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

November 23, 2010

Mr. Rob Jones
NOAA Fisheries Service
Salmon Recovery Division
1201 NE Lloyd Blvd., Suite 1100
Portland, Oregon 97232

Dear Mr. Jones:

Attached is the final Hatchery Genetic Management Plan (HGMPs) for the Washington Department of Fish and Wildlife's (WDFW) Tucannon River summer steelhead endemic stock program, as required for compliance under the Endangered Species Act. We are submitting this HGMP as an application for Endangered Species Act (ESA) Section 10 permit.

Production and operational changes to this program were agreed to in the spring of 2010 by WDFW, Lower Snake River Compensation Program, and the co-managers (Nez Perce Tribe and Confederated Tribes of the Umatilla Indian Reservation) and have been incorporated into the HGMPs. Furthermore, the production changes were submitted through the *U.S. v. Oregon* Production Advisory Committee approval process, and formally approved by the Policy Group in May of 2010 for court reported revisions to the current 2008 – 2017 *U.S. v. Oregon* Management Agreement.

If you have questions or wish to discuss the HGMP, please don't hesitate to contact Mark Schuck at the Snake River Lab, Jon Lovrak, Lyons Ferry Complex Manager, or myself.

Sincerely,

Heather Bartlett
Hatcheries Division Manager

Enclosures (1)

cc: Jon Lovrak
Glen Mendel
Mark Schuck
Joe Bumgarner
James Dixon
Jon Anderson
Scott Marshall, LSRCP
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# WDFW Tucannon River Endemic Stock Summer Steelhead-Tucannon River Release

## HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

| | |
|---|---|
| **Hatchery Program:** | **Snake River Summer Steelhead - Tucannon River Stock: Lyons Ferry Complex** |
| **Species or Hatchery Stock:** | **Tucannon River Summer Steelhead** ***Oncorhynchus mykiss*** |
| **Agency/Operator:** | **Washington Department of Fish Wildlife** |
| **Watershed and Region:** | **Tucannon River / Snake River / Columbia Basin, Washington State** |
| **Date Submitted:** | **September 1, 2001** |
| **Date Last Updated:** | **October 8, 2010** |

# SECTION 1. GENERAL PROGRAM DESCRIPTION

## 1.1) Name of hatchery or program.

Hatchery: Lyons Ferry Complex.
Program: Tucannon River Endemic Summer Steelhead Broodstock Program

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

Summer Steelhead *(O. Mykiss),* Tucannon River (Snake River ESU)

## 1.3) Responsible organization and individuals

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

1. U. S. Fish and Wildlife Service – Lower Snake River Compensation Plan (LSRCP) – Provides Program funding/oversight and provides coordination responsibility between all LSRCP cooperators.
2. Nez Perce Tribe (NPT) – Co-manager.
3. Confederated Tribes of the Umatilla Indian Reservation – Co-manager.
4. NOAA Fisheries – Co-manager.

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

The LSRCP has funded production of mitigation fish (LFH stock summer steelhead) established as a result of hydroelectric projects in the Snake River that were released in the Tucannon River (2010 last release). The LSRCP program is committed to funding actions that are responsive to ESA needs for listed Snake River steelhead affected by LSRCP hatchery actions, while provided mitigation fisheries as detailed in the LSRCP. Currently, steelhead management for mitigation in the Tucannon River is mandated to provide 875 returning adult steelhead for harvest.

While both Operational and Evaluation costs are presently covered by LSRCP funding, additional funding will be required to fully develop the Tucannon River endemic summer steelhead broodstock program (BPA under RPA 40). For example, the temporary adult trap used in the lower/middle Tucannon River is inadequate under high flows, and the location of the trap may be too low in the system, increasing the chance that other basin stocks may be collected as part of the new broodstock. These limitations will likely limit the progress of the program in the future unless a completely separate adult trap can be constructed in the middle/lower river, or returns to the upper basin increase and broodstock can be removed from the river at Tucannon Fish Hatchery without harming the run to the upper river. Program costs (full mitigation program of 150,000 smolts/year) are currently unknown until facility modifications at Lyons Ferry and Tucannon Fish Hatcheries can be made).

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

Broodstock holding and spawning, Incubation, rearing, and marking – Currently this is being done at Lyons Ferry Hatchery – along the lower Snake River in Franklin County, Washington (RM 58), just below the mouth of the Palouse River. In the future, the entire program would be at Tucannon Fish Hatchery following facility modifications.

*Final rearing and transport for release* - Tucannon Hatchery – RM 36 on the Tucannon River (WRIA 35)

*Adult Trapping* – Tucannon FH Adult Trap would be the primary adult trap – RM 36.5 on the Tucannon River (WRIA 35)

*Adult Trapping* - Temporary Adult Trap – Secondary to compliment the Tucannon FH adult trap at an unspecified location further downstream (WRIA 35)

### 1.6) Type of program. **Integrated Recovery / Harvest**

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

**The preferred alternative will immediately eliminate releases of Lyons Ferry Hatchery (LFH) stock from the Tucannon River (2010 last release), and phase in an expansion of the endemic stock production. Evaluation efforts will be expanded to monitor endemic stock**

**performance and the natural population response to increased use of endemic steelhead and elimination of LFH stock releases. The expanded evaluation will also aid in determining wild stock status for ESA. These actions are consistent with RPAs 40 and 50.7 from the 2008 FCRPS Biological Opinion. In the near term, mitigation production of the LFH stock will be moved to direct releases from the LFH into Snake River, however long term management purpose would be to achieve both conservation and mitigation harvest purposes with releases in the Tucannon River:**

1. **Conservation:** Artificially maintain and/or increase numbers of naturally reproducing Tucannon River steelhead that successfully produce viable progeny which contribute to the conservation and recovery of the Tucannon River population and Snake River ESU.

2. **Mitigation Harvest:** Provide mitigation as specified under the LSRCP program for losses to Tucannon River steelhead due to construction of Snake River Dams while meeting conservation and recovery criteria established for the Tucannon River population and Snake River ESU. Provide harvest opportunities established under *US v Oregon*, Washington's Statewide Steelhead Management Plan, and the WDFW's Fishery Management and Evaluation Plan (FMEP) for Snake River for fisheries.

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

Mitigation goals for the LSRCP were established in a three-step process (COE 1975). First the escapement that occurred prior to construction of the four dams was estimated. Second an estimate was made of the reduction in escapement (loss) caused by construction and operation of the dams (e.g. direct mortality of smolt). Last, a catch to escapement ratio was used to estimate the future production that was forgone in commercial and recreational fisheries as result of the reduced spawning escapement. Assuming that the fisheries below the project area would continue to be prosecuted into the future as they had in the past, LSRCP adult return goals were expressed in terms of the adult escapement back to, or above the project area. For steelhead, the escapement above Lower Granite Dam prior to construction of these dams was estimated at 114,800. 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 55,100. This number established the LSRCP escapement mitigation goal. Based on a catch to escapement ratio of 2:1, the anticipated benefit to fisheries below Lower Granite Dam was expected to be 110,200 fish.

| Component | Number |
|---|---|
| Escapement Above Lower Granite Dam | 55,100 |
| Commercial Harvest | 37,000 |
| Recreational Harvest Below Lower Granite Dam | 73,200 |

| | |
|---|---|
| Total | 165,300 |

One component of the steelhead mitigation computations was accounting for the estimated loss of 130,000 recreational angler days of effort caused by transforming the free flowing Snake River into a series of reservoirs. The COE recommended purchasing land to provide access for sportsman to compensate for this loss. When computing expected benefits for this loss, the COE assumed this access would be provided, that the 130,000 angler days would be restored and that that one fish would be caught for each five hours of effort. As such, the COE expected that 26,000 of the 110,200 steelhead would be caught in the Snake River below Lower Granite Dam. Location of the hatchery facilities was a key decision and the COE recommended: " These [steelhead hatcheries] should be constructed upstream of the Lower Snake River Project to provide for the sport fisheries of eastern Oregon, Washington and Idaho as well as the downriver fisheries". While recognizing that some steelhead crossing Lower Granite Dam would be caught, and some used for hatchery broodstock, no other specific priorities or goals were established regarding how the remaining fish might be used.

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 2:1 catch to escapement ratio has been less than expected and this has resulted in fewer adults being produced in most years.
- The listing of Snake River fall Chinook and Snake River Steelhead under the Endangered Species Act has resulted in significant curtailment of commercial, recreational and tribal fisheries throughout the mainstem Columbia River. This has resulted in a much higher percentage of the annual run returning to the project area than was expected.
- The U.S. v. Oregon court-stipulated Fishery Management Plan has established specific hatchery production agreements between the states, tribes and federal government and this has diversified the hatchery program by adding new off station releases to meet short term conservation objectives.

The Tucannon River endemic stock program is being designed to escape 875 steelhead back to the project area after a harvest of 1,750. However, many modifications at Lyons Ferry Complex will have to occur before these goals can be reached. In the short term, this program will act as a conservation program to assist in the recovery of natural steelhead in the Tucannon River. In the long-term, a portion of the program will designated for harvest mitigation to fulfill (or partially fulfill) the LSRCP goals. Depending on smolt-to-adult survivals from this program, it is realized that the harvest mitigation portion of the program could fall short of the LSRCP goals. WDFW will monitor returns, and will likely propose that some of the harvest mitigation may have to be moved to another program. While recognizing the overarching purpose and goals established for the LSRCP, and realities regarding changes since the program was authorized, the following objectives for the beneficial uses of steelhead returns have been established for the period through 2017:

1. To 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.

2. To trap 40-90 broodstock annually to perpetuate this program.

3. Eventually release up to 150,000 Tucannon Endemic stock steelhead smolts annually.

4. Contribute 875 adult steelhead to the project area (Snake River and Tucannon River) where they are available for sport and tribal fisheries.

**1.8) Justification for the program.**

The natural population in the Tucannon River experienced a decline in abundance in the 1990s, culminating in its being listed as threatened under the ESA as part of the Snake River ESU (August 18, 1997; 62 FR 43937). The LSRCP program has been operated since 1983 to provide mitigation for adult steelhead lost because of the construction of the four lower Snake River dams. The program has used Lyons Ferry Hatchery (LFH) stock since the late 1980s (Schuck et al. 1998). The LFH stock was derived from Wells and Wallowa Hatchery stocks; and returns back to Lyons Ferry Hatchery. As such, it does not represent individuals that came from the Tucannon River system. The 1999 Biological Opinion by NOAA Fisheries on the LSRCP-produced hatchery steelhead concluded that the continued use of hatchery steelhead stocks in the Snake River (including Lyons Ferry stock) jeopardized the continued existence and chance for recovery of wild steelhead populations within the Snake River. Recent genetic information from the Tucannon River also indicates that LFH stock adults spawning in the Tucannon River may be contributing to the wild population's current depressed condition (Bumgarner et al 2007). Also, recent PIT tag data shows that Tucannon River fish (both hatchery and natural reared) are returning to above Lower Granite Dam at an alarming rate, with few returning to the Tucannon River, similar to behavior of Tucannon spring Chinook. This behavior is also contributing to the steelhead population's depressed condition.

Development of a hatchery stock based on the endemic stock from the Tucannon River for mitigation production will not necessarily increase natural productivity, but can serve several purposes. 1) Hatchery production can attempt to maintain or increase the numbers of naturally reproducing Tucannon River steelhead in under-utilized spawning and rearing habitat. The intent of efforts within this ESU is to reduce the short-term extinction risk to the existing wild population and to increase the likelihood of their recovery to a healthy status. These objectives may be accomplished by supplementing the population using an endemic brood stock. 2) Minimize the potential for genetic introgression and depression that may occur with continued use of the existing hatchery stock. In the early 1990's genetic allozyme data indicated little introgression between the native stock and the LFH stock had occurred. More recent microsatellite DNA data indicate introgression between the two stocks has occurred (Bumgarner et al 2007). Given that information, interbreeding between the LFH stock hatchery and natural fish may have reduced productivity and fitness within the natural population. 3) Speed the recovery of Tucannon River steelhead once natural productivity has reached or exceeded replacement as a result of habitat improvements within the basin. 4) Provide mitigation production under LSRCP while complying with NOAA Fisheries' Reasonable and Prudent actions as listed in their Biological Opinion for the FCRPS (long term goal of this program). Washington Department of Fish and Wildlife and the co-managers desire to maintain healthy, abundant populations of steelhead within the Snake River, but also want to provide abundant fishery opportunities as negotiated under the LSRCP mitigation program. 5) Potentially reduce straying within the Snake River basin. An original expected benefit of using a local broodstock was reduced straying. However, recent PIT tag data from steelhead emigrating from the Tucannon River (LFH and hatchery endemic stock releases, and natural reared emigrants) have been shown to stray above Lower Granite Dam (about 50% of the total return). If this behavior continues, further actions will be needed to assist this stock in the recovery process.

**1.9) List of program "Performance Standards".**

See 1.10 below.

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

***Recommended by the ICTRT for Monitoring and Evaluation (referenced as presented in the ICTRT document* "Viability Criteria for Application to Interior Columbia Basin Salmonid ESUs" (March 2007)**

**Abundance/Productivity:**

1. Snake River steelhead population specific abundance and productivity data: A majority of populations had little or no recruit/spawner information to assess abundance and productivity criteria; most status assessments relied on a Snake River aggregate (Lower Granite) data set. Population level assessments for steelhead can be difficult given environmental conditions at the time of spawning, the potential distribution across stream drainages, etc. Alternative techniques should be considered (e.g., redd based surveys, weir counts combined with juvenile surveys, etc), incorporating probabilistic sampling protocols for estimating abundance.

3. Snake River steelhead population specific hatchery fraction and age structure data: A majority of populations had inadequate or no hatchery fraction information to assess abundance and productivity criteria. In addition, there is inadequate data to estimate the number of hatchery spawners in the aggregate recruit/spawner analysis. A majority of populations had no or inadequate age structure information to assess abundance and productivity criteria; most status assessments relied on a Snake River aggregate (Lower Granite) data set.

5. SARs and juvenile productivity estimates for all Chinook ESUs and steelhead DPSs: Improve or collect information on SARs and juvenile productivity (i.e. smolts per spawner). SARs are essential for taking into account variability in survival during smolt outmigration and marine life stages in evaluating A&P criteria. The goal is to estimate

SARs that are representative at the population level. There are a number of approaches to accomplish estimating these SARs (e.g. marking wild or hatchery smolts or estimating natural origin smolts and adult production). In addition, measures representing survival from spawning to out-migrating smolts would aid in partitioning productivity between freshwater and marine life-stages.

6. Population level effects of hatchery spawners on natural productivity for all ESUs and DPSs: For populations with hatchery spawners, develop representative estimates of the effects of hatchery spawners on population level productivity. Topics of interest include the effect of hatchery spawner contributions to the average natural productivity of a population and the relative effectiveness of hatchery spawners. In combination with adequate estimates of the relative levels of hatchery fish contributing to natural spawning for a particular population, this information would allow for more representative estimates of current and potential natural productivity levels.

**Spatial Structure and Diversity**

1. Steelhead populations spawner distribution and habitat preference data: Many of populations had inadequate spawner distribution information to assess spatial structure and diversity criteria. In addition, estimates of historical distribution are dependent upon habitat preferences derived from available empirical studies. Those studies are limited in scope and number. Additional information on habitat/steelhead preference or production relationships could improve the assessment of steelhead populations against SS/D criteria.

2. Phenotypic characteristics for populations in all ESUs/DPSs: Little information was available to assess phenotypic changes. Representative estimates of current morphological, life history or behavioral traits are not available for many populations. Additional analysis of relationships between habitat characteristics and phenotypic traits would improve the ability to assess changes from historical patterns at the population level.

3. Steelhead genetics information, particularly for Upper Columbia and Mid Columbia populations: Genetic baseline information and periodic follow-up surveys specifically designed to evaluate the level of variation or differentiation among subcomponents within populations and among populations. Periodic follow-ups would support evaluation of responses to management actions designed to promote restoration of natural patterns of population structure.

5. Spawner composition for steelhead populations with hatchery spawners: Collect specific spawner composition information including proportion and source of hatchery spawners. Information on the relative distribution of hatchery spawners among production areas within populations would also improve the ability to assess status against ICTRT spatial structure criteria.

6. Selective mortality effects for populations in all ESUs/DPSs: Little information was available to assess selective mortality resulting from differential impacts of human induced mortality. Additional information is needed to better assess human induced mortality

effects in each of the four Hs (habitat, hatcheries, harvest and hydropower)

**1.10.1) "Performance Indicators" addressing benefits.**

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. The NPCC standards represent the common knowledge up to 2001. Utilization of more recent reviews on the standardized methods for evaluation of hatcheries and supplementation at a basin wide ESU scale is warranted.

In a report prepared for 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 (Galbreath 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 specific to supplementation projects. The framework utilizes a common set of standardized performance measures as established by the Collaborative System wide Monitoring and Evaluation Project (CSMEP). Adoption of this suite of performance measures and definitions across multiple study designs will facilitate coordinated analysis of findings from regional monitoring and evaluation efforts. This is needed to address management questions and critical uncertainties associated with the relationships between harvest augmentation and supplementation hatchery production, and ESA listed stock status/recovery.

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

**Table 1. 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.<br>1.1.2. Total fisher days or proportion of harvestable returns taken in Tribal resident fisheries, by fishery.<br>1.1.3. Tribal acknowledgement regarding fulfillment of tribal treaty rights. |
| | 1.2. Program contributes to mitigation requirements. | 1.2.1. Number of fish released by program, returning, or caught, as applicable to given mitigation requirements. |
| | 1.3. Program addresses ESA responsibilities. | 1.3.1. Section 7, Section 10, 4d rule and annual consultation |
| 2. IMPLEMENTATION AND COMPLIANCE | 2.1. Program contributes to mitigation requirements. | 2.1.1. Hatchery is operated as a segregated program.<br>2.1.2. Hatchery is operated as an integrated program<br>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.<br>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. |

| Category | Standards | Indicators |
|---|---|---|
| | 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.<br>2.4.2. Number if adult returns by release group harvested<br>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.<br>2.5.2. Numbers of fish per release group are known and reported.<br>2.5.3. Average size, weight and condition of fish per release group are known and reported.<br>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.).<br>2.6.2. Harvest management, harvest sharing agreements, broodstock collection schedules, and disposition of fish trapped at hatcheries in excess of broodstock needs are coordinated among co-management agencies.<br>2.6.3. Co-managers react adaptively by consensus to monitoring and evaluation results.<br>2.6.4. Monitoring and evaluation results are reported to co-managers and regionally in a timely fashion. |
| 3. HATCHERY EFFECTIVENESS MONITORING REGIONAL FOR AUGMENTATION AND SUPPLEMENTATION PROGRAMS | 3.1. Release groups are marked in a manner consistent with information needs and protocols for monitoring impacts to natural- and hatchery-origin fish at the targeted life stage(s) (e.g. in juvenile migration corridor, in fisheries, etc.). | 3.1.1. All hatchery origin fish recognizable by mark or tag and representative known fraction of each release group marked or tagged uniquely.<br>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.<br>3.2.2. Adult to adult or juvenile to adult survivals are estimated.<br>3.2.3. Temporal and spatial distribution of adult spawners and rearing juveniles in the freshwater spawning and rearing areas are monitored.<br>3.2.4. Timing of juvenile outmigration from rearing areas and adult returns to spawning areas are monitored.<br>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 species. | 3.3.1. Number of fish release by location estimated and in compliance with AOPs and US vs. OR Management Agreement.<br><br>3.3.2. Number if adult returns by release group harvested<br><br>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.<br><br>3.4.2. Hatchery strays in non-target populations are predominately from in-subbasin releases.<br><br>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.<br><br>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 trend in abundance of fish by life stage is monitored annually.<br><br>3.6.2. Pre- and post-supplementation trends in adult-to-adult or juvenile to adult survivals are estimated.<br><br>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.<br><br>3.6.4. Timing of juvenile outmigration from rearing area and adult returns to spawning areas are monitored. |
| | 3.7. Natural production of target population is maintained or enhanced by supplementation. | 3.7.1. Adult progeny per parent (P:P) ratios for hatchery-produced fish significantly exceed those of natural-origin fish.<br><br>3.7.2. Natural spawning success of hatchery-origin fish must be similar to that of natural-origin fish.<br><br>3.7.3. Temporal and spatial distribution of hatchery-origin spawners in nature is similar to that of natural-origin fish.<br><br>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).<br><br>3.7.5. Post-release life stage-specific survival is similar between hatchery and natural-origin population components. |

| Category | Standards | Indicators |
|---|---|---|
| | 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.<br><br>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.<br><br>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.<br><br>3.9.2. Life history characteristics of hatchery-origin adult fish are indistinguishable from natural-origin fish.<br><br>3.9.3. Juvenile emigration timing and survival differences between hatchery and natural-origin fish must be minimal. |
| | 3.10. The distribution and incidence of diseases, parasites and pathogens in natural populations and hatchery populations are known and releases of hatchery fish are designed to minimize potential spread or amplification of diseases, parasites, or pathogens among natural populations. | 3.10. Detectable changes in rate of occurrence and spatial distribution of disease, parasite or pathogen between the affected hatchery and natural populations. |
| 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.<br><br>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.<br><br>4.3.2. Water withdrawals compared to NMFS, USFWS, and WDFW juvenile screening criteria.<br><br>4.3.3. Number of adult fish aggregating and/or spawning immediately below water intake point.<br><br>4.3.4. Number of adult fish passing water intake point.<br><br>4.3.5. Proportion of diversion of total stream flow between intake and outfall. |

| Category | Standards | Indicators |
|---|---|---|
| | 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.<br>4.4.2. Juvenile densities during artificial rearing.<br>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.<br>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.<br>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.<br>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.<br>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.<br>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.<br>5.3.2. Recreational fishery angler days, length of seasons, and number of licenses purchased. |

Use the above information to determine whether the population has declined, remained stable, or has been recovered to sustainable levels. The ability to estimate hatchery and natural proportions will be determined by implementation plans, budgets, and assessment priorities.

### 1.10.2) "Performance Indicators" addressing risks.

The suite of performance measures developed by the CSMEP represents a crosswalk mechanism that is needed to quantitatively monitor and evaluate the standards and indicators listed in Table 1. The CSMEP measures have been adopted by the AHSWG (Galbreath et. al. 2008). The adoption of this regionally-applied means of assessment will facilitate coordinated analysis of findings from basin-wide M&E efforts and will provide the scientifically-based foundation to address the management questions and critical uncertainties associated with supplementation and ESA listed stock status/recovery.

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

**Table 2. Standardized performance measures and definitions for status and trends and hatchery effectiveness monitoring and the associated performance indicator that it addresses. (Taken from Beasley et al. 2008).**

| Performance Measure | | Definition | Related Indicator |
|---|---|---|---|
| Abundance | Adult Escapement to Tributary | Number of adults (including jacks) that have escaped to a certain point (i.e. - mouth of stream). Population based measure. Calculated with mark recapture methods from weir data adjusted for redds located downstream of weirs and in tributaries, and maximum net upstream approach for DIDSON and underwater video monitoring. Provides total escapement and wild only escapement. [Assumes tributary harvest is accounted for]. Uses TRT population definition where available | 2.3.2, 3.1.2, 3.2.1, 3.2.2, 3.2.4, 3.6.1, 3.7.1, 3.7.4, 5.3.1 |
| Abundance | Fish per Redd | Number of fish divided by the total number of redds. Applied by: The population estimate at a weir site, minus broodstock and mortalities and harvest, divided by the total number of redds located upstream of the weir. | 3.2.1, 3.2.3, 3.2.4, 3.6.3, 3.7.3 |
| 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 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 number of female 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.<br>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 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 | 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) issued to estimate emigration estimates. Estimates are given for parr, pre-smolts, smolts and the entire migration year. Calculations are completed using a Modified Bailey Method and bootstrapping for 95% CIs. Gauss program developed by the University of Idaho (Steinhorst 2000). | 3.2.1, 3.6.1, 3.7.4 |
| | 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 | This will not be in the raw or summarized performance database. | 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.<br><br>*Smolt-to-adult return rates* are generated for four performance periods; tributary to tributary, tributary to first mainstem dam, first mainstem dam to first mainstem dam, and first mainstem dam to tributary.<br><br>*First mainstem dam to first mainstem dam* SAR estimates are calculated by dividing the number of PIT tagged adults returning to first mainstem dam by the estimated number of PIT tagged juveniles at first mainstem dam. Variances around the point estimates are calculated as described above.<br><br>*Tributary to tributary* SAR estimates for natural and hatchery origin fish are calculated using PIT tag technology as well as direct counts of fish returning to the drainage. PIT tag SAR estimates are calculated by dividing the number of PIT tag adults returning to the tributary (by life stage and origin type) by the number of PIT tagged juvenile fish migrating from the tributary (by life stage and origin type). Overall PIT tag SAR estimates for natural fish are then calculated by averaging the individual life stage specific 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.<br><br>*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.<br><br>*First mainstem dam to tributary* SAR estimates are calculated by dividing the number of PIT tagged adults returning to the tributary by the estimated number of PIT tagged juveniles at first mainstem dam. The estimated number of PIT tagged juveniles at first mainstem dam is calculated by multiplying life stage specific survival estimates (with standard errors) by the number of juveniles PIT tagged in the tributary. The variance for the estimated number of PIT tagged juveniles at first mainstem dam is calculated as follows, where X = the number of PIT tagged fish in the tributary and Y = the variance of the life stage specific survival estimate:<br>$Var(X \cdot Y) = X^2 \cdot Var(Y)$<br>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:<br>$Var\left(\frac{X}{Y}\right) = \left(\frac{EX}{EY}\right)^2 \cdot \left(\frac{Var(Y)}{(EY)^2}\right)$ | 3.2.1, 3.2.2, 3.7.4 |
| | Progeny-per- Parent Ratio | Adult to adult calculated for naturally spawning fish and hatchery fish separately as the brood year ratio of return adult to parent spawner abundance using data above weir. Two variants calculated: 1) escapement, and 2) spawners. | 3.2.1, 3.2.2, 3.7.4 |
| | Recruit/spawner (R/S)(Smolt Equivalents per Redd or female) | Juvenile production to some life stage divided by adult spawner abundance. Derive adult escapement above juvenile trap multiplied by the prespawning mortality estimate. Adjusted for redds above juvenile Trap.<br>*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 |

| Performance Measure | | Definition | Related Indicator |
|---|---|---|---|
| | 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. screw traps) are used to calculate survival estimates. | 3.2.2, 3.6.2, 3.7.5, 3.9.3, |
| Distribution | Adult Spawner Spatial Distribution | Extensive area tributary spawner distribution. Target GPS red locations or reach specific summaries, with information from carcass recoveries to identify hatchery-origin vs. natural-origin spawners across spawning areas within populations. | 3.2.3, 3.2.4, 3.6.3, 3.7.3, 4.3.3, 4.6.1 |
| Distribution | Stray Rate (percentage) | Estimate of the number and percent of hatchery origin fish on the spawning grounds, as the percent within MPG, and percent out of ESU. Calculated from 1) total known origin carcasses, and 2) uses fish released above weir. Data adjusted for unmarked carcasses above and below weir. | 3.4.1, 3.4.2, 3.4.3 |
| Distribution | Juvenile Rearing Distribution | Chinook rearing distribution observations are recorded using multiple divers who follow protocol described in Thurow (1994). | |
| Distribution | Disease Frequency | Natural fish mortalities are provided to certified fish health lab for routine disease testing protocols. Hatcheries routinely samples fish for disease and will defer to then for sampling numbers and periodicity | 3.10, 4.4.3 |
| Genetic | Genetic Diversity | Indices of genetic diversity – measured within a tributary) heterozygosity – allozymes, microsatellites), or among tributaries across population aggregates (e.g., FST). | 3.2.5, 3.8.3, 3.9.1 |
| Genetic | Reproductive Success (Nb/N) | Derived measure: determining hatchery: wild proportions, effective population size is modeled. | 3.7.2 |
| Genetic | 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 |
| Genetic | 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 |
| Life History | Age Structure | Proportion of escapement composed of adult individuals of different brood years. Calculated for wild and hatchery origin conventional and captive brood adult returns. Accessed via scale method, dorsal fin ray ageing, or mark recoveries. Juvenile Age is determined by brood year (year when eggs are placed in the gravel) Then Age is determined by life stage of that year. Methods to age Chinook captured in screw trap are by dates; fry – prior to July 1; parr – July 1-August 31; 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 VIE marking program which identifies fish by brood year. For steelhead we attempt to use length frequency but typically age of juvenile steelhead is not calculated. | 3.8.1, 3.8.2, 3.9.2 |
| Life History | Age–at–Return | Age distribution of spawners on spawning ground. Calculated for wild and hatchery conventional and captive brood adult returns. Accessed via scale method, dorsal fin ray ageing, or mark recoveries. | 3.8.1, 3.8.2, 3.9.2 |

| Performance Measure | | Definition | Related Indicator |
|---|---|---|---|
| | Age–at-Emigration | Juvenile Age is determined by brood year (year when eggs are placed in the gravel) Then Age is determined by life stage of that year. Methods to age Chinook captured in screw trap are by dates; fry – prior to July 1; parr – July 1-August 31; 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 VIE marking program which identifies fish by brood year. For steelhead we attempt to use length frequency but typically age of juvenile steelhead is not calculated. | 3.8.1, 3.8.2, 3.9.2 |
| | Size-at-Return | Size distribution of spawners using fork length and mid-eye hypural length. Raw database measure only. | 3.8.1, 3.9.2 |
| | Size-at-Emigration | Fork length (mm) and weight (g) are representatively collected weekly from natural juveniles captured in emigration traps. Mean fork length and variance for all samples within a life stage-specific emigration period are generated (mean length by week then averaged by life stage). For entire juvenile abundance leaving a weighted mean (by life stage) is calculated. Size-at-emigration for hatchery production is generated from pre release sampling of juveniles at the hatchery. | 3.8.2, 3.9.2 |
| | Condition of Juveniles at Emigration | Condition factor by life stage of juveniles is generated using the formula: $K = (w/l^3)(10^4)$ where K is the condition factor, w is the weight in grams (g), and l is the length in millimeters (Everhart and Youngs 1992). | 3.8.2, 3.9.2 |
| | Percent Females (adults) | The percentage of females in the spawning population. Calculated using 1) weir data, 2) total known origin carcass recoveries, and 3) weir data and unmarked carcasses above and below weir. Calculated for wild, hatchery, and total fish. | 3.8.1, 3.9.2 |
| | Adult Run-timing | Arrival timing of adults at adult monitoring sites (weir, DIDSON, video) calculated as range, 10%, median, 90% percentiles. Calculated for wild and hatchery origin fish separately, and total. | 3.2.4, 3.6.4, 3.8.1, 3.9.2 |
| | Spawn-timing | This will be a raw database measure only. | 3.2.4, 3.6.4, 3.8.1, 3.9.2 |
| | Juvenile Emigration Timing | Juvenile emigration timing is characterized by individual life stages at the rotary screw trap and Lower Granite Dam. Emigration timing at the rotary screw trap is expressed as the percent of total abundance over time while the median, 0%, 10, 50%, 90% and 100% detection dates are calculated for fish at first mainstem dam . | 3.2.4, 3.6.4, 3.8.2, 3.9.2, 3.9.3, 4.8.1 |
| | Mainstem Arrival Timing (Lower Granite) | Unique detections of juvenile PIT-tagged fish at first mainstem dam are used to estimate migration timing for natural and hatchery origin tag groups by life stage. The actual Median, 0, 10%, 50%, 90% and 100% detection dates are reported for each tag group. Weighted detection dates are also calculated by multiplying unique PIT tag detection by a life stage specific correction factor (number fish PIT tagged by life stage divided by tributary abundance estimate by life stage). Daily products are added and rounded to the nearest integer to determine weighted median, 0%, 50%, 90% and 100% detection dates. | 3.2.4, 3.6.4, 3.8.2, 3.9.2, 3.9.3, 4.8.1 |
| Habitat | Physical Habitat | TBD | |
| | Stream Network | TBD | |
| | Passage Barriers/Diversions | TBD | |
| | Instream Flow | USGS gauges and also staff gauges | |
| | Water Temperature | Various, mainly Hobo and other temp loggers at screw trap sights and spread out throughout the streams | |
| | Chemical Water Quality | TBD | |
| | Macroinvertebrate Assemblage | TBD | |
| | Fish and Amphibian Assemblage | Observations through rotary screw trap catch and while conducting snorkel surveys. | 2.4.3, 3.3.3, 3.4.1 |
| In-Hatchery Measures | Hatchery Production Abundance | The number of hatchery juveniles of one cohort released into the receiving stream per year. Derived from census count minus prerelease mortalities or from sample fish- per-pound calculations minus mortalities. Method dependent upon marking program (census obtained when 100% are marked). | 2.5.2, 2.5.3, 2.6.1, 4.4.2 |

| Performance Measure | Definition | Related Indicator |
|---|---|---|
| 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.<br>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, presmolt, parr, etc.). | |
| Size-at-Release | Mean fork length measured in millimeters and mean weight measured in grams of a hatchery release group. Measured during prerelease sampling. Sample size determined by individual facility and M&E staff. Life stage at release varies (smolt, presmolt, parr, etc.). | 2.5.1, 2.5.3 |
| Juvenile Condition Factor | Condition Factor (K) relating length to weight expressed as a ratio. Condition factor by life stage of juveniles is generated using the formula: $K = (w/l^3)(10^4)$ where K is the condition factor, w is the weight in grams (g), and l is the length in millimeters (Everhart and Youngs 1992). | 2.5.3,3.8.2, 3.9.2 |
| Fecundity by Age | The reproductive potential of an individual female. Estimated as the number of eggs in the ovaries of the individual female. Measured as the number of eggs per female calculated by weight or enumerated by egg counter. | 3.8.1, 3.8.2, 3.9.2 |
| Spawn Timing | Spawn date of broodstock spawners by age, sex and origin, Also reported as cumulative timing and median dates. | 3.2.4, 3.6.4, 3.8.1, 3.9.2 |
| Hatchery Broodstock Fraction | Percent of hatchery broodstock actually used to spawn the next generation of hatchery F1s. Does not include prespawning mortality. | 2.2.1 |
| Hatchery Broodstock Prespawning Mortality | Percent of adults that die while retained in the hatchery, but before spawning. | 4.7.2 |
| Female Spawner ELISA Values | Screening procedure for diagnosis and detection of BKD in adult female ovarian fluids. The enzyme linked immunosorbent assay (ELISA) detects antigen of *R. salmoninarum*. | 3.10, 4.4.3 |
| In-Hatchery Juvenile Disease Monitoring | Screening procedure for bacterial, viral and other diseases common to juvenile salmonids. Gill/skin/ kidney /spleen/skin/blood culture smears conducted monthly on 10 mortalities per stock | 3.10, 4.4.3 |
| Length of Broodstock Spawner | Mean fork length by age measured in millimeters of male and female broodstock spawners. Measured at spawning and/or at weir collection. Is used in conjunction with scale reading for aging. | 3.9.2 |
| Prerelease Mark Retention | Percentage of a hatchery group that have retained a mark up until release from the hatchery. Estimated from a sample of fish visually calculated as either "present" or "absent" | 3.1.1, 3.1.2 |
| Prerelease Tag Retention | Percentage of a hatchery group that have retained a tag up until release from the hatchery - estimated from a sample of fish passed as either "present" or "absent". ("Marks" refer to adipose fin clips or VIE batch marks). | 3.1.1, 3.1.2 |
| Hatchery Release Timing | Date and time of volitional or forced departure from the hatchery. Normally determined through PIT tag detections at facility exit (not all programs monitor volitional releases). | 2.5.4, 4.8.1 |
| Chemical Water Quality | Hatchery operational measures included: dissolved oxygen (DO) - measured with DO meters, continuously at the hatchery, and manually 3 times daily at acclimation facilities; ammonia ($NH_3$) nitrite ($NO_2$), -measured weekly only at reuse facilities | 4.2.1 |
| Water Temperature | Hatchery operational measure (Celsius) - measured continuously at the hatchery with thermographs and 3 times daily at acclimation facilities with hand-held devices. | |

WDFW will use the above indicators to determine whether the program has, or is, causing unacceptable risks to the listed natural populations within the Tucannon River. The ability of the evaluation staff to estimate hatchery and natural proportions in the Tucannon River and other basins will be determined by implementation plans, budgets, and assessment priorities.

## 1.11) Expected size of program.

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

The current program level (production of 75,000 smolts on an annual basis) requires the spawning of 17-18 female steelhead, depending on age and size if the female. We desire that a unique male be spawned with each female, so we plan to capture at least 20 males for spawning. We've found in the past that not all males ripen at the same time as the females, so the more males we have on hand during spawning increases our chances of successful fertilization without re-using the same males. Adult collections will be increased until full program is reached as facility modifications are completed.

At full program level, we anticipate the collection of 90 fish annually (may consist of either natural or hatchery-origin) to meet production goals. Percent hatchery origin fish in the broodstock will not exceed 10%.

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

The current production goal for endemic Tucannon steelhead is 75,000 smolts starting in the 2010 brood year. This production level is the maximum amount that can be reared in existing space at the Lyons Ferry Complex (LFH and TFH). An expansion of LFC will need to occur before full production of Tucannon endemic steelhead can be achieved. The WDFW anticipates facility design and construction may not occur before the BY 2013 or 2014 fish are available for collection. How quickly the full production program can be reach will be determined on returns of natural and endemic origin fish and funding for facility modifications.

The existing 2010 brood year LFH stock steelhead production for Tucannon River (100,000 smolts) will be reared at LFH and released into the Snake River on-site in 2011. Release years 2012-2014 will be a transition period from full production of LFH stock for mitigation releases at LFH. A possible stock change from the LFH stock to another Snake River stock and release location is under consideration with the co-managers. Refer to the LFH steelhead stock on-site production HGMP for future production levels of this program.

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

The Tucannon River endemic hatchery broodstock is a new program and has limited performance data. Smolt-to-adult return rates (SAR) for several release years of LFH stock steelhead released into the Tucannon River have been documented (Table 3) and are provided below. SARs have been estimated using a combination of coded-wire tag recoveries and freeze brand observations at Lower Granite Dam. Because the endemic stock fish have not been marked for harvest, we have used PIT tags to determine SARs. PIT tags and CWT survival data are not directly comparable. Table 4 provides estimated survival of Tucannon River endemic stock fish, Tucannon River natural stock and, the LFH stock smolts released into the Tucannon River based on PIT tags. The Tucannon endemic stock smolts have preformed the worst to date among the three groups, with the endemic stock at 50% survival of the natural stock, and the natural stock about 50% the survival of the LFH hatchery stock.

Table 3. Recoveries and estimated smolt-to-adult return rates from LFH stock steelhead released directly into the Tucannon River (upriver and downriver locations), or from Curl Lake Acclimation pond.

| Brood Year | Curl Lake Releases | | Direct Stream Releases | |
|---|---|---|---|---|
| | Total SAR (%) | Total SAR to LSRCP Area (%) | Total SAR (%) | Total SAR to LSRCP Area (%) |
| 1983 | | | 1,732 (1.52) | 1,286 (1.13) |
| 1984 | 555 (0.74) | 398 (0.53) | | |
| 1985 | 748 (0.93) | 538 (0.67) | | |
| 1986 | 650 (1.05) | 528 (0.87) | | |
| 1987 | 631 (1.05) | 524 (0.87) | | |
| 1988 | 474 (0.79) | 374 (0.62) | 562 (1.41) | 412 (1.04) |
| 1989 | 836 (2.11) | 655 (1.65) | 1,555 (1.96) | 1,232 (1.55) |
| 1990 | 292 (0.73) | 235 (0.59) | 271 (0.46) | 212 (0.36) |
| 1991 | 77 (0.26) | 69 (0.24) | 785 (1.32) | 577 (0.97) |
| 1992 | 448 (2.04) | 346 (1.58) | | |
| 1993 | 467 (0.95) | 344 (0.70) | | |
| 1994 | 1,017 (1.93) | 833 (1.58) | | |
| 1995 | 88 (0.33) | 75 (0.28) | 454 (1.56) | 398 (1.37) |
| 1996 | 87 (0.33) | 80 (0.30) | 208 (0.77) | 204 (0.75) |
| 1997 | | | 1,088 (2.20) | 992 (2.01) |
| 1998 | | | 774 (1.95) | 667 (1.68) |
| 1999 | | | 1,279 (3.24) | 1,153 (2.92) |
| 2000 | | | 337 (1.71) | 216 (1.09) |
| 2001 | | | 257 (1.26) | 245 (1.20) |
| 2002 | | | 377 (1.82) | 339 (1.63) |
| 2003 | | | 241 (1.19) | 221 (1.09) |
| 2004 | | | 300 (1.59) | 269 (1.43) |
| Average | 1.02 | 0.81 | 1.60 | 1.35 |

Table 4. Estimated smolt-to-adult survival rates of Tucannon natural stock, Tucannon endemic stock, and LFH stock based on PIT tag returns to Bonneville or into the Snake River (last detected at McNary Dam).

| Smolt Migration Year | Tucannon River Natural Origin | | Tucannon River Endemic Hatchery Origin | | Lyons Ferry Hatchery Origin | |
|---|---|---|---|---|---|---|
| | @ Bonn | @ McNary | @ Bonn | @ McNary | @ Bonn | @ McNary |
| 1999 | 1.65 | 1.38 | --- | --- | --- | --- |
| 2000 | 3.60 | 2.88 | --- | --- | --- | --- |
| 2002 | 2.66 | 2.12 | --- | --- | --- | --- |
| 2003 | 2.31 | 1.93 | --- | --- | --- | --- |
| 2004 | 1.61 | 1.01 | 0.59 | 0.45 | --- | --- |
| 2005 | 1.47 | 1.25 | 0.83 | 0.70 | --- | --- |
| 2006 | 2.47 | 1.69 | 1.24 | 0.82 | 5.22 | 4.11 |
| 2007 [1] | 1.33 | 1.00 | 1.34 | 0.99 | 4.08 | 3.28 |
| **Average** | **2.14** | **1.66** | **1.00** | **0.74** | **4.65** | **3.69** |

[1] Represents only 1-salt returns.

Estimated natural escapement into the Tucannon River may be below replacement in most run years, thus contributing to the decline of the population within the basin and within the ESU. Further, through the use of PIT tags, WDFW has determined that nearly half of the yearly returns stray, and most remain above Lower Granite Dam. This behavior is the same for all steelhead migrating from the Tucannon River, regardless of the stock (Table 5). This straying behavior to areas upstream of Lower Granite Dam may be a natural life history trait, or be environmentally driven. However, with the mainstem dams in place it appears it is more difficult for those fish to return downriver to their intended stream. Many of the fish that return to the Tucannon River from upstream of Lower Granite Dam do so primarily in the early spring.

WDFW had hoped that survival of the endemic brood hatchery reared fish would equal or exceed the SARs for its long-term hatchery stock, though current data suggest we are well short of that goal. Early rearing survivals (egg-to-smolt) within the hatchery have exceeded those observed in the Tucannon River wild population. Fish returning from hatchery production of endemic brood will be allowed to spawn in the wild and contribute to filling available habitat, and increasing the number of naturally produced fish spawning in the wild one generation later. The recruit/spawner ratio is expected to increase because of the broodstock program, but the survival of subsequent natural populations may ultimately depend upon improvements in basin productivity and migratory corridor survival.

Based on the PIT tag information, and from adult migratory observations presented in the next section, average spawning escapement in the Tucannon River Basin is, at a maximum, about 150 natural origin fish/year (Table 6).

Table 5. Disposition of PIT tagged Tucannon Endemic stock, Tucannon natural stock, and Lyons Ferry hatchery stock summer steelhead that crossed Ice Harbor Dam.

| Release Year | Pass Ice | Pass Granite | Enter Tucannon | Unknown Location | Back to Tucannon From Granite | % back to Tucannon from LGR | Total into Tucannon | Percent of those that passed Ice Harbor Dam: % into Tucannon | % above Granite | % Unknown |
|---|---|---|---|---|---|---|---|---|---|---|
| Tucannon Endemic Hatchery Stock Summer Steelhead | | | | | | | | | | |
| 2004 | 48 | 30 | 11 | 7 | 5 | 16.7 | 16 | 33.3 | 52.1 | 14.6 |
| 2005 | 55 | 35 | 17 | 3 | 8 | 22.9 | 25 | 45.5 | 49.1 | 5.5 |
| 2006 | 105 | 69 | 18 | 18 | 16 | 23.2 | 34 | 32.4 | 50.5 | 17.1 |
| 2007 | 79 | 55 | 2 | 22 | 1 | 1.8 | 3 | 3.8 | 68.4 | 27.8 |
| **Totals 04-06** | **208** | **134** | **46** | **28** | **29** | **21.6** | **75** | **36.1** | **50.5** | **13.5** |
| Tucannon Natural Stock Summer Steelhead | | | | | | | | | | |
| 2004 | 17 | 11 | 6 | 2 | 2 | 18.2 | 8 | 47.1 | 52.9 | 11.8 |
| 2005 | 20 | 12 | 6 | 5 | 3 | 25.0 | 10 | 50.0 | 45.0 | 25.0 |
| 2006 | 16 | 8 | 3 | 5 | 0 | 0.0 | 3 | 18.8 | 50.0 | 31.3 |
| 2007 | 3 | 1 | 1 | 0 | 0 | 0.0 | 1 | 33.3 | 66.7 | 0.0 |
| **Totals 04-06** | **53** | **31** | **15** | **12** | **5** | **16.1** | **21** | **39.6** | **49.1** | **22.6** |
| Lyons Ferry Hatchery Stock Summer Steelhead (Released into the lower Tucannon River) | | | | | | | | | | |
| 2006 | 318 | 229 | 54 | 35 | 44 | 19.2 | 98 | 30.8 | 58.2 | 11.0 |
| 2007 | 155 | 75 | 35 | 42 | 7 | 9.0 | 42 | 27.1 | 45.8 | 27.1 |

Note: The Tucannon River PIT tag array was taken out by high stream flow in January, 2009. One-salt returns from the 2007 release year, and two-salt returns from the 2006 release year that entered the Tucannon River after the array was destroyed could not be added to the table. Therefore, the percent of fish into the Tucannon, above Granite, or Unknown destination for the 2007 and 2006 release years are not completely accurate.

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

The broodstock program began in the fall of 1999 with 2000 brood year fish collected from the lower Tucannon River adult trap.

## 1.14) Expected duration of program.

A priority for the endemic program as proposed is to continue mitigation under the LSCRP, while decreasing the negative effects of a hatchery program within the basin. Evaluation of the stock's performance toward this goal will continue and may affect phasing from current proposed production (75,000 smolts) to full production (150,000). WDFW and the co-managers will decide on production levels for the endemics as evaluation results become available.

It is expected that conservation and recovery actions described within this program will continue until productivity within the basin has improved to a level where summer steelhead populations can accurately be determined to be at, or above, the replacement level most years (presumably a requirement which must be met for NOAA Fisheries to de-list the population). However, mitigation will remain a primary goal during this period.

Table 6. Plausible number of Tucannon River natural origin summer steelhead that return to spawn in the Tucannon River based on adult PIT tag returns above Ice Harbor Dam, 2000-2009 run years.

| Migration year | Estimated smolts [a] | Number PIT tagged | Adult return to Ice Harbor | Adjusted return to Ice Harbor [b] | Salt age 1 | Salt age 2 | Salt age 3 | Run year | Total return to Ice Harbor | 50% of return to Tucannon River [c] |
|---|---|---|---|---|---|---|---|---|---|---|
| 1998 | 29,067 | 465 | 2 | 2 | 63 | 125 | 0 | | | |
| 1999 | 23,451 | 363 | 5 | 5 | 258 | 194 | 0 | 2000 | 383 | 192 |
| 2000 | 22,681 | 555 | 14 | 15 | 327 | 450 | 0 | 2001 | 521 | 260 |
| 2001 | 19,754 | 333 | 0 | 0 | 0 | 0 | 0 | 2002 | 450 | 225 |
| 2002 | 18,558 | 1506 | 32 | 34 | 173 | 222 | 25 | 2003 | 173 | 86 |
| 2003 | 18,728 | 1556 | 29 | 31 | 181 | 205 | 12 | 2004 | 402 | 201 |
| 2004 | 13,586 | 1984 | 18 | 21 | 62 | 68 | 7 | 2005 | 291 | 145 |
| 2005 | 14,477 | 1835 | 20 | 22 | 63 | 126 | 0 | 2006 | 144 | 72 |
| 2006 | 8,289 | 1417 | 19 | 23 | 76 | 47 | 0 | 2007 | 209 | 105 |
| 2007 | 10,404 | 300 | 5 | 6 | 104 | 69 | NA | 2008 | 151 | 75 |
| 2008 | 14,304 | 1087 | 36 | 50 | 658 | NA | NA | 2009 | 727 | 364 |
| | | | | **Average 2000-2008 Run Years** | | | | | **303** | **151** |

[a] The estimated smolts presented are for spring (March-June) migrants only. PIT tags were only applied during the spring months, as that is when we typically get the largest number of smolt migrating past the smolt trap.

[b] Returns to Ice Harbor were adjusted based on total smolt production for each migration year. Smolts leaving during the fall and winter months (October-February) represent 5-25% of the total outmigration. We assumed that the fall/winter migrants survival as well as spring migrants.

[c] Based on adult detections at the Snake River dams, it appears that generally 50% of the fish passing Ice Harbor remain above Lower Granite Dam. The remaining 50% have been assigned to the Tucannon River for simplicity. The actual percentage based on the PIT tag array in the lower Tucannon River would suggest 35-40%, though the efficiency of the Tucannon River PIT tag array is unknown.

### 1.15) Watersheds targeted by program.

Tucannon River (WRIA 35).

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

In 2009 and 2010, two independent scientific review groups reviewed this program. Their findings are summarized as follows:

The Hatchery Scientific Review Group (HSRG) made two recommendations to improve the hatchery program: 1) In order to improve fitness and limit genetic introgression, managers should eliminate releases of Lyons Ferry stock steelhead in the Tucannon River. And 2) In the near term, the HSRG recommends that managers continue to operate the current endemic program (50,000 smolts, pNOB 100%). Managers should consider demographic risks to the population and modify their protocols during periods of low abundance. The HSRG acknowledges that managing for the recommended PNI values may not be possible or appropriate in the near term when abundance levels are low and demographic risks to the population increase. To address this concern, managers should develop a variable sliding scale for managing both pNOB and pHOS. An example of such a sliding scale would look like this: Each year, depending on NOR run size, pNOB and pHOS are allowed to "float" or slide.

The HSRG assumes managers will establish an acceptable level of removal of NORs for use in the hatchery brood. This will be a fixed percentage of the total NOR return (say 40%) and will not change, regardless of NOR return. In years of high NOR abundance, this 40% could make up 100% of the needed hatchery brood (pNOB= 100%). In that case, no HORs would be used in the hatchery brood. Hatchery fish can be allowed to reach the spawning ground (pHOS) if needed to achieve an appropriate number of fish spawning naturally (demographic benefit and use of available habitat). This however, would not be required during years of very high NOR returns as both objectives (pNOB and natural spawning) may be met with NORs.

In years of low NOR abundance, the same 40% of the NOR return would be removed for use in the hatchery brood (pNOB). However, in these years, that 40% may make up only a small part of the needed brood (i.e. pNOB 10%). In these years, enough HORs should be used to achieve needed hatchery brood and additional HORs should be allowed to spawn naturally (pHOS) to achieve the minimum acceptable level of naturally spawning.
The goal of this sliding scale is to achieve an "average" PNI over time of the desired level (0.67 or 0.5) depending on the population designation even though it may not be achieved in any one year. A good way to determine the level of NORs that should be removed each year (see above) is to review the return of NORs over a long time frame and iterate what level (30, 40, 50%) are needed, on average, to achieve the desired PNI. Managers should investigate ways to address the problem of adults straying above Lower Granite Dam. Unless this straying problem is solved, it appears unlikely that this population can meet the abundance standards for a Primary population. If this problem is addressed, a number of other options exist, including harvest or increasing the program. The HSRG encourages managers to explore opportunities to increase the harvest contribution, such as increasing daily bag limits. The HSRG supports alternate uses of surplus fish such as distribution to local food banks and/or stream nutrification.

**Response: WDFW and Tribal co-managers have discontinued the release of Lyons Ferry stock steelhead into the Tucannon River (2010 last release) and implemented expanded use of endemic Tucannon steelhead. The managers do not believe that there is a straying problem from the Tucannon River that is a result of the hatchery program. We feel that this is a normal behavior that is negatively affected by the hydro-system, as all steelhead from the Tucannon (natural origin, both hatchery stocks) have shown the same tendency to migrate past Lower Granite Dam upon return. In addition, we have no current means to control hatchery origin fish on the spawning grounds and have not recommended attempting to control hatchery fraction on the spawning grounds through construction of a lower river weir. A permanent weir could have potentially serious negative effects on steelhead, as well as spring Chinook, fall Chinook and bull trout.**

The Hatchery Review Team (HRT) provided 15 preliminary recommendations and 5 draft programmatic alternative actions. The draft recommendation proposed by the HRT is Alternative 2, and calls for addressing the recommendations provided, along with removal of the Lyons Ferry stock releases. Individual recommendations on the Facility, RM&E, Management, or Education and Outreach are presented below.

***Issue TR-SS1: The Review Team understands that the goal of the program is to "evaluate the capability of developing an endemic Tucannon River hatchery stock that can replace the Lyons Ferry stock for meeting harvest mitigation goals while, at the same time and if successful, be used to maintain and/or increase numbers of naturally reproducing Tucannon River steelhead that successfully produce viable progeny."*** *The Team concluded that the current size and scope of the program are consistent with the research goal but not with the goal of rebuilding a natural population via natural spawning supplementation by hatchery-origin fish (see Issues that follow). Management actions and operations inconsistent with the scope and goal of any hatchery program can pose significant risks to natural populations with little likelihood of achieving the intended benefits in most cases. Consequently, the deliberate passage of hatchery-origin fish upstream to spawn naturally and/or the direct release of hatchery-origin fry and smolts upstream of the weir won't achieve the purpose of the current program.*

**Recommendation TR-SS1:** Clearly define the specific goals and objectives (specific, measurable, attainable, realistic, with a timeframe) for the current endemic broodstock program and the methods and metrics for achieving the goals. **Response: WDFW and the co-managers have agreed to implement expansion of the endemic stock program for supplementation and mitigation within the Tucannon River, which is now reflected in the Us v OR management agreement for 2008-2017.**

***Issue TR-SS2: A substantial amount of information and knowledge has been acquired to determine whether Tucannon steelhead can replace the Lyons Ferry stock for meeting harvest mitigation goals in the project area; however, no action has been taken based upon that information.*** *Survival and fish culture data have been collected for seven years.*

**Recommendation TR-SS2:** Use the existing information to determine whether Tucannon steelhead can replace Lyons Ferry stock steelhead for harvest mitigation purposes. **Response: WDFW and Tribal co-managers have evaluated the data for endemic performance and proposed expansion of the endemic program and cessation of the LFH stock releases (2010). Details of the transition are discussed within this HGMP, though full implementation will depend on funding.**

***Issue TR-SS3: The long-term conservation goal of this program is unclear.*** *The Team could not determine whether the long-term goal of the program is to preserve the genetic legacy of the unique Tucannon River steelhead stock (e.g. redfish lake sockeye program) or to yield a viable, self-sustaining natural population of steelhead in the Tucannon River that contribute to the recovery of the Snake River DPS (e.g. Methow River steelhead for the Upper Columbia steelhead DPS). The objectives and management actions for this program would conceivably be quite different depending upon the long-term conservation goal.*

**Recommendation TR-SS3:** Clearly define the long-term conservation goal of this program. **Response: The co-managers are converting the hatchery program to the use of endemic Tucannon steelhead to supplement the population toward greater abundance and recovery, while maintaining mitigation harvest opportunity.**

**Broodstock Choice and Collection**

***Issue TR-SS4: Utilizing only the early portion of the Tucannon River run for broodstock, then allowing the hatchery progeny of those steelhead passage upstream to spawn naturally may, over the long term, impose artificial selection for earlier run timing in the natural population.*** *Tucannon River steelhead return from mid February through mid May; however, only February through March returns are used for broodstock. Collecting only the early portion of the run is performed so that the progeny can be reared and released as one-year-old smolts.*

**Recommendation TR-SS4:** Collect steelhead for broodstock from the entire spectrum of the run. **Response: This action was not taken early on in the endemic program evaluation stage, as it was difficult to reach releases size goals of the program. Also, the program is very small, and extending the broodstock collection over a 3-month time period creates complications in spawners available on any given date. Until the program is expanded, WDFW should collect broodstock during the middle of the run, and expand toward early and late segments as possible based on program size.**

**Hatchery and Natural Spawning, Adult Returns**

***Issue TR-SS5. The genetic effective number of breeders for the broodstock is too low to support a natural spawning supplementation program under the current research goals of the program.*** *Hatchery-origin steelhead of the endemic Tucannon River stock are passed upstream to spawn naturally in the Tucannon River because NOAA Fisheries includes those fish with the ESA listed Snake River Summer Steelhead DPS. However, the deliberate release of those fish upstream to spawn naturally is not consistent with the research goals of the program. The deliberate release of hatchery-origin fish upstream also poses a genetic risk to the natural population because the mean effective number of breeders (parents) per year is only $N_e$ = 27.2 adults, and endemic hatchery-origin fish compose up to 50% of the naturally spawning population in the Tucannon River.*

**Recommendation TR-SS5**: Discontinue passing hatchery-origin steelhead upstream to spawn naturally. Increase the number of steelhead collected for broodstock to yield a minimum effective number of breeders each year of $N_b > 50$. This could be accomplished by spawning equal numbers of endemic hatchery and natural-origin fish pairwise within each of the 2x2 spawning matrices: HxW and WxH, respectively. This would yield a value of *pNOB* = 50%. **Response: WDFW agrees with this comment, however, the test program does not allow more fish to be taken for broodstock. If the program is expanded, this comment will be more fully considered.**

***Issue TR-SS6a: Adult male steelhead held for broodstock and returned to the Tucannon River may transmit diseases from Lyons Ferry FH to the natural population in the Tucannon River.*** *Of special concern is the transmission of the IHN virus.*

***Issue TR-SS6b: Adult male steelhead transported and utilized multiple times during spawning, then returned to the Tucannon River experience excessive stress, increasing the potential for fish health issues.*** *Males returned to the Tucannon River likely die shortly after release.*

**Recommendation TR-SS6:** Discontinue the return and release of adult male steelhead into the Tucannon River. **Response: WDFW will examine the risks of this practice. Many of the males have been in good shape when returned to the river. We believed that they should be given the opportunity to contribute to natural spawning, though their success at this was never confirmed. Further, WDFW did not believe the likelihood of introducing or enhancing IHNV is a valid issue as natural Tucannon steelhead have been confirmed to carry the virus already.**

## Incubation and Rearing

*Issue LF-SS8 and CC-SS8:* ***Delayed treatment of cold water disease may make it difficult to control mortality associated with the progression of the disease.*** *Cold water disease causes 3.5-5% mortality in the Lyons Ferry stock steelhead annually. When fish mortalities reach about 100 per raceway per day, they are treated with medicated feed (florfenicol). Formerly, fish were fed pills coated with 15 mg drug/kg of fish weight as prescribed by a veterinarian. New regulations now require the use of florfenicol medicated feed at 10 mg drug/kg fish weight with a Veterinary Feed Directive. The medicated feed is less effective in controlling disease and delivery time from the feed company is slow, resulting in less efficacious treatment.*

***Recommendation CC-SS8:*** *Test the therapeutic value of early fluorfenicol treatment by comparing treated and untreated fry in the shallow troughs (i.e., before coldwater mortality starts). In conjunction with this, test new diagnostic methods (e.g., PCR, QPCR) and/or culturing alternate tissues (such as brain) for earlier detection of cold water disease to ascertain if medication is warranted prior to ponding into the raceways. Also consider investigating different densities (1.21, 0.5, and 0.2 DI) of fry in the troughs to determine whether early rearing densities influence the development of coldwater disease. Continue working with the Bacterial Coldwater Disease Research Group, as supported by the Pacific Northwest Fish Health Protection Committee, to develop fish culture practices and treatment options to control or eliminate coldwater disease.* **WDFW response: Yes, bacterial coldwater disease has caused problems in rainbow and steelhead at Lyons Ferry Hatchery. The BCWD outbreaks have been successfully controlled with florfenicol medicated fish feed. Any experimental efforts will be first tested on rainbow trout and if successful, will then be applied to steelhead.**

*Issue TR-SS7:* ***Rearing densities in the indoor nursery tanks "shallow troughs" (1.15 max DI) exceed culture guidelines for steelhead, thus increasing fish health risks.*** *Due to space limitations in the intermediate and outdoor raceways, steelhead are held in the troughs beyond recommended rearing densities for steelhead. This protocol results in density indexes attaining D.I. = 1.15 in the indoor nursery tanks prior to transfer to the outdoor raceways.*

**Recommendation TR-SS7:** Reduce rearing densities in the shallow troughs to a maximum of D.I. = 0.5 by increasing the number of nursery rearing or intermediate rearing tanks (see LF-SS12), by reducing the total number of Lyons Ferry steelhead reared, by reducing the number of fish reared in other programs, or by reducing the total number of stocks reared at Lyons Ferry FH. **WDFW Response: This problem was identified a few years ago. WDFW has**

**proposed to increase the rearing capacity by utilizing the area where the spring Chinook captive broodstock program took place. The large 20' circular ponds are proposed for removal and replacement with shallow rearing tanks. It is also desired to have the area covered and, if possible, to be enclosed.**

**Release and Outmigration**

***Issue TR-SS8: Outplanting fry that are progeny of IHN virus positive females may pose fish health risks to the Tucannon River natural population.*** *The risk of the IHN virus being transferred to the progeny is low due to egg disinfection. However, releases still pose fish health risks to natural-origin steelhead populations compared to the low potential benefits. Studies indicate that outplants at the subyearling fry stage have shown extremely low survivals to adulthood and may actually pose significant ecological risks by displacing natural-origin fry which are generally smaller than hatchery-origin fry at the time of outplanting.* [1,2]

**Recommendation TR-SS8:** Discontinue out-planting fry. If the program size is increased, consider sampling the fry for viruses and retain and rear the group to smolt-stage only if they are IHN virus negative. **Response: all co-managers and NOAA fisheries selected fry release of the IHNV females as the preferred alternative. WDFW believes this was a relatively neutral action, with minimal risk to the natural population, while reducing the risk in the hatchery to all other steelhead stocks present. IHNV is present in the basin and out-plants occurred into habitat that had experienced low natural spawning, thus minimizing the ecological interaction between hatchery and natural fry. This practice will likely continue.**

***Issue TR-SS9: Pre-release exams which include testing for virus, bacteria and parasites are not done at the Lyons Ferry FH Complex and associated acclimation sites.*** *There is a potential risk that endemic or vertically transmitted diseases might be undetected in released juveniles. This could affect their future survival and/or infected fish could serve as vectors in infecting other aquatic animals . Pre-release inspections, done 4-6 weeks before release or transfer are required by USFWS fish health policy FW 713.*

**Recommendation TR-SS9:** Sample 60 fish for pre-release inspections to meet the American Fisheries Society – Fish Health Section Blue Book requirements to ensure a 95% confidence in detecting pathogens at the minimum assumed pathogen prevalence level of 5%. Additional testing for non-reportable pathogens, such as *Flavobacterium psychrophilum* and *Nucleospora salmonis*, may be informative for co-managers. **WDFW response: Additional testing for other pathogens such as *Nucleospora sp.* should be accomplished since past efforts have been sporadic and localized. However, *Nucleospora sp.* surveillance using PCR testing is expensive with cost of $30.00 per sample and may be limited. WDFW fish health staff questions the value of testing all fish for selected pathogens before release. If IHN virus (or other pathogens) were detected, we would be strongly hesitant to destroy these ESA listed**

[1] Nickelson, T.E., M.F. Solazzi, and S.L. Johnson. 1986. Use of hatchery coho salmon (Oncorhynchus kisutch) to rebuild wild populations in Oregon coastal streams. Canadian Journal of Fisheries and Aquatic Sciences 43: 2443-2449

[2] Kostow, K., A. Marshall, and S.R. Phelps. 2003. Natural Spawning Hatchery Steelhead Contribute to Smolt Production but Experience Low Reproductive Success. Transactions of the American Fisheries Society 132: 780-790.

# WDFW Tucannon River Endemic Stock Summer Steelhead-Tucannon River Release

## HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

| | |
|---|---|
| **Hatchery Program:** | **Snake River Summer Steelhead - Tucannon River Stock: Lyons Ferry Complex** |
| **Species or Hatchery Stock:** | **Tucannon River Summer Steelhead** *Oncorhynchus mykiss* |
| **Agency/Operator:** | **Washington Department of Fish Wildlife** |
| **Watershed and Region:** | **Tucannon River / Snake River / Columbia Basin, Washington State** |
| **Date Submitted:** | **September 1, 2001(original)**<br>**September 28, 2010 (re-submission)** |
| **Date Last Updated:** | **September 22, 2011** |

# SECTION 1. GENERAL PROGRAM DESCRIPTION

## 1.1) Name of hatchery or program.

Hatchery: Lyons Ferry Complex.
Program: Tucannon River Endemic Summer Steelhead Broodstock Program

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

Summer Steelhead *(O. Mykiss),* Tucannon River (Snake River ESU)

## 1.3) Responsible organization and individuals

*Hatchery Evaluations Staff Lead Contact*

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

1. U. S. Fish and Wildlife Service – Lower Snake River Compensation Plan (LSRCP) – Provides Program funding/oversight and provides coordination responsibility between all LSRCP cooperators.
2. Nez Perce Tribe (NPT) – Co-manager.
3. Confederated Tribes of the Umatilla Indian Reservation.

4. NOAA Fisheries

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

The LSRCP has funded production of mitigation fish (LFH stock summer steelhead) established as a result of hydroelectric projects in the Snake River that were released in the Tucannon River (2010 last release). The LSRCP program is committed to funding actions that are responsive to ESA needs for listed Snake River steelhead affected by LSRCP hatchery actions, while provided mitigation fisheries as detailed in the LSRCP. Currently, steelhead management for mitigation in the Tucannon River is mandated to provide 875 returning adult steelhead for harvest.

While both Operational and Evaluation costs are presently covered by LSRCP funding, additional funding will be required to fully develop the Tucannon River endemic summer steelhead broodstock program (BPA under RPA 40). For example, the temporary adult trap used in the lower/middle Tucannon River is inadequate under high flows, and the location of the trap may be too low in the system, increasing the chance that other basin stocks may be collected as part of the new broodstock. These limitations will likely limit the progress of the program in the future unless a completely separate adult trap can be constructed in the middle/lower river, or returns to the upper basin increase and broodstock can be removed from the river at Tucannon Fish Hatchery without harming the run to the upper river. Program costs (full mitigation program of 150,000 smolts/year) are currently unknown until facility modifications at Lyons Ferry and Tucannon Fish Hatcheries can be made).

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

*Broodstock holding and spawning, Incubation, rearing, and marking –* Currently this is being done at Lyons Ferry Hatchery – along the lower Snake River in Franklin County, Washington (RM 58), just below the mouth of the Palouse River. In the future, the entire program would be at Tucannon Fish Hatchery following facility modifications.

*Final rearing and transport for release* - Tucannon Hatchery – RM 36 on the Tucannon River (WRIA 35)

*Adult Trapping* – Tucannon FH Adult Trap would be the primary adult trap – RM 36.5 on the Tucannon River (WRIA 35)

*Adult Trapping* - Temporary Adult Trap – Secondary to compliment the Tucannon FH adult trap at an unspecified location further downstream (WRIA 35)

**1.6) Type of program.** **Integrated Recovery / Harvest**

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

**The preferred alternative will immediately eliminate releases of Lyons Ferry Hatchery (LFH) stock from the Tucannon River (2010 last release), and phase in an expansion of the**

**endemic stock production. Evaluation efforts will be expanded to monitor endemic stock performance and the natural population response to increased use of endemic steelhead and elimination of LFH stock releases. The expanded evaluation will also aid in determining wild stock status for ESA. These actions are consistent with RPAs 40 and 50.7 from the recent FCRPS Biological Opinion. In the near term, mitigation production of the LFH stock will be moved to direct releases from the LFH into Snake River.**

1. **Conservation:** Artificially maintain and/or increase numbers of naturally reproducing Tucannon River steelhead that successfully produce viable progeny which contribute to the conservation and recovery of the Tucannon River population and Snake River ESU.

2. **Mitigation Harvest:** Continue to provide mitigation as specified under the LSRCP program for losses to Tucannon River steelhead due to construction of Snake River Dams while meeting conservation and recovery criteria established for the Tucannon River population and Snake River ESU. Provide harvest opportunities established under *US v Oregon*, Washington's Statewide Steelhead Management Plan, and the WDFW's Fishery Management and Evaluation Plan (FMEP) for Snake River for fisheries.

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

Mitigation goals for the LSRCP were established in a three-step process (COE 1975). First the escapement that occurred prior to construction of the four dams was estimated. Second an estimate was made of the reduction in escapement (loss) caused by construction and operation of the dams (e.g. direct mortality of smolt). Last, a catch to escapement ratio was used to estimate the future production that was forgone in commercial and recreational fisheries as result of the reduced spawning escapement. Assuming that the fisheries below the project area would continue to be prosecuted into the future as they had in the past, LSRCP adult return goals were expressed in terms of the adult escapement back to, or above the project area. For steelhead, the escapement above Lower Granite Dam prior to construction of these dams was estimated at 114,800. 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 55,100. This number established the LSRCP escapement mitigation goal. Based on a catch to escapement ratio of 2:1, the anticipated benefit to fisheries below Lower Granite Dam was expected to be 110,200 fish.

| Component | Number |
|---|---|
| Escapement Above Lower Granite Dam | 55,100 |
| Commercial Harvest | 37,000 |
| Recreational Harvest Below Lower Granite Dam | 73,200 |
| Total | 165,300 |

One component of the steelhead mitigation computations was accounting for the estimated loss of 130,000 recreational angler days of effort caused by transforming the free flowing Snake River into a series of reservoirs. The COE recommended purchasing land to provide access for sportsman to compensate for this loss. When computing expected benefits for this loss, the COE assumed this access would be provided, that the 130,000 angler days would be restored and that that one fish would be caught for each five hours of effort. As such, the COE expected that 26,000 of the 110,200 steelhead would be caught in the Snake River below Lower Granite Dam. Location of the hatchery facilities was a key decision and the COE recommended: " These [steelhead hatcheries] should be constructed upstream of the Lower Snake River Project to provide for the sport fisheries of eastern Oregon, Washington and Idaho as well as the downriver fisheries". While recognizing that some steelhead crossing Lower Granite Dam would be caught, and some used for hatchery broodstock, no other specific priorities or goals were established regarding how the remaining fish might be used.

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 2:1 catch to escapement ratio has been less than expected and this has resulted in fewer adults being produced in most years.
- The listing of Snake River fall Chinook and Snake River Steelhead under the Endangered Species Act has resulted in significant curtailment of commercial, recreational and tribal fisheries throughout the mainstem Columbia River. This has resulted in a much higher percentage of the annual run returning to the project area than was expected.
- The U.S. v. Oregon court-stipulated Fishery Management Plan has established specific hatchery production agreements between the states, tribes and federal government and this has diversified the hatchery program by adding new off station releases to meet short term conservation objectives.

The Tucannon River endemic stock program is being designed to escape 875 steelhead back to the project area after a harvest of 1,750. However, many modifications at Lyons Ferry Complex will have to occur before these goals can be reached. In the short term, this program will act as a conservation program to assist in the recovery of natural steelhead in the Tucannon River. In the long-term, a portion of the program will designated for harvest mitigation to fulfill (or partially fulfill) the LSRCP goals. Depending on smolt-to-adult survivals from this program, it is realized that the harvest mitigation portion of the program could fall short of the LSRCP goals. WDFW will monitor returns, and will likely propose that some of the harvest mitigation may have to be moved to another program. While recognizing the overarching purpose and goals established for the LSRCP, and realities regarding changes since the program was authorized, the following objectives for the beneficial uses of steelhead returns have been established for the period through 2017:

1. To 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.

2. To trap 40-90 broodstock annually to perpetuate this program.
3. Eventually release up to 150,000 Tucannon Endemic stock steelhead smolts annually.
4. Contribute 875 adult steelhead to the project area (Snake River and Tucannon River) where they are available for sport and tribal fisheries.
5. Help restore a viable, naturally reproducing population in the Tucannon River

### 1.75 - Draft recovery plan goals

**Background**

The program goal to restore a viable natural population of steelhead in the Tucannon River will be guided in part by the recovery plan currently under development for the Snake River ESU of steelhead. The primary units of the recovery plan are Major Population Groups (MPGs). The steelhead that exist in the Tucannon and Asotin basins collectively represent one of these MPGs, which the ICTRT refers to as the Lower Snake MPG. For the ESU to achieve recovery, all MPGs must be viable. A determination of whether or not a MPG is viable is dependent on the status of the constitute populations. In the case of the Lower Snake steelhead MPG, both populations (the Tucannon and Asotin) must achieve viable status or one must achieve highly viable status for the MPG to be judged viable.

As described in the draft recovery plan, the general strategy is to use hatchery fish to help speed the recovery of the Tucannon steelhead population and rely entirely on natural fish to recover the Asotin steelhead population. Therefore, within the Tucannon basin, the recovery strategy includes the implementation of a conservation hatchery program with the intent to balance the adverse short-term impacts on diversity versus the long-term risk of population extirpation.

**Recovery Plan Strategy**

The abundance of natural origin spawners in Tucannon population over the past ten years has been critically low having a geometric mean of 150. This represents only 0.150 of the level necessary to meet the Minimum Abundance Threshold (MAT) of 1,000 established by the ICTRT for this population. As such this population is at risk of demographic collapse which could lead to extirpation. The strategy for this population was developed to address this immediate concern and relies on the use of hatchery fish to do so. In the short term, a hatchery broodstock, initiated from natural adults returning to the population, will be used to supplement the natural population and reduce its chances of demographic extinction. In the long term, the hatchery program will provide for gene banking and fishery benefits. Monitoring and future management of returning adults will also be used to achieve the balance between demographic risk of extinction and the genetic and ecological risks associated with hatchery fish consistent with the long-term goal of population recovery and achievement of a demographically independent naturally reproducing population. Specific actions to achieve this goal will be developed in a manner that is acceptable to the co-managers and consistent with obligations under the US v Oregon agreement.

**1.8) Justification for the program.**

The natural population in the Tucannon River experienced a decline in abundance in the 1990s, culminating in its being listed as threatened under the ESA as part of the Snake River ESU (August 18, 1997; 62 FR 43937). The LSRCP program has been operated since 1983 to provide mitigation for adult steelhead lost because of the construction of the four lower Snake River dams. The program has used Lyons Ferry Hatchery (LFH) stock since the late 1980s (Schuck et al. 1998). The LFH stock was derived from Wells and Wallowa Hatchery stocks, and returns back to Lyons Ferry Hatchery. As such, it does not represent individuals that came from the Tucannon River system. The 1999 Biological Opinion by NOAA Fisheries on the LSRCP-produced hatchery steelhead concluded that the continued use of hatchery steelhead stocks in the Snake River (including Lyons Ferry stock) jeopardized the continued existence and chance for recovery of wild steelhead populations within the Snake River. Recent genetic information from the Tucannon River also indicates that LFH stock adults spawning in the Tucannon River may be contributing to the wild population's current depressed condition (Bumgarner et al 2007). Also, recent PIT tag data shows that Tucannon River fish (both hatchery and natural reared) are returning to above Lower Granite Dam at an alarming rate, with few returning to the Tucannon River, similar to behavior of Tucannon spring Chinook. Especially with respect to the natural fish, this behavior is contributing to the steelhead population's depressed condition.

Development of a hatchery stock based on the endemic stock from the Tucannon River for mitigation production will serve several purposes. 1) Returning hatchery fish will likely increase the spawner numbers in under-utilized spawning and rearing steelhead habitat of the Tucannon River. The intent of efforts within this ESU is to reduce the short-term extinction risk to the existing wild population and to increase the likelihood of their recovery to a healthy status. These objectives may be accomplished by supplementing the population using an endemic brood stock. 2) Minimize the potential for genetic introgression and depression that may occur with continued use of the existing hatchery stock. In the early 1990's genetic allozyme data indicated little introgression between the native stock and the LFH stock had occurred. More recent microsatellite DNA data indicate introgression between the two stocks has occurred (Bumgarner et al 2007). Given that information, interbreeding between the LFH stock hatchery and natural fish may have reduced productivity and fitness within the natural population. 3) Speed the recovery of Tucannon River steelhead as natural productivity responds favorably to habitat improvements within the basin. 4) Provide mitigation production under LSRCP while complying with NOAA Fisheries' Reasonable and Prudent actions as listed in their Biological Opinion for the FCRPS (long term goal of this program). Washington Department of Fish and Wildlife desires to maintain healthy, abundant populations of steelhead within the Snake River, but also wants to provide abundant fishery opportunities as negotiated under the LSRCP mitigation program. 5) Potentially reduce straying within the Snake River basin. One early expectation of using a local broodstock was to reduce straying of returning hatchery fish. However, recent PIT tag data for adult returning steelhead that emigrated as smolts from the Tucannon River (LFH hatchery stock, Tucannon hatchery stock,, and natural reared fish) has shown that all groups stray above Lower Granite Dam (about 50% of the total return). If this behavior continues, further actions will be needed to assist this stock in the recovery process.

**1.9) List of program "Performance Standards".**

See 1.10 below.

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

***Recommended by the ICTRT for Monitoring and Evaluation (referenced as presented in the ICTRT document* "Viability Criteria for Application to Interior Columbia Basin Salmonid ESUs" (March 2007)**

**Abundance/Productivity:**

1. Snake River steelhead population specific abundance and productivity data: A majority of populations had little or no recruit/spawner information to assess abundance and productivity criteria; most status assessments relied on a Snake River aggregate (Lower Granite) data set. Population level assessments for steelhead can be difficult given environmental conditions at the time of spawning, the potential distribution across stream drainages, etc. Alternative techniques should be considered (e.g., redd based surveys, weir counts combined with juvenile surveys, etc), incorporating probabilistic sampling protocols for estimating abundance.

3. Snake River steelhead population specific hatchery fraction and age structure data: A majority of populations had inadequate or no hatchery fraction information to assess abundance and productivity criteria. In addition, there is inadequate data to estimate the number of hatchery spawners in the aggregate recruit/spawner analysis. A majority of populations had no or inadequate age structure information to assess abundance and productivity criteria; most status assessments relied on a Snake River aggregate (Lower Granite) data set.

5. SARs and juvenile productivity estimates for all Chinook ESUs and steelhead DPSs: Improve or collect information on SARs and juvenile productivity (i.e. smolts per spawner). SARs are essential for taking into account variability in survival during smolt outmigration and marine life stages in evaluating A&P criteria. The goal is to estimate SARs that are representative at the population level. There are a number of approaches to accomplish estimating these SARs (e.g. marking wild or hatchery smolts or estimating natural origin smolts and adult production). In addition, measures representing survival from spawning to out-migrating smolts would aid in partitioning productivity between freshwater and marine life-stages.

6. Population level effects of hatchery spawners on natural productivity for all ESUs and DPSs: For populations with hatchery spawners, develop representative estimates of the effects of hatchery spawners on population level productivity. Topics of interest include the effect of hatchery spawner contributions to the average natural productivity of a population and the relative effectiveness of hatchery spawners. In combination with adequate estimates of the relative levels of hatchery fish contributing to natural spawning for a particular population, this information would allow for more representative estimates of current and potential natural productivity levels.

**Spatial Structure and Diversity**

1. Steelhead populations spawner distribution and habitat preference data: Many of populations had inadequate spawner distribution information to assess spatial structure and diversity criteria. In addition, estimates of historical distribution are dependent upon habitat preferences derived from available empirical studies. Those studies are limited in scope and number. Additional information on habitat/steelhead preference or production relationships could improve the assessment of steelhead populations against SS/D criteria.

2. Phenotypic characteristics for populations in all ESUs/DPSs: Little information was available to assess phenotypic changes. Representative estimates of current morphological, life history or behavioral traits are not available for many populations. Additional analysis of relationships between habitat characteristics and phenotypic traits would improve the ability to assess changes from historical patterns at the population level.

3. Steelhead genetics information, particularly for Upper Columbia and Mid Columbia populations: Genetic baseline information and periodic follow-up surveys specifically designed to evaluate the level of variation or differentiation among subcomponents within populations and among populations. Periodic follow-ups would support evaluation of responses to management actions designed to promote restoration of natural patterns of population structure.

5. Spawner composition for steelhead populations with hatchery spawners: Collect specific spawner composition information including proportion and source of hatchery spawners. Information on the relative distribution of hatchery spawners among production areas within populations would also improve the ability to assess status against ICTRT spatial structure criteria.

6. Selective mortality effects for populations in all ESUs/DPSs: Little information was available to assess selective mortality resulting from differential impacts of human induced mortality. Additional information is needed to better assess human induced mortality effects in each of the four Hs (habitat, hatcheries, harvest and hydropower)

**1.10.1) "Performance Indicators" addressing benefits**.

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. The NPCC standards represent the common knowledge up to 2001. Utilization of more recent reviews on the standardized methods for evaluation of hatcheries and supplementation at a basin wide ESU scale is warranted.

In a report prepared for 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 (Galbreath 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 specific to supplementation projects. The framework utilizes a common set of standardized performance measures as established by the Collaborative System wide Monitoring and Evaluation Project (CSMEP). Adoption of this suite of performance measures and definitions across multiple study designs will facilitate coordinated analysis of findings from regional monitoring and evaluation efforts. This is needed to address management questions and critical uncertainties associated with the relationships between harvest augmentation and supplementation hatchery production, and ESA listed stock status/recovery.

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

**Table 1. 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.<br>1.1.2. Total fisher days or proportion of harvestable returns taken in Tribal resident fisheries, by fishery.<br>1.1.3.Tribal acknowledgement regarding fulfillment of tribal treaty rights. |
| | 1.2. Program contributes to mitigation requirements. | 1.2.1.Number of fish released by program, returning, or caught, as applicable to given mitigation requirements. |
| | 1.3. Program addresses ESA responsibilities. | 1.3.1.Section 7, Section 10, 4d rule and annual consultation |
| 2. IMPLEMENTATION AND COMPLIANCE | 2.1. Program contributes to mitigation requirements. | 2.1.1.Hatchery is operated as a segregated program.<br>2.1.2.Hatchery is operated as an integrated program<br>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.<br>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.<br>2.4.2.Number if adult returns by release group harvested<br>2.4.3.Number of non-target species encountered in fisheries for targeted release group. |

| Category | Standards | Indicators |
|---|---|---|
| | 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.<br><br>2.5.2.Numbers of fish per release group are known and reported.<br><br>2.5.3.Average size, weight and condition of fish per release group are known and reported.<br><br>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.).<br><br>2.6.2.Harvest management, harvest sharing agreements, broodstock collection schedules, and disposition of fish trapped at hatcheries in excess of broodstock needs are coordinated among co-management agencies.<br><br>2.6.3.Co-managers react adaptively by consensus to monitoring and evaluation results.<br><br>2.6.4.Monitoring and evaluation results are reported to co-managers and regionally in a timely fashion. |
| 3. HATCHERY EFFECTIVENESS MONITORING REGIONAL FOR AUGMENTATION AND SUPPLEMENTATION PROGRAMS | 3.1. Release groups are marked in a manner consistent with information needs and protocols for monitoring impacts to natural- and hatchery-origin fish at the targeted life stage(s) (e.g. in juvenile migration corridor, in fisheries, etc.). | 3.1.1.All hatchery origin fish recognizable by mark or tag and representative known fraction of each release group marked or tagged uniquely.<br><br>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.<br><br>3.2.2.Adult to adult or juvenile to adult survivals are estimated.<br><br>3.2.3.Temporal and spatial distribution of adult spawners and rearing juveniles in the freshwater spawning and rearing areas are monitored.<br><br>3.2.4.Timing of juvenile outmigration from rearing areas and adult returns to spawning areas are monitored.<br><br>3.2.5.Ne and patterns of genetic variability are frequently enough to detect changes across generations. |
| | 3.3. Fish for harvest are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while avoiding over-harvest of non-target species. | 3.3.1.Number of fish release by location estimated and in compliance with AOPs and US vs. OR Management Agreement.<br><br>3.3.2.Number if adult returns by release group harvested<br><br>3.3.3.Number of non-target species encountered in fisheries for targeted release group. |

| Category | Standards | Indicators |
|---|---|---|
| | 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.<br><br>3.4.2. Hatchery strays in non-target populations are predominately from in-subbasin releases.<br><br>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.<br><br>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 trend in abundance of fish by life stage is monitored annually.<br><br>3.6.2. Pre- and post-supplementation trends in adult-to-adult or juvenile to adult survivals are estimated.<br><br>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.<br><br>3.6.4. Timing of juvenile outmigration from rearing area and adult returns to spawning areas are monitored. |
| | 3.7. Natural production of target population is maintained or enhanced by supplementation. | 3.7.1. Adult progeny per parent (P:P) ratios for hatchery-produced fish significantly exceed those of natural-origin fish.<br><br>3.7.2. Natural spawning success of hatchery-origin fish must be similar to that of natural-origin fish.<br><br>3.7.3. Temporal and spatial distribution of hatchery-origin spawners in nature is similar to that of natural-origin fish.<br><br>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).<br><br>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.<br><br>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.<br><br>3.8.3. Genetic characteristics of the supplemented population remain similar (or improved) to the unsupplemented populations. |

| Category | Standards | Indicators |
|---|---|---|
| | 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.<br><br>3.9.2. Life history characteristics of hatchery-origin adult fish are indistinguishable from natural-origin fish.<br><br>3.9.3. Juvenile emigration timing and survival differences between hatchery and natural-origin fish must be minimal. |
| | 3.10. The distribution and incidence of diseases, parasites and pathogens in natural populations and hatchery populations are known and releases of hatchery fish are designed to minimize potential spread or amplification of diseases, parasites, or pathogens among natural populations. | 3.10. Detectable changes in rate of occurrence and spatial distribution of disease, parasite or pathogen between the affected hatchery and natural populations. |
| 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.<br><br>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.<br><br>4.3.2. Water withdrawals compared to NMFS, USFWS, and WDFW juvenile screening criteria.<br><br>4.3.3. Number of adult fish aggregating and/or spawning immediately below water intake point.<br><br>4.3.4. Number of adult fish passing water intake point.<br><br>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.<br><br>4.4.2. Juvenile densities during artificial rearing.<br><br>4.4.3. Samples of natural populations for disease occurrence before and after artificial production releases. |

| Category | Standards | Indicators |
|---|---|---|
| | 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.<br><br>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.<br><br>4.7.2. Pre-spawning 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.<br><br>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.<br><br>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.<br><br>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.<br><br>5.3.2. Recreational fishery angler days, length of seasons, and number of licenses purchased. |

Use the above information to determine whether the population has declined, remained stable, or has been recovered to sustainable levels. The ability to estimate hatchery and natural proportions will be determined by implementation plans, budgets, and assessment priorities.

### 1.10.2) "Performance Indicators" addressing risks.

The suite of performance measures developed by the CSMEP represents a crosswalk mechanism that is needed to quantitatively monitor and evaluate the standards and indicators listed in Table 1. The CSMEP measures have been adopted by the AHSWG (Galbreath et. al. 2008). The adoption of this regionally-applied means of assessment will facilitate coordinated analysis of findings from basin-wide M&E efforts and will provide the scientifically-based foundation to address the management questions and critical uncertainties associated with supplementation and ESA listed stock status/recovery.

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

**Table 2. Standardized performance measures and definitions for status and trends and hatchery effectiveness monitoring and the associated performance indicator that it addresses. (Taken from Beasley et al. 2008).**

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

| Performance Measure | | Definition | Related Indicator |
|---|---|---|---|
| | Smolts | Smolt estimates, which result from juvenile emigrant trapping and PIT tagging, are derived by estimating the proportion of the total juvenile abundance estimate at the tributary comprised of each juvenile life stage (parr, pre-smolt, smolt) that survive to first mainstem dam. It is calculated by multiplying the life stage specific abundance estimate (with standard error) by the life stage specific survival estimate to first mainstem dam (with standard error). The standard error around the smolt equivalent estimate is calculated using the following formula; where X = life stage specific juvenile abundance estimate and Y = life stage specific juvenile survival estimate: $Var(X \cdot Y) = E(X)^2 \cdot Var(Y) + E(Y)^2 \cdot Var(X) + Var(X) \cdot Var(Y)$ | 3.2.1, 3.6.1, 3.7.4 |
| | Run Prediction | This will not be in the raw or summarized performance database. | 2.3.1, |

| 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.<br><br>*Smolt-to-adult return rates* are generated for four performance periods; tributary to tributary, tributary to first mainstem dam, first mainstem dam to first mainstem dam, and first mainstem dam to tributary.<br><br>*First mainstem dam to first mainstem dam* SAR estimates are calculated by dividing the number of PIT tagged adults returning to first mainstem dam by the estimated number of PIT tagged juveniles at first mainstem dam. Variances around the point estimates are calculated as described above.<br><br>*Tributary to tributary* SAR estimates for natural and hatchery origin fish are calculated using PIT tag technology as well as direct counts of fish returning to the drainage. PIT tag SAR estimates are calculated by dividing the number of PIT tag adults returning to the tributary (by life stage and origin type) by the number of PIT tagged juvenile fish migrating from the tributary (by life stage and origin type). Overall PIT tag SAR estimates for natural fish are then calculated by averaging the individual life stage specific 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.<br><br>*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.<br><br>*First mainstem dam to tributary* SAR estimates are calculated by dividing the number of PIT tagged adults returning to the tributary by the estimated number of PIT tagged juveniles at first mainstem dam. The estimated number of PIT tagged juveniles at first mainstem dam is calculated by multiplying life stage specific survival estimates (with standard errors) by the number of juveniles PIT tagged in the tributary. The variance for the estimated number of PIT tagged juveniles at first mainstem dam is calculated as follows, where X = the number of PIT tagged fish in the tributary and Y = the variance of the life stage specific survival estimate:<br>$Var(X \cdot Y) = X^2 \cdot Var(Y)$<br>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:<br>$Var\left(\frac{X}{Y}\right) = \left(\frac{EX}{EY}\right)^2 \cdot \left(\frac{Var(Y)}{(EY)^2}\right)$ | 3.2.1, 3.2.2, 3.7.4 |
| | Progeny-per-Parent Ratio | Adult to adult calculated for naturally spawning fish and hatchery fish separately as the brood year ratio of return adult to parent spawner abundance using data above weir. Estimates of this ratio for fish spawning and produced by the natural environment must be adjusted to account for the confounding effect of spawner density on this metric. Two variants calculated: 1) escapement, and 2) spawners. | 3.2.1, 3.2.2, 3.7.4 |

| 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, adjusted for the confounding effects of spawner density. Derive adult escapement above juvenile trap multiplied by the pre-spawning mortality estimate. Adjusted for redds above juvenile Trap. *Recruit per spawner* estimates, or *juvenile abundance (can be various life stages or locations) per redd/female*, is used to index population productivity, since it represents the quantity of juvenile fish resulting from an average redd (total smolts divided by total redds) or female. Several forms of juvenile life stages are applicable. We utilize two measures: 1) juvenile abundance (parr, pre-smolt, smolt, total abundance) at the tributary mouth, and 2) smolt abundance at first mainstem dam. | 3.2.1, 3.2.2, 3.7.4 |
| | Pre-spawn Mortality | Percent of female adults that die after reaching the spawning grounds but before spawning. Calculated as the proportion of "25% spawned" females among the total number of female carcasses sampled. ("25% spawned" = a female that contains 75% of her egg compliment]. | 3.2.3, 4.5.1 |
| | Juvenile Survival to first mainstem dam | Life stage survival (parr, pre-smolt, smolt, 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. screw traps) are used to calculate survival estimates. | 3.2.2, 3.6.2, 3.7.5, 3.9.3, |
| Distribution | Adult Spawner Spatial Distribution | Extensive area tributary spawner distribution. Target GPS red locations or reach specific summaries, with information from carcass recoveries to identify hatchery-origin vs. natural-origin spawners across spawning areas within populations. | 3.2.3, 3.2.4, 3.6.3, 3.7.3, 4.3.3, 4.6.1 |
| Distribution | Stray Rate (percentage) | Estimate of the number and percent of hatchery origin fish on the spawning grounds, as the percent within MPG, and percent out of ESU. Calculated from 1) total known origin carcasses, and 2) uses fish released above weir. Data adjusted for unmarked carcasses above and below weir. | 3.4.1, 3.4.2, 3.4.3 |
| Distribution | Juvenile Rearing Distribution | Chinook rearing distribution observations are recorded using multiple divers who follow protocol described in Thurow (1994). | |
| Distribution | Disease Frequency | Natural fish mortalities are provided to certified fish health lab for routine disease testing protocols. Hatcheries routinely samples fish for disease and will defer to then for sampling numbers and periodicity | 3.10, 4.4.3 |
| Genetic | Genetic Diversity | Indices of genetic diversity – measured within a tributary (heterozygosity – allozyme, microsatellite), or among tributaries across population aggregates (e.g., FST). | 3.2.5, 3.8.3, 3.9.1 |
| Genetic | Reproductive Success (Nb/N) | Derived measure: determining hatchery: wild proportions, effective population size is modeled. | 3.7.2 |
| Genetic | Relative Reproductive Success (Parentage) | Derived measure: the relative production of offspring by a particular genotype. Parentage analyses using multi-locus genotypes are used to assess reproductive success, mating patterns, kinship, and fitness in natural 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 |
| Genetic | Effective Population Size (Ne) | Derived measure: the number of breeding individuals in an idealized population that would show the same amount of dispersion of allele frequencies under random genetic drift or the same amount of inbreeding as the population under consideration. | 3.2.5 |

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

| Performance Measure | | Definition | Related Indicator |
|---|---|---|---|
| | Instream Flow | USGS gauges and also staff gauges | |
| | Water Temperature | Various, mainly Hobo and other temp loggers at screw trap sights and spread out throughout the streams | |
| | Chemical Water Quality | TBD | |
| | Macroinvertebrate Assemblage | TBD | |
| | Fish and Amphibian Assemblage | Observations through rotary screw trap catch and while conducting snorkel surveys. | 2.4.3, 3.3.3, 3.4.1 |
| In-Hatchery Measures | Hatchery Production Abundance | The number of hatchery juveniles of one cohort released into the receiving stream per year. Derived from census count minus prerelease mortalities or from sample fish- per-pound calculations minus mortalities. Method dependent upon marking program (census obtained when 100% are marked). | 2.5.2, 2.5.3, 2.6.1, 4.4.2 |
| In-Hatchery 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.<br>Estimated survival of various in-hatchery juvenile stages (green egg to eyed egg, eyed egg to ponded fry, fry to parr, parr to smolt and overall green egg to release) Derived from census count minus prerelease mortalities or from sample fish-per-pound calculations minus mortalities. Life stage at release varies (smolt, pre-smolt, parr, etc.). | |
| 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, pre-smolt, 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 | 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 pre-spawning mortality. | 2.2.1 |
| In-Hatchery Measures | Hatchery Broodstock Pre-spawning 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 ovarian fluids. 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 | Length of Broodstock Spawner | Mean fork length by age measured in millimeters of male and female broodstock spawners. Measured at spawning and/or at weir collection. Is used in conjunction with scale reading for aging. | 3.9.2 |
| 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 (not all programs monitor volitional releases). | 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 | 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. | |

WDFW will use the above indicators to determine whether the program has, or is, causing unacceptable risks to the listed natural populations within the Tucannon River. The ability of the evaluation staff to estimate hatchery and natural proportions in the Tucannon River and other basins will be determined by implementation plans, budgets, and assessment priorities.

## 1.11) Expected size of program.

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

The current program level (production of 75,000 smolts on an annual basis) requires the spawning of 17-18 female steelhead, depending on age and size if the female. We desire that a unique male be spawned with each female, so we plan to capture at least 20 males for spawning. We've found in the past that not all males ripen at the same time as the females, so the more males we have on hand during spawning increases our chances of successful fertilization without re-using the same males. Adult collections will be increased until full program is reached as facility modifications are completed.

At full program level, we anticipate the collection of 90 fish annually (may consist of either natural or hatchery-origin) to meet full production goals. Percent hatchery origin fish in the broodstock will not exceed 30%.

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

The current production goal for endemic Tucannon steelhead is 75,000 smolts starting in the 2010 brood year. This production level is the maximum amount that can be reared in existing space at the Lyons Ferry Complex (LFH and TFH). An expansion of LFC will need to occur before full production of Tucannon endemic steelhead can be achieved. The WDFW anticipates facility design and construction may not occur before the BY 2013 or 2014 fish are available for collection. How quickly the full production program can be reach will be determined on returns of natural and endemic origin fish and funding for facility modifications.

The existing 2010 brood year LFH stock steelhead production for Tucannon River (100,000 smolts) will be reared at LFH and released into the Snake River on-site in 2011. Release years 2012-2014 will be a transition period from full production of LFH stock for mitigation releases at LFH. A possible stock change from the LFH stock to another Snake River stock and release location is under consideration with the co-managers. Refer to the

LFH steelhead stock on-site production HGMP for future production levels of this program.

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

The Tucannon River endemic hatchery broodstock is a new program and has limited performance data. Smolt-to-adult return rates (SAR) for several release years of LFH stock steelhead released into the Tucannon River have been documented (Table 3) and are provided below. SARs have been estimated using a combination of coded-wire tag recoveries and freeze brand observations at Lower Granite Dam. Because the endemic stock fish have not been marked for harvest, we have used PIT tags to determine SARs. PIT tags and CWT survival data are not directly comparable. Table 4 provides estimated survival of Tucannon River endemic stock fish, Tucannon River natural stock and, the LFH stock smolts released into the Tucannon River based on PIT tags. The Tucannon endemic stock smolts have preformed the worst to date among the three groups, with the endemic stock at 50% survival of the natural stock, and the natural stock about 50% the survival of the LFH hatchery stock.

Table 3. Recoveries and estimated smolt-to-adult return rates from LFH stock steelhead released directly into the Tucannon River (upriver and downriver locations), or from Curl Lake Acclimation pond.

| Brood Year | Curl Lake Releases | | Direct Stream Releases | |
|---|---|---|---|---|
| | Total SAR (%) | Total SAR to LSRCP Area (%) | Total SAR (%) | Total SAR to LSRCP Area (%) |
| 1983 | | | 1,732 (1.52) | 1,286 (1.13) |
| 1984 | 555 (0.74) | 398 (0.53) | | |
| 1985 | 748 (0.93) | 538 (0.67) | | |
| 1986 | 650 (1.05) | 528 (0.87) | | |
| 1987 | 631 (1.05) | 524 (0.87) | | |
| 1988 | 474 (0.79) | 374 (0.62) | 562 (1.41) | 412 (1.04) |
| 1989 | 836 (2.11) | 655 (1.65) | 1,555 (1.96) | 1,232 (1.55) |
| 1990 | 292 (0.73) | 235 (0.59) | 271 (0.46) | 212 (0.36) |
| 1991 | 77 (0.26) | 69 (0.24) | 785 (1.32) | 577 (0.97) |
| 1992 | 448 (2.04) | 346 (1.58) | | |
| 1993 | 467 (0.95) | 344 (0.70) | | |
| 1994 | 1,017 (1.93) | 833 (1.58) | | |
| 1995 | 88 (0.33) | 75 (0.28) | 454 (1.56) | 398 (1.37) |
| 1996 | 87 (0.33) | 80 (0.30) | 208 (0.77) | 204 (0.75) |
| 1997 | | | 1,088 (2.20) | 992 (2.01) |
| 1998 | | | 774 (1.95) | 667 (1.68) |
| 1999 | | | 1,279 (3.24) | 1,153 (2.92) |
| 2000 | | | 337 (1.71) | 216 (1.09) |
| 2001 | | | 257 (1.26) | 245 (1.20) |
| 2002 | | | 377 (1.82) | 339 (1.63) |
| 2003 | | | 241 (1.19) | 221 (1.09) |
| 2004 | | | 300 (1.59) | 269 (1.43) |
| Average | 1.02 | 0.81 | 1.60 | 1.35 |

Table 4. Estimated smolt-to-adult survival rates of Tucannon natural stock, Tucannon endemic stock, and LFH stock based on PIT tag returns to Bonneville or into the Snake River (last detected at McNary Dam).

| Smolt Migration Year | Tucannon River Natural Origin | | Tucannon River Endemic Hatchery Origin | | Lyons Ferry Hatchery Origin | |
|---|---|---|---|---|---|---|
| 1999 | 1.65 | 1.38 | - - - | - - - | - - - | - - - |
| 2000 | 3.60 | 2.88 | - - - | - - - | - - - | - - - |
| 2002 | 2.66 | 2.12 | - - - | - - - | - - - | - - - |
| 2003 | 2.31 | 1.93 | - - - | - - - | - - - | - - - |
| 2004 | 1.61 | 1.01 | 0.59 | 0.45 | - - - | - - - |
| 2005 | 1.47 | 1.25 | 0.83 | 0.70 | - - - | - - - |
| 2006 | 2.47 | 1.69 | 1.24 | 0.82 | 5.22 | 4.11 |
| 2007 [1] | 1.33 | 1.00 | 1.34 | 0.99 | 4.08 | 3.28 |
| **Average** | **2.14** | **1.66** | **1.00** | **0.74** | **4.65** | **3.69** |

[1] Represents only 1-salt returns.

The current estimated natural escapement for the Tucannon population is far short of the recovery goal MAT of 1000 fish and is evidence that the capacity and productivity of the existing habitat and associated life cycle survival is insufficient to achieve and sustain this abundance recovery goal. A significant contributing factor for this failure in population productivity is the finding in recent years (from WDFW PIT studies) that nearly half of the yearly returns stray and most remain above Lower Granite Dam. This behavior is the same for all steelhead migrating from the Tucannon River, regardless of the stock (Table 5). This straying behavior to areas upstream of Lower Granite Dam may be a natural life history trait, or be environmentally driven. However, with the mainstem dams in place it appears it is more difficult for those fish to return downriver to their intended stream. Many of the fish that return to the Tucannon River from upstream of Lower Granite Dam do so primarily in the early spring.

WDFW had hoped that survival of the endemic brood hatchery reared fish would equal or exceed the SARs for its long-term hatchery stock, though current data suggest we are well short of that goal. Fish returning from endemic brood hatchery program will be allowed to spawn in the wild and with the expectation they will contribute to filling available habitat, and increasing the number of naturally produced fish spawning in the wild one generation later. Since this is a locally derived hatchery stock it is expected they will have a higher reproductive contribution to natural Tucannon population than would be the case for the non-local and more domesticated LFH hatchery stock. However, whether this expectation is realized may ultimately depend upon improvements in basin productivity and migratory corridor survival.

Based on the PIT tag information and from adult migratory observations the average estimated spawning escapement of natural origin steelhead into the Tucannon River Basin from 1999 to 2008 averaged 150 natural origin fish/year (Table 6).

Table 5. Disposition of PIT tagged Tucannon Endemic stock, Tucannon natural stock, and Lyons Ferry hatchery stock summer steelhead that crossed Ice Harbor Dam.

| Release Year | Pass Ice | Pass Granite | Enter Tucannon | Unknown Location | Back to Tucannon From Granite | % back to Tucannon from LGR | Total into Tucannon | Percent of those that passed Ice Harbor Dam: % into Tucannon | % above Granite | % Unknown |
|---|---|---|---|---|---|---|---|---|---|---|
| Tucannon Endemic Hatchery Stock Summer Steelhead | | | | | | | | | | |
| 2004 | 48 | 30 | 11 | 7 | 5 | 16.7 | 16 | 33.3 | 52.1 | 14.6 |
| 2005 | 55 | 35 | 17 | 3 | 8 | 22.9 | 25 | 45.5 | 49.1 | 5.5 |
| 2006 | 105 | 69 | 18 | 18 | 16 | 23.2 | 34 | 32.4 | 50.5 | 17.1 |
| 2007 | 79 | 55 | 2 | 22 | 1 | 1.8 | 3 | 3.8 | 68.4 | 27.8 |
| **Totals 04-06** | **208** | **134** | **46** | **28** | **29** | **21.6** | **75** | **36.1** | **50.5** | **13.5** |
| Tucannon Natural Stock Summer Steelhead | | | | | | | | | | |
| 2004 | 17 | 11 | 6 | 2 | 2 | 18.2 | 8 | 47.1 | 52.9 | 11.8 |
| 2005 | 20 | 12 | 6 | 5 | 3 | 25.0 | 10 | 50.0 | 45.0 | 25.0 |
| 2006 | 16 | 8 | 3 | 5 | 0 | 0.0 | 3 | 18.8 | 50.0 | 31.3 |
| 2007 | 3 | 1 | 1 | 0 | 0 | 0.0 | 1 | 33.3 | 66.7 | 0.0 |
| **Totals 04-06** | **53** | **31** | **15** | **12** | **5** | **16.1** | **21** | **39.6** | **49.1** | **22.6** |
| Lyons Ferry Hatchery Stock Summer Steelhead (Released into the lower Tucannon River) | | | | | | | | | | |
| 2006 | 318 | 229 | 54 | 35 | 44 | 19.2 | 98 | 30.8 | 58.2 | 11.0 |
| 2007 | 155 | 75 | 35 | 42 | 7 | 9.0 | 42 | 27.1 | 45.8 | 27.1 |

Note: The Tucannon River PIT tag array was taken out by high stream flow in January, 2009. One-salt returns from the 2007 release year, and two-salt returns from the 2006 release year that entered the Tucannon River after the array was destroyed could not be added to the table. Therefore, the percent of fish into the Tucannon, above Granite, or Unknown destination for the 2007 and 2006 release years are not completely accurate.

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

The endemic broodstock program began in the fall of 1999 with 2000 brood year fish collected from the lower Tucannon River adult trap.

### 1.14) Expected duration of program.

A priority for the endemic program as proposed is to continue long-term mitigation under the LSCRP, while decreasing the negative effects of a hatchery program within the basin. Evaluation of the stock's performance toward this goal will continue and may affect phasing from current proposed production (75,000 smolts) to full production (150,000). WDFW and the co-managers will decide on production levels for the Tucannon stock as evaluation results become available.

It is expected that program conservation and recovery actions will continue until the abundance level for this population exceeds the MAT (1000 natural fish) with a productivity rate that is consistent with sustaining this level (an average recruits per spawner of 1.0).

Table 6. Plausible number of Tucannon River natural origin summer steelhead that returned to spawn in the Tucannon River based on adult PIT tag returns above Ice Harbor Dam, 2000-2009 run years.

| Migration year | Estimated smolts [a] | Number PIT tagged | Adult return to Ice Harbor | Adjusted return to Ice Harbor [b] | Salt age 1 | Salt age 2 | Salt age 3 | Run year | Total return to Ice Harbor | 50% of return to Tucannon River [c] |
|---|---|---|---|---|---|---|---|---|---|---|
| 1998 | 29,067 | 465 | 2 | 2 | 63 | 125 | 0 | | | |
| 1999 | 23,451 | 363 | 5 | 5 | 258 | 194 | 0 | 2000 | 383 | 192 |
| 2000 | 22,681 | 555 | 14 | 15 | 327 | 450 | 0 | 2001 | 521 | 260 |
| 2001 | 19,754 | 333 | 0 | 0 | 0 | 0 | 0 | 2002 | 450 | 225 |
| 2002 | 18,558 | 1506 | 32 | 34 | 173 | 222 | 25 | 2003 | 173 | 86 |
| 2003 | 18,728 | 1556 | 29 | 31 | 181 | 205 | 12 | 2004 | 402 | 201 |
| 2004 | 13,586 | 1984 | 18 | 21 | 62 | 68 | 7 | 2005 | 291 | 145 |
| 2005 | 14,477 | 1835 | 20 | 22 | 63 | 126 | 0 | 2006 | 144 | 72 |
| 2006 | 8,289 | 1417 | 19 | 23 | 76 | 47 | 0 | 2007 | 209 | 105 |
| 2007 | 10,404 | 300 | 5 | 6 | 104 | 69 | NA | 2008 | 151 | 75 |
| 2008 | 14,304 | 1087 | 36 | 50 | 658 | NA | NA | 2009 | 727 | 364 |
| | | | | **Average 2000-2008 Run Years** | | | | | **303** | **151(150)[d]** |

[a] The estimated smolts presented are for spring (March-June) migrants only. PIT tags were only applied during the spring months, as that is when we typically get the largest number of smolt migrating past the smolt trap.

[b] Returns to Ice Harbor were adjusted based on total smolt production for each migration year. Smolts leaving during the fall and winter months (October-February) represent 5-25% of the total outmigration. We assumed that the fall/winter migrants survival as well as spring migrants.

[c] Based on adult detections at the Snake River dams, it appears that generally 50% of the fish passing Ice Harbor remain above Lower Granite Dam. The remaining 50% have been assigned to the Tucannon River for simplicity. The actual percentage based on the PIT tag array in the lower Tucannon River would suggest 35-40%, though the efficiency of the Tucannon River PIT tag array is unknown.

[d] Number within parenthesis represents the geometric mean of natural origin spawners for the same time period.

## 1.15) Watersheds targeted by program.

Tucannon River (WRIA 35).

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

In 2009 and 2010, two independent scientific review groups reviewed this program. Their findings are summarized as follows:

The Hatchery Scientific Review Group (HSRG) made two recommendations to improve the hatchery program: 1) to improve fitness and limit genetic introgression, managers should eliminate releases of Lyons Ferry stock steelhead in the Tucannon River, and. 2) continue to operate the current endemic program (50,000 smolts, pNOB 100%). In addition, the HSRG recommended that managers should consider demographic risks to the population and modify their protocols during periods of low abundance. The HSRG acknowledges that managing for the recommended PNI values may not be possible or appropriate in the near term when abundance levels are low and demographic risks to the population increase. To address this concern, managers should develop a variable sliding scale for managing both pNOB and pHOS. An example of such a sliding scale would look like this: Each year, depending on NOR run size, pNOB and pHOS are allowed to “float” or slide.

The HSRG assumes managers will establish an acceptable level of removal of NORs for use in the hatchery brood. This will be a fixed percentage of the total NOR return (say 40%) and will not change, regardless of NOR return. In years of high NOR abundance, this 40% could make up 100% of the needed hatchery brood (pNOB= 100%). In that case, no HORs would be used in the hatchery brood. Hatchery fish can be allowed to reach the spawning ground (pHOS) if needed to achieve an appropriate number of fish spawning naturally (demographic benefit and use of available habitat). This however, would not be required during years of very high NOR returns as both objectives (pNOB and natural spawning) may be met with NORs.

In years of low NOR abundance, the same 40% of the NOR return would be removed for use in the hatchery brood (pNOB). However, in these years, that 40% may make up only a small part of the needed brood (i.e. pNOB 10%). In these years, enough HORs should be used to achieve needed hatchery brood and additional HORs should be allowed to spawn naturally (pHOS) to achieve the minimum acceptable level of naturally spawning.
The goal of this sliding scale is to achieve an "average" PNI over time of the desired level (0.67 or 0.5) depending on the population designation even though it may not be achieved in any one year. A good way to determine the level of NORs that should be removed each year (see above) is to review the return of NORs over a long time frame and iterate what level (30, 40, 50%) are needed, on average, to achieve the desired PNI. Managers should investigate ways to address the problem of adults straying above Lower Granite Dam. Unless this straying problem is solved, it appears unlikely that this population can meet the abundance standards for a Primary population. If this problem is addressed, a number of other options exist, including harvest or increasing the program. The HSRG encourages managers to explore opportunities to increase the harvest contribution, such as increasing daily bag limits. The HSRG supports alternate uses of surplus fish such as distribution to local food banks and/or stream nutrification.

**WDFW Response: WDFW and Tribal co-managers have discontinued the release of Lyons Ferry stock steelhead into the Tucannon River (2010 last release) and implemented expanded use of endemic Tucannon steelhead. WDFW does not believe that there is a straying problem from the Tucannon River that is a result of the hatchery program. We feel that this is a normal behavior that is negatively affected by the hydro-system, as all steelhead from the Tucannon (natural origin, both hatchery stocks) have shown the same tendency to migrate past Lower Granite Dam upon return. In addition, we have no current means to control hatchery origin fish on the spawning grounds and have not recommended attempting to control hatchery fraction on the spawning grounds through construction of a lower river weir. A permanent weir could have potentially serious negative effects on steelhead, as well as spring Chinook, fall Chinook and bull trout.**

The Hatchery Review Team (HRT) provided 15 preliminary recommendations and 5 draft programmatic alternative actions. The draft recommendation proposed by the HRT is Alternative 2, and calls for addressing the recommendations provided, along with removal of the Lyons Ferry stock releases. Individual recommendations on the Facility, RM&E, Management, or Education and Outreach are presented below.

***Issue TR-SS1: The Review Team understands that the goal of the program is to "evaluate the capability of developing an endemic Tucannon River hatchery stock that can replace the Lyons Ferry stock for meeting harvest mitigation goals while, at the same time and if successful, be used to maintain and/or increase numbers of naturally reproducing Tucannon River steelhead that successfully produce viable progeny."*** *The Team concluded that the current size and scope of the program are consistent with the research goal but not with the goal of rebuilding a natural population via natural spawning supplementation by hatchery-origin fish (see Issues that follow). Management actions and operations inconsistent with the scope and goal of any hatchery program can pose significant risks to natural populations with little likelihood of achieving the intended benefits in most cases. Consequently, the deliberate passage of hatchery-origin fish upstream to spawn naturally and/or the direct release of hatchery-origin fry and smolts upstream of the weir won't achieve the purpose of the current program.*

**Recommendation TR-SS1:** Clearly define the specific goals and objectives (specific, measurable, attainable, and realistic, with a timeframe) for the current endemic broodstock program and the methods and metrics for achieving the goals. **WDFW Response: WDFW is proposing to implement expansion of the endemic stock program for supplementation and mitigation within the Tucannon River, and will forward this recommendation as part of the WDFW Steelhead Management Planning process. Once all parties agree upon a long-term program, clearly stated goals and objectives for the program will be developed.**

***Issue TR-SS2: A substantial amount of information and knowledge has been acquired to determine whether Tucannon steelhead can replace the Lyons Ferry stock for meeting harvest mitigation goals in the project area; however, no action has been taken based upon that information.*** *Survival and fish culture data have been collected for seven years.*

**Recommendation TR-SS2:** Use the existing information to determine whether Tucannon steelhead can replace Lyons Ferry stock steelhead for harvest mitigation purposes. **WDFW Response: WDFW and Tribal co-managers have evaluated the data for endemic performance and proposed expansion of the endemic program and cessation of the LFH stock releases (2010). Details of the transition are discussed within this HGMP, though full implementation will depend on funding.**

***Issue TR-SS3: The long-term conservation goal of this program is unclear.*** *The Team could not determine whether the long-term goal of the program is to preserve the genetic legacy of the unique Tucannon River steelhead stock (e.g. redfish lake sockeye program) or to yield a viable, self-sustaining natural population of steelhead in the Tucannon River that contribute to the recovery of the Snake River DPS (e.g. Methow River steelhead for the Upper Columbia steelhead DPS). The objectives and management actions for this program would conceivably be quite different depending upon the long-term conservation goal.*

**Recommendation TR-SS3:** Clearly define the long-term conservation goal of this program. **WDFW Response: The co-managers are proposing to convert the hatchery program to the use of endemic Tucannon steelhead to supplement the population toward greater**

**abundance consistent with achieving recovery goals, while maintaining mitigation harvest opportunity.**

**<u>Broodstock Choice and Collection</u>**

***Issue TR-SS4: Utilizing only the early portion of the Tucannon River run for broodstock, then allowing the hatchery progeny of those steelhead passage upstream to spawn naturally may, over the long term, impose artificial selection for earlier run timing in the natural population***. *Tucannon River steelhead return from mid February through mid May; however, only February through March returns are used for broodstock. Collecting only the early portion of the run is performed so that the progeny can be reared and released as one-year-old smolts.*

**Recommendation TR-SS4:** Collect steelhead for broodstock from the entire spectrum of the run. **WDFW response: This action was not taken early on in the endemic program evaluation stage, as it was difficult to reach releases size goals of the program. Also, the program is very small, and extending the broodstock collection over a 3-month time period creates complications in spawners available on any given date. Until the program is expanded, WDFW will strive to collect broodstock during the middle of the run, and expand toward early and late segments as possible based on program size.**

**<u>Hatchery and Natural Spawning, Adult Returns</u>**

***Issue TR-SS5. The genetic effective number of breeders for the broodstock is too low to support a natural spawning supplementation program under the current research goals of the program.*** *Hatchery-origin steelhead of the endemic Tucannon River stock are passed upstream to spawn naturally in the Tucannon River because NOAA Fisheries includes those fish with the ESA listed Snake River Summer Steelhead DPS. However, the deliberate release of those fish upstream to spawn naturally is not consistent with the research goals of the program. The deliberate release of hatchery-origin fish upstream also poses a genetic risk to the natural population because the mean effective number of breeders (parents) per year is only $N_e$ = 27.2 adults, and endemic hatchery-origin fish compose up to 50% of the naturally spawning population in the Tucannon River.*

**Recommendation TR-SS5**: Discontinue passing hatchery-origin steelhead upstream to spawn naturally. Increase the number of steelhead collected for broodstock to yield a minimum effective number of breeders each year of $N_b > 50$. This could be accomplished by spawning equal numbers of endemic hatchery and natural-origin fish pairwise within each of the 2x2 spawning matrices: HxW and WxH, respectively. This would yield a value of *pNOB* = 50%. **WDFW Response: WDFW agrees with this comment, however, the test program does not allow more fish to be taken for broodstock. If the program is expanded, this comment will be more fully considered.**

***Issue TR-SS6a: Adult male steelhead held for broodstock and returned to the Tucannon River may transmit diseases from Lyons Ferry FH to the natural population in the Tucannon River***. *Of special concern is the transmission of the IHN virus.*

***Issue TR-SS6b: Adult male steelhead transported and utilized multiple times during spawning, then returned to the Tucannon River experience excessive stress, increasing the potential for fish health issues.*** *Males returned to the Tucannon River likely die shortly after release.*

**Recommendation TR-SS6:** Discontinue the return and release of adult male steelhead into the Tucannon River. **WDFW Response: WDFW will examine the risks of this practice. Many of the males have been in good shape when returned to the river. We believed that they should be given the opportunity to contribute to natural spawning, though their success at this was never confirmed. Further, WDFW did not believe the likelihood of introducing or enhancing IHNV is a valid issue as natural Tucannon steelhead have been confirmed to carry the virus already.**

## Incubation and Rearing

***Issue LF-SS8 and CC-SS8: Delayed treatment of cold water disease may make it difficult to control mortality associated with the progression of the disease.*** *Cold water disease causes 3.5-5% mortality in the Lyons Ferry stock steelhead annually. When fish mortalities reach about 100 per raceway per day, they are treated with medicated feed (florfenicol). Formerly, fish were fed pills coated with 15 mg drug/kg of fish weight as prescribed by a veterinarian. New regulations now require the use of florfenicol medicated feed at 10 mg drug/kg fish weight with a Veterinary Feed Directive. The medicated feed is less effective in controlling disease and delivery time from the feed company is slow, resulting in less efficacious treatment.*

***Recommendation CC-SS8:*** *Test the therapeutic value of early fluorfenicol treatment by comparing treated and untreated fry in the shallow troughs (i.e., before coldwater mortality starts). In conjunction with this, test new diagnostic methods (e.g., PCR, QPCR) and/or culturing alternate tissues (such as brain) for earlier detection of cold water disease to ascertain if medication is warranted prior to ponding into the raceways. Also consider investigating different densities (1.21, 0.5, and 0.2 DI) of fry in the troughs to determine whether early rearing densities influence the development of coldwater disease. Continue working with the Bacterial Coldwater Disease Research Group, as supported by the Pacific Northwest Fish Health Protection Committee, to develop fish culture practices and treatment options to control or eliminate coldwater disease.* ***WDFW response: Yes, bacterial coldwater disease has caused problems in rainbow and steelhead at Lyons Ferry Hatchery. The BCWD outbreaks have been successfully controlled with florfenicol medicated fish feed. Any experimental efforts will be first tested on rainbow trout and if successful, will then be applied to steelhead.***

***Issue TR-SS7: Rearing densities in the indoor nursery tanks "shallow troughs" (1.15 max DI) exceed culture guidelines for steelhead, thus increasing fish health risks.*** *Due to space limitations in the intermediate and outdoor raceways, steelhead are held in the troughs beyond recommended rearing densities for steelhead. This protocol results in density indexes attaining D.I. = 1.15 in the indoor nursery tanks prior to transfer to the outdoor raceways.*

**Recommendation TR-SS7:** Reduce rearing densities in the shallow troughs to a maximum of D.I. = 0.5 by increasing the number of nursery rearing or intermediate rearing tanks (see LF-SS12), by reducing the total number of Lyons Ferry steelhead reared, by reducing the number of fish reared in other programs, or by reducing the total number of stocks reared at Lyons Ferry FH. **WDFW Response: This problem was identified a few years ago. WDFW has proposed to increase the rearing capacity by utilizing the area where the spring Chinook captive broodstock program took place. The large 20' circular ponds are proposed for removal and replacement with shallow rearing tanks. It is also desired to have the area covered and, if possible, to be enclosed.**

**Release and Outmigration**

***Issue TR-SS8: Outplanting fry that are progeny of IHN virus positive females may pose fish health risks to the Tucannon River natural population.*** *The risk of the IHN virus being transferred to the progeny is low due to egg disinfection. However, releases still pose fish health risks to natural-origin steelhead populations compared to the low potential benefits. Studies indicate that outplants at the subyearling fry stage have shown extremely low survivals to adulthood and may actually pose significant ecological risks by displacing natural-origin fry which are generally smaller than hatchery-origin fry at the time of outplanting.* [1,2]

**Recommendation TR-SS8:** Discontinue out-planting fry. If the program size is increased, consider sampling the fry for viruses and retain and rear the group to smolt-stage only if they are IHN virus negative. **WDFW Response: all co-managers and NOAA fisheries selected fry release of the IHNV females as the preferred alternative. WDFW believes this was a relatively neutral action, with minimal risk to the natural population, while reducing the risk in the hatchery to all other steelhead stocks present. IHNV is present in the basin and out-plants occurred into habitat that had experienced low natural spawning (generally below river mile 15), thus minimizing the ecological interaction between hatchery and natural fry. This practice will likely continue.**

***Issue TR-SS9: Pre-release exams which include testing for virus, bacteria and parasites are not done at the Lyons Ferry FH Complex and associated acclimation sites.*** *There is a potential risk that endemic or vertically transmitted diseases might be undetected in released juveniles. This could affect their future survival and/or infected fish could serve as vectors in infecting other aquatic animals. Pre-release inspections, done 4-6 weeks before release or transfer are required by USFWS fish health policy FW 713.*

**Recommendation TR-SS9:** Sample 60 fish for pre-release inspections to meet the American Fisheries Society – Fish Health Section Blue Book requirements to ensure a 95% confidence in detecting pathogens at the minimum assumed pathogen prevalence level of 5%. Additional testing for non-reportable pathogens, such as *Flavobacterium psychrophilum* and *Nucleospora*

[1] Nickelson, T.E., M.F. Solazzi, and S.L. Johnson. 1986. Use of hatchery coho salmon (Oncorhynchus kisutch) to rebuild wild populations in Oregon coastal streams. Canadian Journal of Fisheries and Aquatic Sciences 43: 2443-2449

[2] Kostow, K., A. Marshall, and S.R. Phelps. 2003. Natural Spawning Hatchery Steelhead Contribute to Smolt Production but Experience Low Reproductive Success. Transactions of the American Fisheries Society 132: 780-790.

*salmonis*, may be informative for co-managers. **WDFW response: Additional testing for other pathogens such as *Nucleospora sp.* should be accomplished since past efforts have been sporadic and localized. However, *Nucleospora sp.* surveillance using PCR testing is expensive with cost of $30.00 per sample and may be limited. WDFW fish health staff questions the value of testing all fish for selected pathogens before release. If IHN virus (or other pathogens) were detected, we would be strongly hesitant to destroy these ESA listed fish. Testing will simply document the infection, and the cost raises the question of the value of such actions.**

***Issue TR-SS10: Discussions among the managers have also indicated that, should low production numbers (i.e. less than 8,000 fish at smolt release, ~3 females at trapping) occur in the future, the fish will not be reared full term, but released as parr/fingerlings in the upper Tucannon River.*** *Studies indicate that outplants at the subyearling fry stage have shown extremely low survivals to adulthood and may also pose significant ecological risks to natural populations by displacing natural-origin fry which are generally smaller than hatchery-origin fry at the time of outplanting.*[1]

**Recommendation TR-SS10:** Either release the adults so that they can spawn naturally or rear the progeny and release them as smolts per the current program guidelines. The fate of the returning adults of such brood years should be determined as part of a detailed contingency planning that considers the relative proportions of returning adults composed of hatchery-origin fish of that broodyear and natural-origin fish.[2] **WDFW Response: This was an agreed upon plan should broodstock collection fall short again. However, with changes in the adult trap at the Tucannon River to prevent fish from bypassing the weir, this situation will not likely occur in the future. WDFW will develop a broodstock/trapping protocol (fall 2011) which will contain a contingency plan based on the new program levels, and agreed upon by all the co-managers.**

**<u>Facilities/Operations</u>**
**<u>Tucannon FH and Trap</u>**
*(See the Tucannon spring Chinook section for additional facility issues and recommendations)*
***Issue TR-SS11: The temporary weir located below the Tucannon steelhead primary spawning area is ineffective at collecting sufficient numbers of natural and endemic steelhead for endemic program broodstock and is ineffective at excluding Lyons Ferry steelhead from natural spawning areas.*** *Recent modifications have been made to the permanent weir upstream of the temporary weir that increased its trapping efficiencies from 50% to 90-95%. However, approximately 40% of the natural spawning occurs between the site of the lower temporary weir and the permanent weir and an insufficient number of adults are*

[1] Same as previous two footnotes.
[2] For example, if only 60 fish returned to the Tucannon River and 50 of them were the hatchery-origin fish of the (subject) broodyear, then the contingency plan may be to allow all fish to go upstream to spawn naturally. On the other hand, if 100 fish returned and 50 were hatchery-origin and 50 were natural origin, then you may want to restrict the number of hatchery fish passed upstream to 10 to reduce impacts to the naturally spawning population. The remaining 40 hatchery fish should be removed. Such contingency plans need to weigh demographic benefits (which may be negligible) versus genetic risks (which may be significant) in all decisions regarding deliberate passage of hatchery-origin fish. These decisions must be based on the scientific literature and not based on undocumented presumptions.

*available at the upper weir to meet broodstock needs. For this conservation program, all adults must be accessed and monitored downstream from their natural spawning areas.*

**Recommendation TR-SS11:** Investigate the feasibility of constructing a permanent weir in the lower Tucannon River, below the primary spawning areas. A permanent weir in the lower river would also provide a site for collecting spring Chinook broodstock (see Issue and Recommendation TR-SC3 in the Tucannon River spring Chinook section). **WDFW Response: WDFW will not investigate this possibility for the future, as we have discussed this option for at least five years. WDFW and the co-managers have major concerns about the potential harmful effects of a weir in the lower Tucannon River, not just to steelhead, but other listed species as well. Concerns include trap avoidance or displacement of spawners to areas below the weir that could be marginal or poor habitat for long-term survival. Summer steelhead enter the Tucannon River from September through April. ESA listed fall Chinook enter the Tucannon River from October-December, and would very likely be impacted by a weir. ESA listed bull trout and spring Chinook could also be affected, though little overlap in migration timing occurs. However, WDFW has documented weir affects on the spring Chinook population (see spring Chinook HGMP), and had document weir avoidance of summer steelhead from a Mitsubishi floating weir used at the Tucannon Hatchery in the early 1990's (WDW unpublished data).**

**<u>Lyons Ferry FH</u>**

*(See the Lyons Ferry FH Steelhead and Fall Chinook sections for additional facility issues and recommendations)*

***Issue TR-SS12: Tucannon and Touchet steelhead stocks are held in the same adult holding pond at Lyons Ferry FH.*** *The two stocks are separated by a grated partition that splits the pond. Holding two stocks of steelhead in the same pond increases the potential for disease transmission between the stocks.*

**Recommendation TR-SS12:** Consult with engineering to modify existing holding facilities or build new holding ponds so that the stocks can be held separately on first pass water. WDFW Response: **WDFW will examine the possibility of using a different holding pond for the different stocks.**

**<u>Research, Monitoring, and Accountability</u>**

***Issue TR-SS13: Steelhead in the Tucannon River (natural-origin steelhead and Tucannon endemic and Lyons Ferry stock steelhead released into the Tucannon River) have a high degree of straying upstream of Little Goose and Lower Granite dam and into tributaries including Asotin Creek (?).*** *Off-site releases of hatchery reared salmon and steelhead (regardless as to whether they were acclimated or direct stream releases) have consistently demonstrated reduced homing abilities in returning adults (Evenson 1992, Vander Haegen 1995, Johnson 1990). Current hatchery practices may be contributing to these stray rates, including the practice of rearing the fish to smolt stage at Lyons Ferry FH, then transporting them and direct stream releasing them in the Tucannon River, posing genetic and ecological risks to other steelhead stocks. Facilities at mainstem dams to accommodate passage of migrating adults both upstream and downstream may also be inadequate.*

**Recommendation TR-SS13a:** Continue to investigate the degree of homing and straying and experiment with rearing and release strategies to reduce straying. Investigate the feasibility of incubating and rearing Tucannon steelhead at the Tucannon FH to increase homing and reduce straying. **WDFW Response: Should this program be expanded as proposed in one alternative of this HGMP, one option would be to rear the entire program at Tucannon FH. Other programs (rainbow trout and spring Chinook) would have to be modified for such an action, and the overall operation of the steelhead, salmon and trout programs will need to be closely developed.**

**Recommendation TT-SS13b**: Continue to investigate safe passage of adult steelhead, both upstream and downstream of mainstem dams. **WDFW Response: The WDFW agrees, however WDFW has little, if any control, at the mainstem dams to improve upstream/downstream passage of steelhead adults. A study to determine the potential causes of their behavior is needed and could be included with ongoing COE migration studies through the University of Idaho, which attempt to evaluate adult salmon migration behavior through the Hydrosystem. Short of removing the dams, we are unaware of an immediate action to improve this situation.**

***Issue TR-SS14: Current marking and tagging practices are suitable for achieving current program objectives****. Tucannon stock are coded- tagged so that the hatchery fish can be distinguished from natural-origin fish when they return to the trap. 8,000-10,000 steelhead are PIT tagged to provide survival and stray data.*

**Recommendation TR-SS14:** Continue the current marking and tagging practices. Consider increasing the number of steelhead PIT tagged to 10,000-15,000 so that smolt-to-adult survival can be estimated, given that survival rates associated with this endemic program currently vary and are at times low. **WDFW Response: We believe the current tagging levels are adequate. Survival in some years was low, but has been associated with the first years of the programs where the hatchery experienced difficulty in rearing fish up to the appropriate release size. Since release size goals have been met, survival has improved, and the current number of PIT tags is adequate for the monitoring needed.**

**Education and Outreach**

See the Lyons Ferry Fall Chinook and Tucannon Spring Chinook sections for Education and Outreach issues and recommendations regarding Lyons Ferry FH and Tucannon FH.

***Issue LF27: The Lyons Ferry FH displays and handouts are outdated.*** *The existing Lyons Ferry FH displays were installed in the 1980's-early 90's when the facility was constructed.*

**Recommendation LF27:** Update the displays and handouts so that they accurately reflect the present state of salmon and steelhead and the associated programs at Lyons Ferry FH.

***Issue LF28: The information available to the public in regards to the Lyons Ferry FH and its associated programs is inadequate.*** *The LSRCP web site lacks information for* *public consumption. Additionally, WDFW does not currently manage a web page for Lyons Ferry FH.*

**Recommendation LF28: Information in regards to the harvest and conservation benefits the programs provide should be made available by the Service and WDFW in a format for public consumption (e.g. simple brochures, interactive web pages, etc.).** For example, fishery benefits provided by the program for each hatchery could be updated annually on the LSRCP web site and provided in a brochure at the hatchery. This information should include contribution of hatchery-origin Snake River fall Chinook to marine fisheries in Canada and Alaska. If the LSRCP web site is the primary source of information for the program, any WDFW page for Lyons Ferry FH should be linked to this site.

***Issue TR-SC16: The Tucannon FH displays and handouts are outdated.*** *The existing Tucannon FH displays were installed in the 1980's-early 90's when the facility was constructed.*

**Recommendation TR-SC16:** Update the displays and handouts so that they accurately reflect the current status of salmon and steelhead in the Snake River and the associated hatchery programs at Tucannon FH.

***Issue TR-SC17: The information available to the public regarding the Tucannon FH and its associated programs is inadequate.*** *The LSRCP web site lacks information about the hatchery for the public. Additionally, WDFW does not currently manage a web page for Tucannon FH.*

**Recommendation TR-SC17:** Information regarding the harvest and conservation benefits of the programs at Tucannon FH should be made available by the Service and WDFW in a format for public consumption (e.g. simple brochures, interactive web pages, etc.). For example, fishery benefits provided by the program for each hatchery could be updated annually on the LSRCP web site and provided in a brochure at the hatchery. If the LSRCP web site is the primary source of information for the program, any WDFW page for Tucannon FH should be linked to this site.

**Alternative 1:** Current program with recommendations.

**Alternative 2:** Expand the Tucannon endemic steelhead program by creating a stepping-stone program for harvest and conservation (see below for HRT scenario).

**Alternative 3:** Expand the Tucannon endemic steelhead program by creating a segregated, for harvest program downstream of the weir and managing the population upstream of the lower weir for natural production only. There would be no lower weir and no active removal of endemics would occur for at least 8 years while the endemic stock program was built toward full program size.

**Alternative 4:** Rear Tucannon endemic steelhead to full term at Tucannon FH – WDFW agrees with the intent of this recommendation. WDFW will evaluate options for modifying the water supply and facilities at Tucannon FH to enable us to rear the endemic steelhead there in 2014.

Modification and expansion of the Tucannon facilities would have to be consistent with goals for the Tucannon spring Chinook program.

**Alternative 5:** Terminate the Tucannon endemic steelhead program.

**Recommended Alternatives**

The Team recommends Alternative 2: phase-out or terminate the release of Lyons Ferry hatchery steelhead in the Tucannon River and expand the current integrated endemic program for steelhead to a two-stage, stepping-stone program. Implementation of this alternative will require a permanent weir in the lower Tucannon River below the primary spawning habitat for steelhead so that the entire population can be intercepted and monitored. Alternative 2 is intended to be implemented consistent with all the recommendations in Alternative 1.

The intent of Alternative 2 is to address both conservation and harvest goals for steelhead in the Tucannon River. The Review Team understands that the primary purpose of the current endemic program is "research" to determine the potential efficacy of developing a localized integrated hatchery program as an alternative to the continued out-planting of non-native Lyons Ferry steelhead. The Review Team concluded that adult return rates back to the Tucannon River from the current endemic program were sufficient to expand the program for the immediate purpose of addressing conservation needs for steelhead in the Tucannon River. A second broodstock could be developed, based largely on adult returns from the first broodstock, to support Tribal and recreational fisheries. Adult returns from both brood stocks would contribute to the overall LSRCP mitigation goal for steelhead in the Snake River; while fish from the second "segregated" broodstock would contribute exclusively to the mitigation goal of 875 hatchery-origin steelhead available for harvest in the Tucannon River.

Gametes from adults trapped at the new weir constructed in the lower Tucannon River would be used to initially develop the integrated conservation component of the program, the size of which would be based annually on the returning natural population. The current endemic (*integrated*) program could be expanded to approximately 50 adults (25 females), without increasing the number of natural-origin adults used for broodstock, by retaining equal numbers of F1 hatchery-origin and natural-origin adults and crossing the two groups of fish pairwise ( ♀-nat. x ♂-hat., and ♀-nat. x ♂-hat.) - or in a spawning matrix - so that all progeny had at least one natural-origin parent. This spawning protocol would result in a value of *pNOB* = 50% for the first broodstock. Returning F1 hatchery-origin adults (tagged but not fin-clipped) surplus to the needs of the integrated broodstock would not be passed upstream but would be retained and spawned as a second broodstock to produce fish for harvest. These latter F2 hatchery-origin progeny would be given an adipose fin clip and, as returning adults, could be included in the second broodstock as needed by directly crossing them with returning adults resulting from the first broodstock (e.g., ♀-F1-hat. x ♂-F2-hat., and ♀-F2-hat. x ♂-F1-hat). This cross-breeding of natural-origin fish with F1 hatchery fish in the first broodstock, and F1 x F2 hatchery fish for the second broodstock would ensure (a) continuous gene flow from the natural population to the 2$^{nd}$ broodstock, thereby reducing genetic risks to the natural population, and (b) the absence of sibling matings. Surplus hatchery-origin adults produced from the first broodstock would, in general, not be passed upstream unless doing so was necessary to prevent extirpation or maintain minimal viability of the natural population.

The number of adults spawned for the second broodstock would be based on the 875-adult mitigation goal and the expected or predicted smolt-to-adult return rates back to the Tucannon River. For example, assuming a 0.65% smolt-to-adult return rate (SAR) back to the Tucannon River, approximately 135,000 smolts from the second broodstock would need to be released into the Tucannon River to achieve the mitigation return goal of 875 adult steelhead, and approximately 35 females (70 adults total) would need to be retained for broodstock to produce 135,000 smolts. As this "stepping stone" program develops, a greater proportion of the second broodstock could be composed of F1-hatchery fish from the first broodstock. No F2 hatchery-origin adults would be passed upstream to spawn naturally unless absolutely necessary as an emergency conservation measure.

Both components of the stepping stone program could be accomplished at Tucannon and Lyons Ferry fish hatcheries by differentially marking broodstock where the integrated conservation component would be coded-wire tag-only and the harvest component would be 100% adipose-fin clipped with only a portion tagged for monitoring and evaluation purposes. The harvest component could be released at the weir.

The Team's recommendation is intended to meet near-term conservation goals for the Tucannon River population, while developing a harvest component to meet harvest and fishery management goals in the area. The Team's recommended alternative is also meant to be consistent with the intent of the current *US v. Oregon* agreement and LSRCP mitigation obligations. The Team also felt that our recommended alternative would be consistent with any potential actions that may be taken in the future to address ICTRT recovery recommendations.

The Team recognizes that Alternative 2 will require a significant investment to develop a weir and acclimation facilities in the lower Tucannon River, although the Team's recommendation could be initiated at the existing weir at the Tucannon Hatchery until such facilities are developed. **WDFW Response: The current endemic program will be expanded and evaluated. The LFH stock smolt releases in the Tucannon River were terminated in 2010. WDFW and the co-managers agree that a permanent weir in the lower river is not desirable, as the potential negative effects on upstream migration, not only of listed summer steelhead, but other listed species (fall Chinook, spring Chinook, and bull trout) significantly outweigh the ability to control hatchery fraction in the spawning areas. WDFW feels that through harvest regulations, appropriate hatchery stocking levels, and continued monitoring of hatchery fish with PIT tags, we can document the number of hatchery fish into the Tucannon River and make changes as needed.**

If co-managers conclude that implementing Alternative 2 is premature at this time, then the Team recommends implementation of Alternative 1: continuation of the current research program with implementation of all program specific recommendations. These recommendations include termination of the passage of hatchery-origin adults upstream of the weir because doing so creates genetic risks and is superfluous to the research goal of the program. Instead, those hatchery-origin fish should be crossed with natural-origin adults to further test the efficacy of the current program. **WDFW Response: WDFW agrees to change stocks and expand the endemic program to full production. Endemic hatchery fish will continue to be released upstream of the hatchery weir, at least in the short term.**

The Team did not support development of a new, segregated hatchery program for steelhead in the Tucannon River (Alternative 3) largely because it would inevitably create conflicts similar to the current program after many generations and would not – in the long term – provide conservation benefits for a natural population that may not be viable. **WDFW Response: WDFW agrees.**

The Team further assumed that the co-managers had good reasons for not rearing steelhead full-term at Tucannon Hatchery (Alternative 4). **WDFW Response: WDFW agrees with the Team, as the Tucannon Hatchery currently exists. WDFW had devised an alternative that would enable complete full term rearing of both endemic Tucannon steelhead and spring Chinook at the Tucannon hatchery with significant infrastructure improvements. However, after further discussion and review, it was determined that the available water supply to rear both steelhead and spring Chinook is not adequate. WDFW and LSRCP believe the best alternative is to make additional rearing space at Lyons Ferry, where a good pathogen free water supply of good rearing temperature water is known.**

The Team also believed that termination of the current endemic program was premature from a research perspective (Alternative 5). **WDFW Response: WDFW agrees.**

### 1.16.1) Brief Overview of Key Issues

The LSRCP summer steelhead compensation program in the Tucannon River has been active since 1983. Non-endemic hatchery-origin summer steelhead stocks (mainly Wells and Wallowa stocks) were used to develop the current Lyons Ferry Hatchery (LFH) stock to achieve the mitigation goals. Beginning in 2000, unmarked (wild-origin) adult were trapped in the Tucannon River to begin development of an endemic broodstock. The intent was that if this new broodstock was successful it would replace existing LFH stock summer steelhead in the Tucannon River. This intent was realized and in 2011 all of the hatchery steelhead smolts released into the Tucannon wild from the new endemic broodstock. Use of LFH in the Tucannon has been discontinued. The non-endemic LFH program was very successful in returning adults to the Tucannon River for the mitigation fishery. Genetic allozyme data collected in the late 1980s and during the 1990s indicated that distinct Tucannon River steelhead persisted in the basin. More recent microsatellite analysis, however, suggests that some introgression has occurred between LFH and the natural Tucannon River stock of steelhead.

The LFH and recent endemic stocks are related due to introgression over the last 20 years. The endemic broodstock founding population size is small (<15 females/year), possibly creating genetic concerns for the future. The adult trapping location for the endemic broodstock may have been too low in the river, potentially collecting unmarked fish from other river basins and incorporating them in the Tucannon broodstock, hence we've recently moved our broodstock collection efforts 15 miles upstream to the Tucannon FH.

Adult returns from the endemic stock have been detected passing Lower Granite Dam (LGR) and entering other rivers such as Asotin Creek; a behavior that is of concern for stock management and ESA. However, this behavior was documented before LGR was constructed, and may likely represent natural behavior of these fish upon return. Collected broodstock can spawn over a 2-3 month time period resulting in protracted period of egg collection and hatching of subsequent fry. As result the range in size among juvenile fish belonging to each brood year is quite large. When fish are moved to the TFH for final rearing/acclimation prior to release, low rearing temperatures make it difficult to achieve program goal for smolt size, though results have been better in recent years. Facilities at LFH are currently inadequate to correctly handle the large range of juvenile sizes. Also, there is insufficient raceway space at LFH to accommodate this program without causing substantial conflicts with hatchery programs for other species.

### 1.16.2) WDFW Alternatives to the Current Program

**Alternative 1:** Expand the current endemic broodstock and replace the LFH stock summer steelhead for all hatchery releases. Expand monitoring for stock status (including associated Tucannon population tributaries) and evaluation of the endemic hatchery program. If successful, the primary purposes would be continued compensation/mitigation under the LSRCP for sport fisheries, and supplementation of the natural population to improve abundance and productivity. Fish not captured in the sport fishery will be allowed to access the desired spawning areas to assist in natural production stock recovery.

**Alternative 2:** Eliminate all releases of LFH stock in the Tucannon River to protect the listed population of concern. This action would significantly reduce potential impacts to the remaining natural population from further introgression with the LFH stock; however it would not completely eliminate strays of LFH or other origin steelhead from entering and spawning. This alternative is not considered acceptable, unless WDFW is allowed fisheries on a listed stock, as Washington is still legally due compensation under the LSRCP. Currently the compensation provided supports a very popular, and economically important, sport fishery in the Tucannon River and elsewhere.

**Alternative 3:** Removal of the four lower Snake River Dams (Ice Harbor, Lower Monumental, Little Goose, and Lower Granite). With removal of these dams, adults retuning to the Tucannon River may home to their natal stream more efficiently, and the LSRCP program would no longer have responsible to compensate for losses (in the long term). At that point, the LFH stock program could be discontinued. This option is not likely to occur given the current political climate in the region.

**Alternative 4:** Collect more fish for broodstock, or partially spawn additional fish, to reduce the genetic risk form the small founding population size. Until sufficient success in rearing the endemic steelhead has been proven, collecting more fish could unnecessarily "mine" what few natural origin adults do come back currently to the system. The evaluation of the endemic stock is not complete, further survival data and better success in the hatchery is needed to determine the appropriate course of action.

**WDFW Preferred Alternative: WDFW believes that, based on HSRG and HRT recommendations, WDFW documented LFH hatchery stock introgression, and discussions among the co-managers and NMFS, that releases of LFH stock should be discontinued after 2010. Moreover, proceeding with the use and expansion of the**

**endemic Tucannon stock to aid recovery of the depressed Tucannon population is desirable. WDFW is currently developing a Steelhead Management Plan for SE Washington. Under the management plan, we will propose to eliminate the LFH stock releases and expand the endemic stock program at Lyons Ferry Complex for release in the Tucannon over the next few years (WDFW Alternative 1). An analysis and construction of the infrastructure needs at TFH to allow for full term rearing of endemic steelhead, as well as full term rearing of Tucannon spring Chinook, will be needed to fully implement HSRG and HRT recommendations. The WDFW agrees with these recommendations, but significant facility modifications will be needed, including relocating of the current rainbow trout production to LFH or another hatchery.**

### 1.16.3) Potential Reforms and Investments

**WDFW Preferred Alternative: Based on the preferred alternative, WDFW and the co-managers have decided that the preferred rearing for the endemic steelhead program is at Lyons Ferry FH. Major modifications/additions (water supply and additional physical structures) to Lyons Ferry Hatchery will have to occur before this program can move forward to the full program level. A feasibility study is needed at Lyons Ferry for expansion of the program (new wells, additional raceways). Listed below is a short list and estimated costs for implementation of these programs. Estimated cost could be substantially higher once the feasibility study is completed.**

| Estimated Cost | Facility | Description |
|---|---|---|
| 200,000 | Lyons Ferry | Engineering |
| 1,500,000 | Lyons Ferry | 2 new wells and degassing system |
| 1,500,000 | Lyons Ferry | 4 rearing raceways and 1 rearing pond for production |
| 3,200,000 | | Total Estimated Cost |

The following reform/investment options were listed in previous HGMP submittals. We've left them in place to show that other options and their associated costs have been discussed.

**Reform/Investment 1:** Development of the endemic programs (Touchet and Tucannon) has left the hatchery short on rearing space during some times of the years. Modify existing water supply, rearing ponds, or construct additional raceways at LFH for rearing more distinct groups of summer steelhead (i.e. more endemic broodstocks from local rivers instead of the LFH stock). The cost to perform such a modification is currently estimated to be ~**$3,000,000**

**Reform/Investment 2:** Modify/improve existing water supply at Tucannon Fish Hatchery, restructure the incubation building to increase capacity, and construct new outside rearing containers that provide space for intermediate rearing. If successful, the entire spawning/rearing cycle could be moved to the Tucannon Hatchery instead of LFH. The action would free up some rearing space at LFH. Current water supplies at TFH are not adequate and could pose potential disease concerns for steelhead. However, if the water supply and disease concerns could be addressed, rearing the fish entirely at the TFH may benefit the stock by enabling them to spend their entire life cycle in the Tucannon River. This action should be implemented jointly with actions suggested for Tucannon Spring Chinook. Estimated costs would likely be **$1,000,000-<$5,000,000**

**Reform/Investment 3:** An adult trap in the lower Tucannon River to control hatchery fish into the basin. The temporary adult trap can be disabled from relatively moderate flow events. A more substantial trap would allow us to trap more efficiently at higher flow events, and could be used to manage the returning non-native stock steelhead in the Tucannon River, however, we have concerns about negative impacts that could occur to other listed stocks (spring Chinook, fall Chinook, and bull trout). In addition, this could enable WDFW to accurately estimate adult returns of native and hatchery endemic steelhead on an annual basis. Estimated costs would likely be **$1,000,000-<$5,000,000**.

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

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

For the Lyons Ferry LSRCP program, WDFW currently has multiple HGMP documents on each species and stock produced at Lyons Ferry to provide Section 4(d) limitations coverage; USFWS Consultation with NOAA Fisheries for LSRCP actions and the NOAA Fisheries Biological Opinion; statewide Section 6 Consultation with USFWS (Bull Trout), and developed WDFW Fisheries Management and Enhancement Plans (FMEP's) for the Snake River and Mid-Columbia ESU's

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

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

The WDFW has estimated natural steelhead escapement into the Tucannon River since 1987. The largest natural-origin escapement was seen in 1988 when an estimated 525 fish spawned (WDFW 1999). Numbers have decreased steadily since 1990 and the spawning population was estimated at only 71 individuals in 1996 and 31 in 2000. Conversely, the number of hatchery origin fish on the spawning grounds has been estimated between 96-787 fish. Trapping data from the lower river temporary adult trap and the Tucannon Hatchery adult trap show the population to be made up of 3 and 4 year old individuals (primarily one and two year freshwater age, and one or two year ocean age). Age 2 and 5-year-old individuals are usually less than 10% of the returns. Tucannon steelhead are typical of "A" run summer steelhead with more fish returning as 1-ocean age (55-70%) than as 2-ocean (30-45%). One-ocean age fish average 59 cm in length while two-ocean age fish average 67 cm with individuals as large as 80 cm (Martin et al 2000). Sex ratio varies between years and can be heavily skewed to females (70%) but is generally believed to average 50-60% females for most years. Age composition of natural origin since 2000 is variable (Table 7).

Table 7. Summary of fresh and salt-water age composition of natural origin adult steelhead from the Tucannon River, 2000-2008 brood years.

| Year | Age 1.1 | | Age 1.2 | | Age 2.1 | | Age 2.2 | | Age 3.1 | | Age 3.2 | | Percent repeat spawners |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % | N | % | N | % | |
| 2000 | 18 | 25.0 | 6 | 8.3 | 36 | 50.0 | 7 | 9.7 | 5 | 6.9 | 0 | 0.0 | 0.0 |
| 2001 | 0 | 0 | 13 | 27.1 | 13 | 27.1 | 19 | 39.6 | 0 | 0.0 | 3 | 6.3 | 0.0 |
| 2002 | 5 | 8.8 | 10 | 17.5 | 29 | 50.9 | 10 | 17.5 | 3 | 5.3 | 0 | 0.0 | 0.0 |
| 2003 | 0 | 0 | 4 | 3.9 | 29 | 28.2 | 56 | 54.4 | 5 | 4.9 | 6 | 5.8 | 3.6 |
| 2004 | 0 | 0 | 0 | 0.0 | 42 | 68.9 | 13 | 21.3 | 5 | 4.9 | 0 | 0.0 | 1.0 |
| 2005 | 15 | 4.8 | 32 | 10.3 | 99 | 31.9 | 141 | 45.5 | 14 | 4.5 | 7 | 2.3 | 0.6 |
| 2006 | 5 | 4.6 | 7 | 6.5 | 44 | 40.7 | 44 | 40.7 | 6 | 5.6 | 1 | 0.9 | 0.9 |
| 2007 | 1 | 2.0 | 7 | 14.3 | 16 | 32.7 | 18 | 36.7 | 4 | 8.2 | 2 | 4.1 | 0.0 |
| 2008 | 1 | 6.3 | 1 | 6.2 | 8 | 50.0 | 5 | 31.2 | 1 | 6.3 | 0 | 0.0 | 0.0 |
| 2009 | 0 | 0.0 | 2 | 2.7 | 38 | 50.7 | 12 | 16.0 | 11 | 14.7 | 7 | 9.3 | 2.7 |
| **Combined** | **45** | **5.0** | **82** | **9.1** | **354** | **39.4** | **325** | **36.2** | **54** | **6.0** | **26** | **2.9** | **0.9** |

Fish enter the river as early as July and as late as the following April. Spawning in the Tucannon has been observed from RM 3 upstream to RM 52, and in Tumalum, Cummings, Little Tucannon, and Panjab creeks (Figure 1). Spawning is believed to begin as early as late February and continue through May. Hatchery and natural fish enter and spawn concurrently throughout the basin. Anecdotal observations of hatchery fish spawning as early as January have been reported from the lower river.

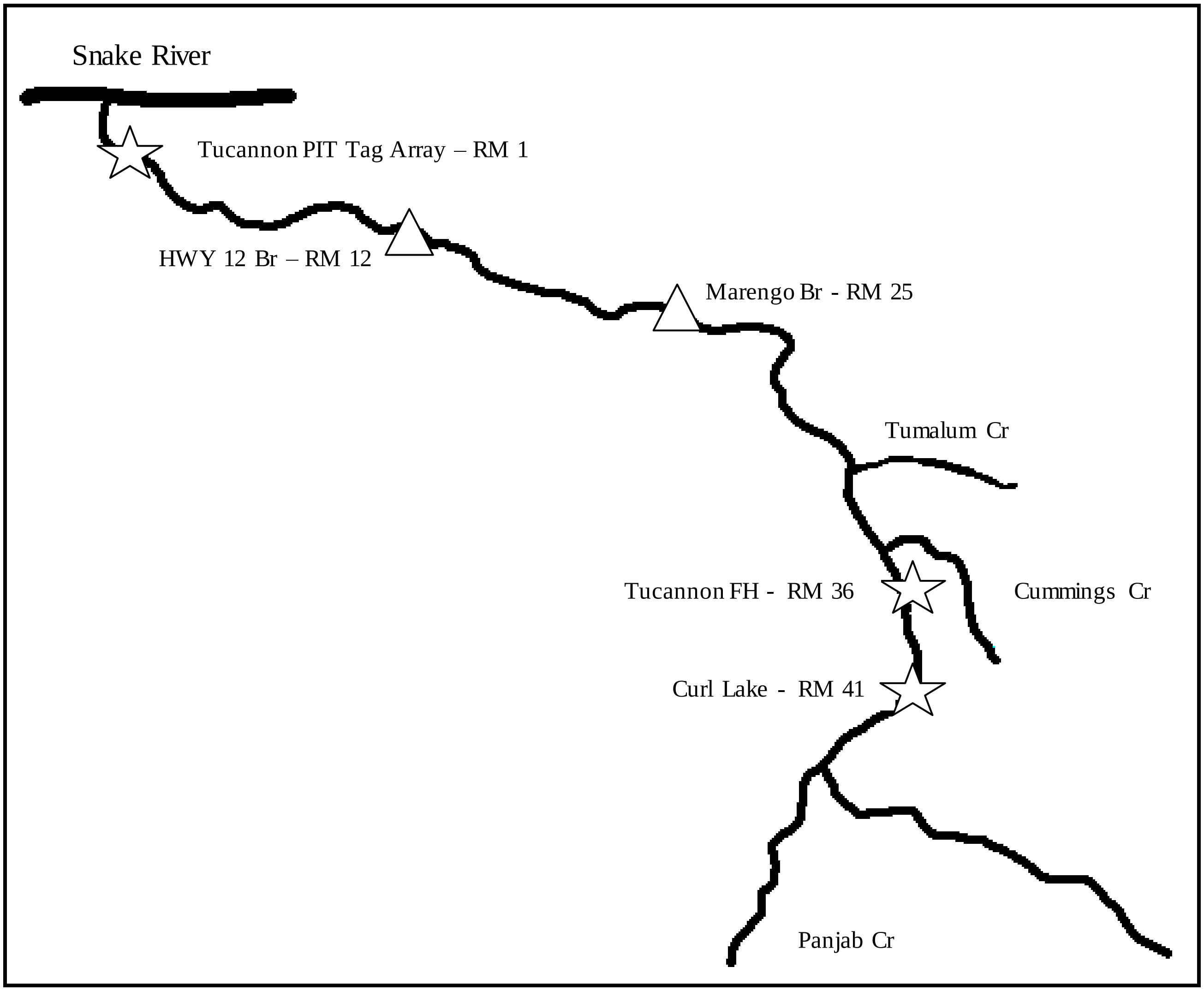



**Figure 1. Map of Tucannon River with major tributaries and other landmarks.**

Juvenile summer steelhead rear successfully in the Tucannon from RM 0-60 inclusive. Rearing success is dependent upon habitat and water quality, which is poor below RM 12 and only moderate between RM 12-20. Above RM 20 rearing conditions are generally good for steelhead. Based on smolt trapping data since 1997, juveniles will typically spend from one to three years in the Tucannon River before migrating as smolts. Age of smoltification is likely determined by both genetic and environmental factors (water temperature and food availability). The river is productive and large numbers of yearling smolts have been identified emigrating from the river in some years. These smolts are believed to originate from lower river reaches where spring/summer water temperatures allow for accelerated growth.

Yearling and age two and three smolts leave the Tucannon River primarily during April and May. Smolt size is highly variable (145 – 265 mm) but typically averages 185 – 195 mm. Hatchery smolts have averaged 195 – 215 mm at release for the duration of the program and were originally released from Curl Lake Acclimation Pond (RM 41) between

1986 and 1997. Since 1998, LFH hatchery stock steelhead have been released at or below RM 25. All endemic stock fish have been direct stream released at the Curl Lake water intake diversion or higher.

**Identify the ESA-listed population(s) that will be directly affected by the program.**

Tucannon River natural origin steelhead are part of the listed Snake River ESU and will be used to establish the new broodstock for conservation / mitigation.

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

Juvenile hatchery steelhead (released smolts) may compete for food and space with naturally rearing Tucannon River bull trout, spring Chinook and fall Chinook, as some degree of extended rearing by steelhead is expected. Bull trout and spring Chinook will also be captured in the Tucannon FH adult trap. There can be a slight overlap with spring Chinook and summer steelhead in May, depending on the migration of spring Chinook. All bull trout captured will be sampled and immediately released after sampling. All spring Chinook captured will follow protocols set forth in the spring Chinook HGMP. Trapping/sampling/handling of bull trout has been authorized by the USFWS under a Section 6 Cooperative Agreement with the WDFW. As a positive benefit to bull trout, any fingerlings that may be released into the system from the hatchery program, or additional natural production of juvenile steelhead in the Tucannon River from the hatchery program, may serve as prey for bull trout

### 2.2.2) Status of 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**.

Washington Department of Fish and Wildlife has estimated natural steelhead escapement into the Tucannon River since 1987 through the use of redd counts. The largest natural-origin escapement was seen in 1988 when an estimated 525 fish spawned (WDFW 1999). Numbers have decreased steadily since 1990 and the spawning population was estimated at only 71 individuals in 1996 and 31 in 2000.

Tucannon summer steelhead were classified as depressed because of chronically low escapement by WDFW (SASSI 1992). The population is likely at a "critical" population threshold because it is chronically depressed. The population is believed to be below replacement in most years, and stochastic events pose significant genetic risk to the population because of low absolute population numbers. Washington established an interim escapement goal in the 1992 SASSI document of 1,200 spawners. Present escapement is far below that goal (Table 8). The ICTRT considers the Tucannon steelhead to be an intermediate population with a Minimum Abundance Threshold (MAT) for population viability of 1,000 fish. Recent escapements have been far below MAT and may fall below critical minimum viability level (250 natural fish) for most years.

Spring/summer Chinook – Natural origin spring/summer Chinook in the Tucannon River are listed as "threatened" under the ESA as part of the Snake River spring/summer Chinook ESU. Status of the population within the Tucannon River is depressed (See Tucannon River Spring Chinook HGMP). The ICTRT considers this to be an intermediate population with a MAT viability level of 750 fish. Natural escapement is significantly below that level with geometric mean abundance of 87 natural origin fish during the 10-year period ending in 2003.

Table 8. Estimated natural and hatchery adult steelhead escapement indices into the Tucannon River (1988-2009) based on redd counts and hatchery:wild composition data collected from trap and creel surveys.

| Year | Natural Origin | Hatchery Origin |
|---|---|---|
| 1988 | 525 | 787 |
| 1989 | 319 | 388 |
| 1990 | 416 | 343 |
| 1991 | 210 | 256 |
| 1992 | 166 | 513 |
| 1993 | 94 | 475 |
| 1994 | 151 | 96 |
| 1995 | 147 | 230 |
| 1996 | 71 | 322 |
| 1997 | No Data * | No Data * |
| 1998 | 97 | 200 |
| 1999 | 138 | 280 |
| 2000 | 31 | 226 |
| 2001 | 198 | 430 |
| 2002 | No Data * | No Data * |
| 2003 | No Data * | No Data * |
| 2004 | 59 | 152 |
| 2005 | 143 | 172 |
| 2006 | No Data * | No Data * |
| 2007 | 137 | 349 |
| 2008 | No Data * | No Data * |
| 2009 | No Data * | No Data * |

* Flood conditions or high stream flows precluded spawning survey estimates of redds, which are the basis for escapement estimates.

Fall Chinook – Natural origin fall Chinook in the Tucannon River are listed as "threatened" under the ESA as part of the Snake River ESU. The spawning population in the lower Tucannon River is considered part of the larger composite population for the entire Snake River Basin. Carcasses recovered from spawners in the Tucannon River consist of natural and hatchery origin fish (Lyons Ferry and Umatilla Hatcheries). As this is not a distinct population separate from other spawning aggregations, fall Chinook in the Tucannon contribute to the overall population abundance in the Snake, which is close to meeting ICTRT viability abundance in most recent years.

Bull Trout – Natural origin fluvial and resident bull trout in the Tucannon River are listed as "threatened" under the ESA as part of the Columbia Basin Bull Trout Distinct Population Segment (DPS). In the Tucannon River, several sub-populations of bull trout apparently exist in the mainstem Tucannon River, and Panjab/Meadow Creek based on draft genetic analyses (Glen Mendel – WDFW pers. comm.). The Tucannon bull trout has been considered a stronghold population, with little risk of extinction, by WDFW(SASI 1998). However, recent data suggests a large decrease within the last five years. Redds and number of migratory bull trout captured at the Tucannon Fish Hatchery have declined to low levels. As an example, numbers of bull trout captured at the Tucannon Fish Hatchery trap decreased from 286 in 2004 to 21 fish in 2009.

Natural origin summer steelhead have been PIT tagged at the Tucannon River Smolt Trap over the years. Since the 2002 migration year, we have PIT tagged between 1,400 and 2,000 fish annually. Based on smolt trap estimates (percent of each year's outmigration that is tagged), adult returns over Ice Harbor Dam, and assuming a 50% entry of those fish into the Tucannon River, we estimated the number of natural origin fish spawning in the Tucannon River (Table 6). Average number of spawners over those years is 151 fish. Actual number of fish may be lower, as data from PIT tag array on the Tucannon River would suggest that only 36% of the fish crossing Ice Harbor dam actually return to the Tucannon River (Table 5).

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

The data are not currently available, but WDFW monitoring and evaluation actions have been undertaken to gather parent-progeny data. It is noted that the interpretation of annual variations in progeny to parent ratios of naturally reproducing fish is difficult because the confounding effect of spawner density needs to be removed as one step of the analysis. The progeny to parent ratio observed when the parental numbers are many, will invariably be lower than when the parental numbers are few. Without means for standardizing this density dependent dynamic, the comparison of progeny to parent ratios among different years can easily lead to erroneous conclusions about population status. In addition, this population is exposed to large variations in downstream passage and ocean survival. These variations also can seriously confound the interpretation of progeny to parent ratios, unless standardization is developed for this factor as well. In the case of this population smolt to adult survival estimates are available which could be used to a tool for this standardization. WDFW has juvenile production estimates for most years between 1986 – 2004 that can be used to estimate survivals for early life stages. WDFW has summer steelhead smolt production estimates since 1996.

**- 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.**

Spawning estimates were provided in Tables 6 and 8 above.

**- 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.**

See Table 8 above.

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

**area, and provide estimated annual levels of take.**

Broodstock Trapping: Listed summer steelhead adults will be trapped at the Tucannon FH adult trap and collected for broodstock from January through May. Other listed summer steelhead adults will be trapped, handled, and passed upstream during trap operation outside of this time frame (e.g. during spring Chinook trapping), which may lead to injury of listed fish. The Tucannon FH adult trap is operated from May-September for spring Chinook. Very few fish have been captured from October-December. Human disturbance or poaching of summer steelhead held in the trap has not been experienced during operation of the trap between 1999-2009. The upper trap (Tucannon Hatchery) is permanent, with security measures to keep the general public away from the listed fish. No mortality of listed steelhead associated with the upper trap has occurred since 1997.

Spring and fall Chinook salmon and bull trout are indigenous to Tucannon River, and incidental takes of all species are anticipated, though at rare occurrence. Historically, fall Chinook have not been captured at the Tucannon FH, as it is too high in the basin. Any spring Chinook or bull trout encountered at the Tucannon Hatchery adult trap will be handled, collected (spring Chinook only), or sampled (length, sex, scale sample and DNA sample), and passed upstream with minimal delay. Trapping and collection of ESA listed Tucannon River spring Chinook is described in draft HGMP that will be submitted to NOAA Fisheries. Trapping and sampling of bull trout has been authorized by USFWS in accordance with a Section 6 Cooperative Agreement for the Endangered and Threatened Fish and Wildlife Program – Washington.

Spawning, Rearing and Releases: Spawning, incubation, rearing and release of summer steelhead for 14 months from March through the following April has a high potential for lethal take of listed summer steelhead (fish from the program are considered listed even in the hatchery). Mortality can occur in association with fish culture activities and conditions that affect fish health and development, from handling procedures, fertilization procedures, water temperature, water quality, water flow, feeding success, transport. The release of endemic origin hatchery-reared Tucannon River summer steelhead may incidentally affect (take) other listed salmonids in the Snake and Columbia basins.

Monitoring and Evaluation: Contact with summer steelhead during spawning ground surveys (March through May), smolt trapping operations (October through June), summer population monitoring (snorkeling), and PIT tagging programs have a potential to take listed summer steelhead. Each of these activities is described in more detail below.

**Spawning Ground Surveys:** Takes (see Take Table 2) associated with spawning ground surveys will occur in the form of "observe/harass" and from occasional carcass recovery of kelts. Spawning surveys for listed steelhead are conducted from early March to early May, and conducted once a week when possible, with the intent to estimate total spawning escapement into the Tucannon River. Index sections, about 3-miles in length, are surveyed multiple times throughout the season to document redds and how quickly redds fade from sight of the surveyors. During each survey, surveyors walk out of the water when possible. Experienced surveyors look for redds, record and mark their location, and look for live and dead fish, with little disturbance. At the end of the season, more extensive areas of the river are walked. The "final survey" and redd visibility rate are then used to estimate spawning escapement. Properly conducted surveys are not expected to result in any direct mortality to spawning steelhead.

**Snorkeling:** Snorkel surveys have been terminated in recent years because of concerns about the degree of bias in the juvenile estimates that result. Snorkel surveys may be re-initiated in the future to assess the effects of changes in the spring Chinook program as currently proposed in that HGMP. A brief description of methods is provided here. Takes in the form of "observe/harass" occur during snorkel surveys (see Appendix Table 2). Snorkel surveys occur July or August, and are conducted to monitor distribution and abundance of juvenile salmonids (Chinook salmon, bull trout, and whitefish) in the Tucannon River. Surveys are conducted with two people, both starting at the lower end of an index site. Each snorkeler moves upstream counting about ½ of the site. The total number of fish is then recorded and the site length and width are measured for total surface area. Total time to complete an index site varies, but is generally less than 15 minutes. Washington Department of Fish and Wildlife has no estimate of the degree of harm, injury, or mortality to listed fish associated with snorkeling activities, but it is believed to be very low. Based on observations during snorkeling, the fish observed move slightly when the snorkelers pass, but quickly re-establish themselves near their original location.

**PIT Tagging:** Takes of listed natural and hatchery origin steelhead will occur during PIT tag studies (see Appendix Table 2). Tagging will occur at the hatchery prior to smolt release, and at the Tucannon River smolt trap (described in the next section). Tagging of listed hatchery-reared fish will provide information on downstream migration performance (relative survival, migration speed, and timing) from various release points in the Tucannon River, and will also assist in the program evaluation by determining smolt-to-adult survival rates. PIT tagging procedures follow established protocols used throughout the Snake River Basin by other agencies. Mortality of the fish PIT tagged is expected to be less than 1%.

**Cast Netting**: Cast netting is a method utilized by WDFW, in conjunction with snorkeling, to evaluate the level and origin of precocious parr on the Tucannon spring Chinook spawning grounds. Recently, other hatchery evaluation programs have discovered a high incidence of precocious parr on spring Chinook spawning grounds that were occurring as a direct effect of the hatchery program (Larsen et al. 2004). WDFW utilizes cast nets to minimize disturbance to the habitat and potential harm to the fish and eggs other sampling methods (i.e., seining, hook and line fishing, etc.) might cause. A snorkeler observes the juvenile fish underwater and directs the cast netting crew where to throw the net. The fish are captured alive, sampled for length, origin, and age, and released back into the water. Takes occur in the form of "observe/harass" during snorkeling and "capture/handle, and release" during cast netting. Properly conducted surveys are not expected to result in any direct or indirect mortality.

**Smolt Trapping:** Takes of outmigrating listed juvenile steelhead (natural and hatchery origin) will occur at WDFW's smolt trap located on the lower Tucannon River (see

Appendix Table 2). The trap is operated October-June to capture natural and hatchery Chinook salmon and steelhead to enable WDFW staff to estimate smolt production from the Tucannon River. Fish generally are captured, measured, weighed and released. Small groups of fish receive a partial caudal fin clip for external identification and are transported back upstream one mile and released to calculate trap efficiency. Other groups of fish (~100/group) may be PIT tagged from the smolt trap to determine migration speed and relative survival. During peak outmigration fish may be held in live boxes for two to three hours before release (mark/recapture trial, or PIT tagged). At other times of year the trap may be checked only once a day. Delayed migration will result for fish captured in the trap, and delayed mortality as a result of injury or increased susceptibility to predation may also result.

Monitoring and Evaluation in adjacent Watersheds: Expanded trapping in tributaries upstream of the Tucannon River (e.g. – Asotin and Alpowa creeks) has recovered stray endemic stock hatchery fish, which had been released into the Tucannon River as smolts. These fish represent a risk to populations outside the Tucannon, especially if their numbers are large. WDFW removes identifiable hatchery fish from tributaries where traps exist to reduce their potential impact on natural populations.

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

Operation of the lower weir/trap during fall and early spring has a low potential to take listed bull trout and spring and fall Chinook salmon. Bull trout may encounter the weir post-spawning, as adfluvial spawners from high in the basin move downstream into the Snake River. Fish may be delayed or descaled as they pass over/through the weir downstream. Bull trout could also impinge upon the weir while attempting to pass downstream if individuals are weakened from spawning. However, the trap/weir is periodically opened to allow unrestricted passage of all fish species.

Trap operation occurs above most fall Chinook spawning but may prevent or delay upstream migration of a very small number of salmon that approach the weir.
Spring Chinook may experience a slight migration delay, or be compromised from capture and handling stress associated with the lower weir. However the chance is very low of spring Chinook encountering the weir, as it will be removed before most spring Chinook enter the river (early April).

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

Washington Department of Fish and Wildlife personnel have operated the lower trap (RM 11) during the fall through early spring each year since 1999. The number of natural origin fish trapped, released, or taken for broodstock are provided in Table 9. Pre-spawning mortality from fish trapped or captured for broodstock has varied over the last four years.

More aggressive formalin treatments during holding at Lyons Ferry have reduced mortality.

Table 9. Number of natural origin summer steelhead captured, passed, and collected at the lower Tucannon River adult trap for the endemic broodstock program.

| Year | Captured | Passed | Collected | Pre-spawn Mortality |
|---|---|---|---|---|
| 1999/2000 | 35 | 3 | 46 [a] | 10 (21.7%) |
| 2000/2001 | 35 | 9 | 36 [b] | 6 (16.7%) |
| 2001/2002 | 74 | 38 | 36 | 6 (16.7%) |
| 2002/2003 | 86 | 50 | 36 | 0 (0%) |
| 2003/2004 | 67 | 34 | 33 | 0 (0%) |
| 2004/2005 | 372 | 336 | 36 | 0 (0%) |
| 2005/2006 | 91 | 56 | 35 | 3 (8.5%) |
| 2006/2007 | 49 | 22 | 27 | 2 (7.4%) |
| 2007/2008 | 3 | 2 | 1 | 1(100%) |
| 2008/2009 | 0 | 0 | 0 | 0 (0%) |

[a] 14 fish were collected by hook and line method.

[b] 10 fish were collected by hook and line method.

During the first year, fish were live spawned and retained at LFH for rejuvenation and possible re-use. However, rejuvenation efforts failed and all fish died. No further attempts at rejuvenation will be made until current research in the Columbia basin on kelt rejuvenation has been completed.

WDFW has operated a trap at the Tucannon Hatchery intake (RM 36.5) for spring Chinook salmon since 1986. Summer run steelhead are regularly trapped in the facility that was re-designed and updated in 1997 (Table 10). Handling may induce delayed mortality but the level of that mortality has not been documented. During high river flows, fish are capable of passing the diversion dam that directs fish through the ladder and trap. Under the current protocols, all LFH steelhead captured at the trap are released downstream and not allowed passage into the watershed above the trap site.

**Table 10.** Natural origin, hatchery LFH stock origin, hatchery Tucannon endemic stock origin summer steelhead trapped at the Tucannon Fish Hatchery from 1998-2009.

| | Natural | | | Hatchery LFH Stock | | | Hatchery Endemic Stock | | | Totals (Percent) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Male | Female | Total | Male | Female | Total | Male | Female | Total | % Natural | % Female |
| 1998 | 8 | 7 | 15 | 28 | 29 | 57 | NA | NA | NA | 69.4 | 50.0 |
| 1999 | 9 | 13 | 22 | 14 | 19 | 33 | NA | NA | NA | 40.0 | 58.2 |
| 2000 | 12 | 6 | 18 | 5 | 5 | 10 | NA | NA | NA | 64.3 | 39.3 |
| 2001 | 9 | 1 | 10 | 3 | 0 | 3 | NA | NA | NA | 76.9 | 7.7 |
| 2002 | 75 | 103 | 178 | 24 | 4 | 28 | NA | NA | NA | 86.4 | 51.9 |
| 2003 | 30 | 34 | 64 | 9 | 3 | 12 | NA | NA | NA | 84.2 | 48.7 |
| 2004 | 23 | 10 | 33 | 5 | 0 | 5 | 4 | 1 | 5 | 78.6 | 25.6 |
| 2005 | 36 | 7 | 43 | 2 | 0 | 2 | 11 | 2 | 13 | 74.1 | 15.5 |
| 2006 | 12 | 8 | 20 | 1 | 0 | 1 | 7 | 11 | 18 | 51.3 | 48.7 |
| 2007 | 12 | 2 | 14 | 3 | 2 | 5 | 11 | 3 | 14 | 42.4 | 21.2 |
| 2008 | 6 | 4 | 10 | 5 | 0 | 5 | 6 | 1 | 7 | 45.5 | 22.7 |
| 2009 | 39 | 49 | 88 | 6 | 2 | 8 | 123 | 119 | 242 | 26.0 | 50.3 |

- **Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery**

**program (e.g. capture, handling, tagging, injury, or lethal take).**

See Appendix Table 1.

- **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.**

The temporary trap located in the lower river is not 100% efficient at trapping steelhead. The design allows fish to pass over the structure during high flows. To further allow for unrestricted passage of steelhead, a slide gate in the trap box can be opened to allow free passage through the trap. In cases where WDFW personnel are unable to check the trap daily, weir panels can be removed or submersed to allow unrestricted passage without fish having to enter the trap box. This ensures that fish are not injured or unnecessarily delayed. Where projected take of ESA listed summer steelhead or another species may be exceeded, the trap is easily removed from the river channel.

Operation of the Tucannon Hatchery intake trap functions integrally with a ladder designed to pass fish around the diversion dam. The trap can be opened; allowing fish unrestricted passage through the ladder and trap.

# SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

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

Lyons Ferry Complex is part of the LSRCP Program. According to the Artificial Production Review (APR-1999), the Council stated, "Management objectives such as for harvest opportunities, or for in-kind, in-place mitigation, or for protection of specific natural populations are all equally important." The WDFW desires to continue mitigation programs in the Tucannon River, however, the current program's steelhead actions were started because use of the LFH stock was believed to jeopardize the listed natural population of summer steelhead (NMFS Biological Opinion (1999)). Actions proposed under this HGMP are consistent with the Reasonable and Prudent Actions suggested by NOAA Fisheries' more recent Biological Opinion on the Federal Power System (2008). Implementation of this HGMP may result in the development of a new endemic stock of steelhead for producing hatchery releases into the Tucannon River.

Further, in 2009, Washington's Fish and Wildlife Commission adopted their "Policy on Hatchery Reform". Its purpose was: To advance the conservation and recovery of wild salmon and steelhead by promoting and guiding the implementation of hatchery reform. Hatchery reform is the scientific and systematic redesign of hatchery programs to help recover wild salmon and steelhead and support sustainable fisheries. The intent of hatchery reform is to improve hatchery effectiveness, ensure compatibility between hatchery production and salmon recovery plans and rebuilding programs, and support sustainable fisheries. Washington Fish and Wildlife Commission Policy: POL-C3619

**3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.** *Indicate whether this HGMP is consistent with these plans and commitments, and explain any discrepancies.*

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

- *Lower Snake River Compensation Plan* – LSRCP goals as authorized by Congress direct actions to mitigate for losses that resulted from construction and operation of the four Lower Snake River hydropower projects. The program is consistent with smolt production but lower than levels as outlined in original LSRCP. The proposed program will continue to support a substantial tribal and sport harvest.
- *US vs Oregon* - The hatchery program outlined within this HGMP is consistent with Appendix B hatchery smolt production agreements of the *US vs Oregon* negotiations and the intent to provide fish for harvest in tribal and sport fisheries into the future.
- *Columbia River Fish Management Plan* – Continue to provide substantial harvest in Zone 6 tribal net fisheries as well as in-basin tribal harvest opportunity.
- *Fisheries Management and Evaluation Plan (FMEP).* – FMEPs for Snake River fisheries have been drafted by WDFW and submitted to NOAA, and describe in detail the current fisheries management within the Snake River Basin (including the Grande Ronde). Fishery management objectives within the FMEP and this HGMP are consistent.
- *WDFW Wild Salmonid Policy.* Washington Department of Fish and Wildlife is directed by State and Departmental management guidelines to conserve and protect native fish and wildlife populations. No other comprehensive management agreements are in effect.
- *Snake River Salmon Recovery Plan* – The Governor of the State of Washington committed WDFW to cooperate and partner with regional governments to develop a science based and community supported strategy for salmon recovery. A draft plan was completed in December 2006. WDFW will continue to work with regional governments to recover salmon and steelhead populations in the Snake River Basin.
- *Washington Statewide Steelhead Management Plan* - Restore and maintain the abundance, distribution, diversity, and long-term productivity of Washington's wild steelhead and their habitats to assure healthy stocks. In a manner consistent with this goal, the Department will seek to protect and restore steelhead to achieve cultural, economic, and ecosystem benefits for current and future residents of Washington State.

**3.3) Relationship to harvest objectives.**

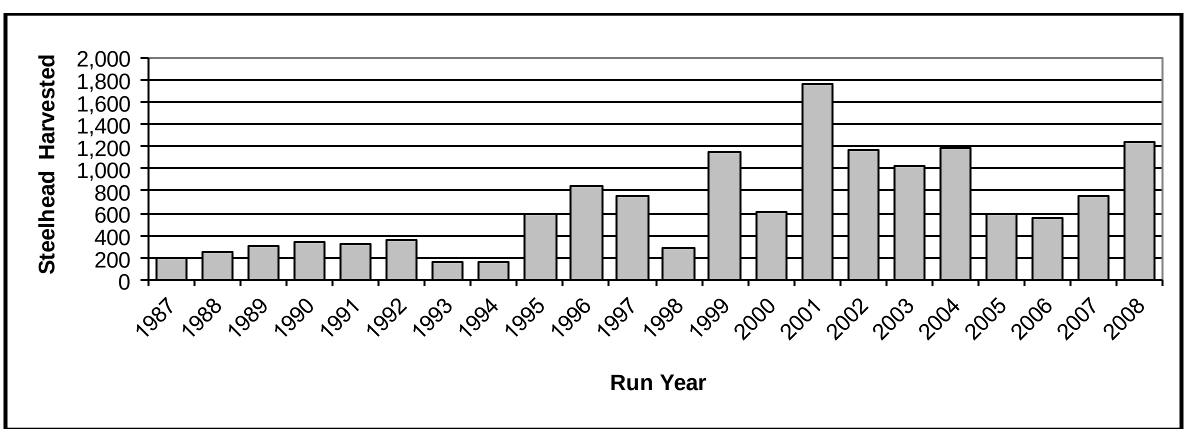
As an integrated conservation/mitigation program, development and use of local Tucannon River broodstock is intended to fulfill both conservation (short and long term) and mitigation harvest (long term) goals. The LSRCP, as a mitigation program, defined replacement of adults "in place" and "in kind" for appropriate state management purposes. In addition, WDFW has identified the maintenance of abundant naturally spawning populations and harvest as valuable management goals (WDFW Wild Salmonid Policy, 1999; WDFW Steelhead Management Plan 2009).

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

During the period 1986–2002, recreational harvest of hatchery origin steelhead from the Tucannon River ranged between 180-842 fish during the September through March fishery (WDFW 1987-2002 – Figure 1). This level of catch represents 25% -70% of the hatchery steelhead adults produced by the Tucannon program. Tucannon origin fish have also contributed to fisheries in the Columbia and Snake Rivers. These fisheries are consistent with LSRCP goals and with *U.S. v. Oregon* management plans and principles for Tribal and recreational fisheries. All sport fisheries within the region are selective for hatchery-reared fish and require release of natural origin fish. Recreational fishing regulations within the Tucannon River have been altered in recent years to reduce the incidental catch of wild fish by closing spawning areas of the river. These actions work in concert with focused fishing effort on hatchery origin fish to maximize wild escapement and minimize escapement of hatchery fish of an unacceptable stock. Selective marking of endemic brood releases will regulate their take in fisheries.

There is no harvest history on endemic Tucannon River steelhead. The existing LFH stock used within the Tucannon River has provided harvestable steelhead annually since 1985 (Figure 1). As this program increases, agreements between the co-managers and NOAA Fisheries will determine the level of marking fish designated for harvest on an annual basis. Limited hooking mortality is expected to occur as a result of recreational fisheries on adults returning. At full production, WDFW desires that 2/3 of the smolts will be marked to allow harvest.

Figure 1. Estimated number of hatchery steelhead (LFH stock) harvested from the Tucannon River from the 1987-2008 run years. Estimates are derived from WDFW punch card estimates.



## 3.4) Relationship to habitat protection and recovery strategies.

The Tucannon Model Watershed Management Plan (CCD 1996) reviewed the ecological health of the Tucannon Watershed in relation to salmonid population status and recovery. Limiting factors such as water temperature, channel stability, sediment, and instream habitat were addressed. Fish & Wildlife and land managers, in association with private landowners and the Columbia Conservation District, described approaches to habitat improvement, both instream and upland, that are required as part of salmonid recovery in the Columbia basin. The plan has been used as a template to guide actions taken by multiple agencies to request funds for habitat improvement. Short and long term goals included bank stabilization, constructing instream fish habitat, riparian re-vegetation, meander reconstruction, construction of sediment basins, and altered farming practices to decrease sediment delivery to the river. This suite of actions will have increasing benefits (e.g.: maturing trees planted in riparian areas) over time. Managers were committed to improving habitat as fish and wildlife programs strive to increase escapement of salmon and steelhead to spawning/rearing areas. More recently, the region developed a Snake River Salmon Recovery Plan (2002) that revisited the habitat issues and priorities for recovery, and committed to recovery of the ESA listed populations in the Tucannon River. Use of an endemic stock of steelhead within the basin is consistent the recovery plan.

## 3.5) Ecological interactions.

The following sections describe ecological interactions that could occur from the program on native fishes (predation, competition and disease). In the short term, returning adults from the program will not be subject to harvest and will be allowed to escape in the basin to supplement naturally produced steelhead. Supplementation is an experimental procedure to stabilize or increase depressed populations while actions are taken to correct basin specific and out-of-basin productivity problems. Tucannon natural steelhead have been affected by numerous long-term and stochastic habitat degradations. The LSRCP program has been shown to effectively return adult steelhead to their point of release (i.e. Snake River Mitigation), but has used an unacceptable stock for this mitigation to date, but is being terminated following the 2010 release.

***Predation*** **-** Predation requires opportunity, physical ability and predilection on the part of the predator. Opportunity only occurs when distribution of predator and prey species overlaps. This overlap must occur not only in broad sense but at a microhabitat level as well. As hatchery steelhead smolts migrate downstream, avian (i.e. kingfishers, mergansers, gulls) and mammal predators will likely prey on hatchery steelhead smolts. While not always desired from a production standpoint, these hatchery fish provide an additional food source to natural predators that might otherwise consume listed fish.

Predation by hatchery fish on natural origin smolts is less likely to occur than predation on fry (NMFS 1995). Salmonid predators are generally thought to prey on fish 1/3 or less their length (Horner 1978; Hillman and Mullan 1989; Beauchamp 1990; Canamela 1992; CBFWA 1996). Jonasson et al. (1995) found no significant relationship between residual hatchery steelhead size and salmonid prey size in pen experiments. Further, Witty et al.

(1995) concluded that predation by hatchery production on wild salmonids does not significantly impact naturally produced fish survival in the Columbia River migration corridor. Martin et al. (1993) also concluded the summer steelhead residuals in the Tucannon River were not affecting listed Chinook salmon populations based on stomach analysis.

Relative size differential of proposed hatchery steelhead smolts (210 mm @ 4.5 fpp) compared to spring Chinook smolts (90-110 mm) and wild steelhead smolts (130-200 mm) should preclude any substantial predator/prey interaction among migrating fish. However, fall Chinook (35-95 mm) could be consumed by hatchery steelhead.

With the exception of spring and fall Chinook, timing of hatchery steelhead smolt releases from the endemic program and the distribution of listed species fry limit potential interaction. Hatchery steelhead smolts are released in late March to early May, approximately mid-way through the spring Chinook emergence period. Residuals from the endemic releases will be present in spring Chinook emergence areas. However, based on previous studies (Martin et al, 1993), predation will be limited. Based on where fall Chinook spawn however, they will completely overlap with the hatchery steelhead smolt migration corridor. Fall Chinook fry will likely be seeking habitat areas near stream margins. Bjornn and Reiser (1991) reviewed literature on habitat preferences of juvenile salmonids and concluded that newly emerged fry prefer shallow areas of low velocity (<10 cm/s) and larger fish occupy deeper and faster areas. Partitioning of habitat by Chinook fry and steelhead smolts minimizes direct interaction between the two species. Naturally produced steelhead fry likely emerge during May-June, long after the majority of released hatchery steelhead smolts from this program have migrated from the system. Bull trout fry tend to rear in headwater spawning areas and thus avoid interaction with steelhead smolts.

A varying percentage of hatchery steelhead releases do not migrate from the system. WDFW considers hatchery steelhead remaining after June 15 to be residuals. These fish, by remaining in the upper Tucannon River near the release point will have an increased opportunity to interact with juvenile listed fish (spring Chinook and natural summer steelhead). Although most residual rates vary from a few percent (Viola and Schuck 1991) to 10% (Partridge 1985, 1986), some estimates have been higher than 25% (Viola and Schuck 1991; Crisp and Bjornn 1978).

Studies of the effect of size at release and acclimation on rates of hatchery steelhead residualism have been conducted in Idaho, Washington, and Oregon. Results are in some cases contradictory. Larger smolts may residualize at a higher rate than smaller smolts (Partridge 1985, 1986) although some minimum size is necessary for outmigration (Crisp and Bjornn 1978). In northeast Oregon, ODFW found that residual steelhead remaining two to five months after release were significantly smaller at release than the mean length of the release group as a whole (Jonasson et. al. 1994 and 1995). Results of residualism studies suggest that direct stream releases residualize at a higher rate than acclimated fish (Schuck 1993; Jonasson et al. 1995).

Steelhead residuals normally remain near their release point (Whitesel et. al. 1993; Jonasson et al. 1994 and 1995; Canamela 1992). Partridge (1986) noted that most residual steelhead were within about 8 km of the upper Salmon River release site. Schuck (1993) reported steelhead residuals were found about 20 km below and 10 km above release sites in the Tucannon River, Washington. Steelhead residual densities were highest within 8 km of release sites and decreased quickly above and below these sites in the Grande Ronde and Imnaha rivers in Oregon (Whitesel et al. 1993).

The number of residual steelhead appears to decline steadily throughout the summer in most Snake River basin release areas. This may be due to harvest, other mortality, and outmigration. Viola and Schuck (1991) noted that residual populations in the Tucannon River of Washington declined at a rate of about 50% per month from June to October (declining from 4.3 to 0.8% of the total released). Whitesel et al. (1993) found residual steelhead up to twelve months after release, however, densities declined rapidly over time.

The LSRCP program funded studies in Oregon, Washington, and Idaho to evaluate food habits of steelhead smolts and residuals. Whitesel et al. (1993) sampled 676 steelhead stomachs (65 smolts and 611 residuals) during spring of 1992 through spring of 1993. Stomachs were taken from smolts collected at the screw trap operated by Nez Perce tribe at river mile four of the Imnaha River. None of the smolt stomachs sampled contained fish. Residuals were sampled by angling and electrofishing in the Imnaha and Grande Ronde basins. No Chinook were observed in any of the residual hatchery steelhead stomachs, although 54 (8.0%) contained fish (mainly sculpins) and 8 (1.2%) contained salmonids (rainbow or whitefish). Subsequent sampling in 1993 resulted in examination of 358 residual hatchery steelhead stomachs. Fish or fish parts were found in only three stomachs including one 63mm *O. mykiss* and sculpins (Jonasson et. al. 1994). Martin et al. (1993) found similar levels of predation in residual steelhead on the Tucannon River. Based on the above studies, residual steelhead would appear not to prey on juvenile Chinook and have low rates of predation on other salmonids.

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

The size difference between residual steelhead and Chinook fry will probably result in selection of different habitat areas (Bjornn and Reiser 1991) and further reduce the likelihood of interactions between species. Direct competition between hatchery smolts or residuals and natural smolts and rearing juveniles is likely due to the substantial overlap in macro and microhabitat. A study of interaction between resident rainbow and hatchery steelhead residuals concluded that in a situation where the two were held together in pens, the smaller resident rainbow showed decreased growth when compared to controls (McMichael, et. al. 1997). This suggests similar influence on smaller juvenile steelhead. In a natural situation juvenile fish can move to alternate habitats to avoid the negative interaction. Although the ultimate result of this type of interaction in the natural environment is unknown, shifts to what may be less suitable habitat may also result in impacts to growth.

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

Bull trout associated with areas influenced by residual hatchery steelhead are generally fluvial adults and are more likely to out compete and prey on hatchery steelhead because of a significant size advantage. Returning adults are expected to spawn concurrently with natural steelhead throughout their entire range in the Tucannon, increasing the abundance of juvenile steelhead throughout the basin and filling available habitat. Complete marking of hatchery-reared endemic brood juvenile will allow returning adults to be enumerated and their contribution to the escapement (in absolute numbers and as a proportion of the run) documented. Some studies suggest that domestication of hatchery-reared salmonids may decrease their reproductive fitness. This loss of fitness could be transmitted to the offspring of these spawning adults. Life history characteristics of the hatchery-reared fish will be documented to compare their performance with the natural population. Size at migration, migration timing and performance, adult return timing and spawn timing will be documented and reported as part of the LSRCP Monitoring and Evaluation project.

***Disease*** - Hatchery operations potentially amplify and concentrate fish pathogens that could affect listed Chinook, steelhead, and bull trout growth and survival. Because the hatchery produced summer steelhead for the endemic program are reared outside the watershed most of their life, disease impacts by this stock on Tucannon River salmonids are reduced. LFH is supplied with constant temperature well water; as a result, disease occurrence and the presence of pathogens and parasites are infrequent. When infestations or infections have occurred, they have been effectively treated. Further evidence for the relative disease-free status of this stock at Lyons Ferry is the low mortality that occurs during rearing following typical early life stage losses. Documentation of disease status in these stocks is accomplished through monthly and pre-liberation fish health examinations.

Documentation of the disease status of the adult steelhead stocks is accomplished through annual fish health examinations of both spawning adults and pre-spawning mortality. Results of these examinations over the past years indicate a low prevalence and incidence of serious fish pathogens and parasites in these stocks. For the Wallowa Stock program described here, the viral pathogen IHNV has not been prevalent to date. Procedures described for this viral disease later (See Section 8 and Section 9) limit the possibilities of outbreaks in the hatchery.

## 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.**

Presently, LFH will be where adults are held and spawned, eggs hatched, and juveniles reared through the pre-smolt stage. However, in the future, it is desired that the Tucannon FH will be modified to accommodate full rearing of the endemic steelhead and spring Chinook programs (per HRT recommendations). Eight wells at LFH produce up to 59,000 gpm of nearly constant 52 $^{0}$F, pathogen free water for LFH. Discharge from LFH enters the Snake River and does not affect Tucannon River water quality. LFH complies with all NPDES standards for pollution discharge. The Tucannon River is a productive watershed flowing from the Blue Mountains of southeast Washington. Winter temperatures approach freezing and rise to 80 $^{0}$F or greater during the summer near the mouth. Water for Tucannon Fish Hatchery (TFH) is provided by springs, wells and from the Tucannon River. Water withdrawals for hatchery use do not significantly reduce natural production capabilities nor affect adult upstream or downstream passage within the 0.75 miles of affected river reach (hatchery withdrawal to hatchery outfall). Steelhead spawn in the Tucannon River during spring when high river flows provide ample water for passage and spawning.

Acclimation of pre-smolts within the Tucannon River basin occur at Tucannon Hatchery. Located at RM 36 on the Tucannon River, the hatchery has the capability to hold fish in river water. Five to six weeks of acclimation occurs before releasing endemic stock smolts into the upper river. Water for the Tucannon Hatchery is removed from the river under permit for non-consumptive fish propagation purposes. Additional water for rearing is provided by springs and wells location on the hatchery site. Tucannon Hatchery complies with all NPDES standards for pollution discharge.

**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.**

Hatchery intake screens meet current NOAA Fisheries screening guidelines and effluent discharge is monitored, reported, and currently complies with NPDES standards.

## SECTION 5. FACILITIES

***The following sections will describe what will occur in the short term for this program with a production level of 75,000 smolts. As the program expands into the future, there will be changes that occur with broodstock number, where the broodstock are spawned, rearing***

***locations, release locations and numbers, etc…. . Future changes will be captured in updated versions of the HGMP as needed.***

### 5.1) Broodstock collection facilities (or methods).

Broodstock will be collected primarily at the Tucannon Hatchery trap, or might be collected from a temporary weir located in the lower river (undecided location at this time, could be from rkm 11-40), or from hook/line efforts. The TFH trap consists of a concrete ladder associated with the hatchery water intake. An enlarged section of the ladder is designed to operate as a trap. When fish are sampled from the trap, they can be released into the ladder and allowed to migrate upstream, or removed and hauled to LFH for broodstock. The temporary trap consists of a floating PVC picket weir and trap box. Each day the trap is operated, personnel will check for fish. The trap may be checked more than once during the day if a large number of fish are expected to be captured. Fish are netted from the trap box, and placed in a v-shaped trough filled with water. The trough has a calming effect on the fish so they can be sampled gently. After origin (natural, hatchery supplementation, or hatchery production-LFH stock) has been determined, the fish will either be collected for broodstock or passed upstream. Most natural origin fish will have scales and DNA samples collected from them before release.

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

Broodstock trapped at TFH would be hauled by tank truck, fitted with re-circulation and oxygenation capability, to LFH. Adults collected from the temporary trap are netted into a plastic transport tank fitted with re-circulation/aeration capability, and hauled in the back of a pickup truck. Up to six adults can be transported in the tank.

### 5.3) Broodstock holding and spawning facilities.

Fish are hauled to LFH where they are placed in an adult holding raceway (10'x 6'x 80') that receives constant temperature well water. Adults are held separate from other hatchery stock adults to prevent any accidental co-mingling of the stocks and to control disease transmission. The raceways are enclosed over the middle one-third of the raceway length by the spawning building, where spawning occurs.

### 5.4) Incubation facilities.

The incubation room at LFH is designed to accept and incubate eggs from individual females, through the eyed stage. Two nested square buckets receive water via individual plastic tubes. Isolated incubation vessels allow disease sampling, detection and control. After eyeing is complete and virus sample results are received, eggs are consolidated into hatching baskets and transferred to shallow hatching troughs. As the eggs hatch, fry fall through the hatching baskets, and settle to the bottom of the rearing troughs where they absorb their egg sacks, and eventually start feeding. Routine maintenance in the incubation and early rearing facilities includes checking on water intake valves, water alarms, disinfection and formalin treatment systems, and general condition of the incubation room.

### 5.5) Rearing facilities.

Four intermediate indoor rearing tanks, eight outside intermediate rearing tanks, and 37 outside raceways are available for rearing juvenile steelhead are available at LFH. Water supply is from wells as previously described. Routine maintenance for the rearing raceways includes checking on water intake valves, water alarms, seals around outlet screens, and general condition of the rearing raceways. Rearing raceways and intermediate tanks are disinfected and cleaned between different stocks of fish.

Tucannon Hatchery has six round ponds, a large raceway designed for rearing spring Chinook salmon and two large raceways designed to rear and release steelhead/trout. Water is supplied from river, well and spring sources as described above. Feeding is by hand several times during the day, usually until the fish are saturated.

**a. Acclimation/release facilities.**
An extended acclimation period of 5-10 weeks is planned for smolts at Tucannon Hatchery. Fish will be reared at LFH through January, then transported to raceways at Tucannon Hatchery that allow for acclimatization to river water. After acclimation, fish will be pumped from the raceways and trucked to numerous locations at or above RM 41 (Curl Lake Intake Structure) and released directly into the Tucannon River.

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

None

### 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.

Lyons Ferry Hatchery follows strict operational procedures as laid out by the Integrated Hatchery Optimization Team (IHOT 1993). Where possible, remedial actions identified in a 1996 IHOT compliance audit were implemented. Staff is available to respond to critical operational problems at all times. Both LFH and TFH are equipped with water flow and low water alarm systems and with emergency generator power supply systems to provide incubation and rearing water to the facilities. Fish health is monitored monthly or more often, as required, in cases of disease epizootics. Fish health practices follow PNWFHPC (1989) protocol.

### 5.9) Maintenance

**Annual Maintenance**

- Annual water supply pump rehabilitation. (***Please reference Snake River Fall Chinook HGMP***).
- Rotating drum screen maintenance for rearing lakes ($1,000).
- Chemicals for egg disinfection and fungus control ($2,500)

- Vehicle maintenance ($500).
- Annual fish transportation; a total of 58,600 lbs. smolts hauled from Lyons Ferry to Dayton AF and direct releases to Walla Walla River ($7,500).
- Dredge intake at Touchet River/Dayton AF. ($3,500)
- Fire safety and maintenance service (***Please reference Snake River Fall Chinook HGMP***).

**Non-recurring Maintenance (next 5 years)**

- Stop log replacement for Lake # 1 ($1,500).
- Asphalt seal Dayton AF pond. ($5,000)
- New fish culture equipment; items such as crowders, dip nets, scales, shallow trough baffle plates etc. ($1,500).
- Increase intermediate rearing capacity (***Please reference Tucannon River spring Chinook HGMP***).
- Remodel and update incubation building to provide more incubation space and intermediate early rearing space. (***Please reference Tucannon River spring Chinook HGMP***)
- Develop increased water supply to meet program diversity requirements (***Please reference Tucannon River spring Chinook HGMP***).
- Replace formalin treatment pump ($1,200).
- Replace blower feeder motor ($1,500).

## 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.

Broodstock will be collected from the Tucannon FH adult trap, a temporary trap located in the lower river, or from hook/line efforts. Natural steelhead and endemic origin fish (up to 10% of the broodstock) will be used for broodstock while the program is at the 75,000 smolt level.

### 6.2) Supporting information.

#### 6.2.1) History.

Endemic stock fish have been released into the upper Tucannon River since 2001. Prior to 2009, all spawned fish used in the program were of natural origin. Because the run appeared to be low in 2009, a decision was reached to rely on endemic hatchery fish for up to 25% of the broodstock needs. For the current program of 75,000 smolts, hatchery origin fish represent 10% of the broodstock. This percentage will likely increase as smolt production levels increase in the future.

#### 6.2.2) Annual size.

The current program level (production of 75,000 smolts on an annual basis) requires the spawning of 17-18 female steelhead. We desire that a unique male be spawned with each female, so we plan to capture at least 20 males for spawning. We've found in the past that not all males ripen at the same time as the females, so the more males we have on hand during spawning increases our chances of successful fertilization without re-using the same males. Endemic stock hatchery fish will comprise no more than 10% of the broodstock used for the hatchery program (the remaining 90% will be natural origin fish).

At full program level, we anticipate the collection of 90 fish annually (will consist of natural and hatchery-origin) to meet production goals with no more than 30% of the broodstock being hatchery origin endemic stock fish.

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

Prior to 2009, all spawned fish used in the program were of natural origin. Because the run appeared to be low in 2009, a decision was reached to rely on endemic hatchery fish for up to 25% of the broodstock needs. For the current program of 75,000 smolts, hatchery origin fish represent 10% of the broodstock. This percentage will likely increase as smolt production levels increase in the future.

### 6.2.4) Genetic or ecological differences.

In 2004, we had acquired multiple years of genetic data from the two endemic brood stock population programs, and from other areas in SE Washington, including the LFH stock. Presented in this next section is a genetic analysis summary report that was provided in 2004 by the WDFW Genetics Lab, Olympia Washington. This section was pulled from the Lyons Ferry Complex Steelhead Evaluation Report for the 2003 run year (Bumgarner et al. 2004).

***Genetic Summary***

Since 1998, the Snake River Lab and WDFW's Fish Management staff have periodically collected samples from SE Washington summer steelhead populations (adult and juvenile) for genetic stock analysis. Samples have been collected from the Walla Walla, Touchet and Tucannon River basins, and LFH stock.

There is always the potential for genetic introgression of LFH steelhead into the Tucannon, Touchet and Walla Walla River populations. However, even with the large releases of LFH summer steelhead in the past, genetic introgression with MCR (Mid-Columbia River) steelhead has not been observed to a large degree in the Touchet and Walla Walla Rivers. Genetic samples collected in the Touchet and Walla Walla basins showed that there are still genetic differences between the natural and hatchery-origin summer steelhead (Figures 2 and 3 - Bumgarner et al. 2007). Individual assignment tests were conducted on the genetic samples (Table 11). The Lyons Ferry stock had a 46% self-assignment rate, approximately 10% assignment to Tucannon and Touchet, and 1% assignment to Walla Walla. The Touchet sample had 53% self-assignment, 6% assignment to Tucannon, 5% assignment to LFH, and 5% assignment to Walla Walla. The Walla Walla sample had the highest self-assignment rate, 56%, the fewest number of individuals assigning to LFH, 1%, and the lowest number of unassigned fish, 27%. With hatchery production cuts, and future decreases likely, the chance for introgression will be further decreased.

The low self-assignment, unassigned and assignment to LFH stock strongly suggests that introgression has occurred in the Tucannon. Conversion to an endemic stock will help reverse this trend and conserve the remaining genetic diversity of Tucannon steelhead.

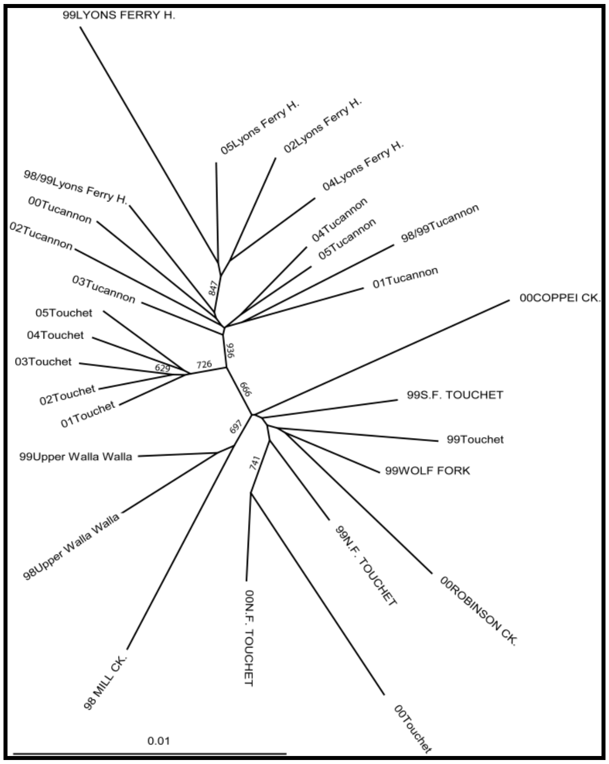



Figure 2. Chord distance tree that includes temporally stratified samples (from Figure 2), plus samples from Touchet River tributaries, Mill Creek, and Walla Walla River. Sample labels with all letters capitalized are juvenile samples. Node support numbers are values from bootstrap analysis (1000 bootstraps).

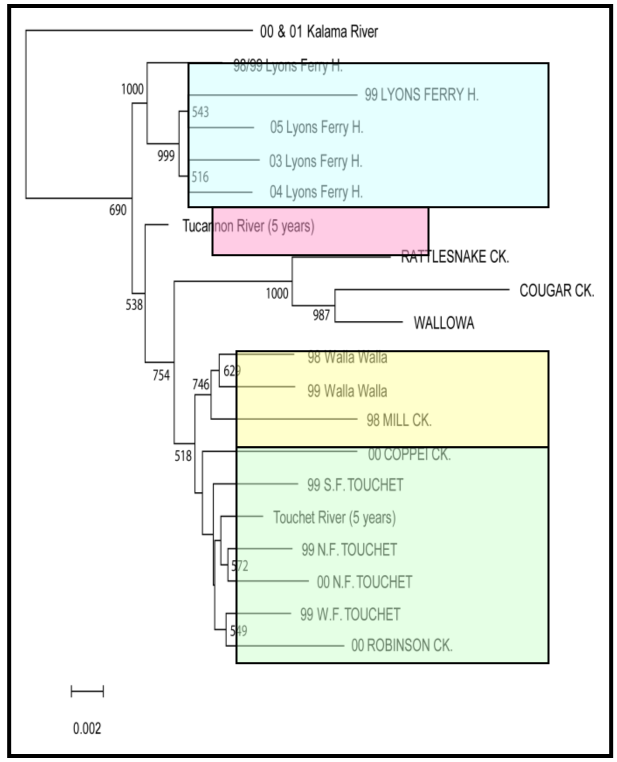



Figure 3. Chord distance tree from steelhead samples from Columbia River, Walla Walla River, and Snake River. Sample labels with all letters capitalized are juvenile samples. Node support numbers are values from bootstrap analysis (1000 bootstraps).

Table 11. Individual assignment results reported are the proportions of individuals assigned to each population category, given the assignment LOD was greater than one and the individual's likelihood resided within the 95% confidence interval for the estimated population of origin.

| | N | Tucannon | LFH | Touchet | Walla Walla | Unassigned |
|---|---|---|---|---|---|---|
| Tucannon River …… | 451 | 0.29 | 0.14 | 0.09 | 0.05 | 0.43 |
| Lyons Ferry Hatchery | 333 | 0.10 | 0.46 | 0.13 | 0.01 | 0.31 |
| Touchet River……… | 987 | 0.06 | 0.05 | 0.53 | 0.05 | 0.30 |
| Walla Walla ……… | 177 | 0.04 | 0.01 | 0.12 | 0.56 | 0.27 |

### 6.2.5) Reasons for choosing.

Endemic steelhead are thought to be better adapted for survival in the Tucannon River than the LFH stock. In the long run, it is expected the Tucannon endemic hatchery stock will be most capable of surviving, returning to and effectively spawning in the Tucannon River.

### 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.**

Use of natural origin adult steelhead for broodstock will provide the greatest protection of the population's genetic structure in a conservation/mitigation program. We will attempt to collect broodstock from the entire run.

## SECTION 7. BROODSTOCK COLLECTION

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

Adults.

**7.2) Collection or sampling design.**

Natural steelhead may enter the Tucannon River from September through April, but their most active entry and migration times occur in the early spring (February-May) at the Tucannon FH. Trapping operations may occur in the lower river where adults from the entire watershed pass the trap site. Hook and line sampling for broodstock may also occur in some years. WDFW will collect adults throughout the spring migration period to ensure a full representation of the run. However, there may be implementation uncertainties that in some years will make this sampling of the entire return period infeasible. Records will be maintained that document the broodstock collection dates for each year and will be periodically reviewed to assess whether or not the long-term multiyear pattern of broodstock collection shows a chronic bias to one segment of the return period. If a bias is detected, modifications to the timing of broodstock collections will be implemented to eliminate this bias and obtain a better representation of the run.

**7.3) Identity.**

Endemic origin naturally produced steelhead are unmarked. All hatchery fish (LFH stock) that were released into the Tucannon River receive an adipose clip or a combination adipose/left ventral/CWT, and can be visually identified. All releases of smolts from endemic origin fish will be CWT for electronic identification when they return as adults. Once full production is reached and fish are designated for harvest, a portion of the annual production will marked with an adipose fin clip for harvest management purposes.

**7.4) Proposed number to be collected:**

**7.4.1) Program goal:** In the short term 40 adults will be collected annually. No more than 10% of the broodstock will be hatchery origin. This number allows for pre-spawning loss that could occur at the hatchery while holding fish, or if fish are detected with high levels of IHNV.

**7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available: (Table 12)**

**Table 12.** Numbers of males and females spawned, eggs taken, and survival by life state of Tucannon River endemic stock summer steelhead spawned at LFH, 2000 to 2010 brood years.

| BY | Spawned Female | Spawned Male | Eggs taken | Eggs retained [a] | Percent retained | Fry | Egg to fry survival | Smolts | Fry to smolt survival | Egg to smolt survival |
|---|---|---|---|---|---|---|---|---|---|---|
| 2000 | 16 | 21 | 80,850 | 71,971 | 89.0 | 71,971 | 100.0 | 60,020 | 83.4 | 83.4 |
| 2001 | 15 | 15 | 113,563 | 101,497 | 89.4 | 98,836 | 97.4 | 58,616 | 79.3 [b] | 82.3 |
| 2002 | 13 | 16 | 74,204 | 66,969 | 90.3 | 51,713 | 77.2 | 43,688 | 84.5 | 65.2 |
| 2003 | 11 | 19 | 73,573 | 46,143 | 62.7 | 45,220 | 98.0 | 42,967 | 95.0 | 93.1 |
| 2004 | 16 | 15 | 75,560 | 59,911 | 79.3 | 58,882 | 98.3 | 61,238 | 100.0 | 100.0 |
| 2005 | 14 | 25 | 77,131 | 71,933 | 93.3 | 70,254 | 91.1 | 65,245 | 92.9 | 90.7 |
| 2006 | 13 | 17 | 72,520 | 67,341 | 92.9 | 66,169 | 91.2 | 62,940 | 95.1 | 93.5 |
| 2007 | 13 | 12 | 64,129 | 59,970 | 93.5 | 56,549 | 94.3 | 53,070 | 93.8 | 88.5 |
| 2008 [c] | 1 | 1 | 3,054 | 2,537 | 83.1 | 2,530 | 99.7 | NA | NA | NA |
| 2009 | 16 | 11 | 77,279 | 62,960 | 81.5 | 61,026 | 96.9 | 57,562 | 94.3 | 91.4 |
| 2010 | 18 | 16 | 89,791 | 81,100 | 90.3 | | | | | |

[a] The number of eggs retained includes all losses from green egg to eye up (mortality and eggs destroyed due to IHNV).
[b] A total of 24,948 fingerlings were released into the upper Tucannon River.
[c] Program not large enough to rear to smolts, all were released as fry into the upper Tucannon River.

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

In the short term (next 2-3 years) all endemic stock smolts are to be released above the Tucannon FH. As such, all returning endemic stock adults will be allowed unrestricted access to the upper basin. As the program expands to greater than 75,000 smolts, release locations will be modified in agreement with all the co-managers, and the total number of endemic stock fish allowed above the Tucannon FH will be determined based on a sliding scale. For the next 2-3 years as LFH stock fish continue to return to the river, all will be removed or passed downstream of the Tucannon FH trap to keep them from the upper basin.

### 7.6) Fish transportation and holding methods.

Adults are transported in plastic tubs or tank trucks with re-circulation aeration and/or oxygenation. Hauling time from TFH to LFH is approximately 45 minutes. Hauling time from a temporary weir/trap lower in the river would vary from 15-30 minutes.

Currently, fish are held in brood stock raceways at LFH as described above. Fish are anesthetized using MS-222 to determine degree of ripeness. Fish may be treated with a suite of approved chemicals to control fungus, parasites and bacterial diseases, as prescribed by a WDFW fish health specialist. Depending on facility modifications at the Tucannon FH, eventually the all activities would occur there (broodstock holding, spawning, rearing, etc…).

### 7.7) Describe fish health maintenance and sanitation procedures applied.

Monthly fish health inspections occur at LFH. Because of very low numbers of adults held in broodstock raceways, raceway cleaning is unnecessary. Treatments for fungal infections are applied as chemical flushes through the raceways.

### 7.8) Disposition of carcasses.

Broodstock females are kill spawned and all carcasses are frozen and then eventually returned to the Tucannon River for nutrient enhancement. Males are live spawned (as they may have to be used multiple times during the spawning process. Any males that die are frozen and later returned to the river for nutrient enhancement. Males that are still alive at the end of spawning are sampled and returned to the river where they have the possibility to continue spawning with fish in the river.

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

Broodstock will be collected from throughout the natural run period to provide for random selection of adults from the entire adult population, prevent run timing divergence of the hatchery reared population from the natural population, and provide for natural fish escapement into the habitat to spawn. Returning hatchery fish from the endemic program will be allowed to enter the natural spawning population with the exception of those fish removed for hatchery broodstock. However, the number of hatchery fish retained for broodstock will be minor, comprising less than 10% of all fish spawned for each year's hatchery production.

Disease control efforts at LFH and TFH are in accordance with Pacific Northwest Fish Health Protection Committee (PNWFHPC 1989) and Integrated Hatchery Operations Team (HOT 1993) standards. Implementation of these standards will effectively control expansion of species specific or general salmonid diseases.

## SECTION 8. MATING

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

### 8.1) Selection method.

All males and females that have been collected for broodstock will be examined weekly during the spawning season to determine ripeness, and all fish will be spawned when ripe. The priority will be to use any males that have not yet contributed in spawning. All males are PIT tagged for identification purposes after they have been spawned to track the number times a particular male may contribute.

### 8.2) Males.

Mating occurs in a 2x2 factorial cross when possible to ensure the highest likelihood of fertilization. If only one female is ripe for spawning, 2 males are typically found, with the egg lot split in half for each male to contribute to each lot.

### 8.3) Fertilization.

Equal sex ratios in the spawning population were originally identified as a goal for the program. However, getting enough ripe males to spawn with females has been a chronic problem for this program. Further, fecundity has generally been greater than originally planned. As such current program goals can be reached by spawning on 16-17 females. As such, additional males will be collected, or live spawned and released at the adult trap to ensure adequate males are available. The small number of fish ripe on individual days usually limits spawning options. Males are usually limited to primary status on one half the eggs from two females. Where insufficient males are available to meet these criteria, males can be used as primary more than twice. In those circumstances, males will be used no more than four times as primary spawners (egg equivalent = 2 females). After fertilization, eggs are rinsed in a buffered iodine solution (100 ppm) to control viral and bacterial disease, and allowed to water harden for one hour in the same solution.

### 8.4) Cryopreserved gametes.

Cryopreservation of semen occurred in the past, with some collections currently being stored at WSU. To date, we have not used any of the cryopreserved semen in any of the fertilizations.

### 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.

Broodstock collection protocol will ensure that adults represent a proportional, temporal distribution of the natural population. A 2x2 factorial mating scheme has been and will be applied to reduce the variance in family survival with the expectation that this will slow the loss of within-population genetic diversity.

## 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.

Only ten years of egg take information is available for endemic Tucannon River steelhead (Table 12).

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

The number of eggs collected could exceed program needs. Eggs in excess of program may be retained to ensure the goal is met in case of unexpected loss from IHNV, cold water disease, or other unexpected circumstances. Eggs from females determined to be IHNV positive would not necessarily be destroyed. The LFH Complex manager and a WDFW Fish Health specialist, and consultation with the co-managers will make the decision.

**9.1.3) Loading densities applied during incubation.**

Eggs from individual females will be incubated separately. Water flow through each incubator is ~2gpm. After eye-up, eggs of similar size/oz are placed in hatching baskets in shallow troughs with a capacity of 20,000 eggs/fry each.

**9.1.4) Incubation conditions.**

Incubation, as with rearing, occurs with pathogen free, sediment free, 51-53 $^{0}$F well water. The incubation building is fitted with back-up pumps to maintain flow through the troughs in emergency situations, and with secondary packed columns to maintain water oxygenation above 10 ppm. Flow monitors will sound an alarm if flow through the incubation troughs is interrupted. IHOT incubation protocols will be followed where practical.

**9.1.5) Ponding**.

Fish hatch from baskets and drop into troughs where they remain for 4-8 weeks after feeding commences. Fish are fed after all are buttoned up (usually 1-3 days post swim-up). Fish are then moved to intermediate inside tanks (usually at about 800 fish/lb). Fish rear in intermediate tanks until July or when fish reach 100/lb, at which time they are transferred to outside raceways.

**9.1.6) Fish health maintenance and monitoring.**

Eggs are examined daily by hatchery personnel. Prophylactic treatment of eggs for the control of fungus is prescribed by a WDFW fish health specialist, and may include treatment with formalin or other accepted fungicides. Non-viable eggs and sac-fry are removed by bulb-syringe, or from egg pickers.

**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.**

Eggs are incubated in pathogen free, silt free well water to ensure maximum egg survival and minimize potential loss from disease. The hatchery incubation room is protected by a separate low water alarm system and an automatic water reuse pumping system, and by the use of wells separate from the hatchery's main well field.

## 9.2) <u>Rearing</u>:

**9.2.1) Provide survival rate data by hatchery life stage for the most recent twelve years (1988-99), or for years dependable data are available.**

See Table 12 for relevant data on the Tucannon Endemic Stock.

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

LFH raceway rearing density index criteria for steelhead will not exceed 0.26 lbs fish/ft$^3$. Where steelhead are reared in rearing ponds, densities can be 10% of the raceway maximum. Generally, indigenous brood juveniles will rear in vessels at a density index much less than 0.26 lbs fish/ft$^3$.

**9.2.3) Fish rearing conditions**

Raceways are supplied with oxygenated water from the hatchery's central degassing building. Approximately 1,000 gpm water enters each raceway through secondary degassing cans. Oxygen levels range between 10-12 ppm entering, to 8-10 ppm leaving the raceway, depending on ambient air temperature and number of fish in the raceway. Flow index (FLI) is monitored monthly at all facilities and rarely exceeds 80% of the allowable loading. Raceways are cleaned three times a week by brushing to remove accumulated uneaten feed and fecal material. Feeding is by hand.

Currently all endemic stock fish (conservation program) are initially reared at LFH and then transferred to TFH in February for final rearing prior to release (provides some acclimation to Tucannon River water). As the program expands to greater than the current 75,000 smolt goal, some of the annual production will be used for harvest mitigation. Tucannon FH has limited rearing space, so some or all of the harvest mitigation fish may remain at LFH for full term rearing prior to release. Many options are currently being explored for rearing other species/programs at LFH, and until those are resolved, it is unknown how the rearing of the harvest mitigation portion of this program will look.

**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.**

Growth rate information for the Tucannon River endemic stock steelhead. (Table 13)

Table 13. Size of Tucannon River Endemic stock steelhead at LFH for the 2006, 2007 Brood Years. Fish destined for the conservation program are transferred during February each year to Tucannon Fish Hatchery for final rearing.

| 2006 Brood Year | | | 2007 Brood Year | | |
|---|---|---|---|---|---|
| Month/Year | FPP | g/fish | Month/Year | FPP | g/fish |
| 3/06 | N/a | N/a | 3/07 | N/a | N/a |
| 4/06 | 700 | 0.65 | 4/07 | 2130 | 0.21 |
| 5/06 | 321 | 1.4 | 5/07 | 670 | 0.68 |
| 6/06 | 215 | 2.1 | 6/07 | 245 | 1.9 |
| 7/06 | 81 | 5.6 | 7/07 | 96 | 4.7 |
| 8/06 | 42 | 10.8 | 8/07 | 58 | 7.8 |

| | | | | | |
|---|---|---|---|---|---|
| 9/06 | 25 | 18.2 | 9/07 | 32 | 14.2 |
| 10/06 | 16.7 | 27.2 | 10/07 | 21 | 21.6 |
| 11/06 | 12.1 | 37.5 | 11/07 | 14.1 | 32.2 |
| 12/06 | 9.9 | 45.9 | 12/07 | 10.1 | 45 |
| 1/07 | 6.4 | 70.9 | 1/08 | 7.7 | 59 |
| 2/07 | | | 2/08 | 7.4 | 61.4 |

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

See Table 13.

**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.**

Fry/fingerling will be fed an appropriate commercial dry or semi-moist trout/salmon diet. Feeding occurs several times daily as necessary to provide the diet at a range of 0.7 – 1.1% B.W./day. Feed conversion is expected to fall in a range of 1.1 – 1.4 pounds fed to pounds produced. Due to the duration of spawning time for the natural steelhead, a variety of starter diets and feed schedules may be used to achieve a similar size among the fish before they are moved outside to the rearing raceways. This strategy will reduce length variation (CV) of juveniles within the supplemented population.

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

A WDFW fish health specialist monitors fish health as least monthly. More frequent care is provided as needed if disease is noted. Hatchery Specialists under the direction of the Fish Health Specialist provide treatment for disease. Sanitation consists of raceway cleaning three times each week by brushing, and disinfecting equipment between raceways and/or between species on the hatchery site.

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

Program goal for the endemic program will be to release fish between April 1-30 at 4.5 fish/lb. Pre-liberation samples will note smolt development visually based on degree of silvering, presence/absence of parr marks, fin clarity and banding of the caudal fin. No gill ATPase activity or blood chemistry samples to determine degree of smoltification, or to guide fish release timing is anticipated.

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

At this time, no “natural” rearing methods are planned for this stock. Raceways are old enough that the walls and bottoms are of nearly natural coloration and texture, and promote natural looking fish.

**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.**

Lyons Ferry Complex facilities are manned by professional personnel trained in fish cultural procedures. Facilities are state-of-the-art to provide a safe and secure rearing environment through the use of alarm systems, backup generators, and water re-use-pumping systems to prevent catastrophic fish losses. Final rearing/acclimation at Tucannon Hatchery will occur on river water to provide acclimation/imprinting time and begin the conversion to natural feed sources present in river water.

## SECTION 10. RELEASE

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

The following (Table 14) shows proposed WDFW endemic stock juvenile or smolt releases (goal and maximum) into the Tucannon River for the first two to three years. Program size will change as funding for facility modifications is made available and work can begin. Additional rearing space is planned for the fall of 2011.

Table 14. Short-term steelhead production releases (by stock) into the Tucannon River.

| Age Class | Maximum Number | Goal | Size (fpp) | Release Date | Location | Stock |
|---|---|---|---|---|---|---|
| Yearling | 85,000 | 75,000 | 4 .5 | 1-30 April | Curl Lake Intake (direct stream release) | Tucannon |

The next phase of the program is expected to increase to 100,000 smolts, (possibly as early as the 2012 brood year). At the 100,000 smolt level, 50,000 would be released in the upper watershed to continue with the conservation program (100% CWT, no external marks). The remaining 50,000 would be released in the middle to lower portion of the watershed (RM11-RM25 – location has yet to be decided), with 100% adipose fin clipped, and about 20,000 that would be given a CWT and LV fin clip for external identification.

### 10.1a) Proposed fish release levels at full program

The following table (Table 15) shows proposed WDFW endemic stock smolt releases (goal and maximum) into the Tucannon River after the proposed full production has been reached.

Table 15. Proposed long-term steelhead production of Tucannon River Endemic Stock into the Tucannon River.

| Age Class | Maximum Number | Goal | Size (fpp) | Release Date | Location | Stock |
|---|---|---|---|---|---|---|
| Yearling | 60,000 | 50,000 | 4.5 | 1-30 April | Near Tucannon Hatchery (direct stream release) | Tucannon |
| Yearling | 110,000 | 100,000 | 4.5 | 1-30 April | First 50,000 near the Hatchery and the remaining released in Lower Tucannon River (between Marengo and HWY 12 - direct stream release) | Tucannon |

| Age Class | Maximum Number | Goal | Size (fpp) | Release Date | Location | Stock |
|---|---|---|---|---|---|---|
| Total Yearling | 170,000 | 150,000 | 4.5 | 1-30 April | See Above for 100,000 goal | Tucannon |

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

**Stream, river, or watercourse:** Tucannon River (WRIA 35)
**Release point:** RM 11-60
**Major watershed:** Tucannon River
**Basin or Region:** Snake River

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

Date of Release (4/9-4/10) - 2000 BY - 2001 Release – Yearling Smolt – 60,020 (5.8 fish/lb)
Date of Release (10/05) - 2001 BY - 2001 Release – Fingerling – 24,938 (28.5 fish/lb)
Date of Release (4/2) - 2001 BY - 2002 Release – Yearling Smolt – 58,616 (5.49 fish/lb)
Date of Release (4/15) - 2002 BY - 2003 Release – Yearling Smolt – 43,688 (5.30 fish/lb)
Date of Release (4/6-26) - 2003 BY - 2004 Release – Yearling Smolt – 42,967 (4.8 fish/lb)
Date of Release (3/29-31) - 2004 BY - 2005 Release – Yearling Smolt – 61,238 (4.8 fish/lb)
Date of Release (4/12-14) - 2005 BY - 2006 Release – Yearling Smolt – 64,245 (4.8 fish/lb)
Date of Release (4/3-11) - 2006 BY - 2007 Release – Yearling Smolt – 62,940 (4.4 fish/lb)
Date of Release (4/17) - 2007 BY - 2008 Release – Yearling Smolt – 57,230 (4.5 fish/lb)
Date of Release (None) – 2008 BY – 2009 Release – Yearling Smolt – 0
Date of Release (4/10-5/13) – 2009 BY- 2010 Release – Yearling Smolt – 57,562 (4.7 fish/lb)

Also, see Figures 4a, and 4b that demonstrates how the program has done in meeting the smolt production goal and size at release goal for the Tucannon River endemic stock program.

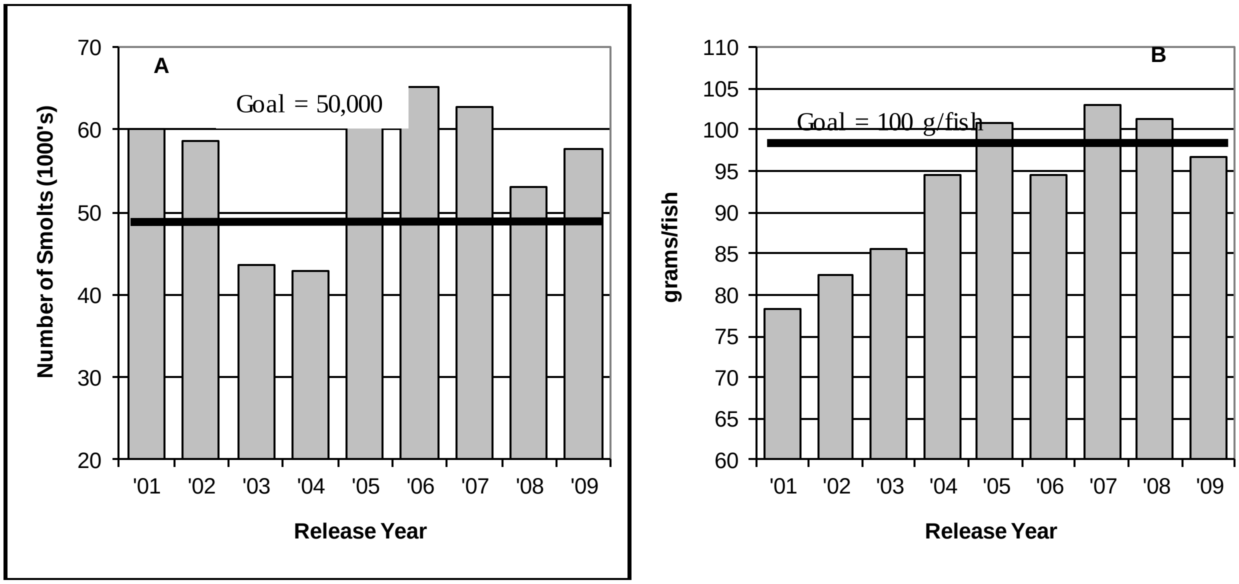



Figure 4. Tucannon River endemic stock smolt production (A) and average size at release (B) from 2001-2008 release years.

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

See 10.3 above for dates of release for endemic broodstock fish. In the short term, fish will be transferred from LFH to TFH in February of the release year and placed in ponds supplied with river water (see 10.6 below). Fish will be fed while at TFH. During April of the release year, when fish appear to be visibly smolted, fish are their approximate release size, or river conditions will provide optimum migration, they will be loaded into trucks and hauled to the upper river (≥ RM 41) and released. As the program expands, release locations will be modified.

### 10.5) Fish transportation procedures, if applicable.

Fish will be transported from LFH to TFH and from TFH to release sites above the hatchery by tank truck. Transportation time from LFH will usually be less than one hour and from TFH to release sites will usually be less than 30 minutes.

### 10.6) Acclimation procedures.

Fish will be reared at TFH from early to mid February through release in April (5-9 weeks). Rearing will occur on Tucannon River water, which will provide acclimation to the chemistry and temperature regime of the Tucannon basin. Acclimation prior to release (other than at the Tucannon Hatchery) is not planned.

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

In the next few years, and until the program can be expanded beyond 75,000 smolts, all fish will receive a coded wire tag in the snout, but will not be adipose clipped. A portion of these will also be PIT tagged to determine smolt-to-adult return rates. As we transition to full production the marking plans will change. At a smolt goal of 100,000, the first priority is that half (50,000) would be for conservation needs and would have CWTs only, the remaining fish (numbers dependant on production for a given year), would be for harvest mitigation needs with 100% AD clipped, and about 20,000 with CWT's and LV fin clips. A portion of both the unmarked and marked production will also receive PIT tags. At the full program goal of 150,000 smolts, the first priority is that 50,000 would be CWT only for conservation needs, and the remaining smolts would be programmed for harvest mitigation with 100% AD clipped and about 20,000 of those LV/CWT marked/tagged. We plan to discontinue the use of LV clips with Ad/CWT marks as soon as we are confident that out of basin sampling for CWTs includes electronic sampling of all fish (not just those with LV clips).

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

Monitoring of fish numbers, growth and mortality at the hatcheries will provide reasonably accurate estimates of live fish throughout their rearing life. Fish in excess of maximum program needs will be planted as fry or fingerlings in the upper watershed.

**10.9) Fish health certification procedures applied pre-release.**

Fish will be examined by a WDFW fish health specialist and certified for release as required under the PNWFHPC (1989) guidelines.

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

Under conditions requiring release of fish at either hatchery in response to a water system failure, all fish would be hauled by truck to the upper Tucannon River and released.

**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.**

In the short term, all fish will be released into the upper river basin, which is currently believed to be under seeded by adult and juvenile steelhead. Since the standard release strategy will consist of releasing smolts, most will orient to the river for a short time (1-10 days) and then emigrate. Some smaller fish may not be developmentally ready to emigrate and could assume residence in the river for up to another year. However, because we believe that the Tucannon River is presently under seeded by adult steelhead, WDFW does not expect these fish to represent a problem for juvenile salmon, steelhead or bull trout in the system.

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

The Species Interaction Work Group (SIWG 1984) reported that potential impacts from competition between hatchery and wild fish is assumed to be greatest in the spawning and nursery areas and at release locations where fish densities are highest (NMFS 1995). These impacts likely diminish as hatchery smolts disperse, but resource competition may continue at some unknown, but lower level as smolts move downstream through the migration corridor. Steward and Bjornn (1990), however, concluded that hatchery fish kept in the hatchery for extended periods before release as smolts (e.g. yearling salmonids) may have different food and habitat preferences than wild fish, and that hatchery fish will be unlikely to out-compete wild fish. Hatchery produced smolts emigrate seaward soon after liberation, minimizing the potential for competition with wild fish (Steward and Bjornn 1990). Competition between hatchery origin salmonids with wild salmonids, including steelhead, in the mainstem corridor was judged not to be a significant factor (Witty et al. 1995).

# 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.

| | Performance Measure | Definition | Performance Measures Currently Completed (Yes, No, Partial) |
|---|---|---|---|
| Abundance | Adult Escapement to Tributary | Number of adults that have escaped to a certain point (i.e. - mouth of stream). Population based measure. Calculated with PIT tag array at mouth of Tucannon River. Provides total hatchery and wild escapement and wild only escapement. [Assumes tributary harvest is accounted for]. Uses TRT population definition where available | YES |
| | Fish per Redd | Number of fish divided by the total number of redds. Applied by: The population estimate at a weir site, minus broodstock and mortalities and harvest, divided by the total number of redds located upstream of the weir. | PARTIAL Above Tucannon FH only |
| | Female Spawner per Redd | Number of female spawners divided by the total number of redds above weir. Applied in 2 ways: 1) The population estimate at a weir site multiplied by the weir derived proportion of females, minus the number of female prespawn mortalities, divided by the total number of redds located upstream of the weir. | PARTIAL Above Tucannon FH only |
| | Index of Spawner Abundance - redd counts | Counts of redds in spawning areas in index area(s) (trend), extensive areas, and supplemental areas. Reported as redds and/or redds/km. | YES When stream flows allow surveys |
| | Spawner Abundance | In-river: Estimated number of total spawners on the spawning ground. Calculated as the number of fish that return to an adult monitoring site, minus broodstock removals and weir mortalities and harvest if any, subtracts the number of female prespawning mortalities and expanded for redds located below weirs. Calculated as hatchery spawner abundance, and 2) wild spawner abundance which multiplies by the proportion of natural origin (wild) fish. In-hatchery: Total number of fish actually used in hatchery production. Partitioned by gender and origin. | YES |

| | | | |
|---|---|---|---|
| | Hatchery Fraction | Percent of fish on the spawning ground that originated from a hatchery. Applied in two ways: 1) Uses weir data to determine number of fish by origin released above Tucannon FH Adult Trap, and 2) Based on the PIT tag array (natural and hatchery origin detected), minus estimates of harvest if needed and mortality prior to spawning | YES |
| | Ocean/Mainstem Harvest | Number of fish caught in ocean and mainstem (tribal, sport, or commercial) by hatchery and natural origin. | PARTIAL<br>hatchery fish only |
| | Harvest Abundance in Tributary | Number of fish caught in tributaries (tribal, sport, or commercial) by hatchery and natural origin. | PARTIAL<br>hatchery fish only |
| | Index of Juvenile Abundance (Density) | Parr abundance estimates using underwater survey methodology are made at pre-established transects. Densities (number per 100 m2) are recorded using protocol described in Thurow (1994). Hanken & Reeves estimator. | NO |
| | Juvenile Emigrant Abundance | Gauss software is (Aptech Systems, Maple Valley, Washington) is used to estimate emigration estimates. Estimates are given for parr pre-smolts, smolts and the entire migration year. Calculations are completed using the Bailey Method and bootstrapping for 95% CIs. Gauss program developed by the University of Idaho (Steinhorst 2000). | YES |
| | Smolts | Smolt estimates, which result from juvenile emigrant trapping and PIT tagging, are derived by estimating the proportion of the total juvenile abundance estimate at the tributary comprised of each juvenile life stage (parr, pre-smolt, smolt) that survive to first mainstem dam. It is calculated by multiplying the life stage specific abundance estimate (with standard error) by the life stage specific survival estimate to first mainstem dam (with standard error). The standard error around the smolt equivalent estimate is calculated using the following formula; where X = life stage specific juvenile abundance estimate and Y = life stage specific juvenile survival estimate:<br>$Var(X \cdot Y)$<br>$= E(X)^2 \cdot Var(Y) + E(Y)^2 \cdot Var(X) + Var(X) \cdot Var(Y)$ | YES |
| | Run Prediction | This will not be in the raw or summarized performance database. | NO |
| 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 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.<br><br>*Smolt-to-adult return rates* are generated for four performance periods; tributary to tributary, tributary to first mainstem dam, first mainstem dam to first mainstem dam, and first mainstem dam to tributary.<br><br>*Tributary to tributary SAR* estimates for natural and hatchery origin fish are calculated using PIT tag technology as well as direct counts of fish returning to the drainage. PIT tag SAR estimates are calculated by dividing the number of PIT tag adults returning to the tributary (by life stage and origin type) by the number of PIT tagged juvenile fish migrating from the tributary (by life stage and origin type). Overall PIT tag SAR estimates for natural fish are then calculated by averaging the individual life stage specific 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.<br><br>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:<br>$Var\left(\frac{X}{Y}\right) = \left(\frac{EX}{EY}\right)^2 \cdot \left(\frac{Var(Y)}{(EY)^2}\right)$ | PARTIAL |
| | Progeny-per-Parent Ratio | Adult to adult calculated for naturally spawning fish and hatchery fish separately as the brood year ratio of return adult to parent spawner abundance using data above weir or PIT tag array. Estimates of this ratio for fish spawning and produced by the natural environment must be adjusted to account for the confounding effect of spawner density on this metric. Two variants calculated: 1) escapement, and 2) spawners. | YES |

| | | | |
|---|---|---|---|
| | Recruit/spawner (R/S)(Smolt Equivalents per Redd or female) | Juvenile production to some life stage divided by adult spawner abundance, adjusted for the confounding effects of spawner density.. Derive adult escapement above juvenile trap multiplied by the pre-spawning mortality estimate. Adjusted for redds above juvenile Trap. *Recruit per spawner* estimates, or *juvenile abundance (can be various life stages or locations) per redd/female*, is used to index population productivity, since it represents the quantity of juvenile fish resulting from an average redd (total smolts divided by total redds) or female. Several forms of juvenile life stages are applicable. | YES |
| | Juvenile Survival to first mainstem dam | Life stage survival (parr, pre-smolt, 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. | PARTIAL<br>Not all fish are treated as run of the river fish – data will need parsing |
| | Juvenile Survival to all Mainstem Dams | *Juvenile survival to first mainstem dam and subsequent Mainstem Dam(s)*, which is estimated using PIT tag technology. Survival by life stage to and through the hydrosystem is possible if enough PIT tags are available from the stream. Using tags from all life stages combined we will calculate (SURPH) the survival to all mainstem dams. | PARTIAL<br>may not be possible based on PIT tag numbers |
| | Post-release Survival | Post-release survival of natural and hatchery-origin fish are calculated as described above in the performance measure "Survival to first mainstem dam and Mainstem Dams". No additional points of detection (i.e. screw traps) are used to calculate survival estimates. | PARTIAL<br>see comments above |
| Distribution | Adult Spawner Spatial Distribution | Tributary spawner distribution. Reach specific summaries based on index areas. Hatchery-origin vs. natural-origin spawners across spawning areas within populations will be determined from weir data or PIT tag arrays. | YES |
| | Stray Rate (percentage) | Estimate of the number and percent of hatchery origin fish on the spawning grounds, as the percent within MPG, and percent out of ESU. Calculated from 1) total known origin based on PIT tag array, and 2) uses fish released above Tucannon FH weir. | YES |
| | Juvenile Rearing Distribution | | NO |
| | Disease Frequency | Natural fish mortalities are provided to certified fish health lab for routine disease testing protocols. Hatcheries routinely samples fish for disease and will defer to then for sampling numbers and periodicity | PARTIAL<br>hatchery fish only |
| Genetics | Genetic Diversity | Indices of genetic diversity – measured within a tributary (heterozygosity – allozyme, microsatellite), or among tributaries across population aggregates (e.g., FST). Baseline was set from 2000-2005, period sampling should occur every ten years after program has reached full production. | YES |
| | Reproductive Success ($N_b$/N) | Derived measure: determining hatchery: wild proportions, effective population size is modeled. | NO |
| | Relative Reproductive Success (Parentage) | The survival or productivity of offspring of hatchery spawners relative to offspring of wild spawners from the same basin. | NO |
| | Effective Population Size (Ne) | Derived measure: the number of breeding individuals in an idealized population that would show the same amount of dispersion of allele frequencies under random genetic drift or the same amount of inbreeding as the population under consideration. | NO |
| Life History | Age Structure | Proportion of escapement composed of adult individuals of different brood years. Calculated for wild and hatchery origin Adult returns. Accessed via scale method, or mark recoveries. Smolt migration age is determined by brood year (year when eggs are placed in the gravel). Scales are collected from natural-origin smolts annually. | YES |
| | Age–at–Return | Age distribution of spawners on spawning ground. Calculated for wild and hatchery adult returns based on PIT tag returns and scale data or marks collected at weirs. | YES |
| | Age–at-Emigration | Smolt migration age is determined by brood year (year when eggs are placed in the gravel). Scales are collected from natural-origin smolts annually. All hatchery-origin steelhead smolts are one year in age at release. | YES |
| | Size-at-Return | Size distribution of spawners using fork length. Raw database measure only. | YES |
| | Size-at-Emigration | Fork length (mm) and weight (g) are representatively collected weekly from natural smolts captured in emigration traps. Mean fork length and variance for all samples within a life stage-specific emigration period are generated (mean length by week then averaged by life stage). Size-at-emigration for hatchery production is generated from pre release sampling of juveniles at the hatchery. | YES |
| | Condition of Juveniles at Emigration | Condition factor by life stage of juveniles is generated using the formula: K = $(w/l^3)(10^4)$ where K is the condition factor, w is the weight in grams (g), and l is the length in millimeters (Everhart and Youngs 1992). Samples taken annually from hatchery and smolt trap in lower Tucannon River. | YES |

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|---|---|---|---|
| | Percent Females (adults) | The percentage of females in the spawning population. Calculated using 1) weir data, Calculated for wild, hatchery, and total fish. | PARTIAL<br>Above Tucannon<br>Hatchery only |
| | Adult Run-timing | Arrival timing of adults at adult monitoring sites (weir, PIT array) calculated as range, 10%, median, 90% percentiles. Calculated for wild and hatchery origin fish separately, and total. | YES |
| | Spawn-timing | This will be a raw database measure only, could be based on hatchery spawning or spawning in the river based on index redd count areas. | YES |
| | Juvenile Emigration Timing | Juvenile emigration timing is characterized by individual life stages at the rotary screw trap. Emigration timing at the rotary screw trap is expressed as the percent of total abundance over time. Emigration timing to the first mainstream dam will be based on PIT tags. | YES |
| | Mainstem Arrival Timing (Lower Monumental) | Unique detections of juvenile PIT-tagged fish at first mainstem dam are used to estimate migration timing for natural and hatchery origin tag groups by life stage. The actual Median, 0, 10%, 50%, 90% and 100% detection dates are reported for each tag group. Weighted detection dates are also calculated by multiplying unique PIT tag detection by a life stage specific correction factor (number fish PIT tagged by life stage divided by tributary abundance estimate by life stage). Daily products are added and rounded to the nearest integer to determine weighted median, 0%, 50%, 90% and 100% detection dates. | YES |
| Habitat | Physical Habitat | | NO |
| | Fish and Amphibian Assemblage | Observations through rotary screw trap catch. | YES |
| In-Hatchery Measures | Hatchery Production Abundance | The number of hatchery juveniles of one cohort released into the receiving stream per year. Derived from census count minus prerelease mortalities or from sample fish-per-pound calculations minus mortalities. Method dependent upon marking program (census obtained when 100% are marked). | YES |
| | In-hatchery Life Stage Survival | In-hatchery survival is calculated during early life history stages of hatchery-origin juvenile steelhead. 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 fin clipping or CWT tagging. These physical fish counts are the most accurate inventory method available. The inventory is checked throughout the year using 'fish-per-pound' counts.<br>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. | YES |
| | Size-at-Release | Mean fork length measured in millimeters and mean weight measured in grams of a hatchery release group. Measured during prerelease sampling. Sample size determined by individual facility and M&E staff. | YES |
| | Juvenile Condition Factor | Condition Factor (K) relating length to weight expressed as a ratio. Condition factor by life stage of juveniles is generated using the formula: $K = (w/l^3)(10^4)$ where K is the condition factor, w is the weight in grams (g), and l is the length in millimeters (Everhart and Youngs 1992). | YES |
| | Fecundity by Age | The reproductive potential of an individual female. Estimated as the number of eggs in the ovaries of the individual female. Measured as the number of eggs per female calculated by weight or enumerated by egg counter. | YES |
| | Spawn Timing | Spawn date of broodstock spawners by age, sex and origin, Also reported as cumulative timing and median dates. | YES |
| | Hatchery Broodstock Fraction | Percent of hatchery broodstock actually used to spawn the next generation of hatchery F1s. Does not include prespawn mortality. | YES |
| | Hatchery Broodstock Prespawn Mortality | Percent of adults that die while retained in the hatchery, but before spawning. | YES |
| | Female Spawner IHNV Values | Screening procedure for diagnosis and detection of IHNV in adult female ovarian fluids. | YES |
| | In-Hatchery Juvenile Disease Monitoring | Screening procedure for bacterial, viral and other diseases common to juvenile salmonids. Gill/skin/ kidney /spleen/skin/blood culture smears conducted monthly on 10 mortalities per stock | YES |

| | | | |
|---|---|---|---|
| | Length of Broodstock Spawner | Mean fork length by age measured in millimeters of male and female broodstock spawners. Measured at spawning and/or at weir collection. Is used in conjunction with scale reading for aging. | YES |
| | Prerelease Mark Retention | Percentage of a hatchery group that have retained a mark up until release from the hatchery. Estimated from a sample of fish visually calculated as either "present" or "absent". ("Marks" refer to adipose fin clips OR ventral fin clips). | YES |
| | Prerelease Tag Retention | Percentage of a hatchery group that have retained a tag up until release from the hatchery - estimated from a sample of fish passed as either "present" or "absent". | YES |
| | Hatchery Release Timing | Date and time of volitional or forced departure from the hatchery. Normally determined through PIT tag detections at facility exit (not all programs monitor volitional releases). | YES |
| | Chemical Water Quality | Hatchery operational measures included: dissolved oxygen (DO) - measured with DO meters, continuously at the hatchery, and manually 3 times daily at acclimation facilities. | PARTIAL |
| | Water Temperature | Hatchery operational measure (Celsius) - measured continuously at the hatchery with thermographs and 3 times daily at acclimation facilities with hand-held devices. | PARTIAL |

***Estimate the contribution of conservation / mitigation program-origin summer steelhead to the basin and compare performance to the natural population.***

1. Differentially tag (CWT) all or a portion of hatchery-reared summer steelhead to allow for distinction from natural-origin fish upon return as adults at area adult traps, or that might be recovered in downriver fisheries. Mark rates will be determined through discussions/agreements with the co-managers during the Annual Operations Plan for Lyons Ferry Complex. In addition, a portion of each brood will be PIT tagged (10,000-15,000) for total contribution estimation at adult return, monitoring straying into other local rivers, and relative downstream migration success. At full program levels, adipose fin clip up to 2/3 of the population for harvest mitigation.

2. Conduct adult trapping at Tucannon FH and possibly a temporary trap in the lower Tucannon River throughout the summer steelhead return to collect broodstock for the hatchery conservation/mitigation program, enumerate overall returns, and to collect information regarding fish origin for the spawning escapement, and age class composition. Utilize PIT detection array(s) to independently estimate overall returns Tucannon River. Through these estimates, age composition and smolt trap data, calculate relative performance (R/S) among natural fish and the endemic stock. In the short term, before harvest mitigation occurs, use the PIT tag array at the Tucannon River mouth to determine the number of hatchery and wild fish on the spawning grounds.

   Conduct adult trapping in small streams (Almota Creek, Deadman Creek, etc…) that enter the Snake or lower Tucannon rivers (from the Tucannon River mouth to below Lower Granite Dam). The ICTRT considered these streams part of the Tucannon River and Asotin (Alpowa Cr) summer steelhead populations. These streams will be monitored on a rotating or periodic basis over the next few years to determine run size, contribution to the total population abundance of adults, age and genetic structure, and hatchery:wild composition within each of these streams.

3. Conduct spawning ground surveys in index areas above HWY 12 to estimate spawners, and use in conjunction with adult traps and PIT tag detection data to estimate the

proportions of natural and endemic hatchery steelhead on the spawning population. Conduct spawning ground surveys in index sections above the Tucannon FH to estimate number of fish/redd or females/redd, which could applied to areas downstream of adult traps.

Conduct spawning ground surveys in select small streams (e.g. Almota Creek) that enter the Snake River (from the Tucannon River mouth to below Lower Granite Dam). Adult trapping will also occur on these streams, but depending on trap locations, or trapping conditions (i.e. high stream flows during the spring), spawning ground surveys may be conducted in all or portions of these streams to determine annual run size of summer steelhead.

4. If necessary or warranted, conduct summer electrofishing and snorkel surveys to estimate densities and populations of Age 0 and Age 1+ summer steelhead throughout the Tucannon River basin to compare to historical records. Electrofishing and snorkel surveys will also be able to determine the degree of residual steelhead left in the river from hatchery supplementation releases. Snorkel and electrofishing surveys for summer steelhead have not been conducted in the Tucannon River since 2006. There are no current plans to conduct these surveys for evaluation of the Tucannon Endemic steelhead program. Any future plans for electrofishing would be submitted as a change to NOAA Fisheries. If warranted in the future for monitoring, WDFW would likely implement hook/line sampling for steelhead residualism estimates as was done in the past.

5. Operate a smolt trap on the Tucannon River to: 1) Estimate the number, timing, and age composition of natural origin steelhead smolts from the river, 2) estimate the migration success to the smolt trap from releases of hatchery supplementation steelhead in the upper basin, 3) allow downriver migration comparison between natural and hatchery propagated steelhead by PIT tagging at the smolt trap, and 4), PIT tag as many natural origin smolts as possible to estimate smolt-to-adult survival and to continue documentation of natural origin smolts that migrate above Lower Granite Dam.

6. Calculate Smolt-to-Adult and Adult-to-Adult survival of hatchery fish by brood year to determine if fish are surviving at expected program levels. Estimate escapement to the Tucannon River, spawning grounds and harvest (when applicable).

7. Use the above activities to evaluate the status of the Tucannon steelhead population for Viable Salmonid Population (VSP) and ESA recovery monitoring. VSP monitoring is essential under the ESA to determine population and status and compare with de-listing criteria and de-listing levels for identified population groups, and for local salmon recovery planning efforts, as well as for mitigation fishery planning. Currently, some of the parameters needed for VSP monitoring in the Tucannon steelhead population are inconsistent or lacking. The population level viability guidelines provided in McElhany et al. (2000) are organized around four major parameters: abundance, productivity, spatial structure and diversity. These biological viability measures are intended to inform long-term regional recovery planning efforts, including the

establishment of delisting criteria for each population. Monitoring activities as described in #'s 1-6 above will allow estimation of the four parameters needed for VSP monitoring in the Tucannon steelhead population.

***Monitor and evaluate any changes in the genetic, phenotypic, or ecological characteristics of the populations potentially affected by the program.***

1. Collect DNA-based genetic samples from regional summer steelhead adult populations at periodic intervals to determine the degree to which discrete populations persist in the individual watersheds.

2. Collect length and scale samples from natural origin adults returning to traps on the Tucannon River. Assess age structure of returning natural fish, and use this data for Smolt-to-Adult and Adult-to-Adult survival estimates.

***Assess the need and methods for improvement of conservation / mitigation activities in order to meet program objectives, or the need to discontinue the program because of failure to meet objectives.***

1. Determine the pre-spawning and green egg to released smolt survivals for the program.
    a. Monitor growth and feed conversion.
    b. Determine green-egg to eyed-egg, eyed-egg to fry, and fry to released-smolt survival rates.
    c. Maintain and compile records of cultural techniques used for each life stage, such as: collection and handling procedures, and trap holding durations for broodstock; fish and egg condition at time of spawning; fertilization procedures, incubation methods/densities, temperature unit records by developmental stage, shocking methods, and fungus treatment methods for eggs; ponding methods, rearing/pond loading densities, feeding schedules and rates for juveniles; and release methods.
    d. Summarize results of tasks for presentation in annual reports.
    e. Identify where the propagation program is falling short of objectives, and make recommendations for improved production as needed.

2. Determine if broodstock procurement methods are collecting the required number of adults that represent the demographics of the donor population with minimal injuries and stress to the fish.
    a. Monitor operation of adult trapping operations to ensure compliance with established broodstock collection protocols.
    b. Monitor timing, duration, composition, and magnitude of run at each adult collection site.
    c. Collect biological information on collection-related mortalities. Determine causes of mortality.
    d. Summarize results for presentation in annual reports. Provide recommendations on means to improve broodstock collection, and refine protocols if needed for application in subsequent seasons.

3. Monitor fish health, specifically as related to cultural practices that can be adapted to prevent fish health problems. Professional fish health specialists supplied by WDFW will monitor fish health.
    a. A fish health specialist will conduct fish health monitoring. Significant fish mortality to unknown causes will be sampled for histopathological study.
    b. The incidence of viral pathogens in broodstock will be determined by sampling fish at spawning in accordance with procedures set forth in PNWFHPC. Recommendations on fish cultural practices will be provided on a monthly basis based upon the fish health condition of juveniles.
    c. Fish health monitoring results will be summarized as part of an annual report.

***Collect and evaluate information on adult returns***.

This element will be addressed through consideration of the results of previous elements, and through the collection of information required under adaptive criteria. All will be used as the basis for determining the success of progress toward program goals and whether the program should continue.

1. Monitor the incidental harvest of endemic stock Tucannon steelhead in recreational and treaty fisheries. Document trends in abundance.
2. Collect age, sex, length, average egg size, and fecundity data from a representative sample of broodstock used in the supplementation program for use as baseline data to document any phenotypic changes in the populations.
3. Compare newly acquired electrophoretic analysis data reporting allele frequency variation of returning hatchery and natural fish with baseline genetic data. Determine if there is evidence of a loss in genetic variation (not expected from random drift) that may have resulted from the supplementation program.
4. Evaluate results of spawning ground surveys and age class data collections to:
    a. Estimate the abundance and trends in abundance of spawners;
    b. Estimate the proportion of the escapement comprised by steelhead of hatchery lineage, and of natural lineage;
    c. Through CWT and PIT tag recoveries, estimate brood year contribution for hatchery lineage and natural-origin fish.
5. Monitor the abundance of stray hatchery fish from this program that enter other waters in the Snake River basin where monitoring is ongoing, or is expected to begin soon. Stray fish from this program (hatchery endemic stock) are considered a risk to other listed populations within the Snake River Bain and will be removed (i.e. Alpowa Creek, Asotin Creek), or might be removed from small tributaries to the Snake River within SE Washington).

Use the above information to determine whether the population has declined, remained stable, or has been recovered to sustainable levels. The ability to estimate hatchery and natural proportions will be determined by implementation plans, budgets, and assessment priorities. Once natural populations have attained the ability to replace themselves, the focus of the program will shift from conservation and recovery of the population, to achieving mitigation goals defined under LSRCP.

**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 LSRCP program as part of the ongoing mitigation program will likely continue funding for Monitoring and Evaluation of certain elements described above (i.e. spawning ground surveys, operation of hatchery adult trap). However, since this program is a direct implementation of RPA 40 directly related to the BIOP, additional funding to cover items listed above should be covered under the Fish and Wildlife program under BPA. The extent of this funding to cover such activities is uncertain at this time.

**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.**

1. Juvenile sampling at hatchery facilities will be conducted with accepted procedures to minimize stress and mortality from sampling. Sample sizes will be the minimum necessary to achieve statistically valid results for growth, tag retention and fish health.
2. Smolt trapping operations will ensure that holding time, stress and potential for injury of captured migrants is minimized. Marked groups for assessing trap efficiency will be the minimum necessary to achieve statistically valid results.
3. Adult trapping facilities will be monitored daily, or more often as necessary to prevent injury and unnecessary delay.
4. Spawning ground surveys will be conducted in such a manner to avoid scaring spawning fish off redds. Also, staff will carefully walk in areas with redds so eggs won't be accidentally crushed.
5. Electrofishing or Snorkel surveys, if used at all, will be conducted only at a minimum number of sites necessary to achieve statistically valid results for population estimates. Displacement of fish will be kept to a minimum by snorkeling on days when water clarity and visibility are at maximum. There are no current plans to conduct electrofishing surveys in the Tucannon River.

# SECTION 12. RESEARCH

**12.1) Objective or purpose.**

The ongoing LSRCP program research is designed to:

- Document hatchery rearing and release activities and subsequent adult returns.
- Determine success of the program in meeting mitigation goals and adult returns to the Tucannon River, Lower Granite Dam, or the Snake River Basin.
- Provide management recommendations aimed at improving program effectiveness and efficiency.
- Provide management recommendations aimed at reducing program impacts on listed fish.

**12.2) Cooperating and funding agencies.**

Lower Snake River Compensation Program – Funding Agency
Nez Perce Tribe – Co-manager
Confederated Tribes of the Umatilla Indian Reservation – Co-manager

**12.3) Principle investigator or project supervisor and staff.**

| | | |
|---|---|---|
| Mark Schuck | Glen Mendel | Joe Bumgarner |
| Jerry Dedloff | Temporary field technicians | |

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

Same as described in Section 2.

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

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

Year Round. Endemic stock fish are present in the hatchery during all times of the year due to the overlap or juvenile rearing/release and adult collection time for broodstock. Specific times for activities conducted under research and monitoring are described below.

Broodstock/Adult Trapping – October through May (This date range applies to both the Tucannon FH trap, and a temporary trap in the lower river if used)
Broodstock Spawning – February through April
Spawning Ground Surveys – March though May
Juvenile Rearing – March though following April/May (releases could occur in May if size goals are not yet reached and stream flow indicate plenty of water will available for downstream migration)
Tagging/marking at the hatchery – August to February (based on regular tagging activities and when PIT tagging can be scheduled)
PIT Tagging at Smolt Trap – October though June
Smolt Trapping – October through June

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

Handling of listed fish will generally be restricted to enumeration and release at the site of capture (Lower Tucannon Adult trap, Tucannon Fish Hatchery Trap, Smolt Trap). Listed fish will generally be anesthetized prior to human handling, except at the adult traps where sampling troughs are used.

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

Injury due to capture and sampling is inevitable. However, precautions have been taken during all activities to make sure that mortalities are kept to a minimum.

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

See attached "take table" for anticipated mortalities to listed fish that could occur.

**12.10) Alternative methods to achieve project objectives.**

Alternatives to the current program were described in Section 1.16.

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

Other listed species that may be potentially affected by this program have been described in Section 2.2 (Fall Chinook, Spring Chinook, and bull trout)

**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.**

WDFW and the other co-managers within the basin, along with NOAA Fisheries have taken all known necessary steps to eliminate and/or minimize ecological effects, injury, and mortality to listed fish as part of this hatchery program. Any specific research conducted on listed fish will be approved by NOAA fisheries before proceeding.

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## SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

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

Name, Title, and Signature of Applicant:

Certified by_____________________________ Date:_____________

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

Currently, there are 40 separate listings of Federal Status endangered/threatened species within the State of Washington. In the list below (Table 17), are all non-salmonid listed species and their current status ratings. Of the following species listed, only the bald eagle, and the plant species Spalding's Catchfly are suspected to be found in the area where the Tucannon River endemic steelhead stock production program occurs (i.e. Lyons Ferry Hatchery and the Tucannon River). Species such as the Gray Wolf, the Grizzly Bear, the Canadian Lynx, and the northern spotted owl were once likely found occasionally in the Tucannon River, but their current existence is unlikely. The geographic distributions of the other listed species were generally limited to the Cascade Mountain Range, the Selkirk Mountains in NE Washington, the Willamette Valley (Oregon), Puget Sound and Coastal areas.

**Table 17. List of current ESA listed species (animal and plant) within the State of Washington.**

| Status Rating | Species |
|---|---|
| **ANIMALS** | |
| Endangered | Albatross, short-tailed (*Phoebastria (=Diomedea) albatrus*) |
| Threatened | Bear, grizzly (*Ursus arctos horribilis*) |
| Threatened | Butterfly, Oregon silverspot (*Speyeria zerene hippolyta*) |
| Endangered | Caribou, woodland (ID, WA, B.C.) (*Rangifer tarandus caribou*) |
| Endangered | Deer, Columbian white-tailed (*Odocoileus virginianus leucurus*) |
| Threatened | Eagle, bald (lower 48 States) (*Haliaeetus leucocephalus*) |
| Threatened | Lynx, Canada (lower 48 States DPS) (*Lynx canadensis*) |
| Threatened | Murrelet, marbled (CA, OR, WA) (*Brachyramphus marmoratus marmoratus*) |
| Threatened | Owl, northern spotted (*Strix occidentalis caurina*) |
| Endangered | Pelican, brown (*Pelecanus occidentalis*) |
| Threatened | Plover, western snowy (Pacific coastal pop.) (*Charadrius alexandrinus nivosus*) |
| Threatened | Sea turtle, green (*Chelonia mydas*) |
| Endangered | Sea turtle, leatherback (*Dermochelys coriacea*) |
| Threatened | Sea-lion, Steller (eastern pop.) (*Eumetopias jubatus*) |
| Endangered | Whale, humpback (*Megaptera novaeangliae*) |
| Endangered | Wolf, gray ( *Canis lupus*) |
| **PLANTS** | |
| Endangered | Sandwort, Marsh (*Arenaria paludicola*) |
| Threatened | Paintbrush, golden (*Castilleja levisecta*) |
| Endangered | Stickseed, showy (*Hackelia venusta*) |
| Threatened | Howellia, water (*Howellia aquatilis*) |
| Endangered | Desert-parsley, Bradshaw's (*Lomatium bradshawii*) |
| Threatened | Lupine, Kincaid's ( *Lupinus sulphureus (=oreganus) ssp. Kincaidii (=var. kincaidii*)) |
| Threatened | Checker-mallow, Nelson's (*Sidalcea nelsoniana*) |
| Endangered | Checkermallow, Wenatchee Mountains (*Sidalcea oregana var. calva*) |
| Threatened | Catchfly, Spalding's (*Silene spaldingii*) |
| Threatened | Ladies'-tresses, Ute (*Spiranthes diluvialis*) |

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

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

**See Section 2.1**

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

**Bald Eagle (**Much of following has been compiled from: Watson, J.W., and E.A Rodrick. 2001. Bald Eagle (*Haliaeetus leucocephalus*) – Washington Department of Fish and Wildlife – Birds (Vol #4, Chapter 8) 18pp.)

*General species description and habitat requirements (citations).*

Bald eagles are one of the world's larger predatory birds, ranging from 7-14 pounds, with wingspans up to 8 feet. They mate for life and are believed to live 30 years or longer in the wild. Habitat requirements generally consist of a moderate forested area with large trees that are generally located nears rivers, lakes, marshes, or other wetlands. Bald eagles have few natural enemies, and in general need an environment of quiet isolation, a condition that has changed dramatically over the last 100 years.

Major wintering concentrations are often located along rivers with salmon runs. Primary food sources have been marine or freshwater fish, waterfowl and seabirds, with secondary sources including mammals, mollusks and crustaceans (Retfalvi 1970, Knight et al. 1990, Watson et al. 1991, Watson and Pierce 1998).

*Local population status and habitat use (citations).*

Bald Eagles breed throughout most of the United States and Canada, with the highest concentrations occurring along the marine shorelines of Alaska and Canada. They winter throughout most of the breeding range, primarily south of southern Alaska and Canada (U.S. Fish and Wildlife Service 1986, Stinson et al. 2000). Within Washington, bald eagles nest primarily west of the Cascade Mountains, with scattered breeding areas along major rivers in the eastern part of the state. The bald eagle is a State Threatened species in Washington, and a Federally listed species. Early declines in populations in the lower 48 states were caused by habitat destruction and degradation, illegal shooting, and contamination of its' food source from the pesticide DDT. It is currently vulnerable to loss of nesting and winter roost habitat and is sensitive to human disturbance, primarily from development and timber harvest along shorelines. Territories are generally defined by 1) nearness of water and availability of food, 2) the availability of suitable nesting, perching, and roosting trees, and 3) the number of breeding eagles the area (Stalmaster 1987).

*Site-specific inventories, surveys, etc. (citations).*

Site-specific inventories (abundance/status) on bald eagles in the Tucannon River is unknown. Bald eagles are sighted nearly every year around the Tucannon Fish Hatchery.

Generally, the eagles prey on rainbow trout being reared at the Tucannon Fish Hatchery rearing pond (Doug Maxey – WDFW Tucannon Hatchery Manager pers. comm. 2002). Nesting sites have not been confirmed, but may exist in the Tucannon River Watershed as habitat requirements are suitable.

**Spalding's Catchfly**

*General species description and habitat requirements (citations).*

Citation: Hitchcock, C.L., A. Cronquist, M. Ownbey, and J.W. Thompson. 1964. Vascular Plants of the Pacific Northwest, Part 2: *Salicaceae to Saxifragaceae*. University of Washington Press, Seattle. 597 pp.

The Spalding's Catchfly is a long-lived, herbaceous perennial; 8-24 inches tall, typically with one stem, but can have several. Each stem bears 4-7 pairs of lance shaped leaves 2 to 3 inches in length. The light green foliage and stem are lightly to more typically densely covered with sticky hairs. The cream-colored flowers are arranged in a spiral at that top of the stem. The outer, green portion of the flower forms a tube, ~1/2 inch long with ten distinct veins running it's length. The flower consists of 5 petals, each with a long narrow "claw" that is largely concealed by the calyx tube and a very short "blade", or flared portion at the summit of the claw. Four (sometimes as many as 6) short petal-like appendages are attached inside and just below each blade.

The species begins to flower in mid- to late July, with some individuals still flowering by early September. Most other forbs within its habitat have finished flowering when *S. spaldingii* is just hitting its peak. A majority of individuals have developed young fruits by mid- to late August.

S. spaldingii occurs primarily within open grasslands with a minor shrub component and occasionally with in a mosaic of grassland and ponderosa pines. It is most commonly found at elevations of 1900-3050 feet, near lower tree line, with a preference for northerly-facing aspects. The species is primarily restricted to mesic (not extremely wet nor extremely dry) prairie or steppe vegetation that makes up the Palouse Region in SE Washington.

*Local population status and habitat use (citations).*

Within the State of Washington, S. spaldingii, has been confirmed to be found in Asotin, Lincoln, Spokane and Whitman counties, with a status listing of 'threatened". A total of 28 populations have been identified (FR# 1018-AF79, Vol 66, No. 196, p. 51598). This plant is threatened by a variety of factors including habitat destruction and fragmentation resulting from agricultural and urban development, grazing and trampling by domestic livestock and native herbivores, herbicide treatment and competition from nonnative plant species (Gamon 1991; Schassberger 1988). It is currently estimated that 98% of the original Palouse prairie habitat has been lost to the mentioned activities (Gamon 1991). Each of the populations documented are generally very small, and are currently quite fragmented, raising questions about their long-term viability.

*Site-specific inventories, surveys, etc. (citations).*

Site-specific findings in Columbia County not available. However, portions of the Tucannon River Basin could contain the listed species. However, the current steelhead program as described would not affect the listed species.

## 15.3) Analysis of effects.

**Bald Eagle**

*Identify potential direct, indirect, and cumulative effects of hatchery program on species and habitat (immediate and future effects).*

To the best of our knowledge, the program as described in this HGMP will not directly have any negative effects on the listed species. Providing adults and juveniles to the system, even within the short term, will provide a potential prey item, which would likely benefit the listed species. Further, the current fishery associated with harvest on the adult steelhead will not likely disturb the behavior (territory, nesting, etc.) of the eagles in the area. The surrounding habitat associated with this hatchery compensation program will not be altered, which would be the only other source of negative "take" possible to the listed species, again unlikely given the habitat requirements of the bald eagle.

*Identify potential level of take (past and projected future).*

Disturbance to listed species from people fishing in the area. A take estimate is not possible for this potential disturbance in the past or in the future. Eagle sightings in the area near the fishery have not been substantiated.

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

Operation of the lower Tucannon River adult trap will not affect (directly or indirectly) the existence of the listed species in the area. Habitat requirements for the species do not apply at there. Activities at TFH all take place on existing hatchery grounds. No new construction activities are planned for the program in either location that could impact the listed species. Effluent from TFH meets state water quality standards and is therefore not a concern.

*<u>Fish health</u> - pathogen transmission, therapeutics, chemicals.*

Not expected to be a problem. The two species have co-existed for thousands of years, the steelhead being the prey of the eagle. Eagles are likely immune to any potential pathogens that hatchery fish might be carrying. Therapeutics and chemicals when applied (at LFH) would follow label directions for proper use, eliminating any potential "take".

*Ecological/biological - competition, behavioral, etc.*

Behavioral disturbances to the listed species could occur if fishing pressure and eagle abundance overlap. This is not likely due to the current fishing areas most utilized by the steelhead anglers, and habitat limitations that seem to preclude the use of bald eagles in the highest fishing areas.

*Predation* -

A positive benefit to adult or juvenile bald eagles in this case (food source).

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

Both the LFH and lower Tucannon River adult trap are not in the suitable habitat areas of the bald eagle. Operation of the upper Tucannon River adult trap could possible disturb any bald eagles that are in the vicinity of the Tucannon Hatchery. However, that activity of the adult trap in itself is minor compared to the other activities that occur daily in the area (campers, trout fishery in Tucannon Lakes, outdoor recreation)

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

Modifications to the surrounding hatchery areas are not planned at this time, so no loss of potential habitat to the listed species is expected.

**Spalding's Catchfly**

*Identify potential direct, indirect, and cumulative effects of hatchery program on species and habitat (immediate and future effects).*

To the best of our knowledge, the program as described in this HGMP will not have direct, indirect, or cumulative effects on the listed species. The surrounding habitat associated with this hatchery compensation program will not be altered, which would be the only source of "take" possible to the listed species. Interactions with the summer steelhead will not occur.

*Identify potential level of take (past and projected future).*

None (past or projected future)

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

Operation of the LFH adult trap will not affect (directly or indirectly) the existence of the listed species in the area. Habitat requirements for the species do not seem to apply at

LFH. Activities at Lyons Ferry all take place on existing hatchery grounds. No new construction activities are planned for the program in either location that could impact the listed species. Effluent from LFH falls below state water quality standards guidelines, and is therefore not a concern.

<u>*Fish health*</u> - *pathogen transmission, therapeutics, chemicals.*

Not Applicable – pathogens would not be transmitted between the species, therapeutics and chemicals are not used.

<u>*Ecological/biological*</u> - *competition, behavioral, etc.*

Not Applicable - Non-overlapping habitats between the summer steelhead and the flower.

<u>*Predation*</u> -

Not Applicable - Hatchery summer steelhead do not prey on the flower.

<u>*Monitoring and evaluations*</u> - *surveys (trap, seine, electrofish, snorkel, spawning, carcass, boat, etc.).*

Not Applicable.

<u>*Habitat*</u> - *modifications, impacts, quality, blockage, de-watering, etc.*

Modifications to the surrounding hatchery areas are not planned at this time, so no loss of potential habitat to the listed species is expected.

### 15.4 <u>Actions taken to mitigate for potential effects.</u>

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

No actions are considered necessary at this time. Only minor disturbance to bald eagles will likely occur in the area (not directly related to this program), and land disturbance where Spalding's Catchfly may habitat will not occur over the course of the program.

### 15.5 <u>References</u>

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

| Listed species affected: Summer Steelhead ESU/Population: Snake / Tucannon<br>Activity: Broodstock Collection, spawning, rearing and releases<br>Location of hatchery activity: Lyons Ferry Complex Dates of activity: Year Round<br>Hatchery program operator: Jon Lovrak | | | | | |
|---|---|---|---|---|---|
| **Type of Take** | **Origin** | **Annual Take of Listed Fish By Life Stage (*Number of Fish*)** | | | |
| | | ***Egg/Fry*** | ***Juvenile or Smolt*** | ***Adult*** | ***Carcass*** |
| **Observe or harass** [a] | Natural | 0 | 0 | 50 | 0 |
| | Hatchery | 0 | 0 | 50 | 0 |
| **Collect for transport** [b] | Natural | 0 | 0 | 0 | 0 |
| | Hatchery | 0 | 0 | 0 | 0 |
| **Capture, handle, and release** [c] | Natural | 0 | 0 | 400 | 0 |
| | Hatchery | 0 | 0 | 600 | 0 |
| **Capture, handle, tag/mark/tissue sample, and release** [d] | Natural | 0 | 0 | 200 | 0 |
| | Hatchery | 0 | 90,000 | 100 | 0 |
| **Removal (e.g. broodstock)** [e] | Natural | 0 | 0 | 90 | 0 |
| | Hatchery | 0 | 0 | 36 | 0 |
| **Intentional lethal take** [f] | Natural | 0 | 0 | 90 | 0 |
| | Hatchery | 0 | 0 | 36 | 0 |
| **Unintentional lethal take** [g] | Natural | 0 | 0 | 15 | 0 |
| | Hatchery | 15% | 10% | 15 | 0 |
| **Other Take (specify)** [h] | Natural | 0 | 0 | 0 | 0 |
| | Hatchery | 0 | 0 | 0 | 0 |

a. Contact with listed fish that could occur from migration delay at weirs (This will be measured by a PIT tag antenna at the entrance to the Tucannon FH trap).
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 (natural and hatchery origin) are captured handled and released upstream or downstream (This applies to the Tucannon River Basin only).
d. Take occurring due to PIT tagging 15,000 fish and coded wire tagging 75,000 fish prior to release. The number shown assumes 75,000 fish for production. This number could vary depending on annual egg takes and survival in the hatchery. Adults would be captured in the Tucannon River Basin only, with some samples collected for scales and genetics.
e. Listed fish (wild and hatchery origin) removed from the Tucannon River and collected for use as hatchery broodstock. Numb ers shown indicate that 90 natural origin fish, and no hatchery origin fish, could be collected for broodstock. The plan will be to collect no more than 40% (36 fish) hatchery fish in the broodstock, so the actual number of natural origin fish collected will vary a nnually.
f. Intentional mortality of listed fish as a result of spawning as broodstock. Same fish as shown in E.
g. Unintentional mortality of listed fish from operation of adult traps (includes Tucannon FH adult trap and Tucannon temporary tr ap), including loss of fish during transport or holding prior to spawning or prior to release back into the wild following broodst ock spawning. Also provided are estimates of egg loss or fry/juvenile loss to the smolt stage as a percent of the total populati on. These estimates are provided in Table 10 for the last 10 years. Adult mortalities are based on a % of mortality due to tr apping/collection of fish from the listed activities.
h. Other takes not identified above as a category.

**Appendix Table 2. Estimated listed salmonid take levels of by Research, Monitoring and**

**Evaluation activities that occur outside the realm of standard hatchery operations.**

**Listed species affected:** **Summer Steelhead** **ESU/Population:** **Snake / Tucannon**

**Monitoring and Evaluation Activities: Spawning Ground Surveys, Snorkel Surveys, Smolt Trapping, out of basin adult trapping and spawning ground surveys (stray monitoring), etc…**

**Location of hatchery activity:** **Tucannon River and population associated Streams in SE Washington (e.g. Pataha, Deadman and Penawawa creeks).** **Dates of activity:** **Year Round** **Research/Monitoring/Evaluation program operator:** **Mark Schuck, Joe Bumgarner and Glen Mendel**

| Type of Take | Origin | Annual Take of Listed Fish By Life Stage (*Number of Fish*) | | | |
|---|---|---|---|---|---|
| | | *Egg/Fry* | *Juvenile or Smolt* | *Adult* | *Carcass* |
| **Observe or harass** [a] | Natural | 2,500 | 2,500 | 10 | 0 |
| | Hatchery | 0 | 0 | 10 | 0 |
| **Collect for transport** [b] | Natural | 0 | 0 | 0 | 0 |
| | Hatchery | 0 | 0 | 0 | 0 |
| **Capture, handle, and release** [c] | Natural | 5,000 | 5,000 | 50 | 10 |
| | Hatchery | 0 | 7,500 | 150 | 10 |
| **Capture, handle, tag/mark/tissue sample, and release** [d] | Natural | 0 | 5,000 | 450 | 10 |
| | Hatchery | 0 | 1,000 | 100 | 10 |
| **Removal (e.g. broodstock)** [e] | Natural | 0 | 0 | 0 | 0 |
| | Hatchery | 0 | 0 | 0 | 0 |
| **Intentional lethal take** [f] | Natural | 0 | 0 | 0 | 0 |
| | Hatchery | 0 | 0 | 300 | 0 |
| **Unintentional lethal take** [g] | Natural | 500 | 400 | 10 | 10 |
| | Hatchery | 0 | 200 | 10 | 10 |
| **Other Take (specify)** [h] | Natural | 0 | 0 | 0 | 0 |
| | Hatchery | 0 | 0 | 0 | 0 |

a. Contact with listed fish through snorkeling.
b. Take (non-lethal) of listed fish for transportation only (i.e. smolt trapping).
c. Take associated with smolt trapping operations where listed fish are captured, handled and released upstream or downstream. Adult kelts (live and dead) are sometimes captured in the smolt trap on the Tucannon River. Also includes hatchery endemic origin adults that could be captured in adult traps outside the Tucannon River Basin (e.g. Pataha Cr., Deadman Cr, Almota Cr, Asotin Creek, Alpowa Creek, Penawawa Cr., Tenmile Cr., Couse Cr.).
d. Take occurring due to PIT tagging and/or bio-sampling (length/weight and scales) of fish collected through smolt trapping operations prior to release. Also includes wild origin or hatchery endemic adults that may be captured at adult traps outside the Tucannon River Basin as part of the rotating panel project (e.g. in Pataha creek, Almota Creek, Alkali Flat, Deadman)
e. Broodstock collection activities do not take place under the Research Section, broodstock numbers for the hatchery endemic program are shown in Take Table 1.
f. Intentional mortality of listed hatchery endemic fish during smolt trapping, or intentional removal of listed hatchery endemic adults from area traps in SE Washington that are outside the Tucannon River basin (i.e. Pataha Creek, Penawawa Creek, Deadman Creek, Almota Creek, Asotin Creek, Alpowa Creek, Tenmile Creek, and Couse Cr, etc…).
g. Unintentional mortality of listed fish, including loss of fish during transport during smolt trapping.
h. Other takes not identified above as a category.