability. Releases have typically occurred at 2 different times, early (May) and late (June) when back to back releases occurred in excess years. These sub-yearling releases had no specific monitoring and evaluation associated with them as mandated in the *FCRPS 2000 Biological Opinion, FWP, Snake Hell's Canyon and Clearwater Subbasin Summaries* and *Wy-Kan-Ush-Mi Wa-Kish-Wit*. We proposed to the 2002 Provincial Rolling Review to expand our scope to include tagging a portion of the sub-yearling release groups as these releases have not received funding for monitoring and evaluation, however the additional funds we requested have not been made available. Therefore, to do minimal evaluation of sub-yearling releases, we have scaled back PIT tag numbers for yearlings and applied tags to the sub-yearlings to at least obtain juvenile survival estimates through the hydro-system.

Our primary study area includes the mainstem Clearwater River from Big Canyon Creek downstream to the mouth, the mainstem Snake River from Pittsburg Landing downstream to the mouth, and the Columbia River from the Snake River confluence downstream to Bonneville Dam.

Our monitoring and evaluation efforts from 1996-2009 have resulted in obtaining up to 9 years of comparative size, condition and health data as well as documenting survival estimates, migration rates and timing of yearlings from the FCAP facilities to Lower Snake and Columbia River dams. Data from 1998-2005 have been analyzed and annual reports for these years are currently posted on the BPA website at http://www.efw.bpa.gov/.

Results from the 1996-2007 monitoring and evaluation of yearling and sub-yearling fall Chinook are encouraging. Numbers of adult fall Chinook returning to Lower Granite Dam have increased dramatically since 1998 (the first year of adults returns from FCAP releases), indicating that supplementation efforts appear to be having positive effects on abundance. Also, redd counts and carcass collections over the years have indicated that redd numbers correlate highly with adult escapement numbers over Lower Granite Dam and supplementation fish are spawning in the natural habitat. Health assessments for BKD levels in supplementation fall Chinook salmon have been variable over the years.

E: GOALS, OBJECTIVES, AND TASKS

Goal: The goal of this project is to monitor and evaluate pre-release health and condition, post-release survival and behavior and adult returns of yearling and sub-yearling fall Chinook salmon released from the FCAP facilities and provide adaptive management opportunities through feedback to co-managers.

Objective 1: Coordinate within the Nez Perce Tribe and with other agencies, share project information, attend training and meetings as required by Nez Perce Tribe policy.

Task 1.1. Attend all relevant inter- and intra-agency meetings as required to coordinate activities and share project information. (January – December)

Task 1.2: Abide by the Nez Perce Tribe policies and procedures as required (Human Resources, Finance, Resolutions, Administrative Actions) and with all other policy personnel directions. (January – December)

Task 1.3: Participate in local and regional Snake River fall Chinook salmon planning activities, including development of management and monitoring and evaluation plans. (January – December)

Objective 2: Monitor, evaluate, and compare pre-release size, condition and health of yearling and sub-yearling fall Chinook released from the FCAP facilities.

Approach: Fish will be collected by Dworshak Fish Health Lab personnel for health sampling. We will collect length and weight data from a sample of yearling and sub-yearling fall Chinook that is representative of each release group.

Task 2.1 Coordinate with the Dworshak Hatchery Fish Health Lab in conducting weekly health assessments on a sample of yearling fall Chinook each at the FCAP facilities. (February – April)

Task 2.2 Document fish size and weight for yearling and sub-yearling fall Chinook. Yearling data will be collected during PIT tagging (Task 3.2). (April – June)

Task 2.3 Using data from Task 2.2; compare size and condition of fish reared at the FCAP facilities and LFH. (May – September)

Task 2.4 Check a representative sample of acclimated yearling fall Chinook for coded wire tag and adipose fin clip retention for quality control assessments (Task 3.2). (April – June)

Products:
1) *Comparative fish health assessments between release locations.*
2) *Comparative analysis of fork length and condition factor between release locations.*
3) *Quality control documentation of coded wire tag and adipose fin clip retention.*

Objective 3: Monitor, evaluate, and compare post-release behavior, migration timing, and survival of yearling and sub-yearling fall Chinook salmon released from the FCAP facilities.

Approach: Of the yearling fall Chinook at each FCAP facility, all will be tagged with coded wire and with 70,000 receiving adipose fin clips in addition. Sub-yearling release groups from the FCAP facilities will have 200,000 receiving coded wire tags and an additional 200,000 receiving coded wire tags plus adipose fin clips. Representative samples of both yearling and sub-yearling release groups will be PIT tagged. Outmigration survival will be estimated from PIT tag interrogations at mainstem dams using the Survival Under Proportional Hazards (SURPH) model (Smith et al. 1994).

Task 3.1 Assist with coded wire tagging a representative sample of the FCAP yearling and sub-yearling fall Chinook. (January – December)

Task 3.2 Conduct tag/mark quality control sampling for coded wire tag and adipose fin clip retention. (January – December)

Task 3.3 PIT tag 5,000 yearling and 2,500 sub-yearling fall Chinook per release group at the FCAP facilities. (April – June)

Task 3.4 Compile PIT tagging data, edit, validate and submit to the PTAGIS database. (April – June)

Task 3.5 Download and analyze PIT tag detection data at all mainstem dams and compare travel times, migration rates and arrival timing for the FCAP yearling and sub-yearling release groups. (August – December)

Task 3.6 Compile flow and temperature data in the Snake and Clearwater Rivers and at

Lower Snake and Columbia River dams. Supplement thermographs where needed. (September - December)

Task 3.7 Use the PIT tag data from Task 3.4 and the SURPH model to estimate juvenile survival from the FCAP facilities to the lower Snake and Columbia River dams. Coordinate with the University of Washington (UW) and the NMFS for SURPH model analysis. (August – December)

Task 3.8 Evaluate post-release migration rates in relation to the flow and temperature data collected in Task 3.5. (August – December)

Products:

1) *A representative sample of coded wire tagged yearling and sub-yearling fall Chinook released from the FCAP facilities.*
2) *2,500-5,000 PIT tagged fish from each release group with the ability to monitor through the FCRPS.*
3) *PIT tagging data uploaded to PTAGIS database and made available to regional managers.*
4) *Observation rates, travel time, migration rate, arrival timing and survival through the FCRPS in relation to river flow and temperature.*

Objective 4: Monitor and compare adult fall Chinook salmon spawner abundance and distribution and smolt-to-adult survivals from FCAP yearling and sub-yearling releases.

<u>Approach:</u> Adult fall Chinook salmon will be trapped and sampled at Lower Granite Dam using a specified subsampling rate based on run predictions. This sampling will provide the run composition data, based on coded wire tags, to develop a run reconstruction that will provide estimates of adult returns from specific releases of yearling and sub-yearling fall Chinook from the FCAP (and any other) facilities. These estimates will then allow for calculation of contribution to the total run and smolt-to-adult return rates of specific FCAP releases. Fall Chinook salmon spawning ground surveys in the Snake River subbasin are conducted in a coordinated effort by several agencies. Spawning surveys and carcass recovery information will provide an indication of spawning locations in relation to the acclimation release sites.

Task 4.1 Conduct spawning ground surveys on the Grande Ronde, Imnaha and Salmon Rivers in coordination with IPC, USFWS and project 198535030. (September – December)

Task 4.2 Assist project 198535030 in sampling adult fall Chinook salmon carcasses in spawning areas on the Clearwater River when needed. When possible, sample adult carcasses on the Grande Ronde, Imnaha and Salmon Rivers to recover CWT and VIE data from supplementation or hatchery released fish, collect scales to identify age class, collect tissue samples for genetic testing and to gather percent spawned information to estimate spawning success. (September – December)

Task 4.3 Based on the above activities, collaborate with the USFWS, IPC and project 198535030 in estimating the total spawning abundance in the Snake River subbasin and the contribution of adults from FCAP releases in the Snake, Clearwater, Grande Ronde, Imnaha and Salmon Rivers. (September – December)

Task 4.4 Assist project 198535030 (NPT) in conducting aerial spawning surveys in the Clearwater River drainage when needed. (September – December)

Task 4.5 Coordinate with co-managers and TAC in compiling the adult recovery information for run reconstruction to estimate and compare contribution to the total run and smolt-to-adult survivals from FCAP juvenile releases. (January – May)

Products:

1) *Quantification and distribution of fall Chinook redds in the Snake, Clearwater, Grande Ronde, Imnaha and Salmon Rivers.*
2) *Identification of origin, composition and success of spawners where possible.*
3) *Genetic identification of adult spawners where possible.*
4) *Quantification of adult fall Chinook abundance, contribution of specific release groups and smolt-to-adult survival estimates.*

Objective 5: Prepare annual reports and provide quarterly progress reports that evaluate the success of supplementation of yearling and sub-yearling fall Chinook salmon above Lower Granite Dam.

Task 5.1 Provide project status reports on a quarterly basis. Quarterly reporting requirements are detailed in the BPA Terms and Conditions (reports are due 15 days after the quarter ending March 31, June 30, September 30, and December 31, 2005).

Task 5.2 Provide an annual report on the results of all objectives and tasks outlined for this project due March 31, 2011. Coordinate and review reports with the USFWS and WDFW. (September 2010 – March 2011)

Products:

1) *Quarterly project status reports.*
2) *Annual report of project results.*
3) *Provide feedback to managers for contribution of FCAP production to fall Chinook abundance above Lower Granite Dam in relation to status of Snake River fall Chinook progress toward meeting recovery goals.*

Attachment 6

LYONS FERRY COMPLEX
ANNUAL OPERATION PLAN

For the Period of

OCTOBER 1, 2009 – SEPTEMBER 30, 2010

Prepared by:

Washington Department of Fish and Wildlife

Nez Perce Tribe

Confederated Tribes of the Umatilla Indian Reservation

And funded by:

Lower Snake River Compensation Plan

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I. INTRODUCTION

A. Facilities

Lyons Ferry Complex (LFC; See **Figure 1**) includes Lyons Ferry Hatchery (LFH), Tucannon Hatchery (TFH), Cottonwood Acclimation Facility (Cottonwood AF), Dayton Acclimation Facility (Dayton AF), and Curl Lake Acclimation Pond (Curl Lake AP).

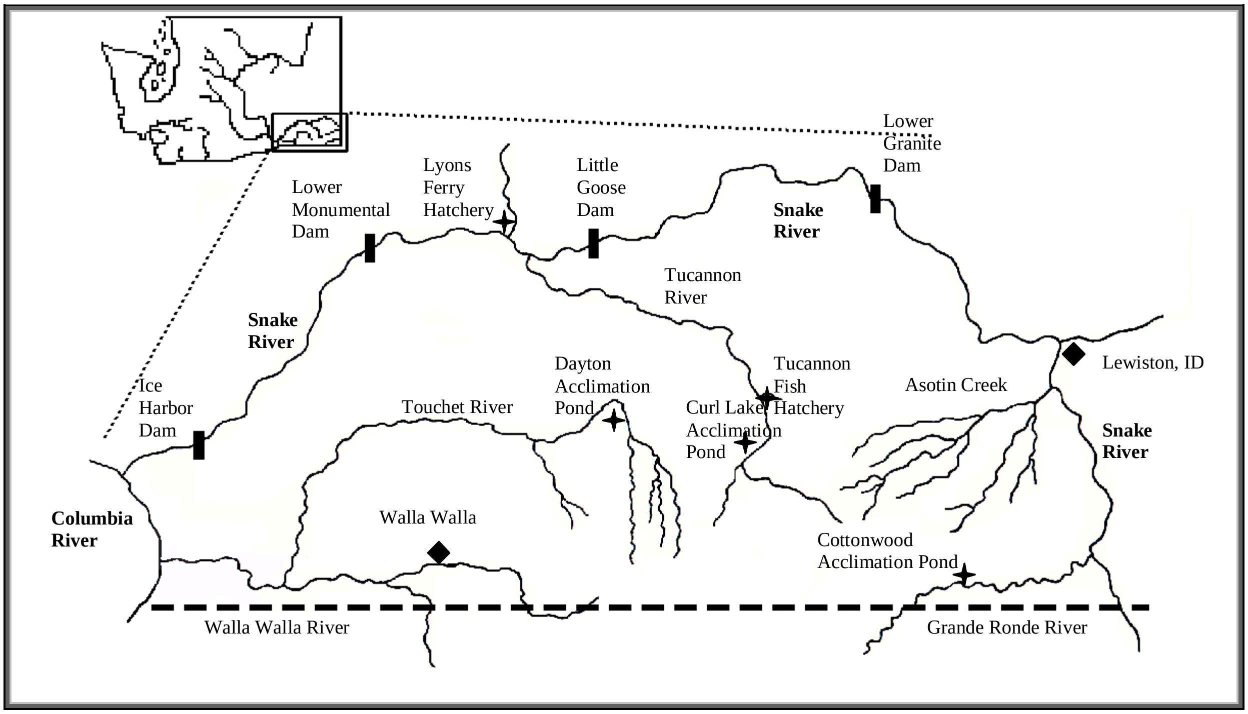

Figure 1. Map of the Lower Snake River Compensation Plan (LSRCP) LFC Facilities, and major rivers and streams in Southeast Washington.

LSRCP funded fish production in Washington began in 1983, with the construction of trout and steelhead rearing facilities at the LFH. Construction of salmon facilities and steelhead acclimation sites followed, and was completed in 1985. Major upgrades at TFH also occurred at that time, and operation of that facility has been funded by LSRCP every since. Production at all facilities has been directed toward meeting established program goals of returning 18,300 adult fall Chinook, 1,152 adult spring Chinook, 4,656 adult summer steelhead, and providing 67,500 angler days of fishing opportunity from 80,000 pounds of rainbow trout production, currently planted at 3 fish per pound (fpp). In addition to these LSRCP production goals, Washington Department of Fish and Wildlife (WDFW) funds a jumbo-sized (1.5 pounds each) rainbow trout program at TFH.

1. Lyons Ferry Hatchery

The LFH is located along the Snake River at river mile (RM) 59.1, directly below the confluence of the Palouse River in Franklin County, Washington. Initially it was operated as two separate facilities. Washington Department of Wildlife (WDW) operated the north hatchery, producing steelhead and rainbow trout. Washington Department of Fisheries (WDF) operated the south hatchery, rearing spring and fall Chinook. A merger of the two agencies in 1994 led to a merging of the two facilities, and has since been operated by WDFW through LSRCP funding as LFH.

Facilities include two incubation buildings with office space and feed storage, plus adult fish trapping, holding and spawning structures. A visitor center provides interpretive information for guests of the hatchery. There are eight residences on-site for staff to fulfill security and emergency response needs.

The LFH rearing facilities include twenty-eight raceways at 10 ft x 100 ft x 2.8 ft and nineteen raceways at 10 ft x 88.5 ft x 3.5 ft. These raceways were covered in 2" square mesh netting in 2005 and 2006. There are three rearing lakes now covered in 2" netting (completed in 2008), holding ~ 590,000 cubic feet (ft^3) of water each, approximately 1,100 ft x 90 ft x 10 ft in size. Netting has been added to these lakes and raceways to reduce predation losses. The adult holding facilities include three 83 ft x 10 ft x 5 ft adult raceways with enclosed spawning facilities incorporated over the center of these ponds. With the addition of new walls in the adult ponds in summer 2009, there are now four 8.5 ft x 150 ft x 4.3 ft and four 10 ft x 150 ft x 4.3 ft adult salmon holding ponds, which also accommodate sub-yearling rearing when not needed for adult holding in the spring of the year. In 2005, channels were cut into two of these ponds, creating three temporary holding areas in each of the two modified ponds to accommodate marking and tagging of the sub-yearlings reared there. Screens were fabricated to fit the channels. Six 3.25 ft x 16 ft x 2.6 ft fiberglass tanks were added below the north side raceways in 2006, allowing for decreased densities and improved flexibility in all stocks during early rearing. The incubation facilities include 112 full stacks (2 units of 8 trays each) of vertical incubators in the south trough room, and 88 shallow eyeing/hatching troughs and four 3.75 ft x 27.5 ft x 2 ft intermediate rearing troughs in the north trough room.

Water is supplied to LFH from the Marmes pump station, which has emergency power backup generation. The Marmes pump (wells) facility has three 300 horsepower (hp) pumps, four 200 hp pumps and one 75 hp pump. The well water right for LFH is 53,200 gallons per minute (gpm), or 118.5 cubic feet per second (cfs) of flow, and water temperature is a constant 52^o F.

2. Tucannon Hatchery

The TFH is located along the Tucannon River, between the towns of Dayton and Pomeroy Washington, at RM 36 in Columbia County. Fish production began in 1949 by the Washington Department of Game. In 1983, construction began to remodel the hatchery as part of a transfer of ownership to LSRCP. In November 1986 construction was complete, and LSRCP has funded operations there ever since.

The TFH includes a combined incubation and office building, back-up power generation building, feed storage shed, shop, domestic water building, two well houses and a spring water collection building. There is also a river intake and trapping facility located upstream of Rainbow Lake, along the Tucannon River. There are two residences for staff on site to fulfill security and emergency response needs.

The TFH is supplied with three different water sources. River water is captured from the Tucannon River and ranges in temperatures from 33 to 60 ^{o} F during use by the hatchery. The intake is located one half mile upstream of the hatchery. This water travels down an open channel into Rainbow Lake. From the outlet of Rainbow Lake the water travels through an 18" above ground pipeline to the hatchery. This pipeline was completely replaced in 2005. Rainbow Lake functions as a reservoir to provide the hatchery with cooler water in the summer months and warmer water in the winter months. It also provides a pool of water to draw from when encountering adverse intake conditions, resulting in temporary loss of water flows. An estimated 8 hours of water supply is currently available, however, a proposed dredging project will increase its capacity and supply. The water right for this source is 16 cfs. Well water is pumped from two separate sources to an aeration tower, and then gravity fed to the rearing units and the domestic pump building. The combined well water right is 2 cfs, with well #2 running around 54 - 57^o F and well #3 running a constant 61^o F. Spring water is pumped from an underground collection site to the same aeration tower and gravity fed to rearing units. The water right for this source is 5.3 cfs, and has a stable temperature of 51 or 52^o F.

The rearing vessels at TFH include 40 concrete 1 ft x 15ft x .5 ft shallow troughs, six concrete round ponds approximately 40 ft in diameter with a maximum of 2,660 ft^3 of rearing area each, two concrete 10 ft x 80 ft x 3 ft raceways, one concrete 15 ft x 136 ft x 5 ft raceway, and one earthen rearing pond with a maximum of 136,221 ft^3 of rearing space. The pond is approximately 170 ft x 200 ft x 6.5 ft in size.

3. Cottonwood Acclimation Facility

Cottonwood AF is located along the Grande Ronde River at RM 28.7, directly above the confluence with Cottonwood Creek in Asotin County, Washington. Construction was completed in February 1985.

This facility includes an adult trapping facility on Cottonwood Creek, and a small storage building. Cottonwood AF has a concrete bottom with earthen walls and holds ~357,000 ft^3 of water. It has a water right of 2,694 gpm (6 cfs) for the period January 1^{st} through July 1^{st}. It is supplied with water from Cottonwood Creek through a gravity water supply system, with the intake integrated into the adult trapping facility located ~ 0.10 miles above the pond. Water temperatures range from 34 to 52^{o} F during operation of the facility. It also has a small trailer for use by staff required to be on-site at all times while the pond is in operation. It is presently used for acclimation and release of Wallowa stock summer steelhead into the Grande Ronde River.

4. Dayton Acclimation Facility

Dayton AF is located along the Touchet River at RM 53 in Columbia County, Washington. There is an adult trapping facility on the Touchet River just upstream of the acclimation pond at RM 53.3.

Construction of the Dayton AF was completed in October 1986. This pond is asphalt lined and holds ~ 200,000 ft^3 of water. The water right to this pond is 2,694 gpm (6 cfs) for the period of Jan 1st – May 15th of each year. It is supplied with water from the Touchet River through a gravity water supply system, with the intake located at the newly constructed adult trapping and bypass facility just upstream of the pond. Water temperatures during operations for steelhead acclimation range from 34 to 52^{o}F. The pond is located adjacent to the Snake River Lab evaluation office and has a storage garage for equipment and feed. It also has a small trailer for use by staff required to be on-site at all times while the pond is in operation. It is presently used for acclimation and release of LFH stock summer steelhead into the Touchet River. The new intake, trap and water supply structure serves multiple functions. During the summer months, local irrigators can now collect water from the intake in place of river dredged dams.

5. Curl Lake Acclimation Pond

Curl Lake AP is located along the Tucannon River at RM 41 in Columbia County, Washington.
The construction of Curl Lake AP was completed in February 1985. Curl Lake AP is an earthen pond holding ~ 784,000 ft^3 of water. It has a water right of 2,694 gpm (6 cfs). It is supplied with water from the Tucannon River through a gravity water supply system. It is currently utilized for acclimation of spring Chinook yearlings for release into the Tucannon River. Water temperatures at this time of year range from 34 to 48 ^{o}F. Chinook acclimation in Curl Lake AP started in 1997. After the spring Chinook are released, the pond is stocked with resident trout for fishing. It is emptied after fishing season ends October 31st each year, and recharged by hatchery staff prior to spring Chinook acclimation the following January.

6. Other Acclimation Facilities

In addition to WDFW acclimation sites, LFC provides up to 465,000 yearling and 1,740,000 sub-yearling fall Chinook to three acclimation facilities operated by the Nez Perce Tribe (NPT): Pittsburg Landing and Captain John's Rapids on the Snake River between Asotin and Hells Canyon Dam, and Big Canyon on the Clearwater River. Size at transfer to the NPT AF's is 12 fpp for yearlings and 65 - 75 fpp for sub-yearlings. Size at release goal for acclimated fall Chinook yearlings is 10.0 fpp, and 50 fpp for sub-yearlings. Sub yearling size goals at transfer have been difficult to achieve due to increased marking, tagging and egg take strategies.

B. Fish Production Summary

Annual hatchery production is intended to meet LSRCP adult return goals for several species. Current production levels are set to meet the adult return goals for hatchery steelhead most years while minimizing any adverse effects on ESA listed salmon and steelhead (**Table 54**). Production levels for salmon and steelhead at LFH have been approved through the *US vs. Oregon* (*US vs Oregon*) 2008-2017 Management Agreement; LFH Fall Chinook salmon production priorities contained in Tables B4A and B4B. LFH is planning BY2008 fall Chinook production based on table *B4B* (**Table 56**). Spring Chinook production is now solely comprised of a conventional program. With the phase out of the captive broodstock program in 2006, the conventional smolt release program goal will be increased to 225,000 smolts per year (as agreed to under US vs Oregon), for release in 2009. LFH utilizes two steelhead stocks (Lyons Ferry and Wallowa) for mitigation objectives under LSRCP, and is testing two natural broodstocks in the Touchet and Tucannon Rivers. Numbers of fish released in 2008 were annual goals proposed for 2009, (**Table 55**) representing the program as negotiated by the co-managers.

It is important to stress that *any* change to a specific program at LFH or TFH will potentially impact the other programs, so "current capacity" values shown in **Table 54** represent rearing limits *as the programs are structured today*. Additionally, restrictions anywhere within the rearing cycle will determine program size. Restrictions can be rearing vessels, water, tagging groups and schedules, fish management decisions regarding harvest or adult return contribution and carrying capacity, etc.

Monitoring and Evaluation (M&E) has been ongoing since 1983 and 1985 for trout and salmon programs respectively. Recent emphasis has centered on meeting Endangered Species Act (ESA) permitting and recovery planning requirements. Hatchery Scientific Review Group recommendations may also affect management decisions in the coming years. Routine monitoring includes length, weight, K factor, external fin evaluation, tag retention and fish health examinations. Pre-release quality control checks on fin clips, tag retention, etc. is completed on all WDFW releases by WDFW staff.

Table 54. LFC production capacities (historical design versus current).

Facility	Location River (Mile)	Water Source	Species	Designed Capacity (#Fish)	Designed Capacity (Pounds)	Current Capacity (#Fish)	Current Capacity (Pounds)
Lyons Ferry	Snake (58)	Wells	Fall Chinook Spring Chinook Steelhead Rainbow TOTALS	9,160,000 132,000 931,200 260,000 **10,483,200**	101,800 8,800 116,400 84,000 **311,000**	3,100,000 289,000 609,500 310,000 **4,308,500**	116,167 9,633 119,570 51,600 **296,970**
Tucannon	Tucannon (36)	Wells, Springs, Tucannon R.	Spring Chinook Rainbow Steelhead TOTALS	132,000 210,000 -0- **342,000**	8,800 39,285 -0- **53,335**	282,000 198,000 90,000 **570,000**	18,800 49,100 20,000 **87,900**
Cottonwood AF	Grande Ronde (28.7)	Cottonwood Creek	Steelhead	250,000	31,250	250,000	55,556
Curl Lake AP	Tucannon (41)	Tucannon R.	Steelhead Spring Chinook	160,000 -0-	32,000 -0-	-0- 480,000	-0- 32,000
Dayton AF	Touchet (53)	Touchet R.	Steelhead	125,000	25,000	112,500	25,000

Table 55. LFC plants and transfers by brood years (BY) – three-year profile.

Species	Year slated for release/transfer				
	2009 Goal	2009 Actual Plants and Transfers	2010 Goal [a]	Fish/Eggs on Hand For 2010 Goal	2011 Tentative Plan [b]
Fall Chinook					
Yearling releases:	**BY 2007**	**BY 2007**	**BY 2008**	**BY 2008**	**BY 2009**
LFH-on station	450,000	455,152	450,000	500,000	450,000
NPT (transfer)	465,000	452,459	465,000	495,000	465,000
Sub-yearling releases:	**BY 2008**	**BY 2008**	**BY 2009**	**BY 2009**	**BY 2010**
LFH-on station	200,000	200,733	200,000	Unknown	200,000
NPT (transfer)	1,420,000	1,419,496	1,420,000	Unknown	1,420,000
Direct- Snake River near Couse Cr (CCD)	200,000	200,744	200,000	Unknown	200,000
Direct-Grande Ronde River near .state line	-0-	181,400	-0-	-0-	-0-
Eyed Egg Transfers:	**BY 2008**	**BY 2008**	**BY 2009**	**BY 2009**	**BY 2010**
Oxbow - IPC	211,000	210,000	211,000	Unknown	211,000
Umatilla - IPC	842,000	835,600	842,000	Unknown	842,000
Irrigon - Direct – Grande Ronde R.	421,000	420,000	421,000	Unknown	421,000
Umatilla-ACOE	345,220 [d]	345,200	345,220[d]-	Unknown	345,220[d]-
Spring Chinook					
	BY 2007	**BY 2007**	**BY 2008**	**BY 2008**	**BY 2009**
Conventional	225,000	114,681	225,000	175,053	225,000
Summer Steelhead (Stock)					
	BY 2008	**BY 2008**	**BY2009**	**BY 2009**	**BY 2010**
On Station (LFH)	60,000	65,050	60,000	65,000	60,000
Tucannon (LFH)	100,000	105,995	100,000	105,000	100,000
Touchet (LFH)	85,000	86,115	85,000	86,000	85,000
Walla-Walla (LFH)	100,000	108,951	100,000	105,000	100,000
Cottonwood (Wallowa)	160,000	170,232	160,000	167,181	160,000
Tucannon (Endemic)	50,000	2,344	50,000	63,135	50,000
Touchet (Endemic)	50,000	49,656	50,000	60,182	50,000
Touchet (Endemic 2-yr)	7,500	*5,697*	5,500	5,500	Unknown
Spokane Rainbow Trout					
Mitigation	**BY 2007**	**BY 2007**	**BY 2008**	**BY 2008**	**BY 2009**
Catchables	236,725	227,920	234,100	237,376	234,935
Jumbo's	500	581	1,000	1,056	1,000
Fry-Idaho Fish and Game (IDFG), transfer	160,000	170,125	160,000	156,900	160,000
State Program					
Jumbo's	4,000	4,180	4,500	4,896	4,500
Legals	200	200	200	200	200
Kamloops RB Trout					
Fingerling -IDFG, transfer	50,000	53,970	50,000	53,422	50,000

[a] all fall Chinook sub-yearling and egg goals in this column are based on full adoption of the Snake River Fall Chinook Hatchery Management Plan (SRFMP). [b] all fall Chinook goals in this column are based on full adoption of the SRFMP.
c these fish were transferred to Dworshak National Fish Hatchery (DNFH) at 100 fpp.
[d] Amount of fish to transfer to get a 328,000 release. In addition the ACOE has requested that number to be increased to 417,000 (or 438893 at transfer) but an agreement has not been made by US vs Oregonegon parties at this time.
[e]Rearing location to change for brood year 2010. Pending future discussions.

II. SNAKE RIVER FALL CHINOOK

The fall Chinook production program at LFH is the cornerstone of a highly coordinated and integrated artificial program for Snake River fall Chinook, implemented through the LSRCP program, the Idaho Power Company (IPC) Hells Canyon Mitigation Agreement, and the Nez Perce Tribal Hatchery (NPTH). Broodstock for the program at LFH are collected at Lower Granite Dam (LGR) and at LFH.,

The *US vs Oregon* 2008-2017 Management Agreement included two tables that determined priority release locations and numbers for fall Chinook production at LFH; production priorities contained in Tables *B4A* and *B4B*. A policy decision has been made to use *B4B* from that agreement. For this AOP, LFH is planning BY2009 fall Chinook production based on table *B4B* (**Table 56**).

The LFH was initially designed to release 9.16 million fall Chinook sub-yearlings (**Table 54**) at around 90 fpp. Currently this facility produces 1.8 million sub-yearlings at approximately 50 fpp, and another 900,000 yearlings at 10-12 fpp. Additionally, this facility traps and spawns returning adult fall Chinook to meet egg take needs elsewhere, which includes providing over 1,000,000 eggs annually for the IPC program. Marking and tagging will occur there as well. These fish will be released into the Grande Ronde River in Washington as sub-yearlings by ODFW. The co-managers will coordinate release timing and location. ODFW fish health staff as coordinated between the two Agencies will conduct viral testing of the females providing eggs for this program. Steve Roberts has assumed the ELISA sampling responsibility for both agencies. This production was historically conducted at LFH, however co managers recognized the opportunity to shift the program to Oregon, reducing densities and creating some flexibility at LFH. Both facilities are funded by LSRCP, so budgets were adjusted accordingly, and the co managers have agreed to this change in production.

Table 56. Revised production table listing Snake River fall Chinook salmon production priorities for LFH per the *USvOR* Management Agreement, Table *B4B*, and agreed upon by members of the SRFMP for Brood Years 2008-2017.

Priority	Production Program				
	Rearing Facility	**Number**	**Age**	**Release Location(s)**	**Marking**
1	Lyons Ferry	450,000	1+	On station	225KAdCWT 225K CWT
2	Lyons Ferry	150,000	1+	Pittsburg Landing	70K AdCWT 80K CWT only
3	Lyons Ferry	150,000	1+	Big Canyon	70K AdCWT 80K CWT only
4	Lyons Ferry	150,000	1+	Captain John Rapids	70K AdCWT 80K CWT only
5	Lyons Ferry	200,000	0+	On station	200K AdCWT
6	Lyons Ferry	500,000	0+	Captain John Rapids	100K AdCWT 100K CWT only 300K Unmarked
7	Lyons Ferry	500,000	0+	Big Canyon	100K AdCWT 100K CWT only 300K Unmarked
8	Lyons Ferry	200,000	0+	Pittsburg Landing	100K AdCWT 100K CWT only
9	Oxbow	200,000	0+	Hells Canyon Dam	200K AdCWT
10	Lyons Ferry	200,000	0+	Pittsburg Landing	200K Unmarked
11	Lyons Ferry	200,000	0+	Direct stream evaluation Near Captain John Rapids	200K AdCWT
12	DNFH/Umatill a	250,000	0+	Transportation Study[a]	250K PIT Tag only
13	Irrigon[b]	200,000	0+	Grande Ronde River	200K AdCWT
14	DNFH/Umatill a	78,000	0+	Transportation Study[a]	78K PIT tag only
15	Umatilla	200,000	0+	Hells Canyon Dam	200K AdCWT
16	Irrigon[b]	200,000	0+	Grande Ronde River	200K Unmarked
17	Umatilla	600,000	0+	Hells Canyon Dam	600K Ad only
TOTAL	**Yearlings**	**900,000**			
	Sub-yearlings	**3,528,000 (of which 328,000 are for Transportation Study)**			

a USACOE Transportation Study wild surrogate groups direct stream released into the Clearwater and mainstream Snake River
b for logistical purposes, fish are reared at Irrigon in lieu of Lyons Ferry. (LSRCP)

A. Fish on Hand

Brood Year 2008

On September 1, 2009, LFH had an estimated 998,000 (BY08) juvenile Snake River fall Chinook on hand. The program goal is to provide 465,000 yearlings to NPT acclimation sites and 450,000 yearlings for release at LFH in the spring of 2010. Due to higher than expected egg survival and fecundity estimates, there will be a surplus of nearly 80,000 yearlings. After the surplus was identified in May 2009, the co-managers agreed to increase the 2010 on-station release at Lyons Ferry to 500,000, and increase the 2010 transfers to the FCAP facilities to 495,000, or 10,000 to each acclimation site.

Table 57. Proposed BY 2008 Snake River fall Chinook tagging, transfers and releases.

Site	Proposed Transfer	Proposed Release	Size (fpp)	Age	Mark/CWT/ Elastomer	PIT Tags	Transfer/Release Date
LFH	500,000	500,000	10	1+	275K AD CWT 225K CWT only	27,778	April 2010
Capt. John	165,000	160,000	12	1+	80K AD CWT 80K CWT Only	5,000	Feb - 2010 (transfer)
Pittsburg Landing	165,000	160,000	12	1+	80K AD CWT 80K CWT Only	5,000	Mar - 2010 (transfer)
Big Canyon	165,000	160,000	12	1+	80K AD CWT 80K CWT Only	5,000	Mar - 2010 (transfer)

B. Trapping

Brood Year 2009

The trapping goal is 3,057 (which includes 1,3230 females) adults and 198 jacks based upon stray rates and pre-spawning mortalities encountered in 2008 (Appendix A), and We anticipate that 70% of the females needed for brood will be trapped at Lower Granite. Refer to Appendix B for goal, however, trap rate may be adjusted. These numbers are all based on a 12% trap rate. This goal is the total number of fish that need to be trapped to meet egg take goals through priority 17 (Table 56). These goals are exclusive to stray culling requirements to meet the stray rate proportion of <5%. Generally, between 3,000 and 5,000 fish are trapped. Collection occurs at LFH and LGR. In effect, trapping is estimated for LGR, and then the remaining numbers of fish needed to meet egg take goals are trapped at LFH. If changes occur in season, the percent trapped at LGR will not change, rather the trapping at LFH changes. Excess adults trapped at NPTH may be used to supplement LFH production shortages of LGR and volunteer adult returns. Based on prior fecundity averages, 1,015 females from LGR and 308 female volunteers at LFH will be needed for program this year.

1. Lyons Ferry Hatchery

Trapping at LFH begins in early September, and continues throughout the spawning season, generally ending by late November or early December. All Snake River fall Chinook that voluntarily enter LFH may be retained for spawning. Once the number of fish needed to trap at LFH is estimated, a trapping schedule will be set to reflect the number of fish that need to be trapped weekly, based upon fall Chinook counts at Lower Monumental Dam. When the weekly target is met, no more fish will be retained until the following week. If the hatchery trap is run for steelhead collection and no fall Chinook are needed at the time, the fish will be recycled back to the river. If both fall Chinook and steelhead targets for the week have been met, . The trap will be operated daily to allow detection of PIT tag returns to Lyons Ferry. This will be pass through trapping, only. An array will be installed in the trap flume to detect PIT tagged fish returning to the hatchery. . Refer to Lyons Ferry trapping protocol (**Appendix C**).
Coho salmon are occasionally identified at LFH during fall Chinook trapping and spawning operations. WDFW does not propagate coho salmon in the Snake River, but will contact NPT representatives for proper disposition of these fish. This year, all coho will be returned to the river.

2. Lower Granite Dam

Trapping at LGR may begin as early as August 18 if river water temperatures are less than 70 ^{o} F. Trapping has occurred at a predetermined sampling rate up to 12% of each hour, twenty-four hours per day. Collected fish are divided between the LFH and NPTH (usually 70:30 ratio) as agreed upon annually, with a predetermined hauling schedule shared between both facilities to meet this need. This hauling schedule is adjusted as appropriate. The goal will focus on females in calculating the 70:30 split. The trapping/sampling protocol is described more completely in Appendix B.

C. Spawning

Brood Year 2009

Spawning protocols will be consistent with that listed in the draft SRFMP. Spawning will occur weekly, generally on Tuesdays and Wednesdays, starting the third or fourth week in October. It will continue until late November or early December, as necessary to meet egg-take goals. All recovered CWTs will be read or elastomer tags identified during spawning to ensure separation of LFH origin fish from unknown fish. Origin determinations based on scale analysis will be used for untagged fish. Origin based on genetic determination was used in 2007.

LFH origin fish (determined by CWT, VIE, DNA or scale analysis) will be retained for broodstock. Natural Origin Snake River fish will be incorporated into the broodstock at a target rate of up to 30% (per the SRFMP), provided that this number does not exceed 20% of the natural origin spawning population. Stray (non-LFH origin) hatchery fish as determined by CWT will be culled if not needed by other Columbia Basin hatcheries.

Unless production goals are at risk, all known strays will be culled. Strays may be included in broodstock up to 5%. This limit may be adjusted if necessary to meet production goals and if approved by the co managers. Changes regarding a higher stray rate usage in the broodstock, which may limit the integration efforts, are currently being discussed. If not needed, strays will be destroyed. It is suggested that unmarked/untagged fish from LGR be used preferentially over unmarked fish at LFH, as they are more likely to be of Snake River origin. This action will be examined on an annual basis. It is the intent of WDFW to minimize use of out-of-basin fish in the broodstock.

No fish less than 57 cm will be included in the broodstock. Fork length determinations were adjusted based on size at age of CWT fish recovered in 2008. A proposal to increase the percentage of four and five year old fish in the broodstock to off set the higher harvest rate of these fish in lower river fisheries was agreed upon by all members

Our mating protocol is to minimize hatchery stray incorporation into Lyons Ferry Hatchery broodstock while incorporating potentially as many wild fall Chinook as possible. Mating will occur in a 1 x 1 cross. A mating matrix is listed in Appendix C. Because the spawning population is large (>1,000), increasing genetic diversity is not presently a concern. Males may be split and used on multiple females if needed.

Fertilized eggs will be water hardened for one hour in 100-ppm iodophore, and incubated in vertical stack incubators. Progeny from below-low enzyme linked immunoassay (ELISA) females are used for the yearling programs[1]. Disposition of eggs from females yielding moderate or high titers during ELISA sampling is determined by co-managers as appropriate. These eggs are used for sub-yearling programs, or may be culled. Progeny of females not ELISA sampled are only used for sub-yearlings.

Assuming full production of **Table 56**, IPC will receive 1,053,000 eyed eggs (842,000 for Umatilla Hatchery + 211,000 for Oxbow Hatchery.

ODFW's Irrigon Hatchery will receive up to 421,000 eyed eggs to meet a release goal of 400,000 sub-yearlings into the Grande Ronde River and 345,000 eyed eggs for the USACOE Transportation Study. These transfers are listed in **Table 59**.

There is the potential that surplus Snake River origin adults may be available at the broodstock collection stations once egg take goals have been met. These fish will be returned to the river to continue their upstream migration, or out-planted into natural spawning areas. All LGR origin adults with CWT must be retained for sampling. Adults and jacks released below LGR will be externally marked to ensure they do not compromise run reconstruction efforts at LGR. **Table 58** lists the areas that have been identified for each broodstock facility as suitable for disposition of surplus adults.

[1] See Section **X**. for a description of this criterion.

Table 58. Identified Areas for fall Chinook juvenile and Adult out planting as presented in the June 1, 2006 Draft SRFMP.

Facility	Out plant Locations		
	Adults/jacks	Fry	Sub-yearlings
Lyons Ferry Hatchery	-Tucannon River -Grande Ronde River -Mainstream Snake River	-Tucannon River -Mainstream Snake River near LFH -Mainstream Snake River above LGR	-Mainstream Snake near Captain John Rapids -Big Canyon -Grande Ronde River -Mainstream Snake downstream of Clearwater River
NPTH	-Lower mainstream Clearwater River -South Fork Clearwater River	-Lower mainstream Clearwater River	-Lower mainstream Clearwater River

D. Rearing

Brood Year 2009

Eggs are reared in the vertical incubators, and are treated with formalin to reduce fungus on a daily basis. They are shocked at eye-up around 550 temperature units (TU's), and handpicked shortly thereafter. After eggs are picked, folded Vexar sheets are added to each tray for substrate. Formalin treatments stop just before hatch, and after complete yolk-sac absorption by hatched fry (at around 1900 TU's), they are transferred to raceways for rearing. Head troughs providing well water to the incubators are alarmed, and visual inspections of flow through the trays along with head trough levels are conducted daily.

LFH production fry are moved to outside raceways at ~1,600 fpp. In addition to standard raceways, adult salmon holding raceways are also utilized for sub-yearling fall Chinook rearing. By utilizing these larger ponds, densities in other raceways are dramatically reduced. Chronic Bacterial Gill Disease has occurred in recent years at LFH and is possibly related to significant increases in the LFH program. The Bacterial Gill problem is similar to that encountered during the initial years of operation at LFH, when extremely high numbers of sub-yearlings were programmed. As a result of these density related concerns, the current density index for fall Chinook sub-yearlings at or smaller than 100 fpp hopefully will not exceed 0.09. Density values can increase on a sliding scale to a maximum value of 0.14 for yearlings at 10-12 fpp. These density index goals were developed to improve fish quality and survival.

Yearling fall Chinook are given a 28 day prophylactic treatment using feed treated with erythromycin to reduce the potential for Bacterial Kidney Disease (BKD) outbreaks.

E. Tagging, Transfers, and Releases

Brood Year 2009

In addition to the eyed egg transfers identified in Section D., this section outlines the anticipated sub-yearling and yearling production for BY2009 assuming full production of Table 3. All tagging, transfers, and releases are listed in Table 5.

A total of 200,000 sub-yearlings are 100% coded-wire tagged and adipose fin clipped in April for release from LFH into the Snake River in early June. There will be no additional PIT tags.
Captain John Acclimation Facility receives 500,000 sub-yearlings in May, as does Big Canyon Acclimation Facility, from LFH. Both groups are comprised of 100,000 CWT, 100,000 AD CWT, and 300,000 unmarked fish. Pittsburg Landing will receive 400,000 sub-yearlings in May. This group is comprised of 100,000 CWT, 100,000 AD CWT, and 200,000 unmarked fish. All marking and tagging is completed by WDFW in March and April, prior to transfer. Pit tagging may occur prior to and/or post transfer to acclimation sires. These fish are acclimated and released in June by NPT.

An additional 200,000 sub-yearlings may be direct stream released into the Snake River at Couse Creek, near Captain John Rapids. These fish are part of a study to compare survival of fish released directly versus those acclimated prior to release. We will coordinate with the NPT to assure that the direct release will correspond with the Captain John acclimated release, scheduled for June. All of these fish will be AD-CWT marked and include 3,500 PIT tags slated for bypass study

ODFW will also direct stream release 400,000 sub-yearlings into the Grande Ronde River near the Washington border. This group of fish is identified as priorities 13 & 16 (**Table 57**). They will be transferred to Irrigon Hatchery from LFH as eyed eggs, reared and tagged there, then released into the Grande Ronde River in Washington in early June. 200,000 fish will be AD CWT marked (*priority 13*), and 200,000 will be unmarked and untagged. The co-managers will coordinate exact release location and timing.

A yearling release of 450,000 fish from LFH directly into the Snake River at 10 fpp is programmed for 2011. All of these fish will be marked and/or tagged during September 2010 (half AD+CWT, and half CWT only), and transferred into Lake Two. A portion of these fish may also be PIT tagged (as many as 30,000) at the same time to better estimate escapement of adults through the hydro system to LFH, LGR, and the Tucannon River (**Table 59**). Those fish receiving a PIT tag will not be VIE tagged. Fish will be released over a 4-day period from the rearing pond into the Snake River during the period of April 1-15, 2011, depending on river flows and dam spills . Since all three lakes share a common release structure, the fall Chinook release must be coordinated with steelhead releases.

Three yearling groups of 155,000 will be marked and/or tagged at LFH in September 2010 (AD+CWT; CWT only; and up to 57,000 PIT tags), then transferred to Captain John, Big Canyon, and Pittsburg Landing acclimation sites (at ~ 12 fpp) for final rearing and release by NPT in April 2011 at a target of 10 fpp. Prior to release, NPT staff will PIT tag 4,000 random fish at each site for emigration timing and survival through the hydro-system. This tagging will be coordinated with the COE transportation study. If COE transportation tagging does not occur tagging will be conducted at the acclimation sites. The IPC sub-yearling program for Oxbow and Umatilla receive eggs from Lyons Ferry in January-February. These fish will be reared, marked and tagged in Idaho prior to releases in early June.

Table 59. Proposed BY2009 Snake River fall Chinook tagging, transfers and releases.

Site	Transfer Goal	Release Goal	Size (fpp)	Age	Mark/CWT/ Elastomer	PIT Tags	Transfer/Release Date
Oxbow (IPC)	211,000	200,000	Eyed Eggs	0+	100% AD CWT	10,000	Jan – Feb 2009 (transfer)
Umatilla (IPC)	842,000	800,000	Eyed Eggs	0+	200K AD CWT 600K AD Only	NA	Jan – Feb 2009 (transfer)
DNFH/research	345,200	328,000	Eyed Eggs	0+	Unknown	328,000	Jan – Feb 2009 (transfer)
LFH	200,000	200,000	50	0+	100% AD CWT	-0-	May – Jun 2009

Grande Ronde Direct - Irrigon	421,000	400,000	Eyed Eggs	0+	200K ADCWT 200K Unmarked	-0-	Jan – Feb 2009 (transfer)
Capt. John	500,000	100,000 100,000 300,000	50 50 50	0+ 0+ 0+	CWT Only AD CWT Unmarked	3,500	Mar – Jun 2009
Big Canyon	500,000	100,000 100,000 300,000	50 50 50	0+ 0+ 0+	CWT Only AD CWT Unmarked	3,500	Mar – Jun 2009
Pittsburg Landing	400,000	100,000 100,000 200,000	50 50 50	0+ 0+ 0+	CWT Only AD CWT Unmarked	3,500	Mar – Jun 2009
Direct near Capt. John	200,000	200,000	50	0+	100% AD CWT	3,500	June 2009
LFH	450,000	450,000	10	1+	225K AD CWT 225K CWT Only	27,778	April 2010
Capt. John	155,000	150,000	12	1+	70K AD CWT 80K CWT Only	5,000	Feb - 2010 (transfer)
Pittsburg Landing	155,000	150,000	12	1+	70K AD CWT 80K CWT Only	5,000	Mar - 2010 (transfer)
Big Canyon	155,000	150,000	12	1+	70K AD CWT 80K CWT Only	5,000	Mar - 2010 (transfer)

F. Research

The ACOE has requested up to 345,220 eyed eggs from LFH for use in an in-river/transportation study. The fish will serve as surrogates for natural fish. Eggs for this study may be shipped to Umatilla Hatchery for incubation and rearing. Then transferred to Dworshak National Hatchery for acclimation and release. All of the fish would be PIT tagged prior to release, as funded and contracted by the ACOE. Additionally, the ACOE requested 250,000 per the *USvOR* agreement. PIT-tags will be divided between all sub-yearling production releases in the Snake River basin, acting to represent the hatchery component of the in river/transportation study. The LFH portion of these fish will be PIT tagged at LFH, as contracted and funded by the ACOE, and coordinated with hatchery staff. This is the fourth year of the five-year study.

The co-managers recognize that acclimation prior to release is expected to provide fish performance advantages, however current facility limitations within the basin preclude acclimation of all sub-yearling groups. A direct versus acclimated study is being conducted by the USFWS, WDFW and NPT to scientifically evaluate the merit of direct stream releases of fall Chinook sub-yearlings versus acclimated releases. BY09 will be the fifth year of this five-year direct release study. The study will determine if new acclimation facilities in the Snake River basin should be constructed, or are unnecessary. It compares fish performance between groups of the same size (current release size goal is 50 fish/lb), but reared and released under different conditions. Rearing protocols will conform to standard practices, with a focus on maintaining acceptable growth rates, environmental quality, and fish health. Since the managers agree that fish size is critical to the survival of sub-yearling fall Chinook, size at release will be the primary determinant of release date. Normal acclimation time at CJR is three weeks, and normal release is expected around May 21-25 each year. The acclimation group will be transported to CJR approximately three weeks prior to scheduled release at a projected average size of 75 mm (70 fish/lb). 3,500 PIT tags will be inserted into a random sample of fish within this group prior to release. A second group will be reared at LFH and direct stream released at Couse Creek, just downriver from CJR. They will also have 3,500 randomly inserted PIT tags within this release group. Every effort will be made to meet fish size, and period of acclimation, but the cooperators recognize the potential for early release if fish health will be compromised by environmental or facility conditions. If an early release occurs, the cooperators will coordinate releases as closely as possible.

This study will provide managers with performance comparisons between CJR acclimated and directly released LFH reared sub-yearling fall Chinook including: (1) passage date at LGR, (2) travel time to LGR, (3) survival from release to the tailrace of LGR, (4) growth and condition measured from release to LGR, (5) smolt-to-adult return rates (SAR's) measured from release to LGR, and (6) spawner fidelity to the Snake River. LGR will be the primary evaluation point for accomplishing all of these objectives with the exception of objective 6.

III. TUCANNON SPRING CHINOOK

The Tucannon River Spring Chinook supplementation program is again solely comprised of conventional in-river broodstock sources. Returning adults trapped at the TFH comprise the conventional broodstock component. The conventional release goal was increased to 225,000 beginning with the 2006 brood year, the final brood year progeny from the interim captive brood program were released.

A. Fish on Hand

Brood Year 2008

On September 1, 2009 LFH had an estimated 175,071(BY08) juvenile spring Chinook on hand. These fish will be transferred to TFH in October from LFH, and released as yearlings at 9 fpp and 15 fpp from Curl Lake AP into the Tucannon River in April 2010

B. Tagging, Transfers, and Releases

Brood Year 2008

In September 2009, the BY08 progeny will be 100% CWT/VIE (½ purple and ½ blue non-fluorescent) tagged with no fin clip (**Table 60**). There are 85,353 tagged fish for one group, and 89,700 from the other group. Each size group for the evaluation study were marked with a separate tag code, along with separate colored elastomer tags. The elastomer tags will be helpful to identify the different fish size groups when sampled, prior to release and during migration.

Both fish groups will be transferred to TFH in October for final rearing and release. At TFH, both groups are reared in concrete round ponds or raceways on river water, except when well water is added mid-winter to maintain water temperatures near 40^0 F. Checks for elastomer and CWT retention are conducted prior to transferring the fish to Curl Lake AP in February. For 2009, the target release goal is 85,000 @ 9 fpp & 89,500 @ 15 fpp (174,500 total). All fish will be released from Curl Lake AF in March or April.

For Brood Year 2009, increased PIT tagging may be incorporated while the VIE tags may be reduced or eliminated. PIT tags up to 10,000 for program is proposed.

Table 60. Proposed BY 2008 Tucannon River spring Chinook tagging, transfers and releases.

Site (Type)	BY08 Goal	Expected at release	Size (fpp)	Age	Mark/CWT/ Elastomer	PIT Tags	Transfer/Release Date
Curl Lake AP (Conventional)	112,500	89,500	15	1+	100% CWT VIE	2,500	Mar – Apr 2010
Curl Lake AP (Conventional)	112,500	85,000	9	1+	100% CWTVIE VIE	2,500	Mar – Apr 2010

C. Spawning

Brood Year 2009

The egg take *estimate* for BY2009 is 272,000 green eggs, the program egg take goal. Spring Chinook adults, trapped at TFH were spawned during September 2009 at LFH. A 2 x 2 spawning matrix protocol is followed as approved by WDFW Evaluation staff. Fertilized eggs will be water hardened in 100-ppm iodophore for one hour. All spring Chinook carcasses are frozen after spawning, and hauled to the upper Tucannon River for nutrient enhancement, if viral samples test negative.

D. Rearing

Brood Year 2009

The production estimate for BY2009 is 225,000 smolts. Eggs are treated with formalin daily to reduce fungus and reared in vertical incubation trays. At eye-up, they are shocked, handpicked, and substrate is added to each tray. Upon complete yolk-sac absorption (~1600 fpp), they are transferred to outside raceways for introduction to feed and final rearing at LFH.

A prophylactic aquamycin treatment is used to control BKD. This treatment lasts 28 days, and is typically applied in May and June, through feed with 3.0% aquamycin.

Six intermediate fiberglass tanks were purchased and installed in 2006, giving culturists greater early-rearing space for all programs. This not only reduced densities, it also allows individual spawn groups to be grown together in size before mixing in outside raceways. It also means fish are moved to the raceways at a much larger size, possibly increasing survival to release. Staff also installed an in-line site tube in the venturi vacuum hose, which allows culturists to physically observe the hose to make sure no fish are accidentally vacuumed during routine pond cleaning. Finally, staff have researched various screen seals, and are now using one type for all stocks, proven to be most effective during rearing.

E. Trapping

Brood Year 2010

Trapping for the Spring Chinook broodstock program is conducted exclusively at the TFH adult trap, located just upstream of the hatchery and adjacent to the Rainbow Lake intake. Up to 170 fish (85 wild and 85 hatchery adults) will be collected for broodstock, while remaining adults and one-ocean fish are counted and released upstream. One-ocean age (jacks) fish will be included in the brood at a rate not to exceed 15% of the adult males although this rate may be exceeded during low run years. The discussion to reduce jack passage is ongoing and will be re-evaluated per the HGMP. This increased limit is necessary to meet the release target of 225,000 yearling smolts. WDFW will collect captive broodstock progeny when run size limits endemic and hatchery origin broodstock collection goals. However, their use in broodstock will be limited. The priority will be to collect natural and hatchery origin broodstock to meet program goals. WDFW may also retain all of the adult, ESA-listed, Snake River spring/summer Chinook salmon that return to the Tucannon River Fish Hatchery adult trap each year if the total annual adult returns to the trap is less than 105 fish. If the total annual adult returns to the trap are 105 fish or more, WDFW is authorized to retain up to 70 percent of the adult, ESA-listed, Snake River spring/summer Chinook salmon that return to the trap each year and must release at least 30 percent of the adult, ESA-listed, Snake River spring/summer Chinook salmon that return to the trap above the hatchery trap for natural spawning. Adults collected for spawning are transferred by truck to LFH for holding. All adults are injected in the dorsal sinus at transfer with oxytetracycline and erythromycin. Females only are re-injected with erythromycin every 30 days until spawning begins. Adults will receive formalin treatments every-other day to control fungus and decrease pre-spawning mortality.

F. Research

In an effort to compare returns based on release size, release numbers will be split in half at marking and reared to two different release sizes. For this fourth study year, one group will have a target release size of 9 fpp and the other will be at 15 fpp. Studies and practical experience at other facilities suggests a larger release size may increase survival rates. The need to explore monitoring alternatives on adult movement above Lower Granite Dam to increase the population is being evaluated. Pending discussion with LSRCP, this study may be modified to include increased PIT tags while reducing VIE tags.

Beginning May 1st, 2010, adult fish will be trapped and released at Lyons Ferry utilizing a pass through PIT tag array for monitoring potential success of Tucannon Spring Chinook trapping. The PIT tag data will be shared with the co managers on impacts to other stocks returning to the basin simultaneously. This information should also provide as an option for future trapping of Tucannon Spring Chinook in low return years and to identify adults by-passing the Tucannon River. The trapping activity will be evaluated day-to-day for success and/or potential negative impacts to other stocks.

IV. SUMMER STEELHEAD - GENERAL

The LFC currently uses three stocks of steelhead in the Snake River basin, (LFH, Tucannon, and Wallowa) and two stocks in the Walla-Walla basin (Touchet and LFH). The LFH and Wallowa stocks are both non-endemic stocks that were originally collected from outside their respective release points. The Wallowa stock was originally collected by Oregon Dept of Fish and Wildlife from Lower Snake River dams (likely comprised of both A- and B-run fish from Oregon and Idaho), and then released in the Wallowa River in the Grande Ronde Basin. The LFH stock was derived primarily from a combination of Wells (upper Columbia River) and returning Wallowa stock fish to LFH. The Tucannon and Touchet stocks are both native to their respective streams, though each has had some degree of genetic introgression from the LFH over the years. All of these stocks are collected from a variety of traps located throughout SE Washington (see each stocks description below for specific trapping locations).

The National Marine Fisheries Service's 1999 Biological Opinion ruled that continued use of LFH and Wallowa steelhead stocks constituted jeopardy to listed steelhead populations in the Snake and Columbia rivers. Concerns about within and out-of-basin straying, and swamping of natural populations by these two hatchery stocks, led NMFS to propose the development of endemic broodstocks where possible, and eventual elimination of non-endemic stocks. Following that ruling, WDFW and the co-managers were responsive to the BIOP by initiating endemic broodstock programs in the Tucannon and Touchet rivers, and have since followed with a decrease in production of the LFH and Wallowa steelhead stocks.

Each endemic broodstock program began with the 2000 BY, with the original goal of collecting 16 pairs for spawning. Adjustments have been made to the broodstock collections because fecundity and survival values were higher than originally estimated.

The original evaluation was to utilize adult traps on the Tucannon and Touchet rivers to evaluate the returns and determine success of each program (smolt-to-adult survival rates of the endemic program compared to Lyons Ferry stock releases). However, adult traps have been only partially successful in trapping fish due to high stream flow events. As such, we are now using PIT tags to evaluate each program (smolt-to-adult returns). Anywhere from 8,000 to 10,000 PIT tags have been incorporated into each endemic stock group since 2004. Returns to date from PIT tags indicate that smolt-to-adult survivals to Bonneville Dam of the endemic stock groups have increased (Touchet = 0.45% (2004-2007 release years), Tucannon = 1.0% 2004-2007 release years). We expect the smolt-to-adult survivals to increase in the next year or so as rearing modifications at LFH have enabled the endemic stock fish to be released near program size goals (4.5 fish/lb) for the last 2-3 years. Release size goals were generally not met during the first 3-4 years of the program. Based on the return information to date, WDFW feels there is not enough information available at this time to make an informed decision about stopping the endemic programs or expanding them.

WDFW will commit to be partial organizers for a meeting to address endemic steelhead programs in the LSRCP program in early 2010. At that time, updated HGMPs and WDFW's Steelhead Management Plan for SE Washington will be nearly complete. All of these documents will be critical in determining the future nature of the LSRCP steelhead program in Washington. A summary report of the endemic programs to date will be provided to all co-managers prior to any such meeting.

V. LYONS FERRY SUMMER STEELHEAD

The LFH stock program was initiated to provide sport fishery opportunities for summer steelhead in the Snake River, its tributaries, and also includes off-site mitigation in the Walla-Walla Basin. Releases of the LFH stock into the project area have been very successful and adult returns have been reduced in recent years because of ESA concerns.

A. Fish On Hand

Brood Year 2009

On September 1, 2009 LFH had 348,000 (BY09) LFH stock summer steelhead juveniles on hand. These fish were marked in late August into Lake #1 and will be planted as yearlings into the Snake, Touchet, Tucannon, and Walla-Walla Rivers. The egg take goal was reduced for BY09 to 460,000 eggs (106 females) from 520,000 (121 females) because of the higher egg and fry survival over the previous three seasons.

B. Tagging, Transfers, and Releases

Brood Year 2009

In August, all LFH stock summer steelhead were adipose fin clipped and transferred to Lake One. In mid-winter, some of these fish are transferred back to raceways to receive additional marks or tags, as determined by WDFW evaluation and Fish Management staff (**Table 61**). About 87,000 fish are transferred to Dayton AF in mid-February. They are reared for around 2.5 months, with volitional release into the Touchet River completed by the end of April. In mid-April, 100,000 are trucked to the Walla-Walla River for direct stream release. Also in mid-April, the lower Tucannon River receives 100,000 of these fish by direct stream release. Finally, 60,000 are released from LFH directly into the Snake River in mid-April.

Table 61. Proposed 2009 LFH stock summer steelhead tagging, transfers and releases.

Site	BY09 Goal	Size (fpp)	Age	Mark/CWT/ Elastomer	PIT Tags	Transfer/Release Date
LFH on station release into the Snake River	40,000 20,000	4.5	1+	AD Only ADLV CWT	-0- 1,500	April 2010
Dayton AF release into the Touchet River	65,000 20,000	4.5	1+	AD Only ADLV CWT	-0- 3,500	Transfer to Dayton AF in February, release in April 2010
Direct stream release into the Tucannon River	80,000 20,000	4.5	1+	AD Only ADLV CWT	-0- 3,500	April 2010
Direct stream release into the Walla Walla River	80,000 20,000	4.5	1+	AD Only ADLV CWT	-0- 3,500	April 2010

C. Trapping

Brood Year 2010

The LFH stock adults are trapped on-station from volunteers that swim into the fish ladder. The LFH trapping goal is to operate between 1 September and 15 November, which provides adequate adults for the program. Trapping protocols have been set to collect 1,650 fish (~150 fish/week over the time period cited). Fish are held in large adult holding raceways adjacent to the trap until sorting and spawning. All retained steelhead will be sorted in late November each year. Fish not needed for broodstock or CWT recoveries will be returned to the Snake River for the active fishery. Pending further discussions, an additional 200 fish may be retained for broodstock for replacing the Wallowa stock in the Cottonwood Creek program.

D. Spawning

Spawning will occur in January-February on a weekly basis. Spawning protocol calls for a 2:1 male to female spawner ratio, with each male only being used one time. The intent is to increase the genetic diversity (effective population size N_e) of the hatchery-reared population, and ensure successful fertilization of eggs. Due to lower IHN virus detection and improved egg survival over the past few years, 106 females will be spawned to produce approximately 460,000 green eggs. This amount is lower than previous egg goals of 520,000. Eggs or fry excess to projected program needs will continue to be destroyed or planted as fry in area lakes. All carcasses from spawned fish will be buried on site. All unspawned fish that were retained for broodstock are sacrificed to obtain coded-wire tag or run information.

E. Rearing

After spawning, fertilized eggs are water hardened in 100-ppm iodophore. They are incubated in down-welling incubation buckets (one fish per bucket). After shocking, they are handpicked and weighed down in hatching baskets suspended over shallow troughs. After hatch and swim-up, they are introduced to feed, and transferred to outside raceways at roughly 500 fpp in April. They are reared in these raceways until marking (tagging is completed later) and transferred to Lake # 1.

F. Research

At this time, there is no direct research associated with the LFH stock summer steelhead at the hatchery (i.e. time or size at release studies, growth studies, etc.). However, starting in 2008, all LFH stock release groups received PIT tags (roughly based on proportional release size and expected number of adults returning). Returns from these PIT tags groups will be analyzed separately or as an aggregate to estimate total returns for mitigation accounting purposes. This is partially in response to an anticipated lack of creel personnel in the future to recover CWTs from the summer steelhead fishery.

VI. TOUCHET SUMMER STEELHEAD

The Touchet River summer steelhead is considered an endemic program, meaning all production is derived from natural parentage broodstock. These adults are trapped on the Touchet River at the Dayton AF intake structure and transferred to LFH for holding and spawning. Their progeny are planted in the North Fork of the Touchet River as yearlings each spring.

A. Fish on Hand

Brood Year 2009

On September, 2009, LFH had 59,031 (BY09) Touchet River summer steelhead juveniles on hand. These fish will ultimately be direct stream released into the Touchet River at Baileysburg Bridge, roughly 1.5 miles upstream from the Dayton AF, in April 2010

Brood Year 2008

On September 1, 2009, LFH had 5,688 (BY08) Touchet River summer steelhead 2-year smolts on hand. These fish were retained for a study on survival of 2-year smolts. The fish will be released with Brood Year 2009 smolts into the Touchet River at Baileysburg.

B. Tagging, Transfers, and Releases

Brood Year 2009

In January, all Touchet River endemic stock steelhead are CWT, with no external fin clips. They are reared in the raceways until release in April or May at Baileysburg Bridge on the North Fork of the Touchet River. Prior to release, evaluation staff PIT tags 8,000 fish in this group. This will allow for improved data gathering, as these fish are currently not marked for harvest in the sport fishery. The use of PIT tags is an alternate means to calculate smolt-to-adult survivals for program evaluation

Also, during this tagging event, a portion (~5,000-10,000) of the population will be designated for the two-year smolt program. The number of fish chosen for the program will be based on fork length size distribution of the population just prior to tagging. Fish designated for this program will be rearing in intermediate tanks and circular ponds in the old captive brood rearing enclosure. Approximately 5,000 of these fish will be PIT tagged in the spring of 2011, and released with the one-year smolts from the 2010 brood year.

The BY09 expected at release will likely be around 55,000-60,000 depending on how many are placed into the 2-year program.

Brood Year 2008

In February 2010, the 2-year smolts will receive PIT tags for monitoring survival during migration following release in April. These fish received a separate coded CWT during the tagging event for all Brood Year 2008 in February 2009, for monitoring survival.

C. Trapping

Brood Year 2010

Trapping of BY09 Touchet River endemic stock begins in January or February (depending on seasonal weather) at the Dayton AF adult trap, located adjacent to the pond intake, and is generally completed by mid-April. WDFW evaluation staff checks the trap daily, transferring only a portion of unmarked adults to LFH based on broodstock needs. All trapped LFH stock fish are transferred to Dayton Juvenile Pond to remove them from the river and provide additional fishing opportunities.

Current survival estimates indicate that 15 spawned females should provide enough eggs to meet the smolt production goal. Therefore, WDFW evaluation staff target collecting 16 females and 20 males for the broodstock (natural origin), with all other wild fish passed upstream for natural spawning. Hatchery fish (endemic origin) are passed above the trap to spawn naturally in the Touchet River. We will spawn a minimum of three (3) females, or the progeny will be released as unmarked/untagged fry.

D. Spawning

Based on fecundity survival estimates, LFH typically spawns 15 females to provide 65,000 green eggs for the program. Fish in excess to the interim program smolt goals (maximum 50,000 smolts) will be planted into the Touchet River as fingerlings in the fall. Spawning usually occurs in March and April. A Matrix type spawning protocol is employed to increase the effective breeder population (N_b), due to the relatively small founding population for this program. The intent of this protocol is to spawn two males with each female, increasing genetic diversity and successful fertilization of eggs. If not enough males are ripe to achieve this goal; 1:1 spawning is employed. A minimum of three spawned females are needed for each production cycle to occur.

E. Rearing

After spawning, fertilized eggs are water hardened in 100-ppm iodophore. They are incubated in down-welling incubation buckets (one fish per bucket). After shocking, they are handpicked and weighed down in hatching baskets suspended over shallow troughs. After hatch and swim-up, they are introduced to feed, and transferred to intermediate raceways at around 500 fpp in June. They are transferred again to outside raceways at roughly 200 fpp in July. In January, these fish will be size selected into three rearing groups (larges, smalls, and two-year – see below in Research). By sorting into different size groups, culturists can adjust growth rates to minimize size variance at release. Additionally, a number of non-traditional fish culture techniques are being employed on this stock to ensure release size goals are met.

F. Research

Over the last few years, evaluation staff have annually PIT tagged portions of the Touchet River endemic stock group (by size) prior to release. PIT tags are being used to document smolt-to-adult survival rates. Results to data show that the group that is released per program goals and release time, have survived nearly twice the rate as those released later and sometimes at a smaller size. This, and trapping data, suggests this could be a continual problem in the Touchet River stock. As such, a proposal to conduct a two-year smolt program on a portion of the population to see if they can survive better was implemented for Brood Year 2009. The study proposes to again retain 10-20% of the 2009 population, as was performed for the Brood Year 2008 population. These fish will again be reared in other rearing containers currently not being used for the other priority stocks at LFH. This will be the second of three years initially proposed for research, and will continue to PIT tag both one and two-year smolt programs for the comparison.

VII. TUCANNON SUMMER STEELHEAD

The Tucannon River summer steelhead is considered an endemic program, meaning all production is derived from natural parentage. The adults for this program are collected at a temporary trap on the lower Tucannon River or from Tucannon FH, and their progeny planted in the upper Tucannon River as yearlings.

A. Fish on Hand

Brood Year 2009

On September 1, 2009, 59,417 (BY09) Tucannon River summer steelhead juveniles were on hand at LFH. The program goal is 50,000 smolts released. The BY09 production increased from BY08 in part to increased trapping success at the Rainbow Lake intake trap. A new structure was built by hatchery staff for deterring adults from jumping the sheet pile adjacent to the fish ladder. Clear vinyl panels were hung on a moveable aluminum cross beam four feet above the sheet pile cap. This diversion structure contributed to the increased success of adult steelhead trapping for Brood Year 2009, with hopes for future success in meeting program goals.

Following the low return of Brood Year 2008, managers agreed that should low production numbers (i.e. less than 8,000 fish at smolt release, ~3 females at trapping) occur in the future, the fish will not be reared full term, but released as parr/fingerlings in the upper Tucannon River. Less than 8,000 fish production would not allow enough fish for evaluations to occur. .

Because in-hatchery survival of endemic origin fish is unknown, up to 75,000 smolts may be released in any given year. If greater than 75,000 smolts are anticipated for production, up to 25,000 fingerlings could be released into the upper Tucannon River basin in the fall before normal migration.

B. Tagging, Transfers, and Releases

In September, all Tucannon River endemic steelhead are CWT tagged, with no external fin clips at LFH (Table 10). In February of 2010, these fish are moved to the TFH. They are reared there until release as yearlings in April or early May. Releases have been roughly five miles upstream of the TFH, at or near Camp Wooten. Prior to release, evaluation staff will PIT tag 8,000 fish in this group. This will allow for improved data gathering because these fish are currently not marked for harvest in the sport fishery. The use of PIT tags is an alternative means to calculate smolt-to-adult survivals for program evaluation. Refer to **Table 62** for BY09 goal.

Table 62. Proposed BY 2009 Tucannon River summer steelhead tagging, transfers and releases.

Site	BY09 Goal	Expected at release	Size (fpp)	Age	Mark/CWT/ Elastomer	PIT Tags	Transfer/Release Date
Tucannon River	50,000	60,000	4.5	1+	100% CWT	***8,000***	April 2010

C. Trapping

Brood Year 2010

Current survival estimates indicate that 13 spawned females should provide enough eggs to meet the smolt production goal. Therefore, we will collect 15 females and 21 males (natural origin) for the broodstock. As in the past, all hatchery origin fish (LFH stock) collected at the TFH adult trap will not be passed upstream. Instead they will be marked and released downstream (or taken back downriver below Marengo if the lower trap is moved upstream) to spawn naturally. All endemic and wild fish captured at the TFH will be passed upstream for natural spawning.

D. Spawning

The number of eggs per female is approximately 5,600. Based on fecundity, survival estimates, and potential IHN positive females, LFH typically spawns 15 females to provide 84,000 green eggs for the program. Spawning has occurred from February to early April. Matrix spawning is employed, due to the relatively small founding population for this program. The intent of this protocol is to spawn two males with each female, increasing genetic diversity and helping ensure successful fertilization of eggs. If not enough males are ripe to achieve this goal; a 1:1 spawning matrix is employed. As stated above, a minimum of 3 females spawned is needed to continue with production for that year.

E. Rearing

After spawning, fertilized eggs are water hardened in 100-ppm iodophore. They are incubated in down-welling incubation buckets (one fish per bucket). After shocking, they are handpicked and weighed down in hatching baskets suspended over shallow troughs. After hatch and swim-up, they are introduced to feed, and transferred to intermediate raceways at around 500 fpp in June. They are transferred again to outside raceways at roughly 200 fpp in July. In September, they are size-selected during marking and split into two raceways. By sorting into two size groups, culturists can adjust growth rates to minimize size variance at release. Additionally, a number of non-traditional fish culture techniques are being employed on this stock to ensure release size goals are met.

F. Research

At this time, there is no direct research associated with the Tucannon River endemic stock summer steelhead at the hatchery (i.e. time or size at release studies, growth studies, etc..). As indicated above, PIT tags along with a CWTs, will give us juvenile migration and SAR data. Other research/monitoring activities are centered on the adult trap (passage issues, location of trap), and getting age composition data from the wild fish.

VIII. WALLOWA SUMMER STEELHEAD

The Wallowa stock program was initiated to provide a fishery for summer steelhead in the Grande Ronde River (for both Oregon and Washington anglers). It has been an extremely successful program in that regard, and adult returns have warranted a program reduction from a 250,000 yearling release goal to the current program of 160,000 yearlings. Due to successful SAR survival, another program reduction may be an option to reduce the number of excess returning adults.

A. Fish on Hand

Brood Year 2009

On September 1, 2009 LFH had 166,074 (BY09) Wallowa stock summer steelhead juveniles on hand. Due to high levels of IHN positive females spawned at Cottonwood Creek (54%), 40,000 eyed eggs from the Wallowa Hatchery were transferred to LFH in early May for meeting program goals. All of these fish will be marked and moved to Lake Three in early September. In early February 2010, these fish will be transferred to the Cottonwood AF. After acclimation at the Cottonwood AF, they are released as yearlings at 4.5 fpp into the Grande Ronde River in April.

B. Tagging, Transfers, and Releases

Brood Year 2009

In September 2009, these fish were all adipose fin clipped, and 20,000 will receive left ventral clips and a coded wire tag. (**Table 63**). After marking and tagging, they are transferred to Lake #3 at the LFH. In February, they are transferred to the Cottonwood AF for final rearing and release into the Grande Ronde River. A total of 6,000 juveniles will be PIT tagged prior to release in April, 2,000 of those PIT tags will be used as part of the Comparative Survival Study (CSS) for steelhead production above Lower Granite Dam. (Fish Passage Center).

Table 63. Proposed BY 2009 Wallowa stock summer steelhead tagging, transfers and releases.

Site	BY08 Goal	Expected at release	Size (fpp)	Age	Mark/CWT/ Elastomer	PIT Tags	Transfer/Release Date
Cottonwood AF on the Grande Ronde River	140,000 20,000	150,000 20,000	4.5	1+	AD Only ADLV CWT	-0- 4,000 + 2,000	Transfer to Cottonwood AF in Feb, release in April 2010 2,000 PIT tags are part of the CSS study from the Fish Passage Center

C. Trapping

Brood Year 2010

Trapping of returning Wallowa stock adults occurs on Cottonwood Creek (a small tributary to the Grande Ronde River) beginning in March each year. This creek also supplies water to the Cottonwood AF. Trapping occurs from March through April. Because of potential low egg survival and/or IHN virus (both of which have been experienced in the past), about 50 complete spawned females are needed to provide 220,000 green eggs for the program of 160,000 smolts. The preference will be to half-spawn 100 females if adult returns are available. This will provide for better genetic variability. Unmarked steelhead are not retained for spawning, but passed upstream to spawn naturally**.** All spawned carcasses will be taken above the trap in Cottonwood Creek and scattered for nutrient enhancement, or returned to LFH to be buried. If low water flows in the creek do not allow returning adults access to the trap, two alternate strategies may be employed. First, the acclimation pond outlet creek can be modified to allow adult capture there. Surplus hatchery origin adults may be removed from the creek at the trap to reduce the potential impacts of IHN to the spawning population and to juvenile hatchery fish being held in the AF.

Pending further discussions, surplus adults and adult passage will be addressed prior to commencing trapping.

A proposal to kill all marked, un-spawned surplus fish for BY10 may be implemented by AOP committee following release of this report. Any unmarked fish will continue to be passed upstream.

D. Spawning

Spawning generally occurs in late March and early April on a weekly basis. All fish are spawned at the Cottonwood Creek trap site, with the gametes transported to LFH for fertilization, incubation, and rearing. A 1:1 male to female mating ratio will continue to be employed whenever possible (see research section below). Second, excess adults from ODFW’s Wallowa Hatchery may be used to provide eggs for this program, as occurred in 2005 and 2009. Eggs/fry excess to projected program needs will be destroyed or planted in area lakes.

E. Rearing

After spawning, fertilized eggs are water hardened in 100-ppm iodophore. They are incubated in down-welling incubation buckets (one fish per bucket). After shocking, they are handpicked and weighed down in hatching baskets suspended over shallow troughs. After hatch and swim-up, they are introduced to feed, and transferred to outside raceways at roughly 500 fpp in June.

F. Research

For the last four years, evaluation staff has conducted a study examining the effect of partially spawning females in the broodstock. Data collected in 2009 were similar to previous years, with the majority (85%) of partially spawned fish depositing their eggs in the stream post release. This compares to 87% in 2006, 75% in 2007 and 67% in 2008. A final summary report from all four years is expected to be complete in the coming year. 2009 was the final year of the study.

IX. SPOKANE AND KAMLOOPS RAINBOW TROUT

Rainbow trout are reared and planted in both southeast Washington and Idaho, to meet LSRCP mitigation goals in both states for lost fishing opportunity as a result of construction and operation of the lower Snake River dams. A small State funded program at the TFH rears rainbow to1½ pounds each, providing a unique fishing opportunity in local lakes.

A. Fish on Hand

Brood Year 2008

On September 1, 2009 LFH and TFH had a combined total of 240,285 Spokane stock rainbow trout on hand. LFH also had 53,585 triploid Kamloops stock rainbow trout on hand. These fish, marked in late August, will be shipped to IDF&G in October 2009.

B. Tagging, Transfers, and Releases

In past years, LFH received approximately 52,000 Kamloops stock rainbow trout from TFH in July of each year, as mentioned above. They are reared in raceways until August or September, when they are adipose fin clipped and either a right or left ventral fin clipped (alternating years –

Table 64). In October, IDFG transports and plants the entire population (usually around 50,000 fish) in Idaho Rivers, at 15 fpp. For 2010, a reduction in the program of 50,000 fingerlings to 13,200 catchables or 3,300 jumbos at the current pounds of production has been proposed. The outplants into the Clearwater basin will be discontinued by Idaho due to a lack of creel data supporting the program. A decision on fish stock and production for Idaho was not reached at the time of this AOP.

No Spokane stock rainbow trout are tagged or fin clipped at LFH. From the raceways, IDFG receives 160,000 fry and transports these fish to designated Idaho waters in April or May, at around 60-80 fpp (

Table 65). About 97,500 Spokane stock rainbow trout catchables (2.5 fpp) and 1,000 jumbos (1.5 lbs each) are planted by LFH drivers into various lakes in southeast Washington. Planting begins in February and is completed in March. In 2009, the total catchable plant allotment was reduced by 1,700 (approx. 97,500 total) and the jumbo plant allotment was increased by 500 (1,000 total)**.**

At the TFH, approximately 137,400 Spokane stock rainbow trout are planted into various lakes in southeast Washington as catchables. Planting typically begins in April, and is completed sometime in July. The jumbo trout (usually around 4,100) are planted February through May each year, supplementing catchable plants.

Table 64. 2009 Kamloops rainbow trout tagging, transfers and releases.

Site	Number	Size (fpp)	Age	Mark/CWT/ Elastomer	PIT Tags	Transfer/Release Date
Idaho Rivers	50,000	15	0+	ADLV or ADRV	None	Transfer to and planted by IDFG October 2009

Table 65. 2009 Spokane rainbow trout tagging, transfers and releases.

Site	Number	Size (fpp)	Age	Mark/CWT/Elastomer	Pit Tags	Transfer/release Date
Idaho Reservoirs	160,000	60 – 80	0+	None	None	Transfer to and planted by IDFG in April/May 2010
SE Washington Lakes	234,935 1,000	2.5 – 4 1	1+ 1+	None None	None None	Planted in February through July 2010
SE Washington Lakes	4,500 200	1.5 lbs ea 3.0 / fpp	1+	None	None	Planted in February through May 2010

C. Rearing

Eggs for Washington's legal and jumbo programs, along with Idaho's fry plants come from WDFW's Spokane Hatchery (Spokane stock). After receiving these eggs in December and January, a small portion (1,750) is transferred from TFH to regional education programs. Eggs for Idaho's fingerling program are Kamloops stock, from IDFG's Hayspur Hatchery. These eggs are shipped to the TFH in January each year.

180,000 eyed rainbow eggs are received at LFH in December for Idaho fry plants in May. After trough rearing, they are transferred to outside standard raceways in March. 140,000 Spokane eyed rainbow eggs, destined as catchables and jumbos, are received at LFH in January. This number was increased in 2009 due to recent years of fry loss due to cold-water disease in the stock. Early rearing is conducted in either shallow troughs or intermediate raceways, before transfer to outside standard raceways in April. The following year, they are planted at roughly 3 fpp into local southeast Washington lakes, usually in February and March.

175,000 eyed rainbow eggs (Spokane stock) are received at the TFH in January each year. Of these, 141,000 are destined for planting as catchables(3.5 fpp – 137,500 planting goal), and 500 are destined for planting as jumbos (1.5 pounds each – 4,000 planting goal). The legal program group is started in shallow troughs, intermediate reared in outside round tanks, and final reared in the earthen rearing pond. The jumbos start in shallow troughs as well, and finish in the round tanks. The entire jumbo program is funded by WDFW.

65,000 Kamloops eyed rainbow eggs are received at the TFH in January. After initial rearing in troughs, they are transferred to outside circular tanks for intermediate rearing. In late June, at 75 fpp, they are transferred to LFH for marking and final rearing.

X. FISH HEALTH

A. Guiding Policies

All fish production at LFH is conducted according to the co-managers Salmonid Disease Control Policy and Integrated Hatchery Operations Team (IHOT) fish health policy. Specifically, all lots of fish are monitored for fish health, all broodstock are inspected annually, strict hatchery sanitation procedures and fish culture practices (rearing criteria) are followed, and egg and fish transfer and release requirements are met. Bacterial Kidney Disease (BKD) management strategies for spring and fall Chinook salmon and Infectious Hematopoietic Necrosis (IHN) management strategies for steelhead trout stocks are employed. No management strategy for BKD specific to spring

Chinook is currently employed within the LFC. 1,054 adults sampled in 2007.

Currently, IHN in Chinook salmon is not a concern at LFH. The strains of IHN found in the Columbia River Basin have been problematic for sockeye, steelhead and rainbow trout, but not for Chinook salmon. Therefore, standard hatchery practices of egg disinfection and use of pathogen-free rearing water during early rearing have been sufficient fish health measures.

The fish health specialist will respond to all fish disease outbreaks at the request of the fish hatchery staff.

B. Monitoring

The fish health specialist will visit LFH and TFH at least once a month. Mortality records and fish in all rearing containers will be inspected. Approximately 5 - 10 fish of each species may be killed and examined at the discretion of the fish health specialist.

At spawning, all broodstock will be tested for viral pathogens. Ovarian fluid and kidney/spleen samples from at least 60 females will be tested.

C. Specific Fish Health Management

1. BKD Management – Fall Chinook

All female fall Chinook broodstock will receive a pre-spawning injection with erythromycin.
All females for use in the yearling production, the IPC program and any others slated for out of state transport will be tested for BKD via ELISA. WDFW categorizes BKD-ELISA optical densities as follows:

- Below-low = < 0.11,
- Low = 0.11 to 0.199,
- Moderate = 0.20 to 0.44,
- High = 0.45 or greater.

Progeny of negative (below low) females will be selected for the yearling fall Chinook program. Eggs from below low and low females will be selected for shipment to Idaho and Oregon. Progeny of all low, moderate and high BKD-ELISA females and untested females may be utilized in the sub-yearling fall Chinook program.

All yearling fall Chinook fry will receive one 28 day Aquamycin feeding in late spring.

2. BKD Management – Spring Chinook

All female fall Chinook broodstock will receive a pre-spawning injection with erythromycin. All female spring Chinook will be tested for BKD using ELISA assay. No segregation or culling will occur.

Spring Chinook fry will receive one 28 day Aquamycin feeding in late spring.

3. IHN Management – Summer Steelhead

All female steelhead broodstock will be tested for IHN virus via cell culture, and the IHN virus levels in the ovarian fluid will be determined.
Eggs from LFH and Wallowa stock females with high levels of IHN virus ($>10^3$) will be destroyed. Eggs from negative and low IHN virus (10^1 to 10^3) females will be reared separately.

Eggs from the Tucannon and Touchet endemic programs with high levels of IHN virus ($>10^3$) may be destroyed, reared separately, or planted into their respective streams as fry, pending agreement among the co-managers. Eggs from negative and low IHN virus (10^1 to 10^3) females will be reared separately.

If IHN outbreaks occur in any fish-rearing vessel, fish from the affected rearing container will be promptly isolated and may be destroyed.

4. Broodstock and Egg Fungus Management

All Chinook and steelhead broodstocks will be treated with formalin every other day to control external fungus. All eggs will be treated with formalin daily to control fungus. Treatments will be started 24 hours after fertilization. Treatment of Chinook eggs will halt at 7 days before hatch. Steelhead egg treatments will stop when the eggs are transferred to baskets for hatching.
Rainbow trout are received eyed and are not treated with formalin.

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XI. COMMUNICATION

The list of people on the following table (**Table 13**) are either directly involved in the operation of the LFC, or in related programs and facilities.

Table 66. Contact List.

Name	Agency	Position	Phone	E-mail
Policy				
Pete Hassemer	IDFG	Anadromous Coordinator	208-334-3791	phassemer@idfg.state.id.us
Craig Burley	WDFW	Anadromous Program Mgr	360-902-2784	BURLECCB@dfw.wa.gov
Dave Johnson	NPT	Fisheries Dept. Manager	208-843-7320 Ext 2442	davej@nezperce.org
Gary James	CTUIR	Fisheries Program Mgr.	541-276-4109	garyjmes@ctuir.com
Production				
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Appendix A: 2010 Requests for Fall Chinook Production Fish/Eggs ***(2010 Brood year)***

2008-2017 USvOR	Priority under USvOR	Who	Release site	Age	# for release	transfer	Survival to release or transfer (revised 8/17/10)	Expanded for loss prior release (1/F)	Estim # green eggs to meet priority	SRL Calcs	Total estim eggtake which will cover needs through this priority
1	1	WDFW	onstation	yearlings	450,000		91.1%	1.09800	494,098	91.1% mean survival, 2005-2008BY	494,098
4	4	NPT	CJ	yearlings	150,000	155,000	91.1%	1.09800	164,699	80.9% mean survival, 2004-2000BY	988,197
3	3	NPT	BC	yearlings	150,000	155,000	91.1%	1.09800	164,699		823,497
2	2	NPT	PIT	yearlings	150,000	155,000	91.1%	1.09800	164,699		658,798
				900,000						988,197	
5	5	WDFW	onstation	subs	200,000		94.5%	1.05770	211,539	94.5% mean survival, 2005-2008BY	1,199,736
6	6	NPT	CJ	subs	500,000	507,143	94.5%	1.05770	528,849	91.2% mean survival, 2004-2000BY	1,728,585
7	7	NPT	BC	subs	500,000	507,143	94.5%	1.05770	528,849	divided 20K b/t FCAP to acct	2,257,433
11	11	WDFW	CCD	subs	200,000		94.5%	1.05770	211,539	for loss from transfer to rel	3,111,159
8	8	NPT	PIT	subs	200,000	202,857	94.5%	1.05770	211,539		2,468,973
10	10	NPT	PIT	subs	200,000	202,857	94.5%	1.05770	211,539		2,899,619
				1,800,000						1,903,855	
12	12	DNFH/Irrigon	Transport	eyed eggs	250,000	263,125	96.3%	1.03842	273,235	96.3% mean survival, 2006-2009BY	3,384,393
13	13	WDFW/Irrigon	GRRI	eyed eggs	200,000	210,500	96.3%	1.03842	218,588	4.99% eye-rel loss	3,602,981
16	16	WDFW/Irrigon	GRRI	eyed eggs	200,000	210,500	96.3%	1.03842	218,588	4.99% eye-rel loss	4,125,406
14	14	DNFH/Irrigon	Transport	eyed eggs	78,000	82,095	96.3%	1.03842	85,249	4.99% eye-rel loss	3,688,230
9	9	IPC-Oxbow	HC Dam	eyed eggs	200,000	211,000	96.3%	1.03842	219,107	5.2% eye-rel loss	2,688,080
15	15	IPC-Umatilla	HC Dam	eyed eggs	200,000	210,500	96.3%	1.03842	218,588	4.99% eye-rel loss	3,906,818
17	17	IPC-Umatilla	HC Dam	eyed eggs	600,000	631,500	96.3%	1.03842	655,763	4.99% eye-rel loss	4,781,169
				1,728,000						1,889,117	
				4,428,000	**released**				**4,781,169**	**green eggs to meet needs through priority 17**	

Appendix B: 2010 Fall Chinook Trapping/Sampling Protocol

by

Debbie Milks, WDFW
Bill Arnsberg, NPT
August 20, 2010

Executive summary:

The trapping rate will be set at 12%. The gates will open for 1.8 minutes, 4 times/hour.

The tagging/sampling protocol for broodstock shipped to LFH and NPTH will be the same.

If the trap is swamped with fish: Shut down trap for an hour or so but clearly identify in the data when the trap was shut down and when it was started up again. Do not shut down and stay shut down for the rest of the day because we need to have a pre and post shut down sample so we can average them to estimate what passed during the shutdown.

WDFW is providing 2 staff for helping with the broodstock collection activities at LGR. Scales sampled at the LGR Trap for LFH and NPTH broodstock will be mounted by WDFW staff at LGR.

Data collected from spring/summer chinook should be put on the same form that is used for FCH. Please note Spring or Summer under comments. If you are getting jacks suspected of being summers we will need to subsample those fish for wires as well.

Males, jacks and minijacks will all be entered on the data forms as males.

In an effort to reduce the numbers of jills and jacks hauled to the hatcheries and to reduce the numbers of fish sacrificed with wire for run reconstruction purposes the following protocol was approved by co-managers in the basin on 8/17/2010. The sub-sampling of wire tagged fish should allow for ample recoveries for evaluation purposes.

Protocol:

1) COLLECT & HAUL: All WIRE TAGGED FCH ≥ 65 cm and every fifth wire tagged FCH < 65cm. Please give 2-ROP punches. Please keep fish <65cm in a tank separate from the larger fish. ALL of these fish will be hauled to LFH.

2) PASS: 4 out 5 WIRE TAGGED FCH <65 cm regardless of sex (even females). Please give 2-LOP punch.

3) COLLECT & HAUL: ALL untagged FCH ≥65 cm. Please give 2-ROP punch. Take scales on every third untagged fish that does not have a PIT tag until September 28 then increase the sampling to 100%.

4) PASS: ALL untagged FCH <65. Please give 2-LOP punch. Take scales on every female and take scales on 1 out of 3 males that do not have a PIT tag.

Note: Overall numbers of scales collected should be similar to what was collected in 2009.
If the trapping rate changes, the numbers of operculum punches will be reduced to 1-ROP for hauled fish and 1-LOP for released fish.

More detailed information regarding trapping/sampling:

1) Trapping at LGR Dam
    a. Trapping/Sampling Protocol based upon water temperature in the ladder at the beginning of the day.

i. Begin trapping August 18 if temperatures allow
ii. Water temps at or below 70^{o} F
    1. Set automatic trapping gates to sample 12% of the entire run, 24 hours a day
        a. Any fish that are retained for broodstock must receive 2-ROP. If a fish to be retained is accidentally punched on the left side, give 1-ROP also and make a note in the comments column.
        b. Any fish released must receive 2-LOP and be scale sampled according to protocols listed above. Place scales in an envelope then mount them on cards for age and origin determinations. Please give the filled cards to the WDFW truck driver and we will mail them in for analysis. Please do this bi-monthly to expedite data results.
        c. If these fish (with operculum punches) are caught again DO NOT scale sample, but enter in data as recapture.

b. Data and Verification
    i. Please note the times you check the trap and when the trap is empty (you are caught up).
    ii. Please write hauling destination (LFH or NPTH) on top of each data form)
    iii. Circle sampling or data recording errors and briefly note in comments column (examples: released with 1-ROP, forgot to scale sample, both sides punched, forgot to record or missing digit in PITTag, sample envelope numbers either out of numerical order or skipped for some reason).
    iv. Briefly check over data forms prior to faxing, sometimes erasures and cross-outs are not transmitted clearly through the fax machine.

c. Hauling of broodstock
    i. Injections at LGR Adult Trap
        1. All fish collected for broodstock (both LFH and NPTH) will be injected as directed by hatchery staff.
    ii. WDFW and NPT will haul fish from LGR Dam (70% go to LFH and 30% go to NPTH).
        1. Fish will be divided weekly unless otherwise agreed to.
        2. It was agreed that trucks would be at LGR at 10am when the 70 degree protocol was in effect.

d. Research
        1. No U of I radio tagging this year.
        2. NOAA sort-by-code fish.
            a. These fish will be used as broodstock at LFH and NPTH.
            b. Doug Marsh will run a program to indicate which fish were trapped during the 12% and which fish were outside of the trapping period (sort-by-code)
            c. Doug will provide a sampling protocol for his fish. These fish may be used for broodstock.
            d. NOAA staff will be in charge of mounting scales collected for NOAA studies

e. Coordination of trapping data and CWT decoding of hauled fish
    i. Fax paper copy of data to LFH, NPT, and SRL daily or whenever fish are hauled.
    ii. Data entry, verification, and finalization by January 14.
        1. WDFW will enter, verify, and finalize the LGR Adult Trap trapping data.
    iii. All database files at seasons end must be sent to NPT (Bill Arnsberg), WDFW (Debbie Milks), and TAC (Stuart Ellis and Henry Yuen).

f. Video monitoring of sort-by-code fish
    i. No video monitoring in 2010
    ii. At seasons end Doug Marsh will let us know what the realized trap rate was for the season (set at 12% then adjusted for time gates left open for sbyc fish)

Appendix C: 2010 Trapping/Sorting Protocol at LFH

2010 Trapping at LFH

Trap 20 fish less than 75cm and 20 fish ≥ 75 on 9/14/2010 to determine sex ratio and composition of males.
Tally females by length and return to pond.
Tally males and kill males with wire to determine age.

Begin trapping the third week of September (9/20/2010) for broodstock.
Schedule will be determined based on run comp of fish sampled on 9/14 /2010.

FCH
71 cm or greater
-goal is 1027 fish (228 females)
-should have 25% of females by October 6 at sorting
49 -71 cm
-Collect 200 fish
-goal is to get sex comp for fish in this size range
-We are using this size range to allow us to detect onstation sub-yearlings because they were not PIT tagged like the yearlings.
<49cm:
-Do not trap any.
We will use PIT tag detections to estimate yearling return of BY08 fish. Since the return in minijacks is primarily (99%) onstation yearlings this will cover our data needs.

2010 Sorting Plan

LGR pond:

Work the LGR Pond containing fish ≥65cm "bigs"

Count females, males
Double check number and side of operculum punches
For fish that do not have 2-ROP:
Give 2-ROP punch and make note of sex, clips, wire of that fish, and what operculum punches they had.

Work the LGR Pond containing fish <65 cm "smalls"

Count females and males
Sacrifice 30 males with wire to determine age at return by fork length
Double check number and side of operculum punches
For fish that do not have 2-ROP:
Give 2-ROP punch and make note of sex, clips, wire of that fish, and what operculum punches they had.

LFH pond:
This pond has a different size category because the composition at return is primarily yearlings consisting of larger sized jacks.

Count females, males (≥ 71 cm), females and males (<71cm)
Sacrifice 20 males (<71cm) with wire to determine age at return by fork length.

Appendix D: 2010 Mating Matrix for Spawning at LFH **(2010 Brood year)**

Volunteers

LF female	→	LF male
	→	AD only male
AD only female	→	AD only male
	→	LF male
unm/untag female	→	**unm/untag male**
wire tagged stray female	→	**Kill outright**
LOST tag (no VIE) female	→	LF male
	→	AD only male

LGR

LF female	→	LF male
	→	AD only male
AD only female	→	AD only male
	→	LF male
unm/untag female	→	unm/untag male
	→	AD only male
	→	LF male
wire tagged stray female	→	**Kill outright**
LOST tag (no VIE) female	→	LF male
	→	AD only male

Incorporate jacks (1salts) in broodstock up to 15%. A single jack will only be used on one female (the female must be and adult)
Jills will be mated with an adult male (2 salt or greater). Progeny of jills may be culled later in the season if production goals can be met with older aged females.

Consider 75cm males adults to begin with then adjust as data dictates
Split age 4 and 5 males(verified by CWT) and use on 3-4 females (make sure one of the females is and older aged fish)

Sub-yearling males will be designated and used preferentially over yearlings if possible.

Culling fish to reduce strays:

wire tagged STRAYS (LGR and LFH trapped)

Appendix E: BY 2010 Fall Chinook Pit Tag Allocation (*US vs Oregon* agreement)

Table 1. Summary of PIT tag allocation in release year 2010 Snake River fall Chinook salmon hatchery production. Based on sample sizes of 250,000 tags for sub-yearling and 328,000 tags for surrogates. Applies 2008-2017 US vs Oregon Agreement Table B4B, a 46/54 split of sub-yearling tags, and a 50/50 split of surrogate tags to T0 and C1 passage routes.

Priority	Production Program						Tagging Timeframe (tagging at rearing facilities)	Release numbers upstream of Lower Granite available for PIT tagging		Tagging Lead / Uploading
								Sub-yearlings	3,400,000	
					PIT Tag #'s	PIT Tag #'s		Yearlings	450,000	
	Rearing Facility	Number	Age	Release Location(s)	Transport if Collected	Bypass if Collected		Sub-yearling Sample Size	250,000	
					TIC	BIC		250,000 and 46 / 54 split		
1	Lyons Ferry	450,000	1+	On station	30,000	0	Aug. 23-27, 2010	**30,000**		WDFW/WDFW
2	Lyons Ferry	150,000	1+	Pittsburg Landing	15,000	4,000	January 30-31	**19,000**		BIOMARK/NPT
3	Lyons Ferry	150,000	1+	Big Canyon	15,000	4,000	January 29-30	**19,000**		BIOMARK/NPT
4	Lyons Ferry	150,000	1+	Captain John Rapids	15,000	4,000	January 28-29	**19,000**		BIOMARK/NPT
5	Lyons Ferry	200,000	0+	On station	0	0	Early to mid-April	**0**		WDFW/WDFW
6	Lyons Ferry	500,000	0+	Captain John Rapids	16,912	19,853	Early to mid-April	**36,765**		BIOMARK?/NPT
7	Lyons Ferry	500,000	0+	Big Canyon	16,912	19,853	Early to mid-April	**36,765**		BIOMARK?/NPT
8	Lyons Ferry	200,000	0+	Pittsburg Landing	6,765	7,941	Early to mid-April	**14,706**		BIOMARK?/NPT
9	Oxbow	200,000	0+	Hells Canyon Dam	6,765	7,941	Early to mid-April	**14,706**		IPC-IDFG/IDFG
10	Lyons Ferry	200,000	0+	Pittsburg Landing	6,765	7,941	Early to mid-April	**14,706**		BIOMARK?/NPT
11	Lyons Ferry	200,000	0+	Direct stream evaluation Near Captain John Rapids	6,765	7,941	Early to mid-April	**14,706**		BIOMARK?-WDFW?/NPT/WDFW
12	DNFH/Umatilla	250,000	0+	Transportation Study[a]	125,000	125,000	Late May -early June	**250,000**		BIOMARK?/NOAA
13	Irrigon	200,000	0+	Grande Ronde River	6,765	7,941	Early to mid-April	**14,706**		BIOMARK?-WDFW?/NPT?WDFW?
14	DNFH/Umatilla	78,000	0+	Transportation Study[a]	39,000	39,000	Late June-July	**78,000**		BIOMARK?/NOAA
15	Umatilla	200,000	0+	Hells Canyon Dam	6,765	7,941	Early to mid-April	**14,706**		BIOMARK?/NPT
16	Irrigon	200,000	0+	Grande Ronde River	6,765	7,941	Early to mid-April	**14,706**		BIOMARK?-WDFW?/NPT?WDFW?
17	Umatilla	600,000	0+	Hells Canyon Dam	20,294	23,824	Early to mid-April	**44,118**		BIOMARK?/NPT
NPTH 1	NPTH	500,000	0+	NPTH	0	3,000	April-May	**3,000**		NPT/NPT
NPTH 2	NPTH	200,000	0+	Lukes Gulch	6,765	7,941	April- May	**14,706**		NPT/NPT
NPTH 2	NPTH	200,000	0+	Ceder Flats	6,765	7,941	April -May	**14,706**		NPT/NPT
NPTH 3	Irrigon	500,000	0+	North Lapwai Valley	0	3,000	April	**3,000**		NPT/NPT
above 17	DNFH/Umatilla	TBD	0+	Transportation Study	0	0		**0**		above 17
TOTAL	**Yearlings**	**900,000**					**TOTAL PIT**	**671,000**	PIT Yrlngs.	PIT Sub-Yrlngs.
	Sub-yearlings	**4,538,000 (of which 328,000 are for Transportation Study)**							**87,000**	**584,000**

Addendum to
Snake River Fall Chinook HGMPs for
Lyons Ferry Hatchery
Fall Chinook Acclimation Project
Idaho Power Company, and
Nez Perce Tribal Hatchery

May 10, 2011

Table of Contents

1.0 Introduction

This document was prepared by Nez Perce Tribe and Washington Department of Fish and Wildlife staff in consultation and cooperation with co-managers, Idaho Department of Fish and Game, Confederated Tribes of the Umatilla Indian Reservation, and Oregon Department of Fish and Wildlife. This document is an addendum to the Hatchery and Genetic Management Plans for Lyons Ferry Hatchery, Fall Chinook Acclimation Project, Idaho Power Company, and Nez Perce Tribal Hatchery submitted to NOAA Fisheries for consultation under Section 10(A) of the Endangered Species Act. This information is contained in an addendum rather than trying to edit and incorporate into multiple sections of the HGMP template in two separate 250 page documents. We felt providing in one document would provide for ease in review and understanding.

The information contained in this document was developed as a result of pre-consultation discussions with NOAA Fisheries regarding operation of the complex and highly integrated hatchery programs for Snake River fall Chinook. This document provides further information in response to concerns or issues raised by NOAA Fisheries and specific questions about the hatchery programs effect on Viable Salmonid Population (VSP) criteria of abundance, productivity, spatial structure and diversity (ICTRT 2007).

Organization of document

The document is organized in the following four major sections:

- Status & viability assessment – summary of NOAA Fisheries assessments
- ‘Givens’ associated with Snake River fall Chinook
- Research, Monitoring and Evaluation Program for Snake River fall Chinook
  - What will we learn by 2017
  - Advancing Best Available Science
- Key Uncertainties
- Approach to address those uncertainties by VSP

2.0 Status and viability assessment of Snake River fall Chinook

NOAA Fisheries has recently completed several documents which contain a status and viability assessment of Snake River fall Chinook. Those assessments are contained in the Federal Columbia River Power System Biological Opinion (BiOp) Supplemental Comprehensive Analysis Section 8.2 (NOAA Fisheries 2008) and the Section 2.2.2.2, pages 40-43 of the Umatilla Hatchery BiOp (NOAA Fisheries 2011). The following information is from these recent assessments[1].

[1] Reference to documents and reports herein does not constitute an endorsement of those documents and reports.

2.1 *Abundance and Productivity*

The current estimate (1999-2008 10-year geometric mean) of natural-origin spawning abundance (10-year geometric mean) of Snake River fall Chinook salmon is just over 2,200 (Figure 1). However, annual returns have declined for six of the last seven years (NOAA Fisheries 2011).

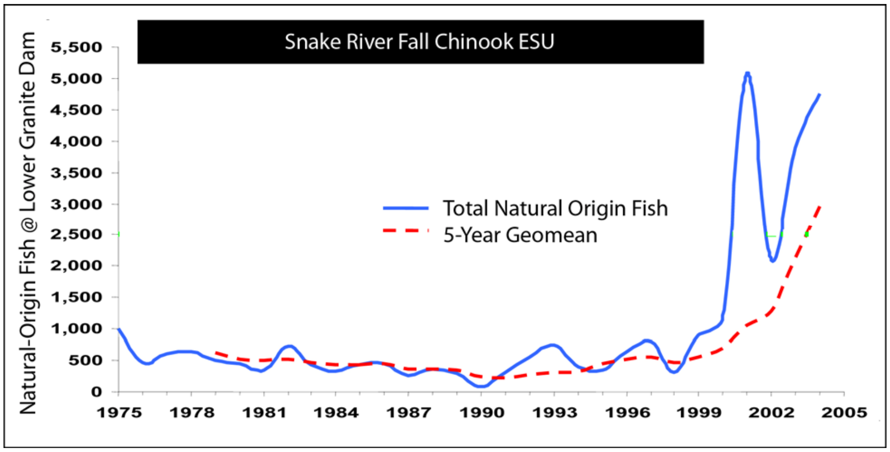

Figure 1. Figure 8.2.2.1-1 in the Supplemental Comprehensive Analysis (NOAA Fisheries 2008) - Snake River Fall Chinook Salmon Abundance Trends (adopted from Fisher and Hinrichsen 2006).

Abundance trends including hatchery-origin fish are also displayed in Table 1 below (which is Table 6. in the Umatilla Hatchery BiOp.- NOAA Fisheries 2011).

Table 1. Table 6 from Umatilla Hatchery BiOp (NOAA Fisheries 2011). Snake River Fall Chinook. Recent abundance and proportion natural origin compared to estimates at the time of listing and the previous BRT review (Ford et al. 2010).

Population	**Natural Spawning Areas**					
	Total Spawners (5 year geometric mean, *range*)		**Natural Origin** (5 year geometric mean)		**% Natural Origin** (5 year average)	
	Prior *(1997-2001)*	**Current** (2003-2008)	***Prior*** *(1997-2001)*	**Current** (2003-2008)	***Prior*** *(1997-2001)*	**Current** (2003-2008)
Snake River Fall Chinook	*2164* (962-9875)	**11321** (7784-17266)	*1055* (306-5163)	**2291** (1762-2983)	51%	**22%**

The overall combined hatchery and natural-origin adult abundance has been increasing significantly beginning in 2000. The 10-year average (2000 to 2009) over Lower Granite Dam has risen to 12,288 compared to the previous decade (1990 to 1999) average of 1,995. Similarly, the 10-year average (2000 to 2009) for natural-origin fish over Lower Granite Dam has risen to 2,588 compared to the previous decade (1990 to 1999) average of 509. A concern is that natural-origin returns declined from 2004 to 2009. Fall Chinook redd counts have risen from only 45 redds counted in 1990 to modern-day record counts of 3,469 in 2009 and 5,271 in 2010 for the Snake River basin upstream of Lower Granite Dam.

2.2 *Spatial Structure and Diversity*

The Lower Snake River fall Chinook salmon population was rated at low risk for allowing natural rates and levels of spatially mediated processes and moderate risk for maintaining natural levels of variation resulting in an overall spatial structure and diversity rating of Moderate Risk (Table 2). Given the combination of current ratings for abundance/productivity and spatial structure/diversity summarized above, NOAA Fisheries determined that the overall viability rating for Lower Snake River fall Chinook salmon population would be maintained (NOAA Fisheries 2011).

Table 2. Table 7 from Umatilla Hatchery BiOp (NOAA Fisheries 2011). Viability assessment for Lower Snake River Fall Chinook salmon population using ICTRT criteria. Updated to reflect returns through 2008 (Ford et al. 2010).

Brood years	Abundance/Productivity Metrics				Spatial Structure and Diversity Metrics			Overall Viability Rating
	ICTRT Minimum Threshold	Natural Spawning Abundance	ICTRT Productivity	Integrated A/P Risk	Natural Processes Risk	Diversity Risk	Integrated SS/D Risk	
1990-2004	3000	2208 (905-5163)	1.28 (0.82-1.63)	Moderate	Low	Moderate	Moderate	Maintained
1985-2004			1.07 (0.93-1.75)	(Moderate)				

2.3 *Updated Risk Summary*

The following is excerpted from NOAA Fisheries (2011):

> Abundance and productivity estimates for the single remaining population of Snake River Fall Chinook salmon have improved substantially relative to the time of listing. However, the current combined estimates of abundance and productivity still result in a moderate risk of extinction of between 5% and 25% in 100 years. The extant population of Snake River Fall Chinook salmon is the only one remaining from an historical ESU that also included large mainstem populations upstream of the current location of the Hells Canyon Dam complex. Natural-origin fall Chinook salmon abundance is much higher compared to 1991 when Snake River fall Chinook salmon were listed, but returns have declined every year since 2004 [although this was not the case in 2010]. Hatchery-origin spawner proportions have also increased dramatically in recent years – on average, 78% of the estimated adult spawners have been hatchery origin over the most recent brood cycle. Overall, the new information considered does not indicate a change in the biological risk category since the time of the last BRT status review (Ford *et al*. 2010).

Figure 2 displays the updated risk assessment per the four VSP criteria.

Spatial Structure/Diversity Risk

Abundance/ Productivity Risk

	Very Low	Low	Moderate	High
Very Low (<1%)	HV	HV	V	M
Low (1-5%)	V	V	V	M
Moderate (6 – 25%)	M	M	M Lower Main. Snake	HR
High (>25%)	HR	HR	HR	HR

Figure 2. Figure 6 from Umatilla Hatchery BiOp (NOAA Fisheries 2011). Snake River Lower Mainstem fall Chinook salmon population risk ratings integrated across the four viable salmonid population (VSP) metrics. Viability Key: HV – Highly Viable; V – Viable; M – Maintained; HR – High Risk; Shaded cells – does not meet viability criteria (darkest cells are at highest risk) (Ford et al. 2010).

3.0 Givens associated with Snake River Fall Chinook

- Hydropower dams have blocked access and inundated approximately 85% of the historic habitat for Snake River fall Chinook. The remaining population only has access to a small proportion (15%) of the historical range for this ESU.
- Snake River fall Chinook are an Upriver Bright stock that provide an important and substantial harvest in ocean (Alaska, Canada, Puget Sound) and Columbia River (tribal and non-tribal) fisheries. These fisheries are governed by the Pacific Salmon Treaty and the *U.S v. Oregon* Management Agreement.
- Snake River fall Chinook are highly influenced by the Federal Columbia River HydroPower System (FCRPS). Juveniles emigrate later in the year than spring Chinook and steelhead and are therefore most affected by the presence or absence of summer spill. Transportation studies, to date, have not been able to determine if barging provides a survival advantage.
- The Snake River fall Chinook HGMPs describe the hatchery programs that were developed to mitigate for the effects of the FCRPS and Idaho Power Company dams. These programs were developed by the *US v. Oregon* Parties who agreed to implement per the 2008-2017 *US v.*

Oregon Management Agreement[2]. The production program is intended to supplement the natural spawning component of Snake River fall Chinook and provide for continued fisheries.

- Uncertainty exists regarding the success or impacts of supplementation.
- The size and nature of the Snake River basin imposes significant challenges in collecting data to assess the Snake River fall Chinook population VSP parameters of abundance, productivity, spatial structure and diversity.
- Sampling methods and statistical procedures used in generating escapement estimates have improved substantially over the past 10-15 years. Beginning with the 2003 return, estimates are available for the total run apportioned into natural and hatchery returns by age (and hatchery origin) with standard errors and confidence limits.
- The accuracy and precision of existing natural production demographic data is in question[3].

4.0 Research, Monitoring & Evaluation of Snake River Fall Chinook

Active monitoring of these hatchery programs have been ongoing since their inception. Section 11.1 of the HGMPs summarizes efforts to monitor metrics that have been generally adopted as indicators of the performance of supplementation programs in the Columbia Basin. Further RM&E actions within the Snake are funded by BPA and are conducted by other research entities such as the USFWS, USGS and various universities. The actions proposed herein are considered in addition to and in context of those ongoing efforts, many of which are critical to the collective knowledge base and need to continue.

4.1 State of Knowledge - What will we learn by 2017?

There is much interest to understand what improved/new knowledge will be available in 2017 to inform adaptive management decisions associated with the Snake River fall Chinook production program. As such, we start this RME section with a summary of our anticipated State of Knowledge by 2017. The details justifying this summary are provided later in the document (Section 6).

By 2017 we will have a good understanding of:

- total escapement upstream of Lower Granite Dam (LGR),
- abundance of natural-origin returns (NOR),
- abundance of hatchery-origin returns,
- percentage of the hatchery-origin fish in the naturally spawning population (pHOS) at the population scale,
- percentage of the natural-origin fish used in hatchery broodstocks (pNOB),

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[2] Pages 70-73 and Table B4A/B of the U.S.v.Oregon Management Agreement identify the Snake River fall Chinook supplementation program juvenile production levels, release locations, and marking as well as adult collection for broodstock, run reconstruction and disposition.

[3] In 2010, the methods utilized to distinguish natural and hatchery-origin fish for run reconstruction were determined to be inaccurate. These problems will most likely require a re-do of run reconstruction to derive better numbers of natural and hatchery fish.

- genetic diversity and effective population size of natural and hatchery-origin population segments ,
- spawning distribution,
- fidelity of subyearling hatchery production groups to release site areas,
- spawning distribution upstream of LGR of Lyons Ferry Hatchery on-station released fish,
- magnitude of predation on juvenile fall Chinook by smallmouth bass and channel catfish in the Snake River,
- best management strategy for juvenile passage through hydrosystem (COE Consensus Study),
- effectiveness of harvest and live capture studies impact on number of hatchery-origin fish available to spawn naturally,
- age-at-return for natural and hatchery-origin fish,
- in-season run forecast,
- natural-origin and hatchery-origin harvest levels in mainstem and terminal area fisheries,
- relative impacts of harvest and hydro mortalities to hatchery effects, and
- relative performance of various hatchery life stage at release and release type strategies.

By 2017 we <u>may have an improved understanding</u> of:

- productivity of the naturally spawning population,
- percentage of the hatchery-origin fish in the naturally spawning population (pHOS) at spawning aggregate scales,
- relative magnitude juvenile production from some spawning aggregates,
- density dependent relationships between spawner abundance and juvenile production,
- relationship of juvenile fish growth and survival to food availability and abundance,
- range of juvenile spatial and temporal rearing patterns,
- heritability of age-at-emigration, and
- pre-season run forecasts.

By 2017 we will still <u>lack an understanding</u> of:

- relative reproductive success of hatchery and natural-origin spawners,
- magnitude of mini-jack returns and their contribution to natural spawning,
- differential use of habitats by hatchery and natural-origin fish,
- abundance of basin-wide juvenile production,
- impact of sturgeon on juvenile production (egg consumption),
- impact of avian predation on juvenile fish upstream of Lower Granite Dam, and
- ecological processes supported (or hindered) by an abundance (or scarcity) of natural spawners.

<u>Significant changes</u> to program implementation to be realized prior to 2017:

- 5.6 percent reduction in hatchery production numbers (completion of COE transportation study),
- 100% marking of hatchery production using Parentage Based Tagging (PBT),
- outplanting of hatchery–origin adults surplus to broodstock needs targeted at areas of underseeded or vacant habitat,

- exploration of live capture techniques by Nez Perce Tribe,
- promotion of local broodstock adaptation in South Fork Clearwater and Selway rivers,
- establishment of ESA recovery criteria for viable ESU with single extant population AND hatchery based mitigation requirements, and
- formal adaptive management process with pre-established management assumptions, monitoring and evaluation, formal report, and symposia conducted in 2013 and 2016.

Background associated with anticipated RME results

- Proposed new monitoring and evaluation actions would be implemented no later than 2012.
- Marking of out-of-basin fall Chinook hatchery production will continue at or above current levels.
- The current U.S.v. Oregon Management Agreement will expire with brood year 2017. Negotiations for a new agreement will begin sometime before or in 2017. Data from adult returns through 2016 will be available to inform 2017 decisions.
- Adult returns (progeny) from any given brood year are functionally complete with 5 year old returns (some 6 year olds do return but in limited numbers). Brood year 2012 production will represent the most current information during U.S.v.Oregon negotiations in 2017.
- If any as yet to be determined changes were made to BY 2011 releases with the intent to reduce pHOS, response of natural-origin juvenile production would not be quantifiable until 2016 (production from naturally spawning fish in 2015). One year of juvenile size, distribution, and survival would be available to inform U.S.v.Oregon negotiations in 2017. NOTE: Changes to BY 2011-2017 are NOT being proposed in this HGMP.
- Response of natural-origin adult productivity will be first available 10 years after any changes are made in release locations/numbers.
- We typically desire to have a minimum of 3-5 years of data to inform decisions. Ideally we would target 2015 -2019 return year data to examine adult return response and 2020 -2024 for analysis of productivity response.

4.2 Advancing Best Available Science

4.2.1 Summary of ongoing RME

A sizable effort to research, monitor, and evaluate (RME) the Snake River fall Chinook salmon ESU is underway. No less than 19 studies are currently being conducted (Table 3); some studies were initiated as early as 1982.

4.2.2 Filling in the Gaps

In 2009 and 2010, a collaborative effort by state, tribal, and federal fish managers established RME strategies and identified knowledge gaps for Columbia River anadromous fish species (Coordinated Anadromous Workshops). Key knowledge gaps associated with Snake River fall Chinook (Crawford Table 2 Chinook Strategies, Gaps, and Prioritized Funding For Each MPG, November 30, 2009) described:

1. Estimate of annual juvenile production is lacking.
2. Robust quantification of juvenile natural survival and life history diversity are needed.

3. Need timely completion of run-reconstruction and better distribution and availability of estimates.
4. Assessment of deep water redds throughout entire spawning distribution is not currently done.
5. Window counts do not provide an estimate of hatchery: natural composition.
6. Window counts currently assess 16 hours passage and fail to account for night time passage.
7. Estimates of natural pre-spawn mortality, direct removals, and direct harvest, and indirect hook and release mortality are lacking to convert escapement to spawner abundance.
8. Estimates of unmarked fish origin determinations are imprecise.
9. Impacts/contributions of hatchery origin spawners is unknown in terms of relative reproductive success or population productivity.
10. Passage of adults and juveniles relative to hydro-system operations is not well understood.

Gaps in our knowledge of population status and management action effectiveness will always exist. This results in implementation of management action under some level of risk. Adaptive management is an effort to routinely adjust management actions based on gained knowledge. In order to characterize our Snake River fall Chinook salmon state of knowledge anticipated in 2017 we describe: 1) management assumptions, 2) current assessment of assumption validity, 3) proposed RME actions to better assess assumption validity, and 4) anticipated knowledge status in 2017 (Table 4). The management assumptions were originally developed by the Ad Hoc Supplementation Work Group (Beasley et al 2008 - Appendix C) and have been modified here for specific application to Snake River fall Chinook. Assumption validity is characterized as: valid, invalid, or unknown. Invalid or unknown assessments help guide adaptive management decisions and prioritize RME activities. New RME activities proposed in the Addendum to LFH and NPTH HGMP contributing to assessment of each assumption's validity are identified. Ongoing RME activities supporting validity assessments are NOT listed. Finally, the anticipated state of our knowledge in 2017 when the next U.S.v.Oregon Management Agreement will be developed is described (assumes newly proposed RME actions are implemented).

Table 3. Summary of ongoing project research, monitoring, and evaluation projects associated with Snake River fall Chinook.

Major Population Group	MSA	Status and Trend Monitoring				Hatchery Evaluations				Uncertainty Research			Harvest Monitoring
		Escapement to	Redd Counts	Juvenile Survival and Emigration Timing	SAR	Hatchery Compliance and Implementation Monitoring	Hatchery Regional Supplementation Effectiveness	Hatchery Project Specific Effectiveness	Hatchery Uncertainty Research	Factors influencing Life History Diversity	Predation	Passage Route Survival	
	Full Population	199801004, TAC	see specific areas below	PTAGIS, 198712700	198201301, 198201302, 198201303, 198201304	NA		199102900	Pending RPA 64 and 65 RFP Guidance	199102900, 200203200, UofI	200203200	ACOE - Passage	200206000, 198201301, 198201302, 198201303, 198201304 , LSRCP WDFW, 198335003, 199801004, TAC
Snake River Fall Chinook Spawning Aggregates	Snake River downstream Lower Granite Dam	ACOE window Counts at Lower Monumental Dam				NA				199102900			State of WA, LSRCP WDFW
	Tucannon	LSRCP -WDFW	LSRCP -WDFW	LSRCP -WDFW		NA							
	Snake River Upstream of Lower Granite Dam	199801004, LSRCP WDFW, 198335003, 200304100, COE window counts	IPC, 199102900	199102900		NA		LSRCP -WDFW, 199102900, 199801004,		IPC, 199102900			200206000, IPC - IDFG, State of WA
	Clearwater River		198335003	198335003, 199801004		NA		198335003, 199801004		198335003, 199801004, NOAA			200206000,
	South Fork Clearwater River		198335003			NA							
	Selway River		198335003			NA							
	Grande Ronde River		199801004			NA							
	Imnaha River		199801004			NA							
	Salmon River		BLM, 198335003			NA							
Hatchery Releases Groups	Lyons Ferry Hatchery	LSRCP WDFW	NA	LSRCP WDFW	LSRCP WDFW	LSRCP WDFW							
	Couse Creek	NA	NA	LSRCP WDFW	LSRCP WDFW	LSRCP WDFW							
	Captain John Rapids	NA	NA	199801004	LSRCP WDFW, 199801004	199801004, 199801005							
	Grand Ronde River	NA	NA	LSRCP WDFW	LSRCP WDFW	LSRCP WDFW							
	Pittsburg Landing	NA	NA	199801004	LSRCP WDFW, 199801004	199801004, 199801005							
	Hells Canyon Dam	NA	NA	IPC IDFG	LSRCP WDFW								
	North Lapwai Valley	NA	NA	198335003	198335003	198335003							
	Nez Perce Tribal Hatchery	198335000, 198335003	NA	198335003	LSRCP WDFW	198335003							
	Big Canyon Creek	NA	NA	199801004	LSRCP WDFW, 199801004	199801004, 199801005							
	Lukes Gulch	NA	NA	198335003	198335003	198335003							
	Cedar Flat	NA	NA	198335003	198335003	198335003							

1982-013-01	Coded Wire Tag-Pacific States Marine Fisheries Commission (PSMFC)
1982-013-02	Coded Wire Tag-Oregon Department of Fish and Wildlife (ODFW)
1982-013-03	Coded Wire Tag-US Fish and Wildlife Service (USFWS)
1982-013-04	Coded Wire Tag-Washington Department of Fish and Wildlife (WDFW)
1983-350-00	Nez Perce Tribal Hatchery Operations and Maintenance
1983-350-03	Nez Perce Tribal Hatchery Monitoring and Evaluation
1987-127-00	Smolt Monitoring by Non-Federal Entities
1991-029-00	Research, monitoring, and evaluation of emerging issues and measures to recover the Snake River fall Chinook salmon ESU
1998-010-04	Monitor and Evaluate (M&E) Performance of Juvenile Snake River Fall Chinook Salmon from Fall Chinook Acclimation Project
1998-010-05	Fall Chinook Acclimation Facilities on Snake/Clearwater Rivers
2002-032-00	Snake River Fall Chinook Salmon Life History Investigations
2002-060-00	Nez Perce Harvest Monitoring on Snake and Clearwater Rivers
2005-002-00	Lower Granite Dam Adult Trap Operations
IPC	Idaho Power Company redd counts and stranding monitoring
IPC IDFG	Idaho Power Company funding of Idaho Department Fish and Game
LSRCP WDFW	Lower Snake Compensation Plan funding of Washington Department of Fish and Wildlife
ACOE -Passage	Corps of Engineers funded Evaluating the Responses of Snake and Columbia River Basin Fall Chinook Salmon To Dam Passage Strategies and Experiences
ACOE - Window	Corps of Engineers funding window counts of adult passage
UofI	UofI otolith microchemistry study
NOAA	Juvenile life history changes in Snake River fall chinook salmon: evolution or phenotypic plasticity?

Table 4. Summary of current status and anticipated 2017 knowledge associated with Snake River fall Chinook salmon management assumptions.

Management Assumption	Current Status	New M&E Action Proposed	Anticipated 2017 Knowledge
1a. Adult progeny per parent (P:P) ratios for hatchery-produced fish significantly exceed those of natural-origin fish.	Valid. Questionable accuracy and precision associated with natural production P:P ratio.	1) PBT marking. 2) Retrospective analysis of NOR abundance using 2010 (subtraction) run-reconstruction methodology. 3) Assess sensitivity of P:P analyses to various levels of non-selective and selective harvest.	10 to 14 years of hatchery production vs natural production P:P ratios. Two years of improved natural production P:P ratio precision.
1b. Natural spawning success of hatchery-origin fish must be similar to that of natural-origin fish.	Unknown. See "Guidance to develop alternatives for determining the relative reproductive success and effects on natural-origin fish of hatchery-origin Snake River Fall Chinook Salmon" (Peven 2010).	1) PBT marking. 2) RPA 64/65 RFP.	Description of natural-origin population growth rate as increasing, decreasing, or stable. Assessment of Relative Reproductive Success is not readily achievable at this time and is the subject of FCRPS BiOp RPA 64 and 65 (even if implemented in 2012 first year results will not be obtained until 2021). RRS study feasibility will be determined prior to 2017.
1c. Temporal and spatial distribution of hatchery-origin spawners in nature is similar to that of natural-origin fish.	Unknown. Carcass sampling only possible in Clearwater River. Fidelity of yearlings to release site areas described in Garcia (2003). Fidelity of subyearling releases unknown. Relative spawn timing of natural and hatchery-origin fish unknown.	1) Radio tag study. 2) PBT marking. 3) Otolith micro-chemistry study	Two years of precise (10 plus years of imprecise) hatchery and natural origin spawner distribution data within the Clearwater River. Three to five years of subyearling fidelity to release site area data and LFH on-station release spawner distribution upstream of Lower Granite. Six years of natal spawning and rearing areas for natural origin fish.

Management Assumption	Current Status	New M&E Action Proposed	Anticipated 2017 Knowledge
1d. Productivity of a supplemented population is similar to the natural productivity of the population had it not been supplemented (adjusted for density dependence).	Unknown. Methods typically involve reference population monitoring which is problematic within an ESU with a single population (see Peven 2010). Questionable accuracy and precision associated with natural production P:P ratio.	1) PBT marking. 2) Retrospective analysis of NOR abundance using 2010 (subtraction) run-reconstruction methodology. 3) Include harvested natural-origin fish in an alternative description of natural productivity. 4) Food web study	Default monitoring is limited to natural population growth rate as increasing, decreasing, or stable. Relationship of juvenile fish growth and survival to food availability and abundance.
1e. Post-release life stage-specific survival is similar between hatchery and natural-origin population components.	Invalid - general production. Valid - surrogate production. Absolute juvenile survival estimates are lacking due to emigration during non-operation periods of juvenile bypass facilities.		Juvenile survival indices and emigration timing for general production subyearlings, general production yearlings, surrogate production, and natural production groups. Relative survival ratios various hydrosystem passage strategies.
2a. Adult life history characteristics in supplemented populations remain similar to pre-supplementation population characteristics.	Unknown. Age at return of hatchery production appears to be altered; higher percentage of mini-jacks from yearling releases, jacks from yearling and subyearling releases; and reduced percentage of 5 and 6 year old returns.	1) PBT marking. 2) Collaborative study that may result from pending Age and size at maturity workshop.	~20 years of age at return trends for hatchery-origin returns. Two years of precise (10 plus years of imprecise) age structure comparisons between hatchery and natural origin fish.
2b. Juvenile life history characteristics in supplemented populations remain similar to pre-supplemented population characteristics	Invalid. Age at emigration appears to be changing; increasing number of reservoir type yearlings. May be a function of altered environmental conditions (Williams et al 2008). Mechanism is likely not solely due to the hatchery program.	1) Otolith micro-chemistry study. 2) Life cycle modeling of juvenile abundance and survival. 3) Representatively PIT tagging hatchery production (110,000 PIT tags).	Assessment of yearling age at emigration heritability (Waples). Juvenile production estimates for the basin as whole and potential spawning aggregate specific.
2c. Within population genetic characteristics are not suppressed by supplementation.	Valid.	1) PBT marking. 2) Assessment of NOR and HOR effective population size.	Comparison of effective population size between the Snake River hatchery produced fish, Snake River natural-origin production, and the Hanford Reach natural-origin production.

Management Assumption	Current Status	New M&E Action Proposed	Anticipated 2017 Knowledge
3a. Genetic characteristics of hatchery-origin fish are indistinguishable from natural-origin fish.	Valid.	1) PBT marking. 2) Assess genetic diversity.	Reaffirmation of genetic similarity.
3b. Life history characteristics of hatchery-origin adult fish are indistinguishable from natural-origin fish.	Invalid.	1) PBT marking. 2) Age and size at maturity workshop.	Complete age at return data for one generation of releases of hatchery fish that includes yearling, subyearling and wild surrogate size subyearlings.
4a. Out of basin strays from a hatchery program (alone, or aggregated with strays from other hatcheries) do not comprise more than 5% of the naturally spawning fish in the Snake River population.	Valid.		
4b. Snake River hatchery production strays do not exceed 5% of the abundance of any out-of-basin natural population.	Valid. Snake River hatchery fish have a high fidelity to the Snake basin based on CWT recoveries of on-station yearlings and subyearlings less than 0.5% of the fish were recovered outside the basin in 2009.		
5a. Hatchery and natural-origin adult returns can be adequately forecasted to guide harvest opportunities.	Invalid. Run forecasts are commonly imprecise and often inaccurate. In-season adjustments to preseason forecasts based on PIT tag detections of returning adults passing mainstem dams are just being utilized.	1) Representatively PIT tagging hatchery production (110,000 PIT tags). 2) Retrospective analysis of NOR abundance using 2010 (subtraction) run-reconstruction methodology.	Weekly adjustments to in-season return estimates for Snake River hatchery-origin fall Chinook. Characterization of NOR abundance and productivity including fish removed via harvest.

Management Assumption	Current Status	New M&E Action Proposed	Anticipated 2017 Knowledge
5b. Hatchery adult returns are produced at a level of abundance adequate to support mainstem and Snake River fisheries in most years with an acceptably limited impact to natural-spawner escapement.	Valid. May not always be true and will rely on 5a forecasts.	1) PBT marking. 2) Assess terminal area selective harvest effectiveness. 3) Explore live capture techniques.	Characterization of NOR abundance and productivity including fish removed via harvest.
5c. Harvest monitoring is adequate to ensure that harvest quotas for natural and hatchery-origin adults are not exceeded.	Unknown. Currently ADCWT subyearlings released on-station at LFH are the indicator of what is going on in the fisheries. Changing the indicator hatchery group to an upstream of LGR subyearling group should be considered.		Description of annual and trends in NOR harvest rates for ocean, mainstem, terminal area fisheries. Characterization of NOR abundance and productivity including fish removed via harvest.
6a. Identify the most effective rearing and release strategies.	Unknown. Juvenile survival and SAR data for individual release groups has just become available with the completion of run-reconstruction.		Relative performance (juvenile survival, SARs, and harvest rates) comparisons for: acclimated vs direct release strategies, yearling vs subyearling age at release groups, transportation vs in-river study completion, and release locations.

Management Assumption	Current Status	New M&E Action Proposed	Anticipated 2017 Knowledge
6b. Management methods (weirs, juvenile traps, harvest, adult out-plants, juvenile production releases) can be effectively implemented as described in management agreements and monitoring and evaluation plans.	Invalid. Lower Granite Dam trapping facility is unable to operate across the entire fall Chinook return period due to high water temperatures. Lower Granite Dam trapping facility is unable to trap sufficient numbers of fall Chinook for RRS studies and target pNOB due to fish processing limitations resulting from high numbers of steelhead and limitations to fish identification from current marking strategy. Lower Granite Dam juvenile bypass facility is unable to sample across entire emigration period due to freezing conditions.	1) Support RPA 28 COE LGD trap modification process. 2) Assess terminal area selective harvest effectiveness to reduce pHOS. 3) Explore live capture techniques to reduce pHOS. 4) Run NOAA selective harvest model. 5) Radio tag study	Three to five years of subyearling fidelity to release site area data and LFH on-station release spawner distribution upstream of Lower Granite. Magnitude of potential and realized influence on pHOS from terminal area fisheries and live capture techniques.
6c. Frequency or presence of disease in hatchery and natural production groups will not increase above unsupplemented levels.	Unknown.		Annual summary disease occurrence and magnitude within hatchery production groups.
7a. Hatchery adults are adequately identifiable to allow accurate annual accounting of natural-origin adult abundance.	Invalid. Currently 24% of the Snake River fall Chinook hatchery production is released unmarked/untagged. Enumeration of NOR in run-reconstruction is based on subtracting total estimated hatchery-origin abundance from untagged fish present in the return.	1) PBT marking.	Two years of precise determination of individual fish origin for quantification of NOR abundance, pHOS, and pNOB.
7b. Describe juvenile fish production in relationship to available habitat in each population and throughout a subbasin.	Unknown.	1) Food web study 2) Otolith micro-chemistry study	Relationship of juvenile fish growth and survival to food availability and abundance. Estimate of predation impacts on subyearling survival.

Management Assumption	Current Status	New M&E Action Proposed	Anticipated 2017 Knowledge
7c. Describe annual (and 10-year geometric mean) abundance of natural-origin adults relative to management thresholds (minimum spawner abundance and ESA delisting criteria) within prescribed precision targets.	Invalid/Unknown. Accuracy of natural origin abundance estimates are suspect due to recent determination that origin classification of unmarked/untagged fish via scales is no longer valid. Use of PBT to estimate NOR harvest in fisheries will require systematic tissue sampling in mainstem and terminal area fisheries.	1) PBT marking. 2) Retrospective analysis of NOR abundance using 2010 (subtraction) run-reconstruction methodology. 3) Include harvested natural-origin fish in an alternative description of natural productivity. 4) Support RPA 28 COE LGD trap modification process.	Comparison of historical (2003-2009) natural origin abundance estimates generated via two run-reconstruction methodologies (scale pattern analysis and 2010 subtraction). Two years of validation for 2010 subtraction method relative to PBT known origin method. Description of virtual population productivity in absence of harvest actions.
7d. Adult fish utilize all available spawning habitat throughout the basin.	Invalid. Spawning ground surveys describe annual distribution of redds. Currently, the Selway, South Fork Clearwater, and Salmon rivers have substantial areas of unseeded historically used habitat.	1) Radio tag study	Spawning distribution and relative abundance of redds in all major and minor spawning areas. Radio tag study will determine fidelity of returning adults from subyearling releases to release locations and overlap with NOR.
7e. The relationships between life history diversity, life stage survival, abundance and habitat are understood.	Invalid. The physically large and spatially expansive river systems constrain typical monitoring methods. Habitat conditions are heavily influenced by hydrosystem operations. A continuum of life history strategies are expressed over 500 miles of riverine habitat.	1) Life cycle modeling. 2) Otolith micro-chemistry study. 3) Food web study.	Correlation of redd abundance and escapement. Range of juvenile spatial and temporal rearing patterns. Relationship of juvenile fish growth and survival to food availability and abundance. . Magnitude of predation on juvenile fall Chinook by smallmouth bass and channel catfish. Note: Predation by sturgeon and avian species will remain unknown.
7f. Minimum Abundance Threshold (MAT) of 3,000 fish recommended by the ICTRT is compatible with management based viability criteria.	Unknown. Management based viability criteria development pending.	1) Develop alternative Minimum Abundance Threshold (MAT).	Assessment of alternative minimum abundance thresholds compatible with pending management criteria for viability determination.

Management Assumption	Current Status	New M&E Action Proposed	Anticipated 2017 Knowledge
8a. Coordination of needed and existing activities within agencies and between all co-managers occurs in an efficient manner.	Valid. Snake River Fall Chinook Salmon coordination meetings are held twice a year.		Common understanding of ongoing management actions, ongoing monitoring and evaluation studies, monitoring gaps, and sampling constraints.
8b. Accurate data summary is continual and timely.	Invalid. Completion of run-reconstruction estimates have been conducted by an Ad Hoc group of staff from multiple entities. The process is lengthy due the complexity of assigning origin to unmarked/untagged fish.	1) PBT marking.	Similarity of run reconstruction estimates generated using multiple approaches.
8c. Results are communicated in a timely fashion locally and regionally.	Valid – Locally. Invalid - Regionally.	1) Symposia in 2013 and 2016.	Common understanding of the best available science associated with Snake River fall Chinook salmon.

5.0 Key Uncertainties

The performance measures listed in Tables 3 and 49 of the Snake River Stock Fall Chinook HGMP and the short description of activities listed above should allow adequate monitoring of populations during supplementation, however as stated above there are significant gaps that may not allow the programs to adequately describe the potential benefits, or lack of negative effects of the program, that might prevent the natural population from moving toward viability, and eventual delisting under the ESA. Snake River fall Chinook monitoring presents some significant sampling challenges in answering these questions.

Key uncertainties are:

- Accuracy of run reconstruction estimates given subsample rate and marking strategy.
- Productivity or relative reproductive success of natural origin and hatchery origin fish – separately.
- Annual production of juveniles, and juvenile production capacity for Snake River upstream of Lower Granite Dam.

6.0 Approach to address Key Uncertainties by VSP criteria

The approach described below, first in outline format and then in narrative with more specific information, is designed to address the key uncertainties while dealing with the logistical challenges identified above. Further, it is intended that this approach will inform adaptive management decisions that will shape the Snake River fall Chinook supplementation program into the future. This approach identifies some actions that currently may not be implementable however, they are addressed in some way within the HGMP. Many of the studies identified to address uncertainties are outside the purview of fisheries co-managers (WDFW, NPT, CTUIR, ODFW, and IDFG) and therefore, we expect that NOAA would be intimately involved in determining adequacy and tracking of ongoing work that affects the evaluation of this HGMP.

Outline:

6.1 Population Abundance

6.1.1 Improve accuracy and precision of natural-origin abundance via run-reconstruction:

i. Describe basic approach to run-reconstruction with impacts of trapping rates, hatchery:natural classification error/bias, and modified methods applied in 2010.

ii. Propose addition of Parentage Based Tagging (PBT). Compare cost of new method with Coded-wire Tagging (CWT)

iii. Clarify lack of alternative trapping site options at other mainstem dams.

6.1.2 Expand run reconstruction of NOR to Columbia River mouth/ocean:

i. Add NOR removed by harvest in existing ocean and mainstem fisheries. Link to existing USvOR BiOp language.

6.1.3 Quantification and management of pHOS: discussion run-reconstruction approach for estimating pHOS and limitations of Lower Granite trap to manipulate pHOS.

6.1.4 Quantification of pNOB: program goal to include NOR up to 30% of broodstock, discuss constraints of Lower Granite Trap to achieve this level.

6.1.5 Proposed actions table

6.2 Productivity

6.2.1 Improve ability to evaluate mechanisms of productivity via ecological interactions

i. Density dependence

ii. Growth and life history

6.2.2 Analyze ability of selective harvest to reduce pHOS

6.2.3 Potential actions to affect number of hatchery-origin fish escaping to spawn

i. Increased harvest and harvest activities reducing pHOS

ii. No releases of fish into Salmon and Imnaha rivers

iii. Reduced production releases after completion of transportation study

6.2.4 Proposed action table

6.3 Spatial Structure and Diversity

6.3.1 Distribution of hatchery and natural spawners: description of dispersion/fidelity rates of hatchery-origin releases between spawning aggregates and our inability to document spatial distribution of natural and hatchery spawners.

i. Fidelity of hatchery adults to release site from yearling releases.

ii. Fidelity of hatchery adults to release site from subyearling releases.

6.3.2 Population-wide vs. spawning aggregate based broodstock development: Comparison of Wenatchee spring Chinook subpopulation management approach and describe the limitations to implementing spawning aggregate based approach in Snake River basin.

6.3.3 Genetic selection and expression: description of current plans to include natural-origin spawners in broodstock, exclusion of strays, and benefits for maximizing effective population size.

6.3.4 Proposed actions table.

6.4 Population Viability

6.4.1 Summarize Snake River fall Chinook population viability provided by NOAA Fisheries in other Biological Opinion documents. This includes summary of other “H” effects (+/-) already permitted by NOAA.

6.4.2 TRT viability criteria: Summarize TRT recommended viability criteria for ESUs with a single extant population as being potentially applied to Snake River fall Chinook recovery.

6.4.3 Hatchery effects: summary of demonstrated hatchery effects (+/-) on Snake River fall Chinook population viability.

6.4.4 Proposed actions table.

6.5 Adaptive Management

6.5.1 Management assumptions and structure for making adaptive changes in Snake River fall Chinook hatchery program.

6.1 Population Abundance

6.1.1 Improve accuracy and precision of natural-origin abundance via run-reconstruction

i. Basic Approach to Run Reconstruction with impacts of trapping rates, hatchery:natural classification error/bias, and modified methods applied in 2010.

Fall Chinook salmon run reconstructions to Lower Granite Dam (LGD) began cir. 1990 to estimate the number of hatchery fish returning to the Snake River, and to above the dam. No systematic trapping occurred at the adult trapping facility during early years since fall Chinook abundance was low and nearly all hatchery releases from LFH occurred below the dam. CWT tagged fall Chinook were often out-of-basin strays during the years before 1998 and an effort was made to remove these fish from the river, often by hauling the tagged fish to LFH where the fish were euthanized and/or spawned and their origin determined from the CWT. Gametes from LFH origin fish were retained in the brood while stray fish gametes were usually discarded. Beginning in 1990 during spawning, LFH fish were separated from stray Chinook based on CWT code and the resulting LFH data were subsequently used to “reconstruct” the hatchery population that had arrived at LGD. The hatchery origin data from spawning was used with window counts to eventually derive an estimate of natural origin adults (by subtraction) arriving at, and moving above the dam. During the years until 2003 sampling and reconstruction protocols were not well established. Various approaches were used by an assortment of personnel and management agencies to estimate the number of natural and hatchery origin fish arriving at and passing Lower Granite Dam.

Beginning in 1996, releases of hatchery origin fall Chinook began at NPT operated fall Chinook acclimation facilities (FCAP) in the upper Snake and Clearwater Rivers. By mid-2000s significant increases in fall Chinook returns to the Snake River were occurring, the result of several factors: 1) yearling releases from FCAP facilities survived well, 2) ocean conditions began to improve, increasing survival for all anadromous populations including yearling and subyearling fall Chinook, 3) restrictions on downriver fisheries imposed in the mid 1990s because of ESA protections allowed more fish to escape and reach the Snake River, 4) increased returns allowed LFH to steadily increase its releases because of more abundant broodstock, including providing up to 1 million eggs to Idaho Power Company (IPC) for its Hells Canyon Mitigation program, 5) NPTH was constructed and began releasing fall Chinook into the Clearwater, 6) refinements to passage and transport through the FCRPS may have improved survival of both yearling and subyearling hatchery releases, and 7) increased spawning of hatchery fish (supplementation) within the basin presumably had resulted in increased natural production. These yearly increases of fall Chinook were concomitant with robust returns of Snake River steelhead.

As a result of the increased returns of Chinook and steelhead in the early 2000’s the operational capacity of the adult trap at LGD was overwhelmed and threatened to compromise research that was being undertaken by numerous entities. Trap capacity and personnel were not sufficient to continue diversion of CWT fish for sampling and stray removal, and increasingly the managers desired more accurate and precise estimates of numbers of natural fish moving above LGD to track their status under the ESA. Further, operation of the trap was identified in the U.S. v. Oregon Management Agreement to occur for 'broodstock collection (hatchery and natural origin), accurate run reconstruction, and for removal of non-Snake origin fish' (*U.S. v. Oregon* 2008). The run reconstruction provided important information on natural and hatchery fish composition but also an evaluation of the myriad of hatchery fish releases occurring throughout the basin to estimate return numbers and their relative performance (direct and acclimated, yearling and subyearling, early and late releases). Moreover, window counts were not considered a reliable representation of run abundance as fish numbers increased because of the incidence of fall back and re-ascent, and unclipped hatchery –origin fish.

To address these constraints and multi-purpose trapping activities a systematic, standardized trapping approach using a fixed trapping rate (or rates) to randomly sample fall Chinook and generate an estimate of the entire run composition to LGD was proposed and adopted in 2003.

<u>Procedures 2003-2009</u>

Preseason forecasts of fall Chinook and steelhead run sizes are used to predict what percent of the run can be reasonably handled at the LGD facility. Gates that divert fish from the ladder to the trap facility would be programmed to open four times hourly around the clock to sample at the pre-determined rate. It was assumed that if gates are open a set percentage of each hour that would provide a sample of fish passing the ladder of equal percentage. This approach served two purposes; 1) provide broodstock for the two fall Chinook hatcheries in the basin, LFH and NPTH, and 2) provide data from hatchery and natural origin fish to inform the run reconstruction. Incorporation of natural origin fish in the hatchery broodstocks is an objective determined to be a high priority by the managers to continue the connection between hatchery /natural portions of this integrated program. In addition to generating estimates of hatchery, natural and individual release groups, systematic random sampling methods used to generate the run reconstruction estimates of total returns to LGD also allowed for the calculation of precision (Steinhorst et al. 2010) and accuracy measures not attainable using window counts.

Trapping rate is based on a combination of trap capacity and broodstock needs for the hatcheries. Section 10 Permit 1530 allowed for a trapping rate of up to 20%. However, the abundance of steelhead and fall Chinook typically limited trap rates to 8 to 12%. The *U.S. v. Oregon* Management Agreement stated, 'Trapping of adult fall Chinook at Lower Granite Dam will occur at a fixed percentage rate agreed upon by the fishery managers prior to initiation of trapping…'. Once trapping begins, the intent is to transport all collected adult males and females to a hatchery. Not all jacks (based on fork length at trapping) are transported since spawning protocols limit the contribution of jacks in brood. Some jacks are scale sampled and passed; the majority of them in abundant fish years. Additional fish may enter the trap as a result of Sort by Code (SbyC) for PIT tagged returning adult fish released as part of an ongoing COE funded juvenile salmon transportation study. These fish are identified and eventually removed from the systematic sample database used for the reconstruction. Also excluded from the data are mini-jacks, fish <30cm fork length, which are not included in window counts and are considered an anomalous life history form. Although the sample rate is intended to provide a sufficient sample of fish for the reconstruction and broodstock, pre-season predictions are often inaccurate, which may require sampling and release of some fish trapped or an adjustment of the sample rate. Untagged/unmarked fish released from the trap are measured and a scale sample collected to estimate the origin and determine age. Although the intent is to haul all CWT tagged fish to the hatcheries, if some must be released from the trap to prevent excess fish at the hatcheries, their gender and length are collected and the composition of other tagged fish taken to the hatcheries is used to represent the composition of released fish.

Fish hauled to LFH and NPTH are used for broodstock and generally all tagged fish are sacrificed and the CWTs decoded. Scales are taken from all untagged fish to provide age and in some cases origin. Hatchery and wild origin are estimated from scales by measuring the radial distance from the scale focus to the first scale check (if applicable) and to ocean entrance (OE). Fish were classified as hatchery origin if the first scale check (assumed to be a hatchery release check) occurred < .5mm, while fish were determined to be from wild origin if the first visible check occurred at or near OE and was greater then .5mm (Campbell/Marsh et al. unpublished report). After tag codes are confirmed, a combined data base of CWTs from both hatcheries is created and used for the run reconstruction.

The reconstruction process begins by expanding CWT codes by sample rate, then including associated untagged fish with each group if appropriate (e.g. – total release from a site is 400,000 fish with only 200,000 tagged with a CWT. The recovery rate of the tagged fish would be applied to the 200,000 untagged fish, thus estimates total return from the release). Not all fish releases can be directly associated with a CWT code (e.g. – different release size, date or river conditions). In that case a surrogate code from a similar release at a similar or same site but different year (or the average of several years by age class) would be used to estimate probable performance of the unassociated group. This process is used to partition all unassigned fish after CWT groups are derived. If unassigned fish remain after allocating all the unassociated groups, the remaining fish are presumed to be of LFH origin. Since few tagged stray Chinook have been identified in recent years in the basin, this seems reasonable for unmarked fall Chinook as well. Because of the error that can exist when expanding CWT groups, there may not be sufficient unassigned fish within the unassociated group to account for all the release location. When multiple groups exist the available unassociated fish are distributed proportionally among the groups. Thus, hatchery origin fish numbers were based on the presence of an adipose fin clip and/or a CWT, and were expanded for the unmarked/untagged portion of individual release groups.

Natural origin fish numbers for this period were based on scale pattern analysis and PIT tag recoveries of the unmarked fish.

Chinook passing Lower Granite Dam are designated fall run from August 18 to December 15. Two periods may occur during this time when sampling is not possible. The first is at the beginning of the run on 18 August each year. Water temperatures are typically in the high 60's, but once fish ladder water temperature exceeds 70 degrees, fish trapping protocols agreed upon by all the managers prevent trapping to protect fish health[4]. Natural Chinook passing during this time are estimated by completing a post hoc estimate of the percent natural origin Chinook of total passage by week at the end of the season. The relationship is regressed over time and the slope of the line is projected back in time to estimate the % of natural Chinook passing the dam before trapping could occur. The estimated weekly % is applied to Chinook window counts to provide the estimate. The remaining fish are presumed to be hatchery origin, and the proportions of each tag code from the inclusive trapping period are applied to derive an estimate of each group passing the dam pre-trapping. The second period is late in the season when the trap closes for winter (on or before December 15) due to inclement weather and small numbers of fish. The approach described for the pre-trap period is similarly applied to fish passing the ladder at this time. The three periods are then summed by category to provide a complete run reconstruction.

<u>Procedure for 2010</u>

The results of a joint NOAA/WDFW study to validate age/ life history and origin (hatchery/wild) was initiated in 2008 (return years 2007-2010). The results of this study suggested a high degree of accuracy for assigning age (95-99%) and life history types (subyearling 99%, Yearling 99% and reservoir reared 97%). The results further showed a relatively high assignment accuracy of known hatchery fish (94, and 88% for 2007 and 2008 respectively, n~850) but a low assignment of known wild fish (18%, n=14) (Campbell/Marsh et al. unpublished report). Because of the low classification accuracy of known wild fish (n=14), natural or hatchery origin was not assigned by scale analysis to the return year of 2010. This high misclassification rate for PIT tagged wild fish was likely the result of several occurrences including; 1) a complex rearing program for fall Chinook that included small subyearling smolts released throughout the upper Snake basin to mimic natural origin fish (surrogates) for the COE funded transportation evaluation study, 2) the possibility that the small (n=14) wild PIT tagged fish are not representative of the wild population as a whole (scale stress checks induced by tagging/handling may mimic the hatchery scale pattern) 3) natural and hatchery subyearlings rearing for another year in the Snake River reservoirs and emigrating as yearlings, and 4) potentially complex and confusing scale patterns resulting from multiple site rearing and tagging events. Since no other reliable means of distinguishing natural and hatchery fish is presently available, the management entities responsible for run reconstruction reverted to a subtraction methodology to derive the estimate of wild fish arrival at LGD. As in the period prior to 2010, this required determining the composition for CWT fish from the hatcheries, then expanding for associated and unassociated releases. Any remaining fish arriving at the dam were presumed natural.

This approach was complicated in 2010 because of a significant discrepancy between window estimates of fall Chinook passage and the estimate derived from the systematic subsample approach used since 2004. Upon evaluation of the passage and trap data it appears that the assumption of, for example, a 10% open gate time providing a 10% population sample is being violated. Although we do not fully understand the reason for the unreliable sampling across time, the systematic method tended to

[4] FCRPS BiOp RPA 28 is already in place to consider options for reducing water temperatures in ladder/trap.

overestimate passage at the dam. The fall Chinook run reconstruction group, comprised of staff from WDFW, NPT, CRITFC and IPC, completed a preliminary analysis of the trapping at the dam (Attachment A) with the assistance of a NOAA statistician and concluded that the trapping was indeed biased high and would account for much of the discrepancy between derived estimates from trapping and window counts. The systematic method for estimating run size was therefore abandoned for 2010, but as in previous years the proportions of CWT groups were taken from the systematic sampling to derive estimates of their respective returns. Total numbers then have to be adjusted to meet window counts of jacks and adults, but no pre or post trapping adjustments have to be made to estimate natural fish numbers.

Once an estimate of hatchery and natural fish arriving at LGD is finalized, the number passed upstream is determined by subtracting fish hauled to the hatcheries for run reconstruction data and spawning. Finally, presumed spawners (escapement) that could be used for productivity analyses are determined by subtracting estimated sport and tribal harvest from the number passed at LGD.

Future Methods

Run-reconstruction generates the core data used to asses natural origin abundance and productivity. The application of various run-reconstruction methods over time raises questions about the consistency of results and sources (past and present) of potential bias. Accurate assignment of origin and fall-back rate are two key uncertainties. In conjunction with NOAA science shop (Sanford) we have started to assess comparability of window counts and random trapping (see Attachment A). This effort will support a retrospective analysis of past run-reconstruction based estimates using 2010 methods.

Fall back of fall Chinook that have ascended the LGD ladder to areas downstream of the dam does occur but the magnitude is unknown. Mini-jacks, jacks and adult fall Chinook are routinely passed downstream at LGD via the juvenile by-pass facility. In addition fish are able to pass undetected via turbines and through the locks. It is hypothesized that LFH on-station released fish may exhibit a higher tendency to fall-back than natural origin fish and hatchery-origin fish released upstream of LGD. Quantifying the rate of fall back with special attention to LFH on-station release groups will be pursued via PIT tag detection data from the juvenile bypass facility and with radio-tagged fish monitoring associated with spawner distribution described in section 6.3.

ii. Hatchery Production Marking - Parentage Based Tagging

Marking schemes for Snake River hatchery-origin fall Chinook salmon are established within the U.S. vs. Oregon 2008 - 2017 Management Agreement. At full production levels 1.4 million (24%) of the hatchery produced fish are unmarked and untagged. Identification of natural-origin from hatchery origin Snake River fall Chinook has relied on scale pattern analysis in the past. However, this method has recently been deemed inaccurate. Several marking approaches that are compatible with the U.S. vs. Oregon Agreement exist and could be used to identify 100% of the hatchery production; (1) Parentage Based Tagging (PBT), (2) thermal marking of otoliths, and (3) Oxytetracycline marking of vertebrae. Other marking approaches, inconsistent with the current US vs Oregon agreement, also exist; (1) adipose fin clipping, and (2) Coded-wire tagging.

We are proposing to utilize PBT starting with the 2011 brood year production. PBT requires a tissue sample from all fish utilized in hatchery broodstock be collected on an annual basis. Upon return as adults tissue samples from unmarked/untagged fish can be examined for matching genotypes to parents used in broodstock. Fish with genotypes that do not match potential broodstock parents can be accurately and precisely classified as probable natural origin, although out-of-basin strays that are unmarked/untagged may still be unidentifiable. Efforts to track specific hatchery broodstock parent pairings and subsequent release locations of progeny will be made, but are not required for robust analyses.

Under the current approach to utilize representative trapping and collection of marked and unmarked adults at Lower Granite Dam for both run-reconstruction and hatchery broodstock, analysis of adult returns does not require additional sampling or genetic analysis.

The current Snake River fall Chinook salmon hatchery program uses approximately 4,000-5,000 adults fish annually for broodstock. Cost to conduct the genetic analyses associated with PBT of 4,000 fish is estimated to be $160,000 - $200,000 annually (cost is expected to decrease).

Each of the marking alternatives have pros and cons in terms of initial infrastructure purchase and set up, amount of fish handling to apply and recover marks/tags, contribution to multiple purposes, and cost (initial and annual). Questions on the relative cost for a CWT approach are commonly asked; CWT tagging of the current 1.4 million unmarked/untagged fish would cost approximately $190,000 (Cost is expected to increase).

Questions regarding assignment error rates of the PBT method have be asked. Essentially, results from steelhead show that when we are able to assign parents for an individual, it should be without error unless there is a record keeping mistake in the metadata. The only scenarios where we may not be able to identify parents for a fish is if the parents were never sampled or if they failed genotyping (missing data). With careful tissue collection and storage, it is probably reasonable to assume that less than 1% of the adults used in broodstocks would not be genotyped. This number will be known and can be used to adjust unassigned progeny (assumed to be natural-origin). Overall, we expect there to be some hatchery origin-fish that we cannot assign to parents but that error rates for mis-assignments will be extremely low.

Funding to support the PBT is not currently provided for under the ongoing program. This newly proposed action within the LFH and NPTH HGMPs will require the additional annual funds.

iii. Lack of trapping sites

Fall Chinook abundance estimates have been provided since 1975 by counts at LGR Dam or through a run reconstruction process. Although other adult trapping facilities have existed in the basin in the past (Lower Monumental and Little Goose Dams), managers have agreed to the use of LGR as the most desirable point of documentation. This requires a separate estimate of spawning escapement for the Tucannon River and recognizes that some small amount of natural spawning occurs in the tailraces of the dams, which inserts some error associated with natural population abundance estimates. However, we do not believe that the error is significant enough to recommend relocation of the primary trapping and run reconstruction effort away from Lower Granite Dam.

6.1.2 Expand run reconstruction of NOR to Columbia River mouth/ocean

i. Include NOR fish removed by harvest in descriptions of abundance:

Harvest of SR fall Chinook in certain years represent a substantial effort by both selective and non-selective fisheries (commercial and sport, both tribal and non-tribal) in the ocean and mainstem Columbia River. Locations, duration, and allowable harvest are determined by the number of forecasted NOR and HOR fish (returning to the mouth of Columbia and up the system to Lower Granite Dam), and is based on a sliding scale approach as agreed to by all parties in the 2008-2017 USvOR Agreement. These seasons are also managed in season based on real-time adjusting of the forecast utilizing fish marked representatively with PIT tags. Accounting for the removals of NOR and HOR is paramount to the efforts to manage the fisheries and to reconstruct the NOR back to the Columbia River mouth and ocean. This accounting is divided geographically into areas of the ocean and areas in the mainstem Columbia.

Run Forecasting

Annual run forecasts of fall Chinook to Lower Granite Dam (LGR) are conducted using two methods. The first run prediction of natural-origin (NOR) adult fall Chinook to the mouth of the Columbia River is completed by the US v OR Technical Advisory Committee (TAC). This prediction uses abundance estimates of Snake River adult NOR fall Chinook salmon to the mouth of the Columbia and age composition obtained from run reconstructions of fall Chinook trapped at LGR and used for broodstock at Lyons Ferry Hatchery (LFH) and Nez Perce Tribal Hatchery (NPTH). The proportion of fall Chinook salmon at each age class is applied to the estimated number of SR fall Chinook to the Columbia River mouth to generate a composite age class structure. Following brood years, each age class is plugged into a linear regression equation to generate an estimate the following years' return. For example, jack (1 ocean) returns are used to predict 2 ocean returns the following year, 2 ocean returns are used to predict 3 ocean returns the following year, etc. Predictions for each age class are summed to get a total return to the Columbia River mouth, then an average conversion rate of 0.58 from the mouth of the Columbia River to estimate the total NOR adult return to LGR.

The second run forecast is based on a simple jack to adult regression model using window counts at LGR to predict returns of total adult (hatchery-origin plus natural-origin) and NOR adult only fall Chinook salmon the following year. Total jacks passing the LGR window during the fall Chinook passage period (August 18 – December 1) are plugged into a regression equation generated from the historical relationship of jack and adult returns. This provides an estimate of the total adult returns to LGR the following year. NOR adult returns are predicted based on an estimate of NOR jacks and adults as determined by the annual run reconstruction using a similar regression analysis method.

2008-2017 US v. Oregon Management Agreement harvest sliding scale

Harvest of SR fall Chinook is predicated on the *U.S. v. Oregon* 2008-2017 Agreement Table A3. This Agreement provides a harvest rate schedule of treaty and non treaty harvest based on a sliding scale approach to manage the risk to the natural fish. This scale takes into account the expected forecast of natural and hatchery fish and the limiting factors based on the allowable mortality rate of Snake River natural fall Chinook. Thus the allowable take increases with increased predictions of natural returning fish.

Table 5. Table A3 in *U.S. v. Oregon* 2008-2017 Management Agreement. Fall Management Period Chinook Harvest Rate Schedule.

Expected URB River Mouth Run Size	Expected River Mouth Snake River Natural Origin Run Size [1]	Treaty Total Harvest Rate	Non-Treaty Harvest Rate	Total Harvest Rate	Expected Escapement of Snake R. Natural Origin Past Fisheries
< 60,000	< 1,000	20%	1.50%	21.50%	784
60,000	1,000	23%	4%	27.00%	730
120,000	2,000	23%	8.25%	31.25%	1,375
> 200,000	5,000	25%	8.25%	33.25%	3,338
	6,000	27%	11%	38.00%	3,720
	8,000	30%	15%	45.00%	4,400

Footnotes for Table.

1. If the Snake River natural fall Chinook forecast is less than level corresponding to an aggregate URB run size, the allowable mortality rate will be based on the Snake River natural fall Chinook run size.

2. Treaty Fisheries include: Zone 6 Ceremonial, subsistence, and commercial fisheries from August 1-December 31.

3. Non-Treaty Fisheries include: Commercial and recreational fisheries in Zones 1-5 and mainstem recreational fisheries from Bonneville Dam upstream to the confluence of the Snake River and commercial and recreation SAFE (Selective Areas Fisheries Evaluation) fisheries from August 1-December 31.

4. The Treaty Tribes and the States of Oregon and Washington may agree to a fishery for the Treaty Tribes below Bonneville Dam not to exceed the harvest rates provided for in this Agreement.

5. Fishery impacts in Hanford sport fisheries count in calculations of the percent of harvestable surplus achieved.

6. When expected river-mouth run sizes of naturally produced Snake River Fall Chinook equal or exceed 6,000, the states reserve the option to allocate some proportion of the non-treaty harvest rate to supplement fall Chinook directed fisheries in the Snake River.

Inseason adult run adjustments using representative PIT tagging

Utilizing the preseason forecasts the managers and stakeholders are able to estimate the potential fish available for harvest, and set and manage harvest seasons accordingly. In the past 5-6 years the increased tagging levels (PIT tags), use of the separation by code (to represent run at large fish), and use of current and historic adult run timing over the dams has given the managers and stakeholders the ability to make informed real time harvest adjustment recommendations (compared to the preseaseon forecasts) during the course of the adults returning.

The recent advancement in information has been the result of the majority of the age classes of Chinook salmon returning to above LGR having a representative group of PIT tags. The detections of these run-at-large tags in returning fish at Bonneville, McNary, Ice Harbor, and Lower Granite dams are expanded by the juvenile tagging rates to generate an estimate of age 3, 4, and 5 Chinook salmon, by stock and release site, back to each dam. For releases that were not PIT tagged, a surrogate release is used to generate return estimates. These estimates are summarized weekly and utilize the historic run timing (early, average, and late) that best represents the current years run timing conditions to allow for a total year projection of returning fish. This projected estimate of the total run of fish, by dam is updated daily, and is based on run strength and timing as the season progresses. Previous years data indicate that PIT tags generally underestimate the number of untagged fish returning due to tag shedding and differential mortality (IDFG & NPT unpublished data). All PIT tag detections are corrected for interrogation efficiencies at each dam. Utilizing these minimum real time estimates compared to the preseason forecast allows managers a valuable tool for inseason harvest management and recommendations.

The Corps of Engineers funded Consensus Study Proposal Evaluating the Responses of Snake and Columbia River Basin Fall Chinook Salmon to Dam Passage Strategies and Experiences has resulted in sufficient PIT tagged returning adults to conduct in-season monitoring. Migration year 2012 represents the last year of this study. Post 2012, additional PIT tags will be needed to maintain in-season return monitoring. Representatively PIT tagging 110,000 of the hatchery production releases will cost approximately $388,000 annually. Funding to support this level of PIT tagging is not currently provided for under the ongoing program. This newly proposed action within the LFH and NPTH HGMPs will require additional annual funds.

Ocean Fisheries Impacting Snake River Fall Chinook

Snake River fall Chinook are harvested in various sport and commercial ocean fisheries from Alaska south to the central California coast. The majority of ocean fishery impacts occur in Alaskan and

Canadian sport and commercial fisheries that are managed under Pacific Salmon Treaty agreements. Smaller impacts occur in sport, tribal, and non-tribal commercial fisheries north of Cape Falcon on the Oregon Coast that are managed by the Pacific Fishery Management Council (PFMC). Minor impacts occur in fisheries in the Strait of Juan de Fuca and in sport and commercial fisheries south of Cape Falcon. There are also minor impacts to Snake River fall Chinook groundfish trawl fisheries such as the Pacific whiting fishery. NMFS monitors groundfish fisheries and tracks salmon impacts in groundfish fisheries. The allowed ESA impacts in ocean salmon fisheries impacting Snake River fall Chinook are framed as a requirement that adult equivalent exploitation rates must annually be held to at least a 30% reduction from a base period exploitation rate. The PFMC's Salmon Technical Team (STT) models proposed ocean fisheries each year to ensure planned fisheries meet ESA requirements. The PFMC STT along with the Pacific Salmon Commission's Chinook Technical Team evaluates actual ocean fisheries to determine actual exploitation rates each year. Because of conservation concerns regarding other weak stocks, ocean fishery impacts on Snake River fall Chinook have generally been significantly less than allowed ESA impacts.

Until recently, all ocean salmon fisheries impacting Snake River fall Chinook were full retention fisheries and therefore impacts to ad-clipped and non-ad-clipped Chinook were the same. Since 2005 some Strait of Juan de Fuca sport fisheries have been converted to mark selective fisheries. Beginning in 2010, part of the Washington Coastal sport fishery has been a mark selective fishery during the early summer. In future years, more ocean sport fisheries and probably at least some commercial troll fisheries will be mark selective fisheries. There will likely be some mark selective Chinook fisheries in Canada as well. This will mean that ocean fisheries will have a higher exploitation rate on ad-clipped Snake River Fall Chinook compared to exploitation rates on unclipped Chinook. The marking strategy currently in place anticipated increased application of mark selective fisheries; CWT evaluation groups are applied independently to adipose clipped and non-clipped release groups.

In-River Fisheries Impacting Snake River Fall Chinook

In-river fisheries impacting Snake River fall Chinook include the Buoy 10 sport fishery, mainstem sport fishery, Zones 1-5 commercial gillnet fisheries, Zone 6 sport fisheries, Zone 6 treaty ceremonial & subsistence fisheries, Zone 6 treaty commercial gillnet fisheries, and sport fisheries upstream of McNary Dam to the mouth of the Snake River and sport fisheries in the lower Snake River. Mainstem fisheries from the river mouth upstream along with lower Snake River fisheries upstream to Lower Granite Dam are managed under the 2008-2017 *U.S. v. Oregon* Management Agreement. Sport fisheries upstream of Lower Granite Dam are managed under a separate Section 10 permit. The Nez Perce Tribe is currently working on a harvest management plan that is expected to provide for some treaty fishery impacts to Snake River fall Chinook in the Snake River basin. Mainstem and Lower Snake river fisheries manage Snake River fall Chinook as part of the Upriver Bright (URB) stock which also includes Hanford Reach, Yakima River, and Deschutes River stocks. Since 2008, allowed total harvest rates have ranged from 31.25% to 38%. In-river fisheries have generally not harvested all of the allowed fish.

Currently, in-river mainstem fisheries are all full retention fisheries. Within the next few years, at least some non-treaty fisheries will be mark selective fisheries. WDFW is investigating alternative commercial fishing gears such as purse seines and beach seines which may be implemented as mark selective fishing gears. Sport fisheries within the Snake River basin are currently mark selective.

6.1.3 Quantification and management of pHOS: discussion run-reconstruction approach for estimating pHOS and limitations of Lower Granite trap to manipulate pHOS.

Estimation of the percent hatchery-origin fall Chinook upstream of Lower Granite Dam is derived from the run reconstruction estimates for hatchery and natural origin fish, adjusted for additional hatchery and natural fish removals (additional broodstock collection from swim-ins to NPTH, and harvest). There is currently no ability to determine pre-spawning mortality, although an estimate of hooking mortality is included in harvest, which would be needed to accurately reflect true percent hatchery origin spawners (pHOS). Managers must use percentages from the run reconstruction to represent pHOS.

Unfortunately, the accuracy and precision of the pHOS estimate from the run-reconstruction estimate (see section 6.1.1) and is currently considered suspect; scale based origin determinations of unmarked-untagged fish appear to misclassify hatchery origin fish as natural origin ~10% of the time, and misclassify natural origin fish as hatchery fish ~85% of the time (Lance Campbell –WDFW pers. Comm.). Currently pHOS is not believed to differ greatly from the run at large returning to the Snake River basin (e.g. removals at Lower Granite dam and Nez Perce Tribal Hatchery or non -selective, and selective harvest rates are relatively low).

Because there is an adult trap operating at Lower Granite Dam there is the misconception that the trap can be operated to sample a large portion of the run and to perhaps selectively remove hatchery-origin fish as they migrate over the dam. Not only is the use of the trap in this way a policy level decision but this operation has several logistical constraints. First, is the physical ability to process trapped fish; processing capacity is approximately 800 - 1,000 fish per day. During the fall, in addition to fall Chinook, Snake River steelhead are also migrating over the dam. The steelhead run has been between 100,000 and 250,000 in recent years. The capacity level of the Lower Granite trap has constrained the trapping rate in recent years to approximately 9 to 12% of the entire run of fish passing the dam. At this trapping rate all trapped fall Chinook are retained for broodstock, with the exception of some hatchery origin jacks in 2009 and 2010. In 2009 there were 3,453 males <61 cm trapped and released upstream of Lower Granite Dam In 2010, 4,363 males <65 cm were trapped and released upstream.

Increasing the trapping rate to intentionally capture and retain more marked fall Chinook will require modifications to the trapping facility to enable expanded fish handling capabilities. Issues of increased steelhead handling and disposition of fall Chinook in excess to broodstock needs would have to be addressed at a technical and policy level.

6.1.4 Quantification of pNOB: program goal to include NOR up to 30% of broodstock, discuss constraints of Lower Granite Trap to achieve this level.

Utilization of Scales for broodstock allocation and origin determination.

Fall Chinook salmon trapped at LGR are used for broodstock at Lyons Ferry Hatchery and Nez Perce Tribal Hatchery. Scales are collected from all unmarked and a portion of marked broodstock. In the past, we have attempted to use scale pattern analysis to determine the proportion of natural-origin fish in the brood; in addition to age and early life history (subyearling or yearling emigrant). The utility of scale analysis for determining each of these parameters was evaluated using tagged fish of known origin. Following the evaluations, it was determined that scale analysis could reliably determine age and early life history, and could determine hatchery origin for most yearling releases and some of the subyearling releases, but not natural origin or rearing location. An analysis of scales from known hatchery- or natural-origin fish revealed that the error rate was definable and relatively consistent for hatchery fish, but because of small sample size of know natural origin fish the method is unreliable. Similarly, using scales to determine rearing location was used for a couple of years in an attempt to estimate straying of Hanford Reach or Umatilla River fall Chinook into the Snake River but an analysis using known Snake River fish demonstrated that this technique was also not reliable. Currently, broodstock age and early life history can be reliably determined using scale pattern analysis, but we cannot use scale analysis to directly determine the proportion of natural-origin fish or the presence of out of basin stray fish in the broodstock.

Access to sufficient natural fish for inclusion in brood stock.

As explained above, current facilities and staffing limits the number of fish that can be trapped and processed at the Lower Granite Dam adult trap. Recent year's trapping rates have been 9-12% of the fish. In most years, this limitation will prevent the managers from achieving the 30% NOR broodstock goal. Proposed infrastructure changes that would allow additional trapping have not been addressed in this document, but the managers will continue to discuss this action as a possible alternative to achieving the goal.

6.1.5 Proposed Actions to address improving certainty of Population Abundance

	Proposed Action	Cost
1	**100% marking of hatchery production via Parentage Based Tagging (PBT).**	**$200,000/yr**
2	**Commitment to complete retrospective analysis of past run-reconstruction based estimates of NOR using 2010 methods, including NOAA science shop (Sanford) critique .**	**$25,000**
3	**Support COE process to consider modification to ladder/trap for a) water intake to eliminate water temperature operation constraints, and b) expanded fish handling capabilities to increase pNOB (see also 3a) - Already required under RPA 28.**	**Existing staff**
4	**Include estimates for NOR harvested fish throughout the Columbia basin in**	**Existing staff**

	population abundance assessments relative to viability thresholds. (*WDFW is concerned about the level of monitoring in fisheries because of the difficulty in full statistical creel. Could catch card estimates (post-hoc like steelhead) and expansions for wild numbers be acceptable?*).	
5	**Representatively PIT tag hatchery production at a level (110,000) that enables in-season run projections.**	**$388,000/yr**
6	**Run NOAA selective harvest model to describe potential changes in pHOS and impacts to NOR.**	**Existing staff**
7	**Evaluate fall-back of mini-jacks, jacks, and adults with focus on LFH on-station releases.**	**$25,000 one-time cost $75,000/yr**

6.2 Productivity

Recent scientific evidence (Araki et al. 2007; Chilcote 2010) suggest that in salmon and steelhead populations high pHOS from hatchery supplementation may result in reduced natural productivity. NOAA staff has recommended reducing proportion of hatchery-origin fall Chinook spawning naturally to reduce the potential risk to productivity. Further, NOAA are concerned that the current SR fall Chinook supplementation program as it is now structured may limit opportunities to evaluate the program's effects on the productivity of the ESU.

Despite these concerns, the populations of both natural and hatchery origin fall Chinook have increased significantly from the baseline period (Tables 1 & 2). It is not presently clear if the high pHOS currently within the Snake is suppressing further expansion of natural production (abundance) through reduced productivity. The lack of understanding of the current efficacy of supplementation on increasing the natural population prevents informed decisions regarding the potential need for changes to this program. Moreover, estimates of yearly productivity for the natural population depend on accurate estimates of spawning escapement from run reconstruction (discussed elsewhere). We propose several actions to improve the accuracy and precision of run reconstruction, which will improve confidence in derived estimates of the status and trend in natural fish productivity.

We also do not presently know if hatchery and natural fish are spatially distributed equally throughout the basin. Part of increasing the understanding of spatial structure within the population and interaction between hatchery and natural fish will be addressed using radio tagged fish of known release locations (see below). A study was conducted in the late 1990s that showed substantial fidelity by acclimated yearling Chinook to return to their river reach of release, but this has not been confirmed for subyearling releases either for acclimated or direct released groups. Understanding return behavior and dispersion of adults from these subyearling releases will substantially improve the manager's knowledge about true spatial spawning structure and hatchery-natural interactions. This effort may also inform a greater understanding of within population productivity, especially if asymmetrical spawning structure currently exists. Variations in actual reach level spawning pHOS may currently exist and additional actions to better understand hatchery and natural fish are necessary before substantive changes to the program are proposed.

6.2.1 Improve ability to evaluate mechanisms affecting productivity via ecological interactions

i. Density Dependence

The USFWS-USGS portion of the Snake River basin fall Chinook salmon research team began beach seining and PIT-tagging natural fall Chinook salmon subyearlings (hereafter, natural subyearlings) along the entire free-flowing Snake River upstream of Lower Granite Reservoir in 1995. Sampling and tagging have continued to the present. The following summary is based on several documents (Connor et al. 2000, 2002, 2003ab; Connor and Burge 2003; Connor and Tiffan 2010; Plumb et al. 2010). Growth in fork length measured between PIT-tagging during rearing and passage at Lower Granite Dam averaged over 1.3 mm/d and the natural subyearlings averaged over 140-mm fork length at dam passage in the 1990s. During the first 10 years of the 21st century growth decreased to an average of less than 1.0 mm/d and mean fork length was less than 98 mm. Regression analyses indicated that increases in basin-wide redd counts and hatchery smolt releases were correlated with the decreases in growth rate and size of natural subyearlings. The researchers concluded that there was preliminary evidence for intra-specific competition for food in the reservoir and that seemingly small changes in growth rate associated with density dependent mechanisms can cause large changes in smolt size. The migration rate of natural subyearlings to Lower Granite Dam has also become faster over time leading to earlier passage dates at Lower Granite Dam (e.g., median dates up to 20 days earlier after increases in redd counts and hatchery releases). The increase in migration rate and earlier passage timing were linked to increases in redd counts by use of regression analyses. These findings suggested that changes in migration rate associated with density dependent mechanisms (if actually present) can influence large changes in passage timing at Lower Granite Dam. Bioenergetics modeling supported the conclusions for increased competition for food and space as factors for decreased growth, increased migration rate, and earlier seaward migration. Apparent mortality of natural subyearlings measured between rearing and passage at Lower Granite Dam generally increased over time. The relations between apparent mortality of natural subyearlings and catch per unit effort of natural subyearlings, redd counts, and the number of hatchery fish released were clearly nonlinear and supported the existence of an asymptote. These results provided preliminary evidence for a density dependent response in apparent mortality for natural subyearlings. The researchers hypothesized that the density dependent response resulted primarily from predation in riverine habitat and possibly from predation in the reservoir.

ii. Growth and Life History

In cooperation with the Snake River fall Chinook salmon research team, the USFWS-USGS staff proposed to continue monitoring the growth and juvenile life history of natural subyearlings in the Snake River and expand on the ability to link management actions to changes in natural subyearling abundance through 2015. As part of this proposed work, two predation studies will be conducted. The first study will focus on predation by smallmouth bass in riverine rearing habitat by (1) estimating the abundance of smallmouth bass, (2) describing the diet of smallmouth bass, and (3) estimating subyearling loss to predation by smallmouth bass. This study will be conducted using methods developed by Nelle (1999) who found predation on natural subyearlings was low in riverine habitat prior to increases in production associated with increases in redd counts and the release of hatchery subyearlings. The second study will focus on predation in Lower Granite Reservoir downstream of the confluence of the Snake and Clearwater rivers by (1) estimating abundance of channel catfish, (2) estimating abundance of smallmouth bass, (3) describing the diets of these two species, and (4) estimating subyearling loss to predation by these two species. The second study will use the methods developed by Naughton et al. (2004) who found that predation on natural subyearlings was low in the reservoir prior to increases in subyearling abundance.

Idaho Power Company (IPC), in coordination with NOAA fisheries, initiated a survey of entrapment pool areas in the upper Hells Canyon Reach of the Snake River in 2005 as part of compliance to an Interim Settlement Agreement relating to consultation for ESA species downstream of Hells Canyon Dam. A total of 45 entrapment pools have been identified at 37 site locations along approximately 60 river miles in the upper HC Reach. Entrapment pools at these sites disconnect from the river at flows ranging between 8,700 cfs and approximately 50,000 cfs with 33 of these pools disconnecting at flows within the operating range of HC Dam (flows less than 30,000 cfs). IPC plans to continue weekly fish surveys of entrapment pool sites in the upper HC reach between March 15 and June 15 (or until no Chinook are observed in pool sites), each year, to document pool use by juvenile fall Chinook salmon and steelhead. Fish in each high priority entrapment pool (18 of the 45 pools) will be enumerated by species when possible. Any observed mortalities of Chinook or steelhead associated with these sites will be documented. The thermal history of each high priority entrapment pool during the rearing period (March 15–June 15) will be collected each year. As part of this plan, Hells Canyon outflows will be adaptively managed with operational protocols to protect and minimize entrapment of juvenile fall Chinook and steelhead at high priority entrapment sites in the upper Hells Canyon Reach. This plan proposes to monitor the use and connection of entrapment pools during the rearing period and maintain a daily connection flow of at least 2 hours for any entrapment pool that is connected and disconnected from daily load following operations at HC Dam. IPC instituted the protocol of connecting entrapment pools daily during the 2005 and 2006 rearing periods. Discussions with NOAA fisheries staff further refined this protocol to that of reconnecting pools for at least 2 hours on a daily basis which was instituted in 2007. Monitoring water temperatures within pools and adaptively managing these temperatures from approaching lethal limits is critical to the protection of juvenile Chinook using entrapment sites in the upper Hells Canyon Reach. This plan proposes a protocol to reconnect entrapment pools with the main river channel at a time during the day before pool temperatures elevate to deleterious levels defined by NOAA Fisheries. This plan further proposes to salvage juvenile fall Chinook salmon and juvenile steelhead back to the river channel from any high priority entrapment pool that is disconnected and will not be reconnected again during the rearing period due to decreases in HC outflows. This practice, in consultation with NOAA fisheries, was conducted effectively from 2005 through the 2010 rearing periods as inflows decreased, leaving high elevation entrapment sites disconnected for the remainder of the rearing period.

Surveys of entrapment pool areas in the upper Hells Canyon Reach of the Snake River (HC Reach) have been conducted annually since 2005. The number of juvenile fall Chinook observed in entrapment pools each rearing season depends largely upon the number of entrapment pools disconnected/connected from Hells Canyon Dam (HC Dam) operations as well as the number and location of adult fall Chinook redds in the upper HC Reach from the previous spawning season. Lower inflows to HC Dam result in greater power production opportunities, larger ranges of outflows from HC Dam, and thus higher numbers of entrapment pools disconnected/connected. From 2005 through 2010 the highest number of juvenile Chinook observed in entrapment pools was 26,369 in 2005. The high number of observed fall Chinook in 2005 can be attributed to a high number (1,047) of entrapment “events” and a relatively high number of adult redds (966). Conversely, 2009 had the second highest number of redds (1,129) for the six year period but had few entrapment events for the season because of high inflow conditions into the HC Reach, thus only 2,647 Chinook were observed in entrapment pools in 2009. No entrapment events were observed in 2006 as HC Dam discharge was above 30,000 cfs until June 2 after which no juvenile fall Chinook were observed in entrapment pool areas. A total of 10 juvenile fall Chinook were observed in high elevation entrapment pools (those above the operation range of HC Dam) during 2006.

6.2.2 Analyze ability of selective harvest to reduce pHOS

The cooperators will populate and run “The Selective Harvest Calculator” that was developed by Paul McElhany at the NOAA Northwest Fisheries Science Center. The Selective Harvest Calculator (SHC) is a computer program for exploring the consequences of mark-selective harvest management strategies. In the fall Chinook mark selective fisheries, hatchery fall Chinook are given an external mark (adipose fin clip) and only marked fish are to be retained. The SHC simulates the progression of a mark-selective harvest starting with an initial pool of fish with three components: 1) natural-origin fish (all unmarked), 2) marked hatchery fish, and 3) unmarked hatchery fish. The simulation proceeds with sequential encounters of individual fish with the fishing gear. Once fish encounter the gear, several fates are possible, including landing by the fishery or "hooking mortality" for unmarked fish that were released. At the end of the simulation, the fate of all the fish in the initial pool is evaluated to explore overall impacts of the fishery on the different components of the population. This model will be used to explore the impacts of sport and tribal fish harvest seasons on fall Chinook fisheries in the Columbia, Snake, and Clearwater rivers and how those changes impacts pHOS and the magnitude of the increase in NOR.

6.2.3 Potential Actions to affect number of hatchery-origin fish escaping to spawn

i. Increased harvest activities reducing pHOS

Marked increases in adult returning fall Chinook have provided the opportunity for harvest of hatchery fall Chinook in the Snake River Basin and Clearwater River Basin. The first fall Chinook fisheries in the Snake River in over 30 years were implemented in 2008. Washington, Idaho and the Nez Perce Tribe currently are growing/expanding these fisheries. To date, recreational state and Nez Perce Tribe fisheries have experienced increasing harvest success. Table 5 below describes the level of fall Chinook

Snake Basin harvest (adipose fin clipped and un-clipped) by each agency which reflects the increased harvest over the last three years. The states are expanding their fishery interest and success through education and fish clinics, with an attempt to increase angler success. The end goal is for significant harvest of hatchery fall Chinook. The Nez Perce Tribe desires to grow their fisheries and fishing capacity to match fish available for Nez Perce treaty harvest year-by-year in a way that incorporates the variability of Snake River spring/summer Chinook runs. The Tribe proposes (BPA #200206000) to investigate the use of live capture fishing methods (tangle nets, weirs, seines, etc.) to catch more fish particularly in hatchery-influenced areas that may support moderate to high harvest levels while maintaining harvest of listed natural-origin fish within acceptable levels. If properly designed and scaled to those tributaries or fisheries, where Tribe has had some difficulty catching fish, they presume that this type of strategy could increase catch and harvest of hatchery fish while maintaining conservation-focused harvest strategies on wild/natural fish.

The activities from the States and Tribes are working (Table 5) and are expected to be able to harvest a significant portion of hatchery fall Chinook in the near future as the interest and techniques continue to expand.

Table 5. Draft harvest totals for fall Chinook, natural and hatchery for Washington Department Fish and Wildlife, Idaho Department Fish & Game, and Nez Perce Tribe for 2008-2010 in the Snake River Basin.

	Chinook Harvest Totals by Agency/Tribe				
Year		WDFW	IDFG	NPT	Total Hatchery
2008	Unclipped	0	0	13	13
	Clipped	10	132	39	181
2009	Unclipped	0	0	29	29
	Clipped	46	806	65	917
2010	Unclipped	**	0	539	539
	Clipped	**	1,255	110	1,365

** will be determined from catch record cards in about 6 months

ii. No releases of fish into Salmon and Imnaha rivers

Increasing numbers of returning fall Chinook in recent years have resulted in expansion of documented spawning activity into the Salmon and Imnaha rivers (Table 16). The cooperators have agreed to no hatchery-origin fall Chinook releases into the Salmon and Imnaha rivers (see sections 1.5 of this HGMP and the Nez Perce Tribal HGMP for details). This decision will reduce the likelihood of hatchery spawners in these areas, reducing pHOS and maximizing NOS spawning in the Salmon and Imnaha rivers and other locations outside of the current juvenile releases.

iii. Reduced production releases after completion of transportation study

Releases of fall Chinook into the Snake and Clearwater rivers described in table B4B from the 2008-2017 *US vs. Oregon* Management Agreement total 5.5 million with an additional 328,000 for the COE transportation study. Releases of subyearlings for the transportation study will conclude no later than 2012 (Consensus Research Proposal, 2007). Return rates for the surrogate group and general production groups of fall Chinook are just beginning to be analyzed and draft results indicate an average smolt to adult return rate around 0.3 percent. After completion of this study this will translate into a reduction of approximately 1,000 adult surrogate hatchery returning fall Chinook (328,000 x 0.003=984) annually.

6.2.4 Proposed Actions to address improving certainty of Productivity

	Proposed Action	Cost
1	**Conduct Life cycle modeling of juvenile abundance and survival**	**$50,000/yr**
2	**Conduct food web study that quantifies food availability and consumption associated with juvenile fall Chinook.**	**$500,000/yr**
3	**Analyze ability of selective harvest to reduce pHOS**	**Existing staff**
4	**Existing activities that will reduce pHOS**	**Existing staff**

6.3 Spatial Structure and Diversity

6.3.1 Distribution of hatchery and natural spawners

i. Fidelity of hatchery adults to release site from yearling releases

Spawning aggregates are not isolated and although the fish released from the FCAP facilities have a strong fidelity to their release location there is a fair amount of interchange of fish. Garcia (2003) tracked 515 fall Chinook from 1997-2001 and determined that 32% of the supplementation fish overall spawned in other than their release reach. Specifically 11% of the males and 4% of the females from Captain Johns spawned in the Upper Snake River Reach. All of this research was done on yearling release groups.

ii. Fidelity of hatchery adults to release site from subyearling releases

Fidelity of adults to release site areas is unknown for sub-yearling release groups. As previously described sampling of carcasses is not feasible throughout most of the Snake River basin. In an attempt to understand spawner distribution associated with sub-yearling releases we propose to replicate the Garcia (2003) study using returning adults PIT tagged as juveniles under the COE consensus transportation study as the known release site fish to radio tag. Sufficient numbers of specific release site PIT tagged adults should be available over the next 3 years (2012 to 2014). Of particular interest is the spawning distribution upstream of LGD ('stray') of LFH on-station release groups. Sufficient numbers of on-station yearling releases have been PIT tagged in recent years and will be included in the 2012-2104 radio tagging. However, additional PIT tagging of the sub-yearling release group will need occur. We propose to PIT tag 20,000 on-station subyearlings from 2012-2014 and then radio-tag subsequent adults in 2014 to 2016. Implementation of this study will cost approximately $195,000 annually for three years and $35,000 for two additional years. Funding to support this level of radio and

PIT tagging is not currently provided for under the ongoing program. This newly proposed action within the LFH and NPTH HGMPs will require additional annual funds.

6.3.2 Population-wide vs. spawning aggregate based broodstock development

Development of broodstocks that promote local adaptation within subpopulations (major spawning aggregates) has been suggested by NOAA and by the HSRG. The Wenatchee spring Chinook salmon hatchery program was suggested as a potential template. The Wenatchee has four major spawning aggregates; Chiwawa River, Nason Creek, White River, and Little Wenatchee River. Each spawning aggregate has unique genetic characteristics. The program is developing segregated broodstocks for three of four spawning areas. The un-supplemented aggregate represents about 10-15% of the basins production. Segregated broodstocks are to be maintained by adult collections at Tumwater Dam, with natal stream determination via pedigree analysis. The program is targeting a pNOB of 33%. Target pHOS has yet to be established.

Application of a similar approach in the Snake River basin appears to be infeasible, with the exception of the South Fork Clearwater River. Operation of weirs and collection of carcasses in the mainstem Snake and Clearwater Rivers is not possible due to river size and morphology. Our target pNOB is 30% but is logistically not achievable at this time. Snake River genetic stock structure appears to be homogeneous.

6.3.3 Genetic selection and expression: discuss inclusion of natural-origin spawners in broodstock, exclusion of strays, gene expression vs. selection, benefits for maximizing effective population size.

<u>Genetic selection and expression</u>

A primary emphasis of the fall Chinook hatchery program since its inception was the maintenance of the stock's genetic integrity. Exceptional actions were taken to trap adults within the Snake basin to establish the egg bank program in the late 1970s and early 1980s. This resulted in releases of juveniles at the LFH site in the mid 1980s that were believed to be of endemic origin only one generation from natural parentage. The effort continued through the 1990s when excessive out-of-basin strays were identified in the brood. To prevent erosion of the genetics of the stock, only identifiable LFH origin Chinook were used for brood while efforts began to reduce out-of-basin straying into the Snake River through marking/tagging of hatchery populations that were identified as strays. These management efforts have been effective and the abundance of out-of-basin strays has been greatly reduced in recent years. As a result, the managers agreed to once again begin infusing naturally produced fall Chinook into broodstock; now for both LFH and NPTH. Despite these efforts there remain concerns regarding the possible expression of genes as a result of selective pressures within the hatchery environment. This selection could affect age at migration, age of return, jack rates, productivity (reproductive success), spawning success and other as yet unidentified population changes that may affect its prospects for recovery. The types of genetic risks generally associated with operation of hatcheries (Wedemeyer 1996) are widely known:

- **Extinction** – a serious concern but mainly the result of stochastic and non-genetic events,
- **Loss of Within-Population Diversity** – typically resulting from drift that can be from a founder event, inbreeding and selection,

• **Loss of Among-population Diversity** – from immigration (straying) that results in introgressive hybridization,
• **Loss of Fitness from Hatchery Selection** – generally accepted as the result of domestication and artificial selection.

A series of actions will be pursued as part of the fall Chinook program to avoid these hazards.

<u>Extinction</u>
Habitat alteration and fishing likely drove Snake River fall Chinook toward extinction by the mid 1970s. We believe that conscientious hatchery actions have greatly increased population abundance (see section 2) and forestalled extinction. While supplementation has had positive results, the interaction between hatchery and natural origin fish on the spawning grounds and their relative reproductive success is unknown. Marking and tagging limitations currently in place under the US v. Oregon Management Agreement make identification of unmarked/ untagged fish difficult, complicating estimates of natural abundance and analysis of reproductive success. The managers desire a better understanding of the effective population size of natural (NOR) and hatchery (HOR) fish spawning in the natural environment to more completely understand whether or not the natural population is trending toward recovery (see Loss of Fitness below). Given the current marking limitations, conducting a genetic based monitoring of NOR and HOR effective population sizes may provide results accurate enough for these metrics to be understood. The managers propose to evaluate these survival variables through the use of Parentage Based Tagging (PBT). All fish used for hatchery broodstock would be genetically sampled and characterized through the use of SNP technology. Once a full generation of brood has been sampled, all returning adult offspring can be positively identified. As importantly, a grand parentage analysis of the 2nd generation of off spring may provide more definitive information on the relative contribution of natural and hatchery origin adults and natural effective population size. One possible approach to conducting the study was provided by Mike Ford, NOAA Fisheries and is provided in Attachment B. Implementation of the study could begin in 2011 with full DNA samples from broodstock at both hatcheries. Full sampling began at NPTH in 2009 as part of a NOAA study (see Loss of Within-Population Diversity below). Current cost estimates for SNP characterization range from $20-40/sample, giving an annual investment need of $100,000-200,000 into the foreseeable future, with first generation results (100% identification of Snake River hatchery origin) expected starting in 2017. Benefits accrue to any salmonid population by maximizing effective population size. The severe bottleneck this population experienced in the 1970s imposed substantial genetic stress. Actions taken by the hatcheries in the past by boosting population abundance significantly reduced extinction risk. Ongoing efforts begun in 2004 to identify and include natural origin fish once again in brood has functionally increased effective population size and reduced the potential for full or half sibling crosses in hatchery matings. The large size of the program and mating protocols designed to reduce the possibility of sibling crosses (size and age diversity of crosses where possible and minimization of jacks in spawning) further maintain a diverse genetic profile.

<u>Loss of Within-Population Diversity</u>

Propagation and release of Snake fall Chinook as yearling smolts has raised concerns about the effect on subsequent generations of hatchery and natural fish. Specifically in question is whether age at emigration is heritable and is it caused by selective pressures experienced in the hatchery. Staff at the NOAA Science Center began a heritability of age at emigration study at NPTH in 2009 by scale and DNA sampling all broodstock at the facility. This study is ongoing with the intent to determine if yearling emigration seen in naturally produced fish results from parents released as hatchery yearling smolts, thus suggesting a hatchery selection effect. Conversely the change in life history may be a response to altered habitat condition and represent gene expression and plasticity. Answers to these questions will significantly inform managers regarding hatchery effects resulting from artificial selection or hatchery domestication. The study will require a minimum of two generations to track and detect possible changes in life history pathway selection based on parentage. The study would utilize PBT samples collected described above, but may require additional analysis for genetic expression. NOAA is funding this study.

A consistent monitoring of the genetic profile of Snake River fall Chinook has occurred since program inception. Microsatellite analysis of samples collected from marked and unmarked (presumed natural origin) fish in 2000 through 2004 showed no significant difference between the populations. Further analysis is relevant and timely to determine if there has been a loss of genetic diversity of the populations, hatchery or natural and if there has been divergence of the two. These types of analyses can be performed using PBT samples, but may require additional SNP analysis to characterize population diversity, and will require re-running samples collected in the past using SNP technology. The comparison could be completed 2011-2014 and is expected to require an additional 2,000 historical samples for comparison.

<u>Loss of Among-population Diversity</u>

This loss of diversity is of highest concern for Snake River fall Chinook next to extinction. Two of the original populations for this ESU are extinct, leaving only one extant population. Loss of its integrity would severely jeopardize the long term prospects for recovery under ESA. As described in the explanation of run reconstruction, natural origin adults were captured within the Snake River in the late 1970s to initiate this hatchery program. This action served to substantially reduce the risk of extinction for the remaining population. Since that time there have been steady, but adaptive, measures to reduce the impacts of out-of-basin strays escaping to spawn in the basin and for inclusion in the broodstock. Exclusion of strays from hatchery broodstocks remains a priority for both hatcheries and positively identified strays (CWT based) are eliminated to the extent possible. Errors in, or inability of, identifying strays generally contributes to strays representing less than 5% of brood stock annually. Implementation of PBT will substantially reduce potential error in stray identification.

<u>Loss of Fitness from Hatchery Selection</u>

As an integrated supplementation program, maintaining connection to the natural population is a priority management objective. Careful program operation initiated in the 1990s prevented any infusion of natural origin fish into broodstock because of large numbers of out-of-basin strays entering the Snake River. The problem has been substantially minimized through marking procedures and other changes in Columbia River programs and infusion of natural fish began in 2004. The intent is to now maximize inclusion of NOR (up to 30%) in broodstocks within the limitations of access to unmarked fish at Lower Granite Dam (historically limited to 20% of fish passing the dam) and positive identification/distinction between natural fish and unmarked/ untagged hatchery returns. These efforts are documented through the spawning process at both hatcheries as each fish is uniquely numbered and eventually identified as of hatchery or natural origin. Access to and selection of natural origin fish at the LGR Dam trap are presently limited by the marking protocol adopted in the US v. Oregon Management agreement, and other identification techniques (scales) have not proven fully effective. Implementation of PBT or some other chemical or thermal marking tool will substantially improve identification of natural origin fish. Once this step has been taken, more accurate tracking of natural contribution to the brood will be possible.

RPAs 64 and 65 of the FCRPS Biological Opinion express the need to understand the affect of ongoing supplementation and high proportions of hatchery spawners on the productivity of this population. The guidance document (Peven et al. 2010) that resulted from a BPA sponsored workshop identified the challenges to answering these questions. River size and remoteness of fall Chinook spawning, difficulty in sampling the population passing LGR Dam and determining the true nature of fish spawning (proportions of hatchery and wild and whether spatial segregation is occurring), high proportions of hatchery fish returning to the river, the genetic similarity between hatchery and natural populations, legal limitations imposed on marking that increases difficulty of determining origin, and others. The guidance document concluded two things:

> 1. Based on logistical, technical, and process constraints, a pedigree-based parentage analysis to estimate RRS is not feasible for SRFCS. A promising alternative at this point appears to be a grandparental study design, but a number of details need to be worked out. Approaches such as using controlled spawning areas or surrogate populations appear far less attractive. Other approaches yielding useful but less direct RRS information are possible.
>
> 2. Evaluating the effect of the hatchery programs on natural SRFCS productivity is very challenging, and the challenge is exacerbated by inadequacies in run reconstruction. The only approach the workgroup recognized as most appropriate was a model-fitting approach similar to that of Buhle et al. (2009). Again, however, a number of feasibility and statistical power details need to be worked out. The option of using a surrogate population is highly undesirable. Other approaches yielding useful but less direct information are possible.

We agree with those conclusions and have significant concerns about attempting studies which may fail. However, no further reasonable alternatives have been offered since the BPA guidance effort. We would propose a collaborative effort by the managers and their science staffs to promulgate a study design to complete the grand parentage analysis to determine relative reproductive success as call for under RPA 64/65.

6.3.4 Proposed Actions to address improving certainty of Spatial Structure and Diversity

	Proposed Action	Cost
1	Conduct study of subyearling release fidelity to spawning area (repeat of Garcia et al study but with subyearlings and existing PIT tagged fish). Special focus on spawning distribution in areas upstream of LGD of LFH on-station releases.	$195,000/yr (1012-1014) $50,000/yr (2015-2016)
2	Kennedy and Zabel otolith study of spawning, early rearing, and overwinter locations).	$75,000/yr
3	Completion of NOAA study heritability of age at emigration.	Existing staff
4	Promotion of local broodstock adaptation in South Fork Clearwater and Selway rivers via weir operation in SFCLWR.	Existing staff
5	Document natal spawning area of NOR fish used in respective broodstocks via otolith micro-chemistry.	Existing staff
6	Expand monitoring of genetic diversity/similarity in hatchery and natural conspecifics at sub population spatial scales once PBT marked adults are realized..	$60,000/yr
7	Conduct genetic based monitoring of NOR effective population size and HOR return effective population size.	$150,000/yr
8	Continued exclusion of strays from hatchery broodstocks.	
9	Maximize inclusion of NOR in broodstocks within the limitations of the current marking strategy.	Existing staff
10	Formalize and communicate conclusions on inability to conduct RPA 64 and 65.	Existing staff

6.4 Population Viability

6.4.1 Summary of limiting factors and threats and VSP criteria in FCRPS BiOp

The following information is summarized from Chapter 8.2 (Snake River Fall Chinook Salmon) of the Federal Columbia River Hydropower System Biological Opinion (FCRPS BiOp) Supplemental Comprehensive Analysis (SCA) (NOAA Fisheries 2008)[5].

The key limiting factors and threats for the Snake River fall Chinook include hydropower projects, predation, harvest, degraded estuary habitat, and degraded mainstem and tributary habitat. Ocean conditions have also affected the status of this ESU. Ocean conditions affecting the survival of Snake River fall Chinook were generally poor during the early part of the last 20 years. Hatchery production is not identified as a key limiting factor.

[5] Reference to documents and reports herein does not constitute an endorsement of those documents and reports.

The FCRPS BiOp analyzed anticipated survival improvements for Snake River fall Chinook based on completed actions that are anticipated to continue into the future and proposed actions contained in the BiOp. These anticipated survival improvements are summarized in Table 6. Based on completed actions NOAA anticipates a 12% increase in survival (primarily from harvest actions) and from proposed actions NOAA anticipates an 11% to 18% increase in survival (primarily from estuary habitat improvements and expected harvest). Improvements in hydrosystem and hatchery operations were not anticipated by NOAA.

Table 6. Proportional changes in survival for Snake River fall Chinook summarized from Table 8.2.3-1 and Table 8.2.5-1 in FCRPS BiOp (NOAA Fisheries 2008). Anticipated changes from actions prior to, and as a result of proposed actions in the BiOp to improve Snake River fall Chinook survival. Factors greater than 1.0 result in higher survival (e.g., 1.225 indicates a 22.5% increase in survival, compared to average current survival); 1.0 indicates no change, and numbers less than 1.0 result in lower survival (e.g., 0.996 indicates a 0.4% reduction in survival, compared to current average survival).

ESU	Survival Improvements	Hydro	Tributary Habitat	Estuary Habitat	Bird Predation	Pikeminnow Predation	Harvest	Hatcheries	Total Survival Multiplier
Snake River Fall Chinook	Base - from completed actions and current human activities likely to continue	N/A	1.0	1.01	1.02		1.09	NA	1.12
	Prospective Actions - as a result of Action Agency projects								
	Population analysis 1990-1999 with allowable future harvest	1.0	1.0	1.09	1.01	1.01	1.0	1.0	1.11
	Population analysis 1990-1999 with expected future harvest	1.0	1.0	1.09	1.01	1.01	1.06	1.0	1.18

NOAA's summary of VSP criteria for Snake River fall Chinook in the FCRPS BiOp are summarized in Table 7 below.

Table 7. VSP information for Snake River fall Chinook summarized from Table 8.2.2-1 and Table 8.2.2-2 from FCRPS BiOp (NOAA Fisheries 2008).

		Abundance			R/S Productivity			
ESU	Population	Most Recent 10 yr Geomean	Years included in Geomean	ICTRT Recovery Abundance Threshold	Average R/S: non-SAR adj.non-delimited	Lower and Upper C.I.	Risk for Distribution	Risk for Diversity
Snake River Fall Chinook	Lower Mainstem Fall Chinook 1977-	1,273	1995-2004	3,000	0.81	0.46 - 1.21	Moderately High' (large portion of historical habitat is inaccessible and the distribution of the extant population makes it vulnerable to variable environmental conditions and large disturbances)	Moderately High' (Loss of diversity associated with extinct populations and significant hatchery influence for the extant population)
	Lower Mainstem Fall Chinook 1990-	1,273	1995-2004	3,000	1.24	0.93-1.66		

Based on the above information NOAA Fisheries (2008) determined that:

- It is likely that the Snake River fall Chinook salmon ESU will trend toward recovery,
- It is likely that the species will have a short-term extinction risk,

- The Snake River fall Chinook ESU is expected to survive with an adequate potential for recovery, and
- That the affected designated critical habitat is likely to remain functional... , and
- Concluded that the FCRPS RPA is not likely to jeopardize the continued existence of the Snake River fall Chinook ESU….

6.4.2 TRT recommended viability criteria for ESUs with a single extant population as being applied to recovery.

Snake River fall Chinook present a significant challenge for recovery under the ESA since only one of the three original MPGs within the ESU remain; two populations or MPGs that existed above Hells Canyon Dam are extinct. The ICTRT (2007) recommended criteria for recovery[6], or more accurately for a population to be a low risk:

An MPG meeting the following five criteria would be at low risk:

1. ***At least one-half of the populations historically within the MPG (with a minimum of two populations) should meet viability standards.***

2. ***At least one population should be classified as "Highly Viable."***

3. ***Viable populations within an MPG should include some populations classified (based on historical intrinsic potential) as "Very Large", "Large" or "Intermediate" generally reflecting the proportions historically present within the MPG. In particular, Very Large and Large populations should be at or above their composite historical fraction within each MPG.***

4. ***All major life history strategies (e.g. spring and summer run-timing) that were present historically within the MPG should be represented in populations meeting viability requirements.***

5. ***Populations not meeting viability standards should be maintained with a) sufficient productivity so the overall MPG productivity does not fall below replacement (i.e. these areas should not serve as significant population sinks) and b) sufficient spatial structure and diversity demonstrated by achieving Maintained standards.***

Further, the ICTRT addressed the greater concern for ESUs that contained only one MPG historically or that currently include only one MPG. As expected the criteria are more stringent. They maintained that those with only one remaining MPG:

"(that the MPG)… for proper function should meet the following criteria:

• A single MPG should meet all the requirements to be at low risk (see above). In addition:

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[6] Reference to TRT recommended criteria herein does not constitute an endorsement of those criteria by co-managers. A Snake River fall Chinook recovery plan has not been completed and recovery criteria have not been adopted.

1. ***Two-thirds or more of the historical populations within the MPG should meet viability standards; AND***

2. ***At least two populations should meet the criteria to be "Highly Viable."***

The managers are uncertain as to how to meet these criteria for Snake River fall Chinook given the significant challenges of either reconnecting historic habitat above the Hells Canyon Complex (HCC) or reestablishing a self sustaining population somewhere above the HCC that could functionally meet these recovery criteria. The managers have therefore not specifically addressed this recovery aspect within this document.

6.4.3 Summary of demonstrated hatchery effects (+/-) on SR population viability.

Snake River fall Chinook population viability as discussed on previous sections is very difficult to calculate, in addition demonstrating hatchery effects both positive and negative is also extremely challenging. The initiation of the fall Chinook program was out of necessity to prevent this population from demographic extirpation. Adult returns were perilously low and harvest was drastically diminished or eliminated throughout the historic range. The HGMP and this addendum document discuss the recent increase of this population (both natural and hatchery) from extreme levels, partially remedied by this program. This moderate increase in the population (no where near historic levels) does demonstrate some effects and a partial list of those hatchery effects are:

- Dramatic increase in adults returning
- Decreased extinction risk
- Recolonization of areas in the recent past devoid of fall Chinook (Salmon, Grande Ronde, Imnaha, and tributaries to the Clearwater rivers) increasing the spatial distribution of spawners
- Influx of marine derived nutrients providing countless ecological benefits
- Harvest opportunities increased in ocean and mainstem fisheries and opening of upstream fisheries previously absent for greater than 40 years

These benefits have been realized and will continue into the future. This program also highly coordinated amongst the States, Tribes, and Federal entities and through continuing dialogue and adaptive management this program is expected to prosper.

6.4.4 Proposed Actions to assess Viability

	Proposed Action	Cost
1	**Develop management criteria for viable ESU with single extant population AND hatchery based mitigation requirements.**	**Existing staff**
2	**Assess options for management based minimum abundance thresholds.**	**Existing staff**
3	**Model sensitivity of SR fall production to climate change conditions (increased temperatures and increased frequency of high flow events).**	**$40,000**
4	**Support NOAA effort to describe relative impacts of all H's on Snake River fall Chinook consistent with U.S. vs. Oregon Management Agreement Section III.E.**	**Existing staff with NOAA staff**

6.5 Adaptive Management

6.5.1 Management Objectives

As an alternative to establishing a static suite of performance standards that could trigger re-initiation of consultation, an adaptive management framework will be followed.

Fisheries co-managers collect and utilize research and monitoring data to inform a variety of management decisions (CSMEP 2008). Pre-labeling core management decision points and the basic information used to guide those decisions is central in maintaining transparent and efficient management of resources. Establishing predetermined thresholds where management decisions are hard-wired is not readily embraced by managers or functionally possible given a complex environment and adaptive management framework.

The information used to inform the hatchery operation decisions is complex. Maintaining effective communications between policy, management, and research level positions is essential in assuring accountability and linking actual project performance into a formal fisheries management decision processes (policy level and management level). Establishing a decision framework, including timeframes, prior to management action implementation is desirable. This decision framework guides regular consideration to continue, terminate, modify specific management actions, or re-initiate ESA consultation. The hatchery management assumptions described below provide the technical link to a decision framework with both base expectations and basic data requirements. If any of the assumptions are proven to be false or suspect, either by direct project findings or literature, the project's ability to achieve management goals will be formally re-considered. Routine assessment for change in program scope (continuation) and direction will be applied as necessary, at a minimum every five years. The next formal assessment of Snake River fall Chinook salmon hatchery program performance is schedule to occur in 2013 as part of a Lower Snake River Compensation Program review. In addition we expect to conduct a program review in 2016 as this lines up better with US v OR negotiations for the new management plan and it fits the standard 5 yr check in that we have promoted in other ESA consultations

The following management objectives and assumptions, taken from the Ad Hoc Supplementation Work Group final report (Beasley et al 2008), have been recommended for application to select hatchery programs. The assumptions were developed through co-management meetings, recommendations and review of monitoring and evaluation literature. They have been slightly modified for application to Snake River fall Chinook.

Management Objective 1: Maintain and enhance natural production in supplemented population.

1a. Adult progeny per parent (P:P) ratios for hatchery-produced fish significantly exceed those of natural-origin fish.

1b. Natural spawning success of hatchery-origin fish must be similar to that of natural-origin fish. (Assessment of this assumption is not readily achievable at this time and is the subject of FCRPS BiOp RPA 64 and 65. Default monitoring may be limited to natural population growth rate).

1c. Temporal and spatial distribution of hatchery-origin spawners in nature is similar to that of natural-origin fish.
1d. Productivity of a supplemented population is similar to the natural productivity of the population had it not been supplemented (adjusted for density dependence). (Methods typically involve reference population monitoring which is problematic within an ESU with a single population. Consider default monitoring of natural population growth rate as stable or increasing to be sufficient).
1e. Post-release life stage-specific survival is similar between hatchery and natural-origin population components.

Management Objective 2: Maintain life history characteristics and genetic diversity in supplemented and unsupplemented populations.
2a. Adult life history characteristics in supplemented populations remain similar to pre-supplementation population characteristics.
2b. Juvenile life history characteristics in supplemented populations remain similar to pre-supplemented population characteristics.
2c. Genetic characteristics of the supplemented population remain similar (or improved) to the unsupplemented populations

Management Objective 3: Operate hatchery programs so that life history characteristics and genetic diversity of hatchery fish mimic natural fish.
3a. Genetic characteristics of hatchery-origin fish are indistinguishable from natural-origin fish.
3b. Life history characteristics of hatchery-origin adult fish are indistinguishable from natural-origin fish.

Management Objective 4: Effects of hatchery programs on non-target (same species) populations remain within acceptable limits.
4a. Strays from a hatchery program (alone, or aggregated with strays from other hatcheries) do not comprise more than 5% of the naturally spawning fish in the Snake River population.
4b. Snake River hatchery production strays do not exceed 5% of the abundance of any out-of-basin natural population.

Management Objective 5: Restore and maintain treaty-reserved tribal and non-treaty fisheries.
5a. Hatchery and natural-origin adult returns can be adequately forecasted to guide harvest opportunities.
5b. Hatchery adult returns are produced at a level of abundance adequate to support fisheries in most years with an acceptably limited impact to natural-spawner escapement.
5c. Harvest monitoring is adequate to ensure that harvest quotas for natural and hatchery-origin adults are not exceeded.

Management Objective 6: Operate hatchery programs to achieve optimal production effectiveness while meeting priority management objectives for natural production enhancement, diversity, harvest, impacts to non-target populations.

6a. Identify the most effective rearing and release strategies.
6b. Management methods (weirs, juvenile traps, harvest, adult out-plants, juvenile production releases) can be effectively implemented as described in management agreements and monitoring and evaluation plans.
6c. Frequency or presence of disease in hatchery and natural production groups will not increase above unsupplemented levels.

Management Objective 7: Understand the current status and trends of natural-origin
7a. Hatchery adults are adequately identifiable to allow accurate annual accounting of natural-origin adult abundance.
7b. Describe juvenile fish production in relationship to available habitat in each population and throughout a subbasin.
7c. Describe annual (and 10-year geometric mean) abundance of natural-origin adults relative to management thresholds (minimum spawner abundance and ESA delisting criteria) within prescribed precision targets.
7d. Adult fish utilize all available spawning habitat in each population and throughout a subbasin.
7e. The relationships between life history diversity, life stage survival, abundance and habitat are understood.
7f. Minimum Abundance Threshold (MAT) of 3,000 fish recommended by the ICTRT is compatible with management based viability criteria.

Management Objective 8: Coordinate monitoring and evaluation activities and communicate program findings to resource managers.
8a. Coordination of needed and existing activities within agencies and between all co-managers occurs in an efficient manner.
8b. Accurate data summary is continual and timely.
8c. Results are communicated in a timely fashion locally and regionally.

Management Assumptions 1a, 1b, and 1d directly address aspects of productivity of naturally spawning hatchery and natural origin fish. Monitoring associated with Management Assumption 7c addresses the ability to describe natural origin fish abundance. Validity of each assumption is checked by hypothesis testing, comparison to pre-established thresholds, and trend monitoring.

Natural origin abundance (4[7] or 5-year geometric mean) trending below a negotiated viability threshold would trigger reexamination of the Snake River fall Chinook salmon natural population management. The co-managers would work with NOAA to analyze the supplementation program compared to other actions and conditions that influence SR fall Chinook abundance, productivity, spatial structure and diversity, as well as legal principles, included by not limited to the Tribes' treaty rights, the States'

[7] A 4-year mean would be consistent with the AMIP document which considers the affects of all four "H's" in population status. A 5-yearmean would represent one generation for SRFC.

interests, the Secretarial Order on ESA and Tribal Treaty rights, the conservation necessity principles and the ESA. Trending below the threshold would not necessarily institute re-consultation but would depend on considering abundance in relation to ocean conditions (adjust for general ocean productivity changes that will broadly affect most populations) and as importantly, to view abundance and productivity together. As previously mentioned, if the population is stable or increasing, even if absolute abundance is below the consultation threshold, the managers would maintain that additional years of productivity data are necessary before considering changes in the program. It is likely that the ongoing interchange of data among the managers and NOAA Fisheries will inform the need for more formal consultation rather than this particular trigger point.

We believe that the suite of expanded RM&E proposed in this addendum will substantially improve the understanding of natural population status and trend and provide the basis for examining the effects of the supplementation program

6.5.2 Proposed Actions to address improving certainty of Productivity

	Proposed Action	Cost
1	**Develop management criteria for viable ESU with single extant population AND hatchery based mitigation requirements.**	**Existing staff**
2	**Commitment to formal adaptive management process with pre-established management assumptions, monitoring and evaluation, formal report, and symposium conducted in 2016.**	**$15,000**
3	**Support NOAA effort to describe relative impacts of all H's on Snake River fall Chinook consistent with U.S. vs. Oregon Management Agreement Section III.E.**	**Existing staff**

Attachment A.

Snake River Fall Chinook Salmon Trapping at Lower Granite Dam

by

Bill Young, Nez Perce Tribe

Stuart Rosenberger, Idaho Power Company

Debbie Milks, Washington Department of Fish and Wildlife

April 6, 2011

Fall Chinook salmon run reconstructions to Lower Granite Dam (LGD) are performed each year using a set trapping rate (or rates) to randomly sample fall Chinook and generate an estimate of the entire run composition to LGD. In addition to generating estimates of hatchery, natural and individual release groups, sampling methods used to generate the run reconstruction estimates of total returns to LGD allow for the calculation of precision and accuracy measures superior to that obtained using window counts. These measures are only useful if the trapping methods are truly random and the composition of the sample can be accurately determined. This memo provides a brief summary of data and analysis obtained from fall Chinook salmon run reconstruction estimates (2006-2010) and the recent observations of bias in the abundance estimates.

Standardized and effective LGD trapping protocols providing adequate accuracy and precision estimates have only been around since 2004; prior to that the trapping protocols were not well established. Since 2004 a comparison of total fall Chinook returns obtained by window counts and run reconstructions revealed a consistent bias, with the run reconstruction estimate greater than window counts in all but one year (Figure 1). Looking only at adults, the run reconstruction estimates were always greater than that determined by window counts (Figure 2). Recently the divergence between the estimates has increased, approaching 20% greater estimates from run reconstructions compared to window counts.

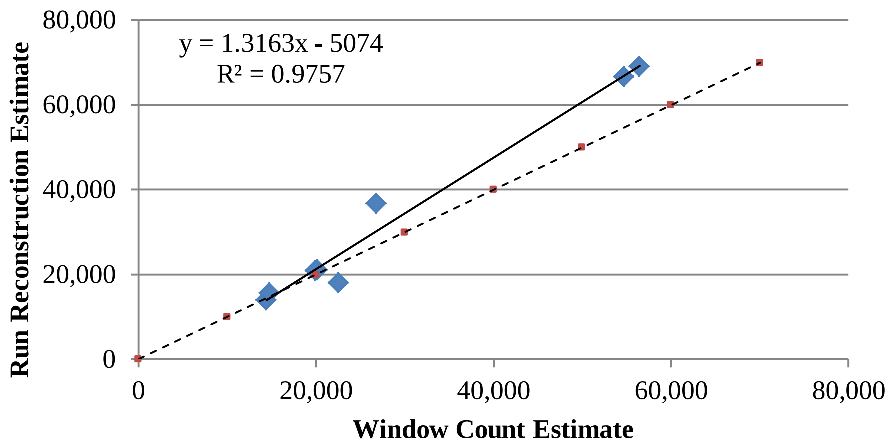

Figure 1. Relationship between the total fall Chinook salmon (jacks and adults) to Lower Granite Dam obtained from window counts and run reconstruction. The solid line indicates the data trend line and the dashed line indicated the expected 1:1 trend line.

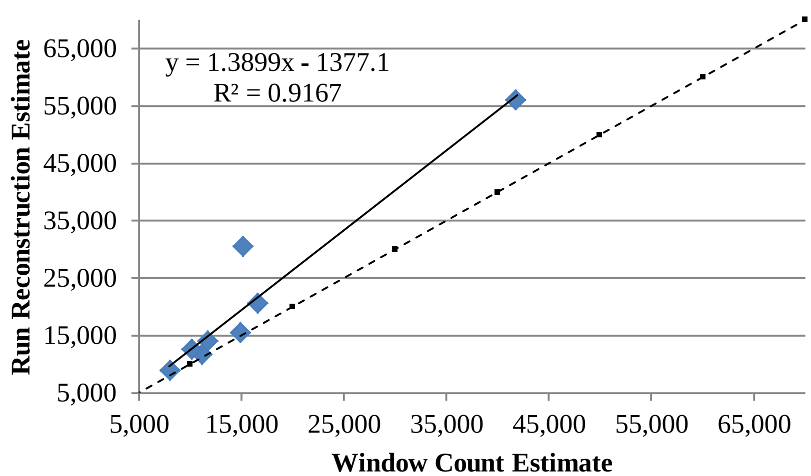

Figure 2. Annual comparison of the number of adult fall Chinook salmon to Lower Granite Dam obtained from window counts and run reconstruction. The solid line indicates the data trend line and the dashed line indicated the expected 1:1 trend line.

If we assume that a bias exists, it is likely that the methods used for the calculation of one of these estimates (window count or run reconstructions) produced the observed bias. Potential bias from window counts could have arisen from how the counts were conducted. Actual counting is performed for 50 out of 60 minutes per hour for 16 hours per day early in the fall Chinook passage period, then is reduced to 10 hour counts late in the season. Both of these factors were accounted for in the final estimates. Hourly estimates were expanded to account for the time period that no counts occurred (expanded by 0.83). Similarly, in our analysis night passage was estimated based on an analysis performed by the fish passage Center that demonstrated approximately 3.2% of fall Chinook salmon pass the ladders at night as determined by the detection of PIT tagged fish (http://www.fpc.org/documents/FPC_memos.html). Finally, window counts were completed on each of the four lower Snake River dams, and total fall Chinook salmon abundance estimates were similar at each facility, suggesting that the counting methods were consistent across the facilities. We are not suggesting that window counts are highly accurate or completely represent fall Chinook abundance, but we can see no factor that leads to a bias in the data.

Run reconstruction estimates were based on trapping a random sample of fish across the return then expanding the sample by the trapping rate. Generally trapping rates ranged from 10% – 20% of the fish passing the ladder, with the rate set before the season at a rate adequate to collect broodstock for ongoing hatchery programs at Lyons Ferry Hatchery and Nez Perce Tribal Hatchery. Depending on the size of the return of both fall Chinook and steelhead and broodstock needs, the trap rate may have changed during the season, usually reduced, as broodstock needs are met or total numbers exceed what is manageable at the adult facility.

Functionally, the trap consists of a set of two gates in the fish ladder, each set to open four times per hour, 24 hours per day for a set amount of time depending on the trapping rate. The gates are computer controlled and a report is generated that provides the exact amount of time that the gate was open down to the second. In addition, the gates are programmed to open when it detects specific PIT tagged fish (sort-by-code fish) so they can be captured outside of the trapping times. This additional time is added to the set trap rate to generate the adjusted trap rate (set trap rate plus sort-by-code time). The adjusted trap rate number is used to expand the sample and come up with a total number of fish passing the trap each day and for the season. Sort-by-code fish are identified by their unique PIT tag at the LGD trap or hatchery and are removed from the sample prior to run reconstruction analysis so that they did not inflate the estimate.

Based on the trapping report and communications with Doug Marsh (NOAA-Fisheries), there does not appear to be any issues with the trap function that would indicate a bias. However, when the number of fish trapped per day is compared to the window counts, it appears that the trap captures a higher percentage of fish than would be expected given the trapping rate. This discrepancy between window counts and trap rate was observed in 2008, 2009, and 2010. With no bias you would expect the number of fish captured by the trap to approximately equal the trapping rate multiplied by the number of fish that passed the trap (or window). For example, if the trap is set to open 10% of the time and 100 fish pass through the ladder on a given day, you would expect to capture 10 fish. On any given day the total fish captured would deviate greater than or less than the expected due to chance, but over multiple days the deviation from the trap rate should equal zero. Detecting anomalies or bias in the trapping rate should be possible by calculating the deviation between the number of fish counted at the window and the number of fish captured in the trap. For this analysis we calculated the daily deviation in trap rate as the difference between the observed and expected trapping rate using these two variables (number of fish counted at the window and number of fish trapped). The observed trapping rate was calculated as the number of fish in the trap divided by the number of fish that passed the window each day (# trapped fish/# fish passing the window). The expected trapping rate was calculated as the adjusted trapping rate multiplied by the number of fish passing the counting window each day (trap rate x # fish passing the window). Given no bias the daily deviation should be evenly distributed around zero with a mean of zero.

An examination of the expected and observed trapping rates and the deviation from the expected trapping rate at the LGD trap from 2005 through 2010 revealed significant deviations between the observed and expected trapping rates in 2008, 2009 and 2010 (Table 1). For every year except 2009 we only used the 80% passage window for this calculation to avoid issues related to small sample sizes early and late in the season. In 2009 only 4 days were available in the early passage period (12% trapping rate) so we included all days with greater than 100 fall Chinook passages during the 12% trapping period. Generally deviations were low early in the trapping period then diverged as the trapping rate was changed (lowered). This was especially evident in 2008, when the trap rate changed twice and the magnitude of the deviation increased each time until it was nearly 12%.

When we plotted the daily deviation in trap rate verses date (Figures 3, 4, 5, 6, 7), a consistent positive bias is revealed only in those years when the trapping rate changed during the season (2010, 2008), but did not occur in those years when the trap rate didn't change (2007, 2006). A closer examination of Figures 3 and 5 revealed that the bias didn't arise until the trap rate changes, prior to that time it appeared to be randomly distributed around zero. Because the trap rate change occurred unusually early in 2009 there was not enough data to conclude anything about the trap rate change observed in Figure 4. However, data from Table 1 suggested that a bias was present after the trap rate changed.

Table 1. Year, trapping start and end dates, expected and observed trapping rates and the deviation from the expected trapping rate at the Lower Granite Dam ladder from 2005 – 2010. Observed and expected trapping rates were calculated from the 80% window passage for all years except 2009, where the entire early trapping period was used in this calculation.

Year	Trapping start date	Trapping end date	Expected trapping rate	Observed trapping rate	Deviation from expected trapping rate
2005	9/6	11/16	13%	10.24%	-2.76%
2006	9/1	11/21	13%	13.43%	0.43%
2007	9/1	11/20	20%	19.88%	-0.12%
2008	8/24	9/12	20.04%	19.78%	-0.26%
	9/13	9/26	12.07%	17.01%	4.93%
	9/27	11/21	10.01%	21.87%	11.86%
2009	8/18	9/8	12.06%	12.73%	0.67%
	9/9	11/15	9.11%	11.56%	2.45%
2010	8/22	9/18	12.11%	12.78%	0.67%
	9/19	11/18	10.07%	13.00%	2.93%

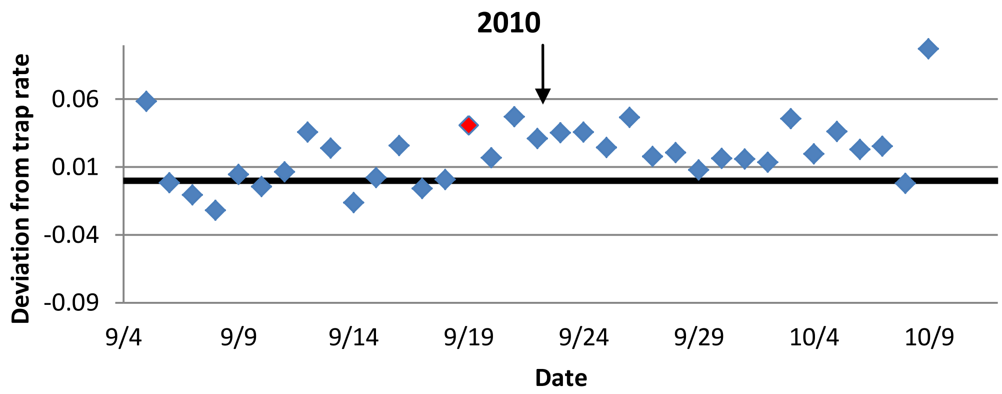

Figure 3. A graph of the daily deviation between the observed and expected trapping rate at the LGD fish ladder for the 80% passage window in 2010. The observed trapping rate was calculated by dividing the number of fish in the trap by the number of fish that passed the counting window that day. The expected trapping rate was the proportion of time that the automatic gates were programmed to open each day plus the number of seconds the gate is open to capture sort-by-code fish, calculated per day then averaged over the trapping period. Window counts were expanded to account for 50 minute observations per hour and night passage. The bold line represents zero deviation. The red data point and arrow represent the day that the set trapping rate changed.

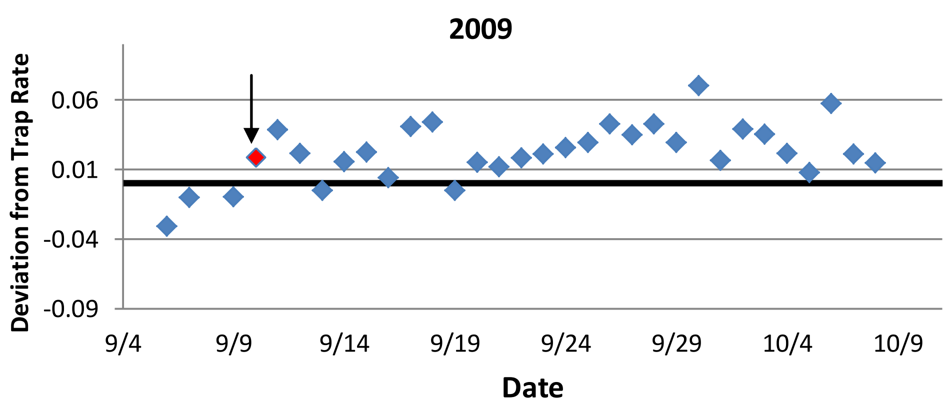

Figure 4. A graph of the daily deviation between the observed and expected trapping rate at the LGD fish ladder for the 80% passage window in 2009. The observed trapping rate was calculated by dividing the number of fish in the trap by the number of fish that passed the counting window that day. The expected trapping rate was the proportion of time that the automatic gates were programmed to open each day. Window counts were expanded to account for 50 minute observations per hour and night passage. The bold line represents zero deviation. The red data point and arrow represent the day that the set trapping rate changed.

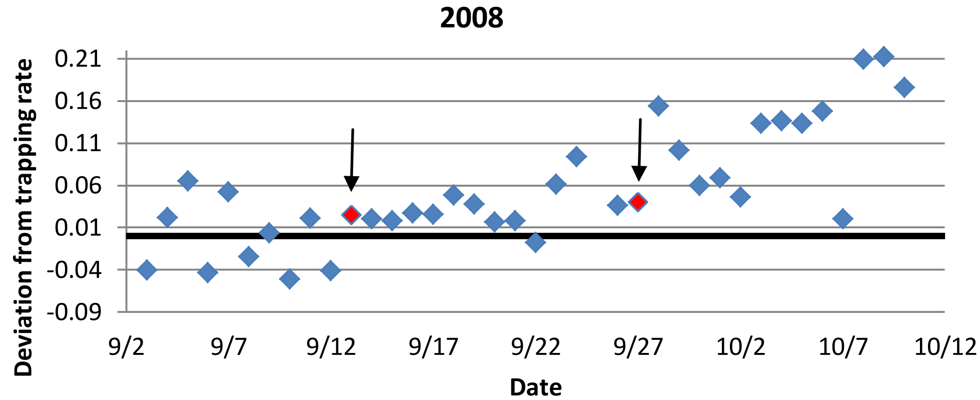

Figure 5. A graph of the daily deviation between the observed and expected trapping rate at the LGD fish ladder for the 80% passage window in 2008. The observed trapping rate was calculated by dividing the number of fish in the trap by the number of fish that passed the counting window that day. The expected trapping rate was the proportion of time that the automatic gates were programmed to open each day. Window counts were expanded to account for 50 minute observations per hour and night passage. The bold line represents zero deviation. The red data points and arrows represent the days that the set trapping rate changed.

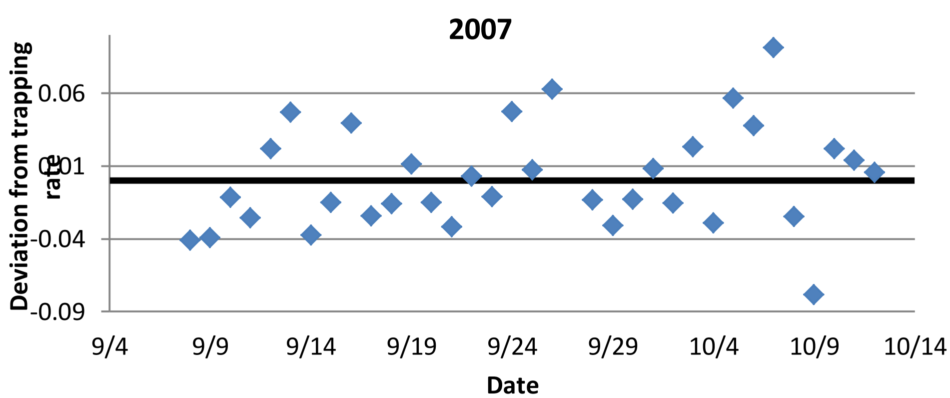

Figure 6. A graph of the daily deviation between the observed and expected trapping rate at the LGD fish ladder for the 80% passage window in 2007. The observed trapping rate was calculated by dividing the number of fish in the trap by the number of fish that passed the counting window that day. The expected trapping rate was the proportion of time that the automatic gates were programmed to open each day. Window counts were expanded to account for 50 minute observations per hour and night passage. The bold line represents zero deviation.

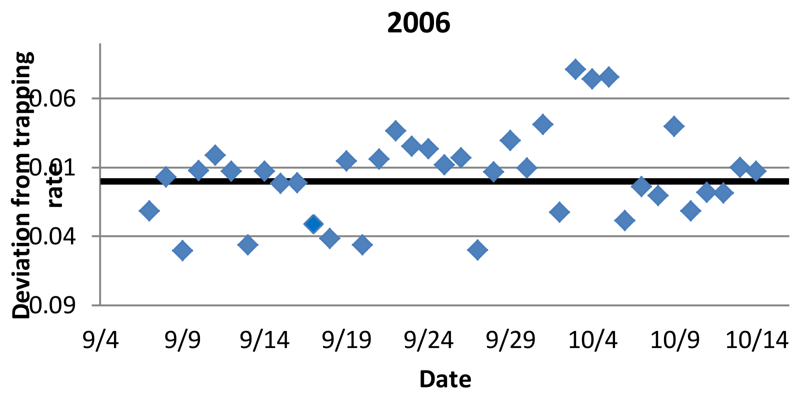

Figure 7. A graph of the daily deviation between the observed and expected trapping rate at the LGD fish ladder for the 80% passage window in 2006. The observed trapping rate was calculated by dividing the number of fish in the trap by the number of fish that passed the counting window that day. The expected trapping rate was the proportion of time that the automatic gates were programmed to open each day. Window counts were expanded to account for 50 minute observations per hour and night passage. The bold line represents zero deviation.

These analyses rely on accurate and unbiased window count estimates and we have not ruled out the possibility that window counts are flawed. However, the apparent increase in observed trapping rate that occurred each time the trap rate was changed suggests that it was more of a trap issue. Ben Sandford (NOAA Fisheries) completed a preliminary statistical analysis of the data from 2008 through 2010. Data from 2009 could not be analyzed because not enough days were available prior to the trap change. Results from 2008 and 2010 were mixed. Ben's summary: 2010 shows the odd effect where a change in the "specified trap rate" seems to have led to a bias. Data from 2009 can't be evaluated due to very early change date. Data from 2008 shows more of a general temporal trend (bias increased linearly over time) in bias but perhaps a finer-scale analysis could be done as there are unique patterns to the data. He recommends a more careful analysis in the future.

Recommendations

1. Install a high resolution video camera to monitor/validate the by-catch associated with sort-by-code fish entering the trap. Recently, the number of sort-by-code fish has increased significantly (>2,600 fish in 2010), so the trap opens much more frequently outside of the set trapping times. If Chinook salmon group together then the trap opening for a single sort-by-code fish may have a higher probability of trapping additional fish compared to the random possibility associated with the gate opening. Previously a video camera was placed over the gate to account for the trapping of sort-by-code and other fish trapped outside the trapping times. Frequent openings for short periods of time also relates to #2.

2. Investigate how the length of time the trap opens influences the trapping rate. Generally the trap is opened four times an hour and the length of those openings is set based on the

overall rate. It is possible that as the trap rate decreases, the four openings are no longer sufficient to provide a representative sample. In both 2008 and 2010 the discrepancy between the observed and expected trap rate is amplified once the trap rate is set below 12 percent. This conclusion is supported by the data from 2006 and 2007, in which the trap rate was held constant at 13 and 20 percent respectively, and the discrepancy between the expected and observed trap rate was low. Further evidence for this explanation was observed in 2009 when the trap was held at a constant 9 percent for nearly the entire season, and yet the expected and observed trap rates were similar to the discrepancies observed in 2008 and 2010 after the rate was decreased. Because there is no reason to doubt the function of the trapping mechanism, and there is little evidence to suggest that the window counts are exceedingly inaccurate, a reduction of the trapping rate below 12 percent may be related to the inaccuracies that have been observed. One possible solution would be to reduce the number of times the trap is opened per hour to ensure that the trap is open for a sufficient amount of time to collect a representative sample.

3. Conduct a thorough review of the window counting protocol could identify potential sources of bias in window count abundance estimates. Our analysis assumed that the window counts are accurate, which may not be the case. Representatives from the window counting and run reconstruction groups should meet and discuss potential counting challenges.