United States Department of the Interior

BUREAU OF INDIAN AFFAIRS
Northern Idaho Agency
P.O. Drawer 277
Lapawi, ID 83540-0277

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:
Office of the Superintendent

May 27, 2011

Mr. Rob Jones
Salmon Management Division
National Marine Fisheries Service
1201 NE Lloyd Blvd, Suite 1100
Portland, OR 97232

Dear Mr. Jones:

The Nez Perce Tribe, through the Bureau of Indian Affairs, submits this Wallowa/Lostine spring Chinook salmon Hatchery and Genetic Management Plan (HGMP). This HGMP was 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 to renew ESA consultation for a Section 10(a)(l)(A) permit for artificial propagation purposes to enhance the survival of ESA listed Snake River spring/summer Chinook salmon. Activities associated with this artificial propagation program were previously permitted through Section 10 Permits #1011, Modification 1 and Modification 2, and Permit #1149. In addition, the Lostine Monitoring and Evaluation program is authorized under ESA Section 10 Permit Number 1134 and USFWS Permit Number TE001598-3.

Please contact the Nez Perce Tribe's technical representative, Becky Johnson at (208) 621-4629, if you have any questions regarding this request. We appreciate your assistance and prompt attention to this request.

Sincerely,

Greg LaFrance, Superintendent

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Grande Ronde Endemic Spring Chinook Salmon Supplementation Program (GRESCSP)
Species or Hatchery Stock:	Snake River Spring/Summer Chinook Salmon – Wallowa/Lostine population
Agency/Operator:	Nez Perce Tribe
Watershed and Region:	Lostine River/ Wallowa River/ Grande Ronde River Basin
Date Submitted:	
Date Last Updated:	May 31, 2011

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Grande Ronde Endemic Spring Chinook Salmon Supplementation Program (GRESCSP); Lostine River stock

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

Oncorhynchus tshawytscha
Snake River spring/summer Chinook salmon
Wallowa/Lostine River population
ESA status: Threatened

1.3) Responsible organization and individuals

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Name (and title): Timothy Hoffnagle, LSRCP Chinook Salmon Project Leader
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Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:
Confederated Tribes of the Umatilla Indian Reservation (CTUIR): Operation of satellite facilities program on Catherine Creek and upper Grande Ronde River.

Oregon Department of Fish and Wildlife (ODFW): Operation of Lookingglass, Imnaha Satellite, Bonneville, Oxbow, and Irrigon hatcheries providing for adult holding and spawning, incubation, and rearing of Lostine River captive brood and conventional endemic stocks.

National Oceanic and Atmospheric Administration Marine Fisheries Service (NOAA Fisheries): Operation of Manchester Marine Lab for rearing of Lostine River captive broodstocks, program oversight-ESA permitting.

U.S. Fish and Wildlife Service (USFWS): Lower Snake River Compensation Plan Program funding/oversight.

Bureau of Indian Affairs (BIA) - Policy and Technical Support

Columbia River Inter-Tribal Fish Commission (CRITFC) - Technical and Policy Support

Bonneville Power Administration (BPA): Funding agency for Lostine weir and acclimation facility. Also providing funding for construction, operation and maintenance of proposed facilities under NEOH.

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

LSRCP--The program is part of the federally mandated LSRCP mitigation program funded through the US Fish and Wildlife Service and designed to mitigate for fish losses at the Lower Snake River dams. The LSRCP spring/summer Chinook program in Northeast Oregon includes Lookingglass Hatchery, integrated with the Grande Ronde Basin Chinook program, Imnaha Basin program, and Safety Net program (SNP). ODFW staff operating this program include; Hatchery Coordinator, Hatchery Manager, Supervisor, 4 hatchery technician positions, one three month technician position shared with Wallowa Hatchery, one Facilities Operations Specialist, and 2 seasonal laborer positions at Lookingglass Hatchery. Annual operation and maintenance costs for the Lostine River portion of the FY 2007 program are estimated at $170,000. Oregon Department of Fish & Wildlife operates the juvenile screw trap on the Lostine River (with NPT assistance) and coordinates the spawning ground surveys in the Grande Ronde and Imnaha basins (with NPT assistance).

***BPA* --** BPA funds NPT to operate the Lostine River acclimation and adult collection facilities (conventional production). Operations and maintenance program staff is 3 full time and 2 seasonal NPT employees. Annual operation and maintenance costs are estimated at $345,979 (2010 budget). BPA also funds monitoring and evaluation staff, 3 full time and 2 seasonal, with annual costs estimated at $197,434 (2010 budget). Funds estimated to be spent on the Lostine River for both operations and maintenance and monitoring and evaluation is estimated at $543,413.

BPA also funds a captive broodstock component of the program. Captive brood was a conservation measure initiated in three subbasins within the Grande Ronde Basin including the Lostine River in response to severely declining abundance of spring Chinook salmon. The program was initiated in 1995 using parr collected from BY1994. Juveniles were reared to maturity, spawned, and the eggs incorporated into the LSRCP program. The FY2010 budget (ODFW) for the overall Grande Ronde River Captive Broodstock Program is $765,000. The release of captive broodstock F^1 smolts from this program in the Lostine River first occurred in 1998. As the conventional production of F^1 smolts increased to the planned production of 250,000 smolts the production of captive F^1 smolts decreased and began phasing out with BY2007. The final release of captive F^1 smolts will occur in 2011. Monitoring and evaluation of adult returns from captive F^1 smolt releases will continue under the Lostine River Monitoring and Evaluation program.

BPA funds ODFW to provide transportation and fish health service associated with the overall endemic program. Total cost is estimated at $70,000.

1.5 Location(s) of hatchery and associated facilities.

Latitude and Longitude (WGS 84) of relevant program components:

- Lostine River Creek Juvenile (Screw) Trap Location: 45.531699 117.469762

- Lostine River Adult Weir Location: 45.543611 117.484729
- Lostine River Acclimation Facility: 45.425000 117.444000
- Lookingglass Fish Hatchery: 45.733900 117.864000, 76657 Lookingglass Rd. Elgin, Oregon 97827

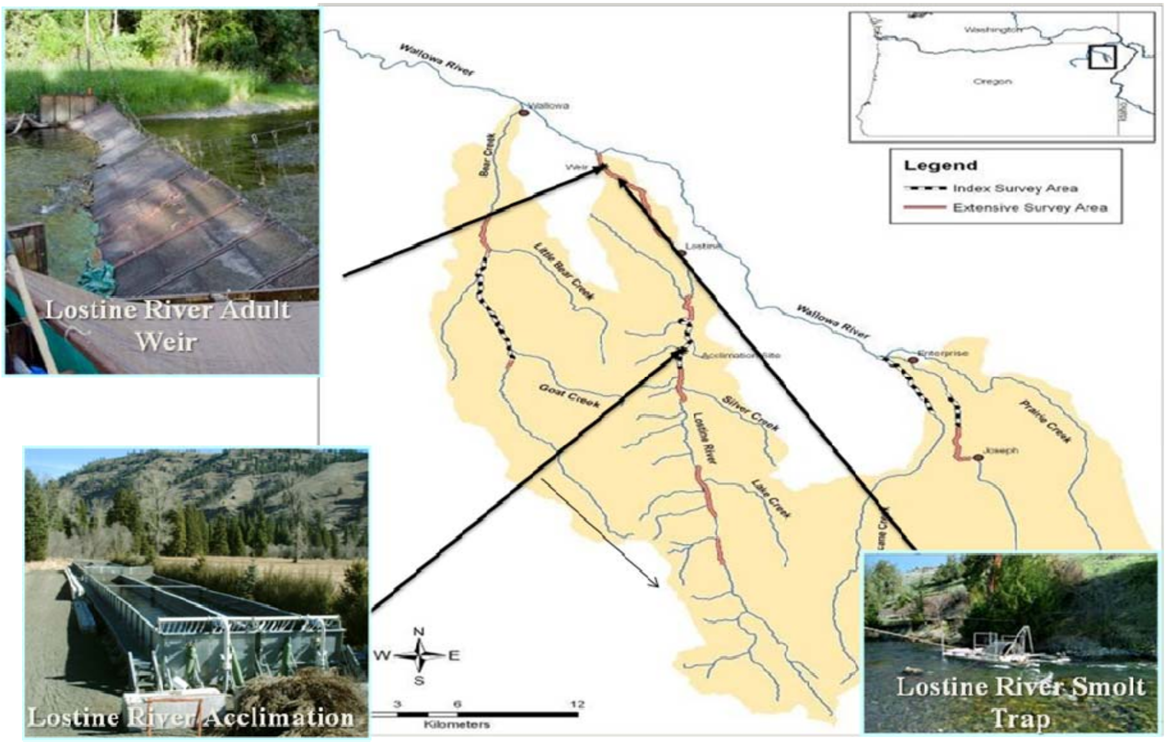

Figure 1. Map the Lostine River Watershed and locations for the Lostine River screwtrap, adult/weir trap, and acclimation facility.

1.6) Type of program.

Integrated mitigation/recovery program. The Lostine spring Chinook salmon program is funded through BPA for mitigation and managed to recover and sustain the population and, in years of abundant returns, provide harvest opportunities.

1.7) Purpose (Goal) of program.

The goal of this program is restoration of spring/summer Chinook salmon in the Lostine River using the indigenous stock. This program is part of the Lower Snake River Compensation Plan, which purpose is to replace adult salmon, steelhead and rainbow trout lost by the construction and operation of four hydroelectric dams on the Lower Snake River in Washington. Specifically, the stated purpose of the plan is:
"… [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)

Specific mitigation goals for the LSRCP were established in a three step process. 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 and habitat loss. 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. Other than recognizing that the escapements back to the project area would be used for hatchery broodstock, no other specific priorities or goals were established in the enabling legislation or supporting documents regarding how these fish might used.

For spring Chinook salmon, the escapement above Lower Granite Dam prior to construction of these dams was estimated at 122,200 adults. Based on a 15% mortality rate for smolts transiting each of the four dams (48% total mortality) the expected reduction in adults subsequently returning to the area above Lower Granite Dam was 58,700 (Table 1). This number established the LSRCP escapement mitigation goal. This reduction in natural spawning escapement was estimated to result in a reduction in the coast wide commercial/tribal harvest of 176,100 adults, and a reduction in the recreational fishery harvest of 58,700 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 293,500.

Table 1. Lower Snake River Compensation Plan goals for escapement and harvest of spring/summer Chinook salmon.

Component	Number of Adults
Escapement above Lower Granite Dam	58,700
Commercial Harvest	176,100
Recreational Harvest	58,700
Total	293,500

Since 1976, when the LSRCP was authorized, many of the parameters and assumptions used to size the hatchery program and estimate the magnitude and flow 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 needing to be produced.
- The listing of Spring Chinook under the Endangered Species Act has resulted in significant curtailment of commercial, recreational and tribal fisheries throughout the mainstem Columbia River. This has resulted in a higher percentage of the annual run returning to the project area.

- The *U.S. v. Oregon* court stipulated Columbia River Fish Management Plan has established specific hatchery production agreements between the states, tribes and federal government. This agreement has substantially diversified the spring Chinook hatchery program by adding new off station releases sites and stocks designed to meet short term conservation objectives.

The LSRCP mitigation goal for the Grande Ronde River Basin is to escape 5,860 spring Chinook back to the project area after providing for a harvest of 23,440 adults. The Lostine River spring Chinook program is one of four components that make up the LSRCP mitigation program for the Grande Ronde River Basin. Program specific goals include:

- Contribute to the recreational, commercial and tribal fisheries in the mainstem Columbia River consistent with agreed abundance based harvest rate schedules established in the 2008 – 2017 U.S. vs. Oregon Management Agreement.
- Reestablish tribal and sport fisheries in the Grande Ronde River Basin.
- Establish an annual supply of brood fish that can provide an egg source capable of meeting mitigation goals. The Lostine River mitigation goal is 250,000 smolts which requires 142 adults for broodstock.
- Restore, maintain, and preserve a viable natural spawning population in the Upper Grande Ronde River.
- Provide adults that contribute toward meeting the LSRCP mitigation goal for the Grande Ronde River Basin.
- Minimize the impacts of the program on other indigenous fish species.

1.8) Justification for the program.

The LSRCP is a congressionally mandated program pursuant to PL 99-662. The goals of the LSRCP program are to provide adult Chinook for recreational and tribal harvest within the LSRCP mitigation area (Snake River and tributaries above Ice Harbor Dam), and the Columbia River as well as provide for hatchery broodstock. The Lostine River population is at high risk of extinction (ICTRT 2005) and the program utilizes an integrated endemic Chinook hatchery stock in order to provide conservation benefits for the natural population.

Prior to the 1900s, returning adult Chinook salmon were estimated to number more than 1.5 million in the Snake River Basin (NMFS 1995). However, numerous stock assessments and review literature have documented the contemporary demise of these Snake River populations (Horner and Bjornn 1979; Howell et al. 1985; Nehlsen et al. 1991). In recognition of this decline, the National Marine Fisheries Service (NMFS 1992) listed Snake River spring and summer Chinook as threatened under the federal Endangered Species Act (ESA) in 1992. Spring Chinook populations in the Lostine River also experienced drastic declines in recent decades (Figure 2) (Ashe et al. 2000). This stock faced a high demographic risk of extirpation at low escapement levels prior to 1999

(Mundy 1999); in 2005 only 11 redds were observed in the Lostine River. This decline is described in the Grande Ronde Subbasin Plan (Nowak et al. 2004) which contains the most recent status assessment of the population.

Some of this reduced productivity was anticipated as the result of constructing and operating four hydroelectric dams on the Lower Snake River. To compensate for an anticipated 48% reduction in survival of juveniles through the hydrosystem, the Lower Snake River Compensation Plan (LSRCP) hatchery program was implemented in the 1980s as mitigation.

In 1994, fisheries co-managers, ODFW, NPT, CTUIR, and USFWS implemented the Grande Ronde Basin Endemic Spring Chinook Supplementation Program in the Lostine River, Catherine Creek and the upper Grande Ronde River. The goal of this program is to prevent extinction of spring Chinook in the three tributaries, provide a future basis to reverse the decline in stock abundance, and ensure a high probability of population persistence. The GRESP proposes to increase the survival of spring Chinook salmon in the Grande Ronde River by increasing egg to smolt survival through hatchery incubation and rearing (80% survival as compared to 12% survival for wild/natural). An increase in adult returns and natural spawners would likewise increase the number of natural-origin offspring. Artificial propagation under this program utilizes conventional and captive brood stock sources and is implemented as an integrated mitigation/recovery program. However, the captive broodstock program began phasing out in brood year 2007 with the final production of F^1smolts occurring for brood year 2009.

Comparison to the Viability Curve

The Lostine/Wallowa Rivers spring Chinook salmon population is at **High Risk** based on current abundance and productivity. The point estimate resides below the 25% risk curve (Figure 2). Returns of natural-origin spawners to the Lostine/Wallowa spring Chinook salmon population have exhibited a slight upwards trend since 1980, exhibiting an average increase of approximately 1% per year. The general pattern in natural returns is similar to many other Snake River spring Chinook salmon populations —relatively low returns in the late 1970s, then increased levels in the mid-1980s followed by a series of low escapement years in the mid-1990s. Returns during the most recent 20 year period peaked in 2001-2003, followed by a decline in 2004/2005. Carcass surveys indicated that a substantial proportion of spawners were of hatchery-origin in this population from 1985-1993, and from 2001-2005 (the most recent year in the available data series). Prior to the 1993 return year, hatchery-origin spawners originated from a non-local broodstock releases in the drainage. The program was transitioned to a local-origin broodstock in the mid-1990s. Non-local origin returns were actively removed at Lower Granite Dam during the transition period. Assuming that hatchery and natural-origin spawners contribute to production at the same rate, the estimated intrinsic population growth rate over the most recent twenty year period has been below replacement (0.94, 33% probability of exceeding 1.0). The estimate of population growth rate is sensitive to the assumption regarding relative hatchery effectiveness at the average level of hatchery-origin spawner proportion observed for the Lostine/Wallowa spring/summer Chinook salmon population. Setting the relative hatchery effectiveness value to 0.00, reflecting the opposite extreme assumption, results in an estimated average population growth rate of 1.03.

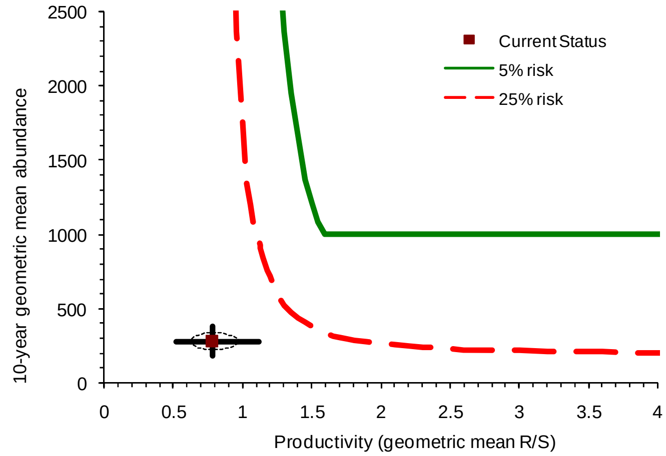

Figure 2. Lostine/Wallowa Rivers spring Chinook salmon current abundance and productivity compared to ESU viability curve. Ellipse = 1 SE. Error bars = 90% CI.

Overall Viability Rating

The Lostine/Wallowa Rivers spring Chinook salmon population does not meet viability criteria and the overall viability rating is considered **HIGH RISK** (Figure 2). Overall abundance and productivity is rated at **High Risk.** The 10-year geometric mean abundance of natural-origin spawners is 276, which is only 28% of the minimum abundance threshold of 1,000. The 20-year geometric mean productivity (0.78 R/S;Table 2) is in the high risk zone and well below the goal of 1.58 R/S at the minimum abundance threshold. The spatial structure/diversity rating is **Moderate Risk** due to reduced life history diversity and spawner composition.

Table 2. Lostine/Wallowa Rivers spring 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 - not meeting viability criteria (darkest cells are at greatest risk).*

		Spatial Structure/Diversity Risk			
		Very Low	**Low**	**Moderate**	**High**
Abundance/ Productivity Risk	**Very Low** (<1%)	**HV**	**HV**	**V**	**M**
	Low (1-5%)	**V**	**V**	**V**	**M**
	Moderate (6 – 25%)	**M**	**M**	**M**	**HR**
	High (>25%)	**HR**	**HR**	**HR Lostine/ Wallowa Rivers**	**HR**

1.9) List of program "Performance Standards".

A 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. Upon review of the NPCC "Artificial Production Review" document (2001) we have determined that this document represents the common knowledge up to 2001 and that the utilization of more recent reviews on the standardized methods for evaluation of hatcheries and supplementation at a basin wide ESU scale was warranted.

In a report prepared for Northwest Power and Conservation Council, 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 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 for specific to supplementation projects. The framework utilizes a common set of standardized performance measures (Table 4) as established by the Collaborative Systemwide 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 aimed at addressing management questions and critical uncertainties associated with 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 natural 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. NPCC 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 in the AHSWG and the later standards should apply to this document. Table 3 represents the union of performance standards described by the Northwest Power and Conservation Council (NPCC 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 (2008).

Table 3. Compilation of performance standards described by the Northwest Power and Conservation Council (NPCC 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 (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.

Category	Standards	Indicators
	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.
	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, 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.
	2.7. Weir management and broodstock collection are consistent with best management practices for the program type.	2.7.1. Number of fish retained for broodstock for each origin and program are in compliance with AOPs and US vs. OR Management Agreement. 2.7.2. Number of fish of each origin and program released above the weir are in compliance with AOPs and US vs. OR Management Agreement.
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.

Category	Standards	Indicators
	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 natural salmon or other 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.
	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 trends 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 outmigrations 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 among 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.
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.

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 Table 3. The CSMEP measures have been adopted by the AHSWG (Beasley et. al. 2008), and are consistent with those presented in the Northeast Oregon Hatchery Monitoring and Evaluation Plan (NEOH M&E Plan) (Hesse et al. 2006). 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 Beasley et al. (2008)) used by the Lostine project, and the assumptions that need to be tested for each standard.

Table 4. Standardized performance measures and definitions for status and trends and hatchery effectiveness monitoring and the associated performance indicator that it addresses. (Modified from Beasley et al. 2008, also consistent with Hesse et al. 2006).

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
Abundance	Fish per Redd	Number of fish (all age classes) 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
Abundance	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 or spawning ground survey 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
Abundance	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
Abundance	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 total number of prespawning 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
Abundance	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
Abundance	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
Abundance	Harvest Abundance in Tributary	Number of fish caught in tributaries (tribal or sport) 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
Abundance	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

Performance Measure		Definition	Related Indicator
	Juvenile Emigrant Abundance	Gauss software is (Aptech Systems, Maple Valley, Washington) isused 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). We estimate hatchery and natural smolt abundance separately. Hatchery smolt numbers are estimated by the numbers released – numbers at the last census minus mortalities. Natural smolt numbers are estimated using two separate estimates. First, we estimate spring tributary migrants using trap efficiency estimates by mark recapture methods. Additionally, natural parr abundance estimates are calculated (ODFW Early life History Project) and PIT-tagged parr are used to estimate smolt numbers from parr that left the system during the fall and were not available for capture at tributary traps. these two estimates are summed to estimate total natural smolt abundance.	3.2.1, 3.6.1, 3.7.4
	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, presmolt, 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	The numbers of mature salmon expected to return to a given stream, by origin and age, for a given run year. Methods for estimating these numbers are evolving and use numbers of smolts, ocean condition indices and abundance of a given brood year in the previous run year (e.g., the number of age 3 returns in run year x is used to predict the number of age 4 returns in run year x+1).	2.3.1

	Performance Measure	Definition	Related Indicator
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. *First mainstem dam to first mainstem dam S*AR 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 summing the individual life stage specific SAR's. 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 lifestage 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 lifestage 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
	Progeny-per- Parent Ratio	Adult-to-adult ratio calculated for natural fish and hatchery fish separately as the brood year ratio of returned adult to parent spawner abundance. Two variants calculated: 1) escapement, and 2) spawners.	3.2.1, 3.2.2, 3.7.4

Performance Measure		Definition	Related Indicator
	Recruit/spawner (R/S)(Smolt Equivalents per Redd or female)	Juvenile production to some life stage divided by adult spawner abundance. Derive adult escapement above juvenile trap multiplied by the prespawning mortality estimate. Adjusted for redds above juv. 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, presmolt, 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, presmolt, smolt, subyearling) 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 screwtraps) 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 redd locations or reach specific summaries, with information from carcass recoveries to identify hatchery-origin vs. natural-origin spawners across spawning areas within populations. Female carcasses are used becasue of their greater fidelity to spawning locations	3.2.3, 3.2.4, 3.6.3, 3.7.3, 4.3.3, 4.6.1
	Stray Rate (percentage)	The percentage of total adults that returned to the Lostine River that originated in (smolted from) populations other than the Lostine river. Calcualted as the number of stray salmon divided by the total number of adult returns.	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	Fish mortalities (from the hatchery as well as from fish sampled in the stream) 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
	Proportionate Natural Influence (PNI)	A ratio of the proportion of natural origin salmon in the hatchery broodstock to the sum of the proportion of natural origin salmon in the hatchery broodstock plus the proportion of hatchery origin adults spawning in nature.	2.6.1,2.6.3,2.7.1, 2.7.3,3.6.1,3.6.2, 3.6.3,3.6.4

	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. Assessed 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 screwtrap are by dates; fry – prior to July 1; parr – July 1-August 31; presmolt – 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. The age of hatchery-origin fish is determined through a CWTmarking program which identifies fish by brood year.	3.8.1, 3.8.2, 3.9.2
	Age–at–Return	Age distribution of adults returning to the spawning grounds. Calculated for wild and hatchery conventional and captive brood adult returns. Assessed 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 screwtrap are by dates; fry – prior to July 1; parr – July 1-August 31; presmolt – 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 CWT marking program which identifies fish by brood year.	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 lifestage-specific emigration period are generated (mean length by week then averaged by lifestage). For entire juvenile abundance leaving a weighted mean (by lifestage) 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: $K = (w/l^3)(10^5)$ 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	Date of spawning at the hatchery or carcass recovery on the spawning grounds.	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 lifestage. 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 lifestage divided by tributary abundance estimate by lifestage). 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 screwtrap 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 Measures	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, premolt, parr, etc.).	2.5.1, 2.5.2, 2.5.3, 2.5.4
In-Hatchery Measures	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, premolt, parr, etc.).	2.5.1, 2.5.3
In-Hatchery Measures	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
In-Hatchery Measures	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
In-Hatchery Measures	Egg Size	Mean weight (g) of individual eggs, estimated from samples of 20 individual egg weights per female.	3.8.1, 3.8.2, 3.8.3,3.9.2
In-Hatchery Measures	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
In-Hatchery Measures	Hatchery Broodstock Fraction	Percent of hatchery broodstock actually used to spawn the next generation of hatchery F1s. Does not include prespawn mortality.	2.2.1
In-Hatchery Measures	Hatchery Broodstock Prespawn Mortality	Percent of adults that die while retained in the hatchery, but before spawning.	4.7.2
In-Hatchery Measures	Female Spawner ELISA Values	Screening procedure for diagnosis and detection of BKD in adult female kidney tissue. The enzyme linked immunosorbent assay (ELISA) detects antigen of *R. salmoninarum.*	3.10, 4.4.3
In-Hatchery Measures	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
In-Hatchery Measures	Size of Broodstock Spawner	Mean fork length and weight by age measured in millimeters and grams, respectively, 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
In-Hatchery Measures	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
In-Hatchery Measures	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
In-Hatchery Measures	Hatchery Release Timing	Date and time of volitional or forced departure from the hatchery. Normally determined through PIT tag detections at facility exit.	2.5.4, 4.8.1

Performance Measure		Definition	Related Indicator
	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 (Kooskia Fish Hatchery).	4.2.1
	Water Temperature	Hatchery operational measure (Celsius) - measured continuously at the hatchery with thermographs and 3 times daily at acclimation facilities with hand-held devices.	

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

"Performance Indicators" determine the degree that program standards have been achieved, and indicate the specific parameters to be monitored and evaluated. Adequate monitoring and evaluation must exist to detect and evaluate the success of the hatchery program and any risks to or impairment of recovery of affected, listed fish populations.

The NPPC "Artificial Production Review" document referenced above presents a list of draft "Performance Indicators" that, when linked with the appropriate performance standard, stand as examples of indicators that could be applied for the hatchery program. If an ESU-wide hatchery plan is available, use the performance indicator list already compiled. Essential 'Performance Indicators" that should be included are monitoring and evaluation of overall fishery contribution and survival rates, stray rates, and divergence of hatchery fish morphological and behavioral characteristics from natural populations.

The list of "Performance Indicators" should be separated into two categories: "benefits" that the hatchery program will provide to the listed species, or in meeting harvest objectives while protecting listed species; and "risks" to listed fish that may be posed by the hatchery program, including indicators that respond to uncertainties regarding program effects associated with a lack of data.

Performance indicators that we use to evaluate the performance standards listed in section 1.9 are presented in Table 4. These performance measures are taken from Beasley et al. (2008) and are consistent with NEOH M&E Plan (Hesse et al. 2006). The performance indicators are broken into the categories of abundance, survival-productivity, distribution, genetic, life history, habitat, and in-hatchery groups. Within each of these groups are the specific indicator(s) and brief description of the definition/method(s).

1.10.1) "Performance Indicators" addressing benefits.
(e.g. "*Evaluate smolt-to-adult return rates for program fish to harvest, hatchery broodstock, and natural spawning.*").

Evaluation of the Lostine program utilizes the performance standards and associated performance indicators in sections 1.9 and 1.10 (respectively). Table 4 will be utilized for addressing the project benefits and risks. In addition to yearly evaluations, every five years the Lostine project performs a comprehensive review of the program to in include adaptive management recommendations addressing the benefits and risks of the program.

1.10.2) "Performance Indicators" addressing risks.
(*e.g. "Evaluate predation effects on listed fish resulting from hatchery fish releases."*).

Evaluation of the Lostine program utilizes the performance standards and associated performance indicators in sections 1.9 and 1.10 (respectively). Table 4 will be utilized for addressing the project benefits and risks. In addition to yearly evaluations, every five years the Lostine project performs a comprehensive review of the program to in include adaptive management recommendations addressing the benefits and risks of the program.

1.11) Expected size of program.

As identified in the U.S. vs. Oregon 2008-2017 Management Agreement, the production goal for the Lostine River is 250,000 Wallowa/Lostine River Stock smolts released into the Lostine River.

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

Between 110 and 200 adults (both hatchery and natural) will be collected annually from the Lostine River depending on prespawning mortality, fecundities, and hatchery survival rates. The exact number of fish to collect for broodstock will be determined annually through the Annual Operation Plan process. In 2010, a target of 71 pairs (142 fish) should be collected (67 females spawned) to produce 250,000 smolts. These estimates are based on female survival of 95%, fecundity of 4,448, and 84.3% green egg to smolt survival.

The Lostine project utilizes a sliding scale approach to determine the rate at which to select broodstock for the supplementation program (Table 5). Since the Lostine program is intended to produce hatchery-reared progeny that are as similar to naturally spawned progeny, broodstock collection goals are regulated by the proportions of hatchery and naturally origin adult returns. As the number natural fish returning increases the number of natural origin fish utlilzed in the broodstock decreases.

Table 5. Sliding scale management tool utilized for managing disposition of Lostine River Chinook salmon adults.

Estimated Natural Run of ADULTS to River Mouth as a Proportion of minimum Interior Columbia Technical Recovery Team recommended abundance threshold1	Number of ADULT Natural Fish to River Mouth	Percent Natural ADULTS for Broodstock	Number of ADULT Natural Fish Retained for Broodstock (Proportion of Natural Brood)	Proportion of ADULT Hatchery Fish Released Above Weir	Percent Natural ADULTS in Broodstock
> .05 of Critical	> 8	0	0	NA	NA
.05 - .5 of Critical	8 - 74	50%	04 - 37	NA	NA
.5 - Critical	75 -149	40%	30 - 60	70%	20%
Critical - .5 of Viable	150 -249	40%	60 - 100	60%	25%
.5 Viable - Viable	250 - 499	30%	75 - 150	50%	30%
Viable - 1.5 Viable	500 - 749	30%	150 - 225	40%	40%
1.5 - 2 Viable	750 - 999	25%	188 - 250	25%	50%
> 2 Times Viable	> 1000	25%	> 250	<10%	100%

1 Lostine River contributes about 50% of production for Wallowa/Lostine Population - Viable level is 50% of TRT recommended minimum abundance threshold for Wallowa/Lostine population (1000) after broodstock collection and fishery.

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

Table 6. Proposed annual fish release levels by life stage and location.

Life Stage	Release Location	Annual Release Level
Eyed Eggs	Bear Cr., Wallowa R., Lostine R.	Unknown – Potential surplus from captive broodstock production not necessary to meet production goals.
Unfed Fry	Bear Cr. Wallowa R., Lostine R.	Annual releases not planned
Fry	Bear Cr. Wallowa R., Lostine R.	Annual releases not planned
Fingerling	Bear Cr.,Wallowa R., Lostine R.	Annual releases not planned
Yearling	Lostine River	250,000
Adult	Lostine River, Bear Cr. Wallowa River	Unknown – Potential surplus as a result of weir management.

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

Smolt to Adult Survival Rates

The most recent performance data for the Lostine program is presented below (Figure 3). This data represents the total estimated escapement of natural and hatchery Chinook salmon to the Lostine River utilizing age structure for adult returns from 2000 to 2009 for brood years 1997 to 2004. The total estimated escapement includes tributary harvest, but not harvest in the ocean or mainstem Columbia or Snake rivers.

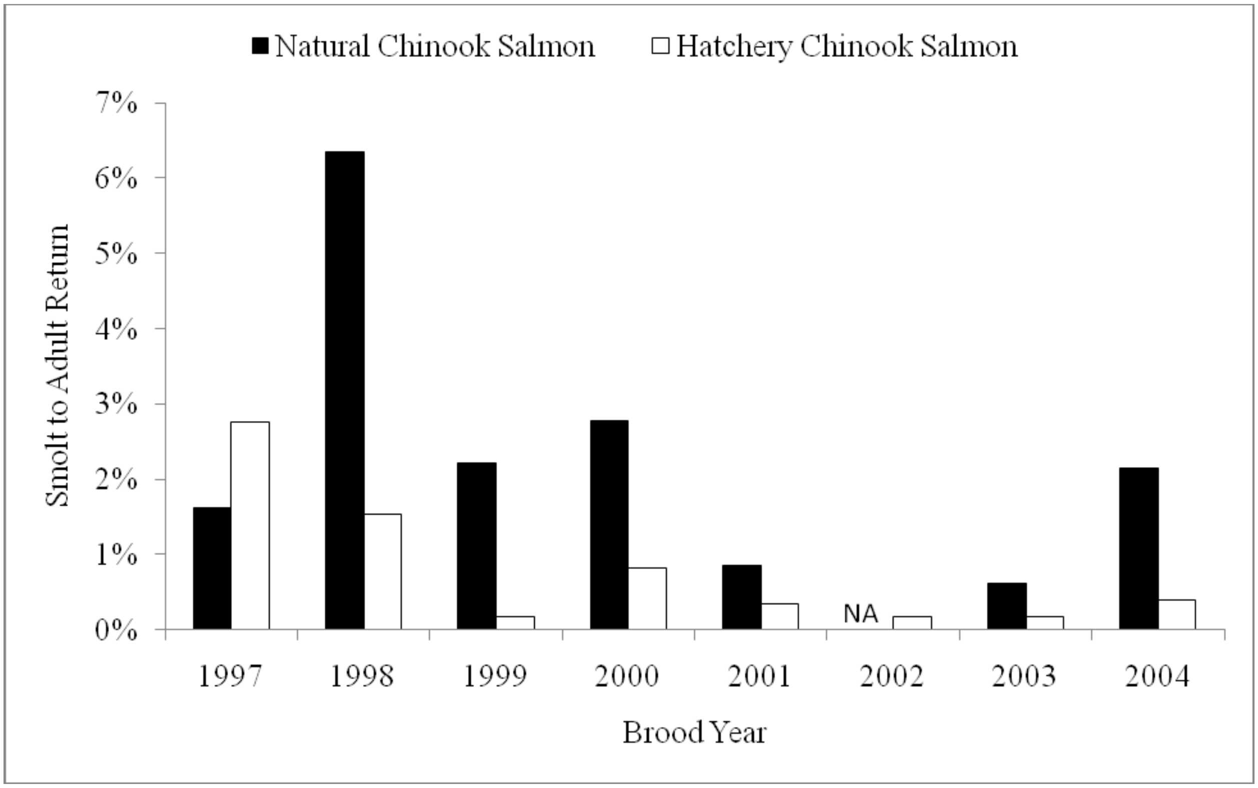

Figure 3. Lostine River natural and hatchery Chinook smolt to adult return rates from broodyear 1997 to 2004 (Lostine M&E data).

The number of hatchery smolts used in smolt to adult return estimates is obtained from the number of fish ponded at Lookingglass Hatchery during coded wire tagging or fin clipping minus any mortalities that occur prior to released. The number of natural smolts used in smolt to adult return estimates is obtained from juvenile abundance estimates of all parr and smolt life stages at the Lostine River screw trap. Natural parr abundance estimates are adjusted for overwinter mortality based on juvenile survival of parr and smolt survival to Lower Granite Dam.

Adult Production

Lostine broodstock performance is detailed in Table 7. These values are only for fish collected as broodstock and do not represent fish released for natural spawning.

Table 7. Lostine River spring/summer Chinook salmon spawning data, 1997-2008

Brood Year	Marked Females Spawned	Unmarked Females Spawned	% Un-marked	Spawning Ratio F/M	Average Fecundity	Egg Take	Fry Ponded	Smolt releases
1997	0	4	100%	0.92:1	4,496	17,000	12,000	11,871
1998	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0
2000	0	8	100%	0.66:1	4,329	34,630	32,000	31,490
2001	11	25	69%	1.06:1	4,463	*160,680	105,000	101,012
2002	1	27	96%	1.03:1	4,766	133,444	130,000	116,370
2003	0	21	100%	1.31:1	5,078	106,646	103,000	102,557
2004	29	22	43%	1.30:1	4,351	221,888	206,421	199,716
2005	39	17	30%	1.37:1	4,182	234,192	207,291	205,000
2006	45	12	21%	1.26:1	4,393	241,715	206,313	194,861
2007	41	20	32.8%	1.13:1	4,290	261,719	227,838	**185,750
2008	37	19	33.9%	0.95:1	4,783	267,834	247,274	**185,410
2009	32	25	43.8%	0.98:1	4,639	255,139	245,394	
	235	**200**	**46.0**		**4,448**	**1,934,887**	**1,722,531**	**962,877**

*Inventory correction due to large losses with egg shipment;
**Does not include 41,997 parr released in the Lostine River Km 21 June 25, 2008, and 54,166 released June 5, 2009
Since 2004, eggs have been electronically counted
2001-07 brood, estimate survival from green egg to smolt at 84.3%

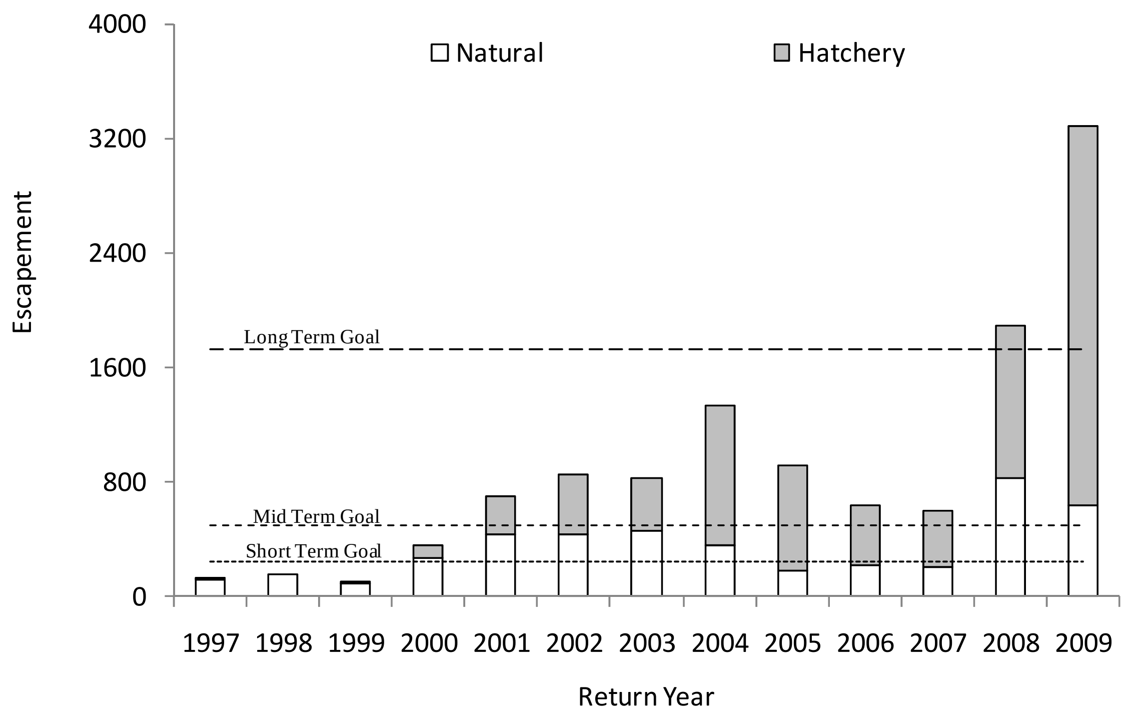

Figure 4. Natural and hatchery-origin escapement to Lostine River relative to short, mid, and long term escapement goasl (1997-2009). Short term goal identified is natural and

hatchery origin fish, mid and long-term goals identified is for natural origin fish only. Lostine M&E data.

<u>Adult Escapement</u>

Since the inception of the project, escapement in the Lostine River population has ranged from a low of 100 fish in 1999 to a high of 3,288 fish in 2009 and has averaged 907 fish per year. As shown in Figure 4, hatchery contribution to the total escapement has varied from 0% in 1998 to almost 81% in 2005.

The total estimated escapement shows that the short-term objective of maintaining escapement of 250 natural and hatchery adult returns has been consistently achieved since 2000. The mid-term objective of achieving escapement of 500 natural adult returns has only recently been met in 2008 and 2009. And while escapement in 2008 and 2009 exceeded the long-term objective of 1,716 natural origin adult returns, less than half of the adult returns in both years were natural origin Chinook salmon. The total long term escapement objective is 1,716 natural origin and 1,625 hatchery origin fish for a total of 3,341 fish. The long term objective for Lostine River Chinook salmon returns for natural origin fish has not yet been met.

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

The Lostine River endemic program began in 1995 with the collection of wild parr for the captive brood program. The first adults for conventional broodstock were trapped in 1997. The first releases of conventional smolts occurred in 1999 and the first releases of captive smolts occurred in 2000.
1997 – Lostine River adult collection facility.
1999 – Lostine River juvenile acclimation facility.
2010 - Construction of Lostine River permanent weir facility.

1.14) Expected duration of program.

The Lostine River spring Chinook program is ongoing as part of the Lower Snake River Compensation Plan program which is congressionally authorized to mitigate for an estimated 48% reduction in salmon and steelhead production due to development and operation of the four lower Snake River dams.

1.15) Watersheds targeted by program.

- Wallowa/Lostine watershed (HUC 17060105)
- The Lostine River (17060105) tributary of the Grande Ronde River is the target of the Lostine River O&M/M&E program)
- Latitude and Longitude (WGS 84) of relevant program components:
    - Lostine River Creek Juvenile (Screw) Trap Location: 45.531699 117.469762

- Lostine River Adult Weir Location: 45.543611 117.484729
    - Lostine River Acclimation Facility: 45.425000 117.444000
    - Lookingglass Fish Hatchery: 45.733900 117.864000

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

The Grande Ronde Endemic Spring Chinook Salmon Supplementation Program was developed based on resolution to a *U.S. vs. Oregon* dispute in 1993. An independent scientific panel[1] was formed and provided alternatives and guidance (Currens et al. 1996), based on genetic data, for initiating a supplementation program for Grande Ronde spring Chinook (including the Lostine River). The program that was developed has been through multiple science reviews since that have considered alternatives to the current program and requested benefit:risk assessments for various alternatives. This program has also been included in *U.S. vs. Oregon* management agreements. The reviews, negotiations, and agreements that have shaped this program include but are not limited to:

- Captive Broodstock Section 10 Permit Process – ESA Permit 1011
    - Application for an Emergency Permit for Scientific Purposes to Enhance the Propagation or Survial of Endangered Grande Ronde River Basin Spring Chinook Salmon under the Endangered Species Act. Submitted by ODFW to NMFS, May, 1996.
    - Responses of the ODFW to 36 questions for review of ESA Section 10 permit application. Letter from R. Carmichael to R. Koch, July 23, 1996.
    - Responses of the ODFW to 3 additional questions for review of ESA Section 10 permit application. Letter from R. Carmichael to R. Kock, August 6, 1996.

- Conventional Broodstock Section 10 Permit Process – ESA Permits 1011 and 1149
    - Modification 1 of Permit 1011 for Scientific Purposes to Enhance the Propagation or Survial of Endangered Grande Ronde River Basin Spring Chinook Salmon under the Endangered Species Act. Submitted by ODFW to NMFS, 1997.
    - Responses of the ODFW to 9 questions for review of Section 10 Modification Request to Permit 1011. Letter from R. Carmichael to R. Koch, May 12, 1997.
    - Modification 2 of Permit Number 1011 for Scientific Purposes to Enhance the Propagation or Survial of Endangered Grande Ronde River Basin Spring Chinook Salmon under the Endangered Species Act. Submitted by ODFW to NMFS, March, 1998.
    - Responses of ODFW to 19 comments for review of Section 10

[1] Members of the Independent Scientific Panel included Kenneth Currens, James Lannan, Brian Riddell, Douglas Tave, and Chris Wood.

Modification Request 2 to Permit 1011. Letter from W. Knox to R. Koch, July, 1998.
  - Application for a Permit to Enhance the Propagation of Survival of Endangered Grande Ronde River Subbasin (Lostine River Component) Spring Chinook Salmon under the Endangered Species Act of 1973. Submitted by BIA to NMFS, April, 1998.
  - Response of the BIA to 15 comments for review of Section 10 permit application. Letter from R. Lothrop to R. Koch, July 1998.
  - Wallowa/Lostine Spring Chinook Hatchery and Genetic Management Plan. Submitted by Nez Perce Tribe to NMFS, 2003.

- U.S. vs. Oregon agreements
  - 2001 Interim Spring Chinook Management Agreement
  - 2005-2007 Interim Management Agreement for Upriver Chinook, Sockeye, Steelhead and Coho
  - 2008-2017 Management Agreement
- Northwest Power Planning Council 3 Step Review Process
  - Response to Questions for the Three-Step Process Review of the Grande Ronde Basin Endemic Spring Chinook Supplementation Projects. Pacific Northwest National Laboratory Ecology Group, May 1998.
  - *ISRP 99-2. Review of the Columbia River Basin Fish and Wildlife Program for Fiscal Year 2000 as Directed by the 1996 Amendment of the Northwest Power Act.*
  - Northeast Oregon Hatchery Project Spring Chinook Master Plan. Submitted by the Nez Perce Tribe to BPA and NPCC April, 2000.
  - ISRP 2000-6. Independent Scientific Review Panel for the Northwest Power Planning Council. Review of the Northeast Oregon Hatchery Spring Chinook Master Plan. Step One Review of the Northwest Power Planning Council's Three-Step Review Process.
  - ISRP 2001-12c. ISRP Step Two Review of the Northeast Oregon Hatchery Spring Chinook Master Plan.
  - ISRP 2001-12a. ISRP Final Review of Fiscal Year 2002 Proposals for the Mountain Snake and Blue Mountain Provinces.
  - ISRP 2002-6. ISRP Lower Snake River Compensation Plan Final Proposal Review for Columbia Plateau, Blue Mountain and Mountain Snake Provinces.
  - ISRP 2003-12. Follow up to the ISRP Step Two Review of the Northeast Oregon Hatchery (NEOH) Spring Chinook Master Plan.
  - ISRP 2004-10. ISRP Step Two Review of the Northeast Oregon Hatchery (NEOH) Spring Chinook Master Plan: Monitoring and Evaluation Plan.

Most recently the Hatchery Scientific Review Group (HSRG) provided a review of the Lostine Spring Chinook program. The HSRG recommended the following:

- Genetic work to determine whether fine-scale structure exists within Wallowa/Lostine population. Outplanting excess hatchery fish restricted to vacant or newly-opened habitat.
- Continue to implement successful broodstock BKD management strategy, which includes culling.
- Manage Wallowa/Lostine population for Proportion of Natural Influence (PNI) of 0.67. Smolt production 190,000. Selectively harvest 20% hatchery fish. Remove 90% of the un-harvested hatchery fish & reduce adult outplants.
- OR Manage Lostine population for PNI of 0.5. Smolt production of 250,000. No selective harvest. Remove 90% of un-harvested hatchery fish & eliminate adult outplants.

In response:

With regard to recommendation #1 regarding outplants – see Section 6.2 and 7.5.

With regard to recommendation #2 regarding fish health management strategies – see Section 9.2.7 and 10.9.

With regard to recommendations #3 and #4 – management of natural spawning escapement and broodstock – see below.

The Hatchery Scientific Review Group (HSRG) effort was directed to answer the questions of whether and in what manner hatcheries can be used to assist the managers in meeting their conservation and harvest goals for salmon and steelhead in the Columbia River Basin. The HSRG's recommendations are not the only possible alternatives for managing hatchery programs to meet conservation and harvest goals. As such, the managers may develop other solutions which better meet their program principles and goals. Success over time will be defined by the managers' ability to take actions in the future to adjust hatchery programs based on good science to meet their conservation and harvest goals (HSRG policy Statement).

The HSRG recommendations are heavily influenced by the AHA model and managing gene flow between natural and hatchery origin fish to a PNI level of 0.67 or higher at the population scale. In a review of the AHA model and its application to HSRG the RIST (2009) concluded:

- *"There is no single correct way to parameterize the fitness function used in the AHA model. The AHA fitness model is also, not surprisingly, quite sensitive to variation in its parameters, particularly the strength of selection and heritability.*
- *Consistent with previous reviews, we strongly recommend caution about putting too much weight on the quantitative results of the AHA model. We believe the general thrust of the HSRG recommendations are scientifically sound and will lead to an improved situation for wild salmon populations,*

but do not think that the AHA model can accurately predict the outcomes of specific hatchery or habitat actions in a quantitative way.

- *As it has been applied, the AHA model has been used to model the expected longterm (decades) consequences of alternative hatchery scenarios. This seems consistent with the HSRG's intent to provide general guidance on the direction for hatchery reform. It is another reason, however, that the AHA model results should be interpreted as guidelines rather than quantitative predictions."*

With the RIST findings in mind, the HSRG AHA model run on the current Lostine program of 250,000 smolts with a PNI of 0.5 (actual average PNI is 0.62) is predicted to return 651 Natural origin fish, and 777 Hatchery origin fish with a harvest of 152 fish. One HSRG recommendation which requires 90% capture and removal of hatchery origin fish (this would only be possible with a new, more efficient weir), a program of 250,000 smolts and a PNI of 0.6 resulted in 229 Natural origin fish and 1,323 Hatchery origin fish returning with a harvest of 65 fish. An alternative HRSG recommendation with 90% capture and removal of hatchery origin fish and unspecified habitat improvements, a program of 187,500 smolts and a PNI of 0.7 resulted in 305 Natural origin fish and 994 Hatchery origin fish with a harvest of 76 fish.

The HSRG recommendations for program operation and the resultant AHA model runs do not achieve the TRT recommended minimum abundance threshold for natural origin fish nor the LSRCP mitigation obligation for hatchery origin fish. Consequently they are not consistent with the goals and objectives established in the NEOH Master Plan for natural and hatchery origin fish (Table 8).

Table 8. The goals and objectives for the Lostine River spring Chinook population as presented in the NEOH Master Plan (Ashe et al. 2000).

Goal	NEOH Master Plan Objectives
Short -term: Prevent extirpation.	1 - Maintain an annual escapement of Chinook salmon from natural and artificial production of no less than 250 adults in the Lostine River. 2 - Maintain genetic attributes and life history characteristics of the naturally spawning Chinook aggregate.
Mid-term: Restore natural population of Lostine spring Chinook salmon above ESA delisting levels and provide an annual sport and tribal harvest.	1 - Achieve an annual escapement of 500 adults in the Lostine River from natural production. 2 - Maintain genetic attributes and life history characteristics of the naturally spawning Chinook aggregate. 3 - Provide tribal and sport harvest opportunity consistent with recovery efforts.
Long-term: Restore Grande Ronde spring Chinook salmon escapement and harvest to historic levels.	1 - Utilize artificial production to provide benefits expected from the LSRCP of 1,625 spring Chinook adults returning from the Lostine River program annually. 2 - Maintain natural self-sustaining population of 1,716 in the Lostine River. 3 - Maintain genetic attributes and life history characteristics of the naturally spawning Chinook aggregate.

Goal	NEOH Master Plan Objectives
	4 - Provide harvest of naturally and artificially produced adult additional to natural spawning, nutrient enhancement, and hatchery broodstock goals.

The production level of 250,000 smolts was set to achieve the goals established in the NEOH Master Plan. This production level has been agreed to by the co-managers and incorporated into the 2008-2017 *U.S. vs. Oregon* Management Agreement.

Management of hatchery and natural origin fish returning to the Lostine River for hatchery broodstock, natural spawning or other disposition is done using a "sliding scale" management tool developed by NPT and ODFW in consultation with NOAA Fisheries. The sliding scale management tool (Table 5) has an underlying premise, that at low population levels the greatest risk to persistence is demographic risk of extinction. In the sliding scale fewer constraints are placed on the number of hatchery fish spawning naturally and the number of naturally produced fish spawned in the hatchery when population levels are low. Thus, fish benefit from the survival advantage provided by the hatchery. As population levels increase, demographic risks are of less concern and greater constraints are placed on the hatchery program to control genetic risks associated with hatchery rearing.

The first option of the HSRG AHA model targets a PNI value of 0.60 and the second option of targets a PNI value of 0.67 with unspecified habitat improvements for the Wallowa/Lostine population. Nether option achieves TRT recommendations or LSRCP obligations. The third and existing option currently in use is the sliding scale shown in Table 5 with our adaptive management structure. Using this option PNI values for the Lostine component of the Wallowa/Lostine population has resulted in an average PNI value of 0.62 (2001 to 2009) and have ranged from 0.50 to 0.77 (Figure 5). However, we agree with the conclusion of the RIST (2009) regarding the use of the AHA model and we are not suggesting that the population be managed for a specific PNI value.

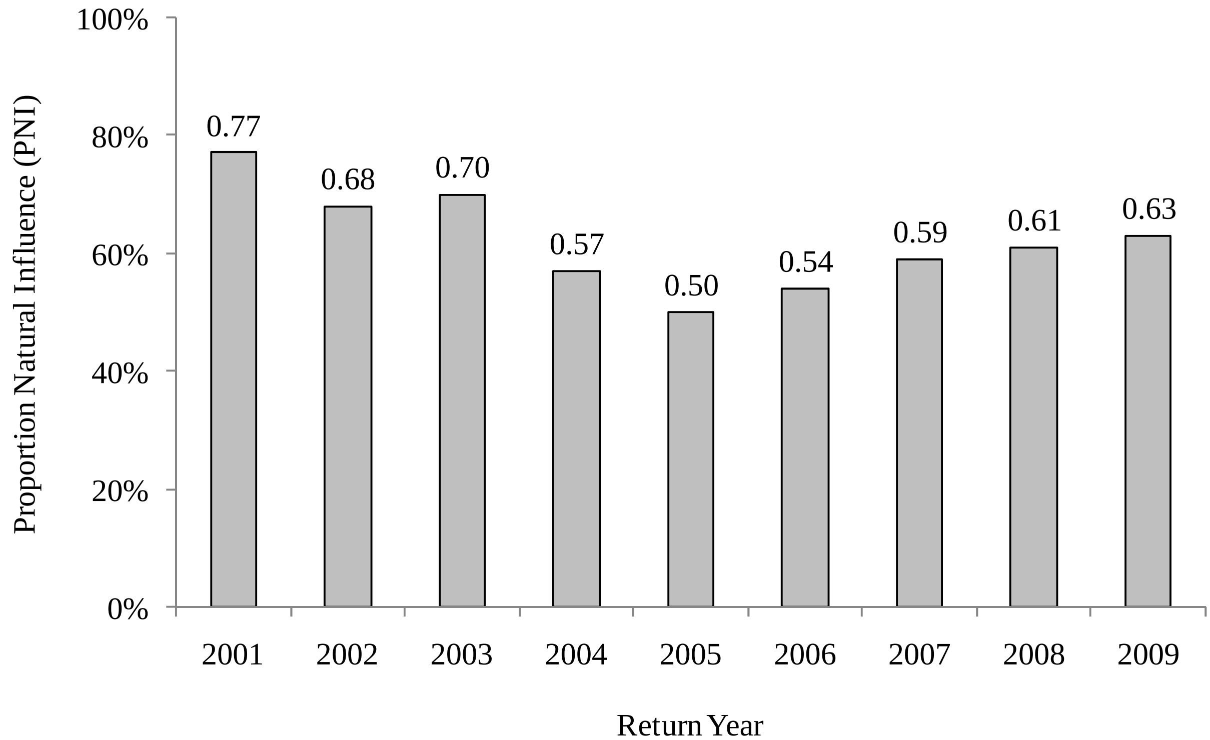

Figure 5. The Proportion Natural Influence (PNI) of hatchery Chinook salmon (combined captive broodstock and conventional programs) in the Lostine River, Oregon, from 2001 to 2009.

Northeast Oregon Hatchery

The Northeast Oregon Hatchery (NEOH) Project Final Design package identifies facility improvements for the Imnaha and Grande Ronde spring Chinook programs. This package was prepared jointly by the Nez Perce Tribe (NPT), the Confederated Tribes of the Umatilla Indian Reservation (CTUIR), the Oregon Department of Fish and Wildlife (ODFW) and U.S. Fish and Wildlife Service (USFWS) and submitted to the Northwest Power and Conservation Council in March 2006. The package of proposed new facilities successfully completed the Council's Three-Step Review process and was recommended to proceed to construction in May 2006. A decision to proceed with construction by Bonneville Power Administration has been pending for 3.5 years.

RPA Hatchery Strategy 2, Action # 42 of 2008 Federal Columbia River Power System Biological Opinion specifically calls for implementation of the Lostine and Imnaha river spring Chinook program;
For the Lostine and Imnaha rivers, contingent on a NOAA approved HGMP, fund these hatchery programs, including capital construction, operation and monitoring and evaluation costs to implement supplementation programs using local broodstock and following a sliding scale for managing the composition of natural spawners comprised of hatchery origin fish.

The facilities proposed for construction through NEOH include:

1) A new incubation and rearing facility on the Lostine River consisting of:

- a hatchery building including incubation and early rearing facilities,
- eight rearing raceways,
- a quarantine raceway,
- a utility building and storage area,
- a clarifier,
- six adult holding ponds with associated fishway, trap, crowding, sorting, and spawning facilities
- three residences

Production at the Lostine River Hatchery would be 250,000 Lostine River spring Chinook smolts and 245,000 Imnaha River spring Chinook smolts (half of the 490,000 Imnaha production). The Lostine River Hatchery would work in conjunction with Lookingglass Hatchery to produce the 490,000 smolts for the Imnaha spring Chinook mitigation program. More detailed information on this facility is contained within this document in the following sections.

2) A new weir/trap on the Lostine River for collection and holding of Lostine spring Chinook. This permanent weir/trap facility is being constructed by BPA during the summer of 2010.

3) Imnaha satellite facility improvements which consisted of:

- Relocation of the intake rock sluiceway to a settling basin east of the existing storage building
- Redesign of the new acclimation and holding ponds to the east side of the existing holding ponds
- Extension of the existing storage building and addition of vehicle parking area
- Relocation of the vehicle access ramp
- Addition of adult holding area extension
- Additional portable generator and skid-mounted air compressor for pneumatically-controlled weir and intake screen cleaning
- Replacement of the existing picket weir with a pneumatically-controlled weir for safer and more efficient broodstock collection over the entire run
- Replacement of the existing intake structure with a larger structure capable of delivering more surface water to the facility.
  More information on this facility is contained in the Imnaha spring Chinook HGMP.

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

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

The Lostine River spring Chinook production program was authorized under ESA Section 10 permit #1011, Modification 1 and Modification 2 of permit #1011, #1149 from 1996 to 2001. An HGMP was submitted to NOAA in 2003.

In addition, the Lostine Monitoring and Evaluation program is authorized under ESA Section 10 Permit Number 1134 and USFWS Permit Number TE001598-3.

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

The Interior Columbia Technical Recovery Team (ICTRT) established biological viability criteria to monitor recovery efforts in the ESUs for salmon and steelhead listed under the Endangered Species Act. The viability criteria were based on guidelines in NOAA Technical Memorandum *Viable Salmonid Populations and the Recovery of Evolutionary Significant Units* (McElhany et al. 2000). These guidelines were used to describe the Lostine River Chinook population.

The Lostine River, a tributary of the Grande Ronde River, hosts one of six populations of Chinook salmon in the Grande Ronde Basin (Watershed Professionals Network 2004). The Interior Columbia Technical Recovery Team (ICTRT) defined Lostine River spring Chinook salmon as part of a population that includes the Wallowa River and tributaries (ICTRT 2005). The Wallowa/Lostine spring Chinook salmon population is considered to be one of eight populations within a major population grouping (MPG) of Snake River spring Chinook salmon within the Grande Ronde and Imnaha River Subbasins.

The ICTRT classified the Wallowa/Lostine Rivers population as a "large" population based on historical habitat potential (ICTRT 2005). A Chinook population classified as large has a mean minimum abundance threshold criterion of 1,000 naturally produced spawners annually with a sufficient intrinsic productivity (greater than 1.45 recruits per spawner at the threshold abundance level) to achieve a 5% or less risk of extinction over a 100-year timeframe.

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

Adult Age Class Structure

Lostine River return adults as age 3 (1-salt), 4 (2-salt), and 5 (3-salt). On average, more hatchery-origin fish returned at age three (16.1%) than age 3 natural origin fish (9.9%). However there was no statistical difference between the average proportion of returning age 3 and 4 natural and hatchery origin fish (P > 0.05) But natural-origin fish did tend to return almost twice the proportion of age-five adults (20.7%) than their hatchery-origin counterparts (10.7 on average) and the difference was significant (P < 0.05)(Figure 6).

Adult Size Range

Using known age adult return data (coded wire tag, PIT tags, and scales) with associated fork length data, there was no size difference found between natural and hatchery age 3, 4, and 5 year old males (P > 0.05) (Figure 7). Additionally, there was no size difference found between natural and hatchery age 3 and 4 females (P > 0.05). There was a statistical difference found between natural and hatchery age 5 females (P < 0.05), with hatchery age 5 females being smaller (Figure 8). However, the difference may not be biologically significant.

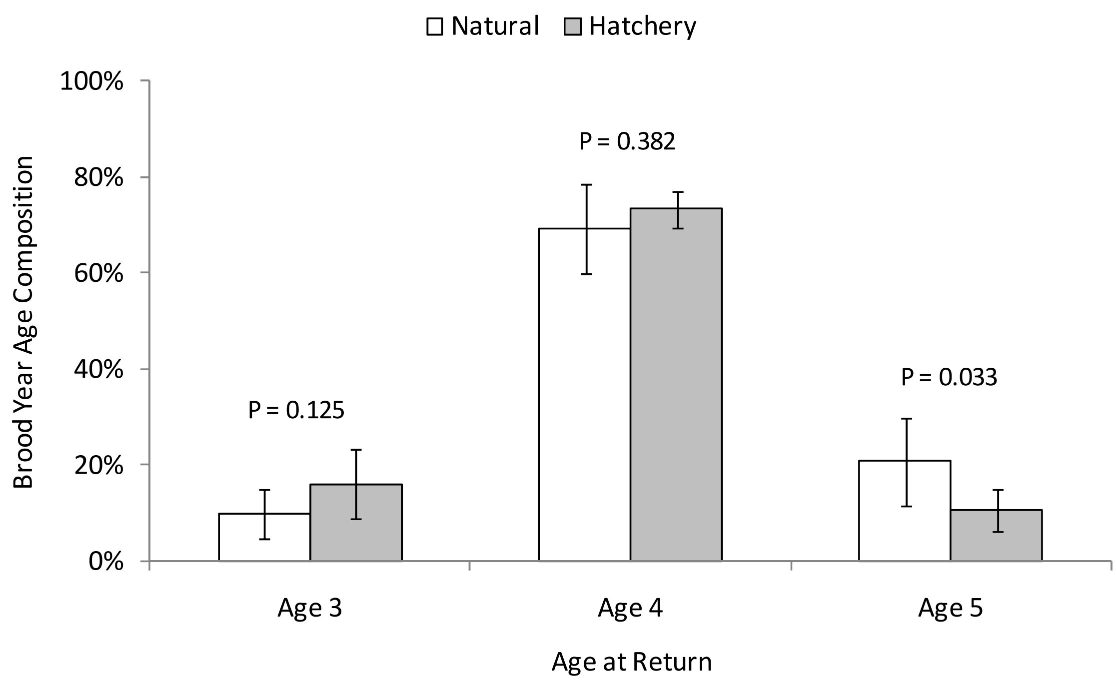

Figure 6. Average age structure (brood years 1997 to 2004) of Lostine River Chinook salmon.

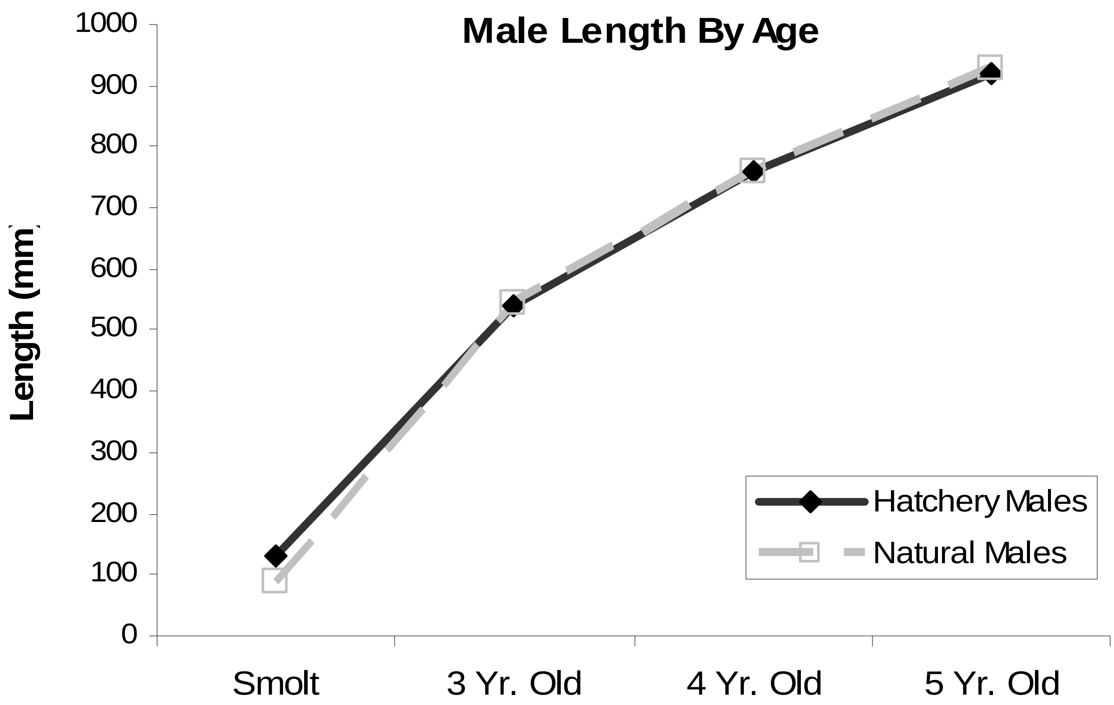

Figure 7. Adult length of natural and hatchery males from known age fish (1997 – 2007).

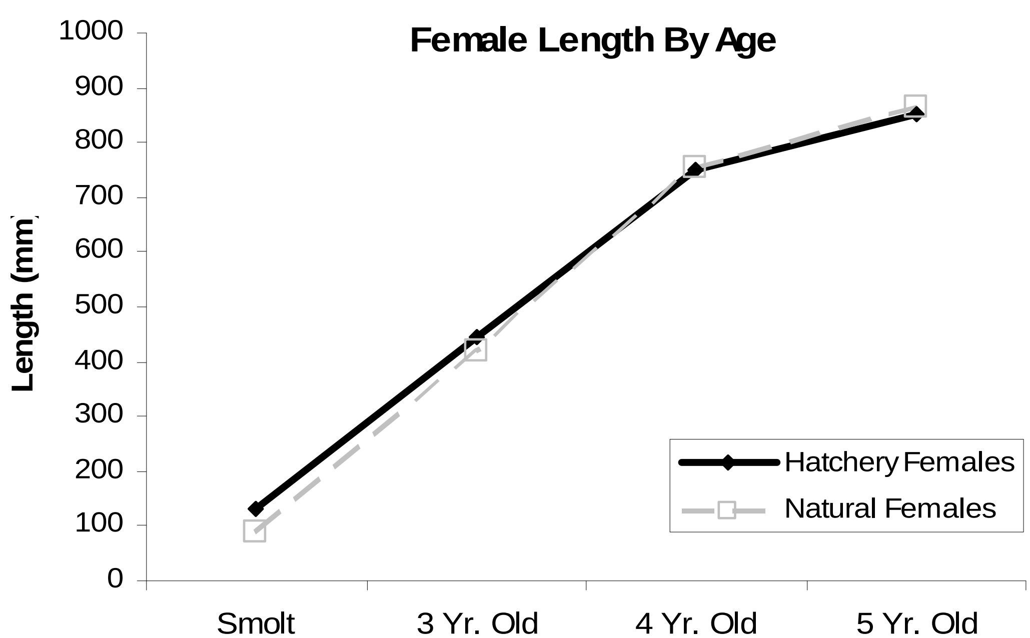

Figure 8. Adult length of natural and hatchery females from known age fish (1997 – 2007).

Juvenile Size Range

Monitoring of hatchery and natural smolts occurs at the Lostine River screw trap (operated by ODFW with assistance from NPT) as fish emigrate from the Lostine River. A comparison of natural and hatchery fork lengths from 1999 to 2007 shows that hatchery smolts tend to be larger than their natural counterparts (Figure 9). Average length for natural juveniles for those years was 90.5 mm and average length for hatchery juveniles during the same time period was 120.3 mm. This is a concern because early male maturation may be influenced by body size, growth rate, and body lipid levels (Silverstein et al. 1997, Silverstein et al. 1998, Shearer and Swanson 2000, Cambell et al. 2003, Larson et al. 2004, Larson et al. 2006, and Shearer et al. 2006). This in turn affects age class structure and indirectly the spawning populations in nature.

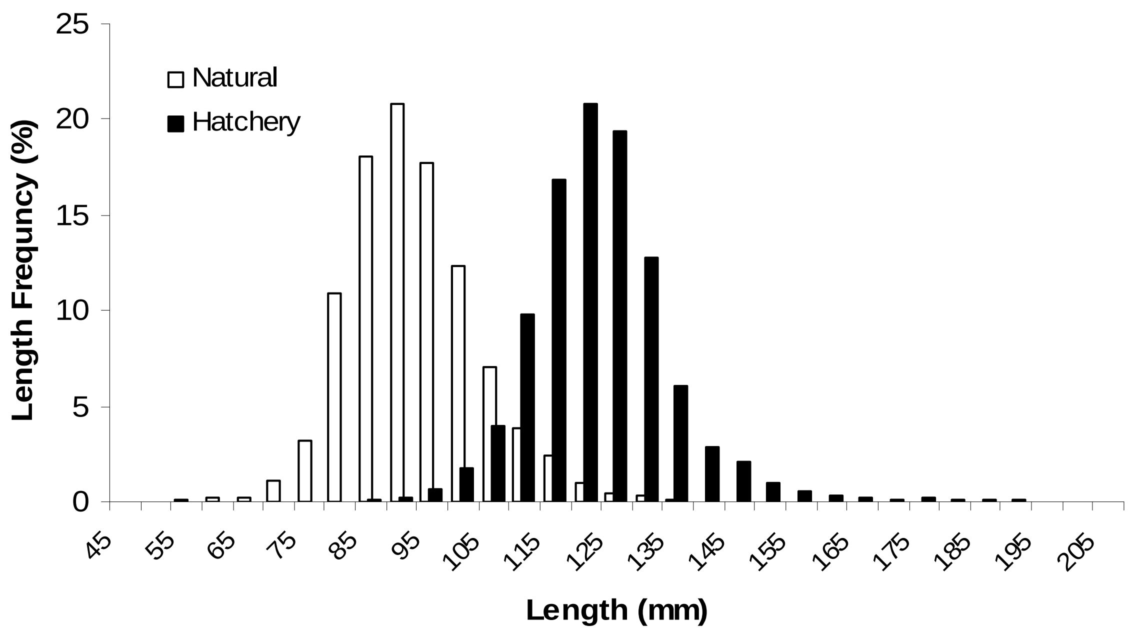

Figure 9. Smolt length of natural and hatchery fish as measured at the Lostine River screw trap (1999 – 2007).

Juvenile Migration Timing

Arrival timing at Lower Granite Dam from 2003 to 2006 showed hatchery fish from both the early and late release groups arrived at Lower Granite Dam earlier than natural Chinook salmon (Figure 10). This result was not to our liking because we wanted our hatchery fish to mimic the natural fish. Given that the later release groups were more prone to leave volitionally than the early release groups we decided in 2007 to shift our acclimated volitional release one week later in 2007. After shifting the release timing a week later in 2007 we still saw a difference in the arrival timing of early, late, and natural Chinook salmon at Lower Granite Dam. However, the later release group appeared to better mimic the arrival timing of the natural Chinook salmon smolts. So in 2008 we shifted the release timing of the early release group later by reducing the duration of the acclimation period of the late release group by one week (Figure 11). The end result was that the hatchery fish mimicked the arrival timing of natural fish at Lower Granite Dam until mid-May. But they continued to have an earlier median and 90% arrival times at Lower Granite Dam. The differences between the hatchery fish and the natural fish may be due in-part to a greater number of natural fish being tagged later in the year at the screw trap. However, it should be noted that more natural fish from the Lostine River are not being tagged in the early spring because they are not being captured until later in the spring.

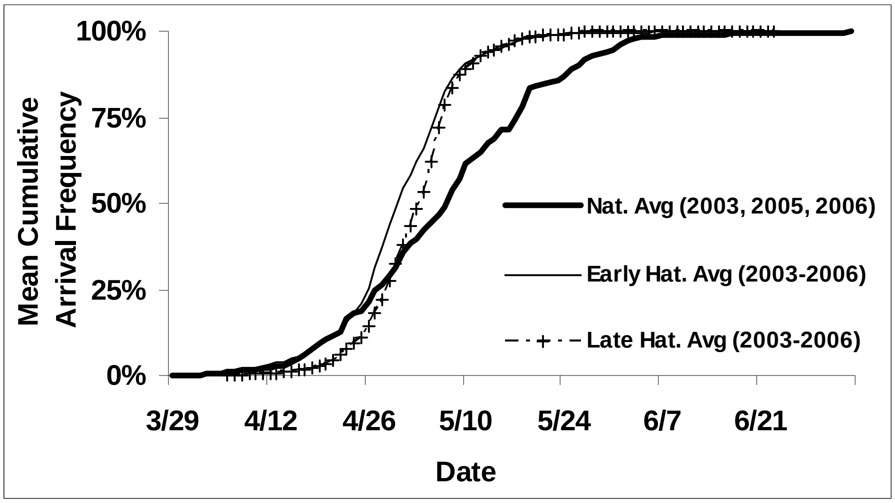

Figure 10. Average arrival timing of natural and hatchery Chinook salmon smolts at Lower Granite Dam from 2003 to 2006. Hatchery smolts were acclimated and volitionally released in early and late spring.

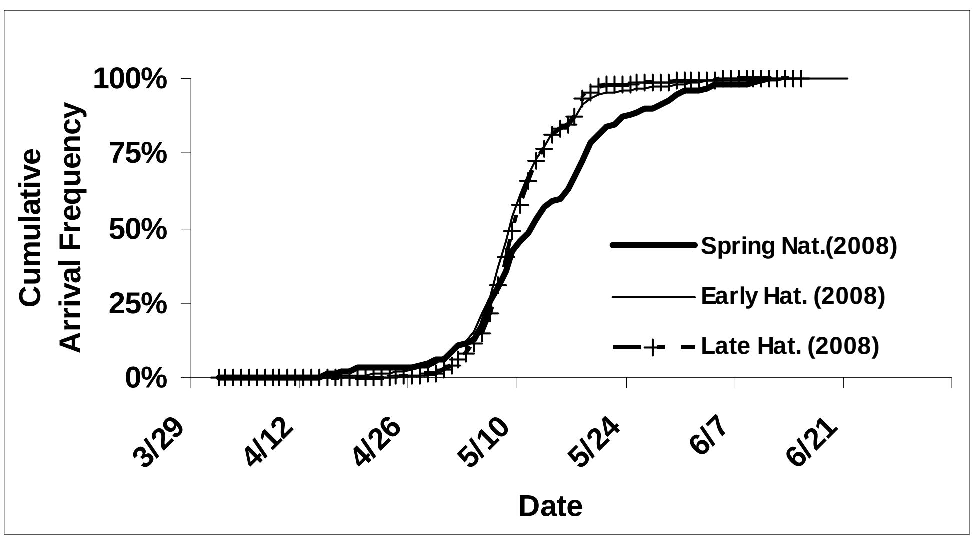

Figure 11. Arrival timing of natural and hatchery Chinook salmon smolts at Lower Granite Dam in 2008. Hatchery smolts were acclimated and volitionally released in early and late spring.

Adult Migration (Arrival) Timing

As shown in Figure 12, there is a pronounced bimodality associated with both natural and hatchery-origin adults at their time of return to the Lostine River weir. Both origin types return in two distinct modes; the first group showing up between mid June and late July, and the second group arriving in August and into early September.

The bimodality of adult migration timing has been consistent over the course of the project and is not uncommon in other populations. A bimodal return occurs in the neighboring South Fork Salmon River (ID), Lake Creek (ID), Secesh River (ID), and in the Johnson Creek (ID) populations.

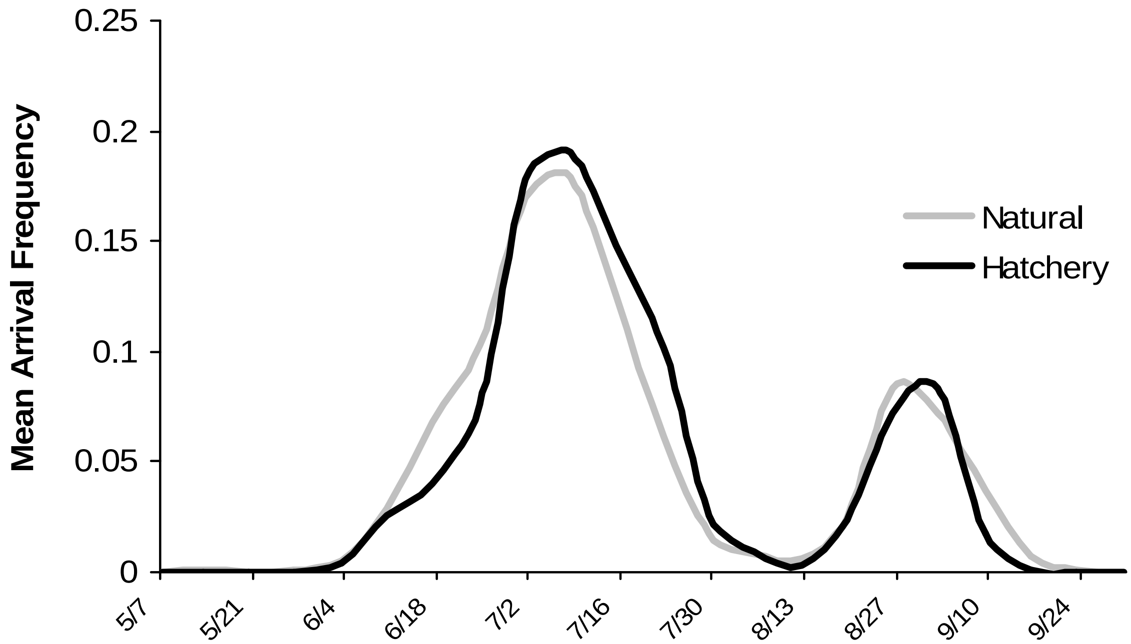

Figure 12. Natural and hatchery adult migration timing according to weekly arrival dates at the Lostine river weir (2000-2008).

Spawning Range

Monitoring of adult life history characteristics includes observing where natural and hatchery fish are spawning. It was assumed that hatchery fish would spawn in similar areas and similar to the assumption for productivity, it was assumed that the spawning distribution prior to supplementation would be similar after supplementation.

Spawning ground surveys are conducted in eight transects in the Lostine River totaling 27.6 km. The proportion of natural and hatchery female carcasses found in the transects from 2001 to 2007 show that natural and hatchery Chinook salmon are spawning in similar areas, with the majority of the spawning taking place in the index area between the Lostine River Ranch bridge and the Six Mile bridge (Figure 13). Prior to supplementation over 70% of the spawning took place in this reach. After supplementation the majority of the spawning occurs in the same reach but the percent of redds dropped below 50% of the total. The percentage of redds in the furthest downstream and upstream transects have more than doubled since supplementation began (Figure 14). Increased spawning in the furthest upstream area may be due to the management practice of transporting fish from the weir upstream during July and August when irrigation withdrawals create questionable passage conditions (< 1.2 m^3/s) (R2 Resources Consultants 1998).

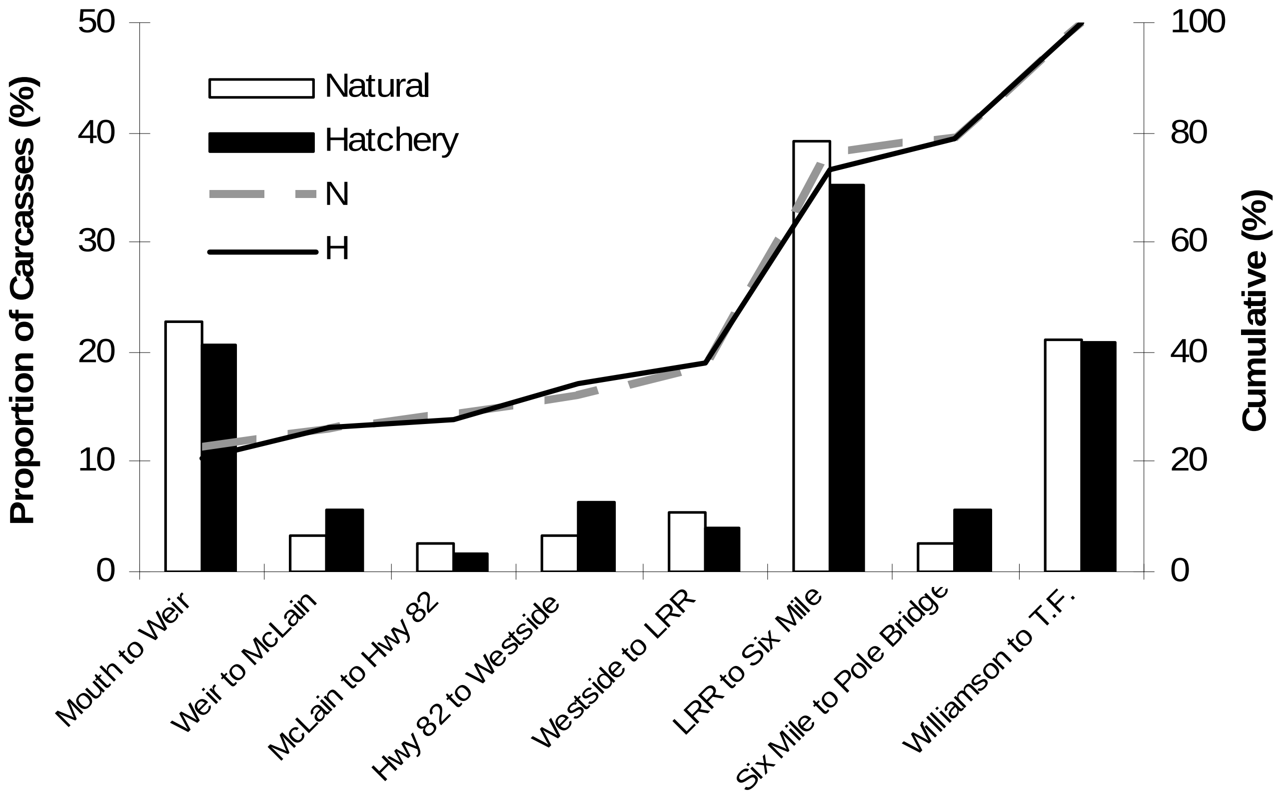

Figure 13. Spawning ground distribution of natural and hatchery fish based on female carcass location (2001-2007).

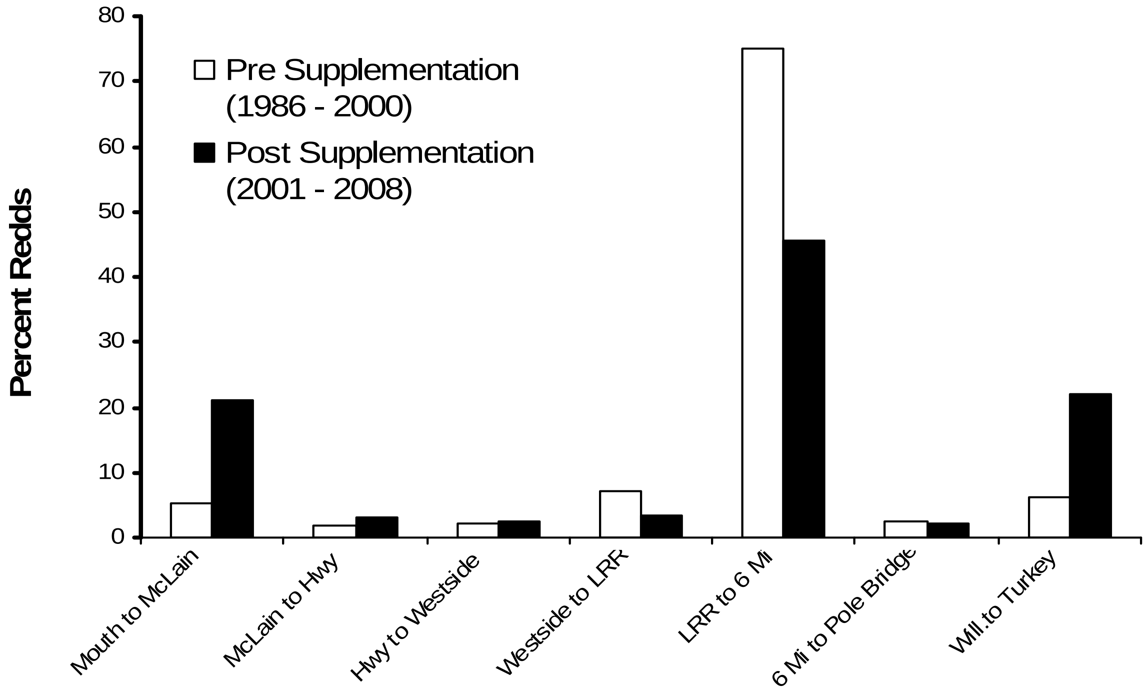

Figure 14. Distribution of spawning redds before and after supplementation.

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

<u>Snake River Spring/Summer Chinook</u>

<u>Grande Ronde spring Chinook</u>
Historically, spring Chinook salmon spawned in the mainstem and headwater areas throughout the Grande Ronde River Basin (GRSS 2001). Currently, five core populations have been identified. Three populations are targeted for hatchery supplementation: Catherine Creek, Lostine River, Upper Grande Ronde River and two populations are managed for natural production: Minam and Wenaha rivers. Another major population in the basin, Lookingglass Creek, was extirpated due to the construction and operation of Lookingglass Fish Hatchery (LFH) in 1982. There has been an ongoing effort by NPT, CTUIR, and ODFW to reestablish a naturally spawning population in Upper Lookingglass Creek in recent years.

Historic native runs of Chinook salmon in the Grande Ronde Subbasin were continuous with the first fish arriving in early-May, runs peaking in June, July, or later depending on the water year, and the last fish arriving in October (Neeley et al. 1994).

Currently spring Chinook return to the Grande Ronde from April to September. Generally, spawning activity occurs from late July through September and peaks in late August. Fry emergence begins in January and extends through June. Fry expand their distribution after emerging in the spring. The extent and direction of fry movement depends on environmental conditions. Parr produced in upper reaches stay either in the Grande Ronde or Snake rivers for a period of about one year before they migrate to the ocean. Smolt migration from the subbasin typically begins in January and extends through late June. Some males do not migrate but stay in the natal stream where they mature (Jonasson et al. 1997). Adults return to their natal stream after one to three (sometimes four) years in the ocean (Neeley et al. 1994).

Lostine River spring/summer Chinook

In the mid-1990's escapement levels in the Lostine River dropped to alarmingly low levels. Redd count totals for the Lostine River plummeted from an estimated 893 in 1957 to 16 in 1994, 11 in 1995, 27 in 1996, 49 in 1997, and 35 in 1998. This program was developed in response to an emergency situation where dramatic and unprecedented efforts were needed to prevent extinction and preserve any future options for use of natural fish for artificial propagation programs for recovery and mitigation.

The combined natural and hatchery returns to the basin have ranged from several hundred in the late 1980s and 1990s to several thousands in the early 2000s.

The majority of the natural and hatchery Chinook salmon are captured in June and July (
Table 9). An average of 12.8% of the hatchery Chinook salmon are captured during the month of June and 68.2% are captured in July. By comparison, 19.0% of the natural fish are captured in June and 58.9% are captured in July.

Smolt production for the Lostine River supplementation program is intended to supplement the Wallowa/Lostine spring Chinook population. Both natural origin and hatchery origin fish are listed as threatened under the Endangered Species Act (NOAA 2005). In addition to the smolt releases in the Lostine River, fry and parr releases have occurred into other Wallowa River tributaries (Bear Creek and Prairie Creek) within the Wallowa/Lostine Spring Chinook population when fecundity of broodstock has been higher than expected. Additionally, the supplementation program has outplanted a portion of the returning adult Lostine River hatchery Chinook salmon to the upper Wallowa River and Bear Creek in underseeded and vacant habitat, from 2002 to 2005 and from 2007 to 2009.

Outside of the Wallowa/Lostine River spring Chinook population there have been a total of 64 coded wire recoveries from brood years 1997 to 2004. Lostine River adult strays within the Grande Ronde River account for 28.1% of the 64 recoveries and it's estimated that the strays accounted for about 1.4% and 1.8% of the spawning population in the Minam River (2002-2003) and the Wenaha River (2002), respectively. Strays into other Snake River tributaries accounted for

51.6% of the 64 recoveries. A total of 18.8% strayed into mainstem Columbia River tributaries such as the Methow River and one (1.6%) of the stray coded wire tag recoveries occurred at the Cole River Hatchery on the Rogue River located in southwest Oregon.

Table 9. The monthly percent of natural and hatchery Chinook salmon captured at the Lostine River weir based on revised records of catch from 2001 to 2008.

			Percent Captured					
Origin	Year	Catch (n)	Apr	May	Jun	Jul	Aug	Sep
Hatchery	2001	104	0.0%	0.0%	34.6%	28.8%	2.9%	33.7%
	2002	275	0.0%	0.0%	3.3%	78.2%	16.0%	2.5%
	2003	201	0.0%	0.5%	2.0%	88.6%	5.5%	3.5%
	2004	777	0.0%	0.1%	5.7%	85.8%	5.5%	2.8%
	2005	626	0.0%	0.0%	29.4%	62.9%	4.0%	3.7%
	2006	327	0.0%	0.0%	3.4%	67.9%	13.8%	15.0%
	2007	382	0.0%	0.0%	23.8%	65.2%	5.0%	6.0%
	2008	614	0.0%	0.0%	0.0%	68.4%	25.2%	6.4%
	Average		0.0%	0.1%	12.8%	68.2%	9.7%	9.2%
Natural	2001	336	0.0%	0.0%	66.4%	16.7%	2.4%	14.6%
	2002	254	0.0%	0.0%	3.9%	69.3%	20.1%	6.7%
	2003	190	0.0%	0.5%	8.4%	82.1%	6.3%	2.6%
	2004	234	0.0%	0.9%	15.8%	68.4%	9.8%	5.1%
	2005	160	0.0%	0.0%	23.1%	59.4%	6.9%	10.6%
	2006	169	0.0%	0.0%	3.6%	63.3%	15.4%	17.8%
	2007	196	0.0%	0.0%	31.1%	55.6%	3.6%	9.7%
	2008	337	0.0%	0.0%	0.0%	56.1%	32.3%	11.6%
	Average		0.0%	0.2%	19.0%	58.9%	12.1%	9.8%

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

Summer steelhead - Grande Ronde basin summer steelhead are typical of A-run steelhead from the mid-Columbia and Snake basins. Most adults (60%) returning to the Grande Ronde basin do so after one year of ocean rearing. The remainder consists of two-salt returns with an occasional three-salt fish. Females generally predominate with a 60/40 sex ratio on average. Returning adults range in size from 45 to 91 cm and 1.4 to 6.8 kg. Adults generally enter the Columbia River from May through August subsequently entering the Grande Ronde River from September through April. Adults utilize accessible spawning habitat throughout the Grande Ronde basin. Spawning is initiated in March in lower elevation streams and spring-fed tributaries and continues until early June in higher elevation "snowmelt" systems. Juveniles utilize a wide range of habitats throughout the basin including areas adjacent to spring Chinook 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 from the Grande Ronde basin extends from late winter until late spring. Peak smolt movement is associated with increased flow events between mid-April and mid-May (ODFW Early Life History Project).

Bull trout – Both fluvial and resident life history forms of bull trout inhabit the Grande Ronde River and a number of tributaries. Little is known of their population structure. Habitat conditions and influence of introduced brook trout vary widely across the basin and affect bull trout productivity in some areas. As a result, basin bull trout populations vary from areas of relative strength in wilderness streams where brook trout are not currently present to areas where habitat condition and/or interaction with brook trout result in substantially depressed bull trout productivity. Fluvial adults migrate into headwater areas during the summer and early fall after over-wintering in mainstem tributaries and the Snake River. Spawning for both resident and fluvial adults occurs in September and October. Fry emerge during the spring. Juvenile rearing is restricted to headwater areas by increasing water temperatures downstream.

Fall Chinook – Fall Chinook in the lower reaches of the Grande Ronde River are part of the Snake River population and exhibit similar life histories. Spawning is generally located in the lower 55 miles of the river. Adult Snake River fall Chinook enter the Columbia River in July and migrate into the Snake River from mid-August through October. Spawning occurs from late October through early December, with fry emergence during March and April. Smolt emigration occurs within several months following emergence with peak migration past Lower Granite Dam in late June.

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

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds (*see definitions in "Attachment 1")*.

The Grande Ronde basin once supported large runs of chinook salmon with estimated escapements in excess of 10,000 as recently as the late 1950's (USACOE 1975). Natural escapement declines in the Grande Ronde basin have paralleled those of other Snake River stocks. Reduced numbers of spawners combined with human manipulation of previously important spawning habitat have resulted in decreased spawning distribution and population fragmentation.

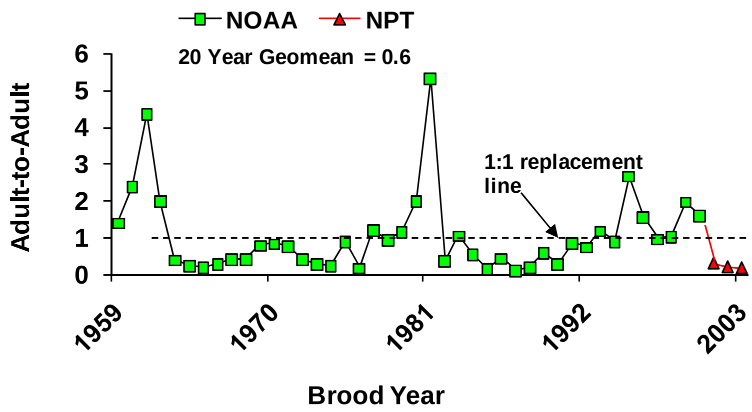

Figure 15. NOAA and NPT spawner adult to adult replacement ratios from brood year 1959 to 2003 .

The Interior Columbia Technical Recovery Team (ICTRT) established biological viability criteria to monitor recovery efforts in the ESUs for salmon and steelhead listed under the Endangered Species Act. The viability criteria were based on guidelines in NOAA Technical Memorandum *Viable Salmonid Populations and the Recovery of Evolutionary Significant Units* (McElhany et al. 2000). These guidelines were used to describe the Lostine/Wallowa River spring/summer Chinook population and other populations within the Major Population Group (MPG) (Table 10). All Grande Ronde River/Imnaha River MPG populations were assessed at high risk (>5%) of extinction in the next 100 year period. Two populations are extinct (Carmichael et al 2006).

Table 10. Grande Ronde River/Imnaha River spring/summer Chinook major population groupings.

Population	**ICTRT size**	**Status**	**TRT viability**
Big Sheep	Basic	Extinct	NA
Catherine Creek	Large/ Intermediate*	High Risk	Viable
Imnaha	Intermediate	High Risk	Viable
Lookingglass Creek	Basic	Extinct	NA
Lostine/Wallowa	Large	High Risk	Highly Viable
Minam	Intermediate	High risk	Viable
Upper Grande Ronde River	Large	High risk	NA
Wenaha	Intermediate	High risk	Viable
ICTRT size • Basic 500 • Intermediate 750 • Large 1,000 • Very Large 1,500		TRT Viability • High <1% • Viable <5% Likelihood of extinction in 100 year period	
*Catherine Creek weir is managed at the Intermediate level due to main stem reach considerations			

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

__Progeny to Parent Ratios__

Natural progeny per parent ratios are based on spawner abundance (estimates of prespawn mortality are subtracted from escapement estimates are shown in Figure 16. Broodstock removals, broodstock mortalities, and fish that were harvested or euthanized are also subtracted from the total escapement to tributary estimate for natural-origin fish. The number of fish removed for broodstock includes broodstock that were spawned, culled, and those that represented mortalities. Progeny per parent ratios for age 4 to 5 natural and hatchery fish are shown in Figure 16 (it's assumed that age 3 Chinook salmon will not contribute significantly to egg production). Progeny per parent ratios decline for natural Chinook salmon from 3.6 in brood year 1999 to 0.19 in brood year 2003. Natural progeny per parent ratios fell below 1.0 in brood year 2000 and remained below 1.0 to brood year 2004. Hatchery progeny per parent ratios have ranged from a low of 6.7 in brood year 2003 to a high of 40.2 in brood year 2000 and have been approximately eight to 50 times higher than natural progeny per parent ratios. The hatchery progeny per parent ratios represent the greater overall survival from the egg to smolt life stage in a hatchery setting.

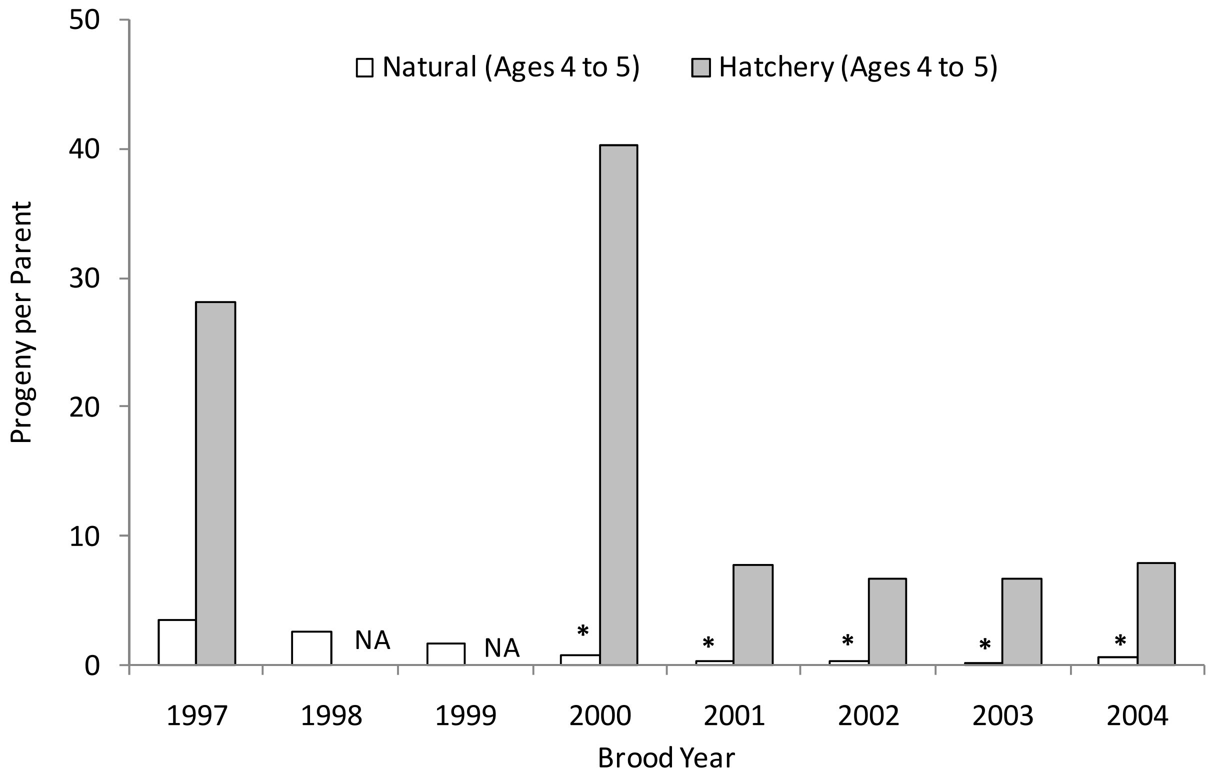

Figure 16. Progeny per parent ratios (adult to adult) for natural and hatchery origin Chinook for brood years 1997-2004 (Lostine M&E data).

Recruit per Spawner Ratios

Recruit per spawner relationships, which are defined within this document as those that enumerate the number of juvenile fish resulting from a preceding adult life history stage, are shown in Figure 17. The juvenile recruits per spawner are the number of estimated smolts surviving to Lower Granite Dam. Prior to returns of age 4 hatchery Chinook salmon females in brood year 2001 the number of recruits per spawner from 1997 to 2000 averaged 57. The number of recruits per spawner from brood year 2001 to 2006 averaged 25.

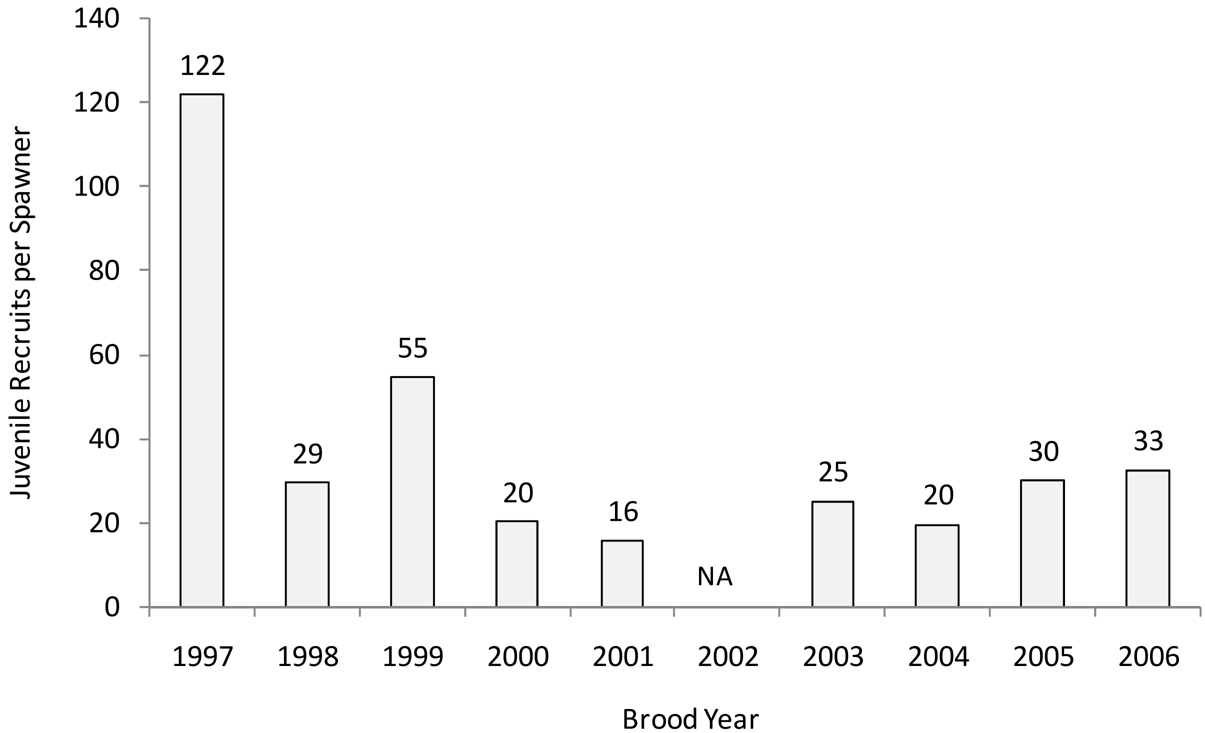

Figure 17. Recruit per spawner relationships Chinook at the tributary (Lostine River) and Lower Granite Dam. (Lostine M&E data).

Juvenile Survival

Figure 18 shows smolt survival from the Lostine River to Lower Granite Dam O&M production goals assume that life stage specific survival is similar between hatchery and natural origin Chinook salmon. Survival of natural Chinook salmon juveniles from the Lostine River to Lower Granite Dam tended to be statistically higher ($P < 0.05$) than hatchery Chinook salmon four out of six years from 1999 to 2006 (Figure 18). Adjustments to release times in 2007 to 2009 are believed to have improved the survival of hatchery Chinook salmon juveniles from 2007 to 2009 by decreasing travel time (Cleary 2008, Monzyke et. al. 2009) and no significant differences between natural and hatchery Chinook salmon juvenile survival from the Lostine River to Lower Granite Dam have been observed.

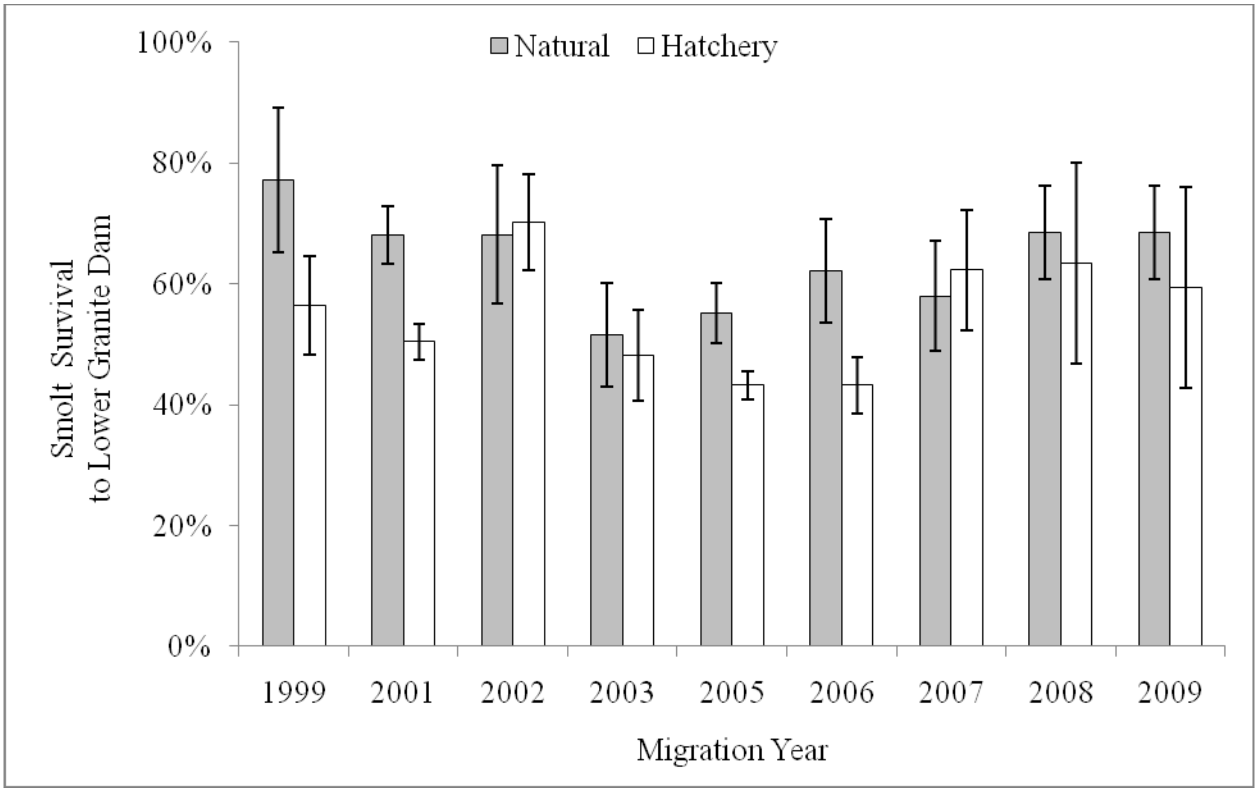

Figure 18. Natural and hatchery-origin juvenile Chinook survival (95% CIs represented by error bars) from Lostine River to Lower Granite Dam (Migration Years 1999-2009; Lostine M&E data).

- Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data. *(Include estimates of juvenile habitat seeding relative to capacity or natural fish densities, if available).*

<u>Spawner Abundance</u>

Since the inception of the project, spawner abundance in the Lostine River population has ranged from a low of 92 fish (1999) to a high of 1,352 fish in 2008 (Figure 19). Redd counts from 1986 to 2009 in the Lostine River have ranged from 11 in 1995 to 293 in 2008 and shows a positive trend (Figure 20). There is a strong correlation (R^2 = 94.7) between mark-recapture escapement estimates above weir and the number of redds above the weir (Figure 21). The strong correlation doesn't necessarily validate the mark-recapture escapement estimates as much as it indicates that whatever error is present is within the escapement estimates is consistently correlated to whatever error is present in redd counts.

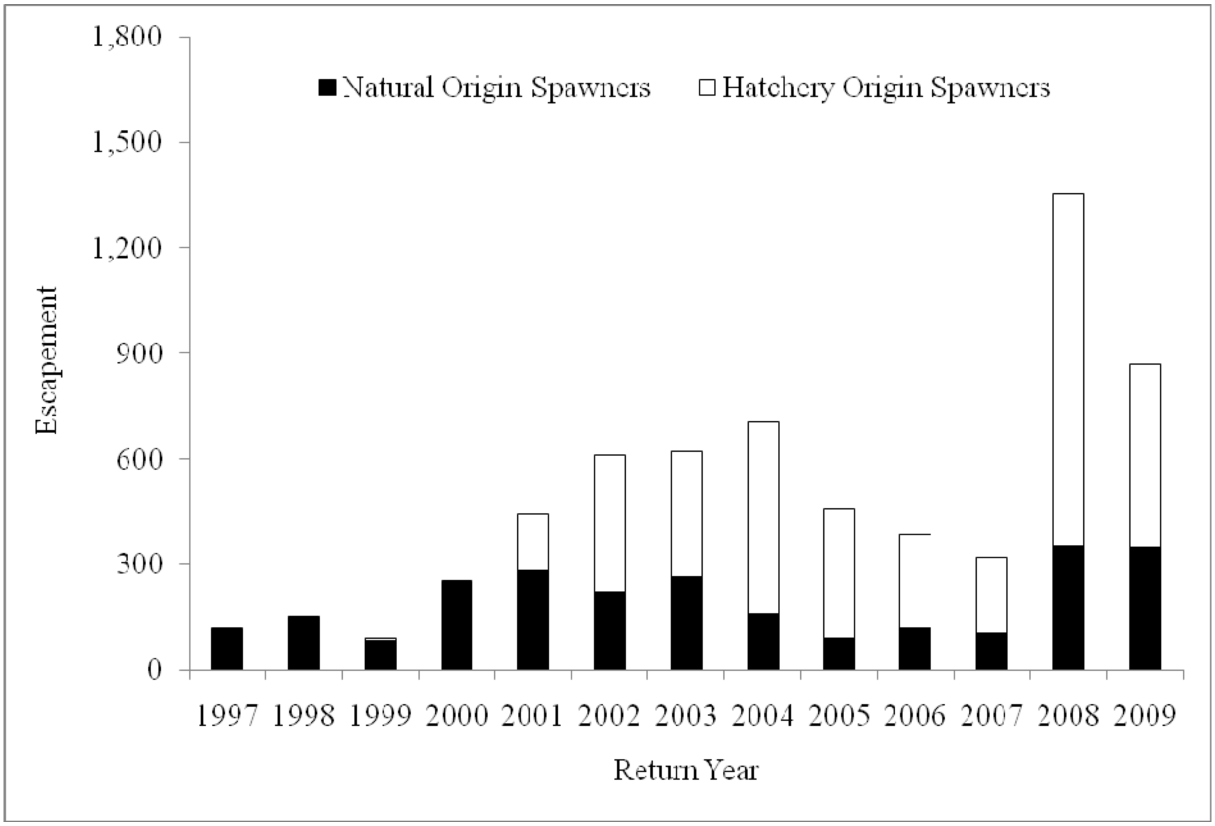

Figure 19. Natural and hatchery-origin spawner abundance in the Lostine River (1997-2009). Lostine M&E data.

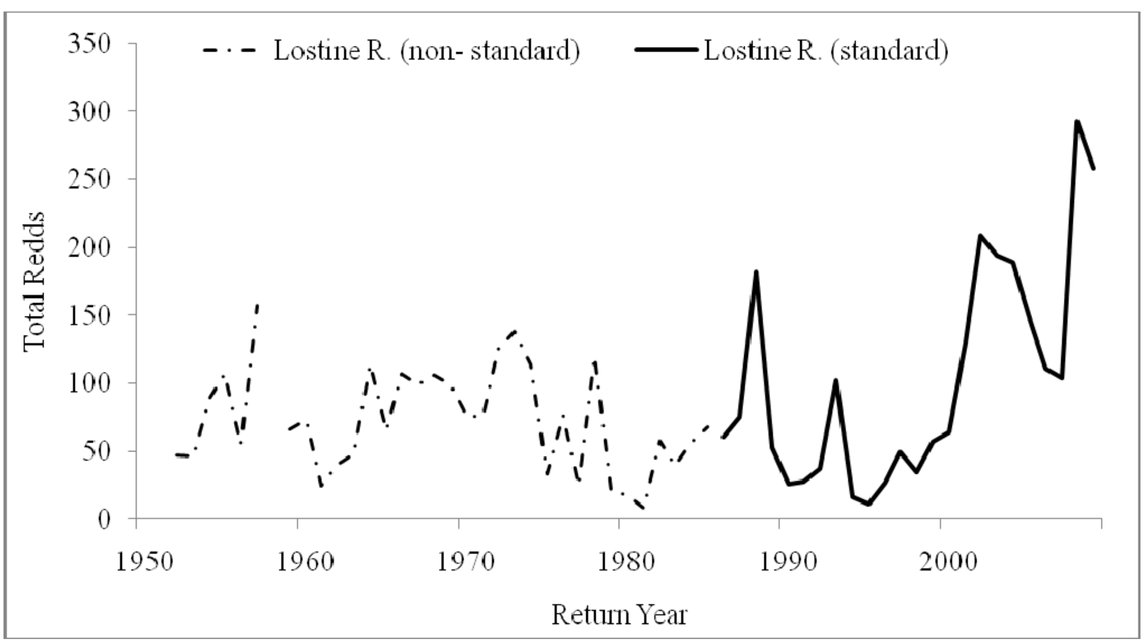

Figure 20. Lostine River standard and non standard redd counts from 1950 to 2009.

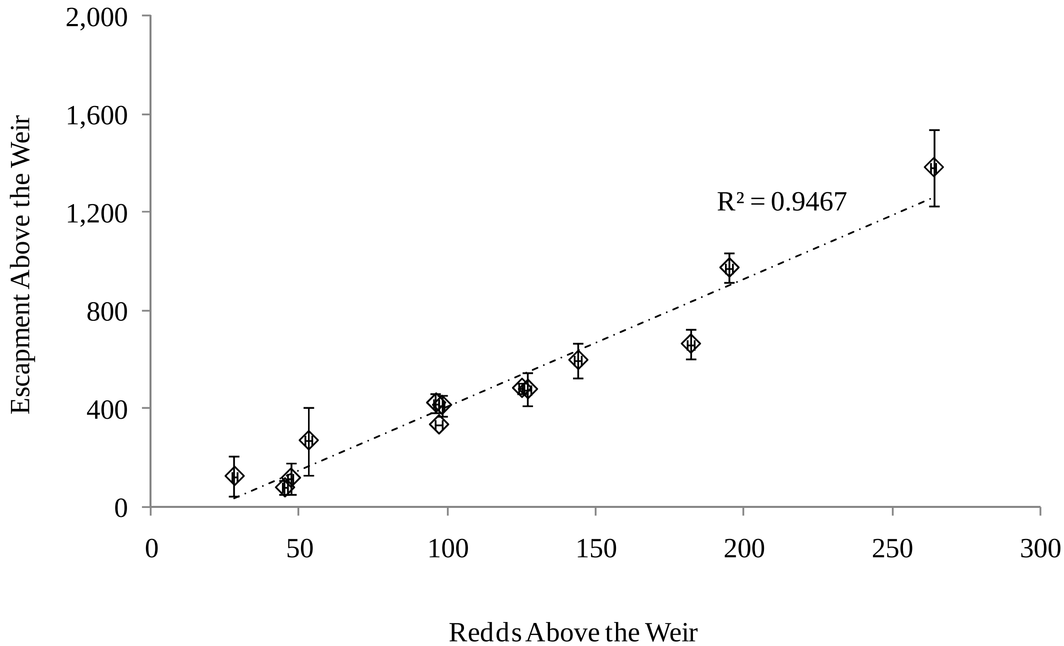

Figure 21. The correlation between the number of redds counted above the Lostine River weir and estimated escapement above the Lostine River weir from 1997 to 2009.

Juvenile Abundance

Estimates of juvenile tributary abundance have been provided by BPA Project 1992-026-04 (Yanke et al 2009). Juvenile tributary abundance is the sum of parr and smolt population estimates. However, not all parr survive to the smolt life stage and a separate estimate of natural smolt abundance is provided by Yanke et al. (2009) that takes into account overwintering mortality. Natural smolt abundance has oscillated from a low of 7,900 smolts during migration year 2000 to a high of 33,646 smolts in migration year 2005 and then back down to 16,720 smolts in 2008 (Figure 22).

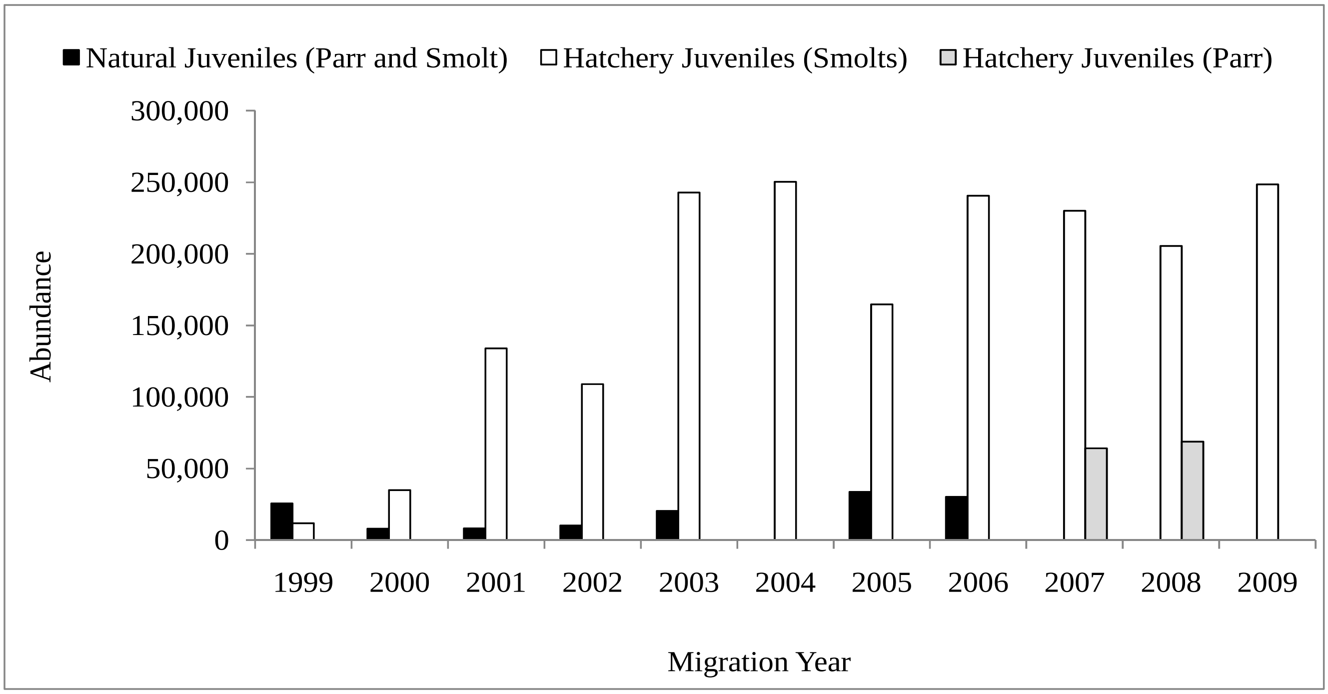

Figure 22. Natural and hatchery-origin Chinook juvenile abundance in Lostine River (1997-2009) Lostine M&E data.

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

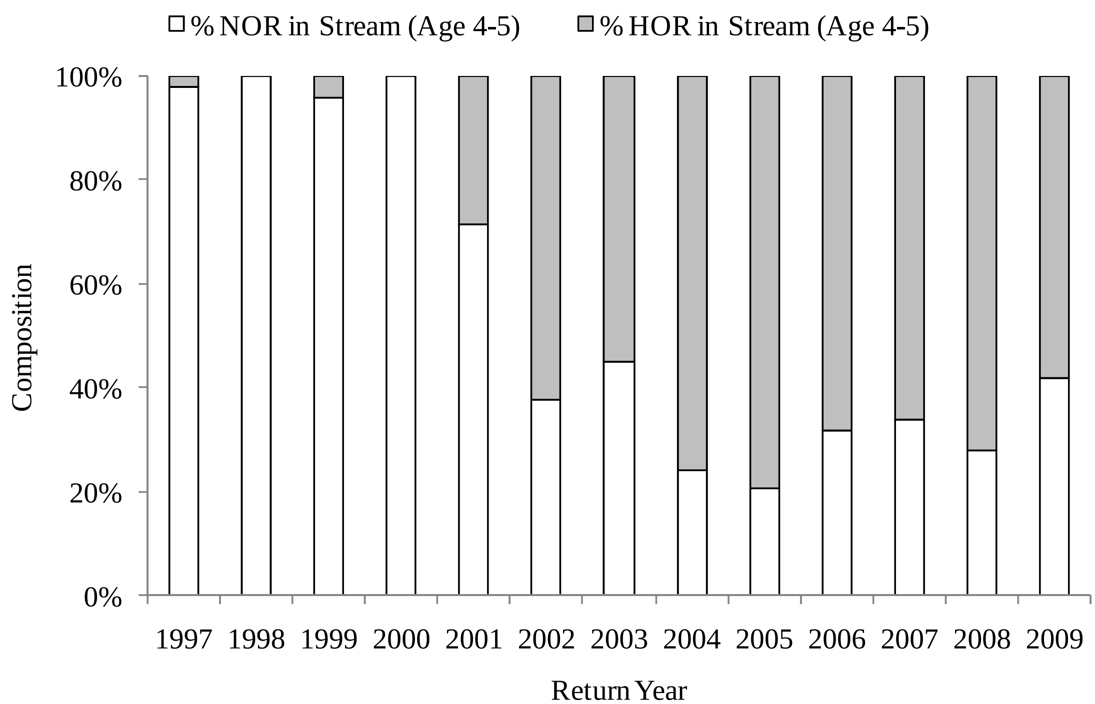

Figure 23. Composition of NOR and HOR spawners in the Lostine River.

Table 11. Recovery of marked (opercle punched) fin clipped and non-fin clipped fish on the spawning grounds above the Lostine River weir from 1997 to 2009.

	Hatchery		Natural		Total		
Year	Marked	Unmarked	Marked	Unmarked	Marked	Unmarked	Total
1997	0	0	5	40	5	40	45
1998	0	0	3	25	3	25	28
1999	0	1	7	38	7	39	46
2000	0	0	6	33	6	33	39
2001	8	4	50	8	58	12	70
2002	68	25	41	31	109	56	165
2003	34	17	23	22	57	39	96
2004	50	15	13	4	63	19	82
2005	62	5	17	0	79	5	84
2006	39	6	18	5	57	11	68
2007	38	0	21	0	59	0	59
2008	97	91	25	42	122	133	255

2.2.3) **<u>Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of NMFS listed fish in the target area, and provide estimated annual levels of take</u>** *(see "Attachment 1" for definition of "take")*.

Broodstock collection will result in the direct take of between 110 and 200 adult summer Chinook annually within the Lostine River of which up to 100% could be natural origin Chinook salmon based on the sliding scale management tool (Table 5). Monitoring and evaluation will employ non-lethal data collection, such as fin clips for genetic analyses. Capture, tagging, and handling-related mortality (incidental take) of adults over the course of the project is shown in Table 12. Percent mortality associated with the operation of the adult weir has generally been less than 1% annually since 2002.

Table 12. Incidental take for natural-origin (NOR) Lostine River adult Chinook (1997; 2000-2009).

Year	Natural Origin Weir Mortalities	Hatchery Origin Weir Mortalities[1]	Natural Origin Broodstock Mortalities	Hatchery Origin Broodstock Mortalities	Total Broodstock Removed	Total Captured at Weir	Percent Broodstock Mortalities	Percent Weir Mortalities
1997	0	2	1	0	9	27	11.1%	7.4%
1998	0	0	0	0	0	23		0.0%
1999	0	1	0	0	0	13		7.7%

Year	Natural Origin Weir Mortalities	Hatchery Origin Weir Mortalities[1]	Natural Origin Broodstock Mortalities	Hatchery Origin Broodstock Mortalities	Total Broodstock Removed	Total Captured at Weir	Percent Broodstock Mortalities	Percent Weir Mortalities
2000	0	0	1[2]	0	33	91	0.0%	0.0%
2001	0	8	8	0	79	440	10.1%	1.8%
2002	0	1	5	2	59	530	11.9%	0.2%
2003	0	0	6	4	49	412	20.4%	0.0%
2004	0	0	3	5	108	1,014	1.4%	0.0%
2005	0	0	2	3	104	788	4.8%	0.0%
2006	1	1	7	27	138	497	24.6%	0.4%
2007	2	2	2	9	122	587	9.0%	0.7%
2008	0	1	3	5	118	954	6.8%	0.1%
2009	1	7	5	3	120	2,431	1.0%	0.3%

[1] Stray hatchery fish were culled at the weir in 1997 and 1999.

[2]Only potential mortality is one 808 mm natural male, tag #0021; we have no record of his fate after he was brought to Lookingglass Hatchery.

- 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.

Adult broodstock collection - Annual broodstock collection is accomplished by operation of a weir on the Lostine River from April to September. In addition, if the proposed Lostine Hatchery is constructed a fish ladder may be operated at the hatchery site to collect broodstock. Operation of the existing Lostine River weir/trap involves complete blockage of stream possibly causing a migrational delay for adults moving up the Lostine River. Trapping and handling of adult fish could cause increased mortality due to stress, injuries, or poaching. In addition, the weir/trap is operated during smolt outmigration. Increased mortality to smolts passing weir/trap may occur due to descaling on instream structures.

Adult spring Chinook (natural and hatchery-origin listed fish) are collected at the Lostine River weir/trap and incorporated into a matrix spawning protocol to maintain genetic similarity between hatchery-origin and natural-origin populations. Adults are collected from May (as early as stream conditions allow fishing) to September based on a "sliding scale" approach to pass fish above the weir, out-plant, or retaining for broodstock based on origin, sex, and age (see Sec. 5.1). The approach is based on a preseason estimate of returning hatchery and natural origin adults and is modified as the run develops. Adult disposition of fish trapped is based on the sliding scale tool (Table 5).

Spawning, incubation and rearing – At Lookingglass Hatchery adult fish and jacks used are killed during the spawning process. This same process would be used at the proposed Lostine Hatchery. Eggs and resulting progeny are subject to mortality during incubation and rearing due to developmental, disease, injury and other causes. Every effort is (and will be) made in the hatchery environment to ensure maximum survival of Chinook at all life stages.

Acclimation – The Lostine River Acclimation facility is operated from February to April. Incidental mortality associated with fish culture practices may occur. The loading and unloading of fish into transport trucks and the initial stress when placed into the raceways at the acclimation facility. Every effort is made at the acclimation facility to ensure the maximum survival of Chinook. Once the proposed Lostine Hatchery is constructed the Lostine River Acclimation facility will be decommissioned and all rearing and release will be done from the hatchery.

Juveniles trapped – Wild juvenile steelhead moving upstream may enter the adult trap during operation. This may result in injury and/or mortality. Design of the new Lostine adult collection facility will feature one inch spacing on the upstream area trash rack and the downstream v-trap holding area entrance to further minimize the probability of juvenile entrapment during operation.

Spawning surveys – Foot surveys are conducted to determine natural spawning abundance and distribution, density and proportion of hatchery-origin fish in key natural spawning areas. These surveys are conducted annually in various reaches of spawning habitat from August through September. Experienced surveyors walk along the stream, crossing when necessary, avoiding redds, counting redds, and observing live fish and carcasses. Although every effort is made to observe adults and determine their origin without disturbance, spawners are occasionally forced to seek cover. These encounters are brief and spawning fish generally resume their activity within a short period of time. Surveyors occasionally disturb existing redds while walking in the river.

Juvenile surveys/collections – Rotary trapping (screw traps), Electro-fishing, snorkeling and hook and line sampling may be used to monitor migration timing, fish density, size, pathogens, and food habits of juvenile Chinook, steelhead, and bull trout and to collect genetic samples from naturally produced Chinook. Also, juvenile Chinook are PIT tagged to monitor survival and migration rate and timing. These activities, which generally occur from May through October, will result in take of juvenile listed steelhead and occasionally spring Chinook and bull trout. Electro-fishing efforts conform to NMFS (NOAA) electro-fishing guidelines to minimize disturbance and injury to listed fish. Snorkeling is a low impact sampling method that may be used to identify relative proportion of residual hatchery steelhead in key stream reaches. Disturbance of rearing juveniles associated with snorkeling is generally limited to forcing individuals to seek cover and is a short duration effect. Snorkeling surveys are conducted when stream temperatures are low, so as to minimize potential for stress and incidental mortality to listed fish.

Imnaha and Lookingglass Hatchery intake maintenance – Natural juvenile Chinook, steelhead, and bull trout maybe encountered when performing seasonal gravel removal operations in the immediate proximity to Lostine River weir, Lookingglass facility intakes, and the proposed Lostine Hatchery intakes. Disturbance of rearing juveniles associated with gravel removal is generally limited to forcing individuals to seek cover and is a short duration effect. This may result in injury and/or mortality.

Monitoring and evaluation projects associated with the Lostine River spring Chinook program:

NPT (BPA project # 199800702) Lostine Supplementation M&E Spawning ground surveys

ODFW (BPA project # 1992-026-04) Early Life History operation of rotary screw traps at Spoolcart and Elgin. PIT tagging of parr from the Upper rearing areas.

ODFW (LSRCP) Oregon Evaluation Studies spawning ground surveys Sampling of fish at the hatchery (genetics, spawning, incubation, pre-release/CWT, PIT tag).

- **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 13 Acclimation release and mortality of Lostine River fish. .

Year	Released (n)	Mortality (n)	Mortality (%)
1999	11,738	0	0.00
2000	34,977	52	0.14
2001	133,982	390	0.29
2002	109,015	224	0.21
2003	242,776	101	0.04
2004	250,251	108	0.04
2005	164,779	56	0.03
2006	240,568	345	0.14
2007	230,010	117	0.05
2008	205,567	144	0.07
2009	248,470	166	0.07

ODFW has reported take under permit #1011 and in Permit No. 1011 annual reports (1997-2001). Take at different life stages and hatcheries are reported by ODFW in the Grande Ronde Basin Spring/Summer Chinook Program HGMP 2002 and 2010. The NPT has reported take under permit #1149 annual reports (2000-2002).

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).

Table 14**. Estimated listed salmonid take levels of by hatchery activity.**

Listed species affected: Spring/Summer Chinook Salmon ESU/Population: Snake River Activity: Wallowa/Lostine Supplementation Program				
Location of hatchery activity: Lostine River Dates of activity: Annual Hatchery program operator: Nez Perce Tribe				
	Annual Take of Listed Fish By Life Stage (*Number of Fish*)			
Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)	unknown	2,500	5,000	500
Collect for transport b)	450,000	0	3,000	500
Capture, handle, and release c)	0	0	5,000	0
Capture, handle, tag/mark/tissue sample, and release d)	450,000	250,000	5,000	0
Removal (e.g. broodstock) e)	0	0	240	0
Intentional lethal take f)	45,000	1,000	200	0
Unintentional lethal take g)	60,000	12,500 (5%)	40	0
Other Take (specify) h)	0	150,000	0	0

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

Table 15**. Estimated listed salmonid take levels of by hatchery activity.**

Listed species affected: Summer Steelhead ESU/Population: Snake River Activity: Spring Chinook Adult Broodstock Collection				
Location of hatchery activity: Lostine River Adult Weir Dates of activity: May through September Hatchery program operator: NPT				
	Annual Take of Listed Fish By Life Stage *(Number of Fish)*			
Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)			500	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)			25	
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass

Instructions:

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

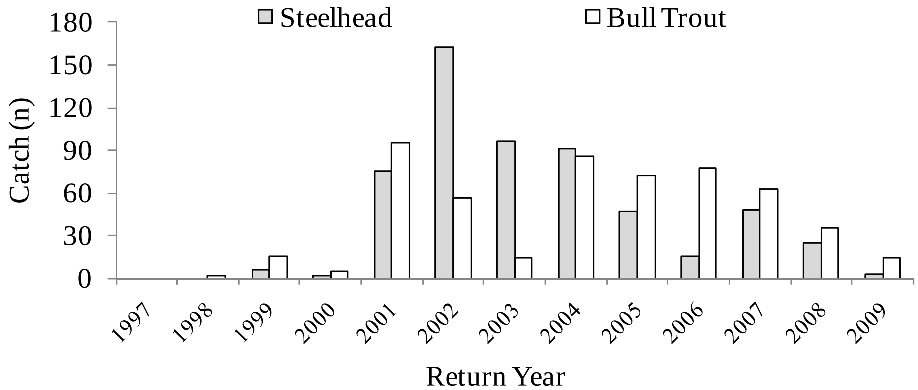

Figure 24. The catch of bull trout and steelhead at the Lostine River weir from 1997 to 2009.

Table 16. The catch of bull trout and steelhead at the Lostine River weir from 1997 to 2009.

Year	Steelhead	Bull Trout
1997	0	0
1998	0	2
1999	6	16
2000	2	5
2001	75	95
2002	163	56
2003	96	14
2004	91	86
2005	47	72
2006	16	78
2007	48	63
2008	25	35
2009	3	14

The catch of steelhead (hatchery and natural) at the weir has ranged from 0 to 163 fish and the catch of bull trout has ranged from 0 to 95 fish.

- 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.

During the adult trapping period, instream temperatures will be monitored to reduce the risk of exceeding take levels. A contingency plan is in place that stipulates trapping activity and adult handling will cease if water temperatures exceed 21.1 °C for three consecutive days. The plan also suggests the daily work schedule may be altered to take advantage of early morning cooler temperatures to keep the actual fish handling parameter below 18.3 °C . Any further necessary inseason program modifications will be applied immediately prevent excess take levels.

Established ODFW fish health protocols are and will continue to be utilized throughout the Lostine program to eliminate or minimize any exceedance of allowable take.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

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

The proposed program outlined in this HGMP is consistent with 2002 HGMP submittal, NWPCC Artificial Production Review (Report and Recommendations), Grande Ronde Subbasin Management Plan (NPCC 2004), expired Section 10 permit (#1149), and addresses issues of concern outlined in the NOAA Hatchery Biological Opinions (1999; 2004).

RPA Hatchery Strategy 2, Action # 42 of 2008 Federal Columbia River Power System Biological Opinion specifically calls for implementation of the Lostine River spring Chinook program;

> For the Lostine and Imnaha rivers, contingent on a NOAA approved HGMP, fund these hatchery programs, including capital construction, operation and monitoring and evaluation costs to implement supplementation programs using local broodstock and following a sliding scale for managing the composition of natural spawners comprised of hatchery origin fish.

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.*

- *Lower Snake River Compensation Plan* **–** The program is consistent with smolt production levels as outlined in original LSRCP. The proposed program will continue to support a tribal and sport harvest level.
- *US vs Oregon* - The hatchery program outlined within this HGMP is consistent with Production Table B.1 of the *US vs Oregon* 2008-2017 Management Agreement and the intent to provide fish for harvest in tribal and sport fisheries in the Columbia River mainstem as well as in-basin tribal and

non-tribal harvest opportunity.

- *Northeast Oregon Annual Operation Plan (AOP LSRCP)*—The program is consistent with co-manager agreements outlined in the Annual Operation Plan.

3.3) Relationship to harvest objectives.

The Nez Perce Tribe has completed a long-term Tribal Resource Management Plan (TRMP or Tribal Plan) that describes the Nez Perce Tribe's (Tribe) treaty fishery regime for Snake River spring/summer Chinook salmon in the Grande Ronde River Subbasin. In its 1855 Treaty (Treaty) with the United States, the Nez Perce Tribe reserved to itself the "right of taking fish in streams running through or bordering" the reservation and "at all usual and accustomed places."[2] The 1855 Treaty, in Article I, describes the Reservation: the lower reaches of Lookingglass Creek, the Wenaha River, and the Grande Ronde, and the entire Lostine, Minam and Wallowa Rivers are within those boundaries. The 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 cultural ways of life. The Treaty is the foundation for the Tribe's fisheries management and for its role as a fisheries co-manager.

Snake River spring/summer Chinook (including fish returning to the Grande Ronde Subbasin) are listed under the Endangered Species Act (ESA). The Tribe's long-term TRMP relies upon the use of annual fish run size information with a harvest sliding scale to shape and manage Nez Perce treaty fisheries in such a way that enables the tribe to appropriately consider harvest relative to the conservation needs of spring Chinook.

At the subbasin scale, this Tribal Plan:

1. Provides for the meaningful exercise of federally-protected Nez Perce treaty-reserved fishing rights in areas where those rights were reserved;
2. Provides for annual tribal and non-tribal fishing opportunity co-managed under the continuing jurisdiction of United States v. Oregon;
3. Maintains compatibility with associated hatchery operations designed to benefit listed anadromous fish; and

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[2] Article III of the Treaty of 1855 reserved to the tribe the right to take fish; Article I identified the area ceded by the Tribe to the United States; and Article II identified the boundaries of the original reservation. The Nez Perce Tribe has provided information in its fishery plan that indicates that certain portions of subbasin is located within the boundaries of the 1855 Reservation described in Article II. That these areas were recognized as being exclusive to the Nez Perce Tribe is also corroborated by the Indian Claims Commission findings and map of areas the Nez Perce Tribe exclusively used and occupied.

4. Provides a method (for purposes of harvest allocation) for the Nez Perce Tribe to identify total allowable hatchery and wild fish harvest to result in the Nez Perce treaty fishery

The tribal fishery will maintain consistency with conditions established in the ongoing United States v. Oregon court proceeding that addresses treaty fishing rights. Spring and summer Chinook produced in the Snake Basin support Nez Perce treaty harvest in key tributaries such as those located in the Grande Ronde River subbasin.

The Grande Ronde Fisheries Management Evaluation Plan (FMEP) developed by the Oregon Department of Fish and Wildlife and the Nez Perce Tribal Resource Management Plan (TRMP) were resubmitted to NOAA Fisheries in February and March 2009. The abundance based harvest sliding scale incorporated in the TRMP and FMEP was developed in to work in concert with the sliding scale for broodstock management (Table 5) therefore, the hatchery program is operated consistent with these plans.

3.3.1) Describe fisheries benefitting from the program, and indicate harvest levels and rates for program-origin fish and associated natural fish for the last twelve years, if available.

Fisheries that benefit from the hatchery fish produced by this program occur mainly in the mainstem Columbia River and the Wallowa River basin. Program contributions to ocean fisheries are minimal, as is the the case for all Snake River spring/summer Chinook. A description of the various fisheries that benefit from the Lostine hatchery production follow.

Lower Columbia River non-tribal commercial fisheries. Lower Columbia River non-tribal commercial fisheries occur below Bonneville Dam in the mainstem (statistical zones 1-5) and in Select Areas (off-channel fishing areas). Currently, winter and spring fisheries in the mainstem are mark selective but summer and fall fisheries are not. The lower Columbia River commercial fisheries primarily target white sturgeon during the early portion of the winter season (January through mid-April) and spring Chinook beginning in early March. In some years, target spring Chinook fisheries may not occur until April and can occasionally extend through the spring season (mid-April through June 15).

Lower Columbia River non-tribal recreational fisheries. The lower Columbia River mainstem below Bonneville Dam is separated into two main areas for recreational harvest; Buoy 10 (ocean/in-river boundary) to the Rocky Point/Tongue Point line, and the Rocky Point/Tongue Point line to Bonneville Dam. These fisheries are mark-selective for spring Chinook. Catch in recreational fisheries above Bonneville is very low compared to the fisheries below Bonneville.

Mainstem Columbia tribal fisheries. Treaty tribal harvest includes commercial and ceremonial and subsistence (C&S) fisheries. The tribal C&S fisheries are of highest priority and generally occur before tribal commercial fishing. The tribal set net fishery above Bonneville Dam (statistical Zone 6) involves members of the four Columbia River treaty Indian tribes: Yakama Nation, Nez Perce Tribe, the Confederated Tribes of the Umatilla Indian Reservation and Confederated Tribes of the Warm Springs Reservation. These fisheries are managed under the jurisdiction of U.S. v. Oregon. The U.S. v. Oregon Management Agreement for 2008-2017 implements abundance-based management on Snake River Chinook and steelhead in the lower mainstem and treaty mainstem fisheries such that fishery impacts increase in proportion to the abundance of natural-origin fish forecast to return once a minimum run-size has been achieved.

Tributary fisheries. Fishing occurs in the Snake River and the Wallowa/Lostine basins for spring/summer Chinook. Annual fishery impact rates are set pre-season consistent with fishery management protocol developed within Tribal and non-Tribal tributary harvest plans, that also has undergone ESA consultation with NOAA Fisheries. This protocol is based on a sliding scale that ties allowed fishery impact rates to forecast return of natural-origin adults. When the return of natural-origin spawners is low, then the fishery will be managed to keep impact rates low. When a large number of natural-origin fish is expected, allowable fishery impact levels will be higher. The allowable impact for each year's fishery is then allocated by the tribal and state managers. Co-managers report catch statistics in season and all fishing stops when the allowable impact for the year is met.

The Nez Perce Tribe targets 50% of the harvestable run in its Treaty areas, with remaining 50% of the harvest share reserved for non-Treaty sport fisheries. To implement treaty fisheries in the Grande Ronde subbasin the Tribe coordinates with ODFW on annual adult fish forecasts and harvest allocation.

The NPT Fisheries Program submits annual technical harvest recommendations for Grande Ronde River spring Chinook fisheries to the Nez Perce Tribe Fish and Wildlife Commission (NPTFWC) and to the Nez Perce Tribal Executive Committee (NPTEC) for consideration. Final season structure is set by tribal regulations. A season regulation will authorize season length, fishing area, gear types, fishery restriction threshold, and Ceremonial and Subsistence (C&S) or commercial purpose applicable to a given treaty fishery.

Areas commonly open to fishing by Nez Perce tribal members in the Lostine and Wallowa rivers include the reach of the Wallowa River from its mouth upstream to the confluence with the Lostine River, then from the mouth of the Lostine River upstream to approximately 60 feet below the adult weir. Typically, all fishing above the weir is closed to treaty fishing to protect naturally spawning wild and hatchery fish that are passed above.

The first opportunity to Tribal anglers for meaningful harvest of Chinook salmon from the Lostine River since 1978 occurred in 2005. Estimates of tribal harvest (Joe Oatman, NPT, personal communication) on the Lostine/Wallowa between 2001 and 2009 are listed in Table 17.

Sport fishing opportunities have been available to anglers since 2008. Sport fishing effort takes place in the Wallowa River, between Minam state park and the mouth of the Lostine River. Sport fishery management is guided by a fishery management evaluation plan (FMEP), most recently submitted to NMFS in July 2010 (ODFW 2010). Sport fishery management is based on a sliding scale that ties allowed fishery impact rates to forecast return of natural-origin adults. The allowable impact for each year’s fishery is then allocated by the tribal and state managers, co-managers report catch statistics in season, and all fishing stops when the allowable impact for the year is met. The Wallowa River sport fishery is monitored using a stratified statistical creel survey. The harvest of hatchery spring Chinook in non-treaty fisheries has ranged from 0 in 2008 to 45 in 2010 (Table 17).

In addition, harvest of Lostine River fish has occurred in tribal and non-tribal fisheries reported with CWT tag recoveries in ocean and lower Columbia River fisheries. Those estimates are for brood years 1983-2003 (Table 18).

Table 177. Estimated spring/summer Chinook escapement and sport fishery harvest impact on Wallowa/Lostine River Chinook (ODFW, unpublished data) and the estimated number of natural (Nat.) and hatchery (Hat.) Chinook harvested by Nez Perce tribal members (Joe Oatman, NPT, personal communication).

	Wallowa/Lostine Escapement			Treaty harvest			Non-treaty harvest[a]			Tributary fishery impact (% mortality)	
Year	Nat	Hat	Total	Nat	Hat	% Nat Impact	Nat[b]	Hat	% Nat Impact	Total % Nat Impact	Total % Hat Impact
2001	689	279	968	0	0	0.0					
2002	744	442	1,186	0	0	0.0					
2003	756	387	1,143	0	0	0.0					
2004	468	1,216	1,684	0	0	0.0					
2005	280	911	1,191	0	20	0.0					
2006	386	421	807	0	5	0.0					
2007	313	411	724	0	0	0.0					
2008				0	55		0	0	0.00		
2009	1,110	2,868	3,978	37	229	3.0	1.1	10	0.01		
2010 (prelimn)	784	2,241	3,978	50	495	6.0	4.7	45	0.60		

[a] Non-treaty harvest includes adults only. Hatchery jack harvest include 0 in 2008, 6 in 2009, and 45 in 2010.
[b] Non-treaty fisheries do not harvest natural-origin fish. Estimates assume a 10% hooking mortality rate on natural-origin adults encountered in the fishery. Natural-origin jacks released in non-treaty fisheries include 0 in 2008, 11 in 2009, and 0 in 2010.

Table 18. Estimated catch of Wallowa/Lostine River hatchery adult spring/summer Chinook salmon in tribal and non-tribal fisheries for the 1983-2003 brood years. Estimated CWT recovery data was obtained from the PSMFC Regional Mark Processing Center (RMPC) database (www.rmpc.org) and summarized through April 2009.

Brood Year	Terminal Area Escapement	Ocean			Columbia and Snake Region			Other		Fishery Total
		Sport	Troll (non-treaty)	Gillnet	Test Fishery Net	Sport	Tribal C/S	Foreign Research Vessels	Hake Trawl Fishery (CA/OR /WA)	
1997			7	112	1	80		1	4	205
1998		2	9	103		166		1		281
1999		3	3	17		43				66
2000		2	8	95		92				197
2001			11	41		65		2		119
2002			1	23		61				85
2003			1	54		34				89

3.4) Relationship to habitat protection and recovery strategies.

Human development and land management impacts consistent with those identified across the Columbia Basin affect Chinook production in the Grande Ronde River Basin. Loss of channel diversity, sedimentation, reduced stream flows, habitat constriction due to effects of irrigation withdrawal, water temperature and fragmentation of habitat all affect productivity of natural Chinook populations within the watershed. State programs in place through the Department of Environmental Quality, Department of Forestry and Division of State Lands along with federal Clean Water Act and Corps of Engineers 404 regulations provide standards for activities on private land that might otherwise contribute to the problems listed above. Activities on public lands or those that are federally funded 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.

These habitat protection programs in conjunction with ongoing private and publicly funded restoration efforts have resulted in an improvement in Chinook and steelhead habitat in many Grande Ronde River Basin tributaries. Most watershed restoration/improvement projects are funded through the Grande Ronde Model Watershed Program, Oregon Watershed Enhancement Board, Bonneville Power Administration funded Northwest Power Conservation Council's Fish and Wildlife Program, Mitchell Act Program and Natural Resource Conservation Service's (NRCS) Conservation Reserve Enhancement Program (CREP). Efforts include fencing streamside corridors to promote riparian vegetative recovery, improved fish passage at road crossings and diversions, reduced sediment production from roads and cropland and screening of irrigation diversions. Some programs like the Mitchell Act screening program began almost 50 years ago, while others like CREP are very recent. Taken together, habitat protection and improvement measures are (and will continue to be) improving habitat, and productivity, for the basin's wild spring/summer Chinook.

See Grande Ronde Subbasin Plan for a comprehensive summary of historic, recent, and ongoing habitat restoration activities in the Wallowa/Lostine watershed and the rest of the Grande Ronde Subbasin.

The FCRPS Biological Opinion Supplemental Comprehensive Analysis anticipates a 2% increase in survival for Wallowa/Lostine spring Chinook based on tributary habitat actions occurring from 2001-2017 (Table 8.3.5-1 of the SCA).

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

Predation- Little evidence exists of predation by hatchery released spring Chinook on other salmonids. Hatchery spring Chinook smolts are programmed for release in the Lostine River at a mean weight of 23 g (20 fish per pound) and should range in length from 100 to 150 mm fork length. Release timing and methods (volitional release following acclimation) are intended to result in rapid emigration and limit interaction with other species in the river. The small size of hatchery migrants, rapid migration from the Lostine River, and limited time for conversion from a hatchery diet to a natural diet reduce the likelihood of predation by hatchery Chinook on other salmonids in the basin.

There is potential for predation by other salmonids, especially bull trout, on hatchery and natural Chinook. Releases of hatchery Chinook and any potential increase in natural production of Chinook resulting from the LSRCP program could enhance listed bull trout populations by increasing available forage.

Avian predation, especially mergansers, cormorants, and Herons, on hatchery and natural Chinook are concern post release. Total consumption is unknown

Competition- Hatchery-origin Chinook smolts have the potential to compete with natural Chinook, natural steelhead and bull trout juveniles for food, space, and habitat. If significant interaction does occur in the Lostine River, it is restricted to a short duration as smolts move downstream or to the immediate vicinity of release sites where hatchery fish are most concentrated. Rapid departure of hatchery smolts from the tributary is likely to limit competition with rearing natural-origin Chinook, steelhead, and bull trout. Differences in food habits and habitat preferences are likely to limit competition with bull trout.

There is potential for competitive interactions between hatchery-origin and natural-origin Chinook and steelhead smolts in migration corridors. We do not have information to assess competitive interactions during downstream migration; however, hatchery-origin Chinook smolts are released at a weight similar to or slightly larger than their natural-origin counterparts (23 g) and may have a competitive advantage as a result of size.

Behavioral - There are limited data describing adverse behavioral effects of hatchery Chinook salmon releases on natural/wild Chinook salmon populations. Hillman and Mullan (1989) reported that larger hatchery fingerling Chinook salmon, released in June and July in the Wenatchee River in Washington, apparently "pulled" smaller wild/natural Chinook salmon with them as they drifted downstream resulting in predation on the smaller fish by other salmonids. While the effects of migrating hatchery smolts (yearlings) on wild/natural Chinook salmon are unknown at this time the potential for similar effects exists especially with large concentrated releases within natural rearing areas.

Fish Health - Hatchery operations potentially amplify and concentrate fish pathogens and parasites that could affect natural-origin Chinook, steelhead and bull trout growth and survival. Because the hatchery produced spring Chinook for the Lostine River program are currently reared at Lookingglass Hatchery, potential disease impacts on wild salmonids are limited to periods of smolt acclimation and migration, adult returns, trapping, holding, and natural spawning. There are several diseases of concern including bacterial kidney disease (BKD) and infectious hematopoietic necrosis (IHN). Infectious hematopoietic necrosis virus (IHNV) has become more prevalent at Lookingglass Hatchery in recent years (personal communication ODFW Pathology). Vertical transmission (parent to progeny) of IHNV is prevented by the ongoing prudent fish culture practice of draining coelomic fluid at spawning and disinfecting eggs in iodophor. Steps have been taken to prevent horizontal transmission (fish to fish) of IHNV and other pathogens present in the surface water supply by the installation of a ultraviolet light water disinfection system for the incubating eggs and early rearing vessels. Prudent fish health actions of culling eggs from females with higher levels of *Renibacterium salmoninarum* antigens have helped with controlling BKD. In general, fish have demonstrated good health when reared at Lookingglass Hatchery, and therefore indicates there is potential for minimal to low level transmission of any agents they harbor to natural population. Documentation of fish health status of Lostine River hatchery Chinook is accomplished through monthly and a pre-liberation fish health examination. Examination of hatchery and natural adults spawned at Lookingglass Fish Hatchery are screened for BKD. There is no evidence of increasing prevalence of diseases (e.g., BKD) (Hoffnagle et al. 2009). Kidney samples are also collected on spawning ground surveys to monitor for potential increase in BKD prevalence due to hatchery adult spawning in nature (O'Connor and Hoffnagle 2007). In Grande Ronde Basin streams from 1997-2008, enzyme-linked immunosorbent assay optical density levels were generally low, with 97% of the samples being <0.2 OD units (no evidence of disease).

Incidental Take at Trapping Facilities – Operation of the Lostine River weir and trapping facility for collection of adult Chinook broodstock has the potential to affect wild steelhead and bull trout. These facilities could delay or otherwise alter migrations and some handling of listed species will occur. When adult steelhead are trapped, they will be checked for marks and passed above the trapping facilities. Kelts observed upstream of trapping facilities that can be captured (netted) will be checked for adipose clips and immediately passed downstream.

Hatchery Effluent—Hatchery effluent discharges directly into Lookingglass Creek, after passing through the settling basin, and may affect survival, growth, and migration of spring Chinook salmon. The pollution abatement system was designed to provide for NPDES (0300-J) permit compliance. The settling basin has a 2 hour retention time, based on a continuous inflow of 1500 gpm, and has an active water volume above the sludge reservation of 27,000 ft^3. Effluent discharges meet DEQ criteria and there is no indication that the effluent is affecting fish or fish habitat in Lookingglass Creek. There are no plans to study effluent effects in the creek.

Chemicals used at the hatchery include iodophor, erythromycin, and formalin. These chemicals are approved fishery compounds and their use is regulated by label instruction or Investigative New Animals Drug (INAD) permits. Both iodophor and formalin undergo high dilution rates before entering the stream, which renders them innocuous to the fish and the ecosystem. Erythromycin is injected into broodstock adults or fed to juvenile fish for 28 days. By either route, the drug is assimilated and metabolized within the fish. Any residual antibiotic present in the effluent would come almost exclusively from uneaten food.   It is highly unlikely the effluent containing erythromycin would affect the ecosystem in any way.

The proposed Lostine Hatchery will have a 65ft L x 25 ft W x 3.67 av. D wastewater clarifying basin in which the fish rearing effluent will pass. Due to low density rearing parameters, effluent is expected to contain solids below NPDES permit requirements. This discharge will be permitted and monitored under the NPDES guidelines. Chemicals used at the hatchery will include iodophor, erythromycin, and formalin. These chemicals are approved fishery compounds and their use is regulated by label instruction or Investigative New Animals Drug (INAD) permits. Both iodophor and formalin undergo high dilution rates before entering the stream, which renders them innocuous to the fish and the ecosystem. Erythromycin is injected into broodstock adults or fed to juvenile fish for 28 days. By either route, the drug is assimilated and metabolized within the fish. Any residual antibiotic present in the effluent would come almost exclusively from uneaten food.   It is highly unlikely the effluent containing erythromycin would affect the ecosystem in any way.

In order to supplement flows in the bypassed river reach, a hatchery outflow pump back station will be installed on the site. This system is designed to return the settled hatchery effluent from the clarifying basin outfall back to the intake.

Water Withdrawal—Water withdrawals to operate Lookingglass Hatchery and the proposed Lostine Hatchery, may affect egg survival, juvenile growth and abundance, adult migrations and spawning of Chinook salmon.

Lookingglass Hatchery water intake diverts a maximum of 50 cfs that results in reduced flows between the diversion and the out fall of the hatchery, approximately 500 meters. These reduced flows are most prominent during late July, August, and September when hatchery water demands are high and the creek is at its lowest flow. During this period, adult upstream passage is restricted; however, there is enough water to allow some passage, spawning activity and juvenile rearing. Redds have been observed in the section of river that has reduced flow because of hatchery water withdrawal. Spawning takes place from mid-August until late September. Spawning in this area would be initiated during the time of the lowest flow, so de-watering of redds is unlikely.

The proposed Lostine Hatchery surface water intake will divert water from the Lostine River. The gravity fed intake system originates from a structure located approximately 2000 ft upstream of the hatchery complex and is designed to supply up to 16.7 cfs to for fish rearing operations. The cast-in-place concrete intake assembly will incorporate a pumpback system to feed a fish passage ladder. This design feature will to prevent dewatering of the reach that is directly downstream of the diversion and provide attraction water for upstream migrants. A complete description of this system and the stream monitoring process is noted in the following section 4.2.

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.

Lookingglass Hatchery

The main water source for Lookingglass Hatchery is Lookingglass Creek (72 cfs water right). Water temperature fluctuates daily and seasonally with mean daily temperature ranging between 1^{o} and 16^{o}C. Additional water sources include one well (6.39 cfs water right) used primarily for de-icing the hatchery intake and consequently favorably moderatating incubation and early rearing inflow temperatures. Capable of pumping 5 cfs of 14.5^{o} C, the unit is typically operated at a maximum of 4 cfs to prevent pumping the well dry. Water discharged is monitored under the general NPDES 0300 J permits. High spring run-off has created problems with turbid water and sediment deposition in egg incubation trays, early rearing troughs, large raceways, and associated water delivery pipes. Compliance for screening criteria will be evaluated.

Lostine Acclimation Facility

The Lostine River Spring Chinook acclimation facility relies solely upon surface water pumped from the Lostine River. The temporary inflow system is typically installed in late February and removed in late April. Pump power is supplied by trailer mounted diesel generators. A main and back up electric submersible pumps are placed in a NMFS compliant instream screen box and plumbed to the rearing vessels using 10 inch semi-rigid pipe. The approximate intake location is Lostine RM 10. This type of water supply has the ability to provide up to 5.7 cfs for fish culture. The only natural limitation to production would be driven by our surface water right to only withdraw up to 5.7 cfs from the river during operation. Water quality is adequate during the acclimation period with an average temperature of 32-34 degrees F and low sedimentation. The current facility fish production is less than 20,000 pounds annually; therefore, NPDES general permits (300-J) are not required.

Proposed Lostine Hatchery (NEOH)

The proposed Lostine Hatchery is designed to be constructed in the Lostine River watershed at RM 10. This facility would hold, incubate, rear and acclimate Lostine River spring Chinook on their natal water supply for the entire time they are held/reared in the facility. The proposed Lostine Hatchery is designed to utilize surface water (18 cfs water right) and pumped well water (3.2 cfs water right). The gravity fed surface water intake structure will be located approximately 2000 ft upstream of the hatchery and will supply up to 16.7 cfs to for fish rearing operations. The cast-in-place concrete intake assembly will incorporate a rock weir structure to facilitate watering of the intake screens, a sluiceway for periodic downstream sediment removal past the weir, a log boom to protect the screen panels and an upland compressor building to house the de-icing air receiver and compressor. The surface water intake structure will be a cast-in-place concrete structure located on the east bank of the Lostine River. The screen will support NOAA fisheries criteria with 1.75 mm spacing. In addition, three wells (total water right 3.2 cfs) will provide a ground water supply. Two will be utilized to facilitate pathogen free incubation and juvenile rearing needs with the third dedicated for domestic water supply (150 gpm capacity). The inflow from the production wells will be pumped to the head box at a combined rate of 1300 gpm and will be processed through degassing towers. The degassing process will strip nitrogen and add oxygen. The treated well water can then be directed to the incubation/early rearing building or the raceways. Mixing with surface water is also a provision of the designed head box. The proposed facility will have pollution abatement facilities and effluent discharge will be monitored under the general NPDES guidelines.

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.

Lookingglass Hatchery

New Lookingglass Hatchery screens have been added to the intake and at the head end of raceways to help prevent native fish from entering the hatchery intake water supply and commingling with hatchery fish. The screens should reduce the debris load entering the hatchery.

Lostine Acclimation Facility –The portable pumpintake screen box conform to NOAA Fisheries screening guidelines to minimize the risk of entrainment of juvenile listed fish. We comply with the Oregon Water Resources minimum instream flow requirement in the facility bypass reaches.

Proposed Lostine Hatchery

Risk aversion measures to prevent the take of listed natural fish have been addressed as part of the hatchery construction planning and permitting process. Specifically, site specific prudent water withdrawal measures were reviewed upon obtaining the Oregon State Permit to Appropriate the Public Waters (BPA application # S-86487 permit #S-54336). This review process determined a maximum year round diversion of 18 cfs was permissible with an approved point of effluent discharge located 2,780 feet downstream of the original point of diversion. Continuous river flow measurement, recording and reporting were conditions of the usage agreement. The results of the regimented monitoring process will be used to apply water conservation measures reducing the amount of hatchery diversion if the stream flow is less than or equal to 30.0 cfs. In addition, an annual report will be issued to the Water Resources Department detailing water usage.

The face of the intake will contain a trash boom to keep larger debris from the face of the structure, a return effluent pipe and a fish screen. Screening precautions have been applied to the NOAA Fisheries approved surface water intake design plans using a 1.75

mm spacing (approx 1/16”). Associated with the hatchery intake devise is a fish passage ladder, designed to accommodate both adult and juvenile passage as appropriate to meet NOAA Fisheries guidelines. Upstream and downstream fish passage will be accommodated by this fish ladder. Average velocities are designed to be 4-5 fps, which is lower than adult swimming speed, but higher than most juvenile swimming speed. Also, the return effluent pipe will be brought back to the top of the ladder, through a 3.5 ft. by 3.5 ft. diffuser screen. At the maximum flow of 12 cfs, the velocity through the diffuser will be lower than 1 fps (NOAA Fisheries criteria), to minimize fish from being attracted to the diffuser. Moreover, the Lostine River Hatchery has been designed with a number of feature that provide flexibility to main a high quality rearing environment in years of low river discharge without negatively affecting the instream environment. The specific design features are:

- Adult holding ponds and raceways are designed to allow operation at multiple depths such that hatchery water demands can be tailored to annual variations in water availability.
- Groundwater that is extracted for incubation and early rearing can be diverted to adult holding ponds to decrease the reliance on river water.
- The two banks of raceways are designed such that water from one bank of raceways can be circulated and reused to the next bank without employing pumps.
- A “pumpback” station that redirects up to 12 cfs of water diverted to the hatchery can be pumped to a point 10 ft below the hatchery intake.

Operating the hatchery to avoid negative impacts to the instream environment requires the capability to adequately monitor flow through the diversion reach and through the hatchery. Total diversion to the hatchery will be monitored at the head box prior to distribution of surface water to adult holding ponds and raceways. The quantity of water in the head box will be compared to real time surface water data from the USGS gage (#13330000) near Lostine, Oregon in order to determine the necessity of pumpback flow required to maintain the prescribed criteria. In addition, the intake weir will be rated such that the hatchery manager can visually assess the amount of water provided to the discharge reach between the intake and outfall.

Potential diversionary effects on discharge were also reviewed. Based on the IFIM (R2 Resource Consultants 1998) and instream flow analysis (MWH 2001), it is the best biological opinion of the NEOH Core Team that these minimum flow criteria are unlikely to exacerbate the impacts to native spawning and natural rearing habitat that would occur in low water years. It should be noted that the months having the highest, and potentially most detrimental, temperatures (July and August) are also those months during which hatchery diversions constitute a small percentage of total flow. Also considered when regarding the hatchery effluent, was the use of well water for incubation and chilling. During July, August, and September, it is likely that water discharged from the hatchery would be slightly cooler on average than the surface water in the Lostine River. Additional design precautions were taken to reduce the probability that water diverted to the hatchery could be subject to a significant warming influence of earth surrounding the pipeline to and from the hatchery. The pipeline will be installed below the frost line, suggesting that it is more likely that water would be cooled during transport. Also significant is the total exposure time of water from the intake to the outfall will be approximately one hour. It is predicted that evaporative cooling during exposure will offset any minimal potential temperature increases resulting from exposure to the sun.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

All of the conventional broodstock for the Lostine River spring Chinook progam is obtained at a single specific fish collection facility located on RM 1 of the Lostine River. A perpetual easement agreement between Bonneville Power Administration and the landowner provides for site access along with operational consent and occupation of the adult collection facility. (Figure 1).

The recently decommissioned instream fish barrier consisted of a collapsible, cable operated metal bar rack spanning the full river channel. The adjacent metal framed v trap and wood paneled holding vessel measures 32' L x 8'W x 3.5'D with an approximate volume of 896 ft3. The secured and shaded holding area was designed for a maximum density of 10 adult fish per cubic foot.

A new weir and trap was constructed in 2010. To alleviate the operational difficulties of the existing cable operated bar rack weir, a new hydraulically controlled weir is to be constructed directly atop the general footprint of the existing weir. The gate will be comprised of pickets, with spacing measuring 1.25 inches to allow the safe passage of juveniles. During operations, the gate will be raised and lowered by means of hydraulic lifts braced along the apron. When not in use, the weir will lie flat atop the concrete apron. At the highest weir position, the weir crest will be located approximately 3 ft above the apron.

Once reaching the weir, upstream migrants continue along the eastern bank where flow from the vertical slot fishway will attract the fish. Upon entering the ladder, fish will ascend to the trapping structure where Chinook will be sorted for transport, or, in the case of non-target species, returned to the river. Considering the highest flows experienced at the site, this fishway would accommodate both juvenile and adult passage criteria as appropriate to meet NOAA Fisheries/ODFW passage criteria. The fishway is designed to operate on up to 25 cfs of maximum flow. During maximum flow capacity periods, the maximum height between each vertical slot will be six inches, in accordance with NOAA Fisheries juvenile passage criteria. During periods of low flow, the water level will be relatively flat from slot to slot, allowing passage through minimal slope and gradient. Water will enter the ladder via a gated opening on the river side of the trapping structure. This opening will be closed during non-operational periods. At the upstream end of the fishway, a 12 ft x 7.5 ft trapping structure will be constructed. This structure will contain a lifting platform, composed of brails that will mechanically raise fish to a working area. This work area will be used to record, measure, and sort all species that ascend the ladder. Chinook broodstock will be transferred to transport trucks, non-target fish will be returned to the river via a return pipe. The trapping structure will be monitored daily, non-target fish will be held for no longer than 24 hours before being returned to the river.

Staff that maintain the weir function and monitor the trap fish holding capacity stay on site in a travel trailer. This vigilance allows for 24 hour, 7 day a week observation of the facility. Captured adults are removed from the trap daily to prevent migration dely and minimize broodstock pre-spawn holding mortality.

In addition, an alternate adult collection site has been designed into the proposed Lostine River Hatchery. This element will only be used as a substitute collection site in the event of weir failure or project evolution discovers it necessary to collect swim-ins at the hatchery location. The 103 ft long x 6 ft wide x 6 ft deep concrete fishway structure begins on the riverbank four feet below the low water line. The fishway attraction water utilizes diverted outflow collected and upwelled from the adult holding facility. The maximum flow (approx 15 cfs) will be gradually (approx. 19 ft. total elevation) sent down the meandering channel over eleven stop-logged sections. Once the adults have traveled up the fishway, they pass through a traditional v-trap picket barrier. Ultimately, trapped fish will be contained and held until sorted in the 30ft x 8 ft x 8 ft center channel.

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

Fish are transported from the Lostine adult collection facility by NPT staff in three pickup truck mounted fish transport tanks. Two are insulated with 300 gallon capacity and the third is a 500 gallon insulated tank. All fish transport vehicles are fitted with supplemental regulated, compressed oxygen fed air stones, and 12 volt powered tank aeration pumps.

5.3) Broodstock holding and spawning facilities.

All conventional broodstock collected for the program are currently held and spawned at Lookingglass Hatchery. Following the construction of the proposed Lostine Hatchery, all broodstock collected from the Lostine River would be transported for holding to Lostine Hatchery instead of Lookingglass Hatchery. Captive broodstock for the program are reared and held at Bonneville Hatchery.

Lookingglass Hatchery

Lookingglass Hatchery consists of one hatchery building complex (11,588 ft^2). The complex includes an office, spawning room, incubation and rearing room, cold fish feed storage area, shop, laboratory, visitor center, and dormitory. The spawning room consists of an anesthetizing tank, brail, spawning table, fish health and fish research stations, and adult return tubes to the adult holding ponds. The Lostine River spring Chinook brood are held in newly reconfigured 76ft x 9.5ft x 3.5ft single pass concrete raceways.

Ripe adults are spawned and the eggs fertilized, water hardened, and transferred to the hatchery building for incubation.

Following the construction of the proposed Lostine Hatchery, all broodstock collected from the Lostine River would be transported for holding at the hatchery.

Proposed Lostine Hatchery
The broodstock holding facility will consist of six 50 ft long X 8 ft. wide X 8ft. deep ponds. Three will be used to accommodate up to 203 adults for the Lostine broodstock needs and up to 400 adults collected for outplanting during the first week of August. The additional three ponds will be utilized to hold the estimated 352 Imnaha program broodstock. The ponds will be equipped with a spray system and jump panels. Adult holding facilities meet preferred adult salmon space criteria (10 cf/fish) and will have acceptable flow criteria of one pond turnover per hour. The rectangular holding ponds and center channel will be equipped with crowders. Manual crowders will be provided for the holding ponds while a mechanically operated unit will serve the central channel. The 1,270 sq ft spawning area will be located contiguous to the adult holding ponds. It will feature of a fish lock to transport fish from the center channel up to the spawning work area. The covered spawning work space will house the necessary modern fish husbandry components: a shock tank, a live tank, a guillotine, egg mixing stations, data collection station, two carcass racks, a chest freezer, and a visitor viewing section. Also integrated into this area are return tubes to send fish back to ponds 1 and 2 or the center channel.

5.4) Incubation facilities.

Lookingglass Hatchery
Lookingglass Hatchery contains 504 incubation trays. Incubation can occur using up to 150gpm of chilled well water and/or UV treated river water. Currently, eggs are eyed on a combination of chilled river water combined with surface water or surface water tempered with warmer pathogen free well water. In 2010, Lookingglass Hatchery is testing moist air incubators for incubation to the eyed stage and utilizing hatch boxes located inside the early rearing troughs.

Proposed Lostine Hatchery
The egg incubation room will consist of 18 double stack vertical flow incubators. Each stack holds 16 trays. The Lostine program fertilized gametes will be contained in trays until their transfer to early rearing vessels. The Imnaha program eggs will be incubated until the eyed stage, at which time half of the Imnaha production will be shipped to Lookingglass Hatchery. The pathogen free ground water will supply the proposed Lostine River Hatchery incubation, and the capacity to chill or heat it will be an option. Two header pipes will feed the incubation stacks: one for heated/chilled groundwater supply and one for natural groundwater supply. Individual feed for each stack will allow differential growth management by varying the water temperature supplied. Incubation facilities meet the preferred criteria for space (one tray per female) and inflow (10 gpm pathogen free water per double stack).

A Formalin drip distribution system will provide treatment for the developing eggs. This system is designed to feed each stack individually at a typical 1:600 dilution. The bulk Formalin will be contained in a separate storage room and pumped to the distribution apparatus at each stack. Hatchery incubation process water containing Formalin treated water should be diluted 1:100 before discharge. Therefore, egg treatments when incubation is full, will occur in two separate applications.

The proposed mechanical, chemical storage, and incubation areas will be located on the east side of the incubation/early rearing building separated from the early rearing facility. In addition, a segregation wall will split the incubation room in two parts, to facilitate fish health management.

Temperature control will be provided for the pathogen-free well water used for incubation and part of early rearing. Temperature control is needed to allow hatchery managers to manipulate fish growth in order to meet the program's smolt release target size of 20 fpp in April. The groundwater temperature is expected to vary relative to the seasonal river water temperature fluctuations. Therefore, during the winter months, the capability to raise water temperatures to 42 degrees F for egg incubation and 47 degrees F for early rearing is needed. Conversely, the capacity to cool the water during late summer incubation will be necessary to reduce temperatures. An energy efficient glycol based recycle loop chiller system will be provided to meet chilled inflow temperature criteria. A diesel powered boiler featuring a glycol based hot water loop heat exchanger will provide heated pathogen free water. Diesel fuel will be stored in an outside, above ground storage tank that is shared with the engine generator.

5.5) Rearing facilities.

<u>Lookingglass Hatchery</u>

Lookingglass Hatchery outside rearing containers include 18 raceways with rearing volume of 3,000 ft^3 (10'x100'x3') each. Inside rearing containers include 30 Canadian troughs. Currently, 7 early rearing troughs and 4 outside raceways are allocated to the Lostine River program.

<u>Proposed Lostine Hatchery</u>

The early rearing facility at the Lostine River Hatchery has been designed with forty-four 18ft x 3ft x 2ft fiberglass deep troughs Working capacity will be approx. 112 ft3 to meet preferred juvenile rearing density index criteria of 0.3. Each trough will have both well and surface water supply. Fish will be transferred from incubation to these early rearing troughs post hatching when they are approximately 1100 fish per pound (fpp). The fry will be reared in these vessels until they reach approximately 180 fpp. At this size, they will be marked and transferred to the final rearing raceways. To allow for the time needed for marking, the facility can safely rear juvenile salmon in these vessels to 150 fpp.

The proposed hatchery final rearing area will consist of eight 120ft L x 10ft W x approximately 5ft. deep raceways. The units are arranged in two banks of four vessels to provide the flexibility to reuse water between the raceways. Each bank will have one outermost unit with the capability to be divided into three individual sections each with dedicated inflow headers and drains. The maximum flow per raceway will be 674 gpm.

Volitional release will be provided through the downstream bay of raceways, through a succession of pools, weirs, and an orifice to enter the final pipe to leading to the Lostine River.

Lostine spring Chinook will be reared to 20 fpp at preferred densities (density index 0.1) once transferred to the final rearing raceways. From these vessels they will be volitionally released to the adjacent Lostine River in April of each year. Imnaha Chinook will be reared at the same density index until March of each year and then transferred at 23 fpp to the Imnaha Satellite Facility for acclimation and released at 20 fpp.

5.6) Acclimation/release facilities.

The Lostine River Acclimation Facility was constructed in 1998 at approximately river mile 10 of the Lostine River (Figure 1). The facility consists of four 2,000 cubic foot raceways that are constructed of metal frames that have plywood bottoms and are lined with a dark PVC pond liner. Each raceway is 88ft L x 8 ft W x 3ft D= 2112 ft3. The water for the facility is pumped from the Lostine River via submersible pumps that are powered by diesel generators. The water supply has the ability to provide 5.8 cfs for fish culture for the facility. Each raceway also has a compressed oxygen delivery system as a backup. The raceway outflow is through four 8” pipes that discharge directly into the stream at a location between the two banks of raceways, roughly 60’ to the side of the raceways. The intake location is variable with the maximum distance between intake and outfall of about 300 feet. The outfall pipes are routed through a PIT tag detection system that time stamps all PIT tagged fish as they leave the facility. This helps in determining migration timing and in managing the raceways. The fish are allowed to exit the raceways volitionally through release portals that are placed on the end of the raceway at a depth that is approximately midway in the water column. The goal is to allow for a release location that is more natural to Chinook salmon who prefer staying within the water column versus going to the surface to find the pond outlet. The facility operations are monitored 24 hours per day, 7 per week. The NPT staff members are temporarily housed in a travel trailer located adjacent to the raceways.

Preparation of the acclimation facility prior to fish transfer includes snow removal, rearing vessel liner and screen inspection, temporary inflow system installation, confirmation of volitional release outmigration piping integrity, and testing of raceway alarm system. Annual maintenance of the grounds includes up keep of landscape irrigation system, road maintenance and noxious weed control.

Upon construction of the Lostine River Hatchery the current fish acclimation apparatus would be decommissioned. The entire existing provisional vessels, walkways, inflow manifolds, valves and outflow system would be dismantled.

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

No major operational difficulties or disasters resulting in significant fish mortality have occurred at the Lostine River acclimation facility or at the adult collection facility.

Lookingglass Hatchery has experienced several events that have caused fish culture concerns and mortality. These include:

1. Icing events at Lookingglass Hatchery intake. Scenarios that can cause ice buildup and blockage of the intake are:
   - Icing of Lookingglass Creek brought on by weather events producing zero and sub-zero temperatures.
   - Icing of Lookingglass Creek followed by heavy snow results in slush ice.
   - Icing events on Lookingglass Creek followed by quick warming result in ice sheet dams that break loose and lodge against the intake.
   - Icing event occurred in the winter of 2009 which resulted in the loss of approximately 58,699 Lostine conventional brood progeny.

2. Water quality problems resulting from upstream landslides in the Blue Mountains on Lookingglass Creek lead to increased sedimentation and turbidity that result in some juvenile mortality or contribute to fish health issues.
3. Deposition of gravel in the water supply intake can reduce flow to the hatchery used for rearing and adult holding. Low flows can result in oxygen deprivation.

In 2008, maintenance of the water intake at Lookingglass Hatchery (deepening for more water) caused the mortality of over 60 (out of around 170) Upper Grande Ronde River broodstock being held in a circular in the same building as the Lostine fish. The maintenance stopped flow into the circular and the fish used all of the oxygen before water flow could be returned. No Lostine stock adult mortality occurred during this event.

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.

<u>Lookingglass Hatchery</u>
Lookingglass Hatchery is staffed full time and equipped with various water alarm systems to help prevent catastrophic fish loss resulting from water delivery failure. The intake well (TW2) is operated for icing emergencies. There is a backup diesel motor for TW2. There are low water alarms on all raceways and circulars. Annual removal of gravel deposition near the intake and screen maintenance occurs.

<u>Lostine River Weir</u>
The Lostine River fish collection site is monitored 24 hours a day, 7days per week during operation of the weir. NPT Operational protocols predicate the trapped adult fish are typically contained in the trap for 6-8 hours.

The holding trap is placed in an area deep enough to maintain oxygen levels during minimum flows and where flow is sufficient to attract fish. Shade material covers the top of the trap and a solid panel on the upstream side of the trap provides a sufficient eddy for captured fish. Metal edges inside the trap are covered by neoprene cushions to prevent injuries to the fish. Final processing of trapped fish for run at large data collection, broodstock identification, and passing delineation occurs efficiently to minimize any effects of handling.

To insure there is no negative impacts to overall run migration, bank surveys are conducted to monitor fish behavior downstream of the barrier. In order to minimize risk during the acclimation period, the existing Lostine rearing facility is staffed 7 days per week for 24 hours per day. Personnel are stationed on site in a travel trailer adjacent to the rearing vessels.

Lostine Acclimation Facility
During acclimation, the existing Lostine acclimation facility is staffed 7 days a week, 24 hours a day. Project personnel monitor the intake screens and water flows during freezing and high flow conditions. There are low water and flow alarms that can alert the operators day or night of water flow problems in the raceways. Oxygen tanks and delivery systems are in place in all raceways to deliver oxygen if water flow cannot be restored immediately. Water inflow to all raceways cascades into the raceway so that the operators can visually confirm that there is flow into each raceway. Raceway ice cover is removed as needed. Inspection of the screens, inflows, and outflows are made every 2-4 hours by the operators during freezing or high flow conditions. The dates of acclimation may be adjusted (later in spring, or until weather breaks) so fish are not in the facilities during severe weather conditions. An emergency fish release procedure document has been developed, and all operations staff will be required to read and understand it.

Proposed Lostine Hatchery
The proposed Lostine Hatchery includes the following backup and risk aversion measures:

The hatchery will be equipped with a basic supervisory control and data aqusition (SCADA) system with a personal computer interface. The SCADA system will allow central monitoring of alarms and data output as well as recording and storage of key hatchery data measurements such as flow rate and temperature. Some limited control features will be programmed into the system. In addition, remote plug-in stations will be provided at the intake, incubation, and early rearing building for system function troubleshooting data analysis using a laptop computer at the designated remote locations. The architecture of the SCADA system will consist of the central programmable logic controller (PLC) located in the main MCC. This PLC will be connected to remote processors via an Ethernet network module. The system can be easily expanded or changed as needed. Using a network eliminates the amount of control and signal wiring that runs from one location to another. This feature greatly improves long-term reliability of the hatchery alarm system.

In addition the modern facilities will possess:

- Emergency standby power will be provided by a diesel generator
- Compressed air intake screen de-icing provision
- Pumpback system

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.

List all historical sources of broodstock for the program. Be specific (e.g., natural spawners from Bear Creek, fish returning to the Loon Creek Hatchery trap, etc.).

The Lostine program broodstock is derived from endemic natural and hatchery-origin adult returns to the Lostine River adult collection site. Previously, a captive brood program using Lostine stock collected as parr and reared to maturity at Lookingglass Hatchery was implemented to obtain adequate egg collection numbers. The progeny from this program, reared and released segregated from the conventional brood, served to supplement the total number of Lostine stock smolts released. Due to the increased escapement of natural and hatchery origin adults on the Lostine, this program has been phased out and will conclude with release of the BY 2011 progeny.

The adult collection goal for conventional broodstock is currently 142 fish comprised of 43 wild and 99 hatchery origin collected at the Lostine River weir. Broodstock collection rates are based on the adult escapement sliding scale (Table 5).). The program incorporates age-three males or jacks in the broodstock to fertilize a maximum of 10% of the eggs. A maximum of six jacks milt can be pooled to fertilize one cell of eggs. An egg cell is typically one-half or one-third of one female's eggs. The spawning sex ratio is 1:1. Actual number of males and females spawned for conventional broodstock are reported in Table 19.

6.2) Supporting information.

6.2.1) History.

Artificial production of spring Chinook in the Grande Ronde River began in 1901 when a weir was constructed across the mouth of the Wenaha River and the Grande Ronde River upstream of the confluence with the Wenaha River (Neeley et al. 1994). In 1903, the hatchery program moved to the Wallowa River about 1.5 miles below the confluence of the Minam River where it operated until 1913 (Neeley et al. 1994). In 1904, the Wallowa River Hatchery Dam was built just above the hatchery. The dam was partially destroyed in 1913 with the closing of the hatchery but remained a partial barrier to passage until it was completely destroyed in 1924 (Neeley et al. 1994). Based on the hatchery operation descriptions and a photograph of Wallowa River Hatchery Dam, Neeley et al. (1994) believe that all salmon (Chinook, coho, and sockeye) were blocked from reaching their spawning grounds in the Wallowa and its tributaries above the dam from at least 1904 through 1912. Therefore, all original salmon populations of the Wallowa and its tributaries above the dam were extirpated during this period.

In 1980, the first release of spring Chinook under the Lower Snake River Compensation Plan (LSRCP) were made into the Grande Ronde River. For the LSRCP, Oregon's mitigation goal to areas above Lower Granite Dam includes 5,820 spring chinook from the Grande Ronde system (ODFW et al. 1990). The LSRCP assumed a smolt-to-adult survival of 0.65 percent for the Grande Ronde and therefore production of 900,000 smolts (the original Design Memorandum lists 898,000 smolts) was estimated to be sufficient to meet the adult return goal.

Rapid River stock was originally chosen for broodstock development in the Grande Ronde River. The smolt releases that began in 1980 were from Rapid River Hatchery (Idaho) and were released into Lookingglass Creek. Use of Rapid River stock was discontinued from 1981-1984 however, due to disease concerns and lack of egg availability. Carson stock (from the mid-Columbia River) was adopted as an interim broodstock source and releases were made into Lookingglass and Catherine creeks, and in later years into the upper Grande Ronde River and Deer Creek. The last year of Carson juvenile releases was 1991 (1989 brood-year) into Lookingglass Creek (Neeley et al. 1994).

Outplants of spring Chinook in the Wallowa River included adults from 1987 to 1990 and smolts in 1990 (1988 brood-year) (Table 18). No releases were made directly into the Lostine River.

Table 18. Hatchery releases of spring Chinook into the Wallowa River by stock, brood year and lifestage. (Neeley et al. 1994)

Stock	Brood Year	Life Stage	Number Released
Lookingglass (Rapid River/Carson)	1987	Adult	394
Lookingglass (Rapid River/Carson)	1988	Adult	568
Lookingglass (Rapid River/Carson)	1989	Adult	88
Lookingglass (Rapid River/Carson)	1990	Adult	75
Rapid River	1988	Smolt	26,445

An Independent Scientific Panel (Currens et al. 1996) of geneticists reviewed and analyzed genetic data collected from Grande Ronde Subbasin spring Chinook salmon in 1996. Based on this analysis, the Panel determined that despite hatchery releases in the subbasin of non-native stock (Rapid River and Carson stock), a substantial component of the native spring chinook populations still existed. The Panel also found that the Lostine population was the most distinctive of the naturally-spawning populations in the Grande Ronde (Currens et al. 1996).

In 1995, co-managers made a decision to use native stock and shift the focus of the program from mitigation to conservation. This decision was a result of a number of factors including: increased emphasis on natural production and native stock recovery; consultations and requirements resulting from listing of Grande Ronde chinook populations as endangered; a lack of success in using non-local stocks for supplementing Grande Ronde chinook populations; preferred strategies for use of artificial propagation identified in the NMFS draft recovery plan; and recommendations of an Independent Scientific Panel (Currens et al. 1996), which was convened under the *U.S. v. Oregon* dispute resolution process. The program implemented is one of the first developed using an integrated, dual component approach (captive and conventional broodstock) to prevent extinction of anadromous salmonid species in the Columbia River Basin. This program is known as the Grande Ronde Endemic Spring Chinook Salmon Supplementation Program.

The captive broodstock program was initiated in 1995 with 1994 broodyear juveniles collected from the Lostine River. Progeny from the captive broodstock have returned annually starting in 2000.

The conventional program began in 1997. The first releases from our acclimation facilities occurred in 1999. The first returns of these fish were as jacks in 2000. In 2001, the first 4- year-old hatchery fish returned to the Lostine River and were allowed above the weir to spawn naturally. In 2002, the first conventional 5 year olds returned. Hatchery supplementation adults from all year classes have returned every year since these initial return years.

Table 19**.** Lostine River spring/summer Chinook salmon hatchery **conventional** broodstock spawning data 1997- 2009.

Brood Year	Hatchery Males Spawned	Hatchery Females Spawned	Natural Males Spawned	Natural Females Spawned	% Natural	Spawning Ratio F/M	Average Fecundity	Egg Take (1,000's)	Fry Ponded (1,000's)	Smolts releases (1,000's)
1997	0	0	7	4	100	0.6:1	4,385	18	12	12
1998	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0
2000	0	0	8	8	100	1:1	4,863	39	36	31
2001	5	9	30	27	80.3	1:1	4,341	156	114	101
2002	2	3	26	25	91.1	1:1	4,766	133	121	116
2003	0	0	19	21	100	1.1:1	5,077	107	103	103
2004	30	30	22	22	42.3	1:1	4,267	223	211	200
2005	31	39	17	17	32.7	1.17:1	4,182	234	207	205
2006	33	42	14	15	27.9	1.21:1	4,162	240	206	206
2007	33	40	19	20	34.8	1.15:1	4,456	267	234	195
2008	36	36	20	20	35.7	1:1	4,783	268	247	190*
2009	40	31	17	26	37.7	1:1	4,612	262	245	180*

*Estimated populations of forthcoming 2010 and 2011 releases

Table 20**.** Lostine River spring/summer Chinook salmon hatchery **captive** broodstock spawning data 1997- 2009.

Brood Year	Males Spawned	Females Spawned	Spawning Ratio F/M	Average Fecundity	Egg Take	Fry Ponded	Smolts releases
1997	0	0	NA	NA	0	0	0
1998	89	47	0.53:1	1,387	65,203	39,878	35,031
1999	181	140	0.77:1	1,741	243,699	150,176	133,883
2000	222	92	0.41:1	1,833	168,659	84,152	77,551
2001	197	131	0.66:1	2,035	266,616	177,514	129,598
2002	175	144	0.82:1	2,319	264,408	181,259	133,729
2003	127	130	1.02:1	1,508	196,043	107,997	62,149
2004	156	56	0.36:1	1,494	83,656	48,894	40,982
2005	132	41	0.31:1	1,216	54,490	28,871	24,604
2006	147	63	0.43:1	1,169	73,674	13,463	10,470
2007	119	130	1.09:1	1,654	215,066	97,591	53,688
2008	99	83	0.84:1	1,545	128,249	-	62,604

6.2.2) Annual size.

The annual size of the Lostine broodstock collection has been determined to facilitate a release of 250,000 smolts. Factors that contribute to the final adult collection goal include; prespawn mortality, fecundity averages, and juvenile rearing survival rates. Yearly, collection goals are established through development of an annual operations plan which employs a predetermined sliding scale (Table 5). The current 2010 calculation results in a target of 142 fish collected including 67 females spawned.

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

The Lostine River supplementation program was initiated using natural origin broodstock. An abundance based sliding scale was developed (Table 5) to manage broodstock collection and release of fish to spawn naturally. See Table 19 for levels of natural origin fish incorporated into the hatchery broodstock.

6.2.4) Genetic or ecological differences.

As described above, an Independent Scientific Panel (Currens et al. 1996) of geneticists reviewed and analyzed genetic data collected from Grande Ronde Subbasin spring Chinook salmon in 1996. Based on this analysis, the Panel determined that despite hatchery releases in the subbasin of non-native stock (Rapid River and Carson stock), a substantial component of the native spring Chinook populations still existed. The Panel also found that the Lostine population was the most distinctive of the naturally-spawning populations in the Grande Ronde (Currens et al. 1996).

The hatchery program was developed from naturally produced Lostine River stock. Tissue samples have been collected and analyzed**.** The analysis of genetic samples were subcontracted to CRITFC and reported as Appendix D in Cleary 2007. Analysis of the population structure indicated that the Lostine River may have experienced a genetic bottleneck at one point in time (perhaps in 1995 when only 11 redds were observed) and is genetically distinct from other populations of Chinook salmon in the Grande Ronde Subbasin (Narum et al. 2007). Broodstock annually incorporates locally adapted naturally produced fish that should minimize differences. We attempt to collect broodstock from a random cross section of the entire return.

6.2.5) Reasons for choosing.

See Section 6.1 and 6.2 above.

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.

Adverse genetic and ecological effects are minimized by the implementation, monitoring, and in season adjustment of the coordinated instream fish barrier pass/keep system.

Broodstock collection is implemented by utilizing an average migration timing schedule that supports run at large representation and run timing diversity.

See also Section 7.2 and Section 8.1.

SECTION 7. BROODSTOCK COLLECTION

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

The life-history stage of the fish collected for the Lostine River program are spring Chinook adults age 3 to 5 years. Actual spawning contribution of 3 year olds will be less than 10 % of program total green egg take.

7.2) Collection or sampling design.

All adults processed at the Lostine River collection facility are sampled for their individual information. The data obtained from each fish consists of; date trapped, gender, mark type(s), PIT tag occurence, and fork length. Once processed, fish that were selected randomly for broodstock are given antibiotic injections and transported by truck to Lookinglass Hatchery. The adults collected for broodstock are typically retained over a 14 week period. The quantity and origin of the fish collected weekly is based on a predetermined collection goal. The weekly goals represent a percentage of average migration timing and are designed to incorporate a ratio of natural and hatchery origin fish into the brood. The origins are determined using the sliding scale developed by NPT and ODFW with consultation from NOAA Fisheries. The sliding scale management tool (Table 5) has an underlying premise, that at low population levels the greatest risk to persistence is demographic risk of extinction. In the sliding scale, then, fewer constraints are placed on the number of hatchery fish spawning naturally and the number of naturally produced fish spawned in the hatchery when population levels are low. Thus, fish benefit from the survival advantage provided by the hatchery. As population levels increase, demographic risks are of less concern and greater constraints are placed on the hatchery program to control genetic risks associated with hatchery rearing.

In 2007, the adult return projection was greater than 500 and therefore, up to 20% of the natural origin fish could be retained for hatchery broodstock, 50% of the fish released above the weir to spawn naturally could be of hatchery origin and 30% of the hatchery broodstock could be natural fish. It was determined that hatchery jacks would be over represented in the spawning population. To manage for this it was determined that some (93 total) hatchery jacks would be for tribal consumption and some (15 total) hatchery jacks would be outplanted to underseeded areas of the Wallowa River.

Table 21. Lostine River weir/trap operation, spring/summer Chinook salmon collected and spawning dates from 1997-2009. No broodstock was collected in 1998 and 1999.

Run	Operation of Lostine weir		Collection at Lostine Weir		Spawning at Lookingglass Hatchery	
Year	Beginning	Ending	Beginning	Ending	Beginning	Ending
1997	7/18	9/30	7/18	9/22		
1998	6/18	9/30	6/19	9/21	NA	NA
1999	4/19	9/30	7/19	8/27	NA	NA
2000	5/5	9/30	6/22	9/20	9-Aug	13-Sep
2001	4/24	9/30	6/1	9/18	14-Aug	18-Sep
2002	4/24	9/30	6/7	9/16	21-Aug	11-Sep
2003	4/30	9/30	5/16	9/21	12-Aug	16-Sep
2004	5/10	9/30	5/19	9/12	17-Aug	14-Sep
2005	5/9	9/30	6/5	9/16	16-Aug	13-Sep
2006	5/16	9/30	6/14	9/27	22-Aug	15-Sep
2007	5/15	9/28	6/2	9/25	14-Aug	13-Sep
2008	5/22	9/26	6/6	9/19	13-Aug	12-Sep
2009	6/9	9/22	6/11	9/17		

7.3) Identity

The identity of Lostine River natural origin brood is determined by the lack of any fin clips, coded wire tags, implanted visual tags, or PIT tags. Conventional hatchery origin adults are determined by the presence of a fin clip and coded wire tag. Additionally, those returning adults resulting from the captive broodstock hatchery program are further distinguished with a visual elastomer eye tag. PIT tags are also present and identifiable in a segment of each hatchery brood type.

7.4) Proposed number to be collected:

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

The Lostine River spring Chinook program collection adult goal represents 71 pairs with a target 67 females spawned to achieve sufficient egg take quantities for the release of 250,000 yearling smolts annually. Currently, the collection protocol specifies a 30% natural origin component of the 142 fish total. The natural to hatchery collection ratio target can change annually relative to the sliding scale provisons.

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

Table 22. Broodstock collection from the Lostine River weir, number of males, females, and jacks spawned, number of eggs taken, and number of juveniles produced.

Year	Adults Females	Males	Jacks	Eggs	Juveniles
1997	5	2	0	17,540	11,738
1998	1	1	0	0	0
1999	1	1	0	0	0
2000	8	12	12	38,900	31,464
2001	42	35	1	156,260	100,916
2002	32	25	1	133,447	116,471
2003	26	17	6	106,609	102,655
2004	52	52	3	221,889	199,586
2005	50	52	2	234,218	205,406
2006	72	62	3	241,372	194,745
2007	66	51	5	267,350	185,765
2008	59	57	2	252,000	184,000*

*Estimated population of forthcoming 2010 release.

Insufficient broodstock were collected in 1998 and 1999 for the conventional program so the fish collected were returned back to the environment to spawn naturally.

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

As part of the supplementation programs that were developed under the Grande Ronde Endemic Spring Chinook Supplementation Program co-managers anticipated that there would be hatchery-origin fish returning to the target supplementation streams that would be “surplus” to broodstock needs or escapement targets upstream of weirs. Outplanting “surplus” hatchery adult salmon to vacant and underseeded habitat is an agreed upon management action between the co-managers of northeast Oregon.

The Interior Columbia Technical Recovery Team (ICTRT) determined that spring Chinook salmon from Bear Creek, Wallowa River, Lostine River and Hurricane Creek all comprise a single population (ICTRT 2005).

In 2002, NPT, ODFW and CTUIR formalized the Grande Ronde Spring Chinook Management Plan that included agreed upon outlet sites for outplanting adult Lostine River spring Chinook salmon that included Bear Creek, the Wallowa River and Hurricane Creek (Zimmerman et al 2002). Agreed upon outlet sites and numbers have been documented in Annual Operating Plans since then. In recent years outplanting of Lostine spring Chinook have occurred almost every season in Wallowa River and it’s tributaries.

The Wallowa portion of the Wallowa/Lostine population, like all other Chinook salmon populations in the Grande Ronde subbasin, experienced significant declines in recent decades (Figure 24). The highest number of index redds occurred in 1956 when 40 were counted (Thompson and Haas 1960). In the past decade multiple years in succession have occurred when no redds were counted during the index surveys. The NPT DFRM started to outplant Lostine hatchery adults into the upper Wallowa River in 2004. A modest increase in total redd counts was documented in recent years. However, the dramatic increase in redd counts witnessed in the Lostine River have not been realized in the Wallowa River portion of the Wallowa/Lostine population.

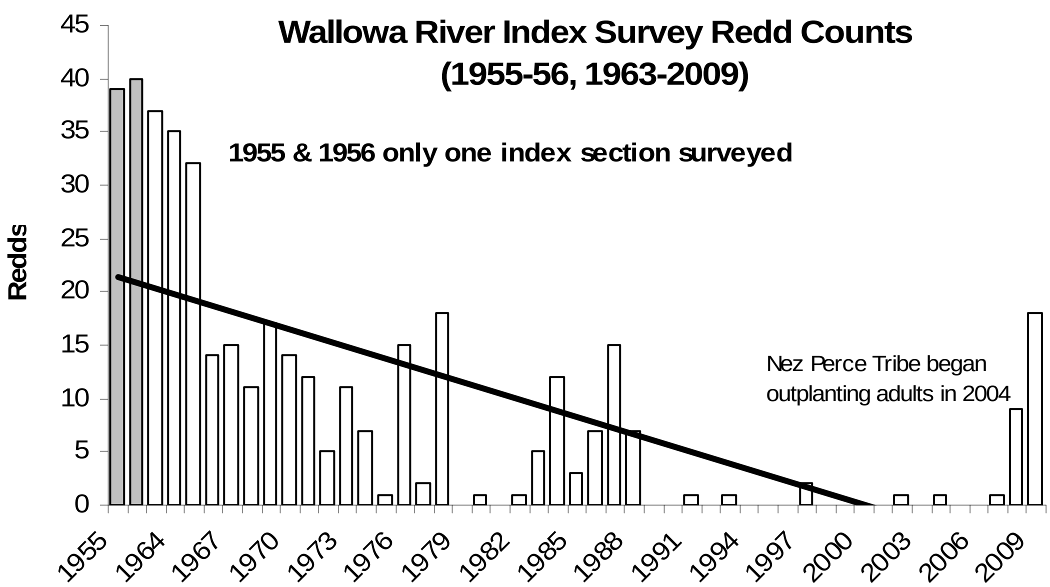

Figure 24. Trend in Wallowa River Chinook salmon redd counts during index surveys.

As described above, surplus Lostine River spring Chinook have been outplanted in Bear Creek, beginning in 2002. Only small numbers of adults were outplanted the first few years and very few redds or wild carcasses were evident during surveys in those years. Outplant numbers increased significantly in 2004 and 2005 (100+). Redds and hatchery carcasses correspondingly increased. Outplants dropped to 3 or less in 2006 & 2007 and redds and carcasses also dropped to near zero, meaning very little to no contribution from wild fish. In 2009 a dramatic increase in redds and “wild” carcasses was recorded in Bear Creek. DNA parentage analysis performed by the NOAA genetics lab in Seattle confirmed that natural adult spawners were offspring from hatchery parents outplanted in 2004 & 2005 (Figure 25).

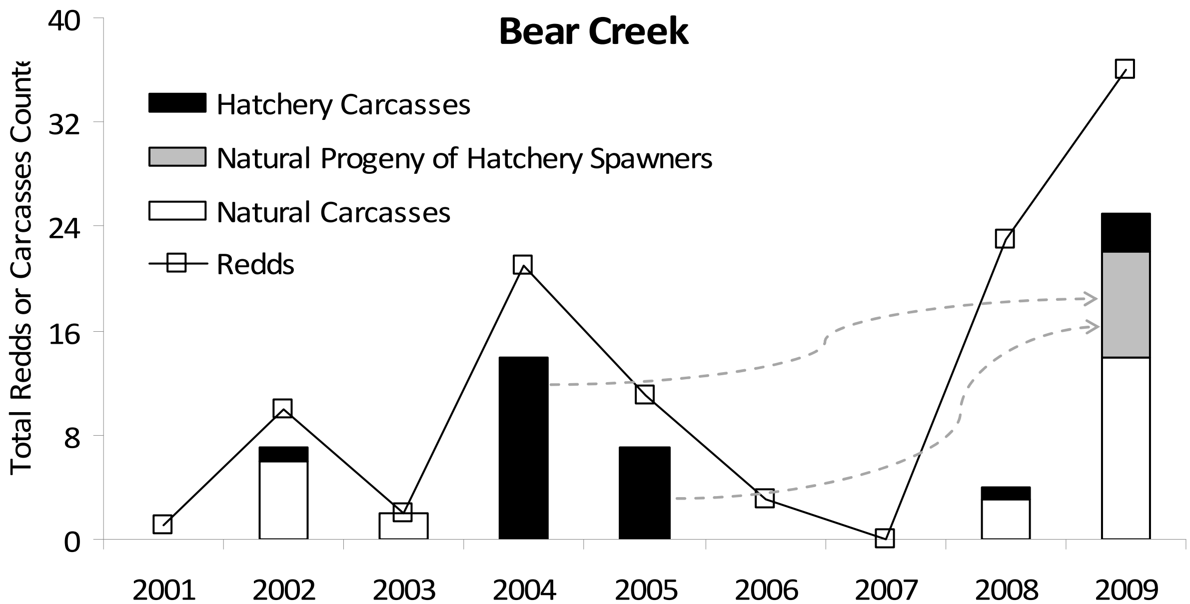

Figure 25. Bear Creek response to outplanting as seen in redd numbers and adults from naturally spawning hatchery fish.

Beginning in 2010, the Nez Perce Tribe has identified sections of the Wallowa River that have recently undergone extensive habitat restoration (channel meander reconstruction) and are essentially vacant of spring Chinook redds which will be identified for priority outplant locations.

These priority outplant locations are identified as the Wallowa River McDaniel Habitat Restoration Project (OWEB Project # 205-095) which was completed in 2005 and the Wallowa River Six Ranch project which was essentially completed in 2009. The stated goals for the projects were to increase available habitat area and habitat complexity for fish. Specific objectives were to “enhance instream habitat for spring Chinook salmon”, increase spawning and rearing habitat for listed fish” including spring Chinook salmon and to “restore use of stream channel segments by anadromous fish”. Over a mile of stream channel on the Wallowa River was restored (see attached maps). Financial support for these efforts came from a variety of sources including the local landowners and totaled well over a $1,000,000.

The Hatchery Scientific Review Group (HSRG; 2009) recommendation for the Lostine/Wallowa spring Chinook population regarding outplanting was that, “outplanting excess hatchery fish should be restricted to vacant or newly-opened habitat”. Based on the graph in Figure 1 habitat in the Wallowa River has been essentially "vacant" for the past 20 years and given the intensive habitat improvement described in Section D above the Wallowa River has a substantial amount of "newly-opened habitat".

These outplant locations are consistent with the ICTRT determination that the Wallowa River down to Parsnip Creek, which includes the reaches of the Wallowa recently rehabilitated, was the major spawning area for this population. <u>Although not currently used for spawning, the rehabbed areas have "*high intrinsic spawning potential*" (ICTRT 2006)</u>. Figure 26 illustrates the major and minor spawning areas of the Wallowa/Lostine population according to the ICTRT.

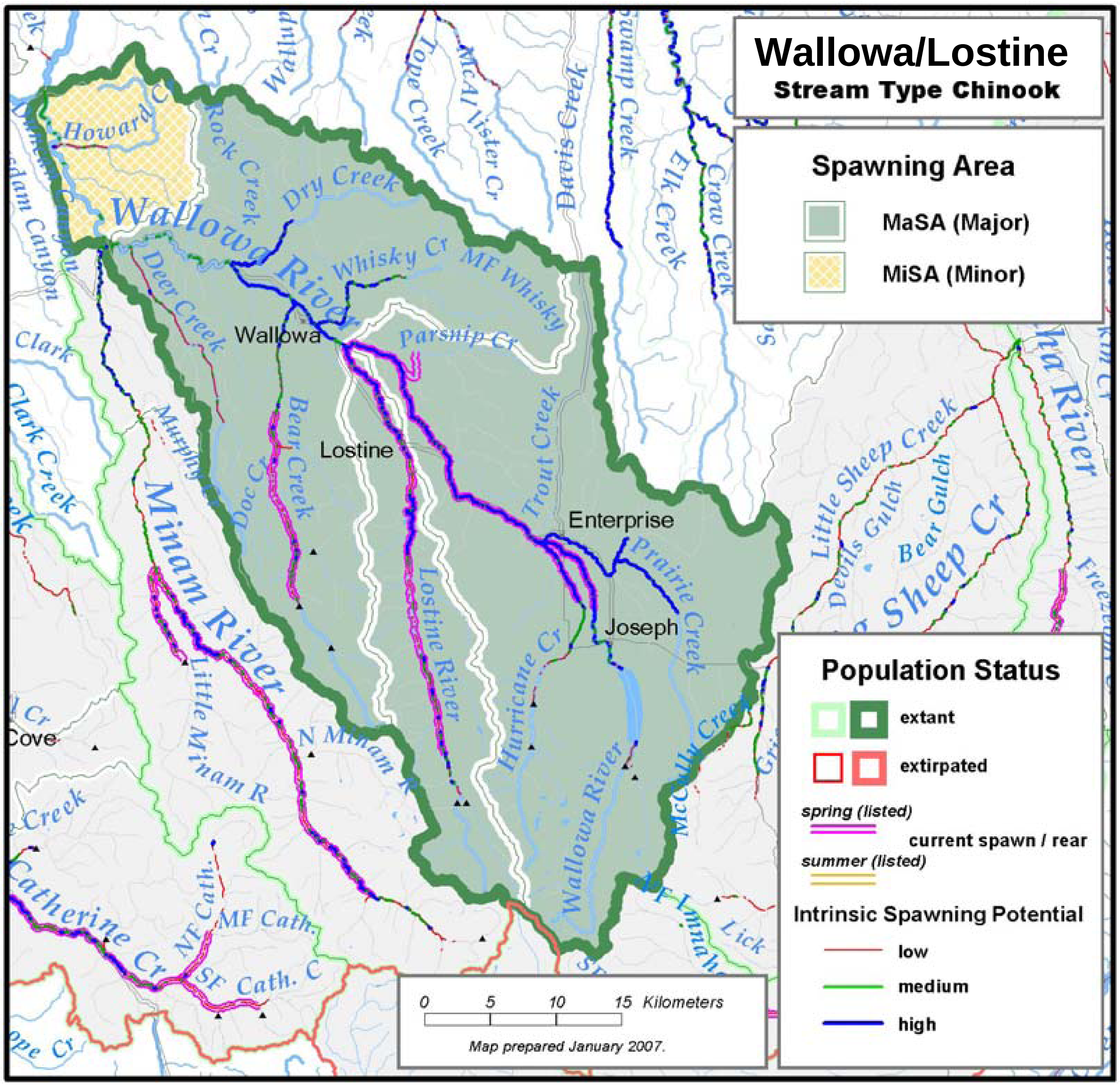

Figure 26. Wallowa/Lostine spring Chinook population boundary and major and minor spawning areas including "high intrinsic spawning potential" areas (ICTRT 2006).

7.6) Fish transportation and holding methods.

Transportation

Fish transportation is accomplished using three pick-up truck mounted tanks specifically designed for accommodating adult Salmon transport. The operation utilizes one 500 gallon capacity unit featuring two separate 250 gallon compartments. In addition, two 300 gallon tanks are employed to safely transport broodstock as well as outplant surplus adults. Typical transport time for broodstock being transferred to Lookingglass hatchery is 60 to 90 minutes.. All of the units have supplemental air stone oxygen systems and aeration pumps. The tanks are filled with water from the Lostine River. Poly-Aqua is added at a level of 5 ml per 38 L (.2 oz per 10 gallons) of water to reduce transport stress.

Holding Methods

Lostine River Weir
The recently decommissioned Lostine weir structure utilized a holding area measuring 256 ft2. To minimize fish detention and migration delay, the trapped adults were processed each day.

The new trap holding structure will feature a holding area measuring 313 ft^2. Total volume is variable based on depth. Water depth in holding structure is dependent on stream flow available for diversion. This structure is designed for a maximum holding capacity of approximately 94 Chinook adults. The practice of processing the trapped adults daily to avoid migration delay and minimize fish health risks from overcrowding in the holding structure will continue with the new Lostine River collection facility.

Lookingglass Hatchery
After transfer from the Lostine collection site, Lostine brood are held until spawning in a 2,527 ft^3 concrete raceway. Using the established density parameter of 1 adult per 8 cubic feet, maximum capacity would be 316 adults.

Proposed Lostine Hatchery
After transfer from the Lostine collection site brood would be held in a 3,200 ft^3 concrete holding pond until spawning. Maximum Chinook adult holding capacity for the proposed Lostine hatchery is 400.

7.7) Describe fish health maintenance and sanitation procedures applied.

Fish that will be retained for broodstock are anesthesized with MS 222, and then processed for data. At this time, they are injected with Oxytetracycline (10 mg/kg) to control Furunculosis and Erythromycin (20mg/kg) as a prophylactic for BKD. Any fish processed for means other than brood collection are handled without anesthesia to avoid the mandatory holding period.

In fish holding ponds at Lookingglass Hatchery, formalin is dripped into the inflowing water to achieve a maximum concentration of 167ppm. The treatment is applied for one hour to control fungus and parasites three times per week. The frequency of treatment is adjusted as necessary from mid-August through the end of spawning. Prespawn adult mortalities may be examined for BKD, IHN, and Whirling Disease.

The broodstock holding fish health maintenance and sanitation procedural protocols applied at Lookingglass Hatchery will be the template for the proposed Lostine River Hatchery. Adult treatment parameters may be altered slightly to accommodate any site specific differences. Alterations may include actual time period or frequency of drip treatment, time of year applied, and desired concentration.

7.8) Disposition of carcasses.

Prespawn "passed" carcass recoveries from the upstream side of the Lostine River fish barrier are frozen and delivered to ODFW Fish Health for examination. Any holding, handling, or barrier mortalities are processed for data then returned to stream below the barrier to facilitate nutrient enhancement.

The Lostine River stock carcasses at the Lookingglass Hatchery are disposed on site.

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.

Adverse genetic or ecological effects to natural fish resulting from collections at the Lostine River weir are minimized several ways:

- The fish holding facility is monitored 24/7 during operation to minimize risk of trapping mortality due to overcrowding.
- Continuous facility monitoring provides vigilance for the barrier's functional integrity during operation. Prevention of destruction during harsh weather events.
- Facility monitoring provides security for the contained adults.
- Detained adults are processed daily to minimize migration delay.
- Sliding scale protocol is used to screen the origin of fish placed above the barrier. Ratio of hatchery to natural spawning contribution is monitored.
- Weekly brood collection goals contain a percentage of each origin and account for fish retention that represents the overall migration population.
- All progeny released as a result of these collections are 100% marked or tagged
- All brood collected are given antibiotic injections to reduce the possibility of unwanted disease proliferation.

SECTION 8. MATING

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

8.1) Selection method.

Broodstock for the Lostine program is to be collected over the spectrum of the run and across age classes. In order to prevent biasing one age class or portion of the run, it is necessary to set an adult take level that will meet both broodstock and natural spawning needs. This is done using an adult escapement estimate to set the percentage of fish to be retained as broodstock. The Lostine project utilizes a sliding scale (Table 5) approach to determine the rate at which to select broodstock for the supplementation program.

In addition to the sliding scale, the Lostine program has developed a run timing curve (Figure 12) for all years of adult trapping (1998 – 2009). Based on this information, the Lostine program can look at the predicted adult return level and calculate how many broodstock to collect in a given week.

Spawning procedures occur at Lookingglass Hatchery beginning in August annually. Adults are sorted weekly and checked for maturity. Due to the collection protocol's representation of average migration timing, selection of the females spawned is based solely on maturity and yields a contribution from natural origin brood in each weekly egg take.

8.2) Males.

Spawned males are selected from the holding area randomly, however, mark type is accounted for to sort effectively and produce hatchery by natural crosses whenever possible. Jacks are spawned with a total contribution of < 10% of the total program egg take.

8.3) Fertilization.

Fertilization methods are designed to maximize natural origin contribution. The individual donations of eggs and milt are selected randomly for mixing; however, the parental origin is noted to confirm combination of a natural origin parent in the mating process. A matrix procedure at fertilization splits each male's contribution over two females. The 2x2 matrix maximizes diversity and utilizes the all of the available natural origin gametes to the fullest extent. In cases of a lack of mature fish on a given spawning day, a 1x1 ratio is used as a default measure.

8.4) Cryopreserved gametes.

Cryopreserved gametes have not been used the Lostine River program and there are no plans to implement their use. Samples have been obtained and are held at the University of Idaho and Washington State University. These samples exist only to serve as a fail-safe support mechanism for the program.

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

Mating risk aversion measures for the Lostine program take form in the execution of the spawning matrix process. The factorial matrix function maximizes diversity and utilizes the all of the available natural origin gametes to the fullest extent. The mating protocol ensures individual contributions are reproduced randomly. In addition, the method promotes propagation of the variety of natural traits presented and limits hatchery origin contribution.

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.

Currently, the Lostine River program spawns 67 females annually with average fecundity of 4,448 eggs per female to obtain a total annual estimated green egg take of 298,016 eggs. Egg to smolt survival avarages approximately 84.3%, typically yielding smolt production near the goal of 250,000 smolts. Green egg counts were low during the first few years of this program due to a lack of adults returning to the Lostine River (Table 23).

Table 23. Egg take and egg loss data for Lostine River spring/summer chinook conventional program at Lookingglass Hatchery, 1997-2008 brood years.

Spawn Year	Total Egg Take	Egg Loss Total	Egg Loss Percent	Percent Survival to Eyed Stage
1997	17,540	5,460	31.13	68.87
1998	0	0	0	0
1999	0	0	0	0
2000	38,900	3,000	7.71	92.29
2001	156,260	42,267	27.05	72.95
2002	133,447	11,984	8.98	91.02
2003	106,609	4,798	4.50	95.50
2004	221,889	11,228	5.06	94.94
2005	234,218	26,927	11.50	88.50
2006	241,372	35,063	14.53	85.47
2007	267,350	35,468	13.27	86.73
2008	267,834	20,560	7.70	92.30

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

Surplus eggs may be generated (~ 10% above need) to provide a buffer against culling associated with the presence of bacterial kidney disease. If there is an excess to the production needs then outlets have been agreed to with ODFW for outplanting fish when the rearing facilities can no longer raise them.

During the past 12 years there have been four releases of spring/summer Chinook salmon representing surplus fish from the captive brood and conventional programs (Table 24). Releases of unfed fry happened in for brood years 2007 and 2009 and were too small to mark and were released in to Bear Creek and into Hayes Fork Creek both tributaries to the Wallowa River. Releases of parr were in brood years 2007 and 2008 and since they were large enough to mark were released into the Lostine River.

Table 24. Releases of Lostine River fish that were in excess to production needs for both captive and conventional programs for years of the program (1997-2010).

Brood Year	Lifestage	Release Site	Total Released
2007	Fry	Bear Creek & Hayes Fork Creek	18,328
2007	Parr	Lostine River	68,124
2008	Parr	Lostine River	68,820
2009	Fry	Bear Creek & Hayes Fork Creek	1,200

9.1.3) Loading densities applied during incubation.

Lookingglass Hatchery

The Lostine River program incubation tray loading density at Lookingglass Hatchery represents one female per Heath style vertical flow through stack tray. Based on the current average fecundity, the eggs per tray loading is approximately 4,448.The individual trays will then be combined to a density of 5000 eggs per tray after disease certification, shocking, and picking.

Proposed Lostine Hatchery

Incubation tray loading density at the proposed Lostine River Hatchery will represent one female per Heath style vertical flow stack tray. Based on the current average fecundity, eggs per tray loading will be approximately 4,448. The loadings will remain at one female per tray throughout the incubation cycle. In the event that space or water availability becomes an issue, the trays will be combined to a density of 5,500 eggs per tray.

9.1.4) Incubation conditions.

Lookingglass Hatchery

Lostine River Chinook egg incubation at the Lookingglass Hatchery utilizes UV treated surface water mixed with chilled well water. As well as reducing pathogens, the UV system features a drum filter that greatly reduces silting in the egg trays. Inflow to the incubation stacks is regulated is set at 4.5 to 6 gpm. Prescribed formalin treatments are used to control fungus as the eggs develop and reduce unnecessary loss.

Proposed Lostine Hatchery

Heath stack trays will be used to incubate eggs at the proposed Lostine River hatchery. Pathogen free 42 degree F, well water will provide 3.5 to 4.5 gpm of inflow to each stack.

The incubation system will also feature a UV treatment system allowing surface water to be used as a contingent water source for the incubating eggs. During development, the eggs will receive Formalin treatments to reduce fungus and control unnecessary egg loss. Controlling and reducing egg loss increases the likelihood that predicted program release goals will be attained.

9.1.5) Ponding.

Ponding of the Lostine program typically occurs in late January or early February each year. Proven fish culture methods are used to insure fish survival upon transfer from the trays to the indoor rearing tanks. Temperature units are recorded throughout development. These records assist in cueing the timing of visual inspection of the fry prior to ponding.

9.1.6) Fish health maintenance and monitoring.

Throughout the incubation process, egg loss due to fungus is controlled with Formalin drip treatments. Typically, a concentration of 1,667 ppm is applied for 15 minutes, 3 times per week. The application may be increased to daily treatments if necessary. Shocking non viable eggs and picking the loss also prevents the incubation environment from be degraded.

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.

Incubation risk aversion measures include the use of pathogen free well water inflow and UV treated surface water. Additionally, after fertilization a green egg disinfection protocol using buffered Iodine solution is utilized to reduce disease transferrence risks and increase progeny survival rates.

9.2) <u>Rearing</u>:

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

Lostine River supplementation through this program began in 1997. Table 25 below illustrates historic program performance rates. Current rearing survival rates can be broken down in stages as; fry to fingerling 91 % and marked fingerling to smolt 93%. Post marking survival is excellent at 91%.

Table 25. Lostine River spring Chinook egg and juvenile survival information.

Brood Year [1]	Number of Eyed Eggs	Number of Fry Ponded to Vats (% survival from eye)	Number of Parr Transferred From Raceways (% survival from eye) [2]	Number of Juvenile Chinook Released	% Eyed Egg To Release Survival[3]	Release Year
1997	12,080	11,891 (98.44%)	11,891 (98.44%)	11,871	98.27	1999
1998	0	0	0	0	0	0
1999	0	0	0	0	0	0
2000	35,900	33,426 (93.11%	33,318 (92.81%)	31,464	87.64	2002
2001	113,993	94,191 (82.63%	94,109 (82.56%)	100,916	88.53	2003
2002	121,463	117,223 (96.51%)	119,604 (98.47%)	116,471	95.89	2004
2003	101,811	100,385 (98.60%)	100,301 (98.52%)	102,655	100.83	2005
2004	210,661	206,249 (97.91%)	205,802 (97.69%)	199,586	94.74	2006
2005	207,291	206,921 (99.82%	205,600 (99.18%)	205,406	99.09	2007
2006	206,309	201,730 (97.78%)	199,927 (96.91%)	194,745	94.39	2008
2007	231,882	230,168 (99.26%)	229,439 (98.95%)	185,765	80.11	2009
2008	247,274	243,490 (98.47%)	242,286 (97.98%)	184,000	74.41	2010
2009	245,394	181,013 (73.76%)	178,422 (72.71%)	180,000	73.35	2011

1 – No broodstock was collected in 1998 and 1999.
2 – Fingerling numbers may increase from fry ponded numbers because of inventory adjustments made after marking inventory.
3 – Percent eyed egg to release survival may be greater than 100% because of inventory adjustments made after marking inventory
4 – 2010 and 2011 release populations are projected.

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

Proposed Lostine Hatchery

The proposed Lostine River hatchery density and loading criteria was developed through co-manager contribution and agreement during the Northeast Oregon Hatchery design process. The collaborative process resulted in the following template of acceptable rearing goals at release for the Lostine stock and the Imnaha stock juveniles reared in the hatchery's eight raceways.

The prescribed goals are as follows:

- Population at release of each 6,000 ft3 vessel at release would be 62,500 fish @ 20 fpp.
- Density of 0.52 lb/ft3
- Density Index of 0.10
- Sufficient inflow to sustain 4 lbs/gpm
- Flow index of 0.74
- The Imnaha stock rearing plan would result in slightly lower density and flow indices as they would be transferred to final acclimation in early March at 22 to 25 fpp.

The existing Lostine acclimation facility currently operates with similar statistics:
- Population at release of each 2,112 ft3 vessel is 31,250 fish @ 20 fpp.
- Density of 0.73 lb/ft3
- Density Index of 0.13
- Inflow sufficient to maintain 4.0 lbs/gpm
- Flow index of0.67

Lookingglass Rearing levels of Lostine stock:
- Population at transfer of each 3,500 ft3 vessel is 62,500 fish @ 20 fpp
- Density of 0.89 lb/ft3
- Density Index of 0.15
- Sufficient flow to maintain 5.2 lbs/gpm
- Flow index of 0.90

9.2.3) Fish rearing conditions

Lostine Acclimation Facility
Fish rearing conditions at the existing Lostine acclimation facility could be best described as supplementary. They allow only for very short term rearing with managed risk. The existing vessels and plumbing apparatus are suitable only due to constant monitoring by on site personnel. The costly and transitory river water pump system requires interminable monitoring to insure functionality. It does, however, provide adequate inflow to sustain oxygen levels in the raceways. Water temperatures range from 34 to 38 degrees F and turbidity is low during the acclimation period.

Proposed Lostine Hatchery
The early rearing facility at the proposed Lostine River Hatchery has been designed with forty- four fiberglass deep troughs Working capacity will be approximately 112 ft3 to meet preferred juvenile rearing density index criteria of 0.3 to 0.76. Start tank rearing at the proposed Lostine River hatchery will begin each January with fry ponded into the indoor start tanks. Inflow provided will be sourced from 42-46 degree F pathogen free well water with UV treated surface water as a contingent.

This type of rearing vessel is beneficial for administering initial feedings and quantifying loss to aid in maintaining correct population statistics. Other benefits favoring quality rearing conditions include ease of daily maintenance and protection from predation to minimize hatchery environment rearing stress. Once they have reached approximately 180 fpp the fish will be marked and transferred to large raceways and reared there until release.

The proposed hatchery final rearing area will consist of eight 6,000 ft3 raceways. This volume provides low density rearing and eliminates the frequency of stressful population splits. The shaded rearing units are arranged in two banks of four vessels to provide the flexibility to reuse water between the raceways. The maximum flow per raceway will be 674 gpm. Further reducing handling stress and improving the rearing conditions, volitional release will occur from the raceways to the adjacent Lostine River.

Lostine spring Chinook will be reared to 20 fpp at preferred densities (density index 0.1) once transferred to the final rearing raceways. Imnaha Chinook will be reared at the same density index until March of each year and then transferred at 23 fpp to the Imnaha Satellite Facility for acclimation and released at 20 fpp.

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.

Actual biweekly or monthly fish growth information is not available for the proposed Lostine River Hatchery. Data would be available after facility construction, when rearing begins. Table 26 below, contains estimated data based on the existing program's performance at Lookingglass Hatchery. Condition factor information was not available.

Table 26. Estimated monthly weight of Lostine River Chinook juveniles throughout rearing program at proposed Lostine River Hatchery.*

Month	**Weight (g)**	**Fish/Lb**
January	0.32	1,400
Febuary	0.41	1,100
March	0.56	800
April	1.00	450
May	1.80	250
June	2.60	175
July	4.80	95
August	9.00	50
September	13.80	32
October	16.80	27
November	17.50	26
December	18.20	25
January	19.00	24
February	19.70	23
March	20.50	22

*Based on reported existing program performance at Lookingglass Hatchery 2007-2008 rearing cycle.

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

Monthly fish growth rate and energy reserve information is not available for the proposed Lostine River Hatchery. Program average performance will be monitored and documented when rearing begins at the facility.

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*).

<u>Lostine Acclimation Facility</u>
Fish feeding at the Lostine acclimation facility is strongly influenced by low water temperatures. Feeding ceases during the brief 11 to 17 day acclimation period when the temperature drops to 34 degree F or below, which frequently occurs. Currently fish are fed BioOregon Clarks Fry 2.5 mm dry feed. The application schedule is a daily ration at a maximum of 2.2% body weight. The feed conversion rate is variable, dependent on the low temperature and short acclimation period. If an adequate daily ration of BioOregon Clarks Fry can be administered, feed conversion average would be 1.03:1, increasing to 2.01:1 or greater depending on rearing vessel water temperatures. The maximum ratio of pounds per gallon per minute of inflow generally equals 3.4 at release, if the fish reach 20 fpp.

<u>Lookingglass Hatchery</u>
Lostine fry are started on feed indoors with a daily ration at a rate of 2.0-4.0% body weight. Feed rate range in the start tanks is reduced to 1.4-1.7% after adequate initial growth and feeding behavior is established. Moved to outdoor raceways in late June, the feed rate is continued in a similar pattern at 1.3-2.2%. As fall temperatures drop, the feed rate diminishes to a maintenance diet of 0.05-0.1%. Increasing temperatures in March facilitate satiation feeding practices to bring fish size to established release goals. The percent bodyweight during this time would represent 0.5-1.0%. Feed conversion rate for the program typically ranges from 1.1:1 to 1.5:1.

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

<u>Fish Health Monitoring</u>
Any fish health monitoring for the Lostine River program is performed by ODFW while they are reared at Lookingglass and after transfer to the Lostine River Acclimation site. The proposed Lostine River hatchery would continue to utilize ODFW Fish Health staff for monitoring.

Monthly sample of about 10 (or available) moribund and/or dead fish will be examined for *R. salmoninarum* (BKD) and systemic bacteria. Every other month, examine five grabsampled fish per raceway and any moribund fish for erythrocytic inclusion body syndrome (EIBS) using blood smears and hematocrits. Perform glucose assays on the plasma from the 5 grab-sampled fish. If EIBS is detected expand monitoring on that raceway to 10 fish per month. Examine gill and skin wet mounts by microscopy from a minimum of five fish. These may be from a combination of moribund and healthy fish. If bacterial gill or cold water disease is suspected, make smears from the gills on agar medium.

Disease treatment

BKD –

Typically occurring in July or August, one prophylactic 28 day medicated feed treatment is administered annually at Lookingglass Hatchery. Thetarget dose is 100 mg Erythromycin per kilogram fish.

EIBS - There is no prophylaxis for EIBS except avoidance of the infectious agent. Bacterial coldwater disease is the most common secondary infection. Oxytetracycline prophylaxis will likely be implemented based on the sensitive nature of this stock if conditions warrant its use.

Fungus - Formalin flushes under a prescription from a consulting veterinarian. Flushes are one-hour treatments for two consecutive days after customary fin clipping and PIT tagging, or VIE marking occurences-- water temperature permitting (>42$_o$F).

Disease Outbreak Plan

Disease outbreaks are treated on a case-by-case basis.
Therapies and remedial measures are based on conventional and available treatments, new information, and innovation. Warm water therapy may be used if EIBS becomes a problem. It would be used, based on priorities of stocks and raceways affected, after consultation with appropriate entities. Formalin treatments may be implemented for parasitic infestations upon recommendation of Fish Health Services.

Sanitation Procedures

Guidelines for current sanitation protocol are outlined in Table 27. This same protocol would be applied at the proposed Lostine River hatchery.

Table 27. Summary of recommended disinfectants and application.

	Application	Concentration	Time	Comment
Iodophor	Nets, gear and equipment, clipping & tagging van, PIT tag stations, large tub disinfectant containers, spawning colanders and buckets, lib truck, footbaths, floors Note: For raceway sanitization**-thoroughly clean the unit to remove dirt, spray or brush on 75-100 ppm iodophor and let this remain for a minimum of 3 days. Allow iodophor to dry and break down with exposure to light. **If the above recommendation cannot be done then sanitize raceways by thoroughly cleaning them and leaving to dry for a minimum of three days. Water hardening eggs Egg transfers- dis-Infection at receiving station	100 ppm Note: to make 100 ppm solution mix 6.7 oz of jug strength iodophor to 5 gallons H_2O or 6.7 oz.=189ml. 100 ppm 100 ppm	10 min. Minimum 15 minutes 10 minutes	-Equipment should be pre-rinsed to remove dirt, mucus or other organic material which reduces the efficacy of disinfectant. -Rinse equipment to remove harmful residue if equipment is going into standing water containing fish or fish are being placed into the equipment (tank or bucket). -Argentyne or other buffered iodophors such as Western Chemicals "PVP iodine" would be acceptable. This is the statewide general practice. Usually applies to Captive Broodstock eggs received
Isopropyl Alcohol	PIT tag needles and any other apparatus used to insert into fish.	70%	10 min. Note: Air dry	-No re-use until air dried -use drying oven to enhance air drying step.

Virkon Aquatic Disinfectant and Virucide	Footbaths.	1% solution .Equivalent to 9.75% Chlorine	7 day solution	For use in cleaning and disinfecting environmental surfaces associated with aquaculture. Breaks down into a neutral salt.
Chlorine or Aqueous solution as sodium hypochlorite (Household Bleach).	Lib truck tanks, raceways Raceway disinfection	100 ppm 100 ppm	10 min.	Organic matter binds and neutralizes. Left to dry and breakdown in sunlight. Assure that no bleach goes to effluent.

***All chemical use will be done in accordance with label use and reporting requirements. Disinfecting and disinfected water must be disposed of in an approved manner.**

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

No smolt development indices are monitored in this program.

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

Examples of natural rearing techniques used while rearing the Lostine River release groups are listed below.

- Long term rearing and acclimation occurs with natural photoperiod.
- Program utilizes natal water for acclimation. Proposed Lostine Hatchery will utilize natal water for entire rearing cycle.
- Feeding occurs with limited exposure to culturist.
- Dark liners in raceways promote an increased natural pigmentation of fish.
- Shaded cover provided in raceways,
- Structure in rearing vessels used to imitate natural conditions.
- Low rearing densities.
- Acclimation liberation timing aligns with natural smolt out migration.
- Adequate acclimation period followed by generous genuine volitional release.

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.
Risk aversion measures with regard to rearing are addressed in several ways. An approved screen is used on acclimation pump intake. Program protocol insures propagation of progeny with natural origin parents. Specified smolt release timing mimics natural out migration.

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program. *Specify any management goals (e.g. number, size or age at release, population uniformity, residualization controls) that the hatchery is operating under for the hatchery stock in the appropriate sections below.*

10.1) Proposed fish release levels. *(Use standardized life stage definitions by species presented in* ***Attachment 2****. "Location" is watershed planted (e.g. "Elwha River").)*

The smolt release goal for the Lostine program is 250,000 Chinook yearlings with a coefficient of varience of 10 or less. Residualization is minimized by a release size of 20 fpp and volitional liberation annually in April. These goals would continue with construction of the proposed Lostine River hatchery.

Table 28. Proposed life stage, number of released, and location for Lostine River supplementation program.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs	Undetermined			Lostine R., Bear Ck., Upper Wallowa R., Hurricane Ck.
Unfed Fry	None	N/A	N/A	N/A
Fry	None	N/A	N/A	N/A
Fingerling	Undetermined			Lostine R., Bear Ck., Upper Wallowa R., Hurricane Ck.
Yearling	250,000	20-25	Mid-March-April	Lostine R., Bear Ck., Upper Wallowa R., Hurricane Ck.

10.2) Specific location(s) of proposed release(s).
Stream, river, or watercourse: Lostine River (HUC-17060105)
Release point: RM 10, 45.415 N - 117.424 W
Major watershed: Grande Ronde River
Basin or Region: Snake River/Columbia River

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

Summary of spring/summer chinook releases in the Lostine River 1999-2010 (estimates for release number and sizes for 2009 & 2010) from Nez Perce Tribe.

Table 29. Lostine River numbers of fish and average size released from 1999-2010.

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1999							11,738	18.49
2000							34,977	19.38
2001							133,882	18.98
2002							109,015	15.77
2003							242,776	16.56
2004							250,251	22.83
2005							164,779	22.69
2006							240,568	24.94
2007							230,010	21.65
2008							205,567	20.03
2009							247,000	20.00
2010							250,000	20.00
Average							176,714	20.11

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

Actual dates of release are illustrated in Table 30. Upon culmination of the prescribed acclimation period, the raceway screens are removed to allow smolt outmigration through an 8 inch valve installed in the sump area of each raceway. The fish are allowed to out-migrate volitionally for 10 to 14 days, then any remaining fish are crowded to the sump area and flushed out of the raceway into the outflow piping system (This process is further described in section 10.6).

Table 30. Summary of Lostine River smolt acclimation and release dates.

Year	Arrival	Volitional Release	Force Release
2004	March 1 March 22	March 15-20 April 1-13	March 21 April 14
2005	February 28 March 21	March 11-19 March 28-31	March 20 April 1
2006	February 27 March 22	March 10-19 March 28- April 9	March 20 April 10
2007	March 5 March 26	March 16-24 April 7-16	March 25 April 17

Year	Arrival	Volitional Release	Force Release
2008	March 3 April 3	March 19-31 April 10-16	April 1 April 17

10.5) Fish transportation procedures, if applicable.

Not applicable, Chinook yearling release occurs on site.

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

Lostine River Chinook yearlings are acclimated annually in vinyl raceways utilizing river water pumped from the adjacent Lostine River. The total release population is divided into two segments to facilitate low rearing densities. Typically the first segment is on station for 17 days until liberated. After a two week volitional outmigration, any remaining fish are crowded to the outflow and flushed to the river. The second group is acclimated for 10 days, volitional outmigration occurs for 10 days, and then the few remaining fish are compulsory removed from the pond as described above. As the fish pass through the outflow piping to the Lostine River an inline PIT tag detector scans and records any tagged fish.

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

The fish released from this facility are 100% marked. The progeny from the conventional brood are released adipose clipped with a numbered coded wire tag in the snout. Captive brood progeny are released without an adipose fin clip but with a numbered coded wire tag in the snout. Previous captive brood releases possessed a colored VIE placed in the eye. In addition, a portion of each release contained a PIT tag group (Table 31).

Table 31. Brood year releases of Lostine River hatchery Chinook salmon and associated coded wire tag groups.

Brood Year	Total Brood Year Releases	Total Brood Year PIT Tags	Life Stage Released	Start of Release	End of Release	Size at Release (fish/lb)	Rearing Program	Program Releases	Applied Marks	Coded Wire Tag Codes
1997	11,738	4,958	Smolt	4/1/99	4/15/99	18.0	Conv.	11,738	AD, CW, RR-VIE	92610
1998	34,977	7,921	Smolt	4/1/00	4/17/00	19.2	Capt.	34,977	AD, CW	92832 92836 92835 92841 92831 92834

1999	133,982	7,885	Smolt	3/29/01	3/29/01	19.0	Capt.	133,982	AD, CW	93060 93062 93061 93103 93102 93063 93101 93104 93105
2000	109,015	15,985	Smolt	4/2/02	4/13/02	15.8	Conv.	31,464	AD, CW, RR-VIE	75852
2000							Capt.	77,551	AD, CW	93421 93422 93425 93419 93426 93428 93429 93423
2001	247,436	15,817	Parr	5/28/02	5/28/02	78.0	Conv./Capt.	4,660	AD CWT	92640
2001			Smolt	3/17/03	3/23/03	15.9	Conv.	51,806	AD, CW, LR-VIE	93539
2001							Capt.	57,995	AD, CW	93535 93538
2001			Smolt	4/1/03	4/13/03	17.4	Conv.	49,110	AD, CW, LR-VIE	93540
2001							Capt.	83,865	AD, CW	93537 93507 93536 93758
2002	250,251	15,900	Smolt	3/15/04	3/21/04	22.5	Conv.	58,413	AD, CW, RR-VIE	93831
2002							Capt.	58,093	AD, CW	93821
2002			Smolt	3/29/04	4/13/04	21.7	Conv.	58,058	AD, CW, RR-VIE	93830
2002							Capt.	75,687	AD, CW	93827 93839
2003	164,819	13,321	Smolt	3/11/05	3/20/05	22.8	Conv.	51,884	AD, CW, LR-VIE	94038
2003							Capt.	43,657	AD, CW	92348
2003			Smolt	3/28/05	4/1/05	23.2	Conv.	50,811	AD, CW, LR-VIE	94037
2003							Capt.	18,467	AD, CW	94041
2004	240,568	14,242	Smolt	3/10/06	3/20/06	17.8	Conv.	65,608	AD, CW	94210 94483
2004			Smolt	3/28/06	4/10/06	17.6	Conv.	133,978	AD, CW	94209 94211 94214
2004							Capt.	40,982	AD, CW, RR-VIE	94248 94212
2005	230,010	6,443	Smolt	3/16/07	3/26/07	18.8	Conv.	53,313	AD, CW	94353
2005								51,796	AD, CW	94356

2005			Smolt	4/7/07	4/17/07	18.3	Conv.	100,297	AD, CW	94355 94354
2005							Capt.	24,604	AD, CW, LR-VIE	94360
2006	205,567	6,430	Smolt	3/19/08	4/1/08	20.4	Conv.	63,875	AD CWT	94352
2006							Capt.	10,822	CWT	94535
2006			Smolt	4/10/08	4/17/08	20.2	Conv.	130,870	AD CWT	94538 94351
2007	330,952	8,956	Fry	2/20/08	2/20/08	1,327.3	Conv./Capt.	18,328	None	NA
2007			Parr	6/25/08	6/25/08	120.0	Conv./Capt.	64,124	AD only	NA
2007			Smolt	3/18/09	4/1/09	25.1	Conv.	124,552	AD CWT	94572 94573
2007			Smolt	4/11/09	4/17/09	21.8	Conv.	61,846	AD CWT	94574
2007							Capt.	62,102	CWT	94575
2008	316,279	7,395	Parr	6/5/09	6/5/09	154.1	Conv./Capt.	68,820	AD Only	NA
2008			Smolt	3/17/10	3/30/10	22.0	Conv.	123,384	AD CWT	94599 94665
2008			Smolt	4/10/10	4/19/10	22.0	Conv.	62,026	AD CWT	94664
2008							Capt.	62,049	CWT	94666

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

Additional production of Lostine River stock above the production goals may be outplanted as other life stages into Bear Creek, Upper Wallowa River, Upper Lostine River, and/or Hurricane Creek.

10.9) Fish health certification procedures applied pre-release.

A qualified ODFW fish health specialist will conduct the described fish health certification procedures applied at release.

At the acclimation site, 30 healthy appearing fish will be examined for *R. salmoninarum* (ELISA), EIBS and plasma glucose. Gill/kidney/spleen samples as 3 fish sample pools will be assayed for viruses. Wet mounts of skin and gill tissue from a minimum of five will be examined by microscopy. These will be sampled within one week of the forced release. A target of 10 (or available) moribund and/or dead fish will be sampled for *R. salmoninarum* (BKD) and systemic bacteria.

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

An emergency release protocol is established for the Lostine acclimation site and would be applied as follows.

Water system failure protocol:
1) Extinguish alarm siren.
2) Start back up oxygen system.
3) Restart primary generator and pump.
4) If primary is not functioning, start backup generator and pump.
5) Notify supervisor, report event.
6) Monitor D.O.
7) Monitor and remove surface ice layer from ponds.

If water system function cannot be restored or raceway dissolved oxygen levels drop below 2 ppm before repairs can be implemented, fish will be released to prevent catastrophic loss.

In case of water system failure, on site personnel will diagnose problem and determine if system restoration can occur in adequate time to maintain fish health. Duplicate power source and instream pumps are maintained to minimize the risk of this occurrence. In addition, low rearing densities, extremely cold raceway water temperatures with high natural levels of dissolved oxygen, combined with a compressed oxygen backup system can generate up to a six hour work window for restoration of raceway inflow. Portable dissolved oxygen meters are issued to stand-by personnel and would be used during crisis management to verify oxygen levels in the raceways.

Flooding event protocol:
1) Notify supervisor and local emergency services of the situation.
2) Shut off instream pump system.
3) Shut off facility power at main breaker.
4) Release fish.
5) Gather valuable equipment if time allows.
6) Evacuate to established meeting location.

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

The prescribed lifestage at release of the Lostine Chinook yearlings promotes eager smolt outmigration. This aspect of the release minimizes ecological risk to listed fish by reducing competition for nutrients and space in the tributary. Release timing also takes advantage of seasonal flow increases and provides more available habitat for the competing species to share. Additionally, the Lostine program’s volitional release strategy introduces the liberated hatchery population to the river in a staggered manner. Resulting is less crowding and reducing unnatural negative impacts of a mass direct release.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

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

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

As stated in the earlier sections 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. NPCC 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 explained more thoroughly in the AHSWG and the later standards should apply to this document. Table 3represents the union of performance standards described by the Northwest Power and Conservation Council (NPCC 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 (2008). Table 32 provides information on the status of the work being conducted on the standardized performance indicators, including the agency and program under which the work is being funded. Much of this work had been conducted by the Oregon Department of Fish and Wildlife and has been presented in annual progress reports (Carmichael et al. 1987; 1988; 1999; 2004; Messmer et al. 1989; 1990; 1991; 1992; 1993; Hoffnagle et al. 2005; Monzyk et al. 2006a; b; c; d; e; 2007; 2008a; b; Feldhaus et al. 2010; 2011).

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 Table 3. The CSMEP measures have been adopted by the AHSWG (Beasley et. al. 2008), and are consistent with those presented in the Northeast Oregon Hatchery Monitoring and Evaluation Plan (NEOH M&E Plan) (Hesse et al. 2006). 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.

Table 4 previously explained earlier in the document are the suite of Performance Measures (modified from the management objectives listed in Beasley et al. (2008)) used by the Lostine project, and the assumptions that need to be tested for each standard.

Table 32. Standardized performance indicators for status and trends and hatchery effectiveness monitoring. The methods column references extensive detailed descriptions of methods from the Lostine River Chinook salmon Monitoring and Evaluation Plan (Hesse et al. 2006 and indications of whether the work is currently being completed. (Table modified from Beasley et al. 2008).

Performance Measure		Methods – References sections within the Lostine M&E Plan (Hesse et al. 2006)	Completed Performance Measures (Status, Program & Agency)
Abundance	Adult Escapement to Tributary	1.a.1,1.a.2, 1.a.3	YES (Lostine River M&E – NPT LSRCP – ODFW M&E)
	Fish per Redd	1.a.1, 1.a.3	YES (Lostine River M&E – NPT LSRCP - ODFW M&E)
	Female Spawner per Redd	1.a.2	YES (Lostine River M&E – NPT LSRCP - ODFW M&E)
	Index of Spawner Abundance - redd counts	1.a.4	YES (Lostine River M&E – NPT) (LSRCP – NPT, ODFW M&E)
	Spawner Abundance	1.a.5	YES (Lostine River M&E – NPT LSRCP - ODFW M&E)
	Hatchery Fraction	1.d.6	YES (Lostine River M&E – NPT LSRCP - ODFW M&E)
	Ocean/Mainstem Harvest	1.d.7 1.a.9	YES (Lostine River M&E – NPT LSRCP - ODFW M&E)
	Harvest Abundance in Tributary		YES (Lostine River M&E – NPT LSRCP - ODFW M&E)
	Index of Juvenile Abundance (Density)	1.d.1 1.d.2	TO BE IMPLIMNETED (NEOH M&E – ODFW M&E)
	Juvenile Emigrant Abundance	1.a.1	YES (Early Life History – ODFW M&E)
	Smolts	1.d.4	YES (Lostine River M&E – NPT, Early Life History - ODFW M&E, LSRCP - ODFW M&E)
	Run Prediction	1.d.6, 5.a.4	YES (Lostine River M&E – NPT) (LSRCP – ODFW M&E)
Survival – Productivity	Smolt-to-Adult Return Rate	1.d.5 1.d.6 1.d.7	YES (Lostine River M&E – NPT LSRCP - ODFW M&E)
	Progeny-per- Parent Ratio	1.a.1-3, 1.a.5-11	YES (Lostine River M&E – NPT LSRCP - ODFW M&E)

	Recruit/spawner (R/S)(Smolt Equivalents per Redd or female)	1.d.5	YES (Lostine River M&E – NPT LSRCP - ODFW M&E)
	Pre-spawn Mortality	1.a.8	YES (Lostine River M&E – NPT LSRCP - ODFW M&E)
	Juvenile Survival to first mainstem dam	1.d.3	YES (Lostine River M&E – NPT LSRCP - ODFW M&E)
	Juvenile Survival to all Mainstem Dams	1.d.3	YES (Lostine River M&E – NPT LSRCP - ODFW M&E)
	Post-release Survival	1.d.3	YES (Lostine River M&E – NPT LSRCP - ODFW M&E)
Distribution	Adult Spawner Spatial Distribution	1.c.1 6.b.1 6.b.2	YES (Lostine River M&E – NPT LSRCP - ODFW M&E)
	Stray Rate (percentage)	1.a.5 4.a.1-5	YES (Lostine River M&E – NPT LSRCP - ODFW M&E)
	Juvenile Rearing Distribution		YES (Early Life History – ODFW M&E)
	Disease Frequency	5.b.1, 5.b.2, 6.c.2	YES (Pathology – ODFW)
Genetic	Genetic Diversity	1.b.4 3.a.1, 3.a.2 3.a.4	YES (Lostine River M&E – NPT LSRCP - ODFW M&E)
	Reproductive Success (Nb/N)	1.b.4 3.a.1, 3.a.2 3.a.4	PARTIAL (Lostine River M&E – NPT) (NEOH M&E – NPT) (NOAA project? - NOAA)
	Relative Reproductive Success (Parentage)	1.b.4 3.a.1, 3.a.2 3.a.4	PARTIAL (Lostine River M&E – NPT) (NEOH M&E – NPT) (NOAA project? - NOAA)
	Effective Population Size (Ne)	1.b.4 3.a.1, 3.a.2 3.a.4	YES (Lostine River M&E – NPT) (NEOH M&E – NPT) (Subcontract - CRITFC)
	Proportionate Natural Influence (PNI)	1.b.4 3.a.1, 3.a.2 3.a.4	YES (ODFW M&E)
Life History	Age Structure	1.a.1 1.a.6 2.a.1	YES (Lostine River M&E – NPT LSRCP - ODFW M&E)
	Age–at–Return	1.a.1 2.a.1	YES (Lostine River M&E – NPT LSRCP - ODFW M&E)
	Age–at-Emigration	2.b.1	YES (Early Life History – ODFW M&E) NEOH M&E – NPT)
	Size-at-Return	2.a.2 1.a.2	YES (Lostine River M&E – NPT LSRCP - ODFW M&E)
	Size-at-Emigration	2.b.2	YES (LSRCP - ODFW M&E; Early Life History – ODFW M&E)
	Condition of Juveniles at Emigration	2.b.2	YES (Early Life History – ODFW M&E)

	Percent Females (adults)	1.a.2, 1.a.7, 2.a.3	YES (Lostine River M&E – NPT) (LSRCP – NPT, ODFW M&E)
	Adult Run-timing	1.a.1 2.a.4	YES (Lostine River M&E – NPT LSRCP - ODFW M&E)
	Spawn-timing	1.a.2	YES (Lostine River M&E – NPT LSRCP - ODFW M&E)
	Juvenile Emigration Timing	1.d.2 2.b.3	YES (Lostine River M&E – NPT) (Early Life History – ODFW M&E; LSRCP - ODFW M&E)
	Mainstem Arrival Timing (Lower Granite)	2.b.3 2	YES (Lostine River M&E – NPT LSRCP - ODFW M&E)
Habitat	Physical Habitat	6.c.1	TO BE IMPLIMNETED (NEOH M&E – NPT)
	Stream Network		TO BE IMPLIMNETED (NEOH M&E – NPT)
	Passage Barriers/Diversions	4.b.1 4.b.2	TO BE IMPLIMNETED (NEOH M&E – NPT)
	Instream Flow	6.d.2	YES (USGS)
	Water Temperature	6.d.1	YES (Lostine River M&E-NPT)
	Chemical Water Quality		TO BE IMPLIMNETED (NEOH M&E – NPT)
	Macroinvertebrate Assemblage		TO BE IMPLIMNETED (NEOH M&E – NPT)
	Fish and Amphibian Assemblage		PARTIAL/ TO BE IMPLIMNETED (NEOH M&E – NPT) (Early Life History – ODFW M&E)
In-Hatchery Measures	Hatchery Production Abundance		YES (LSRCP – Lookingglass Fish Hatchery & ODFW M&E)
	In-hatchery Life Stage Survival		YES (Lookingglass Fish Hatchery & ODFW M&E)
	Size-at-Release	2.b.2	YES (Lostine River M&E – NPT) (LSRCP – NPT, ODFW M&E)
	Juvenile Condition Factor	2.b.2	YES (Lostine River M&E – NPT) (LSRCP – NPT, ODFW M&E)
	Fecundity by Age	5.a.1	YES (ODFW M&E)
	Egg Size	5.a.1	Yes (ODFW M&E)
	Spawn Timing	1.a.2	YES (Lookingglass Fish Hatchery &ODFW M&E)
	Hatchery Broodstock Fraction		YES (ODFW M&E)

	Hatchery Broodstock Prespawn Mortality		YES (ODFW M&E)
	Female Spawner ELISA Values		YES (Pathology - ODFW)
	In-Hatchery Juvenile Disease Monitoring		YES (Pathology - ODFW)
	Size of Broodstock Spawner		YES (Lookingglass Fish Hatchery LSRCP- ODFW M&E) (Lostine River M&E – NPT)
	Prerelease Mark Retention		YES (Lostine River M&E – NPT) (LSRCP – NPT, ODFW M&E)
	Prerelease Tag Retention		YES (Lostine River M&E – NPT) (LSRCP – NPT, ODFW M&E)
	Hatchery Release Timing		YES (Lostine River M&E – NPT) (LSRCP – NPT, ODFW M&E)
	Chemical Water Quality		TO BE IMPLIMNETED (NEOH M&E – NPT)
	Water Temperature		YES (Lookingglass Fish Hatchery – ODFW)

- Monitor smolt release size, numbers, location, migration timing, and survival *(Indicators: 3.4.2(c);3.4.4(a,b,c,d);*
- Monitor adult collection, numbers, status and disposition *(Indicators: 3.3.1(a,b,c); 3.3.2(a,b);3.4.1(a,b):3.4.2; 3.4.3(a,b)*
- Monitor survival, growth and performance of hatchery fish *(Indicators: 3.3.2(a,b);*
- Monitor proportion of hatchery adults in primary natural spawning areas by trapping and carcass recoveries *(Indicators:3.3.1(a);3.3.2(b);)*
- Develop genetic profiles for hatchery and natural spring chinook populations in the basin and conduct regular monitoring *(Indicators: 3.5.1(a); 3.5.2(a,b,c); 3.5.3(a,b,c,d); 3.5.4(a,b,c,d); 3.5.6(a)*
- Monitor wild fish escapement trend in primary natural spawning areas by trapping and carcass recoveries *(Indicators:3.3.2(b);3.4.2(b);)*
- Develop and implement evaluation plans and report findings to facilitate adaptive management *(Indicators: 3.6.1(a);3.6.2(a,b)*

It is expected that these monitoring activities will provide the basic information needed to evaluate this program and its impact on the natural population (both positive and negative). However, additional data or analyses may be necessary to ensure the following key pieces of information are available to evaluate this program:
1 - A time series of wild and hatchery spawner escapement estimates for the entire Wallowa population (not just the Lostine basin),
2 - Distribution of spawners within the watershed that the population occupies,

3 - Proportion of hatchery fish, by year, for the entire population (not just the Lostine),
4 - Age composition of spawners, preferably by year, but if not a summary from multiple years that is useable;
5 - Estimated annual impact of tributary and downstream fisheries (including mainstem Columbia and ocean as appropriate);
6 - Number of wild fish removed for hatchery broodstock and proportion of the hatchery broodstock that are wild fish (i.e., pNOB);
7 - Green egg to smolt survival for hatchery program
8 - Smolt to adult survival for hatchery releases;
9 - Hatchery strays recovered from other basins based on CWT or PIT tag recoveries;
10 - The size of hatchery smolts relative to wild fish;
11 - The timing of the hatchery smolt release versus out-migration timing of the wild smolts;

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

The original concept behind the M&E portion of this project was to evaluate whether or not production goals stated in the NEOH Master Plan were accomplished. As planning for a hatchery in Northeast Oregon progressed the original goals were restated as management assumptions in the NEOH M&E Plan with objectives that could be tested by quantifiable means. Ongoing funding comes from a variety of sources, but is currently insufficient to implement the entire NEOH M&E plan (full funding of the NEOH M&E plan has been previously requested and will be resubmitted in the 2010 categorical review under proposal 200713200; NEOH Monitoring and Evaluation Implementation). The performance measures of the NEOH M&E plan constitute the quantifiable means to test these objectives. The current scope of work for the Lostine River M&E program allows for most, but not all, of the NEOH M&E plan objectives to be achieved as shown in Table 33 and a number of performance measures (e.g. index of spawner abundance) are completed through a multi-agency cooperative with currently funded programs as shown in Table 32.

Full funding of the proposed NEOH M&E Monitoring and Evaluation Implementation project for 2011 would require $2,140,653. This funding includes the cost of the current Lostine River M&E project. The NEOH M&E Monitoring and Evaluation Implementation project would continue to complete work through a multi-agency cooperative effort and would also fund the data gaps shown in Table 32. A data gap for abundance is the index of juvenile abundance. The data gap for distribution is the lack of knowledge about juvenile rearing distribution. And the following habitat data gaps would be accomplished by the NEOH M&E Monitoring and Evaluation Implementation project: physical habitat measurements, chemical water quality analysis, macro-invertebrate assemblage, and fish and amphibian assemblage. The additional work for obtaining information for juvenile abundance and distribution data gaps would require $260,000. The bulk of this cost would be devoted to the manpower required for juvenile snorkel surveys. The work element cost for data collection for the data gaps for habitat performance measures under the NEOH M&E Monitoring and Evaluation

Implementation project was estimated as $270,064 annually and was designed to be consistent with EMAP protocols. The detailed proposal and budget for the NEOH M&E Monitoring and Evaluation Implementation project can be found on the CBFWA web site.

Additionally, given the concern regarding the influence that hatchery salmon may exert on natural populations, we believe that it is imperative that we monitor potential hatchery/wild interactions, hatchery-origin contribution to the natural population, and genetic monitoring to determine whether hatchery salmon are causing changes in the genetic diversity of the natural population that it is supplementing. Additionally, we see the need for a "data steward" within ODFW to develop the databases needed for organizing the data collected while monitoring the hatchery and natural populations. These databases will have to be coordinated with those from LSRCP, BPA and NOAA Fisheries, the agencies to which we will submit these data and will be available to all co-management agencies.

Table 33. Goals and objectives for the Lostine River spring Chinook population in the NEOH Master Plan (Ashe et al. 2000) with the related objectives from the NEOH M&E plan (Hesse et al. 2006).

Goal	NEOH Master Plan Objectives	NEOH M&E Plan Objective
Short -term: Prevent extirpation.	1 - Maintain an annual escapement of Chinook salmon from natural and artificial production of no less than 250 adults in the Lostine River. 2 - Maintain genetic attributes and life history characteristics of the naturally spawning Chinook aggregate.	7C 3A, 3B, 3C
Mid-term: Restore natural population of Lostine spring Chinook salmon above ESA delisting levels and provide an annual sport and tribal harvest.	1 - Achieve an annual escapement of 500 adults in the Lostine River from natural production. 2 - Maintain genetic attributes and life history characteristics of the naturally spawning Chinook aggregate. 3 - Provide tribal and sport harvest opportunity consistent with recovery efforts.	7C 3A, 3B, 3C 5A, 5B
Long-term: Restore Grande Ronde spring Chinook salmon escapement and harvest to historic levels.	1 - Utilize artificial production to provide benefits expected from the LSRCP of 1,625 spring Chinook adults returning from the Lostine River program annually. 2 - Maintain natural self-sustaining population of 1,716 in the Lostine River. 3 - Maintain genetic attributes and life history characteristics of the naturally spawning Chinook aggregate. 4 - Provide harvest of naturally and artificially produced adult additional to natural spawning, nutrient enhancement, and hatchery broodstock goals.	6A, 6B, 6C 1A, 1B, 1C,1D, 1E 3A, 3B, 3C 7C, 5A, 5B

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.

The Lostine Program utilizes a sliding scale approach to determine the rate at which to select broodstock for the supplementation program and released above the weir (Table 5). Since the Lostine Program is intended to produce hatchery-reared progeny that are similar to naturally spawned progeny, broodstock collection goals are regulated by the proportions of hatchery and naturally origin adult returns. As the number natural fish returning increases the number of natural origin fish utlilzed in the broodstock decreases.

The NEOH M&E plan monitors life history and genetic characteristics. Hypotheses testing are designed to compare life history and genetic traits before and after supplementation. The plan utilizes an adaptive management approach and was previously reviewed by the ISRP in 2004 (ISRP Document 2004-10). The ISRP concluded that the NEOH M&E plan was an excellent working draft and the ISRP made several comments concerning the M&E plan. NPT addressed these concerns as part of the Step 3 review for the approval of final design and construction of the Northeast Oregon Hatchery which was approved by the Northwest Power Conservation Council on March 30, 2006.

In addition to the NEOH M&E plan experienced surveyors will be utilized to conduct spawning surveys. Surveyors will walk along the stream, crossing when necessary, avoiding and counting redds and observing fish. The Lostine River M&E program will conduct weekly bank surveys below the weir to determine if the weir is impeding adult migration. The weir will be staffed with qualified individuals and adult fish will not be handled when water temperatures exceeds 17 C. The Lostine River M&E program will also assist ODFW with operation of the Lostine River screw trap during acclimated volitional release periods to minimize handling time for natural Chinook salmon. Hatchery Chinook salmon will be PIT-tagged and coded-wire tagged during the fall prior to release to allow for the maximum recovery time and minimize handling during the initial stages of smoltification.

Genetic Concerns/Mating Protocols:
The Lostine River O&M program collects adult Chinook salmon proportionally across the run using the average run timing observed from 1997 to 2009. Mating occurs using a 2x2 matrix and males will be used no more three times in any given brood year.

SECTION 12. RESEARCH

12.1) Objective or purpose.

The Lostine River M&E will be a collaboration between ODFW and NPT that will implement portions of the NEOH M&E plan to evaluate NEOH M&E plan objectives and determine BiOp VSP parameters. BiOp VSP parameters related to abundance, survival, and productivity determined by this project are natural origin spawner abundance, percent of hatchery escapement, and smolt-to-adult return return rates and recruits-per-spawner ratios. BiOp VSP parameters related to life history characteristics determined by this project are age-at-return, size-at-return, cohort age structure, sex ratios, adult run timing, and spawn timing. DNA collected will also used for BiOp VSP genetic parameters beginning with the 2009 DNA collections. Precision for estimating these parameters will be estimated as in the NEOH M&E Plan. Some of the work described in the NEOH M&E plan is currently being conducted by ODFW under LSCRP funding (Carmichael et al. 1987; 1988; 1999; 2004; 2010; Messmer et al. 1989; 1990; 1991; 1992; 1993; Hoffnagle et al. 2005; Monzyk et al. 2006a; b; c; d; e; 2007; 2008a; b; Feldhaus et al. 2010; 2011) and by NPT under BPA funding (Cleary 2008; Cleary and Edwards 2009; 2011).

Program goals that lead to the development of the NEOH M&E Plan are identified in the Northeast Oregon Hatchery Spring Chinook Salmon Master Plan (Ashe et al. 2000) and have been part of the ODFW statements of work since the LSRCP program began in 1982 (Carmichael and Wagner 1983). These goals incorporate existing LSRCP mitigation goals. The goals focus on (1) preservation/conservation actions to avoid extinction, (2) restoration (recovery) to build population abundances above critical threshold levels, and (3) mitigation (compensation) to support harvest and self-sustaining populations. Each of these goals have related objectives that detail some level of annual escapement and state a need to maintain genetic attributes and life history characteristics of the naturally spawning Chinook salmon populations that support: 1) Protecting, mitigating, and enhancing of Columbia River basin anadromous fish resources, 2) restoring long-term harvest opportunities for tribal and non-tribal anglers, 3) protecting long-term fitness and genetic integrity of targeted fish populations, and 4) limiting ecological and genetic impacts to non-target populations within acceptable limits. The NEOH M&E Plan and ODFW LSRCP statements of work define and use a number of key performance measures, or metrics, to monitor and evaluate abundance, survival/productivity, distribution, genetics, life history, and habitat. Performance measures produced under the plan are used to address testable hypotheses contained in the plan under work element162 (Analyze/Interpret Data)Analysis and interpretation of data will address the needs of both the NEOH M&E Plan and Evaluation of the Lostine River captive broodstock F_1 adult returns.

Adult data collection occurs at the weir maintained under WE 61 (Maintain Hatchery) and as juveniles. Juvenile data collection involves pre-release sampling at the hatchery, monitoring acclimated volitional releases, and retrieving observations of PIT-tagged fish at downstream screw traps and dams. Adult data collection involves inspecting captured adults for marks and tags and collecting biological and genetic samples at the weir, conducting spawning ground surveys and inspecting adult Chinook salmon carcasses for marks and tags and collecting biological and genetic samples as needed, and retrieving PIT and coded wire tag observations of adults at downstream interrogation sites. Management of a database for collected data, WE 160, occurs simultaneously with archiving of collected genetic data as previously described. Three separate databases were used for the Lostine River M&E program and the Lostine River Captive Broodstock Program. The database for the Lostine River Captive Broodstock program is administered and maintained by ODFW under BPA Project #200740400. In addition, ODFW is developing a database that will integrate natural and hatchery production and return data from all monitored streams in northeast Oregon. This relational database will merge data collected by ODFW's Early Life History Project (natural production), the data developed from hatchery production, downstream migration and returns of both hatchery and natural salmon. WE 160 will include continued use of the database for captive broodstock to evaluate F^1 Captive Broodstock adult returns. WE 158 (Mark/Tag Animals) occurs prior to the release of hatchery fish at Lookingglass Fish Hatchery. Mass marking is done by ODFW using a combination of adipose fin clips and coded wire tags. PIT- tagging provides additional marks used for estimating survival to Lower Granite Dam by raceway, and for in-season projections of adult returns over Bonneville Dam. Success of this objective relies on maintenance of the weir structure under WE 61 (Maintain Hatchery).

Although the NEOH M&E Plan has not been funded nor currently implemented in its entirety, the plan's objectives are relevant to this HGMP document. The NEOH M&E objectives are as follows:

1) Maintain and enhance natural production in supplemented spring Chinook salmon populations in the Imnaha and Grande Ronde river subbasins,
2) Maintain life history characteristics and genetic diversity in supplemented and unsupplemented spring Chinook salmon populations in the Imnaha and Grande Ronde river subbasins,
3) Operate the hatchery program so that life history characteristics and genetic diversity of hatchery fish mimic natural fish,
4) Keep impacts of hatchery program on non-target spring Chinook salmon populations within acceptable limits,
5) Restore and maintain treaty-reserved tribal harvest and recreational fisheries,
6) Operate the hatchery programs to achieve optimal production effectiveness while meeting priority management objectives for natural production enhancement, diversity, harvest, and impacts to non-target populations,
7) Understand the current status and trends of spring Chinook salmon natural populations and their habitats in the Imnaha and Grande Ronde river subbasins,
8) Coordinate management action and monitoring and evaluation activities and communicate program findings to resource managers.

NEOH M&E Plan Objective 1- Maintain and enhance natural production in supplemented spring Chinook salmon populations in the Imnaha and Grande Ronde river subbasins

A. Progeny-to-parent ratios for hatchery-produced fish significantly exceeds those of natural-origin fish.
B. Natural reproductive success of hatchery-origin fish must be similar to that of natural-origin fish.
C. Spatial distribution of hatchery-origin spawners in nature is similar to that of natural-origin fish.

D. Productivity of supplemented populations is similar to productivity of populations if they had not been supplemented.
E. Life stage-specific survival is similar between hatchery and natural-origin population components.

Monitoring and evaluating natural production using the NEOH M&E Plan requires estimating and monitoring natural escapement. Escapement is estimated by marking and releasing captured fish at the weir with an opercle punch.

Tissue removed by the opercle punch is utilized for genetic analysis. This genetic tissue can be utilized for determining genetic diversity as in Narum et. al., 2007. The genetic tissue can also be used to determine relative reproductive success by matching parent spawners to migrating smolt or adult offspring. Additionally, genetic tissue is collected from carcasses found without existing opercle punches during spawning ground surveys cooperatively conducted by ODFW and NPT. The NPT Lostine River M&E is responsible for archiving samples, sharing samples with NOAA fisheries for pedigree analysis and relative reproductive success (BPA project number 1989-0960-00), and contracting further genetic diversity analysis with CRITFC (see NEOH M&E Objective 2). It's assumed that genetic samples are representative of the population. Additionally, genetic samples are shared with NOAA (BPA Project # 198909600) to determine relative reproductive success. Archiving of genetic samples occurs under WE 160 (Create/Manage/Maintain Database) and will utilize an online database funded by the LSRCP hosted by Pacific States Marine Fisheries Commission. Success of this objective relies on maintenance of the weir structure under WE 61 (Maintain Hatchery).

Marked and unmarked fish are recovered as carcasses during multiple spawning ground surveys. After the last spawning ground survey, NPT and ODFW estimate escapement above the weir by using an adjusted Peterson estimator (Chapman 1951; Seber 1982). We assume that the weir is 100% efficient after the last spawning ground survey and any catch after the last spawning ground survey is a census count. The population estimate above the weir and total redds above the weir are used to determine the number of fish/redd. An estimate of abundance below the weir is based on this fish/redd estimate multiplied times the number of redds found below the weir. Total escapement is the sum of escapement above the weir, escapement below the weir, and fish removed for broodstock, harvest, adult outplants, or mortality. Once total escapement is known an estimate of natural and hatchery escapement is obtained by using the proportion of natural and hatchery carcasses recovered, or by estimating natural and hatchery escapement separately (provided sufficient samples sizes). Additionally, the proportion of hatchery escapement resulting from returning F_1 captive broodstock is estimated from the percent of captive broodstock hatchery fish represented in the catch of returning hatchery origin Chinook salmon at the weir. Examination of egg retention in female carcasses during spawning ground surveys provides a measure of pre-spawning mortality, where females retaining 75% or more of their eggs are considered pre-spawn mortalities. Using natural escapement and natural spawner abundance natural productivity can be presented as progeny-per-parent ratios (lambda, adult recruits per adult spawner), or as juveniles-per-spawner (smolts per female) after multiple years of adult run reconstruction. Natural and hatchery progeny per parent ratios are compared annually using a two tailed t-test, with replication within a stream over a five year period to characterize variability over time.

The NEOH M&E Plan compares supplemented streams to non-supplemented streams to determine whether or not supplementation has enhanced natural abundance and production. At the most basic level of monitoring and evaluation, total and natural escapement and recruits-per-spawner (adjusted for spawner density) provide indices of abundance that can be compared between supplemented and non-supplemented streams. The slopes of linear trend lines of redds (dependant variable) per year (independent variable) can be compared to determine if observed increases in redd abundance in supplemented streams differs from observed increases in redd abundance in non-supplemented streams. Hypotheses stated in the NEOH M&E Plan will be tested at an alpha level of 0.05. Total and natural escapment and Recruits per spawner (corrected for spawner abundance) will be also ve analyzed.

NEOH M&E Plan Objective 2- Maintain life history characteristics and genetic diversity in supplemented and unsupplemented spring Chinook salmon populations in the Imnaha and Grande Ronde river subbasins.

A. Adult life history characteristics in supplemented populations remains similar to pre-supplementation population characteristics.
B. Temporal variability of life history characteristics in supplemented populations remains similar to unsupplemented populations (assumes robust wild population dynamics).
C. Juvenile life history characteristics in supplemented populations remains similar to pre-supplemented population characteristics.
D. Genetic characteristics of the supplemented population remain similar (or improved) to the unsupplemented populations.

The purpose of NEOH M&E Plan Objective 2 is to determine if adult and juvenile life history characteristics and genetic diversity is altered by hatchery supplementation. Performance measures used to evaluate juvenile life history characteristics are age-at-emigration, size-at-emigration, and juvenile emigration timing (to Lower Granite Dam). The objective is accomplished for the adult life history characteristics using age-at-return, size-at-age, adult spawner sex ratios, and adult run and spawn timing.

Determination of age-at-return is obtained from known age returns from coded wire and PIT tag returns, and scale readings. Fork length is measured at Lookingglass hatchery and on spawning ground surveys. Length frequency plots are then developed by age class and mean length at age is monitored for changes over time. Adult spawner sex ratios are based on the ratio of males and female carcass recoveries. Adult run timing is based on the daily catch at the weir. Spawn timing is determined byt he spawn date of females at Lookingglass Hatchery and the date of female carcass recovery on spawning ground surveys. Juvenile age-at-emigration and emigration timing has been based on PIT tag observations at downstream dams with size at emigration obtained from PIT tag recapture fork length data and pre-release sampling at Lookingglass Hatchery.

Tests for changes in age-at-return and size-at-return due to supplementation range from a simple t-test between populations pre- and post-supplementation, regressions models to characterize trends over time. Adult run timing at the Lostine River weir and juvenile run timing at LGD is typically expressed using cumulative run timing of 10%, 50%, and 90%. The NEOH M&E plan recommends that a Kruskal-Wallis one way analysis of variance test be run based on ranked dates of detection expressed as day of the year to determine if emigration timing differs between populations. However, the Lostine River M&E program has made statistical comparisons of median run timing using a Mann-Whitney (Wilcoxon) test, and a Kolmogorov-Smirnov test to compare cumulative arrival timing (as in Hoffnagle et al. 2008).

Analysis of genetic tissue is accomplished through a subcontract with CRITFC. The CRITFC analysis is attempting to answer three questions by amplifying microsatellite loci and genotyping: 1) Are there significant temporal (year-to-year) genetic variations in the Lostine Chinook population? 2) Are there significant genetic differences between early and late run Chinook (i.e., June/July versus August/September) in the Lostine River? And 3) are there significant genetic differences between hatchery and natural Chinook in the Lostine River? Published results discussing genetic variation and population structure can be found in Narum et al., 2007.

<u>NEOH M&E Plan Objective 3- Operate the hatchery program so that life history characteristics and genetic diversity of hatchery fish mimic natural fish</u>

A. Genetic characteristics of hatchery-origin fish are no different than natural-origin fish.
B. Life history characteristics of hatchery-origin adult fish are similar to natural-origin fish.
C. Juvenile emigration timing and survival differences between hatchery and natural-origin fish must be minimal.

Monitoring and evaluation of life history characteristics in natural and hatchery populations provide a comparison between natural and hatchery origin fish to determine if differences exist. The O&M program has been designed to produce hatchery fish that mimic natural fish. Brood stock collections provide an example of an O&M production strategy designed to produce hatchery fish with the same adult run timing by collecting broodstock proportionally across the run. This broodstock take strategy requires knowledge of past adult run timing and the ability to predict adult run size accurately. In addition to the life history performance measures used for evaluating NEOH M&E Plan Objective 3, fecundity and egg size are used to determine if difference exist between natural and hatchery origin fish.

Analyses to determine if differences exist between natural and hatchery life history characteristics range from a simple t- test to multi-factor ANOVA to compare mean fecundity and egg size at age. The NEOH M&E plan recommends that a Kruskal-Wallis one way analysis of variance test be ran based on ranked dates of detection expressed as day of the year to determine if emigration timing differs between natural and hatchery populations. However, the Lostine River M&E program has made statistical comparisons of median run timing using a Mann-Whitney (Wilcoxon) test, and a Kolmogorov-Smirnov test to compare cumulative arrival timing. We will also compare run timing and spawn timing using a Kolmogorov-Smirnov test (as in Hoffnagle et al. 2008).

NEOH M&E Plan Objective 4 - Keep impacts of hatchery program on non-target spring Chinook salmon populations within acceptable limits

A. Hatchery strays produced from the Lostine River Conventional Hatchery Program do not comprise more than 10% of the naturally spawning fish in the Wenaha and Minam watersheds.
B. Hatchery strays in the Minam and Wenaha rivers are predominately from in-subbasin releases.
C. Hatchery strays from the Lostine River Conventional Hatchery Program do not exceed 10% of the abundance of any out-of-basin natural Chinook salmon populations.

Keeping the impacts of supplementation on non-target populations of Chinook salmon within acceptable limits requires knowledge of straying of hatchery origin adults. This is accomplished by determining the origin of hatchery carcasses within the Minam and Wenaha rivers and other non-supplemented streams. The acceptable limit is defined in the NEOH M&E Plan as the proportion of hatchery origin carcasses being no greater than 10%. Identification of hatchery carcasses requires that hatchery fish be marked with coded-wire tag prior to release as juveniles. Coded-wire tag recoveries reported to and retrieved from the Pacific States Marine Fisheries Commission RMIS database identifies whether the hatchery fish recovered are from the Lostine River O&M program or other hatchery program (Carmichael et al. 1987; 1988; 1999; 2004; 2010; Cleary 2008; Cleary and Edwards 2009; 2011; Messmer et al. 1989; 1990; 1991; 1992; 1993; Hoffnagle et al. 2005; Monzyk et al. 2006a; b; c; d; e; 2007; 2008a; b; Feldhaus et al. 2010; 2011).

NEOH M&E Plan Objective 5- Restore and maintain treaty-reserved tribal and recreational fisheries

A. Hatchery and natural-origin adult returns can be adequately forecasted to guide harvest opportunities.
B. Hatchery adult returns are produced at a level of abundance adequate to support fisheries in most years with an acceptable level of impact to natural-spawner escapement.

Restoration and maintenance of a fishery requires the ability to accurately predict adult returns to determine what will be available for harvest. The NEOH M&E Plan uses a common age-class-to-age class conversion model where the estimated number returning per age group is based on conversion rates of the number of earlier age group returns from the previous year, with age 3 natural returns based on total redd counts from three years prior and age 3 hatchery jacks based on the number of smolts released. During the development of the NEOH M&E plan a high degree of correlation (R = 0.94) was found between predicted and actual escapement using this method. However, recent estimates from 2003 to 2009 for natural and hatchery returns of Chinook salmon have shown a weaker correlation (R = 0.29 – natural, R = 0.55 – hatchery). Alternative multivariate linear models that factor in mature age 2 abundance and ocean conditions have been developed by ODFW that improve accuracy but have not been in use long enough to evaluate. In-season run predictions that use adult run timing over Bonneville dam and PIT tag expansion rates have been used for management with some success but tend to underpredict actual adult returns, possibly due to transportation/in-river ratios (currently all Lostine River PIT tag fish represent in-river survival). Run prediction models require run reconstruction as outlined in NEOH M&E Objective 1.

It should be noted that estimates of harvest and catch-per-unit-effort are not estimated by the Lostine River M&E program because harvest monitoring occurs within the NPT DFRM Harvest Division. Estimates and statistics for harvest can be found in the NEOH M&E Plan. NPT and ODFW reports tribal and sport harvest annually.

NEOH M&E Plan Objective 6 - Operate the hatchery programs to achieve optimal production effectiveness while meeting priority management objectives for natural production enhancement, diversity, harvest, impacts to non-target populations

A. We can identify the most effective rearing and release strategies.
B. 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.
C. Frequency or presence of disease in hatchery and natural production groups will not increase above historic levels.

Operation of the hatchery to achieve optimal production effectiveness while meeting priority management objectives for natural production and enhancement requires estimating natural and hatchery smolt survival, juvenile emigration timing, and smolt to adult survival performance measures.

Smolt survival is estimated from release at the Lostine River Acclimation Facility to Lower Granite Dam. Cormack Jolly-Seber estimates of survival are estimated with PITPRO software (Westhagen and Skalski 2003) using PIT tag observations. A total of 8,900 PIT tags have been budgeted for estimating survival for each migration year. A total of 1,200 PIT tags are provided to BPA Project 199202604 (Early Life History of Spring Chinook Salmon in the Grande Ronde Basin) to supplement PIT tagging of natural Chinook salmon juveniles captured at the Lostine River screw trap. Although BPA Project 199202604 PIT tags 1,000 natural Chinook salmon juveniles, only 500 are tagged as smolts in the spring. The 1,200 PIT tags provided to BPA project 199202604 are used across the migration year on parr, pre-smolts and smolts and ensure that an estimate of natural survival for all life stages will be available for comparisons to hatchery juveniles. Comparisons of natural and hatchery survival are made at the smolt life stage because the Lostine River O&M program is releasing hatchery smolts from the acclimation facility. The minimum sample size for obtaining an estimate with 95% C.I of ± 5.0% using SampleSize (Lady 2003) predict that a minimum of 1,200 PIT tags are needed. The remaining 7,500 PIT tags will be allocated to the 250,000 smolts produced by the Lostine River O&M program. Use of PIT tags for in-season adult run predictions for NEOH M&E Objective 5 requires that PIT tags be representative of the run at large to avoid differences in transport/in-river smolt survival ratios. This will be accomplished by diverting 90% of the PIT tagged juvenile hatchery Chinook salmon into the smolt transportation system at Lower Gratie Dam. Under this scenario SampleSize predicts that 7,500 PIT tags are needed for an estimate with 95% C.I. of ± 5.0%.

Methods for estimating juvenile emigration timing is described in NEOH M&E Plan Objective 2. Smolt to adult return rate require estimates of total escapement and run reconstruction as described in NEOH M&E Plan Objective 1.

NEOH M&E Objective 7 - Understand the current status and trends of spring Chinook salmon natural populations and their habitats in the Imnaha and Grande Ronde river basins

A. In-basin habitat is stable and suitable of spring Chinook salmon production
B. We can describe juvenile spring Chinook salmon production in relationship to available habitat in each population and throughout the basin.
C. We can describe annual (and 8-year geometric mean) abundance of natural origin adults relative to management thresholds (minimum spawner abundance and ESA delisting criteria) within prescribed precision targets.
D. Adult spring Chinook salmon utilize all available spawning habitat in each population and throughout the basin.
E. The relationships between life history diversity, life stage survival, abundance and habitat are understood.

Knowledge of water temperature and flow is essential in understanding current status and trends of natural Chinook salmon populations and their habitats because they can influence productivity. Under the NEOH M&E plan these environmental variables are measured using an Environmental Monitoring and Assessment Program (EMAP). However, the scope of work for the Lostine River M&E plan is limited to the collection of water temperatures at river kilometer 1 and at river kilometer 41 using HOBO Water Temp Pro V2 monitors that measure temperature every hour. Flow is obtained from the USGS gage at Baker Road. Bi-weekly median water temperatures from August 1 to September 30 for rkm 1 and 41 will be compared using a Wilcoxon W-test (StatPoint 2005) to determine if water temperatures at river kilometer 41 section differ significantly from river kilometer 1. Bi-weekly intervals will coincide with spawning ground survey sample periods.

NEOH M&E Objective 8 - Coordinate monitoring and evaluation activities and communicate program findings to resource managers

A. Coordination of needed and existing activities within agencies and between all co-managers occurs in an efficient manner.
B. Accurate data summary is continual and timely.
C. Results are communicated in a timely fashion locally and regionally.
D. The M&E program facilitates scientifically sound adaptive management of NEOH.

Timely and thorough communication of the program's status and performance is critical in the adaptive management process of hatchery programs. This is especially important given the co-management nature of this program, the dual authorization from the LSRCP and Northwest Power and Conservation Council (NPCC), and its relationship to the ESA. Facilitating the adaptive management framework involves elements of communication among co-managers throughout the entire M&E program. Every five years, materials will be summarized to facilitate a performance review of the hatchery program. The first of these reviews occurred in 2009 at NPT's 2009 Symposium on Supplementation. The Captive Broodstock Program was coordinated successfully through the Technical Oversight Team (and the Technical Oversight Committee – a basin-wide coordination forum organized by BPA). A similar oversight team would be benficial for coordinating activities among the co-managers for the Lostine River and other LSRCP streams.

Applied adaptive management of fisheries resources is inherently a dynamic process. The Department of Fisheries Resources Management decision process follows eight core steps in a balance of program content, management process, and relationships (between co-managers, resources users, and policy). The steps include: 1) define desired resource condition, 2) determine resource status, 3) identify limiting factor (s), 4) develop management options, 5) apply selected manage action(s), 6) monitor and evaluate results, 7) modify/adjust manage action or goals, and 8) monitor and evaluate results.

As a fisheries co-managers, Nez Perce Tribe and ODFW collect and utilize RME 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 a predetermined decision tree[1] where management recommendations are hard-wired is not readily embraced by managers or functionally possible given a complex environment and adaptive management framework. The following are common decisions associated with hatchery programs, including the Lostine program.

- *Decision to initiate hatchery program*
- *Decision to terminate hatchery program,*

[1] The establishment of a decision tree has been requested by the ISRP in previous proposal reviews. We acknowledge their request and trust our comment to and demonstrated application of transparent and routine assessment of our hatchery programs is an adequate alternative. We remain committed to meet the request for increased accountability and formal decision structure through a "decision framework."

- *Release date,*
- *Size at release,*
- *Release sites*
- *Release method*
- *Release numbers*
- *Numbers of adults collected*
- *Adult collection rate*
- *Distribution (time) of adult collection*
- *Composition (hatchery vs. natural) of hatchery broodstock*
- *Percent hatchery-origin in natural escapement (annual application of multi-year sliding scale, or set percentage for 10 year period)*
- *Pass/keep and trapping rates.*
- *Decision to cull existing production due to fish health condition.*
- *Decision to cull existing production due to production level.*

The information used to inform the decisions listed above 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 process (policy level and management level). Establishing a decision framework, including timeframes, prior to management action implementation is desirable. The framework will guide regular consideration to continue, terminate, or modify specific management actions. The NEOH management assumptions described below provide the technical link to the decision framework with both base expectations and basic data requirements. If any of the assumptions are proven to be false or subject, either by direct project findings or literature, the project's ability to achieve management goals will be formally reconsidered. Routine assessment for change in program scope (continuation) and direction will be applied as necessary, at a minimum every five years.

The following management assumptions were structured from management questions posed in the NEOH M&E Conceptual Plan (Hesse and Harbeck 2000) and are organized by management objectives. The assumptions were developed through co-management meetings, recommendations and review of monitoring and evaluation literature. In 2009, the Nez Perce Tribe held its first supplementation symposium to review performance of our hatchery programs. The symposium was structured around these management assumptions.

The decision framework previously described above does not address the legal and social issues regarding supplementation in the Lostine River. Core GRESCSP O&M production activities for the Lostine River O&M program are funded in part through the authority of the Lower Snake River Fish and Wildlife Compensation Plan (LSRCP). The LSRCP program was approved by the Water Resources Development Act of 1976, PL 94-587, Section 102, 94th Congress, in accordance with the Special Report, LSRCP, June 1975 on file with the Chief of Engineers. The LSRCP was prepared and submitted in compliance with the Fish and Wildlife Coordination Act of 1958, PL 85-624, 85th

Congress, August 12, 1958 to mitigate for the losses of fish and wildlife caused by the construction of dams on lower Snake River. The level of fish production for the Lostine River O&M program for mitigation has been agreed to and incorporated into the court ordered U.S. v. Oregon Interim Management Agreement (2005). The premise behind Lostine River Supplementation is the assumption that the hatchery origin spawners can increase wild (natural) adult abundance without long-term productivity effects (recruits: natural spawner ratios). However, recent evidence questions this assumption (Araki and Blouin 2005; Araki et al. 2007; ODFW unpublished data). The maximum production is capped at 250,000 smolts. Any future decision to alter production goals will be dependent on whether or not the abundance level of naturally produced Chinook salmon meets minimum population viability thresholds as defined by the Interior Columbia Technical Basin Recovery Team (ICTRT 2005) and concurrence through U.S. v. Oregon.

Grande Ronde Supplementation: Lostine River Monitoring and Evaluation: #199800702
To promote the recovery of listed salmon, supplementation programs are recommended by the National Marine Fisheries Service (NMFS 1995), the Northwest Power Planning Council (NPPC 1994), the National Research Council (1996) and the Independent Science Group (1996). These groups define supplementation as “the use of artificial propagation in an attempt to maintain or increase natural production while maintaining the long-term fitness of the target population and keeping ecological and genetic impacts on non-target populations within specific biological limits”.

In response to the recommendation, the Grande Ronde Supplementation O&M/M&E project was initiated as a conservation measure to prevent imminent extirpation of spring Chinook salmon in the Lostine River. The Nez Perce Tribe along with its co-managers proposed a conservation hatchery program in the Grande Ronde Subbasin that consisted of artificial production facilities for salmon as a means of enhancing natural production. Nez Perce Tribe and ODFW monitor and evaluate hatchery supplementation activities on the Lostine River. Since 1997 a weir and trap have been used on the Lostine River to collect chinook broodstock and to acquire biological data. Daily monitoring of the weir coincides with its operation along with the collection of environmental data. In addition, ODFW coordinates spawning ground surveys with NPT. Therefore, the performance of adult and juvenile hatchery fish can be evaluated against the standards set by natural production.

However, there are risks associated with supplementing natural populations. Monitoring and evaluation are integral to managing those risks. Thus, the Lostine River Monitoring and Evaluation project serves as an adaptive management tool for assessing the utility of supplementation as an endangered species recovery method. This proposal addresses the uncertainty specific to hatchery intervention in the Lostine River and will add to our knowledge regarding supplementation in general.

Captive Broodstock Artificial Propagation: #199801006
The Nez Perce Tribe recommended implementation of a captive broodstock and/or conventional hatchery chinook smolt production program in the Lostine River in 1994 in an attempt to preserve a salmon spawning aggregate that was at low levels of abundance

and high risk of extirpation. Subsequently, in 1995, the Tribe cooperated with the ODFW in the planning and development of a chinook salmon captive broodstock management plan for the Grande Ronde River.

Chinook captive broodstock program activities were initiated in 1995 with the collection of juvenile chinook salmon from the Lostine River, Catherine Creek and upper Grande Ronde River. Fish were reared at Lookingglass Fish Hatchery until the smolt stage and then were transferred to temporary facilities at Bonneville Hatchery and to the Manchester laboratory. This allowed the ability to evaluate freshwater and saltwater captive broodstock rearing strategies. Chinook salmon parr were also collected in 1996 from the Lostine River and Catherine Creek and in 1997 through 2003 juvenile chinook were collected from all three streams. Chinook salmon parr are scheduled for captive collection from all three streams in 2004.

Progeny from the captive broodstock program are acclimated under this project with the final acclimation of captive broodstock juveniles occurring in 2011. However, the activities associated with the operation of the captive brood program are covered under a separate section 10 permit (#1101).

<u>Listed Stock Gamete Preservation: #199703800</u>
A link exists between the Listed Stock Gamete Preservation project and this hatchery program. Gametes are collected at Lookingglass Hatchery from adult male Lostine River spring chinook salmon that are collected at the Lostine River weir. This project is covered under its own section 10 permit. The gametes are cryopreserved but would only be used in a last case scenario due to the very low fertilization rates. Cryopreserved gametes have not been used to date in the Lostine River conventional programs. However, gametes have been used in the captive brood program.

<u>Lower Snake River Compensation Plan: #200107</u>
The Nez Perce Tribe Lower Snake River Compensation Plan (LSRCP) hatchery evaluations program is structured to monitor aspects of hatchery production performance, natural production status and performance, interactions of hatchery and natural juveniles, promote genetic conservation, and to contribute to the co-management of the LSRCP program. Adult escapement of both natural and hatchery origin chinook salmon and steelhead in several key spawning aggregates, monitoring of life stage survival of naturally and hatchery produced fish, and identification of the genetic stock structure are monitored. This includes the investigation of downstream emigrating juvenile chinook salmon and steelhead in the Imnaha River to document emigration timing through the Imnaha River and emigration timing, travel time and survival estimation to Snake River dams. Survival estimation to Lower Granite Dam and through the Snake River hydroelectric projects to McNary Dam are estimated using the SURPH.2 model if sufficient numbers of smolts are available for PIT tagging. Smolt to adult return rates (SAR's) of natural chinook salmon will also be estimated dependent on sufficient PIT tag sample sizes. Adult steelhead spawner abundance, genetic structure, and adult steeelhead natural:hatchery composition information is collected on Lightning Creek and Cow Creek in the lower Imnaha River system. Coordination of chinook salmon and steelhead

cryopreservation activities will continue at LSRCP hatchery facilities and in tributary streams in an effort to develop and maintain a germ plasm repository for adult male salmon and steelhead gametes.

12.2) Cooperating and funding agencies.

Cooperators include the U.S Fish and Wildlife Service – Lower Snake River Compensation Plan, Oregon Department of Fish and Wildlife, and the Confederated Tribes of the Umatilla Indian Reservation, NOAA Fisheries, and United States Forest Service.

12.3) Principle investigator or project supervisor and staff.

Jay Hesse – Principle Investigator
Nez Perce Tribe Department of Fisheries Resources Management
Director of Biological Services

Jason Vogel – Technical Coordinator
Nez Perce Tribe Department of Fisheries Resources Management
Research Division Deputy Director

Peter Cleary - Project Supervisor
Nez Perce Tribe Department of Fisheries Resources Management
Lostine M&E Project Leader

Rich Carmichael – Program Director
Northeast-Central Oregon Research and Monitoring
Oregon Department of Fish and Wildlife

Tim Hoffnagle – Research Biologist
Northeast-Central Oregon Research and Monitoring
Oregon Department of Fish and Wildlife
LSRCP Chinook Salmon Project Leader

Joseph Feldhaus – Research Biologist
Northeast-Central Oregon Research and Monitoring
Oregon Department of Fish and Wildlife
LSRCP Chinook Salmon Assistant Project Leader

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

Same as section 2:

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

Index of Spawner Abundance (redd counts)

The index of spawner abundance (redd counts) is a performance measure identified in the monitoring and evaluation plan for northeast Oregon hatcheries (Hesse et al. 2006) and listed in Table 1. Redd counts conducted in the Lostine River are designed to survey all available spawning habitat for spring Chinook salmon. However, redd counts in the Wallowa River only surveyed primary spawning habitat. Redd counts in Hurricane Creek are designed to survey 100% of the spawning habitat (Bill Knox, personnel comm.). All spawning habitat is surveyed in Bear Creek with the exception of a limited portion downstream of the second Forest Service Bridge to the mouth.

Wallowa/Lostine River Spring Chinook Salmon Redd Counts

Spawning ground surveys have been conducted by ODFW since 1950 (Tranquilli et al. 2004). The present methodology was standardized in approximately 1987 and is similar to that used by Hassemer (1993). New redds were flagged on each survey to avoid double counting of redds. Carcasses and live fish encountered during each survey were recorded. The number of new redds observed were recorded and summarized by reach.

Spring Chinook salmon spawning ground surveys are conducted in several streams for the Wallowa/Lostine population. Redd counts in the Lostine River consist of one index section (4.2 km) and five extensive sections (23.4 km). The total distance covered for the index and extensive surveys is 27.6 km (Table 34). In the Walowa Basin downs tream of the confluence with the Lostine River, the Wallowa River was surveyed between the mouth of Bear Creek and Lower Diamond Lane (3.9 km) and one index section (12.7 km) and two extensive are sections (3.6 km) were surveyed in Bear Creek. The total distance surveyed in Bear Creek is 19.3 km. In the Wallowa River Basin upstream of the confluence of the Lostine River, redd count surveys are conducted on Hurricane Creek and the Wallowa River above Enterprise, Oregon. Hurricane Creek has only one index section (5.2 km) and the Wallowa River has one index section (5.3 km) and one extensive section (3.1 km). An additional survey in the Wallowa River was conducted from the Wortman Ranch downstream to Sunrise Road (3.9 km). The total distance surveyed in Hurricane Creek during 2007 was 5.2 km and the total distance surveyed in the Wallowa River during 2007 was 16.2 km.

The total number of redds located in the Lostine River (treatment stream) and Minam River (unsupplemented reference stream) were compared by fitting the number of redds by year with a linear regression. The intercepts and slopes of the linear regression lines where compared using ANOVA (Statpoint 2005) and differences were considered significant at a 90% or higher confidence level when $P < 0.05$.

Table 34. Total distance and GPS locations for redd count survey sections in the Lostine River, Bear Creek, Hurricane Creek, and Wallowa River. Start and end coordinates are listed from downstream to upstream (redd surveys are conducted in both directions.

River	Section	Transect Length (km)	GPS Start Location	GPS End Location
Lostine R.	Index	4.2	45.43897 117.42633	45.40825 117.42809
	Downstream of Index (confluence to Hwy 82)	8.4	45.55216 117.49007	45.49648 117.44029
	Downstream of Index (trout farm bridge to index)	5.0	45.46925 117.42517	45.43897 117.42633
	Upstream of Index (Six Mile Brdg. to Pole Brgd.)	2.7	45.40825 117.42809	45.38668 117.42517
	Upstream of Index (Williamson to W.W. C.G)	4.7	45.34184 117.41120	45.30055 117.39697
	Upstream of Index (Bowman TH. to Turkey Flat.)	2.6	45.29335 117.39547	45.27642 117.38981
	Upstream of Index (French C.G. to Arrow C.G.)	0.3	45.49528 117.44667	45.33694 117.42361
Bear Cr.	Index	12.7	45.50818 117.55701	45.41048 117.53494
	Downstream of Index	3.4	45.48250 117.55549	45.50818 117.55701
	Upstream of Index	3.2	45.41048 117.53494	45.40504 117.53803
Hurricane Cr.	Index	5.2	45.41908 117.29877	45.38189 117.26238
Wallowa R.	Index	5.3	45.39671 117.25234	45.37479 117.24860
	Downstream of Index (Bear Creek to Lower Diamond Lane).	3.9	45.35082 117.31946	45.3566 117.31785
	Downstream of Index (Wortman Ranch to Sunrise Road)	3.9	45.26003 117.19248	45.26707 117.21214
	Upstream of Index	3.1	45.37479 117.24860	45.35301 117.23663

Adult Escapement to Tributary

Mark and recapture methodology was used to estimate tributary specific adult escapement, a performance measure identified in Hesse et al. 2006 (Table 4). The Lostine River was the only tributary in the Wallowa/Lostine River Spring Chinook salmon population for which adult escapement estimates were calculated because the stream is monitored by a weir that allows for mark recapture estimates. The following data sets were used to estimate this performance measure: weir/trap data, redd count data, and carcass data.

Trap/Weir Operations

Adult escapement of Lostine River Chinook salmon was monitored via a panel weir placed at river kilometer (rkm) 1.4. The panel weir was suspended from above by a crane and was anchored to the stream bed and lowered when debris accumulated on the panels. The weir was equipped with an upstream live box. The entrance to the live box was a standard fyke style configuration.

All fish captured were anesthetized with a tricaine methanesulfonate (MS-222) bath containing 3 grams of MS-222 per 18.9 L of water. Fish were examined for fork length (cm), sex (using visual morphometric characters), and marks (radio tags, passive integrated transponder tags (PIT), coded wire tags, visual implant elastomer (VIE) tags, jaw tags and fin clips). Fish handled at the weir were marked by taking a standard sized paper punch of tissue from the opercle. Genetic samples were collected from opercle tissue removed by the paper punch and stored in a labeled vial with 100% solution of non-denatured ethanol. The tissue was shared with the Genetic Monitoring and Evaluation Program for Salmon and Steelhead (BPA project #1986-096-00) for a future genetic pedigree analysis. The opercle punch was used as the identifying mark to determine recaptures for the adult population estimate above the weir. Anesthetized adults were then placed in a sheltered pool upstream of the weir and allowed to leave, volitionally, after sufficient recovery. The water depth in the Lostine River above the weir does not always provide at least 20 cm of water across the width of the stream channel which is the sufficient stream flow for adult Chinook salmon passage (R2 Resource Consultants 1998). When stream flows (during drought periods) reach this minimum level adults were transported by truck to rkm 21 or further upstream. The total numbers of Chinook salmon returning to the adult trap and their disposition (released upstream to spawn naturally or collected for broodstock) were recorded daily.

Carcass Surveys

Carcass collections generally coincided with redd count surveys from approximately August 24 to September 19. Additional carcasses were collected when they were known to be present during periods outside of the scheduled redd count surveys. The date and location (reach) in which carcasses were recovered was noted. Carcasses were examined for opercle punches to determine if the fish was observed at the weir, adipose fin clips and VIE tags to determine rearing origin, and sex. Carcass fork length was measured to the nearest half cm. Scales were collected from natural origin fish and snouts were collected from hatchery origin fish to verify age. Female carcasses were cut open to visually estimate the percent spawned in 25% gradations. The tails of examined carcasses were cut off to prevent duplication of sampling.

Escapement Estimates

Escapement above the Lostine River weir was estimated by using an adjusted Peterson estimator (Chapman 1951; Seber 1982);

$$N = \frac{(n_1 + 1)(n_2 + 1)}{(m_2 + 1)} - 1$$

where n_1 is the total number of marked (opercular punched) adults released above the weir with possibility of recapture, n_2 is the total number of carcasses (marked and unmarked) recovered above the weir, and m_2 is the total number of opercular punched adults recovered as carcasses. The variance for escapement was estimated as in Seber (1970) and Wittes (1972), as cited in Seber (1982);

$$V = \frac{(n_1 + 1)(n_2 + 1)(n_1 - m_2)(n_2 - m_2)}{(m_2 + 1)^2 (m_2 + 2)}$$

Confidence intervals were assumed to be asymptotically distributed and estimated as $\pm 1.96 \cdot (SE)$. The mark and recapture estimate was terminated after the last complete carcass survey of the year because fish captured and released at the weir after the last carcass survey would have no chance of being recovered.

Utilizing this escapement estimate divided by the redds counted above the weir results in a fish per redd estimate above the weir. The above the weir fish per redd estimate was multiplied by the number of redds below the weir to estimate escapement below the weir.

Fish captured after the last survey and passed above the weir were added to the point estimate of escapement. The estimate for total escapement was the sum of estimated escapement above and below the weir plus adults that were captured and removed due to mortality, broodstock needs, adult out-plants, used for subsistence distribution or were captured and released after the last redd survey.

An underlying critical assumption for the mark-recapture population estimate used for estimating abundance is that all marked carcasses have an equal chance of recovery. A comparison of fork lengths of marked releases to fork lengths of marked recaptures using a Mann-Whitney (Wilcoxon) rank sum test (Seber 1982) was used to determine if recoveries of marked carcasses were influenced by size. If recoveries were influenced by size then escapement would be estimated by size class. ODFW (unpublished data) found that the mean recovery rate of carcasses of age 3 adults (jacks) was one-half that of ages

4 and 5 adults.

Adult Spawner Abundance

Adult spawner abundance, a performance measure identified in Table 1, represents the number of available fish that were available to spawn in nature. Spawner abundance in the Lostine River was determined from mark-recapture estimates. Pre-spawning mortality was estimated from the number of female carcass recoveries with estimates of 75% or more of their eggs remaining and the number of male carcasses recovered prior to the construction of the first redd divided by the total number of carcasses recovered. Spawner abundance in the Wallowa River, Bear Creek and Hurricane Creek were estimated using a standard fish/redd estimate multiplied by the number of redds.

Hatchery Fraction

The hatchery fraction is a performance measure in Table 1 that describes the run composition of natural and hatchery fish abundance. Weir data were used when available. When weir data were not available, carcass recovery data were used. Two different hatchery fractions were needed to describe run composition to the Lostine River. The first characterized the total return to the Lostine River. The second characterized the remaining fish left in-river to spawn because removal of returning adults for broodstock, out-planting, and harvest can alter the hatchery fraction of fish returning to the weir.

Hatchery Escapement and Spawner Composition

Hatchery escapement composition was calculated from the proportion of hatchery and natural carcasses collected on the spawning grounds. The hatchery spawner composition above the weir was also estimated from the proportion of natural and hatchery Chinook salmon carcasses collected on the spawning grounds.

Hatchery Production Abundance

Hatchery production abundance is a performance measure identified in Table 1 that describes the abundance of juvenile hatchery Chinook salmon.

Lostine River Juvenile Hatchery Abundance

Juvenile abundance for hatchery Chinook salmon was presented as the total number of smolts transported to the Lostine River Acclimation Facility (LRAF) minus the mortalities that occurred prior to release. The initial number of fish per raceway at Lookingglass Hatchery was determined from a census count taken during coded wire tagging minus mortalities.

Juvenile Emigrant Abundance

Juvenile emigrant abundance is a performance measure identified in Table 4 that describes the number of juvenile natural Chinook salmon estimated to have emigrated from a tributary. These estimates come from the smolt trap operated by the ODFW Early Life History Project.

Lostine River Natural Chinook Salmon Smolt Abundance

Natural Chinook salmon juvenile abundance estimates were obtained using a screw trap located at rkm 3 by ODFW. Methods for estimating juvenile abundance can be found in the annual report for BPA project # 199202604 (Van Dyke et al. 2008). Estimates of smolt abundance were provided by ODFW (Brian Jonasson personal comm.).

Adult Spawner Spatial Distribution

Adult spawner spatial distribution is a performance measure identified in Table 1 that describes the range and location of spawning Wallowa/Lostine River Chinook salmon. Knowledge of the distribution of redds is confined to redd count survey areas. Only the female carcasses are used to describe distribution of natural and hatchery Chinook salmon because males may roam between two or more redds after spawning.

Distribution of Redds and Female Carcasses

The percentage of redds within each survey reach above and below the weir were summarized to show the distribution of redds within the Lostine River. The percent of redds per reach was calculated as the total number of redds in a given reach divided by the total number of redds identified within the stream. The numbers of natural and hatchery Chinook salmon female carcasses recovered in each survey reach were summarized to compare the spawning distributions of hatchery and natural females. The frequency of natural and hatchery female recoveries per reach was compared using a Chi-square test as described by Quinn and Keough (2002). Differences were considered significant when $P < 0.05$.

Juvenile Survival to Lower Granite and McNary Dams

Juvenile survival to Lower Granite Dam, and Columbia River mainstem dams are two separate performance measures of the monitoring and evaluation plan for northeast Oregon listed in Table 4. Methods for survival estimates are given below.

Juvenile Survival Estimates

Hatchery fish were PIT-tagged during October at Lookingglass Hatchery prior to transportation to the acclimation facility. Fish selected for PIT-tagging were marked using hand injector units following the methods described by Prentice et al. (1986, 1990) and Matthews et al. (1990, 1992). Natural fish were PIT-tagged during the spring at a screw trap located at rkm 3 and operated by ODFW for the program titled "Investigate Life History of Spring Chinook salmon and Summer Steelhead in the Grande Ronde River Basin and Monitor Salmonid Populations and Habitat" (BPA project # 1992-026-04). Only natural Chinook salmon tagged and released from March 1 to May 31 were retrieved from the PTAGIS database to compare to hatchery Chinook salmon smolts (ODFW unpublished data). March 1 to May 31 was chosen because it represents a time frame when spring migrating natural Chinook salmon smolts are captured and PIT-tagged in the Lostine River. A previous study from July 1999 to June 2000 showed that 68% of juvenile natural Chinook salmon emigrated from July to January and that 31% emigrated from February to June (Monzyk et al. 2002). Spring acclimated volitional releases of conventional and captive broodstock juveniles are intended to mimic spring migrating natural Chinook salmon smolts. The only comparison made between natural and hatchery Chinook salmon is at the smolt life stage.

Downstream juvenile survival probabilities from release to downstream dams were estimated using the Cormack, Jolly, and Seber (1964, 1965, and 1965, respectively, as cited in Smith et al. 1994) methodology with the Survival Using Proportional Hazards (SURPH) model (Smith et. al., 1994). The 95% confidence intervals were approximated from the standard error calculated by SURPH as SE · (±1.96). A Z-test was used to compare survival estimates of natural and hatchery Chinook salmon. Differences were considered significant when $P < 0.05$. Abbreviations used in this report for downstream dams are as follows: Lower Granite Dam (LGD), Little Goose Dam (LGS), Lower Monumental Dam (LMD), Ice Harbor Dam (IHD), McNary Dam (MCD), and Bonneville Dam (BVD).

Individual survival estimates from the acclimation facility to the Lostine River screw trap (S_1) located 18 km immediately downstream of the acclimation facility were calculated as the ratio of the overall survival estimate from the acclimation facility to LGD ($S_{Overall}$) divided by the estimated survival from the screw trap to LGD (S_2). It was assumed that survival probabilities of release groups from the acclimation facility and from the screw trap would be equal from the screw trap to LDG. Therefore, a standard error (se_1) for S_1 could be estimated as:

$$se_1 = S_1\sqrt{(se_{Overall} / S_{Overall})^2 + (se_2 / S_2)^2}$$

where se_2 and $se_{Overall}$ are the standard errors for S_2 and $S_{Overall}$, respectively.
Smolt-to-Adult Return Rates

The smolt-to-adult return rate is a performance measures of the monitoring and evaluation plan for northeast Oregon listed in Table 4. The performance measure describes the ratio of adult returns for a group of migrants. Methods for survival estimates are given below.

Lostine River Smolt to Adult Return Rates

A smolt to adult return rate was estimated for hatchery Chinook salmon as the number of adult returns per brood year divided by the number of smolts released. Adult returns of hatchery Chinook salmon were derived from the total escapement estimate multiplied by the escapment composition for annual total escapement estimates produced. The annual number of conventional and captive returns per year was determined from the percentage of conventional and captive adults captured annually. Estimates of age at return for any given year were determined by fork length (corrected for known age returns). The estimated percentage of age 3, 4, and 5 year old Chinook salmon per rearing program (natural, conventional, or captive) observed at the weir was applied to the estimated escapement for conventional and captive returns and the total number of returns per brood year was calculated. The smolt-to-adult return rate for hatchery Chinook salmon included post-release mortality and harvested downstream of the weir.

Natural Chinook salmon smolt-to-adult return rates were estimated using total escapement. The number of natural Chinook salmon returning per brood year was estimated the same as was previously described for hatchery Chinook salmon. The number of natural Chinook salmon brood year adult returns was divided by the estimated number of smolts estimated as previously described in the methods for Juvenile Emigrant Abundance. Natural Chinook salmon smolt-to-adult return rates assume there is no natural production contributing to natural adult returns in the 2 rkm between the weir and the screw trap. Although there is some suitable spawning habitat in the vicinity of the weir, much of the substrate between the weir and screw trap consists of large cobles and bedrock and few if any redds are located within the 2 rkm.

Progeny-to-Parent Ratios

Progeny-to-parent ratios are a survival/productivity measure listed in Table 1 that can be used to gage recruitment. Progeny-to-parent ratios may change due to changes in life history characteristics over time or changes in life stage specific survivals (i.e., smolt-to-adult return rates). Methods for estimating progeny-to-parent ratios are given below.

Natural and Hatchery Chinook Salmon Progeny-to-Parent Ratios

Natural and hatchery Chinook salmon progeny-to-parent ratios were calculated. Natural progeny-to-parent ratios were calculated by dividing the number of returning natural origin adult progeny produced during a single brood year, by their number of natural and hatchery origin parents spawning in nature during that brood year. Hatchery Chinook salmon progeny-to-parent ratios were calculated by dividing the number or returning hatchery origin adult progeny produced during a single brood year by the number of parent broodstock.

Two performance measures were used to inform co-managers on the genetic characteristics of natural and supplemented Chinook salmon in the Lostine River; genetic diversity and reproductive success. These performance measures are life-stage specific and are applicable at the population level. Analysis of the genetic material was completed by the Columbia River Inter-Tribal Fish Commission’s Hagerman Fish

Culture Experimental Station and the Northwest Fisheries Science Center.

Genetic Diversity

The questions posed for genetic diversity were as follows: 1) Are there significant temporal (year-to-year) genetic variation in the Lostine River Chinook salmon population? 2) Are there significant genetic differences between early and late run Chinook salmon (i.e., June/July versus August/September) in the Lostine River? And 3) Are there significant genetic differences between hatchery and natural Chinook salmon in the Lostine River?

Tissue Sample Analysis

Tissue samples were collected at the weir from the opercle plate of captured adults and stored in a 2 ml vial of non-denatured ethanol. Vials were labeled by year and a sequential ID number that related to the time of capture, origin, and biological characteristics. Samples were split at Hagerman Fish Culture Experimental Station and provided to the Northwest Fisheries Science Center.

Parentage Analysis

Microsatellite variation was used to conduct parentage analysis and attempt to quantify relative reproductive success of natural and hatchery origin Chinook salmon (Baird et al. 2006). All analysis were conducted by the Northwest Fisheries Science Center by the Genetic Monitoring and Evaluation Program for Salmon and Steelhead (BPA project #198609600).

Age-at-Return

Age-at-return is an important performance measure identified in Table 4 necessary for reconstructing adult returns by brood year.

Lostine River Adult Spring Chinook Salmon Age-at-Return

Age was determined by the fork length of returning adults: age 3, < 63 cm, age 4, 63 - 85 cm, and age 5, > 85 cm. When possible, age was validated using VIE, CWT, PIT tags, or scales. Adults captured from the conventional rearing program were marked with VIE tags as juveniles. Placement of the VIE tag alternated from the right and left side annually so it was possible to verify the age of returning conventional-produced Chinook salmon using the fork length and position of the VIE tag (juvenile Chinook salmon were marked near the right eye in even brood years and on the left in odd brood years). If a known aged fish had been incorrectly aged by fork length it was reassigned to the correct age class by determining which age classes had matching VIE tags or by reading coded-wire tags.

Brood year age structure was reported as the percentage of ages 3, 4, and 5 Chinook salmon returning in the first, second, and third year after the juveniles would have migrated to the ocean. The number of brood year returns per age class was calculated as described in the methodology for smolt to adult return rates. Statistical differences between the percentage of natural and hatchery (conventional, or captive) brood year returns per age class were determined using a one tailed Z-test where differences were considered significant when $P < 0.05$ (Moore and McCabe 1993).

Size-at-Emigration and Size-at-Return

Two performance measures listed in Table 4, size-at-emigration and size-at-return, are used to determine if life history characteristics of natural and hatchery Chinook salmon are similar.

Lostine River Spring Chinook Salmon Size at Emigration and Size-at-Return

Juvenile size at emigration of hatchery Chinook salmon released in the spring relative to natural Chinook salmon captured in the spring was obtained from fork length data provided by ODFW though funding by the Bonneville Power Administration (BPA) for project 1992-026-04, titled "Investigate Life History of Spring Chinook Salmon and Summer Steelhead in the Grande Ronde River Basin and Monitor Salmonid Populations and Habitat." Fork length data for both natural and hatchery Chinook salmon represents natural and hatchery Chinook salmon collected from March 1 to May 31, 2007 at the Lostine River screw trap. Length was measured to the nearest mm. A t-test was used to compare means when standard skewness values were within ±2 and a Wilcoxon W test to compare medians when the distributions were not normal as indicated by standard skewness values outside of a range of ±2 (StatPoint 2005). Differences were considered significant at $P < 0.05$.

Adult return fork lengths were collected at the weir and grouped by origin as determined from external markings. Length frequency distributions were plotted using 1 cm length classes by origin. No comparisons of adult returns per age class were made because of limited sample sizes of tagged known aged returns for 2007.

Adult Spawner Sex Ratio

The adult spawner sex ratio performance measure listed in Table 4 describes this life history trait for returning natural and hatchery Chinook salmon.

Lostine River Spawner Sex Ratio

The sex of captured adults at the weir was determined visually. The proportion of male and females captured was used to represent the escapement sex ratio. Adult spawner sex ratio above the weir was calculated from the number of males and females passed above the weir and applied to the estimated number of spawners above the weir to calculate the number of male and female spawners. Above the weir the escapement sex ratio was applied to the estimated number of spawners below the weir. Chinook salmon of all age classes were included in the summary of spawner sex ratio.

Fecundity

Fecundity was determined at Lookingglass Hatchery, using a variety of methods. Early methods used the weight of a known number of eggs divided by the total weight of all of the eggs. More recently a Jensorter has been used to count live and dead eggs at eye-up, which were summed to provide total fecundity.

We compared fecundity between natural and hatchery Chinook salmon of the same age class. An analysis of variance table was constructed and an F-test was used to determine if there were significant differences between slopes and y-intercepts (Statpoint 2005). Differences were considered significant when $P < 0.05$.

Comparison of fecundity of known age 4 Chinook salmon spawned in 2004 to 2006 was made using a T-test where differences were considered significant when $P < 0.05$.

Adult Run Timing

The adult run timing performance measure listed in Table 4 is used to compare this life history characteristic of natural and hatchery Chinook salmon.

Lostine River Adult Run Timing

Adult run timing at the Lostine River weir was summarized by calculating the cumulative catch per day divided by the cumulative catch per year for an estimate of 10%, median, and 90% passage at the Lostine River weir. Adult run timing was estimated for each rearing program; conventional, captive, and naturally produced Chinook salmon. Significant differences in cumulative run timing distribution between rearing programs was compared by converting individual arrival dates to numeric values ranging from 1-365 and comparing the cumulative distributions using a Kolmogorov-Smirnov test with differences considered significant when $P < 0.05$ (Statpoint 2005).

Mainstem Arrival Timing (Lower Granite Dam)

Juvenile arrival timing at Lower Granite Dam is a performance measure listed in Table 4 and is used to compare this life history characteristic of natural and hatchery Chinook salmon.

Spring Migrant Arrival Timing at Lower Granite Dam

Juvenile Chinook salmon arrival timing at LGD was determined from first observations at LGD. Only natural Chinook salmon PIT-tagged ore recaptured from March 1 to May 31 at the ODFW Lostine River screw trap were used for comparisons to juvenile hatchery Chinook salmon (ODFW unpublished data). Observations were grouped daily and the cumulative percent of arrival was calculated from the total number detected on any given day divided by the total number detected per year. Significant differences in cumulative run timing distribution between natural and hatchery origin fish were compared by converting individual arrival dates to numeric values ranging from 1-365 and comparing the cumulative distributions using a Kolmogorov-Smirnov test with differences considered significant when $P < 0.05$ (Statpoint 2005).

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

<u>Adult Summer Chinook Salmon Spawning Ground Surveys</u>
Studies will be implemented mainly between July and September.

<u>Operation of Juvenile Trapping and Marking</u>
Studies will be implemented mainly between January and December.

<u>Operation of Adult Weir</u>
Studies will be implemented mainly between May and September

Research occurs during weir operation. See Section 7.

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

See Sections 5, 7, and 10.

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

The Lostine program anticipates that there is a certain level of mortality associated with this supplementation program. This mortality includes, but is not limited to pre-spawn mortality of adult broodstock, culling of diseased eggs, green egg-to-smolt rearing mortality, handling mortality during transfer/transport, disease sampling, and tagging mortality. The size of the program is developed to account for these mortalities in order to meet the desired production target.

All estimates of take are made by direct count of fish at the trapping facility, during frequent bank surveys for a one-mile reach above and below the weir, or during six spawning ground surveys both above and below the weir.

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

See Section 2; Table 14 and Table 15.

This program currently has no ESA coverage for the operation of the adult weir or hatchery operations. The research activities are covered under ESA Permit #1134 for the juvenile screw trap and completion of spawning ground surveys, for take limits and restrictions refer to those specific permits. The requested level of take by hatchery activity is listed in Table 14 and Table 15.

12.10) Alternative methods to achieve project objectives.

Unknown.

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

See Sections 2 and Table 1.

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.

<u>Operation of Adult Weir</u>

Trapping, handling or tagging occurs during the conduct of this project. NMFS standards for barrier/trap facilities have been incorporated into the study. The picket weir in place in the Lostine River captures Chinook salmon and a very small number of adult post spawned steelhead. These fish are handled and released with minimal opportunity for injury. An adjustable mount will be used that permits the transducer to be adjusted for changing water level.

NOAA Fisheries criteria for weir and trap facilities were followed in the development of the Lostine River panel weir. The weir spans approximately 60 meters across the river channel at a 45 ° angle with 16 panels spanning the river. The trap is designed to guide fish into the trap and with a V-shaped fyke opening to inhibit escape.

The holding area is placed in an area deep enough to maintain fish during minimum flows and where flow is sufficient to attract fish. Shade material covers the top of the trap and a solid panel on the upstream side of the trap provides an eddy for captured fish. Metal edges inside the trap are covered by neoprene cushions. Processing of trapped fish occurs quickly to minimize their time out of water and their time under anesthetic.

Although the weir is designed to guide immigrating fish to the traps, there is concern that it may negatively affect fish migrations. During weir operation, bank surveys are conducted to detect any negative impact on fish movement.

SECTION 13. ATTACHMENTS AND CITATIONS

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

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

Name, Title, and Signature of Applicant:

Certified by_____________________________ Date:_____________

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

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

Activities associated with the operation of the Lostine program as they affect bull trout are authorized under USFWS Permit #TE001589-3.

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

Bull Trout

Current population or demographic status for bull trout, specific to Lostine River, was not available.

There is reason to believe that bull trout captures in Lostine River are made on fish that are in the process of upstream spawning migrations into smaller tributaries, and that their subsequent downstream migrations occur during periods when traps (e.g., adult weir) are not operative. For example, it is not typical for Lostine personnel to observe bull trout redds during mainstem Chinook redd surveys. This lack of documentation is not surprising due to the difference in spawn timing between the two species; however bull trout spawn timing has been documented to occur as early as September, or once water temperatures reach 48°F (e.g., Fraley and Shepherd 1989). Because we often see a decrease in mean temperatures in mainstem reaches, and still fail to see mainstem spawning of bull trout, it is reasonable to assume that the bull trout that are trapped at the Lostine River weir are using mainstem habitats for only for migration, and rather rely upon the smaller, unsurveyed tributaries for spawning.

15.3) Analysis of effects.

Hatchery operations - The only identified direct effect of the hatchery operation on bull trout in Lostine River is trapping migrant fluvial fish in the adult Chinook trap. The trap is operated June into mid September. Number of fish trapped annually ranges from 0 to 20. These range in size from 17 mm to 60 mm in length. Fish are held a maximum of one day, handled and passed upstream.
Fish health –See section 3.5 and 7.7.

Ecological/biological - Releases of smolts and juveniles occur downstream of most bull trout rearing areas minimizing potential competition and predation. These releases may however provide substantial forage for larger fluvial bull trout over-wintering in the lower reaches of the system.

Predation/competition – NA

Monitoring and evaluations – There is no direct monitoring of Bull trout, however they are a bycatch product of trap operations.

Habitat - See USFWS (2005) for habitat based classification methodology.

15.4) Actions taken to mitigate for potential effects.

- Smolts are released at a time and size designed to optimize the percentage of smolts migrating out of the system and minimize interaction with bull trout.
- Bull trout handled at the adult trap are sorted and released immediately upstream.

15.5) References

See Section 13 above.