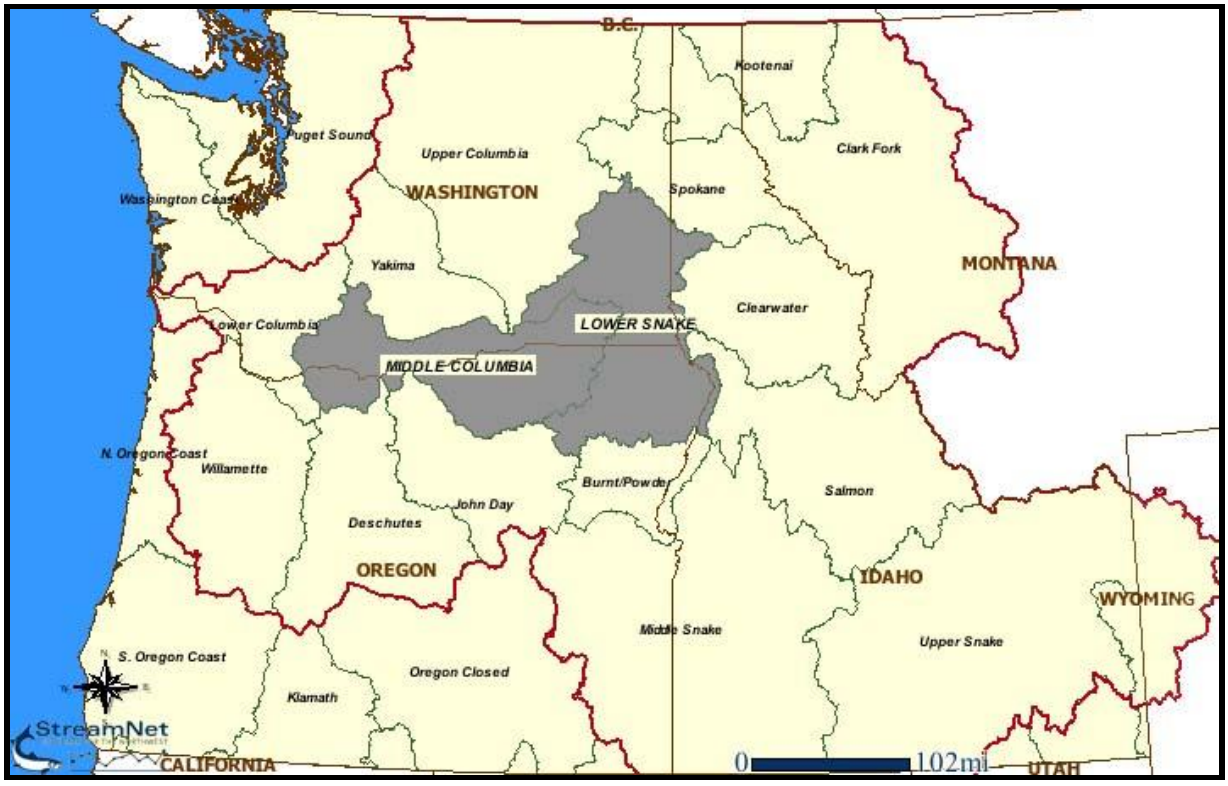
U.S. Fish & Wildlife Service - Pacific Region

Columbia River Basin Hatchery Review Team

# Columbia River Basin
# Lower Snake and Middle Columbia Regions

***Lower Snake Mainstem, Grande Ronde, Tucannon, Touchet, and Walla Walla River Watersheds***




## Washington Lower Snake River Compensation Plan

## State Operated Hatcheries

***Lyons Ferry and Tucannon Fish Hatcheries***

## Assessments and Recommendations

## Final Report

## March 2011

*Please cite as:*

U.S. Fish and Wildlife Service (USFWS). 2011. *Washington Lower Snake River Compensation Plan State Operated Hatcheries, Lyons Ferry and Tucannon Fish Hatcheries: Assessments and Recommendations. Final Report, March 2011*. Hatchery Review Team, Pacific Region. U.S. Fish and Wildlife Service, Portland, Oregon. Available at: http://www.fws.gov/Pacific/fisheries/Hatcheryreview/reports.html.

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# Preface

The assessments and recommendations presented in this report represent the independent evaluations of the Hatchery Review Team and do not necessarily represent the conclusions of the U.S. Fish and Wildlife Service (Service). The Review Team used the most current scientific information available and the collective knowledge of its members to develop the recommendations presented in this report. The Service will respect existing agreements with comanagers when considering the recommendations presented in this report. The Review Team and Service acknowledge that the *U.S. v Oregon* process is the appropriate forum for defining or modifying hatchery programs in the Columbia River Basin. The Service looks forward to working with comanagers to advance forward the principles of hatchery reform and sustainable fisheries management.

# Summary

Long-term conservation needs of natural salmonid populations and their inherent genetic resources require a reexamination of the role of hatcheries in basin-wide management and conservation strategies. Hatcheries need to be viewed as part of the environmental and ecological landscape to help achieve both conservation and harvest goals. These goals need to be part of a holistic and integrated strategy that combines habitat, hydropower and harvest needs for conserving and managing fishery resources. These strategies, to be successful, must establish short- and long-term goals for both hatchery-propagated and naturally-spawning populations.

To ensure that its hatchery programs are best meeting conservation and harvest goals, the U.S. Fish & Wildlife Service (Service) began, in October 2005, a five-year review of 21 salmon and steelhead hatcheries that the Service owns or operates in the Columbia River Basin. The goal of this review is to ensure that Service hatcheries are operated in accordance with best scientific principles, and contribute to sustainable fisheries and the conservation of naturally-spawning populations of salmon, steelhead and other aquatic species. The Service's review process is modeled after the recent Puget Sound and Coastal Washington Hatchery Reform Project[1].

The report presented here is one of three reports for federally-owned hatcheries that are operated by state agencies in the Snake River basin under the auspices of the Lower Snake River Compensation Plan (LSRCP), a federally-funded program to mitigate for fish losses resulting from the construction and operation of four hydroelectric and transportation dams on the lower Snake River in Washington State. The report here provides benefit-risk assessments and recommendations for salmon and steelhead programs in Washington at Lyons Ferry Fish Hatchery (FH), Tucannon FH, and associated satellite facilities where juvenile fish are released and/or adults are trapped for broodstock. Lyons Ferry FH is located on the north shore of the Snake River at river mile (RM) 59.1, immediately downstream from the mouth of the Palouse River. The Tucannon FH is located along the Tucannon River, between the towns of Dayton and Pomeroy Washington, at RM 36. The Tucannon River enters the south side of the Snake River nearly opposite the Palouse River. Both hatcheries are operated by the Washington Department of Fish and Wildlife (WDFW). Complementary reports exist for Idaho and Oregon. A fourth report reviews programs for three National Fish Hatcheries in Idaho.

The Review Team considered, as a foundation for its assessments, four characteristics of each salmonid stock in watersheds where fish are released as part of the LSRCP in Washington: *biological significance*, *population viability*, *habitat* conditions, and *harvest* goals. The Review Team attempted to use both short- (15 years) and long-term (50–75 years) goals for each salmonid stock, as identified by the fishery comanagers[2], as a foundation for assessing the benefits and risks of the reviewed hatchery programs. Source documents not readily available to the general public, including appendices and background documents for this report, are accessible via the Service's hatchery review website.[3]

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[1] *www.lltk.org/HRP.html. See also www.hatcheryreform.us/.*

[2] *LSRCP comanagers in Washington State are the U.S. Fish and Wildlife Service, Washington Department of Fish and Wildlife, Nez Perce Tribe, and the Confederated Tribes of the Umatilla Indian Reservation, with comanaging input from the National Marine Fisheries Service (NOAA Fisheries).*

[3] *www.fws.gov/Pacific/fisheries/HatcheryReview/*

## *Lyons Ferry and Tucannon Fish Hatcheries*

***Lyons Ferry FH, facility overview:*** Lyons Ferry FH is located at RM 59 of the Snake River adjacent to the reservoir pool behind Lower Monumental Dam. The hatchery was constructed under the LSRCP Program to offset fish losses caused by the construction and operation of four hydropower dams on the lower Snake River. The hatchery was completed and became operational in 1984. The hatchery rears Snake River fall Chinook, Tucannon River spring Chinook (in collaboration with Tucannon FH), four stocks of steelhead, and two stocks of rainbow trout. Four satellite acclimation facilities are associated with the hatchery: *Captain Johns Acclimation Facility* (AF) at RM 164 of the Snake River between Asotin, Washington and the mouth of the Grand Ronde River (fall Chinook release site); *Pittsburg Landing AF* at RM 215 of the Snake River, approximately 31 miles downstream from Hells Canyon Dam (fall Chinook release site); *Big Canyon AF* at RM 35 of the Clearwater River (fall Chinook release site); *Cottonwood Creek AF* at RM 29 of the Grande Ronde River at Cottonwood Creek (steelhead release and adult broodstock collection site); and *Dayton Pond AF* at RM 53 of the Touchet River within the Walla Walla River watershed (steelhead release and adult broodstock collection site). The principle water source for rearing fish at Lyons Ferry FH is well water which is pumped from an underground aquifer.

***Tucannon FH, facility overview:*** Tucannon FH is located at river mile 36 of the Tucannon River, between the towns of Dayton and Pomeroy, Washington. The hatchery first became operational in 1949 as a trout hatchery operated by the Washington Department of Game.[4] Construction to remodel the hatchery for anadromous fish began in 1983 and was completed in 1986 as part of a transfer of ownership to LSRCP in 1991.[5] The hatchery currently supports steelhead, spring Chinook, and resident rainbow trout programs under the LSRCP. The *Curl Lake AF* is located at RM 41 of the Tucannon River, construction of which was completed in February 1985. The hatchery is supplied with water from three sources: the Tucannon River, two wells with oxygenation, and a spring. *Curl Lake AF* is supplied with Tucannon River water.

### Snake River Fall Chinook

***Program overview:*** The program is intended to operate as an *integrated conservation and harvest* program within the lower Snake River watershed. The immediate goal of the program is to conserve and help recover fall Chinook native to the lower Snake River and tributaries. The LSRCP mitigation goal is to return 18,300 hatchery-origin fall Chinook adults upstream of Ice Harbor Dam on the lower Snake River. The long-term goal of the program is to restore fall Chinook in the lower Snake River to a sustainable level of viability that will support tribal and recreational fisheries in the Snake River region. A long-term recovery goal for fall Chinook, under the U.S. Endangered Species Act, is to restore at least one natural population in the upper Snake River upstream of the Hells Canyon dam complex (three dams), which is currently impassible to upstream migration by salmon and steelhead. Adult fall Chinook are trapped for broodstock from returns back to Lyons Ferry FH and at Lower Granite Dam. The broodstock goal is to collect up to 5,000 adults and spawn approximately 3,500 adults (≈1,600 females) to yield 4.6 million eyed eggs. Surplus adults collected in excess of broodstock needs are returned to the Snake River

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*[4] The Washington Department of Game was historically responsible for managing freshwater sport fishes and game animals (deer, ducks, etc.) in Washington State. The name of the agency was subsequently changed to the Washington Department of Wildlife which later was merged with the Washington Department of Fisheries to form the current Washington Department of Fish and Wildlife.*

*[5] The USFWS accepted the transfer of ownership from the Army Corps of Engineers on March 25, 1991.*

upstream of Lyons Ferry FH or Lower Granite Dam depending on where they were trapped. All spawning occurs at Lyons Ferry FH. Approximately 200,000 and 400,000 eyed eggs are transferred to the Oxbow FH (Idaho Department of Fish and Game) and Umatilla FH (Oregon Department of Fish and Wildlife), respectively, for hatching, rearing, and release of subyearling smolts into the Hells Canyon reach of the Snake River. Approximately 420,000 eyed eggs are transferred to the Irrigon FH (Oregon Department of Fish and Wildlife) for hatching, rearing, and release of subyearling smolts into the lower Grande Ronde River. Approximately 3.0 M eyed eggs are retained on station for hatching and rearing. These latter fish are released at Lyons Ferry FH (200,000 subyearlings + 450,000 yearlings), Captain Johns AF (500,000 subyearlings + 150,000 yearlings + direct release of 200,000 subyearlings), Big Canyon AF (500,000 subyearlings + 150,000 yearlings), and Pittsburg Landing (400,000 subyearlings + 150,000 yearlings).

***Benefits:*** Total adult returns from the hatchery program back to the Snake River have increased substantially in recent years from less than 1,000 hatchery-origin fish each year, 1983-1996, to over 10,000 fish each year, 2001-2008. Returns of natural-origin adult fall Chinook have similarly increased from less than 1,000 fish each year, 1976-1998, to a range of 2,273-6,630 adults per year, 2000-2008. As a consequence, the program is conferring a significant demographic and conservation benefit to ESA-listed Snake River fall Chinook. Harvest of fall Chinook in the Snake River was not allowed until 2008 when a tribal and recreational fishery was allowed for the first time since inception of the hatchery program. Only a few hundred fall Chinook were caught or harvested in the Snake River. WDFW estimated that 1,054 and 1,790 Lyons Ferry fall Chinook were harvested in mainstem Columbia River and ocean fisheries, respectively, in 2006.

***Risks:*** The difficulty of trapping sufficient numbers of natural-origin adults to compose the desired 30% of the broodstock poses a long-term domestication risk to the broodstock, particularly if hatchery-origin fall Chinook outnumber natural-origin fall Chinook among naturally-spawning fish in the Snake River. The trapping of adults for broodstock only at Lyons Ferry FH and Lower Granite Dam inhibits the future development of spatial structure and between-population genetic diversity among the principle natural spawning locations in the Hells Canyon reach of the Snake River (upstream from the confluence of the Salmon River), the lower mainstem Snake River (below the confluence of the Salmon River), and the Clearwater River in the vicinity of the Big Canyon AF. The large number of hatchery-origin fall Chinook spawning in the Snake River in recent years could eventually impede the establishment of self-sustaining natural populations if hatchery-origin adults continue to far outnumber, and compete with, natural-origin adults on the spawning grounds. The release of yearling fall Chinook at each of three upstream acclimation sites poses an unknown competition risk to natural-origin fall Chinook. The exclusive dependence of pumped well water for all fish culture activities poses a demographic risk to the fish reared on station at Lyons Ferry FH.

***Recommendations for current program:*** The Review Team identified 28 specific recommendations to reduce risks and/or improve benefits of the current Snake River fall Chinook program at Lyons Ferry FH. These recommendations include: (a) establish natural spawning escapement goals for the Clearwater River and the two Snake River reaches upstream and downstream of the confluence of the Salmon River, respectively; (b) improve adult trapping capabilities at Lower Granite Dam to facilitate collection of natural-origin adults for broodstock; (c) explore opportunities to collect adults for broodstock at Nez Perce Tribal Hatchery and Oxbow FH with the ultimate goal of establishing separate, self-sustaining, localized broodstocks for the Clearwater River and the Hells Canyon reach of the Snake River, respectively; (d) assess the benefits versus risks of releasing fall Chinook as yearlings and retain the yearling program only if the survival benefits clearly outweigh the cultural and ecological risks of rearing and releasing

yearlings; (e) initiate a PIT tagging program for fish released as subyearlings; (f) increase monitoring and evaluation of naturally spawning fall Chinook in the Snake River, particularly with respect to the proportion of natural spawners composed of hatchery-origin fish; and (g) update public outreach displays and handouts at Lyons Ferry FH.

***Alternatives to current program:*** The Review Team considered the pros and cons of four alternatives to the existing Snake River fall Chinook program at Lyons Ferry FH, ranging from (a) the current program with full implementation of all program specific recommendations (Alternative 1) to (b) termination of all programs at Lyons Ferry FH and decommissioning the facility (Alternative 4). The Review Team recommends Alternative 2: develop an early returning stock of fall Chinook (early fall-run or late summer-run) for the Middle Fork Clearwater River upstream from the North Fork Clearwater River as a near-term alternative to reintroducing fall Chinook upstream of Hells Canyon Dam. This recommended alternative is intended to be implemented in conjunction with all the recommendations associated with Alternative 1. Together, these two recommended alternatives would establish, as a long-term goal, the establishment of four separate hatchery broodstocks and associated natural spawning aggregations (sub-populations) for fall Chinook in the lower Snake River region: Middle Fork Clearwater River (early-fall/late summer-run), lower mainstem Clearwater River, Hells Canyon Snake River, and lower mainstem Snake River (Lyons Ferry stock). The Review Team concluded that the hydrologies and water temperature profiles for each of the four regions of the lower Snake and Clearwater rivers warranted the establishment of separate hatchery broodstocks, each adapted to the local conditions, as a means of optimizing stock viabilities, spatial structure, and genetic diversity. The Team further suggests that Oxbow FH, the Nez Perce Tribal Hatchery, and Kooskia NFH could each contribute to achieving those long-range goals for the Hells Canyon region, lower mainstem Clearwater, and Middle Fork of the Clearwater River, respectively.

## Tucannon River Spring Chinook

***Program overview:*** The program is intended to operate as an *integrated conservation* program within the Tucannon River. The immediate goal of the program is to restore and enhance spring Chinook salmon in the Tucannon River. The LSRCP mitigation goal is to return 1,152 hatchery-origin spring Chinook adults to the Tucannon River. The long-term goal of the program is to restore spring Chinook in the Tucannon River to a sustainable level of viability that will support tribal and recreational fisheries. No harvest goal exists at the present time. Adult spring Chinook are trapped for broodstock at a permanent weir located at RM 59 immediately upstream of the Tucannon FH. The broodstock goal is to collect equal numbers of hatchery and natural-origin fish for a total of 170 adults (85 females and 85 males) to yield approximately 250,000 eyed eggs. Adults retained for broodstock are transferred to Lyons Ferry FH where spawning, hatching, and early rearing of juvenile fish occurs. Sub-yearling fish are transferred to Tucannon FH in September for subsequent rearing and then transferred as yearlings from Tucannon FH to Curl Lake AF in February for two months of acclimation prior to release. The program objective is to annually release 225,000 yearling smolts from Curl Lake AF.

***Benefits:*** Measurable conservation benefits of this program have not been documented. The mean number of natural-origin adults returning to the Tucannon River in recent years is not greater than the mean number of natural-origin adults returning prior to 1990. The hatchery program is presumed to be serving as a "genetic reserve" and "demographic buffer" for the natural population in the Tucannon River, but the available data do not demonstrate a detectable conservation benefit. The program provides little or no harvest benefit.

***Risks:*** The comparatively low recruit-to-spawner ratio for naturally spawning fish (R/S < 1.0 for most brood years) coupled with the high proportion of hatchery-origin spring Chinook spawning in the Tucannon River inhibits development of a "properly-integrated" hatchery program, thus posing a genetic domestication risk to the spring Chinook population in the Tucannon River. Removal of natural-origin adults for broodstock also poses a demographic risk to the natural population. Significant numbers of hatchery and natural-origin spring Chinook adults from the Tucannon River stray upstream of Little Goose and Lower Granite dams, thus increasing demographic risks to the Tucannon River populations and posing potential genetic and ecological risks to other populations. This relatively high level of straying appears to be environmentally related and not a direct cause of the hatchery program (e.g., Tucannon River steelhead show the same pattern).

***Recommendations for current program:*** The Review Team identified 17 specific recommendations to reduce risks and/or improve benefits of the current Tucannon River spring Chinook program. These recommendations include: (a) restate and prioritize program goals (e.g., conservation vs. mitigation) in terms of short-term and long-term numeric outcomes that do not conflict with each other, and develop clearly defined objectives (e.g., broodstock size and composition) that directly support those prioritized goals; (b) evaluate the need for regularly scheduled prophylactic use of erythromycin feed with the goal of phasing out its use if possible; (c) discontinue stocking catchable trout in Rainbow Lake which is a water source for Tucannon FH; (d) continue to investigate potential causes (e.g., parasites, predation by exotic fish) of low smolt productivity for naturally spawning spring Chinook in the Tucannon River; (e) conduct a genetic study of natural reproductive success of spring Chinook passed upstream of the weir on the Tucannon River; and (f) investigate the feasibility of constructing a permanent weir in the lower Tucannon River downstream from the natural spawning habitat for spring Chinook (see also recommendations for Tucannon River steelhead).

***Alternatives to current program:*** The Review Team considered the pros and cons of six alternatives for the existing Tucannon River spring Chinook program, ranging from (a) the current program with full implementation of all program specific recommendations (Alternative 1) to (b) termination of the program and decommissioning the Tucannon FH (Alternative 6). The Review Team recommends Alternative 3: convert the current integrated program for Tucannon River spring Chinook to a two-stage, stepping-stone program based on the entire natural population in the Tucannon River. Implementation of this alternative would require the construction of a permanent weir in the lower Tucannon River below the primary spawning habitat for the entire population. This recommendation is intended to be implemented consistent with all recommendations in Alternative 1. The intent of this alternative is to use the first, genetically integrated broodstock to develop specific management goals and objectives for conservation of the indigenous spring Chinook population in the Tucannon River, and then subsequently develop a second broodstock - derived from returning adults of the first broodstock – to (a) provide fish for Tribal and recreational fisheries and (b) meet the LSRCP mitigation goal of 1,152 adults back to the Tucannon River.

## Lyons Ferry Summer Steelhead

***Program overview:*** The program is intended to operate as a *segregated harvest* program within the lower Snake River watershed. The "Lyons Ferry steelhead stock" is considered an "out-of-basin" composite stock derived, in the early 1980's, primarily from steelhead returning to Wells FH on the upper Columbia River and Wallowa FH in the Grande Ronde River watershed. The Lyons Ferry FH stock is considered an "A" run steelhead, typical of most Columbia River stocks.

The goal of the program is to support recreational and tribal fisheries in the lower Snake, Tucannon, Touchet, and Walla Walla rivers. The specific goal is to return a minimum of 630 adults back to the vicinity of Lyons Ferry FH for harvest and broodstock collection, 875 adults to the Tucannon River for harvest, 750 adults to the Touchet River for harvest, and 900 adults to the Walla Walla River for harvest. Broodstock collection, spawning, egg incubation, and juvenile rearing all occur at Lyons Ferry FH. The broodstock goal is to collect up to 1,650 adults, maintain a maximum of 400 adults for broodstock, and spawn a minimum of 106 females and 200 males to yield 460,000 eyed eggs. Approximately 150 adults per week in excess of broodstock needs are retained for reading coded wire tags; the remaining fish not retained for broodstock (generally 1,000-1,200 adults) are returned ("recycled") to the Snake River for harvest. The program releases 60,000 yearling smolts on-station at Lyons Ferry FH, 100,000 yearling smolts into the Tucannon River (direct release), 85,000 yearling smolts into the Touchet River (acclimated release from the Dayton Pond AF), and 100,000 yearling smolts into the Walla Walla River (direct release). The total release objective of the program is 345,000 smolts.

***Benefits:*** Annual estimated harvest of Lyons Ferry stock steelhead within the lower Snake River region averaged 3,069 adults (range = 1,565 to 4,161 adults) for broodyears 2000-2003. This total average harvest was apportioned as follows: 1,146 (range = 701-1,621) fish in the Tucannon River, 759 (range = 297-1,032) fish in the Touchet River, 788 (range 325-1,138) fish in the Walla Walla River, and 377 (range 242-593) fish in the Snake River at Lyons Ferry FH.

***Risks:*** Lyons Ferry steelhead returning to the Tucannon River pose genetic risks to the natural population because a high proportion of the naturally spawning steelhead are composed of hatchery-origin fish. Similar outplanting of Lyons Ferry steelhead into the Touchet and Walla Walla rivers poses genetic risks to natural populations in those two rivers also; however, those risks are considered lower than in the Tucannon River because a smaller proportion of naturally spawning fish are Lyons Ferry steelhead. The outplanting of Lyons Ferry steelhead smolts into the Tucannon, Touchet, and Walla Walla rivers also poses ecological competition risks to the natural populations in those streams.

***Recommendations for current program:*** The Review Team identified 17 specific recommendations to reduce risks and/or improve benefits of the current Lyons Ferry steelhead program at Lyons Ferry FH. These recommendations include: (a) improve the weirs in the lower Tucannon and Touchet rivers to exclude Lyons Ferry steelhead from natural spawning areas and/or reduce the number of fish released to ensure that Lyons Ferry steelhead compose less than 5% of the steelhead spawning naturally in each river; (b) reduce rearing densities in the indoor nursery tanks to be consistent with fish culture guidelines; and (c) conduct pre-release fish health exams to test for pathogens prior to transfer and release of steelhead smolts.

***Alternatives to current program:*** The Review Team considered the pros and cons of five alternatives to the existing Lyons Ferry steelhead program, ranging from (a) the current program with full implementation of all program specific recommendations (Alternative 1) to (b) terminate the Lyons Ferry steelhead program and use the space at Lyons Ferry FH for Chinook salmon and endemic steelhead programs (Alternative 5). The Review Team recommends implementation of Alternative 2: (a) terminate off-station releases of Lyons Ferry steelhead into the Tucannon, Touchet and Walla Walla rivers, (b) expand the Tucannon and Touchet river endemic programs and/or increase the number of steelhead released on-site from Lyons Ferry Hatchery, and (3) implement all elements of Alternative 1 that apply to the on-station releases. These short-term goals and recommendations are consistent with the recommendations for the endemic steelhead programs in the Tucannon and Touchet rivers (see below). The Team further recommends, as a

long-term goal, replacement of the Lyons Ferry steelhead stock with a stock indigenous to the Snake River. The Team concluded that the out-of-basin Lyons Ferry stock is inappropriate for long-term use in the Snake River Basin. The pros and cons of potential candidate stocks would need to be evaluated by comanagers before a specific stock is selected.

### Cottonwood Creek Summer Steelhead

***Program overview:*** The program is intended to operate as a *segregated harvest* program within the lower Grande Ronde River. The goal of the program is to return approximately 1,500 adult steelhead back to the lower Grande Ronde River for harvest and broodstock collection. The Cottonwood Creek steelhead stock is considered an "out-of-basin" composite stock. It was derived exclusively from the Wallowa Hatchery stock of steelhead which, in turn, was originally derived from adult steelhead trapped at Ice Harbor and Little Goose dams in the early 1980's. The stock was likely developed from both "A" and "B" run steelhead from the Snake River basin, and could include fish that originated from the Clearwater, Salmon and Grande Ronde river basins. A permanent adult trapping facility was installed in Cottonwood Creek to trap broodstock beginning in 1992. The broodstock goal is to annually collect and spawn 150 hatchery-origin (marked) steelhead (50 females) at the Cottonwood Creek trap. All unmarked adults and marked adults in excess of broodstock needs are passed upstream of the weir. In recent years, more than 1,000 fish have been passed annually upstream. Gametes are collected at the trap and transported to Lyons Ferry FH where the eggs are fertilized and incubated. The resulting fish are reared at Lyons Ferry FH until transferred to the Cottonwood Pond AF prior to release as yearling smolts. The program objective is to release 160,000 yearling smolts from the Cottonwood Pond AF adjacent to the confluence of Cottonwood Creek and the Grande Ronde River. A gravity-feed pipeline from Cottonwood Creek is the water supply for the acclimation pond, the intake for which is integrated into the adult trap on Cottonwood Creek.

***Benefits:*** The program is conferring very significant harvest benefits in the lower Grande Ronde River. Annual estimated harvest of hatchery-origin steelhead released as smolts from the Cottonwood Pond AF averaged 2,968 (range = 1,209-5,341) fish in the lower Grande Ronde River for broodyears 1997-2003 These harvests substantially exceed the mitigation goal of 1,500 fish per year and accounted for 86.5% of the total estimated harvest on Cottonwood Creek hatchery steelhead.

***Risks:*** The genetic effective number of breeders for propagating the Cottonwood Creek hatchery stock of steelhead is less than desired for maintaining genetic viability of the stock over many generations. High holding densities at the adult trap on Cottonwood Creek increase disease risks among adult steelhead trapped for broodstock. The deliberate passage of large numbers of adult steelhead (n > 1,000 fish/year) upstream of the trap on Cottonwood Creek poses fish health risks to juveniles held in the Cottonwood Pond AF because of the high likelihood that adult steelhead will shed pathogens into the water supply for the pond. The passage of large numbers of steelhead in Cottonwood Creek, far in excess of the stream's apparent carrying capacity, also poses water quality risks to that small stream. Wallowa stock steelhead, including the Cottonwood Creek strain released in the Grande Ronde River, stray at a relatively high rate into the Deschutes and John Day rivers, thus posing genetic risks to the natural populations in those latter two rivers.

***Recommendations for current program:*** The Review Team identified 15 specific recommendations to reduce risks and/or improve benefits of the current Cottonwood Creek steelhead program. These recommendations include: (a) restate program goals based on current conditions, realized smolt-to-adult return rates, and harvest opportunities in the lower Grande

Ronde River relative to areas downstream; (b) explicitly state the desired benefits intended from passing hatchery-origin steelhead upstream of the adult trap in Cottonwood Creek, and discontinue that passage if the fish health and ecological risks outweigh the realized benefits, in which case, find alternative beneficial uses for surplus adults (e.g., transfer to food banks); (c) increase the number of adults spawned for broodstock to 75 females and 150 males, and cull each family to an approximately equal number of eyed eggs to increase the effective population size of Cottonwood Creek hatchery population to approximately $N_e$ = 500 per generation (3-4 broodyears per generation); (d) test a sample of 60 juvenile steelhead for pathogens prior to release, including DNA testing for a new infectious strain of IHN virus; and (e) modify the adult trap on Cottonwood Creek to increase the adult fish holding capacity, add safety railings to the top of the trap, and add security fencing around the facility.

***Alternatives to current program:*** The Review Team considered the pros and cons of seven alternatives to the existing Cottonwood Creek hatchery program, ranging from (a) the current program with full implementation of all program specific recommendations (Alternative 1) to (b) termination of the program and decommissioning the Cottonwood Creek trap and acclimation facilities (Alternative 7). The Review Team recommends Alternative 1: continuation of the current program with implementation of all recommendations. This alternative includes the continued monitoring of Cottonwood Creek steelhead that stray into the Deschutes and John Day rivers and modifying the program in accordance with updated program goals to reduce those risks (e.g., reducing the number of fish released). Some team members felt that development of an endemic Grande River stock (Alternative 2) should be evaluated as an attempt to reduce straying risks, both within and outside the Grande Ronde River basin. However, the general consensus of the Team was that the risks of this alternative may significantly outweigh the benefits because it would require collecting broodstock from one or more ESA-listed natural populations in the lower Grande Ronde River to support a harvest mitigation program with no conservation goals, at least at the present time.

## Touchet River (endemic) Summer Steelhead

***Program overview:*** The program is intended to operate as an *integrated research* program to test the efficacy of developing an endemic hatchery program to replace the outplanting of Lyons Ferry steelhead in the Touchet River. The ultimate goal of the current program is to develop protocols that will achieve an overall smolt-to-adult return rate (SAR) back to the Touchet River comparable to the current SARs for Lyons Ferry steelhead. If that research goal is achieved, then the release of Lyons Ferry steelhead would be terminated and the Touchet River program would be expanded to meet LSRCP mitigation goals and harvest goals for steelhead in the Touchet River. At the present time, the broodstock goal is to annually collect and spawn 32 natural-origin (unmarked-untagged) steelhead (16 females) from the Touchet River to yield 50,000 smolts for release back into the Touchet River. Adults retained for broodstock are transferred to Lyons Ferry FH for spawning. Fertilization, incubation, and rearing of juvenile steelhead occur at Lyons Ferry FH. Yearling steelhead are transported to the Touchet River and directly released upstream of a permanent weir. All hatchery-origin steelhead from the Touchet River endemic stock are released unmarked (no fin clips) but tagged (PIT, VIE, or CWT)[6]. All unmarked-untagged (natural-origin) adult fish in excess of broodstock needs and all unmarked-tagged (Touchet River hatchery-origin) adult fish are passed upstream of the weir to spawn naturally.

[6] *Passive Integrative Transponders (PIT), Visual Implant Elastomer (VIE), or Coded-Wire tags (CWT).*

***Benefits:*** Smolt-to-adult return rates for the Touchet River endemic steelhead (SAR < 0.5%) have been substantially lower than those for Lyons Ferry steelhead (mean SAR ≈ 1.6%). The protracted return and spawn timing of natural-origin adults in the Touchet River has impeded the ability to rear smolts to the desired size within one year. As a result, a significant portion of the fish released from the Touchet River endemic program are below the minimum size necessary to maximize post-release survivals and SARs back to the release locations.

***Risks:*** The comparatively small effective breeding number of the broodstock (mean $N_b = 28$), coupled with the deliberate upstream passage of hatchery-origin progeny from those parents, poses a genetic risk to the natural population upstream of the weir by reducing the effective population size of the natural population. Collection of adults for broodstock emphasizes the early-returning portion of the run which, over the long term, can impose artificial selection for earlier run timing in the natural population when hatchery-origin fish are allowed to spawn naturally. Significant numbers of Touchet River hatchery-origin steelhead appear to be straying upstream of Ice Harbor Dam.

***Recommendations for current program:*** The Review Team identified 14 specific recommendations to reduce risks and/or improve benefits of the current Touchet River endemic steelhead program. These recommendations include: (a) define more precisely the specific goal and purpose of the research program and restrict management actions to only those operations that directly support that specific goal (e.g., the current release of hatchery-origin fish upstream of the weir does not support the research goal of the program, but it creates risks); (b) collect adult steelhead for broodstock from the entire spectrum of the run to minimize artificial selection for run and/or spawn timing; (c) discontinue passing hatchery-origin adults upstream of the weir but, instead, either (*i*) cross them pairwise with natural-origin fish as part of the broodstock and/or (*ii*) adjust the research goals and data collection protocols to justify passage of hatchery fish upstream (i.e., hatchery fish should not be passed upstream without a specified desired benefit that is subsequently evaluated); (d) discontinue outplanting fry that are the progeny of females that test positive for IHN virus; (e) investigate the use of heated water and/or releasing juveniles as two-year old smolts to achieve the desired size at release; and (f) determine whether acclimated releases from Dayton Pond increase SARs compared to direct releases upstream of the weir (see also recommended alternative for Lyons Ferry hatchery steelhead).

***Alternatives to current program:*** The Review Team considered the pros and cons of five alternatives to the current Touchet River endemic steelhead program, ranging from (a) the current program with full implementation of all program specific recommendations (Alternative 1) to (b) termination of the Touchet River endemic steelhead research program (Alternative 5). The Review Team recommends Alternative 2: phase-out or terminate the release of Lyons Ferry hatchery steelhead in the Touchet River and expand the current integrated endemic program with the goal of eventually developing a two-stage, stepping-stone program that can support both harvest and conservation goals. Alternative 2 is intended to be implemented consistent with all the recommendations in Alternative 1. The Review Team concluded that adult return rates back to the Touchet River from the current endemic program were sufficient to expand the program for the immediate purpose of continuing the research goals of the program and addressing conservation needs for steelhead in the Touchet River. For example, hatchery-origin fish from the current program could be crossed pairwise or in a spawning matrix with natural-origin fish to double the number of smolts released with no additional impact on the natural population. Returning hatchery-origin adults from this integrated broodstock could then be spawned amongst themselves as a second broodstock to produce fish that are marked (fin-clipped) for harvest prior to release. The Review Team concluded that terminating the release of Lyons Ferry steelhead in the Touchet

River would facilitate an expanded research program (e.g., use of Dayton pond to compare SARs for acclimated fish vs. direct-released fish) with the long-term goal of developing a conservation and harvest stepping stone (two broodstock) program if the necessary protocols and desired SARs can be achieved.

### Tucannon River (endemic) Summer Steelhead

***Program overview:*** The program is intended to operate as an *integrated research* program to test the efficacy of developing an endemic hatchery program to replace the outplanting of Lyons Ferry steelhead in the Tucannon River. The ultimate goal of the current program is to develop protocols that will achieve an overall smolt-to-adult return rate (SAR) back to the Tucannon River comparable to the current SARs for Lyons Ferry steelhead. If that research goal is achieved, then the release of Lyons Ferry steelhead would be terminated and the Tucannon River program would be expanded to meet LSRCP mitigation goals and harvest goals for steelhead in the Tucannon River. At the present time, the broodstock goal is to annually collect and spawn 30 natural-origin (unmarked-untagged) steelhead (15 females) from the Tucannon River to yield 50,000 smolts for release back into the Tucannon River. Adults are collected for broodstock at a temporary weir at RM 24 and a permanent weir at RM 35 of the Tucannon River. Fish retained for broodstock are transferred to Lyons Ferry FH for spawning. Fertilization, incubation, and rearing of juvenile steelhead occur at Lyons Ferry FH. Yearling steelhead are transported to the Tucannon FH for acclimation prior to release. After approximately two months, fish are transported and directly released at RM 42 of the Tucannon River. All hatchery-origin steelhead from the Tucannon River endemic stock are released unmarked (no fin clips) but tagged (PIT, VIE, or CWT)[7]. All unmarked-untagged (natural-origin) adult fish in excess of broodstock needs and all unmarked-tagged (Tucannon River hatchery-origin) adult fish are passed upstream of the weir to spawn naturally.

***Benefits:*** Smolt-to-adult return rates for Tucannon River endemic steelhead (SAR ≈ 1.0% in recent years) have been substantially higher than those for the Touchet River steelhead but still less than those for Lyons Ferry steelhead (mean SAR ≈ 1.3%). The Tucannon River program has been more successful at achieving the desired release objective of 50,000 smolts and the desired mean size (100 g/fish) than the Touchet River program. Nevertheless, like the Touchet River program, the protracted return and spawn timing of natural-origin adults in the Tucannon River has been a difficult component of broodstock collection and subsequent juvenile rearing.

***Risks:*** The comparatively small effective breeding number of the broodstock (mean $N_b < 36$), coupled with the deliberate upstream passage of hatchery-origin progeny from those parents, pose a genetic risk by reducing the effective population size of the natural population in the Tucannon River. Collection of adults for broodstock emphasizes the early-returning portion of the run which, over the long term, can impose artificial selection for earlier run timing in the natural population when hatchery-origin fish are allowed to spawn naturally. The location of the permanent weir above 40% of the primary spawning area for the natural population, and the inefficient temporary weir below the primary spawning area, prevent efficient management of the proportion of naturally-spawning fish composed of hatchery-origin steelhead, thus contributing to genetic and ecological risks. Significant numbers of Tucannon River hatchery-origin steelhead stray to the Snake River.

[7] *Passive Integrative Transponders (PIT), Visual Implant Elastomer (VIE), or Coded-Wire tags (CWT).*

***Recommendations for current program:*** The Review Team identified 14 specific recommendations to reduce risks and/or improve benefits of the current Tucannon River endemic steelhead program. These recommendations include: (a) define more precisely the specific goal and purpose of the research program and restrict management actions to only those operations that directly support that specific goal (e.g., the current release of hatchery-origin fish upstream of the weir does not support the research goal of the program, but it creates risks); (b) collect adult steelhead for broodstock from the entire spectrum of the run to minimize artificial selection for run and/or spawn timing; (c) discontinue the deliberate passing of hatchery-origin adults upstream of the weirs but, instead, either (*i*) cross them pairwise with natural-origin fish as part of the broodstock and/or (*ii*) adjust the research goals and data collection protocols to justify passage of hatchery fish upstream (i.e., hatchery fish should not be passed upstream without a specified desired benefit that is subsequently evaluated); (d) discontinue outplanting fry that are the progeny of females that test positive for IHN virus; (e) investigate the feasibility of constructing a permanent weir in the lower Tucannon River, below the primary spawning areas; and (f) continue to investigate the degree and potential causes of straying of hatchery and natural-origin steelhead (and spring Chinook) past the Tucannon River and upstream of Lower Granite Dam, and experiment with potential methods to reduce straying (e.g., artificial imprinting to an organic chemical additive in the acclimation water supply at Tucannon FH).

***Alternatives to current program:*** The Review Team considered the pros and cons of five alternatives to the current Tucannon River endemic steelhead program, ranging from (a) the current program with full implementation of all program specific recommendations (Alternative 1) to (b) termination of the Tucannon River endemic steelhead research program (Alternative 5). The Review 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 with the goal of eventually developing a two-stage, stepping-stone program that can support both harvest and conservation goals. Alternative 2 is intended to be implemented consistent with all the recommendations in Alternative 1. 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 continuing the research goals of the program and addressing conservation needs for steelhead in the Tucannon River. For example, hatchery-origin fish from the current program could be crossed pairwise or in a spawning matrix with natural-origin fish to double the number of smolts released with no additional impact on the natural population. Returning hatchery-origin adults from this integrated broodstock could then be spawned amongst themselves as a second broodstock to produce fish that are marked (fin-clipped) for harvest prior to release. The Review Team concluded that terminating the release of Lyons Ferry steelhead in the Tucannon River would facilitate an expanded research program with the long-term goal of developing a conservation and harvest stepping stone (two broodstock) program if the necessary protocols and desired SARs can be achieved. This recommended alternative includes construction of a permanent weir on the Tucannon River downstream from the natural spawning areas for steelhead (and spring Chinook).

## Spokane [strain] rainbow trout

***Program overview:*** This program is intended to provide 67,500 angler-days of fishing in Washington and Idaho in partial fulfillment of LSRCP mitigation obligations. A total of approximately 500,000 eyed rainbow trout eggs are transferred from the Spokane Trout Hatchery (WDFW) to Lyons Ferry FH and Tucannon FH for hatching and initial rearing. Approximately 160,000 subyearling rainbow trout fry are transferred from Lyons Ferry FH to Idaho Department of Fish and Game (IDFG) for stocking inland lakes and ponds in Idaho. Approximately 100,000

yearling rainbow trout are transferred from Lyons Ferry FH and stocked in various lakes in southeast Washington. Similarly, approximately 138,000 yearling rainbow trout are transferred from Tucannon FH and stocked in lakes and reservoirs (impoundments) in southeast Washington.

***Benefits:*** Limited harvest data exists for the rainbow trout program. A 2003 report by WDFW indicated that program supported 38,116 angler-hours and 19,749 angler-days of fishing effort. IDFG has no harvest or angler effort data for the rainbow trout stocked in Idaho.

***Risks:*** Spokane rainbow trout are susceptible to bacterial coldwater disease which reduces survival. In addition, the rearing of those fish at Tucannon FH and Lyons Ferry FH increases fish health risks to Chinook salmon and steelhead at both facilities. Rainbow trout at Lyons Ferry FH compete with anadromous fish for space and water.

***Recommendations for current program:*** The Review Team identified four specific recommendations to reduce risks and/or improve benefits of the current Touchet River endemic steelhead program. These recommendations include: (a) develop a monitoring program to determine whether the rainbow trout program is meeting its LSRCP mitigation goal; (b) investigate the potential use of another strain of rainbow trout that is less susceptible to bacterial coldwater disease; and (c) conduct pre-release fish health exams on samples of 60 fish at both hatcheries.

***Alternatives to current program:*** The Review Team considered the pros and cons of three alternatives to the current Spokane rainbow trout program, ranging from (a) the current program with full implementation of all program specific recommendations (Alternative 1) to (b) termination of the program (Alternative 3). The Review Team recommends Alternative 2: transfer the Spokane rainbow trout program to a WDFW inland trout facility. Implementation of Alternative 2 would increase rearing space available to salmon and steelhead at Lyons Ferry FH and Tucannon FH, and would also reduce fish health risks at both facilities.

### Kamloops [strain] rainbow trout

***Program overview:*** This program is intended to provide 67,500 angler-days of fishing in Idaho in partial fulfillment of LSRCP mitigation obligations. IDFG transfers approximately 70,000 triploid (genetically sterile) eyed Kamloops rainbow trout eggs from IDFG's Hayspur Hatchery to Tucannon FH each year. The eggs are hatched at Tucannon FH and the resulting subyearling fry (≈ 52,000) are transferred to Lyons Ferry FH in July of each year for subsequent rearing. The fish are given an adipose fin clip and either a right or left ventral fin clip (alternating each year). IDFG transports and stocks the entire population of approximately 50,000 subyearling rainbow trout in the lower Salmon and lower Clearwater rivers at ≈15 fish per pound.

***Benefits:*** Although IDFG samples the lower Clearwater and lower Salmon rivers to determine the presence/absence of program fish, harvest benefits are not adequately documented.

***Risks:*** The rearing of Kamloops rainbow trout at Tucannon FH and Lyons Ferry FH increases fish health risks to Chinook salmon and steelhead at both facilities. Rainbow trout at Lyons Ferry FH compete with anadromous fish for space and water.

***Recommendations for current program:*** The Review Team identified four specific recommendations to reduce risks and/or improve benefits of the current Kamloops rainbow trout program. These recommendations include: (a) develop a monitoring program to determine

whether the rainbow trout program is meeting its LSRCP mitigation goal; (b) increase sampling efforts in the lower Salmon and Clearwater rivers to determine the extent of predation by Kamloops rainbow trout on anadromous fish, and discontinue stocking those fish in anadromous waters if predation is detected; and (c) conduct pre-release fish health exams on samples of 60 fish prior to transport from Lyons Ferry FH.

***Alternatives to current program:*** The Review Team considered the pros and cons of three alternatives to the current Kamloops rainbow trout program, ranging from (a) the current program with full implementation of all program specific recommendations (Alternative 1) to (b) termination of the program (Alternative 3). The Review Team recommends Alternative 2: transfer the Kamloops rainbow trout program to another facility. Implementation of Alternative 2 would increase rearing space available to salmon and steelhead at Lyons Ferry FH and Tucannon FH, and would reduce fish health risks at both facilities.

## *Conclusions*

The Review Team concluded that the Lyons Ferry FH fall Chinook program and the Cottonwood Creek steelhead program are providing very significant conservation and harvest benefits, respectively. In contrast, the Tucannon River spring Chinook program is providing little documented benefits.

The Team also concluded that the segregated hatchery steelhead programs with Lyons Ferry steelhead were providing substantial fishery benefits in the Tucannon, Touchet, and Walla Walla rivers, but those programs also posed significant risks to natural populations both within and outside the Snake River Basin. Releases of Lyons Ferry steelhead into the Tucannon River have resulted in a high proportion of hatchery fish on the natural spawning grounds downstream of the permanent weir in the Tucannon River. While the risks of releasing Lyons Ferry steelhead into the Touchet and Walla Walla rivers were considered lower than those in the Tucannon River, Lyons Ferry steelhead still pose risks to natural populations within those two rivers. Propagation and release of Wallowa stock steelhead at Cottonwood Creek in the lower Grande Ronde River appear to pose only minor biological risks to natural populations within the Grande Ronde River; however, the Wallowa stock strays at a relatively high rate into the Deschutes and John Day rivers, thus posing genetic and demographic risks to natural populations in those latter rivers.

The Review Team concluded that termination of off-site releases of Lyons Ferry steelhead into the Tucannon, Touchet, and Walla Walla rivers would reduce the risks to natural populations and that expansion of on-station (Lyons Ferry FH) releases and/or increases in the size of the Touchet and Tucannon River endemic steelhead programs should be implemented to meet the harvest benefits currently being realized by the existing Lyons Ferry steelhead program. The Team also concluded that the Lyons Ferry stock should be replaced in the long-term with a stock indigenous to the Snake River Basin. The Team also concluded that the steelhead program at Cottonwood Creek should continue to be assessed and reduced in size if straying into the Deschutes and John Day rivers occurs at levels that pose a risk to natural populations in those latter two rivers. The Team also felt that managers should assess development of an endemic Grande Ronde River stock that may reduce the risks of straying both within and outside the Grande Ronde River Basin but only if this latter alternative proved feasible relative to the viability and biological status of natural populations within the Grande Ronde River Basin.

The Review Team concluded that the deliberate passage of hatchery-origin adults upstream of weirs in the Tucannon and Touchet rivers, as part of the endemic Tucannon and Touchet river steelhead programs, was inconsistent with the stated management goal of those programs (i.e., to test the efficacy of developing endemic hatchery programs to replace the Lyons Ferry steelhead stock). The current small effective breeding numbers for each broodstock, coupled with the deliberate upstream passage of hatchery-origin progeny and difficulties to collect adult steelhead across the entire temporal period of the run, poses a significant genetic risk to the natural populations upstream of the respective weirs. The Team further concluded that the recent adult return rates back to both basins from the endemic programs were sufficient to expand the programs with the long-term goal to establish a two-broodstock, "stepping-stone" hatchery program for each endemic population in each river. Such programs could have both harvest and conservation goals. Recent improvements to the Touchet River weir and additional improvements to the lower Tucannon River weir would be critical to expanding the size of the endemic programs. In addition, the continued assessment of straying of hatchery origin steelhead from both endemic programs to upstream of Lower Granite Dam should be continued to (a) investigate the level and causes of straying and (b) identify potential management solutions.

The Review Team concluded that the low recruit-to-spawner ratio for naturally spawning spring Chinook (a) inhibits the development of an integrated hatchery program in the Tucannon River and (b) places the natural population at significant risk of local extirpation. Significant numbers of adult hatchery and natural-origin spring Chinook from the Tucannon River bypass the Tucannon River and migrate upstream of Lower Granite Dam. WDFW staff suggested that the cause of this straying may be water flow problems in the backwaters of the Snake River behind Lower Monumental Dam at the confluence of the Tucannon River. The Team concluded that a permanent weir should be constructed in the lower Tucannon River to meet comanager goals and recommended the development of a two-stage stepping-stone program for the entire Tucannon River population with specific management goals identified for conservation and harvest. In addition, the continued assessment of straying to upstream of Lower Granite Dam for the program should be continued to investigate the level and causes of straying, and to identify potential management solutions.

The Review Team concluded that the current fall Chinook broodstock collections at Lyons Ferry FH and Lower Granite Dam will not be sufficient at current adult return levels to meet the goal of integrating (30%) natural-origin fish into the broodstock. The program may also pose a long-term genetic risk to recovery of the natural Snake River population if hatchery-origin fish continue to compose a very high proportion of naturally spawning fish as the abundance of the population continues to increase in the Snake River. Broodstock collection at only the two current sites (Lyons Ferry FH and Lower Granite Dam) will also inhibit the long-term development of spatial structure and diversity among natural spawning locations in the Hells Canyon area of the Snake River, the lower mainstem Snake River, and the Clearwater River. The Team concluded that, in the near-term, an early returning stock could be developed for the Clearwater River (Middle Fork) consistent with the long-term goals of the Nez Perce Tribe, and that the feasibility of developing additional localized stocks in the lower mainstem Clearwater River and Hells Canyon reach of the Snake River should be long-term goals.

The Review Team concluded that the rainbow trout programs (Spokane and Kamloops) provided significant harvest benefits but recommended the rearing of those fish at other facilities (e.g., a WDFW trout hatchery) to reduce disease risks at Lyons Ferry and Tucannon FHs and free up rearing space for salmon and steelhead at those latter two facilities.

# I. Introduction

In the past 150 years, habitat alterations, hydroelectric development and consumptive fisheries have affected the productivity, abundance, spatial distribution, and diversity of natural populations of Pacific salmon and steelhead (*Oncorhynchus mykiss*) in the Pacific Northwest. To mitigate for those impacts, hatcheries have been used to increase the number of fish available for harvest. However, long-term conservation needs of natural salmonid populations and their inherent genetic resources now require a reexamination of the role of hatcheries in basin-wide management and conservation strategies.

Hatcheries need to be part of a holistic and integrated strategy that combines habitat, hydropower and harvest needs for conserving and managing fishery resources. These strategies must establish short- and long-term goals for both hatchery-propagated and naturally-spawning populations. However, modifying hatchery programs and operations to achieve both conservation and harvest goals in a coordinated manner is difficult and complex. Scientific uncertainties exist regarding the ability of hatcheries and hatchery-origin fish to directly assist with recovery of naturally-spawning populations while, at the same time, sustaining major fisheries. Uncertainties also exist regarding genetic and ecological interactions between natural- and hatchery-origin fish. Only an objective, collaborative, science-based approach can address these problems in a manner that is both scientifically defensible and accepted by the public.

In an effort to improve its hatchery programs and to ensure that existing facilities are best meeting conservation and harvest goals, the U.S. Fish & Wildlife Service (Service) initiated, in October 2005, a review 21 salmon and steelhead hatcheries that the Service owns or operates in the Columbia River Basin. That review was expanded in 2008 to include three National Fish Hatcheries (NFHs) on the Olympic Peninsula of Washington State. The goal of these reviews is to ensure that Service hatcheries are operated in accordance with best scientific principles, and contribute to sustainable fisheries and the recovery of naturally-spawning populations of salmon, steelhead and other aquatic species.

This internal review is modeled after the recent Puget Sound and Coastal Washington Hatchery Reform Project conducted by the Hatchery Scientific Review Group (HSRG).[8] That project provided a solid template and operational tools (e.g. software spreadsheets, population dynamic models) for reviewing Service hatcheries in the Columbia River Basin. Much of the background information necessary for reviewing hatcheries in the Columbia River Basin has already been compiled in Hatchery and Genetic Management Plans (HGMPs),[9] Comprehensive Hatchery Management Plans (CHMPs),[10] and the Artificial Propagation Review and Evaluation (APRE)[11] database developed by the Northwest Power and Conservation Council (NWPCC).

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[8] *For more information on this project and fall project publications see www.hatcheryreform.org and www.hatcheryreform.us.*
[9] *For more information on HGMPs, visit www.nwr.noaa.gov/Salmon-Harvest-Hatcheries/Hatcheries/Hatchery-and-Genetic-Management-Plans.cfm.*
[10] *For more information on CHMPs, visit www.fws.gov/pacific/Fisheries/CHMP.htm.*
[11] *For more information on APRE, visit www.nwcouncil.org/fw/apre/.*

Based on the recommendations of a Hatchery Review Working Group (Working Group)[12], the Service's Assistant Regional Director for Fisheries (ARD) assembled a Columbia Basin Hatchery Review Team (Review Team). This Review Team, comprised of Service and other federal agency scientists, has adapted the HSRG's scientific framework, principles and hatchery review tools for reviewing each federal hatchery program and facility. The Team provides continuity with the HSRG because the two co-chairs served on the HSRG and the Hatchery Reform Policy Coordinating Committee, respectively. The Service has contracted for project facilitation with Long Live the Kings (LLTK), a non-profit organization devoted to restoring wild salmon to the waters of the Pacific Northwest. LLTK has provided facilitation, communications and coordination for the Puget Sound and coastal Washington hatchery review process.

Review Team members for the review presented here include:

- **Don Campton** (Co-Chair), Science Advisor, USFWS, Pacific Regional Office, Portland, Oregon.
- **Douglas DeHart** (Co-Chair), Fish Biologist, Coffee Creek Bioscience, Oregon City, Oregon.
- **Tom Flagg**, Supervisory Fish Biologist, NOAA Fisheries, Manchester Research Station, Manchester, Washington.
- **Susan Gutenberger**, Supervisory Microbiologist, USFWS, Lower Columbia River Fish Health Center, Willard, Washington.
- **Joe Krakker**, Fishery Biologist, USFWS, Lower Snake River Compensation Plan Office, Boise, Idaho.
- **Bryan Kenworthy,** Project Leader and Manager**,** USFWS, Hagerman National Fish Hatchery, Hagerman, Idaho.
- **Larry Marchant**, Project Leader and Manager, USFWS, Spring Creek NFH, Underwood, Washington.
- **Doug Olson**, Hatchery Assessment Team Leader, USFWS, Columbia River Fisheries Program Office, Vancouver, Washington.
- **Chris Pasley**, Project Leader and Manager, USFWS, Winthrop NFH, Winthrop, Washington.
- **Herb Pollard,** Fish Biologist and Management Specialist, Independent Consultant.

Team support members include:

- **Michael Schmidt** (Facilitator), Director of Fish Programs, Long Live the Kings, Seattle, Washington.
- **Jed Moore,** Project Assistant, Long Live the Kings, Seattle, Washington.
- **Cheri Anderson** (Outreach), Information and Education Manager, USFWS, Spring Creek NFH, Underwood, Washington.

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*[12] The Working Group was appointed in November 2004 by the Service's Assistant Regional Director for Fisheries, Pacific Region. The Working Group's report and all other Columbia Basin Hatchery Review documents are available from the project's website, www.fws.gov/pacific/fisheries/hatcheryreview/.*

The Fisheries ARD has also appointed a Hatchery Oversight Team (Oversight Team), consisting of line supervisors with policy and managerial responsibilities, as the Service's primary internal mechanism to oversee the review process, monitor its progress, and transmit communications and reports from the Review Team to the ARD and project leaders within the Service's Pacific Region Fisheries Program. The Oversight Team, along with the ARD, will be the primary contact group between the Service and its partners for developing mechanisms and policies for implementing, or modifying, the Review Team's recommendations.

The review process began in October 2005 with the Warm Springs National Fish Hatchery (NFH). This hatchery is located on the Warm Springs River, in the Deschutes River watershed/Columbia Plateau province, in Oregon. This review was conducted as a pilot to help the Service test and refine the review process. Fishery comanagers and stakeholders were involved in the review process and asked to comment on draft reports and recommendations. The final report for Warm Springs NFH was released in May 2006 (available at www.fws.gov/Pacific/fisheries/hatcheryreview/reports.html).

Following this pilot review, the Service adjusted the process for reviewing federal hatcheries that support artificial propagation programs for four regions: Lower Columbia River, Mid-Columbia River, Snake River, and the Olympic Peninsula (Fig. 1). Facilities in those regions include five NFHs in the Lower Columbia River region (Eagle Creek, Carson, Little White Salmon, Willard and Spring Creek NFHs); three NFHs in the Mid-Columbia River region (Leavenworth, Entiat and Winthrop NFHs); three NFHs in the Snake River region: (Dworshak, Kooskia and Hagerman NFHs), three NFHs in the Olympic Peninsula region (Makah, Quilcene, and Quinault NFHs), and nine federally-owned hatcheries operated by the states of Idaho, Oregon, or Washington as part of the Lower Snake River Compensation Plan (LSRCP).

The report presented here reviews programs at two federally-owned LSRCP hatcheries in Washington State: Lyons Ferry Fish Hatchery (FH), Tucannon FH, and satellite facilities in southeast Washington (Fig. 2).

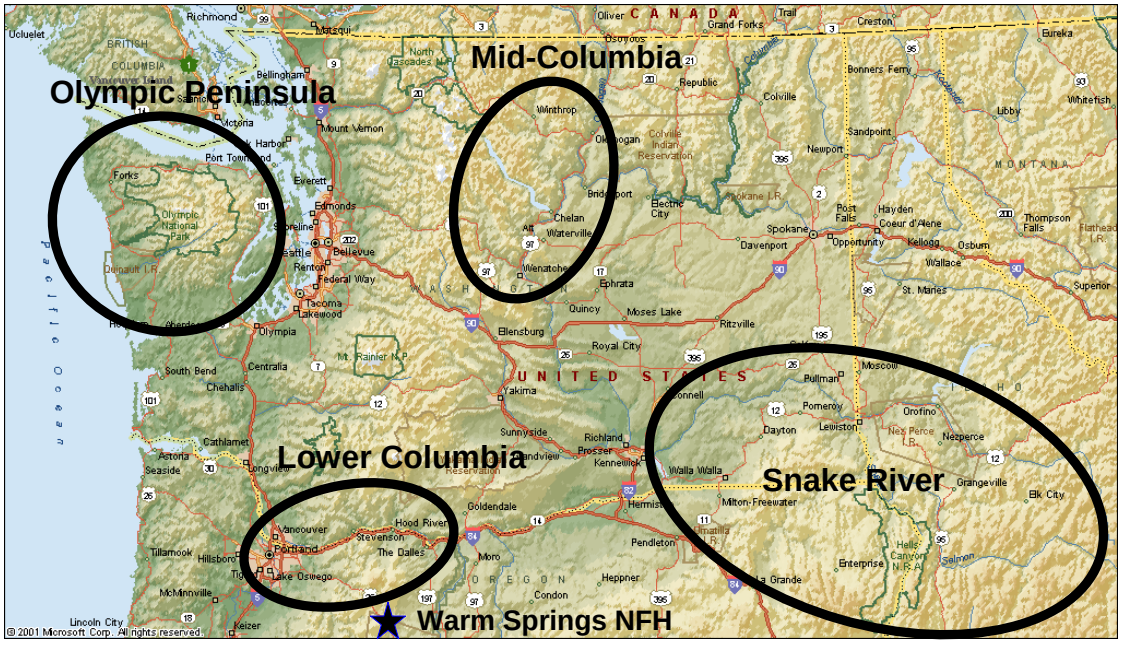


**Figure 1. Regions of the Pacific Region Hatchery Review Project**

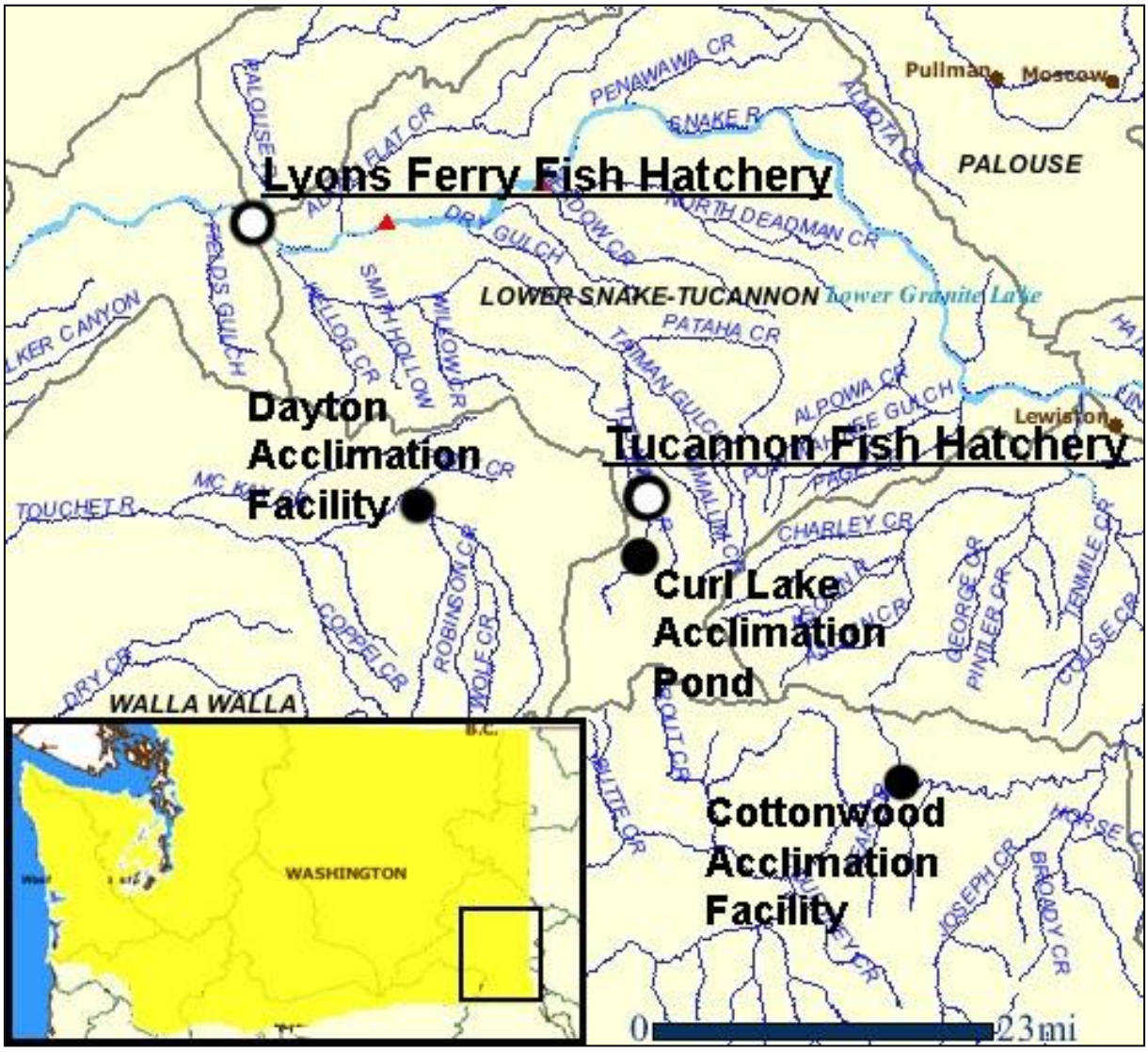


**Figure 2. Location of Lyons Ferry Fish Hatchery and Tucannon Fish Hatchery in Washington State.[13] Both hatcheries are operated by the Washington Department of Fish and Wildlife as part of the federally-funded Lower Snake River Compensation Plan (LSRCP).**

[13] *Modified figure from: Streamnet. <http://map.streamnet.org/website/snetmapper/viewer.htm>*

# II. Components of this Report

This report provides assessments and recommendations developed from a comprehensive review of current propagation programs at Lyons Ferry FH, Tucannon FH, and their satellite juvenile acclimation and adult recapture facilities. Recommendations presented herein are based on the best scientific information available at the time of the review. This information includes peer-reviewed scientific information in published works (scientific journals, etc.), agency reports, and pertinent information directly accessible via electronic download. In its review, the Team followed three fundamental principles it adopted from the HSRG (Mobrand et al. 2005[14]): (1) hatchery programs need to have well-defined goals in terms of desired benefits; (2) hatchery programs and protocols must be scientifically defensible; and (3) hatchery programs need to monitor and evaluate their benefits and risks with programmatic flexibility to respond adaptively to new information.

The Review Team reviewed a large number of background documents, toured the two LSRCP state operated fish hatcheries, their satellite facilities, and local habitat features, and received presentations on a variety of salmonid management issues within the Grande Ronde, Lower Snake Mainstem, Tucannon, Touchet, and Walla Walla River watersheds. The Team then met with biologists representing the LSRCP cooperators and regional stakeholders to discuss the purpose of the review, hatchery operations, stock goals, and specific issues the cooperators and stakeholders wanted the Review Team to consider. Workshops for gathering that information used the All-H Analyzer (AHA) decision support tool[15] to document goals, premises and explore alternatives (Appendix A). All source documents not readily available to the general public are accessible via the Service's hatchery review website[16]. Appendix B of this report summarizes background information and operational details of the hatchery programs on which the review and recommendations are based.

Based on the information gathered, the Review Team assessed benefits and risks of each hatchery program relative to current or short-term (10-15 years) goals and then drafted a set of preliminary recommendations designed to increase or maintain benefits while minimizing or reducing risks. The Team also examined possible program alternatives to address long-term (15-50 years or greater) conservation and/or harvest goals. The initial results of the review were presented orally to LSRCP cooperators. The Review Team then developed a draft report, circulated it to cooperators for initial comment and revision, and then posted it on the Team's website for one month for public comment. The Team also conducted a meeting with interested stakeholders (e.g., fishing guides, conservation groups, etc.) to introduce the review process and receive verbal input. The final report presented here was prepared after written comments on the draft report were received from cooperators, interested stakeholders, and the general public. Review Team responses to those written comments are presented in Appendix C. The complete texts of all written comments received are compiled in Appendix D. Finally, a summary of the annual operating costs associated with each hatchery is presented in Appendix E.

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[14] *Mobrand, L., J. Barr, L. Blankenship, D.E. Campton, T.T.P. Evelyn, T.A. Flagg, C.V.W. Mahnken, L.W. Seeb, P.R. Seidel, and W.W. Smoker. 2005. Hatchery reform in Washington State: principles and emerging issues. Fisheries 30(6): 11-23.*

[15] *For more information on AHA, see the Analytical Tools page of www.hatcheryreform.us.*

[16] *www.fws.gov/Pacific/fisheries/hatcheryreview/*

## *Watershed Overview*

The following report contains a background overview of the Washington portion of the Lower Snake River and tributaries, including the Grande Ronde, Tucannon, Touchet, and Walla Walla rivers. Although the Walla Walla River is not a tributary to the Snake River, it enters the Columbia River approximately 16 miles downstream from the Snake River and supports hatchery programs as part of the LSRCP for Washington. The overview includes information on geography, fisheries, conservation, habitat, and the current status of each salmonid stock within those watersheds. Information on the status and hatchery propagation of each stock is summarized in a table for quick reference.

### Stock Status

An understanding of the current status of each salmonid stock in each watershed was necessary for assessing the benefits and risks associated with each hatchery program. The Review Team summarized the current status of each stock in terms of four population parameters: *biological significance*, *viability*, *habitat*, and *harvest*. Each of those parameters was given a generalized rating of "high", "medium", or "low" as a foundation for assessing the benefits and risks of each hatchery program. The Review Team also needed to understand the short-term (10–15 years) and long-term (50 years or greater) goals for each salmonid stock within each watershed relative to the four population parameters. However, it was neither the mandate nor the responsibility of the Review Team to perform detailed, scientific assessments of population status. Instead, the Review Team relied on the consensus assessments of the comanagers: Washington Department of Fish and Wildlife (WDFW), National Oceanic and Atmospheric Administration/National Marine Fisheries Service (NOAA Fisheries), Nez Perce Tribe, Confederated Tribes of the Umatilla Indian Reservation (CTUIR), and our own Service biologists. The Review Team also relied on the subbasin plans of the Northwest Power and Conservation Council (NWPCC)[17] and reports of the Interior Columbia Technical Recovery Team (ICTRT).[18] Working definitions for each of the four population parameters are provided below.

***Biological significance*** is a measure of the biological uniqueness of a particular stock or population relative to other stocks of the same species. This measure considers the genetic origins of the stock (e.g. native or non-native), biological attributes that are unique or shared with other stocks (e.g. life history, physiological, or genetic attributes), and the extent to which the stock may be considered one component of a larger population structure, including population subdivisions within the stock. In general, a stock is defined as *low*, *medium* or *high* biological significance depending on its level of uniqueness and the ability of other stocks to potentially replace it in the occupying habitat if local extirpation were to occur. Stocks with *high* biological significance usually have one or more unique biological characteristics that may reflect local adaptations and would be difficult to replace by other stocks of the same species. Consequently, biological significance is not based on the degree to which the stock may be considered essential for recovery or important for harvest, but rather on its own innate biological attributes within the watershed in which the stock occurs. For example, a particular stock or population may be abundant and productive and, therefore, considered to have high *management* significance for harvest or recovery. However, that stock would not necessarily be considered to have high *biological* significance unless (a) it possessed biological attributes not shared

[17] *http://www.nwcouncil.org/fw/subbasinplanning/Default.htm*

[18] *http://www.nwr.noaa.gov/Salmon-Recovery-Planning/Recovery-Domains/Interior-Columbia/Index.cfm*

by other stocks of the same species or (b) all other stocks within the region or DPS/ESU[19] were substantially less viable. This approach thus distinguishes the *evolutionary legacy* of a stock within a particular watershed from co-manager decisions regarding the potential *management value* of that stock. In this context, *biological significance* ratings are based on the factors described by Mobrand et al. (2005)[20].

***Population viability*** measures the ability of a stock to sustain itself under current environmental conditions. NOAA Fisheries has assembled several *Technical Recovery Teams* (TRT) to assess viabilities and develop recovery criteria for ESA-listed salmon and steelhead populations throughout the Pacific Northwest. Those assessments involve significant mathematical modeling and attempt to predict extinction probabilities over the next 100 years based on four viability parameters: abundance, productivity, spatial structure, and diversity.[21] Preliminary viability estimates for listed salmonid stocks in the Snake River region have been compiled by the Interior Columbia TRT (ICTRT)[22]. Where available, the Review Team relied on those viability estimates, as developed by the ICTRT; otherwise, the Review Team relied on the viability criteria of Mobrand et al. (2005)[23]. The goal here was to establish a qualitative understanding of the current viability of each salmonid stock potentially affected by each Service hatchery program as a foundation for assessing potential benefits and risks of those programs. However, estimating the viability of a natural population, including *integrated* hatchery stocks, is difficult because those estimations require detailed evaluations of natural reproductive output and enumeration of natural-origin adult returns over multiple generations. In contrast, the viability of *segregated* hatchery stocks is relatively simple and is determined primarily by the number of hatchery-origin adult recruits (R) recaptured in fisheries, the hatchery, or other areas per adult spawner (S) in the hatchery one generation earlier (R/S).

***Habitat*** conditions for a particular stock are assessed quantitatively through estimates of the *capacity* and *productivity* of the environment under current conditions to support returning adult spawners and juvenile fish (assessed via spawner-recruit models). In this context, premises regarding habitat refer primarily to natural populations and the specific watersheds in which hatcheries are located. These premises are important for assessing the ability of the local habitat and watershed to support self-sustaining natural populations and genetically *integrated* hatchery broodstocks, including assessment of risks posed by hatchery-origin fish spawning naturally. The productivity and capacity of a watershed are difficult to estimate directly, but the *Ecosystem Diagnosis and Treatment* (EDT) model attempts to predict those parameters for a "focal species" based on empirical estimates of a variety of habitat parameters (www.mobrand.com/MBI/edt.html). Where available, the Review Team relied on HSRG (2009) estimates of current and future habitat conditions (productivity and capacity) for each salmonid stock in the pertinent watersheds associated with a Service hatchery.[24] Habitat and capacity

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*[19] Distinct Population Segment (DPS) and Evolutionarily Significant Unit (ESU). ESU is NOAA Fisheries' definition for a Distinct Population Segment (DPS) of Pacific Salmon under the U.S. Endangered Species Act. NOAA Fisheries has retained DPS designations for steelhead.*

*[20] Mobrand, L., et al. 2005. Hatchery reform in Washington State: principles and emerging issues. Fisheries 30(6): 11-23.*

*[21] McElhany, P., M.H. Ruckelshaus, M.J. Ford, T.C. Wainwright, and E.P. Bjorkstedt. 2000. Viable salmon populations and the recovery of evolutionary significant units. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-42, Seattle, WA 156pp. Also see www.nwfsc.noaa.gov/trt/trt_Columbia.htm*

*[22] http://www.nwr.noaa.gov/Salmon-Recovery-Planning/Recovery-Domains/Interior-Columbia/Index.cfm*

*[23] Mobrand, L., et al. 2005. Hatchery reform in Washington State: principles and emerging issues. Fisheries 30(6): 11-23.*

*[24] Hatchery Scientific Review Group (HSRG). 2009. Population Reports, Appendix E, Columbia River Systemwide Report. Available at: www.hatcheryreform.us/.*

parameters can also be adjusted iteratively in spawner-recruit population dynamic models to yield results that best fit empirical estimates of total adult returns and/or smolt output under current conditions (Appendix A). This latter approach allows cooperators and others to evaluate potential alternative strategies for improving long-term population viabilities via habitat enhancements or other management actions.

***Harvest*** on salmonid fishes occurs at different locations and times and can be assessed by the mean number of adult fish harvested annually in mixed stock ocean fisheries, mainstem Columbia River fisheries, and/or terminal fisheries within the particular sub-basin or watershed under consideration (Appendix A). Harvest parameters can be adjusted in a manner analogous to adjusting habitat parameters (as described above) to identify levels of harvest that are sustainable under a particular set of habitat conditions as measured by productivity and capacity.

## Hatchery Programs

Hatchery programs are associated with many salmonid stocks. In general, all hatchery programs can be classified according to their type and purpose. Hatchery programs are classified (1) as either *integrated* or *segregated* according to the genetic management goals for the broodstock and (2) according to the purpose of the program with respect to intended benefits (e.g., harvest, conservation, research, etc.).

A hatchery program (or broodstock) is classified as *integrated* if natural-origin fish are purposefully included in the broodstock each year, or the intent of the program is to purposefully include natural-origin fish in the broodstock, with the goal that the natural environment will primarily determine the genetic constitution of hatchery-origin fish. The integrated strategy manages hatchery and wild fish as one population (or one gene pool) that spawns in two different environments but recognizes that the phenotypic performances of hatchery and wild fish can be quite different even when the two components are genetically the same. A properly integrated broodstock requires that the proportion of a broodstock composed of natural-origin fish (symbolized by "*pNOB*") exceed the proportion of natural spawners composed of hatchery-origin fish (*pHOS*).

A hatchery population is defined as *segregated* if it is propagated as a "closed" population where only hatchery-origin fish are used, or are intended to be used, for broodstock. *Segregated* programs or broodstocks are intended to maintain the hatchery population as a distinct, genetically-segregated population via the exclusive use of hatchery-origin adults for broodstock.

The segregated and integrated strategies yield very different broodstock goals and propagation protocols. The segregated strategy creates a hatchery-adapted population that can facilitate management goals (e.g. harvest) but which can also increase genetic and ecological risks to natural populations. In contrast, the integrated strategy attempts to increase the abundance of fish representing an existing natural population or gene pool.

Hatchery programs need to be defined also in terms of their intended benefits. The primary purpose of most hatchery programs is to achieve *harvest* or *conservation* benefits, or both. Secondary purposes can include conservation or harvest, but often include education, research, socioeconomic or cultural/ceremonial benefits. These purposes should be closely linked to the goals of hatchery programs. Although *mitigation* is often stated as a "purpose" of a hatchery program, mitigation typically refers to the replacement of wild fish with hatchery fish without defining specific goals in terms of desired benefits (e.g., *mitigate* for fish losses associated with hydropower dams).

## *Operational Considerations*

The Review Team considered all components of each hatchery program. Major features and issues of each program were summarized into the following subcategories: (a) program goals and objectives; (b) broodstock choice and collection; (c) hatchery and natural spawning, including adult returns; (d) incubation and rearing; (e) release and outmigration; (f) facilities and operations; (g) research, monitoring, and accountability, and (h) education and outreach.

## *Benefit and Risk Assessment*

In conducting this review, the Review Team considered a wide range of possible benefits and risks potentially conferred and imposed, respectively, by hatchery programs.

**Benefits** considered include:

- Contributions to tribal and non-tribal harvests (commercial and recreational).
- Short- and long-term conservation benefits (both demographic and genetic).
- Research opportunities afforded by the program.
- Educational, cultural, ceremonial and socioeconomic benefits conferred by the program and the hatchery facility itself.

**Risks** considered include:

*Genetic Risks*

- Risks from artificial propagation on the genetic constitution and fitness of hatchery-origin fish representing the cultured stock.
- Risks from natural spawning by hatchery-origin adults on the mean fitness of natural-origin fish of the same species in target and non-target watersheds.

*Demographic Risks*

- Pre-release risks from the hatchery facility and operations on the abundance of the propagated stock including the following: pre-spawning mortality associated with trapping, holding and/or bypassing adults; disease risks associated with overcrowding or high rearing densities of cultured fish; inadequate fish health protocols and water flow alarms to prevent catastrophic fish losses in the hatchery; poaching by humans; and predation by birds, mammals and fish at the point of release or on the hatchery grounds (e.g. by otters and birds).
- Post-release risks to the abundance of the propagated stock, including congregation of released fish at the release point and/or unnatural surface feeding (conditioned by hatchery rearing) that may increase vulnerability of released fish to predators, thus decreasing smolt-to-adult survival.
- Demographic risks from hatchery operations on the abundance of other stocks and species within the watershed in which the hatchery is located (e.g. effects of a barrier weir for trapping adults for hatchery broodstock).

*Ecological Risks*

- Competition, predation, and disease transfer from hatchery-origin adults and juveniles of the propagated stock to naturally spawning populations of the same species or stock in target and non-target watersheds.
- Competition, predation, and disease transfer from hatchery-origin adults and juveniles of the propagated stock to naturally spawning populations of different species in target and non-target watersheds, including non-salmonid fish species of particular concern (e.g. lamprey).
- Risks from the hatchery facility and operations on the aquatic biota and ecosystem within the target watershed, including the effects of hatchery effluent, water intake, use of chemicals, and upstream/downstream passage of fish and other aquatic species in the watershed.
- Risk of antibiotic use resulting in developing resistant strains of pathogenic organisms that infect salmonid fishes, other aquatic species, and humans.
- Producing fish that are not qualitatively similar to natural fish of the same species in size, growth rate, morphology, behavior, physiological status or health, which may adversely affect the performance of natural fish via competition or predation.
- The Team recognizes that hatchery-origin juveniles and adults may ecologically impact other fish species and populations in the estuary and ocean environment; however, little information on these *cumulative effects* is currently available.

*Physical Risks*

- Risks from the hatchery facility and operations to human health and safety, including potential contaminants.

The Team evaluated the benefits and risks of all operational and physical components of each hatchery program. These components are the same as those outlined above under *Operational Considerations.* Those evaluations then formed the bases of the Team's recommendations.

## *Recommendations*

After careful assessment of the benefits and risks conferred by a hatchery program, the Review Team developed a series of recommendations to increase the likelihood of achieving the desired goals and benefits of the program and/or reducing biological and other risks. Recommendations for the current hatchery programs are grouped into the same categories as listed above under *Operational Considerations*. Recommendations for current programs are intended to address short-term goals and needs.

## *Alternatives*

The review team then identified several alternatives to the current program, as suggested by comanagers or inferred from long term goals for salmonid stocks within the region, with an overall assessment of the value and merits (pros and cons) of those potential alternatives relative to the current program. By default, the following alternatives were included in each assessment: (a) the current program with full implementation of all recommendations and (b) termination of the current program and decommission of the hatchery in favor of alternative mitigation strategies (e.g., habitat restoration,

construction of a new hatchery elsewhere, etc.). The Team then selected a recommended alternative, or combination of alternatives, that the Team concluded would provide the greatest benefit-risk ratio in support of long-term harvest and conservation goals.

# III. Washington Lower Snake River Basin

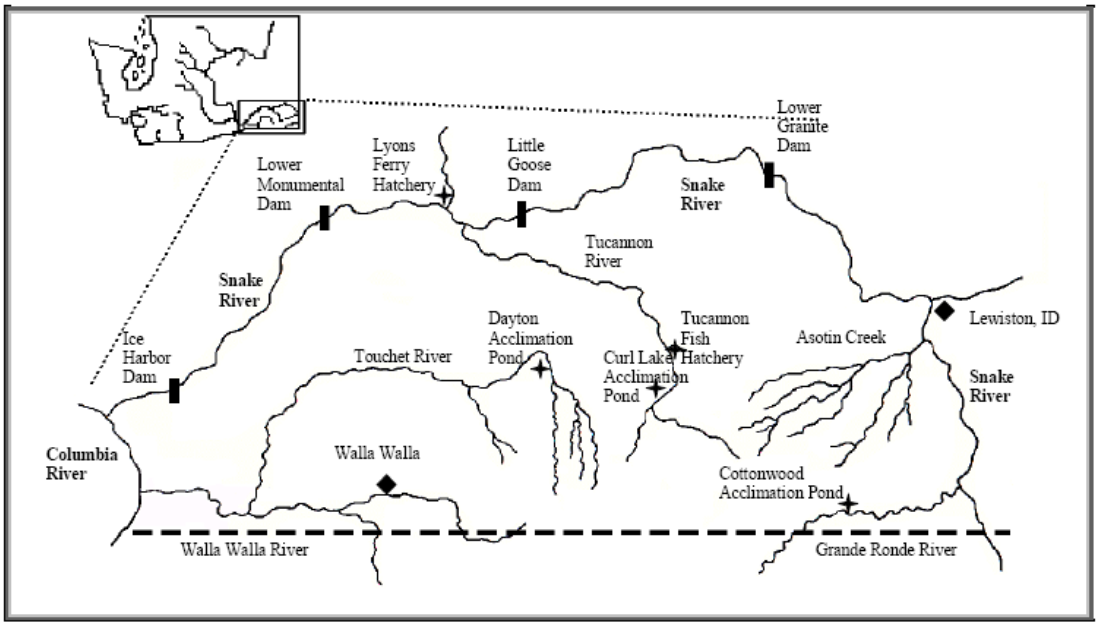


Figure 1. Map of the Lower Snake River Compensation Plan (LSRCP) LFC Facilities, and major rivers and streams in Southeast Washington.

**Figure 3. Map of the Lower Snake River Compensation Plan (LSRCP) Lyons Ferry Complex facilities, and major rivers and streams in Southeast Washington [25]**

[25] *WDFW, 2008. Lyons Ferry Complex. Annual Operating Report October 1 2007 through September 30, 2008. WDFW Lyons Ferry Complex and Snake River Lab staff.*

# Washington LSRCP Overview

## *Watershed Description*

The geographic regions addressed in this report include the mainstem Snake River and tributaries within the state boundaries of Washington upstream from the confluence of the Snake and Columbia rivers near Pasco, Washington (Fig. 3 on preceding page). This geographic region also includes the Walla Walla River which enters the Columbia River approximately 16 miles downstream from the Snake River. Major tributaries to this region of the Snake River include the Palouse, Tucannon Clearwater, and Grande Ronde rivers. The Palouse River enters the north side of the Snake River near the Tucannon River but does not support anadromous fish populations because of a large, natural barrier falls (Palouse Falls) immediately upstream from the Snake River. Smaller tributaries supporting salmon and/or steelhead include Asotin and Alpowa creeks.

The Snake River drainage of southeast Washington area is bounded by the Columbia River to the west, the Snake River canyon to the north and east, and the Oregon-Washington state line to the south. The Blue Mountains lie along the state boundary and are a major geological feature of the area. Terrain varies from low elevation agricultural land in the lower river valleys to over 6,000 foot elevations in the Blue Mountains. The Snake River Basin has a total drainage area of approximately 108,700 square miles from its headwaters in Wyoming to the confluence with the Columbia River. Only about five percent of this area occurs in Washington.

Reservoirs behind four mainstem hydropower dams (Ice Harbor, Lower Monumental, Little Goose, and Lower Granite) flood 140 of 175 miles of the main Snake River located in Washington. These dams were constructed by the U.S. Army Corps of Engineers in the 1960s and 1970s for hydropower and navigation. Lake Wallula behind McNary Dam on the Columbia River floods the lower five miles of the Snake River. Only 30 miles of the Snake River within Washington, from the town of Asotin upstream to the state border with Oregon, is free flowing.

### Tucannon River

The Tucannon River originates in the Tucannon-Wenaha Wilderness near the Oregon border and flows northward 70 miles and flows into the Snake River at river mile (RM) 62.2, three miles upstream of Lyons Ferry State Park, near the mouth of the Palouse River. There are two major drainages in the Tucannon subbasin; the main stem drains 318 square miles. Pataha Creek drains an additional 190 square miles, but has been severely impacted by land use and does not support significant fishery resources.

### Grande Ronde River

The Grande Ronde River flows in northeast direction 212 miles from its origin in the Wallowa and Blue Mountains in Oregon. The Grande Ronde crosses into Washington at RM 38.7 before joining the Snake River at RM 169, about 20 miles upstream of Asotin, Washington and 493 miles from the mouth of the Columbia River. The Grande Ronde subbasin drains 3,600 square miles in the extreme northeast corner of Oregon as well as 341 square miles in the extreme southeast corner of Washington.

### Walla Walla River

The Walla Walla River originates in the Blue Mountains of southeastern Washington and northeastern Oregon and flows north and west to enter the Columbia River at Lake Wallula behind McNary Dam. About 73 percent of the 1,758 square miles drainage lies in Washington. Elevations in the subbasin range from only 300 feet at the Columbia River to about 6,000 feet at mountain crests. The eastern portion of the drainage lies in steep, timbered slopes of the Blue Mountains within the Umatilla National Forest. The remainder of the drainage consists of middle-elevation rolling hills of the Palouse and level terrain in valleys. The Touchet River is the main tributary to the Walla Walla River.

### Regional climate

The climate of the southeast Washington watersheds is largely determined by the Cascade Mountains to the west and prevailing westerly winds from the Pacific Ocean. Maritime air masses are intercepted by the Cascade Mountain range, creating a rain shadow which contributes to the arid steppe of the Columbia River basin between the Cascade Mountains to the west and the Blue Mountains to the east.

Elevation is another major factor affecting the climate and weather patterns in southeast Washington watersheds. Landscapes vary from warm and semiarid in the western and lower river valleys to cool and relatively wet in the higher elevations of the Blue Mountains. Precipitation across the southeast Washington subbasins falls mainly in the winter, with 64% of the total annual precipitation occurring from October through March. Precipitation falls primarily as rain in the lower elevations and snow in the higher elevations. Temperatures exhibit a large seasonal variation with maximum daily temperatures greater than 38°C (100°F) in summer and minimum temperatures less than –18°C (0°F) in winter.

## *Fisheries*

Tribal and recreational fisheries for salmon and steelhead in southeastern Washington are supported primarily by hatchery programs based at federally-owned Lyons Ferry FH, Tucannon FH, and associated satellite facilities used for releasing juveniles and/or trapping adults and/or releasing juveniles. Fisheries on salmon and steelhead in southeast Washington also intercept anadromous fish migrating upstream through the lower Snake River toward several release points and hatcheries in Idaho and Oregon. The current threatened status of natural populations of steelhead and Chinook salmon in southeast Washington preclude significant fisheries on natural populations (see *Conservation* section below).

### Fall Chinook

Fisheries on fall Chinook in the lower Snake River have been severely limited by the ESA status of natural populations (see below). Opportunity for harvest in tribal and recreational fisheries has been limited by conservation concerns while the Lyons Ferry program has developed. However, some hatchery fish in excess of conservation needs have returned in the recent years and limited harvest, mostly incidental to the popular steelhead fishery, has been allowed. Fall Chinook salmon, including fish from Lyons Ferry Hatchery; continue to provide important fisheries in the ocean and Columbia River. In 2008, Idaho, Washington, and the Nez Perce Tribe opened fall Chinook fisheries in the Snake River. Idaho anglers caught an estimated 132 marked adult and jack fall Chinook on the Snake River between Lewiston and Hells Canyon Dam (Oct 3 through Oct 31, 2008). Washington anglers caught an estimated nine fall Chinook on the Snake River between the vicinity of the Tucannon River

and approximately one mile upstream of Little Goose Dam (Sept. 25 through Oct. 15), and the Nez Perce Tribe harvested an estimated 52 fall Chinook in the Clearwater River.

### Spring/summer Chinook

The main Snake River is the migration corridor for numerous ESA-listed populations of spring and summer Chinook. Fisheries are usually constrained by conservation concerns for impacts to the listed, wild populations in mixed-stock harvest. However, opportunity to harvest non-listed hatchery-origin spring/summer Chinook in excess of conservation needs has occurred since 2000.

*Estimates of Annual Spring/Summer Chinook Harvested in the Snake River Recreational Fisheries (preliminary data, pers. comm. Glen Mendel, WDFW, 2010).*

| **Year** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** |
|---|---|---|---|---|---|---|---|---|---|
| **Kept** | 1,439 | 866 | 513 | 1,224 | 76 | 190 | 287 | 511 | 508 |
| **Released** | 558 | 351 | 426 | 347 | 92 | 106 | 83 | 145 | 104 |
| **Total** | 1,997 | 1,217 | 939 | 1,571 | 168 | 296 | 370 | 656 | 612 |

### Steelhead

Hatchery–origin steelhead returning to local facilities in the lower Snake River, as well as to upstream hatchery programs, support significant fisheries in the southeastern Washington area. Steelhead returning to hatchery facilities, concentrating near dam tailraces and pools, and at the respective confluences of the Clearwater and Grande Ronde rivers with the Snake, provide high catch rates and create popular fisheries. Harvest varies annually depending on returning fish numbers and environmental conditions. From 1995 through 2002, steelhead harvest ranged from approximately 4.000 to 11,000 fish in the Snake River, and 1,500 to 5,400 fish in the Grande Ronde River.

| *Estimates of annual steelhead harvest in tribal and recreational fisheries (WDFW)* | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **1995-96** | **1996-97** | **1997-98** | **1998-99** | **1999-00** | **2000-01** | **2001-02** |
| Main Snake - WDFW | 5,580 | 5,144 | 6,757 | 4,053 | 5,243 | 8,114 | 10,979 |
| Grand Ronde - WDFW | 2,913 | 3,412 | 4,597 | 1,470 | 2,064 | 5,390 | 7,725 |

### Resident Trout

Resident rainbow/redband and bull trout provide limited recreational fisheries in headwater streams. Harvest of bull trout in recreational fisheries is prohibited and harvest of resident rainbow/redband trout is limited to two fish per day over eight inches minimum total length. Hatchery-reared trout released in ponds and lakes provide a popular fishing opportunity in lowland areas and residual steelhead smolts are harvested as trout in the Snake River reservoirs. Hatchery-origin rainbow trout are stocked in ponds as partial mitigation for the lower Snake River dams.

### Other species

Introduced populations of warm-water game fish including smallmouth and largemouth bass, crappie, bluegill sunfish and several species of catfish in Snake River reservoirs support popular fisheries during the warmer months when anadromous fish are not available. Recreational fishing for white sturgeon is permitted on a catch-and-release basis only.

## *Conservation*

Several species and races of anadromous fish are native to southeastern Washington, but habitat losses have greatly reduced numbers and distribution, and extirpated some populations. Coho were declared extinct in the Snake River in 1986. Spring/summer and fall Chinook, steelhead, and bull trout in the Snake River and tributaries are all listed as *threatened* species under the U.S. Endangered Species Act. White sturgeon and lamprey are greatly reduced from historical abundance.

### Fall Chinook

Populations of fall Chinook occurred historically upstream from Hells Canyon, but their upstream migration was blocked and the populations extirpated after construction of the Hells Canyon Hydroelectric Complex (Hells Canyon, Oxbow, and Brownlee Dams) by Idaho Power Company between 1958 and 1968. Spawning areas in the Washington reach of the Snake River were inundated after construction of the four lower Snake River dams. The remaining Snake River fall Chinook were restricted to the free flowing river between the backwaters of Lower Granite Reservoir and Hells Canyon Dam, which is estimated to be less than 15% of the formerly occupied habitat. The presently existing natural spawning population of fall Chinook in the lower Snake River represents the remnant Snake River stock, enhanced by recent hatchery supplementation efforts. Fall Chinook salmon upstream of Lower Granite Dam are considered part of a single genetically similar aggregate and are designated by NOAA Fisheries as one evolutionarily significant unit (*Snake River Fall Chinook Salmon ESU*).

The Lyons Ferry FH fall Chinook program was initiated as an "egg bank" in 1982, based on collection of adult Chinook from fish ladders in the Snake River dams. When the remnant natural population dwindled to fewer than 100 spawning fish in the Hells Canyon reach of the Snake River in the early 1990s, most of the genetic heritage of this ESU was considered to persist in the hatchery stock (1992 NMFS Status Report). Improved smolt-to-adult survival and expansion of the hatchery program into supplementing natural spawners in the Snake and Clearwater rivers has contributed to large numerical and distribution increases in the population. Degraded habitat and straying of out-of-basin fish into the Snake River remain important conservation concerns.

### Spring/summer Chinook

Native populations of spring /summer Chinook in the Walla Walla River and Asotin Creek were extirpated by habitat and environmental factors in the last century. The indigenous spring Chinook population of the Tucannon River persists and is the focus of a conservation hatchery program operated at Tucannon and Lyons Ferry FHs. A few pairs of spawning Chinook, of unknown origin, have been observed in Asotin Creek in recent years, and the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) fisheries department is experimentally reintroducing spring Chinook to the Walla Walla River using out-of-basin hatchery stocks.

### Coho salmon

Coho salmon were declared extinct in the Snake River in 1986. Coho may have been native to the Walla Walla and Tucannon Rivers. Natural spawning of coho salmon in the Snake River basin (i.e., before current reintroduction efforts were initiated) was last reported in spring-fed tributaries of the Wallowa River, tributary to the Grande Ronde River. This stock of coho was considered biologically unique in terms of migration distance from the ocean and elevation of spawning habitat within the range of the species.

The Nez Perce Tribe, in collaboration with the U.S. Fish & Wildlife Service, is currently attempting to reintroduce coho salmon in the Clearwater River utilizing lower Columbia River stocks. Coho salmon, thought to be strays from the Clearwater River, have been observed in the lower Tucannon River. Tribal co-managers are interested in reintroducing coho into suitable habitat in southeast Washington if the Clearwater River reintroduction effort is successful.

### Steelhead

Steelhead in the Snake River Basin are often classified as two life history forms, commonly referred to as "A-run" and "B-run" steelhead (Kiefer et al. 199226). B-run steelhead generally return later in the year and at a larger mean size and older mean age than A-run steelhead. Both A-run and B-run steelhead exist in the southeastern Washington and are included in the Snake River Steelhead ESU. The indigenous steelhead that spawn in tributaries of the lower Snake River and Walla Walla system are considered to be A-run steelhead. B-run steelhead spawn in the Clearwater and Salmon rivers and only occupy the main Snake River as a migration corridor. Natural populations of steelhead in the southeastern Washington drainages are currently listed as threatened under the ESA. Hatchery-origin steelhead representing the endemic populations in the Touchet and Tucannon rivers are included with the Snake River Summer Steelhead ESU and ESA listing.

### Bull trout

Bull trout are present in the Tucannon River, the Walla Walla River, and the Grande Ronde River and occasionally in the Snake River near the confluence of the Grande Ronde River. Although bull trout are widely distributed in southeastern Washington drainages, the populations are primarily limited to cooler headwater streams. Historical connectivity between those populations is now blocked by physical and thermal barriers. Isolation of small populations in fragmented habitat is a conservation concern for this species.

### Pacific lamprey

Pacific lamprey are considered an endangered species by the state of Idaho (IDFG 2001c), but are not listed under the U.S. ESA. Throughout their range in the Columbia River Basin, Pacific lampreys have declined to only a remnant of their pre-1940s populations. Counts of upstream migrating Pacific lamprey at lower Snake River dams were over 30,000 fish in the late 1960s but have declined to less than 500 fish in recent years. Currently, an estimated 3% of the lamprey that pass Bonneville Dam are counted at Lower Granite Dam (Close 2000). As a result, the abundance of Pacific lamprey in the southeastern Washington subbasins is thought to be extremely depressed (CBFWA 1999). Identified threats to Pacific lamprey in southeastern Washington include the effects of the hydropower dams on

[26] *Kiefer et al. 1992. Full citation needed.*

the Snake and Columbia Rivers, stream alterations, and amnocoet harvest by bait fishermen.[27] Because Pacific lamprey spend extended periods in freshwater, they are especially vulnerable to degraded stream conditions, including sedimentation due to land disturbance and water quality limitations that impact diatom (food) production in nursery streams (Paradis et al. 1999b).

### Other species

Other species of conservation interest include inland redband/rainbow trout, mountain whitefish, and white sturgeon. Resident trout and mountain whitefish have been affected by many of the same habitat and anthropogenic factors that have affected the abundance of anadromous salmonids and are expected to benefit from recovery actions directed at salmon and steelhead in the Snake River basin.

White sturgeon is a large, long-lived species that depends on large, free-flowing rivers to complete their life cycle. Sturgeon populations of the Snake River are now limited to a few free-flowing sections like the Hells Canyon reach. Sturgeon habitat has been fragmented by dams and connectivity between the Snake River and Columbia River populations has been blocked. Although a naturally reproducing population persists in the Snake River and individual sturgeon are occasionally observed in the reservoirs and tailraces of the Snake River Dams, habitat fragmentation and migration barriers remain a conservation concern.

## *Habitat*

The abundance of salmon and steelhead in the southeastern Washington subbasins is limited by three primary factors: (1) marine survival and anthropogenic factors outside the area (e.g. dams, harvest); (2) reduced habitat carrying capacity and fish survival within the subbasins due to land management activities which affect hydrology, levels of sedimentation, and water quality; and (3) inundation of 80 percent of the Snake River by the backwater reservoirs behind the four dams on the lower Snake River. More than a century of agriculture in this region has contributed to sediment and high runoff in the streams. Water diversions for irrigation reduce instream flows, and irrigation return waters may be too warm and laden with sediment to support salmonid fishes. Extensive habitat improvement actions for the benefit of anadromous salmonids are either under way or being contemplated (see Northwest Planning and Conservation Council, Subbasin Plans). However, current habitat conditions in the lower sections of these rivers are not favorable.

### Fall Chinook

Fall Chinook occupy the main Snake River and lower reaches of the Grande Ronde and the Tucannon rivers. Over 80% of the potential spawning habitat for fall Chinook in the lower Snake River is inundated by the reservoirs behind the four lower Snake River dams. Cold water and mid-winter floods reduce the suitability of the tributaries for fall-spawning stocks. Fall Chinook generally emigrate as subyearling smolts a few weeks after emerging from the gravel in the spring. However, a portion of the fall Chinook emerging from Snake River tributaries are now rearing in the reservoirs for one year before emigrating. This yearling life history appears to be evolving in response to the altered hydrology of the lower Snake River.

[27] *Status review by the Idaho Chapter of the American Fisheries Society (cited by Paradis et al. 1999b).*

## Spring Chinook

The remaining suitable habitat for spring Chinook in southeastern Washington is located in the upper reaches of the Walla Walla River, the Tucannon River, and Asotin Creek. In each case, suitable spawning and rearing habitat exist in the headwaters, but land use and water flows limit the rearing capacity and may affect migration through the lower main stems of those streams. Spring Chinook return and spawn in the upper reaches and tributaries of the Grande Ronde River in northeast Oregon with the lower Grande Ronde and Snake rivers in southeast Washington serving as migration corridors for downstream-migrating smolts and upstream-migrating adults when water flows and temperatures allow passage.

The Washington Department of Fish and Wildlife (WDFW) has assessed, for subbasin planning purposes, adult habitat capacities for spring Chinook in the Asotin, Tucannon, and Walla Walla subbasins based on the Ecosystem Diagnosis and Treatment (EDT) model (Power Planning and Conservation Council subbasin plans). The EDT model predicts the number of adult spawning fish that the analyzed habitat can support under three scenarios: current conditions, "properly functioning conditions", and a "Reference" or historical maximum capacity (see Table below).

**Predicted habitat capacities for adult spring Chinook derived from the EDT model. Current conditions account for reduced survivals imposed by the hydropower system. PFC and reference conditions refer to "properly functioning conditions" and "historical maximum capacity", respectively.**

| Drainage | Current | PFC | Reference |
|---|---|---|---|
| Asotin Creek | 158 | 1018 | 4348 |
| Tucannon | 506 | 2665 | 9317 |
| Walla Walla | 420 | 9318 | 17629 |

## Coho salmon

Coho salmon are native to the Snake River, although their historical occurrence in specific tributaries is not well documented. Degraded habitat, water withdrawals, ,and overharvest in lower Columbia River mixed stock fisheries are believed to have led to the extirpation of coho salmon in Snake River tributaries during the last half of the 20$^{th}$ century. Habitat actions designed to achieve recovery of steelhead and spring Chinook populations would also benefit coho salmon in reintroduction programs.

## Steelhead

Steelhead are able to utilize smaller headwater streams for spawning than spring Chinook, and the life cycle of the A-run steelhead indigenous to southeastern Washington allows them to use small and even intermittent streams. A-run steelhead of southeastern Washington migrate up the Columbia and Snake Rivers in late summer and early fall and overwinter in the mainstem Snake River and lower sections of the larger tributaries. In addition, summer-run steelhead in interior watersheds – particularly males –often complete their life cycles in their home stream and may reproduce before they smolt or outmigrate as kelts. As a result, steelhead are able to persist in habitats where some salmon species have been extirpated (e.g., Clearwater River).

For subbasin planning purposes, WDFW used the Ecosystem Diagnosis and Treatment (EDT) method to assess steelhead habitats in the Asotin, Tucannon, and Walla Walla subbasins. The EDT model produces estimates of the number of adult spawning fish that might be supported by current habitat

capacity, habitat under "properly functioning conditions" and a "Reference", or historical maximum capability. Results are summarized in the following table.

**Predicted habitat capacities for adult steelhead derived from the EDT model. Current conditions account for reduced survivals imposed by the hydropower system. PFC and reference conditions refer to "properly functioning conditions" and "historical maximum capacity", respectively.**

| Drainage | Current | PFC | Reference |
|---|---|---|---|
| Asotin Creek | 206 | 358 | 8677 |
| Tucannon | 636 | 1213 | 12953 |
| Walla Walla | 1070 | 4159 | 16451 |

According to the EDT model, current steelhead habitat capacity is 25 to 60 percent of 'Properly functioning' and a much smaller fraction of historical potential.

## *Current Status of Salmonid Stocks*

Fish Biologists associated with the LSRCP have identified 19 principal salmonid stocks, including two extirpated stocks of fall Chinook and one extirpated stocks of spring/summer Chinook, in the Snake River Basin and adjacent regions of Oregon and Idaho potentially affected by LSRCP hatchery programs in Washington.

### CHINOOK

#### *Snake River Fall Chinook ESU*

**Snake River Fall Chinook MPG**

- Lower Snake River mainstem fall Chinook (natural + integrated hatchery) [28]
- Marsing Reach Snake River fall Chinook (extirpated)
- Salmon Fall Snake River fall Chinook (extirpated)

#### *Snake River Spring-Summer Chinook ESU*

**Lower Snake River Spring Summer Chinook MPG**

- Tucannon River spring Chinook (natural + integrated hatchery)
- Asotin Creek spring Chinook (natural, but considered "functionally extirpated")

#### *Mid-Columbia River Spring Chinook ESU*

- Walla Walla River spring Chinook (extirpated)

[28] *Broodstock collection occurs at Lyons Ferry FH and Lower Granite Dam, and subyearling and yearling releases occur in the Snake River at Lyons Ferry FH, Captain John Rapids and Pittsburg Landing acclimation ponds, and into the Clearwater River near Big Canyon Creek. Eggs are also transferred to the Umatilla and Oxbow hatcheries for releases into the Snake River and to Irrigon FH for releases into the Grande Ronde River.*

## STEELHEAD

### *Mid-Columbia River Steelhead DPS*

**Walla Walla and Umatilla Rivers MPG**

- Touchet River summer steelhead (natural + integrated hatchery) [29]
- Walla Walla summer steelhead (natural)

### *Snake River Steelhead DPS*

**Lower Snake River MPG**

- Tucannon River summer steelhead (natural + integrated hatchery)[30]
- Asotin Creek summer steelhead (natural)

**Grande Ronde River MPG**

- Lower Grande Ronde River summer steelhead (natural)
- Joseph Creek summer steelhead (natural)
- Wallowa River summer steelhead (natural)
- Upper Grande Ronde River summer steelhead (natural)

### *Segregated Hatchery Steelhead Populations*

- Lyons Ferry hatchery summer steelhead (segregated hatchery)[31]
- Cottonwood Creek hatchery summer steelhead (segregated hatchery) [32]
- Wallowa hatchery summer steelhead (segregated hatchery)
- Oxbow hatchery summer steelhead (segregated hatchery)

## RESIDENT TROUT

- Lower Snake River rainbow trout (Tucannon River, Asotin Creek)
- Walla Walla and Touchet river rainbow trout

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*[29] Broodstock collection and smolt release occur at Dayton Pond on the Touchet River. Rearing occurs at Lyons Ferry FH.*

*[30] Broodstock collection and smolt release occur at Tucannon FH on the Tucannon River. Rearing occurs at Lyons Ferry FH.*

*[31] Broodstock collection occurs at Lyons Ferry FH. Smolts are acclimated and released into the Snake River from Lyons Ferry FH, the Touchet River from Dayton Pond, and direct-stream released into the Walla Walla and Tucannon rivers.*

*[32] Broodstock collection and smolt release occur at Cottonwood Pond on the Grande Ronde River. Rearing occurs at Lyons Ferry FH.*

- Grande Ronde River rainbow trout
- Lower Snake River bull trout (Tucannon, Touchet, Grande Ronde, Asotin, Walla Walla rivers and Asotin Creek)

The following tables summarize the current status and management premises of the principal salmonid stocks in the southeast Washington LSRCP area. The principal sources of information for these tables were the1996 and 1998 NOAA-Fisheries status reviews of west coast steelhead and Chinook salmon populations, respectively[33]; Sub-Basin Plans of the Northwest Power and Conservation Council[34]; and the Snake River Salmon Recovery Plan for SE Washington.[35] Additional information was obtained from Hatchery Science Review Group (HSRG)[36] reports, Hatchery and Genetic Management Plans (HGMPs), Supplemental Comprehensive Analysis (SCA) of the Federal Columbia River Power System[37], WDFW research progress reports, WDFW Salmonid Stock Inventory (SaSI), and various documents produced by the Interior Columbia Technical Recovery Team (ICTRT)[38].

[33] *http://www.nwr.noaa.gov/ESA-Salmon-Listings/Salmon-Populations/*
[34] *http://www.nwcouncil.org/fw/subbasinplanning/Default.htm*
[35] *http://www.snakeriverboard.org/resources/library.htm*
[36] *http://www.hatcheryreform.us*
[37] *http://www.nwr.noaa.gov/Salmon-Recovery-Planning/*
[38] *www.nwfsc.noaa.gov/trt/*

## *Table 1. Lower Snake River mainstem fall Chinook (natural; Lyons Ferry FH and satellite facilities)*

| **Management Premises and Goals** | |
|---|---|
| *ESA Status* | *Threatened.* The Lower Snake River Fall Chinook population is part of the Snake River Fall Chinook ESU that is classified as threatened under the Endangered Species Act, April 22, 1992 (57 FR 14653)., reaffirmed June 28, 2005. |
| *Biological Significance* | *High.* The Snake River Fall Chinook Salmon ESU consists of a single major population group and independent population: the Lower Snake River Mainstem population. This population occupies the Snake River from its confluence with the Columbia River to Hells Canyon Dam, and includes spawning habitat in the lower reaches of the Clearwater, Imnaha, Grande Ronde, Salmon, and Tucannon rivers.<br><br>The HSRG (2009) classified the Snake River fall Chinook population as *primary* with respect to ESA recovery. |
| *Population Viability* | *Low (natural) to Medium (hatchery).* Current numbers of natural-origin Snake River fall Chinook salmon have increased in recent years, with estimates at Lower Granite dam of 2,652 fish in 2001, 2,095 fish in 2002, and 3,895 fish in 2003. The natural-origin returns were as low as 78 adults in 1990. The most recent 10-year geometric mean abundance was 1,273 for the years 1995-2004. The 1977-99 brood year recruit per spawner was 0.81 and the 1990-99 broodyear recruit per spawner was 1.24 (NOAA 2008 SCA). Interior TRT recommends minimum abundance threshold of 3,000 natural origin spawners, with no fewer than 2,500 natural origin spawners in the mainstem Snake River. The HSRG (2009) estimated habitat productivity ($R/S_{max}$) and capacity as 2.95 and 7,125, respectively.<br><br>Hatchery returns to the Snake River basin have ranged from 1,800 to 18,000 for the years 1995 to 2005. Hatchery smolt-to-adult survival has been > 1% for release years after 1995, where previously it was often < 0.5% (Appendix B Tables 5 and 6 and Figure 8). |
| *Habitat* | *Low*. Only 10 to 15% or less of historical spawning and rearing habitat remains (NOAA 2008_SCA). Present habitat includes mainstem Snake River downstream of Hells Canyon Dam and the lower reaches of the Tucannon, Grande Ronde, Imnaha, Salmon, and Clearwater River subbasins. |
| *Harvest* | *Medium*. For yearling on-station release, 33% of all coded-wire tag recoveries were in the ocean fisheries, and 17% in Columbia River fisheries for release years 1989-1998 combined (Table 7 of HGMP).<br><br>The Pacific Salmon Commission uses the subyearling release and recovery data from Lyons Ferry Hatchery as surrogate for wild fish. For the 2003-2006 catch years, total fishing mortality (ocean and freshwater combined) was estimated as 27.8% (Table E.72 of Pacific Salmon Commission Technical Report, December 2008).<br><br>Within the Columbia/Snake rivers, harvest rate is abundance based where harvest ranges from 21.5% to 45% depending on expected upriver bright and Snake River natural returns to the mouth of the Columbia River (Table A.3 of 2008-2017 *U.S. v Oregon* Management Agreement).<br><br>The last fishery on fall Chinook in the Snake River was 1988 followed by a more recent limited opening in 2008 (see "Benefits" section of this report on fall Chinook). |

| | |
|---|---|
| | The harvest contribution value used by HSRG (2009) was 18,767. Total exploitation rate averaged 75% from 1986-91, and 45% from 1992-2006 (NOAA 2008 SCA). |
| **Hatchery Program** | |
| *Facilities* | Lyons Ferry FH (WDFW) and satellite facilities managed by the Nez Perce Tribe (Captain John, Pittsburgh Landing, Big Canyon). Eggs are also transferred to Umatilla, Oxbow and Irrigon hatcheries. |
| *Type* | Integrated |
| *Authorization and Funding* | LSRCP and BPA |
| *Primary Purpose* | Harvest and Conservation. The primary purpose for the hatchery program is mitigation for losses to fisheries from construction of the four Federal Dams on the lower Snake River and to maintain fisheries. However, because of the depressed population status, the program has focused conservation and restoration, but harvest in the Snake River was first allowed in 2008 because of substantial increases in abundance. |
| *Secondary Purposes* | Conservation |
| *Broodstock Origin(s)* | Snake River at Ice Harbor and Lower Granite dams. |

## *Table 2. Tucannon River spring Chinook (natural; Lyons Ferry FH and Tucannon FH)*

| **Management Premises and Goals** | |
|---|---|
| *ESA Status* | *Threatened*. Included with the Snake River Spring/Summer Chinook ESU (ESA Listed 1992 and reaffirmed 2005). |
| *Biological Significance* | *High*. The Tucannon River spring Chinook population is part of the Snake River spring/summer ESU which has 5 major population groupings. The Tucannon population is one of two historic populations in the lower Snake River (the other historic population is Asotin Creek which is considered functionally extinct by the TRT). For the HSRG review, the population has been classified as Primary. |
| *Population Viability* | *Low (natural) to Medium (hatchery)*. The Tucannon River population is considered at high risk. The population is classified by the ICTRT as an "Intermediate" population with recovery goal of 750 spawners. Recent abundance (number of adult spawning in natural production areas) has ranged from 897 in 2002 to 11 in 1995, with the return/spawner averaging 1.23 for brood year 1985-2003 (Appendix B Table 22). Recent 20-year average recruit per spawner was 0.72, and the 10-year geometric mean abundance for 1997-2006 was 82 naturally produced adults (NOAA 2008 SCA). Hatchery returns have ranged from 25 to 830 with return/spawner averaging 2.25 for brood years 1985-2003 (Appendix B |

| | |
|---|---|
| | Table 22). The HSRG (2009) estimated habitat productivity and capacity as 2.2 and 550, respectively. |
| *Habitat* | *Poor to Good*. Tucannon River spring/summer Chinook typically spawn and rear above RKM 40. Limiting factors such as water temperature, channel stability, sediment, and instream habitat are known to exist in the basin (WDFW unpublished data), but the extent of these problems is unquantified. |
| *Harvest* | *Low*. There is very little tribal, or sport harvest benefit inside the project area (Snake River and Tucannon River). Currently, Tucannon River spring Chinook are not adipose-fin clipped and are not available for mark-selective fisheries. The ocean fishery mortality is very low (near zero) and the incidental take of natural-origin upriver spring/summer Chinook in the Columbia River harvest averaged 10.2% since 2001 (NOAA 2008 SCA). The harvest contribution value used by HSRG (2009) for the current program was 88. |
| **Hatchery Program** | |
| *Facilities* | Lyons Ferry FH and Tucannon FH. |
| *Type* | Integrated. |
| *Authorization and Funding* | LSRCP |
| *Primary Purpose* | Harvest and Conservation. The primary purpose for the hatchery program is mitigation for losses to fisheries from construction of the four Federal Dams on the lower Snake River and to restore tribal and recreational fisheries. However, because of the depressed population status the current operation is conservation and restoration. |
| *Secondary Purposes* | Conservation |
| *Broodstock Origin(s)* | Tucannon River |

## *Table 3. Asotin Creek spring Chinook (natural)*

| **Management Premises and Goals** | |
|---|---|
| *ESA Status* | *Threatened* . Included with the Snake River Spring/Summer Chinook ESU. The Asotin Creek population is considered "functionally extirpated" by the Interior Columbia Technical Recovery Team (ICTRT). |
| *Biological Significance* | *Low to Moderate.*. The Asotin Creek population is one of two historic populations in the lower Snake River of Washington (the other historic population is Tucannon River). Asotin Creek was recently considered functionally extinct by the TRT. For the HSRG review, the population has been classified as Stabilizing. |
| *Population* | *Very Low*. The Asotin Creek population is considered at high risk. Very few spring |

| | |
|---|---|
| *Viability* | Chinook spawn in Asotin Creek. The population is not currently viable. The ICTRT analysis categorized the historic habitat potential of Asotin Creek as a "basic" rating, and a minimum abundance threshold criteria of 500 naturally produced spawners. The HSRG (2009) estimated habitat productivity and capacity as 2.3 and 467, respectively. |
| *Habitat* | *Low*. Asotin Creek has been modified by land and water use, and the migration corridor through the Snake and Columbia Rivers has been highly modified by dams, inundation, and regulated water flows. |
| *Harvest* | *Low*. Naturally produced fish are generally protected from harvest in fisheries. Also, this is a relatively small population. However, some incidental harvest may occur in non-selective tribal fisheries in the Columbia River, and some angling mortality may occur in ocean and river recreational fisheries. The ocean fishery mortality is very low (near zero), and the incidental take of natural-origin upriver spring/summer Chinook in the Columbia River harvest averaged 10.2% since 2001 (NOAA 2008 SCA). The harvest contribution value used by HSRG (2009) for the current program was 11. |

### *Table 4. Walla Walla River spring Chinook (extirpated)*

| **Management Premises and Goals** | |
|---|---|
| *ESA Status* | *Extirpated* |
| *Biological Significance* | Not applicable |
| *Population Viability* | Not applicable |
| *Habitat* | *Poor to Good*. Walla Walla River has been modified by land and water use, and the migration corridor through the Walla Walla and Columbia Rivers has been highly modified by dams, inundation, and regulated water flows. Habitat can be in excellent condition in the undeveloped headwaters, but low-elevation reaches have thermal and flow barriers, and degraded habitat.. |
| *Harvest* | Not applicable |

***Table 5. Walla Walla River hatchery spring Chinook, Carson NFH stock (Umatilla Tribal Hatchery)***

| **Management Premises and Goals** | |
|---|---|
| *ESA Status* | *Not Listed.* Carson hatchery stock were not included in any ESU. |
| *Biological Significance* | *Low.* The original natural population is extirpated. Confederated Tribes of the Umatilla Indian Reservation are re-introducing spring Chinook salmon using Carson NFH stock. |
| *Population Viability* | *Unknown.* This is a new, reintroduced stock, and little data are available. 250,000 yearling smolts are transferred annually from Carson NFH to the Walla Walla River for direct stream release. The HSRG (2009) estimated habitat productivity and capacity as 4.0 and 443, respectively |
| *Habitat* | *Poor to Good*. Walla Walla River has been modified by land and water use, and the migration corridor through the Walla Walla and Columbia Rivers has been highly modified by dams, inundation, and regulated water flows. Habitat can be in excellent condition in the undeveloped headwaters, but low-elevation reaches have thermal and flow barriers, and degraded habitat. |
| *Harvest* | *Low.* This is a new, reintroduced stock, and little data are available. The harvest contribution value used by HSRG (2009) for the current program was 190. The ocean fishery mortality is very low (near zero), and incidental take of natural-origin upriver spring/summer Chinook in the Columbia River harvest averaged 10.2% since 2001 (NOAA 2008 SCA). |
| **Hatchery Program** | |
| *Facilities* | Umatilla Tribal Hatchery and Carson National Fish Hatchery. Hatchery program releases first occurred in 2005 from brood year 2003 fish. Before 2003, spring Chinook adults collected from Ringold Hatchery were released into the Walla Walla. |
| *Type* | Segregated |
| *Authorization and Funding* | BPA and Mitchell Act |
| *Primary Purpose* | Re-introduction. The purpose of the Walla Walla program is to help mitigate for fish losses in the Columbia River Basin associated with development of the federal Columbia River hydropower system and other basin development. |
| *Secondary Purposes* | Harvest |
| *Broodstock Origin(s)* | Carson hatchery stock. Carson hatchery stock was started with natural-origin spring Chinook salmon trapped during upstream migration at Bonneville Dam, 1955-1964 and brought to Carson NFH for artificial propagation. |

### *Table 6. Touchet River summer steelhead (natural; endemic -Lyons Ferry FH)*

| **Management Premises and Goals** | |
|---|---|
| *ESA Status* | *Threatened*. Included with the mid-Columbia Steelhead DPS *(ESA Listed in 1999, reaffirmed 2006)*. |
| *Biological Significance* | *High.* Subbasins in this mid-Columbia River ESU include Yakima, Klickitat, Deschutes, John Day, Umatilla, and Walla Walla rivers (including Touchet River). On the basis of genetic and geographic data, the ICTRT designated the Touchet River as an independent population. For the HSRG review, the population has been classified as Primary. |
| *Population Viability* | *Low to Medium (Unknown).* TRT classified spatial structure in the Touchet River as "branched discontinuous, intermediate in size with one major spawning area". The HSRG (2009) estimated habitat productivity and capacity as 1.7 and 691, respectively. Current returns to the Touchet River estimated at 400-500 adults, with 10 to 20% of those fish from both the endemic hatchery and Lyons Ferry FH programs. Recent smolt-to-adult survival for the endemic program was 0.5% (BY2005). Recovery goal is 1,000 natural-origin adults.<br><br>Estimated smolt-to-adult (upstream of McNary Dam) survival rate of PIT tagged fish from the endemic hatchery program averaged 0.30 for years 2004-2006 smolt migration year (Table 2 of WDFW draft 2008 evaluation report). |
| *Habitat* | *Low to Medium*. All spawning occurs in the middle and upper reaches of the Touchet River (above the Coppei Creek confluence). Habitat in the lower river is unsuitable because of high temperatures, high embeddedness/sedimentation, and low flows. |
| *Harvest* | *Low*. Hatchery-origin fish from the endemic program are not fin clipped for selective fishery. Few steelhead (assumed zero) are caught in ocean fisheries. The recent Columbia River harvest rates on A-run steelhead in non-Indian and treaty Indian fisheries ranged from 1.0% to 1.9% and 4.1% to 12.4%, respectively (NOAA 2008 SCA). An incidental terminal harvest rate of 10% has been estimated for Touchet River NORs (HSRG 2009). The harvest contribution value used by HSRG (2009) for the current program was 60. |
| **Hatchery Program** | |
| *Facilities* | Touchet River adult collection facility and Lyons Ferry FH. |
| *Type* | Integrated |
| *Authorization and Funding* | LSRCP |
| *Primary Purpose* | Research. Long-term goal: Harvest, if results from the research demonstrate feasibility of the program to meet mitigation goals. |
| *Secondary Purposes* | Conservation |
| *Broodstock Origin(s)* | Touchet River in year 2000 |

### *Table 7. Walla Walla summer steelhead (natural)*

| **Management Premises and Goals** | |
|---|---|
| *ESA Status* | *Threatened.* Included with the mid-Columbia Steelhead DPS. |
| *Biological Significance* | *High.* Subbasins in this mid-Columbia River ESU include Yakima, Klickitat, Deschutes, John Day, Umatilla, and Walla Walla rivers (including Touchet River). On the basis of genetic and geographic data, the TRT designated the Walla Walla River as an independent population. For the HSRG review, the population has been classified as Primary. The abundance of the historical Walla Walla River steelhead population has been estimated at about 2,700 fish (HSRG 2009). |
| *Population Viability* | *Low to Medium (Unknown).* The ICTRT classified the Walla Walla River population at moderate risk and intermediate in size with five major and six minor spawning areas. Recovery goal is 1,000 naturally produced adults. HSRG (2009) estimated habitat productivity and capacity as 1.84 and 2,180, respectively. The estimated annual spawning escapement for Walla Walla steelhead, upstream of Nursery Bridge, averaged 389 natural (range 224-722) and 14 hatchery origin (range 2-29) for the years 1992-93 to 2000-01 (Table 4-6 of 2004 subbasin plan). Video counts in 2001-02 and 2002-03 were 1,205 and 547 total steelhead, respectively. Video did not distinguish natural- from hatchery-origin fish, but based on previous counts at Nursery Bridge, the number of Lyons Ferry stock fish spawning in this area appears to be small |
| *Habitat* | *Low to Medium*. Although substantially reduced from historic times, spawning is widely distributed within the North and South Forks and the upper mainstem of the Walla Walla River, Couse Creek, middle and upper Mill Creek, and upper Dry Creek (Recovery Plan for Oregon's Middle Columbia River Steelhead 2006). Natural-origin steelhead do not spawn in the mainstem Walla Walla River from the mouth to the Dry Creek confluence because of high water temperatures, high embeddedness/sedimentation, and low flows. |
| *Harvest* | *Low.* Few steelhead (assumed zero) are caught in ocean fisheries. The recent Columbia River harvest rates on A-run steelhead in non-Indian and treaty Indian Fisheries ranged from 1.0% to 1.9% and 4.1% to 12.4%, respectively (NOAA 2008 SCA). An incidental terminal harvest rate of 3% has been estimated for Walla Walla River natural-origin adults (HSRG 2009). The harvest contribution value used by HSRG (2009) for the current program was 25. |

### *Table 8.Tucannon River summer steelhead (natural; endemic - Lyons Ferry FH)*

| **Management Premises and Goals** | |
|---|---|
| *ESA Status* | *Threatened.* Included with the Snake River Steelhead DPS (ESA Listed in 1997 and reaffirmed 2006). |
| *Biological Significance* | *High.* Subbasins in this ESU include Tucannon, Clearwater, Grande Ronde, Imnaha, and Salmon rivers. The Lower Snake River includes the Tucannon River population (also includes nearby streams Alali, Almohta, Penawawa, and Apowa creeks) and Asotin Creek. There are no reliable estimates of the percentage of fish that historically have returned to the Tucannon River; however, EDT modeling of historic habitat conditions indicates the |

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|---|---|
| | subbasin may have supported over 6,000 adult steelhead (Draft Snake River Recovery Plan 2007). WDFW has suggested historic run sizes on the order of 3,400 fish. For the HSRG review, the population has been classified as Primary. |
| *Population Viability* | *Low to Medium*. TRT classified spatial structure in the Tucannon as "branched discontinuous". Population and habitat in the Tucannon River was "intermediate" in size with one major and two minor spawning areas. Recent 20-year average recruit per spawner estimated at 1.09 (NOAA 2008 SCA). Current returns to the Tucannon River estimated at 600-800 adults, with 50% of those fish from the endemic hatchery program. Recent smolt to adult survival for the endemic hatchery program was 1.3% for brood year 2005. Recovery goal is 1,000 naturally produced adults. HSRG (2009) estimated habitat productivity and capacity as 1.8 and 275, respectively.<br><br>Estimated smolt to adult (upstream of McNary Dam) survival rate of PIT tagged naturally produced smolts averaged 1.75% for 1999-2006 smolt migration years (Table 1 of WDFW 2008 draft evaluation report). For the endemic hatchery program, smolt-to-adult return rates for PIT tagged fish averaged 0.66 for 2004-2006 release years (Table 2 of WDFW 2008 draft evaluation report). |
| *Habitat* | *Low to Medium*. Spawning has been observed from RM 3 upstream to RM 52, and in Tumalum, Cummings, Little Tucannon, Pataha and Panjab creeks. Populations have extensive temperature and habitat limitations. |
| *Harvest* | *Low*. Hatchery-origin fish from the endemic program are not fin clipped for selective fishery. Few steelhead (assumed zero) are caught in ocean fisheries. The recent Columbia River harvest rates on A-run steelhead in non-Indian and treaty Indian Fisheries range from 1.0% to 1.9% and 4.1% to 12.4%, respectively (NOAA 2008 SCA). The harvest contribution value used by HSRG (2009) for the current program was 91. |
| **Hatchery Program** | |
| *Facilities* | Tucannon FH and Lyons Ferry FH |
| *Type* | Integrated |
| *Authorization and Funding* | LSRCP |
| *Primary Purpose* | Research. Long-term goal: Harvest, if results from the research demonstrate feasibility of the program to meet mitigation goals |
| *Secondary Purposes* | Conservation |
| *Broodstock Origin(s)* | Tucannon River in year 2000 |

### *Table 9. Asotin Creek summer steelhead (natural)*

| **Management Premises and Goals** | |
|---|---|
| *ESA Status* | *Threatened.* Included with the Snake River Steelhead DPS. |
| *Biological Significance* | *High.* Subbasins in this ESU include Tucannon, Clearwater, Grande Ronde, Imnaha, and Salmon rivers. The Lower Snake River includes the Tucannon River population (also includes nearby streams Alali, Almohta, Penawawa, and Apowa creeks) and Asotin Creek. EDT modeling of historic steelhead production indicates that the stream may have produced over 2,500 adults (HSRG 2009). For the HSRG review, the population has been classified as Primary. |
| *Population Viability* | *Low to Medium.* The ICTRT classified spatial structure in Asotin Creek as "branched continuous". Population and habitat in the Asotin was "basic" in size with two major and five minor spawning areas. Recovery goal is 500 naturally produced adults. HSRG (2009) estimated habitat productivity and capacity as 2.5 and 1,400, respectively. Recent 20-year average recruit per spawner estimated at 1.09 (NOAA 2008 SCA).<br><br>In 2006, 477 adult steelhead were recorded at the adult trap on Asotin Creek. Of the fish captured, 34 were of hatchery origin. Based on trap efficiency values, WDFW estimated that 555 adults spawned in the stream above the trap site that year (HSRG 2009). |
| *Habitat* | *Low to Medium*. Steelhead spawning has been observed in the upper mainstem Asotin Creek and in several tributaries (George Creek, Pintler Creek, Charlie Creek, and the North and South Forks). This population also includes steelhead in Alpowa, Almota, Steptoe, Tenmile and Couse creeks. Habitat has temperature limitations. |
| *Harvest* | Low. Few steelhead (assumed zero) are caught in ocean fisheries. The recent Columbia River harvest rates on A-run steelhead in non-Indian and treaty Indian Fisheries range from 1.0% to 1.9% and 4.1% to 12.4%, respectively (NOAA 2008 SCA). The harvest contribution value used by HSRG (2009) for the current program was 38. |

### *Table 10. Lower Grande Ronde River summer steelhead (natural)*

| **Management Premises and Goals** | |
|---|---|
| *ESA Status* | *Threatened.* Included with the Snake River Steelhead DPS. |
| *Biological Significance* | *High.* This population includes natural-origin steelhead in the Grande Ronde River and tributaries downstream from the Wallowa River, including the Wenaha River. For the HSRG review, the population has been classified as Primary. |
| *Population Viability* | *Low to Medium.* Limited redd counts and fishery observations indicate that this population is persistent and well distributed but likely much less abundant than historically. Recent 20-year average recruit per spawner estimated as 1.09 (NOAA 2008 SCA). The ICTRT classifies this population as Intermediate. HSRG (2009) estimated habitat productivity and capacity as 3.9 and 1,951, respectively. Adult escapement to the Lower Grande Ronde River and tributaries has been estimated at approximately 600 fish and recovery goal for |

| | |
|---|---|
| | abundance at 1,000 fish (HSRG 2009). |
| *Habitat* | *Low to High.* The headwater areas of the Wenaha River are used for spawning and rearing, are located within a designated wilderness area, and remain in nearly pristine condition. Other tributaries have been impacted by land use including forestry and agriculture. The lower Grande Ronde River has been modified by land and water use, and the migration corridor through the Snake and Columbia Rivers has been highly modified by dams, inundation, and regulated water flows. The ICTRT classified the lower Grande Ronde River as Intermediate in size with two major and five minor spawning areas. Recovery goal is 1,000 naturally produced adults. |
| *Harvest* | *Low to Moderate.* Natural-origin steelhead are protected in recreational fisheries. Few steelhead (assumed zero) are caught in ocean fisheries. The recent Columbia River harvest rates on A-run steelhead in non-Indian and treaty Indian Fisheries range from 1.0% to 1.9% and 4.1% to 12.4%, respectively (NOAA 2008 SCA). The harvest contribution value used by HSRG (2009) for the current program was 135. |

### *Table 11. Joseph Creek summer steelhead (natural)*

| **Management Premises and Goals** | |
|---|---|
| *ESA Status* | *Threatened.* Included with the Snake River Steelhead DPS. |
| *Biological Significance* | *High.* Genetic surveys by NOAA NW Fisheries Science Center identified Joseph Creek as a unique population within the Grande Ronde River (Paul Moran, NOAA Fisheries, unpublished). The watershed is reserved for wild fish production only; therefore, no hatchery fish are released to the stream. For the HSRG review, the population has been classified as Primary. |
| *Population Viability* | *Low to Medium.* Limited redd count and fishery observations indicate that this population is persistent and well distributed but likely much less abundant than historically. ODFW biologists believe this population to be intact and resilient, but somewhat depressed in abundance. Recent 20-year average recruit per spawner estimated at 1.26 (NOAA 2008 SCA). The ICTRT classified the Joseph Creek population as a "Basic" population based on historical habitat potential (ICTRT 2005). Recovery goal for abundance is 500 adult fish. Recent estimates have put steelhead escapement at a little over 1,500 fish (Draft Snake River Recovery Plan as cited in HSRG 2009). The HSRG (2009) estimated habitat productivity and capacity as 3 and 3,500, respectively. |
| *Habitat* | *Excellent to poor.* Joseph Creek is largely contained in a rugged canyon where habitat remains in excellent condition, but the upper tributaries are on national forest land where habitat is in fair condition. The mainstem of the Grande Ronde River has been modified by land and water use, and the migration corridor through the Snake and Columbia Rivers has been highly modified by dams, inundation, and regulated water flows. |
| *Harvest* | *Low to moderate.* Natural-origin steelhead are protected in recreational fisheries. Few steelhead (assumed zero) are caught in ocean fisheries. The recent Columbia River harvest rates on A-run steelhead in non-Indian and treaty Indian Fisheries range from 1.0% to 1.9% and 4.1% to 12.4%, respectively (NOAA 2008 SCA). The harvest contribution value used by HSRG (2009) for the current program was 254. |

### *Table 12. Wallowa River summer steelhead (natural)*

| **Management Premises and Goals** | |
|---|---|
| *ESA Status* | *Threatened.* Included with the Snake River Steelhead DPS. |
| *Biological Significance* | *High*. The Wallowa River population includes the steelhead in the Minam and Lostine Rivers, Wallowa River and tributaries. For the HSRG review, the population has been classified as Primary. |
| *Population Viability* | *Low to Medium.* Limited red count, adult trapping, and fishery observations indicate that this population is persistent and well distributed but likely much less abundant than historically. Wild adult escapement to the Wallowa River and tributaries has been estimated at approximately 1,200 fish (NPPC 2004 as cited in HSRG 2009). Recent 20-year average recruit per spawner estimated at 1.28 (NOAA 2008 SCA). The ICTRT classifies this population as Intermediate. Recovery goal for abundance is 1,000 adult fish. HSRG (2009) estimated habitat productivity and capacity as 2.9 and 2,000, respectively. |
| *Habitat* | *Excellent to poor.* The headwater areas used for spawning and rearing in the Minam and Lostine Rivers are located within designated wilderness area and remain in nearly pristine condition. Most other tributaries and the mainstem of the Wallowa River have been modified by land and water use, and the migration corridor through the Snake and Columbia Rivers has been highly modified by dams, inundation, and regulated water flows. |
| *Harvest* | *Low to Moderate*. Natural-origin steelhead are protected in recreational fisheries. Few steelhead (assumed zero) are caught in ocean fisheries. The recent Columbia River harvest rates on A-run steelhead in non-Indian and treaty Indian Fisheries range from 1.0% to 1.9% and 4.1% to 12.4%, respectively (NOAA 2008 SCA). The harvest contribution value used by HSRG (2009) for the current program was 139. |

### *Table 13. Upper Grande Ronde River summer steelhead (natural)*

| **Management Premises and Goals** | |
|---|---|
| *ESA Status* | *Threatened.* Included with the Snake River Steelhead DPS. |
| *Biological Significance* | *High.* This population includes natural origin steelhead in the upper Grande Ronde River, including Catherine and Lookingglass Creeks. For the HSRG review, the population has been classified as Primary. |
| *Population Viability* | *Low to Medium.* Limited red count, adult trapping, and fishery observations indicate that this population is persistent and well distributed, but likely much less abundant than historically. Recent 20-year average recruit per spawner estimated at 0.93 (NOAA 2008 SCA). The ICTRT classified the Upper Grande Ronde River population as a "Large" population based on historical habitat potential (ICTRT 2005). Recent estimates have put steelhead escapement at a little over 1,800 fish (Draft Snake River Recovery Plan as cited in HSRG 2009). Recovery goal is 1,500. HSRG (2009) estimated habitat productivity and capacity as 1.8 and 3,665, respectively. |
| *Habitat* | *Low to High.* The headwater areas used for spawning and rearing in Catherine Creek are |

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| | located within a designated wilderness area and remain in nearly pristine condition. Most other tributaries and the mainstem of the Grande Ronde River have been modified by land and water use, and the migration corridor through the Snake and Columbia Rivers has been highly modified by dams, inundation, and regulated water flows. |
| *Harvest* | *Low to Moderate.* Natural-origin steelhead are protected in recreational fisheries. Few steelhead (assumed zero) are caught in ocean fisheries. The recent Columbia River harvest rates on A-run steelhead in non-Indian and treaty Indian Fisheries range from 1.0% to 1.9% and 4.1% to 12.4%, respectively (NOAA 2008 SCA). The harvest contribution value used by HSRG (2009) for the current program was 149. |

### *Table 14. Lyons Ferry hatchery summer steelhead (Lyons Ferry FH)*

| **Management Premises and Goals** | |
|---|---|
| *ESA Status* | *Not listed*. NOAA Fisheries excluded this stock from any existing ESUs |
| *Biological Significance* | *Low*. This hatchery stocks represents an admixture of hatchery fish from the upper Columbia River (Wells Hatchery stock) and Snake River (Wallowa Hatchery stock). |
| *Population Viability* | *High*. A large number of returning hatchery origin adults are trapped each year at Lyons Ferry FH for broodstock. Currently, about 2,000 fish return annually to the hatchery of which 40% are from on station releases at Lyons Ferry FH, 25% are from releases in the Touchet River, 25% are from releases in the Walla Walla River, and 10% are from releases in the Tucannon River, most of which (1,000-1,200) are eventually returned to the Snake River for the fishery.<br><br>For the Lyons Ferry on-station release, mean smolt-to-adult survival back to the Snake River project area was 1.7%, brood years 1982-2003. For the Touchet River release, mean smolt-to-adult survival back to the Snake River project area was 1.6% for brood years 1987-2003. For the Walla Walla River release, smolt-to-adult survival back to the Snake River project area was 1.5% for brood years 1989-2003. For the Tucannon River release, smolt-to-adult survival back to the Snake River project area was 1.4%, brood years 1989-2003. Estimated recruits-per-spawner for all release sites combined are approximately 15 adult recruits per adult spawned at Lyons Ferry FH. |
| *Habitat* | The Lyons Ferry FH steelhead stock relies strictly on the mainstem Columbia and Snake rivers for migration. This habitat is significantly compromised by a series of six mainstem dams and pools. Returning adult steelhead must volitionally enter the hatchery from the pool behind Lower Monumental Dam on the Snake River. |
| *Harvest* | *High*. WDFW estimates annual harvest in the Snake River project area to be about 11,600 steelhead for the years 1985 to 2006. The WDFW creel census reports appear to reflect contribution from Lyons Ferry hatchery, Cottonwood Pond, and additional interception of steelhead destined to return to upstream release sites in Oregon and Idaho.<br><br>Based upon a release of 345,000 smolts @ 1.7% smolt-to-adult survival would return approximately 6,000 adults to project area; 60% harvest rate would be about 3,600 harvested. |

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|---|---|
| | Few steelhead (assumed zero) are caught in ocean fisheries. The recent Columbia River harvest rates on A-run steelhead in non-Indian and treaty Indian Fisheries range from 1.0% to 1.9% and 4.1% to 12.4%, respectively (NOAA 2008 SCA). The terminal harvest rate on hatchery-origin recruits (HORs) has been estimated at 30% (CBFWA Program Amendment Process 2007 cited in HSRG 2009). |
| **Hatchery Program** | |
| *Facilities* | Lyons Ferry FH, Dayton Pond |
| *Type* | Segregated. Between 300 and 400 hatchery-origin adult steelhead are spawned at Lyons Ferry FH each year, which yields approximately 345,000 smolts for the entire program, of which 60,000 smolts are released on site at Lyons Ferry FH, 100,000 smolts are released in the Tucannon River, 85,000 are released in the Touchet River, and 100,000 smolts are released in the Walla Walla rivers). |
| *Authorization and Funding* | LSRCP |
| *Primary Purpose* | Harvest |
| *Secondary Purposes* | None |
| *Broodstock Origin(s)* | Wells Hatchery stock (WDFW) and Wallowa Hatchery stock (ODFW). |

### *Table 15. Cottonwood Creek hatchery summer steelhead (Lyons Ferry FH)*

| **Management Premises and Goals** | |
|---|---|
| *ESA Status* | *Not listed*. NOAA Fisheries excluded this stock from any existing ESUs |
| *Biological Significance* | *Low*. This hatchery population was derived from the Wallowa Hatchery stock. |
| *Population Viability* | *High.* A large number of returning hatchery-origin adults are trapped each year at the trap on Cottonwood Creek for broodstock (currently about 800 to 2,000 fish annually). Smolt to adult survival back to the Snake River is 1.85%, brood years 1984-2003.<br><br>The spawning of 150 hatchery-origin adults yields approximately 160,000 smolts, resulting in approximately 3,000 adults (1.85% smolt-to-adult return rate which equals approximately 20 adult recruits per spawner. |
| *Habitat* | The Cottonwood Pond release relies strictly on the mainstem Columbia and Snake rivers for migration. This habitat is significantly compromised by a series of eight mainstem dams and pools. |

| | |
|---|---|
| *Harvest* | *High.* An estimated mean of approximately 3,000 hatchery-origin steelhead from this program are harvested per year in the Snake River project area, 1997-2003 broods. Few steelhead (assumed zero) are caught in ocean fisheries. The recent Columbia River harvest rates on A-run steelhead in non-Indian and treaty Indian Fisheries range from 1.0% to 1.9% and 4.1% to 12.4%, respectively (NOAA 2008 SCA). |
| **Hatchery Program** | |
| *Facilities* | Cottonwood Pond, adult trap on Cottonwood Creek, and Lyons Ferry FH |
| *Type* | Segregated |
| *Authorization and Funding* | LSRCP |
| *Primary Purpose* | Harvest |
| *Secondary Purposes* | None |
| *Broodstock Origin(s)* | Wallowa Hatchery stock which was developed from trapping adult steelhead at Ice Harbor and Little Goose dams in the early 1980s. |

### *Table 16. Wallowa hatchery summer steelhead (Irrigon FH, Wallowa FH)*

| **Management Premises and Goals** | |
|---|---|
| *ESA Status* | *Not listed* |
| *Biological Significance* | *Low.* Not included in the listed Snake River Steelhead DPS. |
| *Population Viability* | *High. H*atchery population is abundant and productive. The program has an R/S value of 15.0 (HSRG 2009). |
| *Habitat* | *Variable.* The hatchery population is negatively impacted by a modified migration corridor similar to natural populations. |
| *Harvest* | *Moderate to High.* All smolts produced from this program are marked for harvest. . Few steelhead (assumed zero) are caught in ocean fisheries. The recent Columbia River harvest rates on A-run steelhead in non-Indian and treaty Indian Fisheries range from 1.0% to 1.9% and 4.1% to 12.4%, respectively (NOAA 2008 SCA). Recreational and tribal fisheries in the Snake River Basin take approximately 60% of the hatchery steelhead that pass Lower Granite Dam. The harvest contribution value used by HSRG (2009) for the current program was 6,030. Example of catch distribution and escapement of 12,862 hatchery fish from 2004-05 run year, 1% Columbia River Tribal Treaty Net, 2% Columbia River sport, <1% Deschutes River sport, 68% Snake River and tributary sport, 2% stray, and 27% in-basin escapement and hatchery weir (ODFW 2005 Progress Report). |

| Hatchery Program | |
|---|---|
| *Facilities* | Irrigon and Wallowa FHs, Big Canyon satellite facility. |
| *Type* | Segregated. Irrigon Hatchery is a typical northwest steelhead production facility designed to rear one-year smolts using well water of fairly constant temperature. Incubation and early rearing take place in a hatchery building with final rearing in outdoor concrete raceways. The Big Canyon satellite facility consists of one large concrete acclimation ponds for final rearing and release of smolts produced at Irrigon Hatchery. Wallowa Hatchery includes an adult trap to capture returning adults for broodstock and two large concrete acclimation ponds for final rearing and release of smolts produced at Irrigon Hatchery. |
| *Authorization and Funding* | Authorized and funded through the Lower Snake River Compensation Plan |
| *Primary Purpose* | Harvest. The primary purpose for the Wallowa steelhead program is mitigation for losses to fisheries from construction of the four Federal Dams on the lower Snake River and to restore tribal and recreational fisheries. |
| *Secondary Purposes* | None |
| *Broodstock Origin(s)* | The Wallowa Hatchery stock originated from adult steelhead trapped at Ice Harbor and Little Goose dams in the early 1980s. |

### *Table 17. Oxbow hatchery (Snake River, Hells Canyon) summer steelhead (Oxbow FH, Niagara Springs FH)*

| Management Premises and Goals | |
|---|---|
| *ESA Status* | *Not listed*. Oxbow FH steelhead are not included with the *Snake River Steelhead DPS*. The ICTRT (2005) classified the Hells Canyon, Snake River population of A-run steelhead as *extirpated.* |
| *Biological Significance* | *Medium*. This hatchery stock represents the genetic legacy of extirpated steelhead populations indigenous to the Snake River basin upstream of Hells Canyon. The HSRG (2009) classified the natural population below Hells Canyon Dam as *stabilizing* based on residual spawning and rearing habitat. |
| *Population Viability* | *High.* The HSRG (2009) estimated R/S = 12.6 for hatchery-origin Oxbow A-run steelhead released in the Hells Canyon region of the Snake River. The HSRG (2009) estimated the habitat productivity and capacity for A-run steelhead in the Hells Canyon region of the Snake River as R/S = 2.0 and 500 natural-origin adults, respectively. |
| *Habitat* | *Low.* Historic spawning and rearing habitat for steelhead are blocked by the Hells Canyon complex of dams. Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers. |

| | |
|---|---|
| *Harvest* | *Moderate to High.* Few steelhead (assumed zero) are caught in ocean fisheries. The recent Columbia River harvest rates on A-run steelhead in non-Indian and treaty Indian Fisheries range from 1.0% to 1.9% and 4.1% to 12.4%, respectively (NOAA 2008 SCA). Oxbow A steelhead contribute to sport and tribal fisheries in the Little Salmon River, the lower Snake River, and the lower Columbia River. For brood years 1992 to 1999, the sport fishery annually harvested an average of 220 (range 0-1,757) Oxbow A-run steelhead released into the Salmon River from Magic Valley FH and 1,580 (range 0-6,808) Oxbow A-run steelhead released into the Salmon River from Hagerman NFH. |
| **Hatchery Program** | |
| *Facilities* | Oxbow FH, Hells Canyon trap, and Niagara Springs FH. Oxbow FH A-run steelhead have been used in the past to "backfill" Sawtooth and Pahsimeroi FH A-run stocks reared at Hagerman NFH and Magic Valley FH. |
| *Type* | *Segregated.* Hatchery-origin fish are collected for broodstock at Hells Canyon Dam. |
| *Authorization and Funding* | Idaho Power Company Mitigation. |
| *Primary Purpose* | *Harvest.* Oxbow FH steelhead are reared at the Niagara Springs FH and released into the Little Salmon River (275,000 smolts) to support harvest and in the Snake River at Hells Canyon Dam (525,000 smolts) to support fisheries in the lower Snake River and provide adult returns for broodstock. |
| *Secondary Purposes* | *Conservation.* Although not explicitly stated as a purpose, the Oxbow FH stock represents the genetic legacy of natural populations of steelhead that are now extirpated upstream of the Hells Canyon Dam complex. Resident (non-anadromous) populations of *Oncorhynchus mykiss* (rainbow/redband trout) remain in those historic areas upstream of Hells Canyon. |
| *Broodstock Origin(s)* | The Oxbow FH stock of steelhead originated from the Pahsimeroi FH Stock, which was developed from natural-origin adult steelhead trapped at Oxbow and Hells Canyon dams from 1966 through 1970. The hatchery stock developed at Pahsimeroi FH may have included some steelhead and rainbow trout native to the Pahsimeroi River. Steelhead from the Pahsimeroi stock were first released into Hells Canyon in the early 1990's and returning fish founded the Oxbow FH stock. The ICTRT (2005) classified the Hells Canyon, Snake River population of A-run steelhead as *extirpated.* |

## *Table 18. Lower Snake River rainbow trout: Tucannon River, Asotin Creek, lower Grande Ronde River (natural)*

| **Management Premises and Goals** | |
|---|---|
| *ESA Status* | *Not listed (non-anadromous resident form). However, r*ainbow trout occurring in anadromous fish waters can receive the same protective measures as steelhead under the *similarity of appearance* clause of the ESA (Sec. 4(e) ). Native populations of rainbow/redband trout upstream of natural anadromous fish barriers are currently excluded from ESA protections. |

| | |
|---|---|
| *Biological Significance* | Medium to High. Rainbow trout are sympatric with steelhead and interbreeding does occur |
| *Population Viability* | Low to Medium. Local populations persist. |
| *Habitat* | See the stock tables for Tucannon River, Asotin Creek, and lower Grande Ronde River steelhead, above. Smaller trout redds observed in upper reaches during steelhead spawning ground surveys presumed to be from rainbow trout (Joe Bumgarner, WDFW, pers. comm.) |
| *Harvest* | Recreational fishery, both catch- and- release and some harvest. Harvest of resident rainbow/redband trout is limited to two fish per day over eight inches minimum total length. Hatchery-reared trout released in ponds and lakes provide a popular fishing opportunity in lowland areas, and residual steelhead smolts are harvested as trout in the Snake River reservoirs and tributaries. |

### *Table 19. Walla Walla and Touchet River rainbow trout (natural)*

| **Management Premises and Goals** | |
|---|---|
| *ESA Status* | *Not listed (non-anadromous resident form). However, r*ainbow trout occurring in anadromous fish waters can receive the same protective measures as steelhead under the *similarity of appearance* clause of the ESA (Sec. 4(e) ). Native populations of rainbow/redband trout upstream of natural anadromous fish barriers are currently excluded from ESA protections. |
| *Biological Significance* | Medium to High. Rainbow trout are sympatric with Walla Walla River steelhead and interbreeding does occur (HSRG 2009) |
| *Population Viability* | Low to Medium. Local populations persist |
| *Habitat* | See the stock tables for Walla Walla River and Touchet River steelhead, above. Smaller trout redds observed in upper reaches during steelhead spawning ground surveys presumed to be from rainbow trout (Joe Bumgarner, WDFW, pers. comm.) |
| *Harvest* | Recreational fishery, both catch- and- release and some harvest. Harvest of resident rainbow/redband trout is limited to two fish per day over eight inches minimum total length.. Hatchery-reared trout released in ponds and lakes provide a popular fishing opportunity in lowland areas and residual steelhead smolts are harvested as trout in the Snake River reservoirs and tributaries. |

### *Table 20. Grande Ronde River rainbow trout (natural)*

| **Management Premises and Goals** | |
|---|---|
| *ESA Status* | *Not listed (non-anadromous). However, r*ainbow trout occurring in anadromous fish waters can receive the same protective measures as steelhead under the *similarity of appearance* clause of the ESA (Sec. 4(e)). Native populations of rainbow/redband trout upstream of natural anadromous fish barriers are currently excluded from ESA protections. |
| *Biological Significance* | *Medium to High.* |
| *Population Viability* | *Low to Medium*. Rainbow-redband trout persist throughout the Grande Ronde River Basin. Populations are locally abundant, particularly in wilderness streams including the Wenaha and Minam rivers, and the upper Lostine River Isolation of small populations due to passage barriers and streams dewatered by irrigation is a concern. |
| *Habitat* | *Low to High*. Habitat in several headwater streams is in wilderness areas and remains in nearly pristine condition. Other streams on public land provide fair habitat. Habitat is in excellent condition in the undeveloped headwaters, but low-elevation reaches have thermal and flow barriers and degraded habitat. |
| *Harvest* | *Low to moderate*. Fishing access is limited in many areas where rainbow-redband trout are abundant. Recreational harvest is restricted by state regulations designed to protect wild, native trout and juvenile steelhead. |

### *Table 21. Bull trout: Tucannon, Touchet, Grand Ronde, Asotin, Walla Walla, and Snake rivers (natural)*

| **Management Premises and Goals** | |
|---|---|
| *ESA Status* | *Threatened (1999)* |
| *Biological Significance* | *Medium to High* |
| *Population Viability* | *Low to Medium*. Bull trout persist in isolated populations in headwater areas of the Walla Walla, Touchet, Tucannon and Asotin Creek[39]. Populations are locally abundant. Redd counts in the upper Tucannon River have ranged from 57 to167 for the years 1991-2001 (additional redds also found in upper Tucannon River tributaries, for example Bear Cr, Panjab Cr. and Meadow Cr.). Surveys in Asotin Creek are intermittent where three redds were found in 1996 and 59 redds were found in 1999 (with nine additional redds in Cougar Creek). For the Walla Walla basin, redd counts have ranged from 300 to 750 for years 1994-2000 (combined total for South Fork Walla Walla, Mill Cr., and Touchet River). |

[39] *U.S. Fish and Wildlife Service (October 2002). Bull Trout (Salvelinus confluentus) Draft Recovery Plan, Portland, Oregon (Chapter 10: Umatilla and Walla Walla and Chapter 24: Snake River, Washington).*

| | |
|---|---|
| *Habitat* | *Low to Medium*. Habitat in the upper Tucannon is in wilderness area, and Mill Creek is a protected municipal watershed. Habitat is in excellent condition in the undeveloped headwaters, but low-elevation reaches have thermal and flow barriers and degraded habitat |
| *Harvest* | *Low*. Access is limited to areas where bull trout are abundant and harvest is prohibited by state regulations. |

## *Other Species of Concern*

***Table 22. Non-salmonid fish species native to the Snake, Wallowa, Touchet, Tucannon, and Grand Ronde watersheds[40, 41, 42, 43]***

| Common name | Scientific Name |
|---|---|
| Suckers | *Catostomus* sp. *(4 species)* |
| Chiselmouth | *Acrocheilus alutaceus* |
| Largescale sucker | *Catostomus macroheilus* |
| Dace | *Rhinichthys* sp. *(4 species)* |
| Sculpins | *Cottus* sp. (6 species) |
| Mountain whitefish | *Prosopium williamsoni* |
| Northern pikeminnow | *Ptychocheilus oregonensis* |
| Pacific lamprey[44] | *Lampetra tridentata* |
| Brook Lamprey | *Limper richardsoni* |
| River lamprey | *Lampetra ayresi* |
| Redside shiner | *Richardsonius balteatus* |
| Sandroller | *Percopsis transmontana* |
| Peamouth | *Mylocheilus caurinus* |
| White sturgeon | *Acipenser transmontanus* |

Avian predators commonly observed include gulls, bald eagle, osprey, great blue heron and kingfisher. River otters also occur in the region and have the potential to prey on program fish. Caspian tern and white pelican nesting colonies on artificial islands in Lake Wallula, near the mouths of the Snake and Walla Walla Rivers are known to take numerous hatchery salmon and steelhead smolts (Columbia River Bird Reports).

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*[40] Lower Snake mainstem Subbasin Plan, Table 2-1. Composite Resident Fish Species List and Sources of Data for the Lower Snake River. May 2004, pg 20 and 21.*

*[41] Walla Walla subbasin Plan, Table 2-3 Fish Species Present in the Walla Walla river subbasin May 2004 pg. 15 and 16.*

*[42] Grande Ronde Subbasin Plan may 2004. Appendix 2: Species Tables, Table 1. Fish Species known to occur in the Grande Ronde subbasin, pg 317.*

*[43] Tucannon subbasin Plan Table 2-2 Fish Species Present in the Tucannon Subbasin, pg.15 and 16, May 2004.*

*[44] Pacific lamprey is a "species of special concern".*

## *Relevant Salmon and Steelhead Hatcheries in the Region*[45,46]

### Lyons Ferry Fish Hatchery (Washington Department of Fish and Wildlife and LSRCP)

The Lyons Ferry FH is located along the Snake River at river mile (RM) 59.1, directly below the confluence of the Palouse River in Franklin County, Washington. The hatchery was constructed in 1984 under the LSRCP Program, as authorized by the Water Resources Development Act of 1976, Public Law 94-587, to offset fish losses caused by the construction and operation of four hydropower and transportation dams on the lower Snake River. Lyons Ferry FH was designed to rear 101,800 pounds (9,162,000 smolts) of fall Chinook salmon (90 fish per pound) for release.

The hatchery was completed and became operational in 1984. Initially it was operated as two separate facilities. Washington Department of Wildlife (WDW) operated the north hatchery, producing steelhead and rainbow trout. Washington Department of Fisheries (WDF) operated the south hatchery, rearing spring and fall Chinook. A merger of the two agencies in 1994 led to a merging of the two facilities, and has since been operated by WDFW through LSRCP funding.

The hatchery rears Snake River fall Chinook, Tucannon River spring Chinook, four stocks of steelhead, and two stocks of rainbow trout. The hatchery operates with 47 raceways, 3 - 2.1 acre rearing ponds, three 83 ft. x 10 ft. x 5 ft. adult raceways with enclosed spawning facilities incorporated over the center of these ponds. There are also two 18 ft. x 150 ft. x 4.3 ft. and two 21 ft. x 150 ft. x 4.3 ft. adult salmon holding ponds which will be divided into 8 ponds in the near future to improve broodstock management. There are 112 full stack heath incubators and the water supply comes from the Marmes pump (wells) facility with a full water right of 53,200 gpm at a constant 52 degrees F.

Four satellite acclimation facilities (see below) are associated with the hatchery: *Captain Johns Acclimation Facility* on the Snake River between Asotin, Washington and the mouth of the Grand Ronde River at RM 164 (fall Chinook release site); *Pittsburgh Landing Acclimation Facility* at RM 215 of the Snake River, approximately 31 miles downstream from Hells Canyon Dam (fall Chinook release site); *Cottonwood Creek Acclimation Facility* at RM 29 of the Grande Ronde River at Cottonwood Creek (steelhead release and adult broodstock collection site); and *Dayton Pond Acclimation Facility* at RM 53 of the Touchet River within the Walla Walla River watershed (steelhead release and adult broodstock collection site).

### Tucannon FH and Curl Lake Acclimation Facility (Washington Department of Fish and Wildlife and LSRCP)

The Tucannon FH is located along the Tucannon River, between the towns of Dayton and Pomeroy Washington, at RM 36 in Columbia County. Fish production began in 1949 by the Washington Department of Game. In 1983, construction began to remodel the hatchery as part of a transfer of ownership to the LSRCP.[47] In November 1986, construction was complete, and LSRCP has funded operations there ever since. The hatchery currently supports steelhead, spring Chinook, and resident

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[45] *See Figure 3.*

[46] *Descriptions of the facilities located in the Clearwater River Basin (Nez Perce Tribal Fish Hatchery, Big Canyon Fall Chinook Acclimation Project, Dworshak) that receive fall Chinook transfers from Lyons Ferry are described in the Team's Lower Snake NFH Assessments and Recommendations Report, http://www.fws.gov/Pacific/Fisheries/Hatcheryreview/index.html.*

[47] *The USFWS accepted the transfer of ownership from the Army Corps of Engineers on March 25, 1991.*

rainbow trout programs under the LSRCP. The Curl Lake Acclimation Facility is located along the Tucannon River at RM 41 in Columbia County, Washington. The construction of the Curl Lake facility was completed in February 1985. Curl Lake receives approximately 114,000 spring Chinook from Tucannon FH in February for acclimation and release in April.

### Captain Johns Acclimation Facility (Nez Perce Tribe and LSRCP/BPA)

This site is located at Captain John Rapids on the Snake River at RM 164 between Asotin, Washington and the mouth of the Grand Ronde River. The site is on the Washington side of the river, 20 miles upstream of Asotin, WA. The facility began operations in 1998. Lyons Ferry FH provides up to 150,000 yearling and 500,000 sub-yearling fall Chinook for acclimation and release from Captain Johns Acclimation Facility operated by the Nez Perce Tribe. Size at transfer is 12 fish per pound for yearlings and 65 - 75 fish per pound for sub-yearlings. Size at release goal for acclimated fall Chinook yearlings is 10.0 fish per pound, and 50 fish per pound for sub-yearlings.

### Pittsburgh Landing Acclimation Facility (Nez Perce Tribe and LSRCP/BPA)

Pittsburg Landing is located in the Hells Canyon National Recreation Area (HCNRA) near Whitebird, Idaho. The site is located on the Idaho side of the Snake River at River Mile (RM) 215, about 31 miles downstream of Hells Canyon Dam. The facility began operations in 1996. Lyons Ferry FH provides up to 150,000 yearling and 400,000 sub-yearling fall Chinook for acclimation and release from Pittsburg Landing Acclimation Facility operated by the Nez Perce Tribe. Size at transfer is 12 fish per pound for yearlings and 65 - 75 fish per pound for sub-yearlings. Size at release goal for acclimated fall Chinook yearlings is 10.0 fish per pound, and 50 fish per pound for sub-yearlings.

### Big Canyon Acclimation Facility

The Nez Perce Tribe operates and maintains three satellite facilities developed since 1996: two facilities on the Snake River and one facility at the confluence of Big Canyon Creek and the Clearwater River. Each satellite acclimates and releases fall Chinook smolts reared at Lyons Ferry Hatchery. Up to 150,000 yearling smolts are acclimated and released at each facility each year. Up to 1.8 million subyearling have also been acclimated and released by dividing them between the three satellite facilities. Fish released from the three satellite facilities are uniquely marked and returning adults are allowed to ascend upstream of Lower Granite Dam to spawn naturally.

### Cottonwood Pond Acclimation Facility (Washington Department of Fish and Wildlife and LSRCP)

Cottonwood Acclimation Facility is located along the Grande Ronde River at RM 28.7, immediately upstream of the confluence with Cottonwood Creek in Asotin County, Washington. Construction was completed in February 1985. It is presently used for acclimation and release of 160,000 summer steelhead (Wallowa Hatchery stock origin) into the Grande Ronde River at 4.5 fish per pound. Fish from Lyons Ferry FH are transferred to Cottonwood acclimation pond in February at seven fish per pound. This facility includes an adult trapping facility on Cottonwood Creek with a goal of collecting gametes from 50 females and 50 males, and then transporting those gametes to Lyons Ferry FH for fertilization, incubation, hatch, and rearing.

### Dayton Pond Acclimation Facility (Washington Department of Fish and Wildlife and LSRCP)

Dayton Acclimation Facility is located along the Touchet River at RM 53 in Columbia County, Washington. There is an adult trapping facility on the Touchet River just upstream of the acclimation pond at RM 53.3. Construction of the Dayton AF was completed in October 1986. It is presently used for acclimation and release of Lyons Ferry FH stock summer steelhead into the Touchet River. About 87,000 steelhead are transferred from Lyons Ferry FH to Dayton AF in mid-February for a release in April at 4.5 fish per pound. Trapping of Touchet River endemic stock begins in January or February (depending on seasonal weather) at the Dayton AF adult trap, located adjacent to the pond intake, and is completed by mid-April. Only a portion of unmarked adults are transferred to Lyons Ferry FH based on broodstock needs. Trapped Lyons Ferry FH stock steelhead will be returned downstream of the ladder. Lyons Ferry FH typically needs to spawn only 15 females to provide 65,000 green eggs for the program. Fish in excess to the interim program smolt goals (maximum 75,000 smolts) are planted into the Touchet River as fingerlings in the fall

### Oxbow Fish Hatchery (Idaho Power Company, IPC/ Idaho Department of Fish and Game)

The Oxbow Fish Hatchery is owned by Idaho Power Company and is located at Oxbow Dam on the Snake River. The IDFG operates the facility under contract. Idaho Power Company's current mitigation goal for steelhead production at Oxbow FH is to trap and spawn a sufficient number of adult steelhead to allow for the production of 200,000 lbs. of steelhead smolts at Niagara Springs FH. To produce the minimum 1.2 million eyed-eggs/ fry necessary to reach that goal, approximately 550 adult steelhead are trapped in the fall and held over winter. An additional 50 females or 10% of the broodstock are trapped the following spring. This provides for pre-spawning mortality, culling for disease management and manipulation of run timing. It will also provide a small surplus for use at Pahsimeroi FH and Sawtooth FH in the event that returns to their weirs do not meet production goals Steelhead spawning occurs in the spring and the resulting eggs and swim-up fry are transferred to Niagara Springs FH beginning in June.[48]

### Nez Perce Tribal Fish Hatchery (Nez Perce Tribe)

The Nez Perce Tribal Hatchery is located at river mile 38 (rkm 61) of the Clearwater River near the Cherry Lane Bridge. The hatchery is funded by BPA via the authority of the Northwest Power and Conservation Act. This facility mitigates for the loss of naturally-reproducing salmon in the Clearwater River subbasin resulting from hydroelectric development in the Columbia and Snake rivers. The purpose of the facility is to produce and release fish that will survive to adulthood, spawn in the Clearwater River subbasin, and produce viable offspring that will support future natural production, genetic integrity, and harvest opportunities. The hatchery includes satellite facilities on the lower South Fork Clearwater and lower Selway rivers, respectively. Those facilities are used to initiate restoration and reestablishment of "early-run" populations of fall Chinook salmon in the Clearwater River subbasin.

Fall Chinook production is targeted at 1.4 million subyearling juveniles. Targeted releases are: 1) 500,000 smolts on station to the Clearwater River (Site 1705) in June of the year. 2) Approximately 200K subyearling juveniles are transferred to the North Lapwai Valley acclimation facility in April for release to the Clearwater River in May. 3) 200,000 juveniles are transferred to the Lukes Gulch

[48] *Salmon River AOP, p 24*

acclimation facility in late April-early May and released to the South Fork Clearwater River in mid-June, and 4) 200,000 juveniles are transferred to the Cedar Flats acclimation facility in late April-early May and released to the Selway River in mid-June.

### Umatilla Hatchery (Idaho Power Company, IPC/ Oregon Department of Fish and Game)

Umatilla Hatchery is located adjacent to the Columbia River, 3.5 miles west of Irrigon, Oregon. The site is at an elevation of 277 feet above sea level, at latitude 45o 54' 79" N (45.9114) and longitude 119o 33' 28" W (119.5504). The site area is 23 acres, owned by the US Army Corps of Engineers. The Umatilla Hatchery was authorized under the Northwest Power Planning Council's (NPPC) Fish and Wildlife Program and began operation in 1991. Hatchery funding is provided by Bonneville Power Administration. The hatchery is used for egg incubation and rearing of spring Chinook, fall Chinook and summer steelhead.

Satellite facilities provide for broodstock collection and adult holding, as well as, juvenile acclimation. Three-Mile facility provides adult trapping and holding, and Minthorn and South Fork Walla Walla are used for adult holding. Juvenile acclimation occurs at Pendleton, Minthorn, Thornhollow, and Imeques facilities. The satellite facilities are maintained and staffed by the Confederated Tribes of the Umatilla Indian Reservation.

Programs include:

- Fall Chinook: Umatilla River Stock:: 550,000 eggs to Bonneville Hatchery and 600,000 sub-yearlings (13,500 pounds) for release into the Umatilla River. Snake River Stock: 800,000 sub-yearlings (16,000 pounds) for the Idaho Power Company for release into the Snake River below Hells Canyon Dam.

- Spring Chinook: Umatilla River Stock: 810,000 smolts (54,000 pounds) for acclimated release into the Umatilla River.

- Summer Steelhead: Umatilla River Stock: 150,000 smolts (31,313 pounds) for acclimated release into the Umatilla River.

# Lyons Ferry Fall Chinook

Operator: Washington Department of Fish and Wildlife

## Summary of Current Program

### *Goals*

- ***Harvest goal:*** No quantified "harvest" goal exists for this program separate from the LSRCP adult mitigation return goals. The total adult return goal under the LSRCP program is to return 18,300 hatchery-origin fall Chinook upstream of Ice Harbor Dam. Of those returning adults, approximately 3,600 adults are required for broodstock at Lyons Ferry FH, and the remaining fish are available to supplemental natural spawning in the Snake River or for harvest. Based on the draft fall Chinook management plan, the long-term goal is to return 24,750 hatchery-origin fall Chinook to the project area. The long-term goal includes fish resulting from LSRCP, Idaho Power, and Nez Perce Tribal hatcheries.

- ***Broodstock escapement goal:*** Collect approximately 3,400-3,500 fall Chinook adults (~1,600 females) and 200 jacks for broodstock for the Lyons Ferry fall Chinook salmon program. This is the total number of fish that must be collected to meet egg take goals listed in *Priority 17* of the current *US v OR* agreement. The number of broodstock collected/utilized is dependent upon fecundity and the number of strays intermixed in the broodstock (no greater than 5% of the broodstock utilized can be strays). Generally, between 3,000 and 5,000 fish are trapped at Lower Granite Dam and Lyons Ferry FH.

- ***Conservation goal:*** Conserve and perpetuate the unique Snake River fall Chinook population and its biological and genetic characteristics. The Snake River fall Chinook ESU, which includes Lyons Ferry fall Chinook, is listed as threatened under the ESA.

- ***Escapement goal for natural-origin adults:*** A minimum of 80% of all natural-origin adults must remain in the natural environment, with a maximum of 20% retained for broodstock, as measured at Lower Granite Dam. The ICTRT recommended recovery targets for Snake River fall Chinook adult abundance and productivity are 3,000 fish and 1.5 adult recruits per spawner, respectively. Of the 3,000 adult spawners, the ICTRT recommends that at least 2,500 of the fish spawn in the mainstem Snake River.

  The recovery goal for listed Snake River fall Chinook is under development**.** The Draft Fall Chinook Management Plan (June 2006)[49] states that the interim goal is to achieve a population of 7,500 natural-origin fall Chinook (adults and jacks) above Lower Monumental Dam. The long term goal is to achieve a population of 14,360 natural-origin fall Chinook (adults and jacks) above Lower monumental Dam.

- ***Research, education, and outreach goals:*** Provide surrogates for the wild fall Chinook population for various studies (e.g., juvenile downstream transportation studies). Provide accurate

[49] *The latest draft of the Fall Chinook Management Plan was dated 6/1/06 and was developed by a US v Oregon workgroup.*

information and educational opportunities for the public, media, schools, Tribal, State, and Federal agencies, and elected officials to enhance participation in understanding and stewardship of Lyons Ferry FH and LSRCP programs. The Dayton Lab monitors, evaluates, and coordinates fishery services and research activities for the Lyons Ferry FH Complex.

## *Objectives*

- Trap up to 5,000 adult fish at Lower Granite Dam and Lyons Ferry FH to provide 3,400-3,500 fall Chinook adults (1,600 females) and 200 jacks for broodstock for the program, for analyzing coded-wire tags for program evaluation, and for run reconstruction/composition purposes (this goal is the total number of fish that need to be trapped to meet egg take goals listed in *Priority 17* in the *US v OR* agreement).

- Spawn 1,600 females and 1,600 males to yield 4.95 million green eggs (4.6 million eyed eggs).

- Transfer 1,053,000 eyed eggs to ODFW and IDFG for Hells Canyon mitigation (842,000 eggs for Umatilla FH and 211,000 eggs for Oxbow FH, respectively).

- Transfer 421,000 eyed eggs to Irrigon FH (release goal of 400,000 subyearlings into the Grande Ronde River) as part of the LSRCP mitigation program.

- Utilize 345,000 eyed eggs at Lyons Ferry FH or transfer the eggs to Irrigon FH or Dworshak NFH to be reared for use in an US Army Corps of Engineers transportation study.

- Retain approximately 2.8 million eyed eggs for the LSRCP program releases in the Snake River (release locations in table below).

- Transfer and release smolts according to the table below. Available smolts in excess of program goals are combined with one of the groups in the table below, as determined by the comanagers.

***Proposed BY2008 Snake River fall Chinook tagging, transfers and releases:***

| Site | Priority *(US v. Oregon)* | Transfer Goal | Release Goal | Size (fish/ pound) | Age | Mark/CWT Elastomer | PIT Tags | Transfer/ Release Date |
|---|---|---|---|---|---|---|---|---|
| Oxbow Hatchery (Idaho Power Company (IPC)) | 9 | 211,000 | 200,000 | Eyed Eggs | 0+ | 100% AD CWT | 10,000 | Jan–Feb 2009 (transfer) |
| Umatilla Hatchery (IPC) | 15 (200k) 17 (600k) | 842,000 | 800,000 | Eyed Eggs | 0+ | 200K AD CWT 600K AD Only | NA | Jan–Feb 2009 (transfer) |
| Lyons Ferry FH /Irrigon FH /Dworshak NFH/research (transportation study) | 12 (250k) 14 (70k) | 345,200 | 328,000 | Eyed Eggs | 0+ | Unknown | 328,000 | Jan–Feb 2009 (transfer) |
| Lyons Ferry FH | 5 | 0 | 200,000 | 50 | 0+ | 100% AD CWT | 47,222 | May–Jun 2009 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Grande Ronde Direct Stream Release- Irrigon FH | 13 (200k) 16 (200k) | 421,000 | 400,000 | Eyed Eggs | 0+ | 200K ADCWT 200K Unmarked | 3,500 | Jan–Feb 2009 (transfer) |
| Capt. John | 6 | 500,000 | 100,000<br>100,000<br>300,000 | 50<br>50<br>50 | 0+<br>0+<br>0+ | CWT Only<br>AD CWT<br>Unmarked | 3,500 | Mar–Jun 2009 |
| Big Canyon | 7 | 500,000 | 100,000<br>100,000<br>300,000 | 50<br>50<br>50 | 0+<br>0+<br>0+ | CWT Only<br>AD CWT<br>Unmarked | 3,500 | Mar–Jun 2009 |
| Pittsburg Landing | 8 (200k) 10 (200k) | 400,000 | 100,000<br>100,000<br>200,000 | 50<br>50<br>50 | 0+<br>0+<br>0+ | CWT Only<br>AD CWT<br>Unmarked | 3,500 | Mar–Jun 2009 |
| Direct near Capt. John | 11 | 200,000 | 200,000 | 50 | 0+ | 100% AD CWT | 3,500 | June 2009 |
| Lyons Ferry FH | 1 | 450,000 | 450,000 | 10 | 1+ | 225K AD CWT VIE 225K CWT VIE | 30,000 | April 2010 |
| Capt. John | 4 | 155,000 | 150,000 | 12 | 1+ | 70K AD CWT 80K CWT Only | 5,000 | Feb - 2010 (transfer) |
| Pittsburg Landing | 2 | 155,000 | 150,000 | 12 | 1+ | 70K AD CWT 80K CWT Only | 5,000 | Mar 2010 (transfer) |
| Big Canyon | 3 | 155,000 | 150,000 | 12 | 1+ | 70K AD CWT 80K CWT Only | 5,000 | Mar 2010 (transfer) |

## *Program Description*

After the LSRCP program was established in 1976, WDFW initiated a fall Chinook egg bank development program for the Snake River to preserve and enhance the now listed Snake River fall Chinook population. The program originally was scheduled to produce 9.16 million fall Chinook subyearlings for release from Lyons Ferry FH, and stream release sites as part of Idaho Power Company (IPC) mitigation, at around 90 fish per pound. Currently the facility produces 1.8 million subyearlings at approximately 50 fish per pound, and another 900,000 yearlings at 10-12 fish per pound. Additionally, the facility traps and spawns returning adult fall Chinook to meet egg take needs elsewhere, which includes providing over 1,000,000 eggs (1.0 million smolts) annually for the IPC program. A program change was implemented in 2007 which includes 421,000 eyed eggs (400,000 smolts) from Lyons Ferry FH transfer to Oregon Fish and Wildlife (ODFW) for rearing at the Irrigon Hatchery. Adult trapping for the program occurred at Ice Harbor Dam between 1977 and 1993. Fall Chinook have been trapped on-site at Lyons Ferry FH since 1984 and at Lower Granite Dam since 1990.

Fall Chinook salmon production in the Clearwater River occurs through two programs –the LSRCP fall Chinook acclimation project and the Nez Perce Tribal hatchery.

# Assessment of Current Program

## *Operational Considerations*

Listed below are the principal operational components of the hatchery program that the Review Team considered as part of its review.

### Broodstock Choice and Collection

- Snake River fall Chinook are managed as one population across several facilities.
- Both the natural and hatchery populations of Snake River fall Chinook are listed as threatened under the Endangered Species Act.
- Two out of the three fall Chinook populations identified by the TRT are extinct (Marsing Reach and Salmon Falls). Snake River fall Chinook is the only remaining major population group for the Snake River fall Chinook ESU.
- The incidence of stray fish in the broodstock at Lyons Ferry FH began increasing until 1989 when it was determined after spawning that 41% of fish used for broodstock were strays from fall Chinook programs outside the Snake River basin. Moreover, the management agencies were concerned that strays were spawning in the wild with natural Snake River stock and the integrity of the natural population was being compromised. The 1989 brood year were not used as broodstock.
- In 1990, trapping also began at Lower Granite Dam to monitor and remove strays from the Snake River and to supplement broodstock for Lyons Ferry FH.
- As of 1990, WDFW began reading coded-wire tags to determine origin of fish prior to spawning. Until 2003, any fish of unknown origin were removed at Lower Granite Dam and excluded from the broodstock used for supplementation releases (to maintain the integrity of the natural population). Genetic sampling and characterization has been done and results indicate that Snake River stock reared at Lyons Ferry FH are indeed more similar to the original natural spawning population in the Snake River than the Columbia River stocks or the Snake River population during high stray rate years.
- In 1993, trapping ceased at Ice Harbor dam because of the high number of strays from the Columbia River that were detected during a three-year radio telemetry project and verified through coded-wire tag analyses.
- In 2003, the program began including unmarked/untagged females in the broodstock in an effort to include natural-origin fall Chinook and untagged in-basin hatchery-origin fish in production. Scale analysis was used in an attempt to differentiate natural-origin from unmarked/untagged hatchery-origin fish, but as of 2007, it was unable to determine in-basin from out-of-basin hatchery fish. In 2004, unmarked/untagged females (both hatchery and natural-origin) from both trapping locations (Lyons Ferry FH and Lower Granite Dam) were used for broodstock. DNA was used in 2007 to

determine origins of untagged hatchery fish, but it was only able to assign origins to approximately 30% of the fish with 85% confidence. WDFW is seeking to identify ways to tag more fish prior to release for a more accurate determination of origin of returning adults.

- Since 2005, natural-origin males have been incorporated in the broodstock.
- As of 2008, WDFW increased the priority for trapping at Lower Granite Dam to increase the proportion of natural-origin broodstock and now "backfill" with fish trapped at Lyons Ferry FH. Historically, trapping was maintained at Lyons Ferry FH due to concerns regarding adult migration above the dams. Now that a set sample rate is required at Lower Granite Dam and there is a need for incorporating natural-origin Chinook, Lower Granite Dam has become the priority location for broodstock collection.
- Bringing natural-origin fall Chinook into the broodstock is difficult because approximately 50% of the released hatchery-origin fall Chinook in the Snake River basin are unmarked.
- Less than 1% of the natural-origin fall Chinook returning to the Snake River enter the Lyons Ferry FH ladder.
- Of the adults trapped at Lower Granite Dam, 70% are transported to Lyons Ferry FH and 30% are transported to the Nez Perce Tribal Hatchery. This is done to mimic historic natural production in the Snake River basin and reflects Lyons Ferry FH as the priority location for maintaining the population.
- The majority of broodstock are still collected at Lyons Ferry Hatchery.
- Broodstock collection protocols at Lower Granite Dam (LGD):
    - Trapped fish meeting criteria for collection are transported: ≈70% to Lyons Ferry Hatchery and ≈30% to Nez Perce Tribal Hatchery. Scan all fall Chinook for wire and PIT tags.
    - Any fish hauled to Lyons Ferry FH or Nez Perce Tribal Hatchery must be given a right operculum punch. All released fish must be given a left operculum punch and be scale sampled prior to release.
    - Collect and haul: (a) All wire-tagged fall Chinook adult and jacks (31-52 cm); (b) Two-out-of-three unmarked/untagged adult fall Chinook. Collect scales on 50% of these fish; (c) All adipose-fin clipped only (no wire) adult fall Chinook.
    - Pass upstream: (a) Every third unmarked/untagged adult fall Chinook; (b) All unmarked/untagged fall Chinook jacks; (c) All adipose-fin-clip-only (no wire) jack fall Chinook; (d) All mini-jacks (30 cm or less).
- Broodstock collection protocols at Lyons Ferry Hatchery (Lyons Ferry FH):
    - Fish retained for broodstock collection are transferred to the holding pond every day to reduce stress to fish.
    - Fish captured at Lyons Ferry FH are held separately from fish collected at LGD.
    - Collect all adults and jacks.

  - Collect and sacrifice approximately 100 fish (<40cm FL) throughout the run for coded-wire tag analysis.
  - Count and record the number of fish returned to the river each day.

- Sampling During Spawning:
  - Collect, retrieve and decode wire from 100% of Lyons Ferry FH trapped and LGR trapped wire tagged fish.
  - Collect scale samples from all fish without wire (adipose-fin clip only, VIE only, or unmarked/untagged).
  - Scan all fish for PIT tags.
  - Females are weighed each spawning day as time allows.
  - See mating and spawning protocols below.

- Adult collection protocols do not allow 100% exclusion of unmarked/untagged hatchery-origin strays from being included in the broodstock. However, adult collection protocols (including the screening of each fish for tags, marks, and scale readings) are believed to minimize the inclusions of unmarked/untagged hatchery-origin fish in the broodstock.

- Steelhead are at times inadvertently collected in the fall Chinook ponds during collection. This occurs because steelhead are collected simultaneously.

- Coho are collected at Lyons Ferry FH during collection of fall Chinook. The coho are taken to Dworshak NFH for the Nez Perce Tribe's Clearwater coho program. The Team has recommended discontinuation of the practice of including coho trapped at Lyons Ferry Hatchery with the Clearwater River broodstock.[50]

### Hatchery and Natural Spawning, Adult Returns

- Fall Chinook occupy the Snake River from its confluence with the Columbia River to Hells Canyon Dam, and the lower reaches of the Clearwater, Imnaha, Grande Ronde, Salmon, and Tucannon Rivers. The majority of the fish spawn in the mainstem Snake River between the head of Lower Granite Reservoir (RM 146.8) and Hells Canyon Dam (RM 247.6), with the remaining fish distributed among lower sections of the major tributaries.

- The total adult return goal under the LSRCP program is to return 18,300 hatchery-origin fall Chinook upstream of Ice Harbor Dam. The LSRCP mitigation goal was based on the assumption that three-quarters of returning adults would be caught downstream of Ice Harbor (presumed 3:1 recreational-to-commercial catch ratio), while one quarter of the returning adults would be available for recreational and tribal/commercial fisheries upstream of Ice Harbor Dam (presumed 1:1 catch ratio).

- 85% of the fall Chinook habitat has been lost in the Snake River due to dam construction. Human development and land management impacts, consistent with those identified across the Columbia

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[50] *Dworshak, Kooskia, and Hagerman National Fish Hatcheries: Assessments and Recommendations. Final Report, June 2009. http://www.fws.gov/Pacific/ fisheries/Hatcheryreview/reports.html.*

and Snake River basins, affect natural fall Chinook production in the Snake River. Loss of channel diversity, increased sedimentation, reduced stream flows, habitat constriction due to effects of irrigation withdrawal, water temperature, and inundation and loss of spawning/rearing habitat through dam construction, and fragmentation of habitat all affect productivity of natural fall Chinook populations within the watershed. The Lower Snake River dams have contributed largely to habitat loss; however, the Upper Snake River dams, including the Hells Canyon complex, have had the greatest impact on the fall Chinook habitat.

- Estimated numbers of returning natural-origin Snake River fall Chinook salmon have varied greatly since 1975, with estimates of natural-origin fish passing above Lower Granite dam averaging 1,543 (range = 101-6,607 ) fish per year from 1975 to 2007 (see following table).[51]

| Return year | Total # fall Chinook to LGR | Hatchery | Natural | % Natural |
|---|---|---|---|---|
| 1975 | 1000 | 0 | 1,000 | 100.00% |
| 1976 | 470 | 0 | 470 | 100.00% |
| 1977 | 600 | 0 | 600 | 100.00% |
| 1978 | 640 | 0 | 640 | 100.00% |
| 1979 | 500 | 0 | 500 | 100.00% |
| 1980 | 450 | 0 | 450 | 100.00% |
| 1981 | 340 | 0 | 340 | 100.00% |
| 1982 | 720 | 0 | 720 | 100.00% |
| 1983 | 540 | 112 | 428 | 79.26% |
| 1984 | 640 | 316 | 324 | 50.63% |
| 1985 | 691 | 253 | 438 | 63.39% |
| 1986 | 784 | 335 | 449 | 57.27% |
| 1987 | 951 | 698 | 252 | 26.50% |
| 1988 | 627 | 259 | 368 | 58.69% |
| 1989 | 706 | 411 | 295 | 41.78% |
| 1990 | 575 | 474 | 101 | 17.57% |
| 1991 | 1019 | 701 | 318 | 31.21% |
| 1992 | 957 | 337 | 620 | 64.79% |
| 1993 | 1209 | 432 | 777 | 64.27% |
| 1994 | 1037 | 328 | 484 | 46.67% |
| 1995 | 1375 | 996 | 379 | 27.56% |
| 1996 | 1732 | 898 | 840 | 48.50% |
| 1997 | 1955 | 1,134 | 821 | 41.99% |
| 1998 | 3911 | 3,284 | 627 | 16.03% |
| 1999 | 5237 | 3,515 | 1,722 | 32.88% |
| 2000 | 10994 | 7,335 | 3,659 | 33.28% |
| 2001 | 17915 | 11,285 | 6,630 | 37.01% |
| 2002 | 18478 | 11,871 | 6,607 | 35.76% |
| 2003 | 21047 | 16,714 | 4,333 | 20.59% |
| 2004 | 22077 | 15,711 | 6,366 | 28.84% |
| 2005 | 13,985 | 10,558 | 3,427 | 24.50% |
| 2006 | 15,664 | 11,987 | 3,677 | 23.47% |
| 2007 | 20,960 | 18,687 | 2,273 | 10.84% |

[51] *Data provided by Debbie Milks, WDFW. The data in the table are for fish at Lower Granite Dam only and do not include fish trapped at Lyons Ferry FH or fall Chinook in the Tucannon River, and does not take into account fish removed for broodstock at Lyons Ferry FH or Nez Perce Tribal Hatchery.*

- The weighted mean SAR to the Snake River was 0.53% for yearlings (brood years 1990-1998) released on station at Lyons Ferry FH. When all recovery and return data are included, the total mean SAR was 0.96%. Survival has improved in recent years. The 5-year weighted mean SAR to the Snake River (brood years 1994-1998) was 0.84% for yearlings released on station at Lyons Ferry FH: contributing to a total mean SAR of 1.56% when all recovery and return data were included.

- Survival appears to have improved in recent years for subyearlings also. The weighted mean SAR to the Snake River was 0.35% for subyearlings (BY90, BY92, and BY98) released on station at Lyons Ferry FH, with a total weighted mean SAR of 0.62%.

- Yearling releases out performed subyearling releases in all but two brood years (1990 and 1992). Overall yearling survival has increased except for BY1994 and BY1996. (Note: The 1996 flood event could have contributed to low returns from the BY1994 releases). The SAR data presented here will be compared with the survival of fish released from upstream Nez Perce Tribal acclimation facilities in a future cooperative report.

- Comanagers' desire is to include 10-30% naturally produced Snake River stock fall Chinook in Lyons Ferry FH broodstock annually. Any Snake River origin hatchery adults, transferred and held at Lyons Ferry FH and not needed for production, monitoring, or run reconstruction are returned to the Snake River at Lyons Ferry FH to "supplement" the natural population. The majority of unmarked fish are allowed to spawn naturally in the Snake River each year.

- Lyons Ferry began incorporating natural-origin fall Chinook into their broodstock beginning with broodyear 2003 collections. From 2003 through 2008 the percent natural-origin used in the broodstock has averaged 5.4% (2003-0.12%, 2004-4.9%, 2005-5.3%, 2006-12.6%, 2007-3.3%, and 2008-5.9%).

- The Snake River fall Chinook salmon ESU has been greatly influenced by the Lyons Ferry FH. The Lyons Ferry FH stock was founded from the native stock, and has been propagated through the Lyons Ferry, Idaho Power, and Nez Perce Tribal Hatchery programs. The Lyons Ferry stock has been through several generations of artificial propagation and there is evidence of inclusion of out-of-basin strays and exclusion of natural-origin Snake River fall Chinook in the broodstock.

- In addition to the Lyons Ferry stock hatchery fish, non-Snake River hatchery fall Chinook salmon have been identified at Lower Granite Dam since the mid-1980s. The NOAA Fisheries Biological Review Team noted the primary contributor of non-ESU hatchery strays continues to be from the Umatilla (Priest Rapids stock). The percentages of non-ESU fish in the escapement to Lower Granite Dam has dropped in recent years and is now less than 5% due to systematic removal of the strays identified at the dam and changes to the Umatilla program, including a substantial decrease in production and implementing methods to increase homing. In the past, the largest number of strays came from subyearlings. Presently, the yearling Umatilla program contributes the highest number of strays to the Snake River (detected at Lower Granite and Lyons Ferry FH). Currently, all the Umatilla releases are tagged so that they can be detected.

- Due to facility and handling constraints at Lower Granite Dam, only about 15% of the strays can be removed.

- Lyons Ferry fall Chinook adults sometimes stray (8 coded-wire tag recoveries in the Hanford Reach for fall Chinook salmon released from Lyons Ferry Hatchery in the 1980s) into the Hanford Reach and spawn[52].

- Lyons Ferry FH origin fish (determined by coded-wire tag, elastomer tag, DNA or scale analysis) are retained for broodstock. Natural-origin Snake River fish are incorporated into the broodstock at a target rate of up to 30% (per the Snake River Fall Chinook Management Plan), provided that this number does not exceed 20% of the natural-origin spawning population. Stray (non-Lyons Ferry FH origin) hatchery fish as determined by coded-wire tag are culled if not needed by other Columbia Basin hatcheries (based on needs described in US vs. Oregon).

- Mating protocol is to minimize incorporation of strays in the Lyons Ferry FH broodstock while incorporating as many natural-origin fall Chinook as possible (up to 30% of the fish used for broodstock).
    - Fall Chinook matings conducted at Lyons Ferry FH:
    - Jacks are to be used in no more than 10% of the matings.
    - Gametes from wire-tagged strays are discarded.
    - Known Lyons Ferry FH fish (coded-wire tag and/or VIE) x known Lyons Ferry FH fish.
    - Adipose-fin clip-only x known Lyons Ferry FH fish.
    - Unmarked/untagged x known Lyons Ferry FH fish.

- Broodstock collection and spawning protocol are complicated because not all hatchery fish are identified by marks or tags. Current protocols are followed to reduce the potential for incorporating stray hatchery fish and increase the inclusion of natural-origin fall Chinook. Approximately 70%-80% of the Snake River fall Chinook production released throughout the basin are marked and/or tagged in some manner.

- Comanagers are investigating alternative marks, including thermal otolith marks, which could be applied to 100% of the Snake River hatchery fall Chinook production. WDFW claims that thermal marks can be analyzed in real time to identify hatchery fish during spawning.

- Currently, Lyons Ferry females can be mated with a Lyons Ferry hatchery-origin male or an unclipped natural-origin male.

- Mating occurs in a 1 x 1 cross.

- One ocean males less than 57cm fork length (called jacks) are incorporated into the broodstock at a level not to exceed 15% of the adult males collected. No fish less than 45 cm are included in the broodstock.

- Males may be split and used on multiple females if needed.

- To maximize the incorporation of natural-origin Snake River fall Chinook in broodstock, all unmarked/non coded-wire tagged fish are scanned for PIT tags. Natural-origin Snake River fall

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[52] *Pers. comm. W. Connor, USFWS, 2009.*

Chinook are beach seined above Clarkston, WA and PIT tagged. Fish determined to be natural origin are used in spawning.

- Currently, due to lack of PIT tag equipment, not all males can be scanned for PIT tags prior to spawning. All females are scanned before spawning and males are scanned after spawning.

- Surplus Snake River adult fall Chinook (currently only hatchery origin) are returned to the river to continue their upstream migration. The surplus fall Chinook trapped at Lyons Ferry FH are returned to the river upstream of Lyons Ferry. These Chinook are externally marked to ensure they do not compromise run reconstruction efforts at Lower Granite Dam. Surplus fall Chinook trapped at Lower Granite Dam are returned to the river upstream of Lower Granite Dam, between Lower Granite Dam and the Clearwater River confluence. All adults trapped at Lower Granite Dam with coded-wire tags are retained for sampling and run reconstruction.

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

- Fall Chinook collected at Lower Granite Dam are held separately at Lyons Ferry FH from those that are trapped at the hatchery.

- Fall Chinook collected at Lower Granite Dam are injected at capture with oxytetracycline and erythromycin (20 mg/kg fish) before transfer to Lyons Ferry FH. The fish collected from Lower Granite receive a second injection of erythromycin one month before spawning.

- Fall Chinook collected at Lyons Ferry FH ladder are injected with erythromycin (20 mg/kg fish) at sorting, up to 25 days after collection. Once spawning starts, newly trapped fish are injected at the next spawn day (up to seven days after trapping).

- All fall Chinook are treated with formalin (167 ppm) every other day to control fungus.

- Prior to spawning, all personnel disinfect raingear and boots before entering the spawn building.

- All females contributing to yearling production are tested for bacterial kidney disease (BKD) using the enzyme-linked immunosorbent assay (ELISA) technique. Fish are sampled across the run. For brood year 2004, females from the second through the fifth spawning weeks were sampled with 98% testing as "below-low" by ELISA. Progeny from these females were used in the yearling programs and progeny from all other females were utilized in the subyearling programs. From 1991 to 2008, only 105 of 12,145 females (<1%) sampled had BKD at high levels (>0.4 optical density) by ELISA.

- Sixty females used for broodstock are sampled to detect viral pathogens. Segregation and/or culling of progeny from virus positive females is not done.

- All adult fall Chinook are held in concrete raceways. One pond holds the new arrival fish trapped at Lyons Ferry FH. After they have been sorted through the spawning room and injected with erythromycin, the Chinook are moved to the second pond. The third pond holds fish hauled from Lower Granite Dam. After the Lower Granite fish are sorted through the spawning building the

first time, they are placed in the fourth pond. In 2009, the fall Chinook adult holding ponds were split from four to eight, resulting in improved broodstock management and holding capabilities.

- During weekly spawning activities, fish are crowded into a channel, enter an elevator, are hoisted into the building and submerged in anesthetic, and then placed on the sorting table. Ripe Snake River origin fish (hatchery and natural) required for that day's spawning are killed and spawned.

- Adult fish are anesthetized with MS-222.

- Adults released as yearlings dominate the broodstock due to higher survival rates and a higher proportion of elastomer tags. As of 2008, efforts have been made to minimize the number of yearling males used in matings. CWTs and elastomer tags are read prior to spawning to differentiate between yearling and subyearling released males to ensure that subyearling males contribute to the broodstock.

### Incubation and Rearing

- Fertilized eggs are water hardened for one hour in 100-ppm iodophor, and incubated in vertical stack incubators.

- Progeny from females rated as "below-low" (<0.1 optical density by ELISA) for BKD are used for the yearling programs. Progeny of "low", "moderate", and "high" BKD-ELISA and untested females can be utilized in the subyearling fall Chinook program. These fish are distributed among all subyearling releases when possible.

- When available and according to priority, "eggs" from "below-low" and "low" ELISA females are selected for transfer to Oregon and Idaho programs.

- Eggs are reared in the vertical incubators, and are treated with formalin (1,667 ppm, for 15 minutes daily), beginning 24 hours after fertilization and halting at 7 days before hatch to reduce fungus. Each tray is loaded with approximately 5,000 eggs. The incubation room is designed to accept and incubate eggs from individual females through the eyed stage.

- Eggs are shocked at eye-up, around 550 temperature units (TU's), and handpicked shortly thereafter. After eggs are picked, folded Vexar sheets are added to each tray for substrate.

- Each female is kept separate until eye up. After eyeing is complete and ELISA and virus sample results are received, eggs are combined, according to sample results, and placed in trays with substrate.

- The natural-origin fish used in matings are incorporated into all release groups. This is managed at the egg stage.

- Head troughs providing well water to the incubators include alarm probes, and visual inspections of flow through the trays along with head trough levels are conducted daily.

- Formalin treatments stop just before hatch. After complete yolk-sac absorption by hatched fry (at around 1900 TU's), they are transferred to raceways for rearing.

- Lyons Ferry FH production fry are moved to outside raceways at ~1,600 fish per pound. In addition to standard raceways, since 2003, the adult raceways have been used to rear subyearling fish destined for transfer to acclimation and release sites managed by the Nez Perce Tribe (Captain Johns, Pittsburgh Landing, and Big Canyon acclimation facilities). By utilizing these larger ponds, densities in other raceways are dramatically reduced. Fish rearing densities are very low (≤0.10 lbs./$ft^3$).

- Initial rearing of fall Chinook occurs in outside raceways, 10ft wide x 100 ft. long x 2.8 ft. deep, which run 600 gpm of well water.

- After fish reach fingerling size, the on-station yearling production group fish are marked and placed into one of Lyons Ferry FH's three 2.1-acre rearing lakes. The fish will remain in the lake until release.

- Fish health practices follow the Pacific Northwest Fish Health Protection Committee's Model Comprehensive Fish Health Protection Program (Pacific Northwest Fish Health Protection Committee Approved September 1989, revised February 2007). Fish are examined monthly for health and as needed.

- Bacterial gill disease (BGD) has occurred in recent years at Lyons Ferry FH and is possibly related to significant increases in the complexity of the programs and production. The BGD problem is similar to that encountered during the initial years of operation at Lyons Ferry FH, when extremely high numbers of subyearling fall Chinook were propagated. In late December 2004, Chinook in the yearling program were diagnosed with BGD and treated with potassium permanganate (1.0 ppm, 8 hours drip for 3 days) and increased water flow. The estimated loss to BGD was 16,000 fish or 3.5%. Fish recovered and were healthy at release in spring 2005. BGD also occurred in subyearling fall Chinook reared in one raceway in 2005. These were successfully treated with chloramine-T at 10 ppm in a 1 hour drip for three consecutive days. In 2008, BGD was identified in the juveniles held in the adult ponds, and it has shown up in the lakes.

- The current density index for fall Chinook subyearlings at or smaller than 100 fish per pound does not exceed 0.08 as a result of disease concerns. Density values can increase on a sliding scale to a maximum value of 0.14 for yearlings at 10-12 fish per pound. These density index goals were developed to improve fish quality and survival.

- Fry/fingerling are fed an appropriate commercial dry or semi-moist trout/salmon diet. Fry are initially fed 8 or more times per day. Feeding frequency, percent body weight fed per day, and feed size are adjusted as fish increase in size in accordance with good fish culture practices and program goals.

- Fall Chinook designated for the yearling releases and the subyearling releases from Captain Johns, Pittsburgh Landing, and Big Canyon acclimation facilities are given a 28 day prophylactic treatment using feed treated with erythromycin in June of their first year to reduce the potential for Bacterial Kidney Disease (BKD) outbreaks. In the years 2001 to 2004, clinical signs (pustules in kidney) and moderate to high levels of BKD as measured by ELISA were significant in the yearling juveniles in pre-release exams done by the Idaho Fish Health Center. From 2005 to 2008, there have been no clinical signs of BKD in the yearlings; however, low levels of BKD were detected by ELISA during regular monitoring in 4 to 42% of the yearlings at the acclimation sites.

- The subyearlings are not treated with erythromycin and can be progeny from females with higher titers of BKD. At release from Lyons Ferry FH and the acclimation sites, BKD levels are low (as measured by ELISA) and the prevalence has progressively declined since 2005 (from 22% to 1.5%).

- De-scaling and lack of parr marks are notable in the yearlings released from Lyons Ferry FH and the acclimation sites.

- From 2003 to 2006, infectious hematopoietic necrosis virus (IHNV) has been detected in the pre-release exams done on the subyearling and yearling juveniles at the Big Canyon Acclimation site although no mortality was noted. Fish are at the acclimation sites long enough to pick up infections from anadromous salmonids in their river water supply. Enteric redmouth disease caused some mortality at this site in 2007.

- The parasite *Nucleospora salmonis* has been detected among fall Chinook yearlings at Lyons Ferry FH and at the Big Canyon Acclimation Site. Sampling was done in 2008, 2009 at Lyons Ferry FH and from 2007-2009 at Big Canyon. In addition, subyearlings at were sampled in 2009. The biological significance and fish health risks of this parasite to Lyons Ferry fall Chinook remains to be determined. In the Hagerman Valley, this parasite is immunosuppressive and responsible for increased mortality and disease issues. Recently, there is evidence that the parasite may be transmitted vertically.

- A program change was implemented in 2007 which includes 421,000 eyed eggs from Lyons Ferry FH transfer to Oregon Fish and Wildlife (ODFW) for rearing at the Irrigon Hatchery (identified as priorities 13 and 16). Marking and tagging will occur there as well. These fish are released into the Grande Ronde River in Washington as subyearlings by ODFW.

### Release and Outmigration

- Fish release groups do not represent egg takes across the run because the size variability at time of tagging is too high to tag each release group as one lot. Two egg takes are sequentially rotated through release groups annually to compensate for this.

- A total of 200,000 subyearlings are 100% coded-wire tagged and adipose-fin clipped in April for release from Lyons Ferry FH into the Snake River in early June. At release, these fish are pumped from the raceway using a four or six inch Aqua-Life® fish pump. The fish are directed through an irrigation pipe to the Snake River. Staff monitor the hydrograph in low flow years to ensure that the Chinook are released during a high flow period and when the dams are spilling.

- Pre-release exams for the subyearlings and yearlings going to the Nez Perce managed acclimation sites consist of tests for virus, bacteria, *Myxobolus cerebralis, Nucleospora salmonis* and *R. salmoninarum* (for BKD) and are done by the Idaho Fish Health Center at Lyons Ferry FH. At the acclimation sites, the IDFHC also visits and tests fish health throughout juvenile rearing, including frequent monitoring for BKD, and performs pre-release exams (60 fish tested for virus, *N. salmonis*, bacteria and *R. salmoninarum)* approximately one week prior to release.

- As needed, formalin is used to treat and control tail rot and external parasites at Big Canyon Acclimation site.

- Subyearlings are transported in May to acclimation facilities on the Snake River (Captain John Acclimation Facility- 500,000, Big Canyon Acclimation Facility -500,000 , Pittsburg Landing - 400,000). These fish are acclimated and released in June by the Nez Perce Tribe. An additional 200,000 subyearlings may be direct-stream released into the Snake River at Couse Creek, near Captain John Rapids. These fish are part of a study to compare survival of fish released directly versus those acclimated prior to release. The Lyons Ferry FH staff coordinate with the Nez Perce Tribe to assure that the direct-stream release will correspond with the Captain John acclimated release, scheduled for June.

- Oregon Department of Fish and Wildlife (ODFW) will also direct-stream release 400,000 subyearlings into the Grande Ronde River near the Washington border. They are transferred to Irrigon Hatchery from Lyons Ferry FH as eyed eggs, reared and tagged there, then released into the Grande Ronde River in Washington in early June. The co-managers will coordinate exact release location and timing.

- A yearling release of 450,000 fish from Lyons Ferry FH directly into the Snake River at 10 fish per pound is programmed for a volitional release over a three day period from Lake Two into the Snake River between April 1 and April 15. Since all three lakes share a common release structure, the fall Chinook release must be coordinated with steelhead releases. Screens and stop logs are pulled around April 1 to allow fish to volitionally move to the outlet structure. The outlet structure is a concrete raceway approximately 11 ft. wide x 59 ft. long x 4 ft. deep (total depth without water). Fish move out of this channel to the Snake River.

- Three yearling groups are marked and/or tagged at Lyons Ferry FH in September, then transferred to Captain John, Big Canyon, and Pittsburg Landing acclimation sites (at ~ 12 fish per pound) for final rearing and release by Nez Perce Tribe in April at a target of 10 fish per pound.

- Lyons Ferry FH adds salt to the water in the transport tank when shipping fall Chinook but not when shipping steelhead or rainbow trout. Salt is added at 0.5% by weight (50 lbs./ 1,200 gallons of water).

- The steelhead are released on-station shortly after the fall Chinook release.

### Facilities and Operations

- There are separate holding and spawning facilities for fall Chinook and steelhead.

- All adult fall Chinook are currently held in 4 raceways that are approximately 18 ft. wide by 150 ft. long with a water depth of 4.3 ft. In 2009, funding was approved by the Northwest Power and Conservation Council to divide the fall Chinook adult holding ponds into eight 9 ft. by 150 ft. raceways. The additional pond units will allow fish trapped at Lower Granite Dam and transported to the hatchery, and adults that voluntarily swim into the facility, to be segregated by run-timing, sex, origin and sexual maturation. The additional ponds are intended to reduce the need to crowd fish, handle and sort fish by maturity status at Lower Granite Dam and as such decrease fish stress.

- The incubation room at Lyons Ferry FH is designed to accept and incubate eggs from individual fall Chinook females through the eyed stage. The south side incubation room holds four banks of 28 stacks, which hold 1,568 usable Heath trays. Each 8 tray half stack has its own water source. Only 7 trays are used for incubating with the top tray used as a settling tray. Water is single-pass

flow through the incubation stacks at about 4.5 gallons per minute. The water temperature is 51-53 degrees F.

- The incubation building is fitted with back-up pumps to maintain flow through the trays 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.

- There are 47 outdoor raceways available for rearing at Lyons Ferry FH. Twenty eight raceways are 10'x100' (600 gpm maximum) and 19 are 10'x88' (1000 gpm maximum).

- Lyons Ferry FH has three 2.1-acre rearing lakes. The three large lakes receive 3,500 – 4,200 gpm total providing a good flow with no hydraulic problems. These large ponds limit flexibility to produce small groups of fish, commonly required for restoration and recovery programs.

- Water is supplied to Lyons Ferry FH from the Marmes pump station, which has emergency power backup generation. There are eight deep wells at the site that produce nearly constant $52^0$ F, fish pathogen-free water. The hatchery is permitted to pump up to 53,000 gpm (118.1 cfs). The Marmes pump (wells) facility has three 300 horsepower (hp) pumps, four 200 hp pumps and one 75 hp pump. The well water right for Lyons Ferry FH is 53,200 gallons per minute (gpm), or 118.5 cubic feet per second (cfs) of flow, and water temperature is a relatively constant 52 F.

- Water supply at Marmes site has remained stable for many years.

- Lyons Ferry FH cannot utilize their total water right. Staff believe that mineral accumulation (i.e. manganese) in the line from the pumping station to the facility is likely constricting water availability.

- From December-early March, during peak production, pump failure (especially one of the 300 hp pumps) combined with the constrained water line could result in fish loss.

- High concentrations of dissolved manganese (variable among the eight wells, but especially high in Well #4 since it is shallower than the others), and particulate Manganese Oxide, is strongly suspected of limiting the density at which fall Chinook can be reared in raceways at Lyons Ferry FH. While the water also has higher concentrations of other minerals (common in deep wells), no negative impacts on eggs or fish from these are known.

- There is no water source alternative to the Marmes pump station.

- Water flow and low water alarm systems, and emergency generator power supply systems to provide incubation and rearing water to the facilities are installed at Lyons Ferry FH. All pumps are now fitted with automatic restart systems in case of power outages.

- The Army Corps of Engineers currently holds the water right.

- Although this facility reports water flow in its Monthly Discharge Monitoring Reports as a requirement for its NPDES Permit, water diversions are not adequately measured and reported to meet Service standards for documenting beneficial use and state standards for annual reporting.

- All outside rearing units, except for the adult holding ponds and intermediate circular tanks (which are both at times used for juvenile rearing), are covered with netting to exclude birds. All rearing lakes at Lyons Ferry FH were covered with netting in 2003-2004 to prevent excessive bird predation.

- Predator fencing is not used but mammal predation is not considered a major problem. At times, traps are used under a permit to remove otters. Additionally, bird netting around the lakes reaches the ground, which likely deters some predation.

- Discharge from Lyons Ferry FH complies with all NPDES standards. Fall Chinook spawning effluent is routed to the offline pollution abatement pond.

- The hatchery has a sophisticated alarm system and read-out screen. Some onscreen outputs for flow are erroneous. They have also experienced false alarms on occasion. The alarm system requires constant maintenance (i.e. cleaning probes) to reduce the instances of erroneous readouts and false alarms.

- An emergency action plan to maintain flow in the incubation room was developed by Lyons Ferry FH and is implemented in case of emergency. Egg incubation room water supply contains an alarm system. Portable pumps are available to pull water from outside raceways into the incubation room during power failure at Marmes pump station. Employees carry digital pagers after hours for alarm response. Because of the complexity of the hatchery and its program, an alarm situation requires two employees to respond.

- The hatchery has undergone a Service safety review to indicate safety problems and hatchery staff indicated they have a backlog of needed safety improvements. For example, a number of catwalks in and around the spawning/sorting area lack appropriate safety handrails and fall protection.

- The roof on the fall Chinook spawning building is leaking and needs to be replaced.

- Nursery rearing space at Lyons Ferry FH is limited. Hatchery staff have indicated that the location where the intermediate circular tanks are located could be covered and adjusted to provide additional early rearing space.

- There are no shade covers over the raceways.

- Lyons Ferry FH has maximized its production capabilities, restricting program increases or additions. Demands are increasing for rearing multiple stocks at Lyons Ferry FH that is limited in flexibility given that the hatchery is designed with fewer, larger rearing vessels (e.g. three large lakes, early rearing troughs, etc.). Lyons Ferry FH is a production hatchery, and as such, the raceways were not designed for small group rearing. The hatchery's design also limits the facility's ability to utilize aspects of *NATURES* rearing, such as in-pond structures, shade covers, in-water feeders, etc.. However, WDFW is investigating alternatives for improving the rearing environment. Modifications to the facility to use natural rearing techniques may be cost prohibitive.

### Research, Education, and Outreach

- A total of 200,000 subyearlings are 100% coded-wire tagged and adipose-fin clipped in April for release from Lyons Ferry FH into the Snake River in early June. Fall Chinook subyearlings

released on station are not currently PIT tagged. WDFW has proposed PIT tagging the on-station subyearling release, and have calculated that they would need to PIT tag 48,000 based on SAR's to obtain adequate adult return data.

- Captain John Acclimation Facility receives 500,000 subyearlings from Lyons Ferry FH in May, as does Big Canyon Acclimation Facility. Both groups are comprised of 100,000 coded-wire tag, 100,000 adipose-fin clip + coded-wire tag, and 300,000 unmarked fish. Pittsburg Landing will receive 400,000 subyearlings in May. This group is comprised of 100,000 coded-wire tag, 100,000 adipose-fin clip + coded-wire tag, and 200,000 unmarked fish. All marking and tagging is completed by WDFW in March and April, prior to transfer. PIT tagging may occur prior to and/or post transfer to acclimation sites. These fish are acclimated and released in June by the Nez Perce Tribe. Prior to release, the Nez Perce Tribe will PIT tag 2,500 fish at Big Canyon, 2,500 fish at Pittsburg Landing, and 3,500 fish at Captain John to be compatible with the direct-stream released fish outplanted at Couse Creek.

- A unique coded-wire tag code is used for each release group.

- All of the 200,000 subyearlings that may be direct-stream released into the Snake River at Couse Creek, near Captain John Rapids are adipose-fin clipped and coded-wire tagged. 3,500 are PIT tagged.

- Of the 400,000 to be direct-stream released into the Grand Ronde by ODFW, 200,000 fish are adipose-fin clip + coded-wire tag marked (*US v Oregon priority 13*), and 200,000 are unmarked and untagged. WDFW will randomly PIT tag 3,500 fish from this release.

- A yearling release of 450,000 fish from Lyons Ferry FH directly into the Snake River at 10 fish per pound is programmed for 2010. All of these fish were marked and/or tagged during September 2009 (225,000 adipose-fin clip, coded-wire tag and elastomer tag by left eye, and 225,000 coded-wire tag and red elastomer tag by left eye), and transferred into Lake Two. A portion of these fish are PIT tagged (as many as 30,000) at the same time to better estimate escapement of adults through the hydro system to Lyons Ferry FH, Lower Granite Dam, and the Tucannon River. Those fish receiving a PIT tag will not be elastomer tagged.

- Three yearling groups were marked and/or tagged at Lyons Ferry FH in September 2009 (adipose-fin clip and coded-wire tag or coded-wire tag only; and up to 57,000 PIT tags—see release table in the "Objectives" section above for a breakdown by release group), then transferred to Captain John, Big Canyon, and Pittsburg Landing acclimation sites (at ~ 12 fish per pound) for final rearing and release by the Nez Perce Tribe in April 2010 at a target of 10 fish per pound. Prior to release, Nez Perce Tribal staff PIT tag 4,000 fish at each site for emigration timing and survival through the hydro-system. This tagging is coordinated with the Army Corps of Engineers transportation study. If Army Corps of Engineers transportation tagging does not occur tagging will be conducted at the acclimation sites.

- An initiative is being developed among LSRCP comanagers to standardize monitoring and evaluation and create a standardized data management system for data entry and reporting.

- A study is being performed by the University of Idaho, School of Fisheries, extracting otoliths from adult Chinook and comparing them to juvenile progeny to quantify the variability in the otolith signature at Lyons Ferry FH.

- Approximately, 840 tourists visit Lyons Ferry FH annually.
- Lyons Ferry FH has a visitor center with signs describing salmon life-history, the Snake and Columbia River basin environment, and hatchery production.
- Lyons Ferry FH staff work with three local schools as part of salmon in the classroom projects. School groups tour the facility annually.
- Lyons Ferry FH/WDFW cosponsors fishing derbies in ponds adjacent the Tucannon River and in Clarkston.
- The facility has no volunteer program.
- The USFWS maintains a web site with the goal to provide timely information to the public regarding hatchery operations and program benefits.
- WDFW does not have a web page describing Lyons Ferry FH and its programs.

## *Benefit and Risk Assessment*

### *BENEFITS CONFERRED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY*

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to the propagated stock and local community,[53] the Review Team identified the following benefits of this hatchery program:

#### Harvest Benefits

- The program provided no local harvest benefits in the Snake River region until 2008. In 2008, Idaho conducted a fall Chinook harvest season on the Snake River, the first season in decades. The season opened October 3, 2008 on the Snake River from Lewiston upstream to Hells Canyon Dam and ended Friday, October 31, 2008. Anglers caught and kept 132 marked adult and jack fall Chinook in the Snake, and they released 409 adult and jack salmon during 21,749 hours of angler effort. Hatchery-origin fish were marked with a clipped adipose fin.
- Washington conducted a fall Chinook harvest season on the Snake River from the Railroad Bridge crossing the Snake River about a half mile downstream of the mouth of the Tucannon River upstream to the no fishing zone below Little Goose Dam, plus from the safety zone boundary above the dam up to the boat launch approximately one mile upstream of Little Goose Dam (along the south shore). The season opened from September 25, 2008 through Oct.15, 2008. This was the first fall Chinook fishery for adult salmon retention in decades in the Snake River and it is being used as a test fishery for planning for potential future fall Chinook fisheries. Washington reported nine fall Chinook harvested and 32 fall Chinook released during the season.
- Nez Perce tribal harvest in the Clearwater River reported 52 fall Chinook taken in the Clearwater River during 2008.

[53] *See Section II, "Components of This Report", for a description of these potential benefits and risks.*

### Conservation Benefits

- Total adult returns from the hatchery program back to the Snake River have increased substantially in recent years from less than 1,000 hatchery-origin fish each year, 1983-1996, to over 10,000 fish each year, 2001-2008. Returns of natural-origin adult fall Chinook have similarly increased from less than 1,000 fish each year, 1976-1998, to a range of 2,273-6,630 adults per year, 2000-2008. As a consequence, the program appears to be conferring a significant demographic and conservation benefit.

- The hatchery program serves as a demographic buffer and potential genetic reserve for the naturally spawning population.

### Research, Education, Outreach and Cultural Benefits

- Ongoing hatchery evaluation of rearing protocols, disease histories, feed conversion, and growth and survival rates are used in adaptive management feedback loops to improve hatchery operations. The information is also communicated to the fisheries community and greater public through scientific and management forums.

- Coded-wire tag data provide information regarding contribution to fisheries. PIT tag data provide juvenile and adult survival information through the Columbia River Basin dams and can be used for in-season harvest adjustments based on adult detections at the dams.

- Evaluations of annual hatchery and natural escapement allow for assessments of stock status and progress toward recovery of the ESU.

- Tribal harvest and surplus adults trapped at facilities provide cultural and subsistence benefits to Columbia River tribes.

- Fall Chinook juveniles are used to evaluate the efficacy of downstream barging.

- A study being conducted by the USFWS, WDFW and the Nez Perce Tribe evaluates the merit of direct stream releases of fall Chinook subyearlings versus acclimated releases.

- Lyons Ferry FH staff co-sponsor fishing derbies and provide educational opportunities to school groups and other visitors.

#### *BENEFITS CONFERRED TO OTHER STOCKS, SPECIES, AND COMMUNITIES*

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to other species and stocks,[54] the Review Team identified the following benefits of this program:

### Harvest Benefits

- Lyons Ferry FH fall Chinook contribute to ocean and Columbia River sport, commercial and tribal fisheries. Locations and estimated contributions (expanded to reflect total take) of Lyons Ferry fall Chinook in 2006 from fish released by WDFW include:

[54] *Ibid.*

- 1,054 fish in the Columbia River: 313 fish in the sport fishery below Bonneville Dam, 208 fish in the non-treaty gillnet fishery below Bonneville Dam, and 533 fish in the treaty gillnet fishery between Bonneville and McNary Dams.
- 1,790 fish in the ocean fishery: 3 fish in the Alaska sport fishery, 32 fish in the Alaska troll fishery, 2 fish in the Alaska purse seine fishery, 213 fish in the British Columbia sport fishery, 799 fish in the British Columbia troll fishery, and 85 fish in the high seas troll fishery.
- 201 fish in the Washington sport fishery, 63 fish in the Washington troll non-treaty fishery, 243 fish in the Washington treaty troll fishery, and 6 fish in the Washington treaty drift gillnet fishery.
- 24 fish in the Oregon sport fishery, 113 fish in the Oregon troll fishery, and 6 fish in the California troll fishery.

### Conservation Benefits

- None identified.

### Research, Education, Outreach and Cultural Benefits

- Hatchery and evaluation staffs provide educational opportunities offsite to other communities.
- Results of the ongoing transportation study contributes to the body of research regarding downstream barging of juvenile salmon and steelhead.
- Tribal harvest and surplus adults trapped at facilities provide cultural and subsistence benefits to Columbia River tribes.

#### *RISKS POSED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY*

In the context of all possible genetic, demographic, ecological and other risks that a hatchery program can pose to the propagated stock,[55] the Review Team identified the following risks of the hatchery program:

### Genetic Risks

- Inclusion of unmarked stray hatchery fall Chinook from outside the Snake River Basin (e.g., from the Umatilla River) into the broodstock jeopardizes the genetic reserve benefit of the program.
- Inability to capture adequate numbers of natural-origin fall Chinook for inclusion into the hatchery broodstock results in a domestication risk.
- Inability to segregate within population broodstock sources (Clearwater River, Snake River Reach downstream of Hells Canyon Dam, and lower Snake River) for developing locally adapted broodstocks within the existing Snake River basin population impedes establishment of spatial structure and diversity as part of the overall supplementation and restoration program.

[55] *Ibid.*

- The high proportion of hatchery-origin fall Chinook spawning naturally could impede recovery of a naturally spawning population if the proportion remains high over time.

- Restricting on station releases of fall Chinook representing a narrow temporal portion of the egg takes impedes maintenance of genetic diversity for the Lyons Ferry fall Chinook stock.

### Demographic Risks

- A recovery plan consistent with the ICTRT's designations (recovery of at least one population upstream of Hells Canyon Dam) could inhibit management strategies designed to maximize the spatial structure and recovery of fall Chinook populations in the Snake River downstream from Hells Canyon complex and in the Clearwater River.

- Lyons Ferry FH is dependent upon the continuous operation of pumped well water, increasing the risk of catastrophic loss. Pumped well water is the exclusive water source for the facility.

- High concentrations of dissolved manganese in the well water (especially in the shallow well, number 4) poses a fish health risk to fall Chinook and may contribute to the incidence of Bacterial Gill Disease.

- The accumulation of manganese precipitate restricts flow and water conveyance reducing the rearing capabilities of the facility over time. Manganese accumulation in the main water line reduces overall water availability. Accumulation in the smaller pipes can constrict water flow to individual rearing units.

- Fish are not easily released from the facility in an emergency, increasing the risk of catastrophic loss.

- The water alarm does not function properly which could lead to fish loss.

- Lack of shade covers over the ponds concentrates fish in shaded areas along walls during summer months, increasing densities, potential stress, and disease risks

- Crowding and loading in association with transportation to release sites may physically harm the fish, which may be contributing to increased post-release mortality.

- Transportation to release sites poses a demographic risk to the stock during transport and unknown physiological (stress) risks during transport and following release.

- Trapping and hauling fish from Lower Granite Dam poses a demographic risk of handling at the dam and transportation to Lyons Ferry FH.

### Ecological Risks

- Bacterial Gill Disease and BKD periodically occur, posing a fish health risk.

- *Nucleospora salmonis* may also affect fish health.

- The release of large numbers of hatchery-origin fall Chinook juveniles into multiple locations for supplementation within the Snake River Basin poses a competition risk to natural-origin juvenile fall Chinook.

- The use of antibiotics (via erythromycin injections and prophylactic use of medicated feeds) poses ecological risks from antibiotic resistance in bacterial flora within the hatchery system and in the effluent.

### Physical Risks

- A number of identified safety issues associated with the adult trap and collection facility (e.g. catwalks and railings) pose a human safety risk to hatchery staff. The spawning area at Lyons Ferry FH is also crowded with staff during collection, injection, sorting, and spawning of fall Chinook.

### Research, Education, Outreach and Cultural Risks

- None identified.

#### *RISKS POSED TO OTHER STOCKS, SPECIES, AND COMMUNITIES*

In the context of all possible genetic, demographic, ecological, and other risks that a hatchery program can pose to other stocks and species in a watershed,[56] the Review Team identified the following risks from the hatchery program:

### Genetic Risks

- None identified, although a small number of coded-wire tags from Lyons Ferry FH fish have been recovered in the Hanford Reach area of the Columbia River.

### Demographic Risks

- Lyons Ferry FH was not designed to rear multiple stocks in lots of varying sizes. This situation poses demographic risks in raceways that are over loaded and exceed maximum rearing densities.

### Ecological Risks

- The amplification of disease within the hatchery poses a risk of disease transmission to Snake River and downstream fish populations and the risk of vectoring disease in the region.

- Lyons Ferry fall Chinook are susceptible to BKD and BGD. *Nucleospora salmonis* may also be an issue.

- The collection and barging of fall Chinook smolts at mainstem Snake River and Columbia River dams poses a stress (crowding and handling) and overall fish health risk to other populations of salmon and steelhead that are co-collected for barging.

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[56] *Ibid.*

### Research, Education, Outreach and Cultural Risks

- None identified.

## Recommendations for Current Program[57]

The Review Team considered all the benefits and risks outlined in the preceding section. The Team concluded that some of the risks outlined in the preceding section were either minor or their probability of occurrence was small and, thus, did not warrant a proposed change or recommendation for the current program. The recommendations outlined below, in addition to potentially increasing benefits towards achieving program goals, address the identified risks or potential problems considered by the Review Team to warrant a potential modification to the current program. Preceding each numbered recommendation is a brief summary of the issue.

### *Program goals and objectives*

***Issue LF-FC1: At the present time, fall Chinook in the accessible portions of the Snake River are managed as one single stock or population. In the long term, this will inhibit the development of spatial structure and diversity for naturally spawning populations (aggregations) of fall Chinook in the Snake River.*** *The Snake River fall Chinook ESU was reduced to a single remnant population, largely maintained by Lyons Ferry FH. As a result of the successes of the current program, the abundance of Snake River fall Chinook in recent years has increased substantially from a few hundred fish in the mid 1990's to close to 20,000 fish in recent years. This increased abundance of fish addresses the NOAA VSP[58] criteria of abundance, but the current management strategy does not address the VSP parameters of spatial structure and diversity.*

**Recommendation LF-FC1:** Establish natural spawning escapement goals for each of the three major spawning areas in the Snake River currently: (1) Clearwater River, (2) Snake River between the mouth of the Salmon River and Hells Canyon Dam, and (3) the Snake River below the mouth of the Salmon River. Correlate the number of hatchery-origin fish released (direct and acclimated) in each area with the natural spawning escapement goals for each of those major spawning aggregates. Establish a sliding scale to adjust the number of broodstock collected (and hatchery fish released) for each natural spawning area as escapement goals for natural-origin fish are achieved in each of those three areas. For example, broodstock collection, specifically for supplementation purposes, could be adjusted on an annual basis based upon returns to the Lower Columbia River dams, or the sliding scale could be established as part of a management plan and adjusted on a generation by generation basis (e.g. 5 years). The long-term intent of this recommendation, if it can be implemented, is to allow the restoration of spatial structure and diversity of fall Chinook in the Snake River

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[57] *The Review Team believes that the WDFW and the LSRCP office will be the logical parties to coordinate to implement most of the following recommendations.*
[58] *McElhany, P., M.H. Ruckelshaus, M.J. Ford, T.C. Wainwright, and E.P. Bjorkstedt. 2000. Viable salmonid populations and the recovery of evolutionarily significant units. U.S. Dept. Commerce, NOAA Tech Memo NMFS-NWFSC-42. 158p.*

after the population has gone through a major bottleneck demographically (See Recommendation LF-FC7 for additional details).

***Issue LF–FC2: The purpose of the current fall Chinook program is to mitigate for reduced abundance of natural-origin fish as specified under the LSRCP program while meeting the interim conservation and recovery criteria established for the Snake River fall Chinook ESU.*** *The mitigation goal is to return 18,300 hatchery-origin fall Chinook to the project area. Comanagers have identified general short-term and long-term natural-origin spawning goals for the entire ESU (7,500 and 14,360, respectively[59]). However, short and long term adult escapement goals have not been established for specific natural spawning areas associated with current release locations. Additionally, specific harvest goals have not been established for each release location.*

**Recommendation LF-FC2a:** Establish specific natural-origin spawning escapement goals consistent with release strategies (numbers and locations) and conservation and recovery criteria developed for Snake River fall Chinook.

**Recommendation LF-FC2b:** Establish specific harvest goals that are associated with current release strategies and consistent with natural-origin spawning escapement goals for conservation and recovery.

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

**Recommendation LF-FC3:** Comanagers should complete a recovery plan that identifies how Snake River fall Chinook recovery should be achieved.

## *Broodstock Choice and Collection*

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

**Recommendation LF-FC4:** The Review Team supports comanager efforts to achieve a *pNOB* value = 30% which is expected to reduce domestication risks, provided that this number does not exceed 20% of the natural-origin spawning population. In the near term, the focus should continue to be on properly integrating the Lyons Ferry portion of the proposed program (see LF-FC7) by trapping natural-origin fall Chinook adults at Lower Granite Dam.

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[59] *Draft Snake River Fall Chinook Management Plan.*

The likelihood of achieving this recommendation would be increased by improving broodstock collection and sorting capabilities at Lower Granite Dam (see LF-FC14).

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

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

**Recommendation LF-FC5:** Mark or tag all hatchery-origin fish in some manner so that they can be distinguished from natural-origin fish when sorting at Lower Granite Dam and during broodstock collection at the adult recapture sites proposed in LF-FC7 (Nez Perce Tribal Hatchery, Oxbow FH, Lower Granite Dam, and Lyons Ferry FH). Consider using a marking method or methods which can be distinguished while the fish are alive to allow monitoring and sorting for passage to natural spawning areas as well as broodstock collection (see recommendation LF-FC14 regarding improvements to the Lower Granite trap).

***Issue LF-FC6: While the yearling fall Chinook on station releases represent the majority of the broodstock egg takes, the subyearling fall Chinook released on station and transfers to the fall Chinook acclimation facilities represent only a few spawn takes.*** *Progeny from only two egg takes are used in many of the release groups. The egg takes are rotated through release groups annually. This is performed because tagging across all egg takes for each release group is difficult due to the high variability in fish size. This results in an effective number of breeders that is less than 50% of the total number of adults spawned for some of the release groups. Restricting on station releases to fall Chinook representing a narrow temporal portion of the egg takes each year is a form of artificial selection and poses genetic risks to the Lyons Ferry fall Chinook stock.*

**Recommendation LF-FC6:** Maximize the contribution from each egg take to represent the entire run for each of the release groups. Consider manipulating incubation temperatures to equal out temperature units among egg takes and ultimately reduce size variability at the time of marking and tagging.

## *Hatchery and Natural Spawning, Adult Returns*

***Issue LF-FC7: The current management strategy of collecting broodstock at Lower Granite Dam and Lyons Ferry FH, and then releasing the progeny of those fish in the Clearwater River and Snake River below Hells Canyon, prevents the long-term development of spatial structure, diversity, and local adaptations of both hatchery and naturalized populations in those latter two, major spawning aggregate areas.*** *For example, comanager agreements*

*under the US v Oregon process assigns low priority of egg transfers to Oxbow FH, although Oxbow FH is a location where a local broodstock for the Hells Canyon reach of the Snake River could be developed. The long-term practice of capturing broodstock at Lower Granite Dam, and then releasing the progeny of those fish at upstream locations (i.e., Clearwater River and lower Hells Canyon) with different temperature profiles and hydrologies, overlooks the selective advantage or biological characters of the adult Chinook that return back to the specific areas of their release. In the long run, the current strategy is expected to (a) inhibit optimization of smolt-to-adult return rates (SARs) back to the release locations, (b) result in stray rates between the spawning aggregates that is higher than expected for locally-adapted populations, and inhibit – over the long term -the mean productivity (recruit per spawner) of fish that do reproduce naturally in the respective spawning aggregate areas. Ideally, broodstock should be collected from returning adults within the spawning aggregates where they were released as juveniles and where natural spawning supplementation is desired. The development of separate locally adapted broodstocks and naturally spawning aggregates for the Clearwater River and the Hells Canyon reach of the Snake River could contribute to increased spatial structure and diversity, thereby assisting with meeting management goals and objectives of the remaining Snake River fall Chinook population. Local adaptations that maximize productivity can only develop if adult fish are allowed to return to the areas where they were released or originated as juveniles, and then successfully reproduce and produce progeny in the same areas where their parents reproduced successfully. Based on existing facilities, the Review Team envisions the possibility for at least three subpopulations of fall Chinook in the Clearwater and Snake rivers.*

**Recommendation LF-FC7:** Explore opportunities for recapturing adult fall Chinook within regions of the upper Snake and Clearwater spawning aggregates (Nez Perce Tribal Hatchery and Oxbow FH) for developing local broodstocks for the Clearwater River and the Hells Canyon reach of the Snake River, respectively. Localized broodstocks developed at the two sites would then be used to produce fall Chinook for harvest and to supplement the Clearwater River and Hells Canyon reach of the Snake River. Continue to maintain an integrated program utilizing adult returns to Lyons Ferry FH and Lower Granite Dam for release of juveniles at Lyons Ferry FH and other mainstem release sites below the confluence of the Snake and Salmon rivers to (a) help meet LSRCP mitigation goals and harvest goals for the lower Snake River, (b) serve as a genetic reserve for Snake River fall Chinook, and (c) provide a source of fish for developing two localized stocks for the Clearwater River and the Hells Canyon reach of the Snake River, respectively. In particular, the Nez Perce Tribal Hatchery may be an appropriate place for developing an "early-run" fall Chinook population for the Clearwater River in addition to restoriing the current run in the lower Clearwater River. Developing an "early-run" population of fall Chinook is a long-term goal of the Nez Perce Tribe.

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

**Recommendation LF-FC8:** As the number of natural-origin adult recruits' increases over time, the number of hatchery-origin fish spawning naturally should decrease to allow the establishment of viable, self-sustaining naturally spawning populations. Ultimately, this might require the development of a sliding scale for the number of hatchery-origin fish allowed to pass upstream of Lower Granite Dam**.** Modifications to the Lower Granite Dam collection and

sorting facility (see recommendation LF-FC14) may be required to achieve this objective. Strays from other fall Chinook populations should be minimized if other mainstem collection sites are identified by comanagers (e.g, at Lower Monumental Dam or Ice Harbor Dam).

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

**Recommendation LF-FC9:** Concurrent with the future objective of establishing viable, self-sustaining naturally spawning populations, discontinue returning hatchery-origin adults to the Snake River as long as adult returns continue to number in the thousands of fish as they have in recent years**.**

## *Incubation and Rearing*[60]

***Issue LF-FC10: The fall Chinook reared at Lyons Ferry FH periodically experience outbreaks of Bacterial Gill Disease which can result in substantial losses to a broodyear****. Reductions in rearing densities achieved by utilizing the adult holding ponds have reduced outbreaks; however, mortalities have still reached 3.5% since the rearing modification was made. Therapeutic treatment is required. Most of the bacterial gill disease occurs in the raceways although it can occur in the lakes (a bacterial gill disease outbreak only occurred once in 14 years of rearing fall Chinook in the lakes). Fish size (less than 35 fish per pound) at time of movement between the raceways and the lakes and manganese in the water supply are hypothesized to increase susceptibility to the disease. Rearing densities are currently low and not thought to be a contributing factor, but the complexity of the program and fish distribution practices at the hatchery may favor bacterial infections when fish are most susceptible*.

**Recommendation LF-FC10:** Investigate modifying hatchery practices to reduce or eliminate the incidence of Bacterial Gill Disease. Consider adjusting feed frequency or amounts, investigating flow patterns and turnover in lakes for modifications of water flow, increasing aeration in the lakes, and improving cleaning methods in the raceways**.** Comanagers may need to consider resizing the yearling and subyearling programs**.**

***Issue LF-FC11: Juvenile fall Chinook released as yearlings are given a medicated feed to help control bacterial kidney disease.*** *These treatments are given prophylactically (i.e. when the fish do not show clinical signs of disease). The U.S. Department of Agriculture and other federal agencies have published warnings and advisories regarding the biological risks and potential overuse of antibiotics. However, BKD is annually detected in the fall Chinook juveniles at Lyons Ferry FH and the acclimation sites, indicating that antibiotic treatment may be necessary to control this disease if the fish are reared to the yearling stage. At release, the yearling fish show de-scaling and a loss of parr marks, indicators of physiological*

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[60] *The public review draft version of this report previously included an issue and recommendation (formerly LF-FC10) that recommended against the use of Lyons Ferry fall Chinook for "back-filling" egg/fish shortages of other fall Chinook programs. That issue was redundant with other other issues/recommendations and was deleted in the final report presented here in response to comments received from the Confederated Tribes of the Umatilla Indian Reservation (see Appendices C and D). As a result, Issues LF-FC10 through LF-FC27 presented here in this final report are one less in number than Issues LF-FC11 through LF-FC28 referenced by stakeholders and comanagers in Appendices C and D.*

*maturity/stress. Propagation of fall Chinook beyond the stage of smoltification increases their susceptibility to BKD.*

**Recommendation LF-FC11:** Re-evaluate the need for regularly scheduled prophylactic use of erythromycin feed with the goal of phasing out its use. Included in this phase-out could be a study that evaluates adult returns from erythromycin treated and untreated juvenile groups.

## *Release and Outmigration*

***Issue LF-FC12a The natural life history of fall Chinook in the Snake River includes the outmigration of juveniles to the ocean as sub-yearlings or as yearlings after over-wintering in fresh water or the Columbia River estuary.*** *Currently, natural-origin Chinook from the Snake River commonly enter the ocean as subyearlings, whereas juveniles from the Clearwater River commonly enter the ocean as yearlings. The majority of hatchery-origin fall Chinook are currently released as subyearlings; however, fall Chinook are released into the Snake River as yearlings at three locations: Lyons Ferry FH (200,000 fish), Pittsburg Landing (150,000 fish), and Captain John Rapids (150,000 fish). In addition, fall Chinook are released as yearlings at one location in the Clearwater River: the Big Canyon facility (150,000 fish).It is unclear whether the current strategy of releasing a proportion of each brood year as yearlings confers any net benefits with respect to meeting the stated goals of the program.*

***Issue LF-FC12b: Fall Chinook salmon released as yearlings are held in the hatchery and acclimation sites beyond the natural physiological stages of smoltification and outmigration for this species****. Signs of stress and maturation are detected by de-scaling and loss of parr marks during fish health pre-release exams done at Lyons Ferry FH and the three acclimations sites. At the acclimation sites, the yearlings are held for several months and can be infected by pathogens such as IHNV and enteric redmouth disease, transmitted from migrating adult salmonids in the river water supply. When water conditions become less favorable at the acclimation sites, the fish can show increased mortality due to pathogens. Prior to 2005, bacterial kidney disease (BKD) was significantly worse among pre-release yearling juveniles than subyearling juveniles until stringent BKD prevention techniques (erythromycin injections of adults, use of progeny from low BKD female parents, and use of medicated feed) and improved fish culture (low densities) reduced disease progression. However, low levels of BKD have been detected since 2005 in 4 to 42% of the yearling fish during the five-month rearing period prior to release.*

***Issue LF-FC12c: Adult return rates for fall Chinook released as yearlings are, at the present time, approximately twice (2x) return rates of fish released as subyearlings.*** *This ratio was more than ten times (10x) greater during the early 1990's when return rates were much lower. Substantially more fish could be reared if all fish were released as subyearlings.*

***Issue LF-FC12d: The acclimation facilities (Captain John's, Pittsburgh Landing, and Big Canyon) have problems with intake water supplies and back-up power generation that require highly trained personnel during emergency situations****. Fish in the yearling program are on site for 2.5 –3 months, just before the subyearling program Chinook which are on site for 6-8 weeks.*

**Recommendation LF-FC12:** Assess the overall benefits and risks of releasing a proportion of each brood year as yearlings versus releasing all fish as subyearlings. These evaluations should include considerations of the natural life history strategies of fall Chinook in areas

where hatchery fish are released to determine if current yearling release levels and locations are consistent with program goals and the current life history strategies of natural-origin fall Chinook in the Snake and Clearwater rivers. For example, it may be desirable to continue the yearling program for releases in the Clearwater River – where water temperatures are colder – but discontinue the yearling program for releases in the Snake River downstream of Lower Granite Dam (e.g., at Lyons Ferry FH). If the benefits of releasing fall Chinook as yearlings do not significantly outweigh the risks, consider terminating or greatly reducing the yearling program and prioritize/increase the number of subyearlings released to achieve the LSRCP mitigation goal of the program. Determine if increases in the subyearling program would continue to meet the necessary densities and/or environmental conditions required for healthy production at Lyons Ferry FH and the acclimation sites. Use of a lake for rearing subyearlings could be investigated to reduce densities. The goal would be to establish acclimations of 6-8 weeks so that time in the acclimation sites is reduced, thereby decreasing exposure to pathogens, reducing operational time and exposure to limiting water conditions at the acclimation sites.

## *Facilities/Operations*

*See Lyons Ferry Steelhead for additional Facilities/Operations issues and recommendations.*

***Issue LF-FC13: The adult collection and sorting facilities at Lower Granite Dams are inadequate as a broodstock collection site for the fall Chinook program to meet current program objectives.*** *During years when large numbers of steelhead and hatchery-origin fall Chinook return to Lower Granite Dam, facility constraints at the dam, stress associated with handling large numbers of fish, and water temperatures limit the ability to collect and sort broodstock to meet program objectives (trap up to 20% of the run, incorporate up to 30% natural origin fish into the broodstock, and do not trap adult fish when temperatures exceed 70 degrees F). As a result, based on the current run size projections for steelhead and fall Chinook in 2009, only 12% of the fish ascending the ladders at Lower Granite Dam will be targeted for interception and sorting, thus resulting in a likely integration of only 6%-8% natural origin fish into the broodstock. The adult holding ponds for adult fall Chinook at Lyons Ferry FH fall Chinook are scheduled for modification in 2010 (dividing the four ponds into eight) which will allow more fish trapped at Lower Granite Dam to be safely handled at the facility.*

**Recommendation LF-FC13:** Consult with the Army Corps of Engineers and comanagers to modify the collection facilities at Lower Granite Dam to allow for improved broodstock and escapement management (see LF-FC4) including the sorting of a high proportion of fall Chinook in the presence of large numbers of steelhead passing at the same time. Facility modifications would also allow for the future management of hatchery-origin fish passage upstream of Lower Granite Dam (*pHOS*).

***Issue LF-FC14: Lack of shade covers over the raceways increases crowding of fish, particularly during the summer months, potentially increasing stress and disease risks to the fish reared on station.***

**Recommendation LF-FC14:** Evaluate the use of shade covers to reduce stress and improve post release survival.

***Issue LF-FC15: The accumulation of manganese precipitate in the water supply lines restricts flow and water conveyance, reducing the rearing capabilities of the facility over time****. Manganese precipitate has been observed in hatchery manifold lines which has resulted in constricted water flow and subsequent line replacement. The Review Team presumes that this precipitate is accumulating in the main water line also which could eventually reduce overall water availability. High concentrations of dissolved manganese in the well water also poses a fish health risk to fall Chinook and may contribute to the incidence of Bacterial Gill Disease. The shallowest well (number 4) is considered the largest contributor of manganese. (The Hatchery Complex Manager reported to the Review Team that recent work to rehabilitate well pump number 5 found heavy accumulation of manganese precipitate on the pump shaft and spyder casing. In addition, he stated that they have purchased a water testing kit to monitor manganese in the water supply).*

**Recommendation LF-FC15:** Consult with Service engineers to investigate modification of water chemistry to preclude formation of precipitate. In addition, consider deepening well number 4. Determine whether accumulated manganese precipitate can be removed from the main water line or if sections must be replaced, and remove or replace smaller pipes that are constricted.

***Issue LF-FC16: Although the hatchery has a sophisticated alarm system, the alarm does not function properly and - at times - provides false or erroneous information which could lead to fish loss.***

**Recommendation LF-FC16:** Service the alarm system and/or consider upgrading the system so that it functions properly**.**

***Issue LF-FC17: Pumped well water from the Marmes pump station is the exclusive water source for the facility, increasing the risk of catastrophic loss to fish reared on station. Lyons Ferry FH rears several out-of-basin stocks at the facility. There are risks associated with the loss of these fish on station and/or releasing these stocks into the mainstem Snake River.***

**Recommendation LF-FC17:** Develop a contingency plan to address the loss of the water supply. This should include prioritization of stocks and plans for emergency transportation or direct release into the Snake River. WDFW should investigate the possibility of installing a backup pump system that would draw water from the mainstem Snake River.

***Issue LF-FC18: The Lower Snake River Compensation Plan office is reviewing the ownership status of water rights associated with all comanager-operated facilities which divert water for fish culture.*** *In the case of Lyons Ferry FH, the water right is currently held by the Army Corps of Engineers. In addition, state law requires adequate documentation and reporting of the beneficial use of the water in support of the water right to maintain that right to divert water.*

**Recommendation LF-FC18:** Complete transfer of the water right from the Army Corps of Engineers to the U.S. Fish and Wildlife Service. WDFW should work with the Lower Snake River Compensation Plan office to ensure water diverted for fish culture is measured and reported correctly. Water use information needs to be maintained by the Service's, Region 1 Engineering, Division of Water Resources.

***Issue LF-FC19: The roof of the fall Chinook spawning building leaks.***

**Recommendation LF-FC19:** Repair the roof of the fall Chinook spawning building.

***Issue LF-FC20: A number of safety issues were identified at Lyons Ferry FH during a Service safety review but have yet to be corrected, thus posing a safety risk to hatchery staff****. Identified issues include catwalks and railings for the fall Chinook adult trap and collection facility.*

**Recommendation LF-FC20:** Contract or hire temporary maintenance staff to correct safety issues.

## *Research, Monitoring, and Accountability*

***Issue LF-FC21: Fall Chinook subyearlings released on station are not currently PIT tagged.*** *WDFW has proposed PIT tagging the on-station subyearling release, and have calculated that they would need to PIT tag 48,000 fish based on past SAR's to obtain adequate adult return data.*

**Recommendation LF-FC21**: PIT tag the subyearlings at the recommended rate.

***Issue LF-FC22a: Information is limited regarding the proportion of hatchery and natural-origin fall Chinook spawning naturally.*** *Proportions of hatchery versus natural origin fall Chinook migrating upstream are monitored at Lower Granite Dam; however, spawning ground surveys in natural production areas have been difficult.*

***Issue LF-FC22b: Little is known regarding differential reproductive success of natural-origin versus hatchery-origin recruits in natural spawning and rearing areas.***

***Issue LF-FC22c: Released hatchery-origin fall Chinook juveniles may pose competition and predation risks to natural-origin fall Chinook, but little or no information is presently available to evaluate this.***

**Recommendation LF-FC22:** Increase monitoring of adult hatchery and natural interactions on the spawning grounds and juvenile interactions in the rearing habitat. Consider a structured evaluation of differential reproductive success of hatchery and natural origin recruits spawning in the Snake River above Lower Granite Dam.

***Issue LF-FC23: A consistent mechanism for dealing with contingencies that are not covered in management documents or through the Annual Operation Plan process appears to be lacking****. The comanagers meet on an annual basis to agree upon program actions; however, if contingencies arise, there is no apparent, agreed upon process to discuss and reach agreement. Additionally, management documents designed to facilitate contingency planning, such as HGMPs or Statements of Work (SOWs), are not updated on a regular basis, and, in the case of HGMPs, have not been approved which means a formal ESA consultation process has not been completed for salmon and steelhead.*

**Recommendation LF-FC23:** Continue to work with the comanagers to establish such a consistent mechanism, such as within the AOP process and including the finalization and approval of all HGMPs.

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

**Recommendation LF-FC24:** Continue to work through the backlog of annual reports, and complete annual reports within one year of the previous year's work.

***Issue LF-FC25: The evaluation and dissemination of sampling data are not timely, inhibiting the ability for managers to make decisions based on current information. At the present time,*** *reporting of coded-wire tag data does not meet the specified standards of the Pacific Salmon Commission.*[61] *Those standards require preliminary reporting of data for the current calendar year no later than January 31 of the following year.*

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

## *Education and Outreach*

***Issue LF26: The Lyons Ferry FH displays and handouts are outdated.*** *The existing Lyons Ferry FH displays were installed in the 1980's through early 1990's when the facility was constructed.*

**Recommendation LF26:** Update the displays and handouts so that they accurately reflect the present state of salmon and steelhead and the associated programs at Lyons Ferry FH.

***Issue LF27: Dissemination of public information regarding Lyons Ferry FH and its associated programs could be improved.*** *The LSRCP web site lacks information for the general public. Additionally, WDFW does not currently manage a web page for Lyons Ferry FH.*

**Recommendation LF27:** Information regarding the conservation (and harvest) benefits that the programs provide should be readily available to the public (e.g., simple brochures, interactive web pages, etc.). For example, benefits provided by each hatchery program could be updated annually on the LSRCP website 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

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

information for the program, any WDFW page for Lyons Ferry FH should be linked to this site.

# Alternatives to Current Program

The Review Team considered the benefits and risks of the existing fall Chinook program at Lyons Ferry FH and developed four alternatives designed to reduce risks and/or increase benefits. The first alternative is the current program with all previously-described recommendations adopted. The last alternative is the "no hatchery" option. Following these descriptions of alternatives, the Review Team has identified recommended alternatives.

## *Alternative 1: Current program with recommendations*

**Pros**

- Maintains gene bank for Snake River fall Chinook.
- Provides fall Chinook for mitigation harvest opportunities.
- Provides adult hatchery spawners to supplement natural spawning populations until supplementation and natural spawning escapement goals and objectives are met.
- Maintains a high priority for reducing demographic risk in the one remaining fall Chinook population until at least one of the two extirpated fall Chinook populations within the Snake River MPG required for recovery are available for natural production.
- Explores opportunity to develop a localized broodstock for the Clearwater and Hells Canyon portions of the Snake River population.
- Explores potential for providing localized adult hatchery spawners to supplement natural spawning populations until natural spawning escapement goals and objectives are met.
- Can reduce risks associated with maintaining population gene bank at one facility (Lyons Ferry FH) and emphasizes the development of Nez Perce Tribal Hatchery and Idaho Power portions of the program for additional broodstock collection and rearing.
- Allows for reductions in *pHOS* as natural production increases to meet comanager goals and objectives.
- Provides fall Chinook for mitigation harvest opportunities.
- Increases the long-term viability of the Lower mainstem Snake River population.

**Cons**

- Will not lead to recovery of Snake River fall Chinook as recovery is currently defined (two of three pre-existing populations within the ESU need to be viable).
- Reduces the potential harvest opportunities in the Snake River until natural production goals and objectives are achieved on a regular basis.

## *Alternative 2: Develop an early returning stock of fall Chinook for the Middle Fork Clearwater River upstream from the North Fork Clearwater River as an alternative to reintroducing fall Chinook upstream of Hells Canyon Dam*

Implement Alternative 1 but manage fall Chinook as four populations versus three populations. Establish two stocks of fall Chinook in the Clearwater Basin that includes an "early fall" Chinook stock in the Middle Fork Clearwater River. The Nez Perce Tribe's oral history describes a stock of Chinook that spawned in the Middle Fork Clearwater River in early fall. Spawning salmon and extensive Tribal fisheries were described in the Journals of Lewis and Clark at the time the expedition was camped at "Canoe Camp" just upstream of the confluence of the North and Middle Forks in early October 1805. This stock of salmon was apparently extirpated by Lewiston Dam in the early 20$^{th}$ century. The Nez Perce Tribe has proposed to reestablish the "early-spawning fall Chinook" life history by selectively rearing the earliest spawners at Nez Perce Tribal Hatchery and Lyons Ferry FH and releasing the progeny in the Middle Fork Clearwater River, the lower portion of the South Fork Clearwater River, and lower Selway River.

**Pros**

- Potentially adds an additional and unique spawning aggregate to the Snake River Fall Chinook ESU and allows the ESU to develop additional diversity (or to express diversity that currently exists).
- Increases the distribution of the Snake River Fall Chinook ESU into habitat that is currently not occupied.
- Increases the abundance of natural-origin Snake River fall Chinook.
- Increases productivity by utilizing suitable, but vacant, habitat.
- Contributes to recovery of the Snake River Fall Chinook by increasing the diversity, distribution, abundance, and productivity within the ESU.
- If successful, contributes to the LSRCP mitigation goal.
- Restores a traditional Tribal fishing opportunity.
- Contributes to recreational and commercial fisheries.

- Tests the concept of using artificial propagation to accelerate adaptation to the unique temperature and hydrographic conditions of the Middle Fork.

**Cons**

- Although artificial selection has changed spawning and return timing of some hatchery populations, the concept of using artificial propagation to adjust the spawn timing of a naturally producing population has not been tested.

- Spawn timing changes induced in the "early spawning" component would not be desirable and could have a negative survival impact on the other spawning aggregates within this ESU.

- Production allocated to development of an early-spawning component could, in the short term, reduce the number of fish available for harvest mitigation.

## *Alternative 3: Reallocate program priorities to include the release of fall Chinook upstream of Hells Canyon Dam in the extirpated Marsing Reach and/or Salmon Falls population's historic spawning and rearing areas*

Include the release of fall Chinook salmon upstream of Hells Canyon Dam as a high priority. This alternative puts equal priority on meeting the LSRCP mitigation goal and recovery of the ESU as prescribed by the ICTRT. This alternative requires both upstream and downstream fish passage through the Hells Canyon complex of three dams and extensive habitat restoration in the area upstream of Hells Canyon Dam.

**Pros**

- Aides in meeting the recovery criteria for the Snake River fall Chinook population set forth by the ICTRT.

- Continues to support LSRCP mitigation goals.

- Maintains harvest opportunities for Snake River fall Chinook.

**Cons**

- Historic spawning and rearing habitat for the Marsing Reach and Salmon Falls populations are severely limited (e.g. poor water quality, impoundments, flow and temperature issues, water diversions, exotic predatory fish species, etc.).

- Extensive investment to modify infrastructure to provide upstream and downstream migration/passage of adult and juvenile fall Chinook, respectively, including trap and haul facilities.

- Requires relicensing of Hells Canyon Dam and possibly other dams to address habitat and passage issues.

## *Alternative 4: Terminate the program and other programs at Lyons Ferry FH and decommission the facility*

Decommission hatchery in favor of alternative mitigation strategies such as habitat restoration, passage improvements, or alternative hatchery production at another site.

**Pros**

- Significantly reduces the proportion of hatchery-origin fall Chinook spawning naturally in the Snake River.

**Cons**

- Eliminates the gene bank program for Snake River fall Chinook.
- Eliminates harvest mitigation of Snake River fall Chinook.
- Eliminates the priority for reducing demographic risk of extinction of Snake River fall Chinook.
- Does not directly address the need to reestablish two of the three populations within the Snake River fall Chinook MPG, required for the population group to be considered recovered.

## *Recommended Alternatives*

The Team recommends implementing Alternative 2 in conjunction with the current program recommendations (Alternative 1). This approach involves: (a) developing management goals and objectives for four major spawning aggregates within the Lower Snake River mainstem fall Chinook population; and (b) establishing an early returning stock of fall Chinook for the Middle Fork Clearwater River upstream from the North Fork Clearwater River. The intent of this approach is to;

i. Fully implement the Nez Perce Tribal Hatchery program to provide a localized broodstock source for release and acclimation in the mainstem Clearwater River between the North Fork Clearwater and the Snake River;

ii. Fully implement the Idaho Power Company Hells Canyon program to provide a localized broodstock source for release and acclimation in the Snake River between Hells Canyon Dam and the Salmon River;

iii. Explore the potential for establishing an early-returning fall Chinook broodstock program to provide a localized broodstock source for release and acclimation in the Middle Fork Clearwater River upstream from the confluence of the North Fork Clearwater River; and

iv. Continue to collect broodstock at Lower Granite Dam and Lyons Ferry FH for the Lyons Ferry program to maintain a Lower Snake River Mainstem fall Chinook population reserve that would be used to maintain LSRCP mitigation harvest in the Snake River and as a reserve to seed the entire population if the abundance of natural-origin fish collapses to levels experienced in the mid-1990's.

This recommendation is intended to expand on the current success of the initial supplementation of the entire lower mainstem Snake River population with the existing broodstock source taken at Lower Granite Dam and Lyons Ferry FH. Implementation of this alternative would lead to development of localized broodstock sources within four major spawning aggregates of the Snake River fall Chinook population downstream of Hells Canyon Dam and in the Clearwater River. If successful, this strategy would increase spatial structure and diversity within the Snake River fall Chinook population while regional managers continue to develop a final recovery strategy based on the original ICTRT criteria, if necessary, to restore at least one of two extirpated populations upstream of the Hells Canyon complex. The Team's recommended alternative is also meant to be consistent with the intent of the current *US v. Oregon* agreement and the desire for increased harvest opportunities for state and tribal fisheries.

Given that only one population within the Snake River fall Chinook ESU currently remains, the Review Team is concerned that the continued use of a single broodstock source collected at Lower Granite Dam and Lyons Ferry FH, released throughout the entire population, would - under the current large numbers of natural and hatchery returns - reduce the long-term diversity within the naturally spawning population aggregates.

The Team also recognizes that the recommendation will require considerable time and facility investments to fully develop and implement the programs at Nez Perce Tribal Hatchery and in the lower Hells Canyon reach of the Snake River as part of the mitigation component of Idaho Power Company.

While the Team also considered reallocating the release of Snake River fall Chinook upstream of the Hells Canyon complex (Alternative 3), consistent with the ICTRT recovery recommendations, the Review Team concluded that such actions will require extensive planning, investments in infrastructure and fish passage, and a large number of management challenges to be overcome, and that such actions had a very low likelihood of being implemented in the near term. The Team also believes that the recommended alternative will be consistent with potential future actions by the ICTRT to address ESA recovery of Snake River fall Chinook.

The Team does not recommend Alternative 4, given the long-term needs to continue to conserve Snake River fall Chinook and to meet the management intent of the states and tribes under the current *US v Oregon* agreement.

# Tucannon River Spring Chinook

Operator: Washington Department of Fish and Wildlife

## Summary of Current Program

### *Goals*

- ***Harvest goal:*** There is no stated harvest goal at the present time. However, the total adult mitigation return goal under the LSRCP program is to return 1,152 spring Chinook to the Tucannon River. Of those returning adults, approximately 170 adults are required for broodstock at Lyons Ferry FH and the remaining fish are available to supplement the Tucannon River population. If successful, this program will provide harvest opportunities in the Tucannon River as originally designed under the LSRCP program.

- ***Broodstock escapement goal:*** Collect 170 spring Chinook adults (85 natural origin and 85 hatchery origin, and 50% male, 50% female) including jacks not exceeding 15% of the adult males for broodstock.

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

- ***Escapement goal for natural-origin adults***: The ICTRT identified the Tucannon River spring Chinook as an intermediate sized population with a minimum interim abundance and productivity target for ESA-listed spring Chinook in the Tucannon River of 750 natural-origin spawners and 2.2 recruits per spawner, respectively.

- ***Research, education, and outreach goals:*** Determine whether the productivity of the natural-origin Tucannon population is maintained or improved through supplementation of natural spawning by hatchery-origin fish. Determine whether Tucannon spring Chinook can be used to reintroduce spring Chinook in Asotin Creek. Provide accurate information and educational (I/E) opportunities for the public, media, schools, Tribal, State, and Federal agencies, and elected officials to enhance participation in understanding and stewardship of Lyons Ferry FH and LSRCP programs.

### *Objectives*

- Collect 170 fall Chinook (85 females and 85 males) at the Tucannon weirs and transfer the adults to Lyons Ferry FH. Spawn the adults to yield 272,000 green eggs.

- Spawn 85 hatchery and 85 natural-origin fish with the goal of using 50% females and 50% males from each group. Include a maximum of 15% jacks among the male spawners.

- Incubate and hatch the fertilized eggs at Lyons Ferry FH and rear the fish to 30 fish per pound.

- Transfer 246,000 spring Chinook from Lyons Ferry FH to Tucannon FH at 30 fish per pound in September.
- Transfer 227,000 spring Chinook from Tucannon FH to Curl Lake Acclimation Facility at approximately 12 and 18 fish per pound in February.
- Release 225,000 spring Chinook smolts at approximately 9 and 15 fish per pound into the upper Tucannon River from Curl Lake Acclimation Facility (river mile 40) in April.
- Pass hatchery-origin spring Chinook upstream of the weir on the Tucannon River to increase the size of the naturally spawning population.
- Estimate productivity of the naturally spawning population during supplementation.

## *Program Description*

The program was initiated with adult collections in 1985, however due to low adult returns in the mid-1990's, a 10-year captive brood program component was initiated in 1997 to prevent extirpation of the listed stock. It was designed to last only one generation (five brood years). This program concluded with the release of 2006 broodyear smolts in 2008. Returning adults trapped at the Tucannon FH comprise the conventional broodstock component. The conventional release goal was increased to 225,000 beginning with the 2006 brood year.

# Assessment of Current Program

## *Operational Considerations*

Listed below are the principal operational components of the hatchery program that the Review Team considered as part of its review.

### Broodstock Choice and Collection

- Natural and hatchery-origin Tucannon spring Chinook are utilized for broodstock.
- Spring Chinook are collected from April through September at the adult trap (river mile 59) located just upstream of Tucannon FH on the mainstem Tucannon River. The bulk of the run returns in May and June.
- Since the broodstock collection goal has increased from 100 to 170 adult fish (in 2006), broodstock collection goals have not been met. For 2006, 2007 and 2008, 36, 54, and 42 (average 44) natural-origin and 53, 34, and 92 (average 60) hatchery-origin spring Chinook were collected, respectively. In order to meet broodstock collection goals, WDFW is discussing adjusting the number of hatchery versus natural-origin fish used for broodstock.
- According to the section 10 permit for the program, if the total annual adult return to the Tucannon trap is predicted to be less than 105 fish, then WDFW will retain all hatchery and natural-origin

Tucannon spring Chinook salmon. If the total annual adult returns to the trap are 105 fish or more, WDFW is authorized to retain up to 70 percent of that total and release the remaining 30 percent for natural spawning. This protocol is under review by WDFW.

- Jacks are included in the brood at a rate not to exceed 15% of the adult males although this rate may be exceeded during low run years. This increased limit is necessary to meet the new release target of 225,000 yearling smolts.

- Tucannon spring Chinook, as part of the Snake River spring/summer Chinook ESU, are listed as threatened under the Endangered Species Act.

- There is currently no approved recovery plan for listed Snake River spring Chinook**.**

### Hatchery and Natural Spawning, Adult Returns

- The interim recovery goal is 750 natural-origin adults and the interim restoration goal is 2,400 - 3,400 natural and hatchery-origin adults (Snake River Salmon Recovery Plan) to the mouth of the Tucannon River (Glen Mendel, WDFW, pers. comm.). Tribal harvest occurs in the lower Columbia River (zone 6). Incidental take occurs in non-tribal commercial and sport fisheries in the ocean and in the lower Columbia River.

- In the Tucannon subbasin, spring Chinook are mainly restricted to portions of the mainstem Tucannon River. Spawning occurs in the Tucannon River from the mouth of Sheep Creek (RM 52) downstream to King Grade (RM 21). Although a very limited amount of spawning has been documented in lower Panjab Creek, spawning is rarely observed in any other Tucannon River tributary.

- Two sliding scales are being developed by WDFW to determine appropriate levels of harvest and escapement: one that does not include a mark-selective fishery and one that does. The sliding scales were included in the Fisheries Management Evaluation Plan submitted to NOAA in May, 2009 and are currently under review by NOAA.

- Based on coded-wire tag data, some summer Chinook hatchery strays have been recovered in the lower part of the Tucannon River. Stray rates vary by year. From 1990-2008, 0-13.6% (mean = 3.3%) of the spring Chinook returning to the Tucannon River were strays. During the same time period, 0-12.1% (mean=2.7%) of the spring Chinook returning to the Tucannon River were Umatilla spring Chinook.

- There has not been a comprehensive review of the ecological health of the Tucannon River watershed in relation to salmonid population status and recovery. Limiting factors such as water temperature, channel stability, sediment, and instream habitat are known to exist in the basin, but the extent of these problems is un-quantified.

- Information on the historical distribution and abundance of Tucannon spring Chinook is not available, although the Tucannon Subbasin Plan cites an estimate of 30,000 adult spawners in the Tucannon River prior to 1916 and approximately 5,000 in the 1950s. Based on the EDT analysis in the subbasin plan (Section 4.0), the historical capacity and adult abundance ranged from 12,215 to 12,688 adult spawners, the current capacity and adult abundance was estimated at 235 to 712 fish, and under an improved habitat scenario (Properly Functioning Conditions) the capacity and

adult abundance was 1,769 to 2,412 fish. The run averaged 316 natural-origin fish annually between 1985 and 2002.

- WDFW states that habitat has improved significantly in the Tucannon River since the 1980s although the lower 40 kilometers of the river were still temperature limited for spring Chinook in 2007. WDFW estimates that improving riparian cover and channel morphology in the Tucannon River mainstem would increase Chinook-rearing capacity present in the early 1980s by a factor of 2.5. Habitat restoration efforts should increase habitat utilization by spring Chinook salmon in the marginal sections of the Hartsock and Marengo strata of the Tucannon River and increase fish survival.

- Based on the 2007 annual spring Chinook report, WDFW has identified that a significant portion (approximately 53%) of the returning PIT tagged spring Chinook (both hatchery and natural-origin) bypassed the Tucannon River and were detected at Lower Granite Dam. Both hatchery and natural-origin spring Chinook stray upstream of Lower Granite Dam at approximately the same rate (57.1% for hatchery origin and 50.0% for natural origin).

- In 2007, approximately 76.7 % of the estimated hatchery-origin and 56.6% of the estimated natural-origin spring Chinook returning to the Tucannon River were trapped at the Tucannon FH trap.

- All unclipped spring Chinook not retained for broodstock , both hatchery- and natural-origin, are passed upstream to spawn naturally. All adipose-fin clipped spring Chinook are considered strays and killed at the trap. From 1986-2007, an average of 88 hatchery-origin and 94 natural-origin spring Chinook were passed above the weir.

- The HSRG estimated that hatchery-origin spring Chinook composed an average of 47% of the naturally spawning population in the Tucannon River (*pHOS* = 0.47).

- Approximately 1/3 of the primary spawning area for Tucannon spring Chinook is downstream of the Tucannon FH weir.

- The abundance of spring Chinook salmon in the Tucannon River declined significantly in 1994 and 1995, reducing the population to only 54 adult fish. In response to this decline, WDFW collected the majority of the run in 1995 for hatchery broodstock in an effort to maximize survival and maintain the population.

- Except for two years in the 1960s, non-native, hatchery-reared spring Chinook have not been released in the Tucannon River. The Klickitat and Willamette rivers were the two sources of non-native hatchery fish released in those years.

- Spawning ground surveys have occurred annually in the Tucannon River since 1985. The surveys occur on a weekly basis during the spawning period. All primary spawning areas are surveyed.

- Natural-origin fish comprised only 38 percent of the natural escapement from 1998 to 2002.

- From 1985-2008, there were on average 133 redds (range 5-299) in the Tucannon River.

- From 1985-2008, the estimated escapement to the Tucannon River was a mean of approximately 500 adults (range = 54-1,191). Of those spring Chinook, a mean of 312 (range = 3-718) fish were natural-origin adults and a mean of 214 (range = 19-658) fish were hatchery-origin adults.

- Based on broodyears 1985-2002, the approximate smolt-to-adult return rate for the natural and hatchery-origin fish was 1.48% and 0.22%, respectively.

- The recruit per spawner for the natural population is R/S = 0.56 (geometric mean) and less than one in most years. The HSRG estimated the recruit per spawner for the hatchery population as R/S = 3.0 based on generalized assumptions.

- Tucannon River spring Chinook adults collected for broodstock are transferred by truck to Lyons Ferry FH for holding and spawning. The adults are held in 52 to 54 degree F well water at Lyons Ferry FH. The low water temperatures help minimize pre-spawning mortality. The spring Chinook are held in one steelhead adult holding pond.

- All adult and jack salmon captured and hauled for broodstock from Tucannon FH are transported in a stainless steel, 500 gal tank on the back of a flatbed truck. The tank is equipped with supplemental oxygen and aerators. Transportation time to Lyons Ferry FH is about 50 minutes. Up to 15 adults can be transported in the tank at one time.

- Maintaining an equal sex ratio in the spawning population is an objective of the hatchery program. Spawning protocols currently employ 2x2 factorial design[62] to increase the number of pairwise crosses and genotypic diversity among the progeny.

- All spring Chinook carcasses are frozen after spawning, and hauled to the upper Tucannon River for nutrient enhancement of the watershed, if viral samples test negative.

- A representative number of fish are tested for virus. In 2006, 36 females and 36 males were tested.

- All adults are injected at least two times with erythromycin to help prevent bacterial kidney disease (BKD). All female adults are tested for BKD using the enzyme-linked immunosorbent assay (ELISA). BKD levels are low in this population--only 5 of the 656 females tested from 1992-2007 had high levels (>0.45 OD) of BKD.

- Adults are treated with formalin (167 ppm formalin drip) every other day to control fungus prior to spawning.

- *Nucleospora salmonis* has been detected in the spring Chinook at Tucannon FH. No pathology was associated with this detection.

Unidentified environmental limitations, potentially including warm water temperatures in the lower Tucannon River, lack of pools and riparian habitat, may be inhibiting adult spring Chinook from returning and accessing primary spawning habitat.

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[62] *In a "2x2 factorial" design, the eggs from each of two females are each partitioned into each of two aliquots of approximately equal proportion. One sub-lot from each female is fertilized my one male, and the other sub-lot from each female is fertilized by a second male. This protocol results in four, pairwise crosses of eggs and sperm (2 females x 2 males in a factorial or "matrix" design).*

### Incubation and Rearing

- The average fecundity for age-4 natural-origin Tucannon River spring Chinook is 3,400 eggs and age 4 hatchery-origin Tucannon River spring Chinook is 3,000 eggs. Age 5 natural-origin Tucannon River spring Chinook fecundity is 4,300 eggs/female and age 5 hatchery-origin Tucannon River spring Chinook fecundity is 3,600 eggs/female.

- After fertilization, eggs are rinsed and transferred to the vertical stack heath trays where they are water hardened in iodine solution (100 ppm) for one hour to control viral and bacterial disease.

- Vertical stack Heath trays are used for the Tucannon spring Chinook program. Up to 6 stacks of 14 trays are used. Flow through the stacks is about 3.5 gpm. Trays are stocked one female per tray (approximately 3,000-4,000 eggs). Individual trays allow for documenting fecundities and fertilization success of the different groups.

- Incubation and rearing at Lyons Ferry FH occur in sediment free, 51-53 degree F (11 C) well water.

- Incubating eggs are treated with formalin every other day at 1,667 ppm (37% formalin) for 15 minutes to control fungus.

- After development to the eyed-egg stage, the eggs are shocked and dead eggs are removed. Substrate (layered plastic screening material) is added to the trays, and eggs from each female are placed back in their original tray. Eggs are allowed to hatch and sac fry rear in the trays until yolk absorption is complete.

- When the incubating fry (supplementation and captive progeny) have completely absorbed their yolk sacs, they are ponded directly into the raceways. The raceways are partitioned by a screen to aid in initial feeding. The outdoor intermediate tanks may be used if there are small egg takes from three to five females. Those would be reared to a size large enough to consolidate with larger takes in the raceways.

- Six intermediate fiberglass rearing tanks were installed in 2006 to provide more space during early rearing to reduce rearing densities so that they would not exceed 0.15 DI. The intermediate tanks also allow individual spawn groups to be grown together in size before mixing in outside raceways and allow fish to be moved to the raceways at a much larger size, possibly increasing survival to release. Currently, these intermediate rearing tanks are not used for the program.

- In November-December, the spring Chinook are transferred to the standard raceways at Lyons Ferry FH (10 x 100 x 2.8 feet in water depth). Each raceway is supplied with 500-1,000 gal/min of well water at constant temperature. Up to three raceways are used for this program with a maximum flow index of F.I. = 0.52.

- Raceways are cleaned weekly by brushing screens and vacuuming pond floors.

- Lyons Ferry FH guidelines for “early rearing” densities are not to exceed 0.15 DI to control BKD. These guidelines are followed. When the spring Chinook are reared in rearing ponds (Curl Lake), densities are very low, approximately 10% of the maximum rearing densities in the raceways.

- Fry are initially fed eight or more times per day. Feeding frequency, percent body weight per day, and feed size are adjusted as fish increase in size in accordance program goals.

- Tucannon River spring Chinook are transferred from Lyons Ferry FH at approximately 30 fish per pound to Tucannon FH in September for final rearing and release. The Chinook are coded-wire and elastomer tagged about two weeks before transfer.

- At Tucannon FH, spring Chinook are reared in concrete round ponds or raceways on river water, except when well water is added mid-winter to maintain water temperatures near 40 degrees F. Depending on the number of fish transferred to Tucannon FH, fish are placed in a 15 x 136 x 4 feet in water depth raceway, two 10 x 80 x 3 feet in water depth raceways and/or in circular ponds (40 ft. diameter x 2 feet in water depth). In early to mid-October, the Chinook are moved into the adult pond until release into Curl Lake.

- In an effort to eliminate the potential for bacterial gill disease, the hatchery staff uses a vacuum system to clean the raceways. This method of cleaning results in less raceway sediments becoming suspended during cleaning.

- The maximum density and flow indexes for various concrete ponds at Tucannon FH are 0.11 DI in the raceways and 0.06 in the larger adult pond. FI in each of the units is approximately 0.88 and 0.67 respectively.

- Survival: Green to eyed egg survival rate is 96%, eyed eggs to hatch is 96%, fry to fingerling transfer to Tucannon FH, is 98%-99 % survival from fingerling to release from Curl Lake (average of the last 5 years).

- One prophylactic treatment of aquamycin (erythromycin) is used to control BKD in the juvenile spring Chinook at Lyons Ferry FH. This treatment lasts 28 days, and is typically applied in July and August, through feed with 4.5% aquamycin. This is performed as a preventative measure as BKD is currently not an issue in the spring Chinook juveniles.

- Unidentified environmental limitations, including temperature, sedimentation, parasites (e.g. *Nucleospora salmonis, Ceratomyxa shasta*) or potential predators, may reduce egg-to-smolt survival of natural-origin fish in the Tucannon River.

### Release and Outmigration

- Spring Chinook are 100% coded-wire and elastomer tagged with no adipose-fin clip.

- Fish are transferred to Curl Lake from Tucannon FH in mid-February (at approximately 12 and 18 fish per pound), and allowed 3-4 weeks of acclimation before the outlet of the pond is opened, allowing for volitional outmigration. Once the pond outlet screens are pulled, fish have about 4-5 weeks when they can leave the pond at any time. Generally, most of the fish don't exit the pond until April. During the final week of release, dam boards in the pond outlet are slowly removed to lower the pond. This generally encourages all remaining fish to leave.

- Checks for elastomer and coded-wire tag retention are conducted at Tucannon FH prior to transferring the fish to Curl Lake AP in February.

- In 2009, the large group was transferred at 16 fish per pound and the small group, 20 fish per pound.

- Density indexes within Curl Lake are very low, maximum DI ≈ 0.005. Fish are fed by truck mounted feed blower.

- For 2009, the target release goal was 55,000 fish @ 9 fish per pound & 59,000 fish @ 15 fish per pound (114,000 total). Fish are released at two different sizes as part of a study (see description in the Research section below).

- Only 60% of the smolts released from Curl Lake survive to the mouth of the Tucannon River.

- Survival components for natural-origin spring Chinook in the Tucannon River (brood years 1985-2005) have been estimated as: egg-to-parr = 10.1%, parr to smolt = 55.8%, and egg to smolt = 5.8%.

- Survival components for hatchery-origin spring Chinook in the Tucannon River (brood years 1985-2005) have been estimated as: egg to parr = 84%, parr to smolt = 87.3%, and egg to smolt = 72.6%.

## Facilities and Operations

### *Lyons Ferry FH*

- Lyons Ferry FH was designed to rear 8,800 pounds (142,000 smolts) of spring Chinook salmon (15 fish per pound) for release.

- There are three ponds used for adult holding that are 83x10 with a water depth of 5 feet. Adult steelhead are held in 2 ponds and spring Chinook and/or Touchet and Tucannon stock steelhead in the third pond. These adult holding raceways are enclosed over the middle one-third of the raceway length by the spawning building, where spawning occurs.

- A catastrophic power and water system delivery failure may require release of spring Chinook into the Snake River at Lyons Ferry FH.

- Discharge from Lyons Ferry FH complies with all NPDES standards. However, steelhead and spring Chinook spawning effluent are discharged directly into the Snake River.

*See Lyons Ferry Fall Chinook section for additional information regarding Lyons Ferry FH Facilities and Operations*

### *Tucannon FH*

- The Tucannon FH adult trap was constructed in 1998 after floods in 1996 destroyed the previous trap. The new trap is located at the intake diversion dam and includes a ladder system around the dam. The ladder can be opened to allow unrestricted passage if necessary. Trap efficiency is highly dependent on springtime flows. Plastic flaps were added to the top of the trap's weir/intake diversion dam in 2008 to help restrict upstream passage of adults when flows are high.

- The ladder at the trap is left open October-January to allow for unrestricted passage of fish populations.

- At Tucannon FH, raceways are supplied with oxygenated well or river water from the hatchery's central degassing building. Approximately 1,000 gpm (2.2 cfs) water enters raceway (15 x 136), 400 gpm (0.9 cfs) enters raceways (10 x 80), and 200 gpm (0.45 cfs) enters the round ponds.

- 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 (FI) is monitored monthly and rarely exceeds 80% of the allowable loading. The flow index is about 1.5 at Tucannon FH.

- Tucannon FH is supplied with three different water sources. River water is fed from the Tucannon River, and ranges in temperature from 33 to 60 degrees F, during use by the hatchery. The intake is located one half mile upstream of the hatchery. This water travels down an open channel into the man-made Rainbow Lake. From the outlet of Rainbow Lake the water travels through an 18" above ground pipeline to the hatchery. This pipeline was completely replaced in 2005. Rainbow Lake functions as a reservoir to provide the hatchery with cooler water in the summer months and warmer water in the winter months. It also provides a pool of water to draw from when encountering adverse intake conditions, resulting in temporary loss of water flows. The water right for this source is 16 cfs. Well water is pumped from two separate sources to an aeration tower, and then gravity fed to the rearing units and the domestic pump building. The combined well water right is 2 cfs, with well #2 running around 54 – 57 degrees F and well #3 running a constant 61 degrees F. Spring water is pumped from an underground collection site to the same aeration tower and gravity fed to rearing units. The water right for this source is 5.3 cfs, and has a stable temperature of 51-52 degrees F.

- The Team was unable to determine if the Service is the owner of record for the water right(s) for Tucannon FH and Curl Lake Acclimation Pond.

- The Team was unable to determine if water diversions are adequately measured and reported to meet Service standards for documenting beneficial use and state standards for annual reporting.

- The sluice way to the Rainbow Lake intake is being undermined and requires repair.

- The Rainbow Lake intake screen meets NOAA screening criteria.

- The Rainbow Lake outlet channel is an earthen dam structure that is monitored frequently by WDFW hatchery and wildlife staff.

- The rotating drum screen at the outlet of Rainbow Lake requires maintenance. The outlet screen is aged and a request for replacement was submitted in 2009.

- The Hatchery staff reported no water quantity issues at Tucannon FH.

- Rainbow Lake is stocked with rainbow trout and managed for public fishing.

- The volume of Rainbow Lake has been reduced by approximately 50% due to silt buildup.

- WDFW is investigating alternatives for improving the rearing environment at Tucannon FH. However, modifications to the facility to use natural rearing techniques may not be feasible economically.

- The facility has a low and high water alarm system and an emergency backup generator that provides power to the entire facility.

- There are no shade covers over any of the ponds.

- There is overhead wire but no bird netting over the circular ponds. WDFW has put in a request for netting over these ponds (2009).

- There is no predation control (fencing or netting/wire) around the two small raceways. The earthen pond is protected with a low 4' chain link and electric fence to reduce otter predation. Overhead wire is used to reduce bird predation. The single large raceway is surrounded by a 6' chain link fence but has no bird predation control.

***Curl Lake Acclimation Pond***

- Curl Lake AP has a water right of 2,694 gpm (6 cfs), though rarely more than 5 cfs is used. It is supplied with water from the Tucannon River through a gravity water supply system. It is currently utilized for acclimation of spring Chinook yearlings for release into the Tucannon River. Water temperatures at this time of year range from 34 to 48$^{o}$ F. Based on the river water temperature, oxygen levels range from 11 to 14 ppm.

- Curl Lake Acclimation Pond is a 0.85 hectare natural bottom lake, with a mean depth of 2.7 m (pond volume estimated at 22,203 $m^3$), and is supplied with a maximum of 0.17 $m^3$/sec (6 cfs or ~2,690 gal/min) river water.

- Curl Lake water is held in by an earthen dam that is monitored frequently by WDFW hatchery and wildlife staff.

## Research, Education, and Outreach

- The Dayton Lab monitors, evaluates, and coordinates fishery services and research activities for the Lyons Ferry FH Complex.

- Spring Chinook are 100% coded-wire and elastomer tagged with no adipose-fin clip. The elastomer tags are used for a size at release study that is ongoing. The elastomer tags are used to identify the different fish size groups when sampled, prior to release and during migration. Spring Chinook are split into two groups when marked. At Tucannon FH, the two groups are fed at different rates and put on different water temperatures. The size at release goals for each group are 9 and 15 fish per pound. Results are forthcoming.

- 2,500 PIT tags are also applied to each release group as part of the size at release study. PIT tags are used to study the emigration timing and relative success of the hatchery releases.

- Coded-wire tag data provides information regarding contribution to fisheries. PIT tag data provides juvenile survival information through the Columbia River basin dams.

- A smolt trap is operated on the Tucannon River to monitor hatchery and natural-origin spring Chinook outmigration.

- Redd surveys and smolt trap operations are used to monitor natural-origin spring Chinook abundance and productivity.

- For broodyears 1997-2002, a captive brood study was performed. The program was only planned for one generation to reduce the genetic impacts. Additionally, smolt-to-adult survivals for the conventional supplementation program have been better than the captive brood program. The captive brood adults were held in circular tanks at Lyons Ferry FH. The program may be reinstated as a "safety net" program, as identified in the Federal Columbia River Power System Biological Opinion, so that production goals can be met on an annual basis.

- Captive brood progeny were released from 2002-2007. In 2007, estimated survival of PIT tagged releases from Curl Lake to Lower Monumental Dam was estimated as 68% for supplementation releases and 61% for captive releases. . Additional information on smolt to adult survival rates is forthcoming and will continue until 2011, when the last adult should return from the captive program.

- An initiative is being developed among LSRCP comanagers to standardize monitoring and evaluation and create a standardized data management system for data entry and reporting.

- Approximately, 1,200 tourists visit Tucannon FH annually.

- Occasional school and college tours occur at Tucannon FH, especially during broodstock collection and spawning. Tourists traveling to the wildlife area and summer anglers stop in to tour the facility.

- Fishing opportunities are provided to the public at Rainbow Lake on the Tucannon FH property (estimated 10,000 fish harvested; 15,000 angler hours). Curl Lake is also stocked with rainbow trout to provide fishing opportunities during the summer. The US Forest Service holds an annual fishing derby on Rainbow Lake.

- Tucannon FH maintains a Kids Fishing pond in Dayton.

- Tucannon FH has a visitors' kiosk with signs describing salmon life-history, the Snake and Columbia River basin environment, and hatchery production.

- The USFWS maintains a web site with the goal to provide timely information to the public regarding hatchery operations and program benefits.

- WDFW does not have a web page describing Tucannon FH and its programs.

## *Benefit and Risk Assessment*

### *BENEFITS CONFERRED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY*

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to the propagated stock and local community,[63] the Review Team identified the following benefits of this hatchery program:

#### Harvest Benefits

- There is very little tribal, or sport harvest benefit inside the project area (Snake River and Tucannon River). Currently, Tucannon River spring Chinook are not adipose-fin clipped and are not available for mark-selective fisheries.

#### Conservation Benefits

- The long-term goal of the program is to rebuild the Tucannon River population of spring Chinook to a viable and sustainable level that can provide recreational and tribal fishing opportunities.
- The hatchery broodstock serves as a genetic reserve for the Tucannon spring Chinook population.
- The program reduces the demographic extinction risk of Tucannon spring Chinook because the recruits-per-spawner for the naturally spawning population is approximately R/S = 0.5, but R/S is greater than 1.0 for fish spawned in the hatchery.

#### Research, Education, Outreach and Cultural Benefits

- The spring Chinook captive broodstock program developed methodology and is monitoring results which can be useful in determining future need/role of captive programs for rebuilding numbers of Tucannon spring Chinook.
- The experimental captive broodstock program for Tucannon spring Chinook contributed valuable research information regarding the use of captive broodstock strategies in rebuilding this threatened salmon stock.
- Spring Chinook are historically an important subsistence food source for Native peoples in the region. Restoring a harvestable population will maintain an important cultural opportunity.
- Tucannon FH is located adjacent to the Wooten Wildlife Area and Camp Wooten and provides educational opportunities to anglers and tourists that come to the area.

### *BENEFITS CONFERRED TO OTHER STOCKS, SPECIES, AND COMMUNITIES*

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to other species and stocks,[64] the Review Team identified the following benefits of this program:

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[63] *See Section II, "Components of This Report", for a description of these potential benefits and risks.*

### Harvest Benefits

- There is very little commercial, tribal or recreational harvest benefit downstream of the project area. Tucannon River spring Chinook are not adipose-fin clipped and are not available for mark-selective fisheries. Based on 1985-2003 brood year, coded-wire tag recoveries reported to the RMIS database, sport and commercial harvest combined accounted for an average of less than 2% of the adult Tucannon River hatchery fish recovered for the 1985-1996 brood years.

- Increased fishery impacts occurred for the 1997 through 1999 broods (fishery harvest comprised an average of 20% for recoveries). The subsequent cessation of adipose clipping of hatchery production, and additional fishery restrictions, resulted in a less than 1% fishery impact on the 2000-2003 Tucannon Spring Chinook broods.

- Estimated total harvest (based on data downloaded from RMIS database on 5/9/08) of Tucannon River hatchery Chinook harvested in fisheries reported by agencies other than WDFW (sport, treaty, and commercial fisheries) averaged 15.3 fish per broodyear (range 0-191) for broodyears 1985-2003.

- Estimated total harvest (based on data downloaded from RMIS database on 5/9/08) of Tucannon River hatchery Chinook harvested in fisheries reported by WDFW (sport, treaty, and commercial fisheries) averaged 1.4 fish per broodyear (range 0-14) for broodyears 1985-2003.

### Conservation Benefits

- Tucannon spring Chinook is a possible donor stock for reintroduction of naturally spawning Chinook into Asotin Creek.

### Research, Education, Outreach and Cultural Benefits

- The experimental captive broodstock program for Tucannon spring Chinook contributed valuable research information regarding the use of captive broodstock strategies in rebuilding threatened salmon stocks.

- Tucannon FH is located adjacent to the Wooten Wildlife Area and Camp Wooten and provides educational opportunities to anglers and tourists that come to the area.

#### *RISKS POSED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY*

In the context of all possible genetic, demographic, ecological and other risks that a hatchery program can pose to the propagated stock,[65] the Review Team identified the following risks of the hatchery program:

### Genetic Risks

- The comparatively low recruit to spawner ratio for naturally spawning fish coupled with the high proportion of hatchery-origin spring Chinook spawning in the Tucannon River inhibits

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[64] *Ibid.*
[65] *Ibid.*

development of a properly integrated program, which poses a genetic domestication risk to the Tucannon River spring Chinook population, although PNI is slightly greater than 0.5.

- Removal of a substantial proportion of natural-origin spring Chinook at the hatchery weir for the integrated broodstock program poses genetic and demographic risks to the natural population.

### Demographic Risks

- Lack of shade covers over the raceways concentrates fish in shaded areas along raceway walls during summer months, increasing densities and potential stress, which can exacerbate fish health risks.

- Limited fencing and bird netting at Tucannon FH increases demographic risks to fish on station due to predation by birds and mammals.

- Transportation of adults to the holding and spawning site (Lyons Ferry FH) and juveniles to the intermediate rearing site (Tucannon FH) and to the acclimation site (Curl Lake) poses demographics risk to the stock during transport and physiological (stress) risks during loading, transport, and following release.

- A power outage at Lyons Ferry FH poses a risk of catastrophic loss to the Tucannon spring Chinook stock because the facility relies exclusively on pumped well water.

- Sediment accumulation has reduced the water storage capacity of Rainbow Lake, posing a risk of catastrophic loss when the intake is obstructed by debris during high flows.

### Ecological Risks

- Silt accumulation in Rainbow Lake is a potential source for disease, including IHNV, parasite hosts and bacteria, posing a fish health risk to the fish reared on station at Tucannon FH.

- Stocking of hatchery trout in the Tucannon FH water supply (Rainbow Lake) poses a disease risk to the program while juveniles are reared at Tucannon FH.

- Anadromous fish in the Tucannon FH and Curl Lake water supply (Tucannon River) pose a disease transmission risk to the propagated stock.

- Amplification of disease within the hatchery poses a disease risk to the propagated stock.

- Ecological risk from antibiotic resistance in bacterial flora within the system from erythromycin injections and prophylactic use of medicated feeds for hatchery-reared fish, and antibiotics in effluent.

### Physical Risks

*See the Lyons Ferry fall Chinook section for physical risks associated with Lyons Ferry FH.*

### Research, Education, Outreach and Cultural Risks

- None identified.

### *RISKS POSED TO OTHER STOCKS, SPECIES, AND COMMUNITIES*

In the context of all possible genetic, demographic, ecological, and other risks that a hatchery program can pose to other stocks and species in a watershed,[66] the Review Team identified the following risks from the hatchery program:

#### Genetic Risks

- High stray rates of Tucannon River spring Chinook may pose a genetic risk to other populations of Chinook salmon.

#### Demographic Risks

- Lyons Ferry FH was not designed to rear multiple stocks of fish in lots of varying sizes. This situation increases fish health risks.

- Operation of weirs and traps for spring Chinook and steelhead hatchery programs in the Tucannon River pose risks of migration blockage, injury, and stress to other endemic fish species within the Tucannon Basin.

#### Ecological Risks

- The release of untreated effluent from the spawning area at Lyons Ferry FH poses fish health and water quality risks to fish and other species downstream of Lyons Ferry FH.

- High stray rates of Tucannon River spring Chinook may pose an ecological risk to other populations of Chinook salmon.

- The collection and barging of spring Chinook smolts at mainstem Snake River and Columbia River dams poses a stress (crowding and handling) and overall fish health risk to other populations of salmon and steelhead that are co-collected for barging.

#### Research, Education, Outreach and Cultural Risks

- None identified.

[66] *Ibid.*

# Recommendations for Current Program[67]

The Review Team considered all the benefits and risks outlined in the preceding section. The Team concluded that some of the risks outlined in the preceding section were either minor or their probability of occurrence was small and, thus, did not warrant a proposed change or recommendation for the current program. The recommendations outlined below, in addition to potentially increasing benefits towards achieving program goals, address the identified risks or potential problems considered by the Review Team to warrant a potential modification to the current program. Preceding each numbered recommendation is a brief summary of the issue.

## *Program goals and objectives*

***Issue TR-SC1: Program goals, separate from mitigation goals, are not expressed quantitatively in terms of intended benefits.*** *According to the HGMP (2005), the purpose of the program is to "provide mitigation under the LSRCP program [by returning 1,152 hatchery-origin spring Chinook back to the Tucannon River] while meeting conservation and recovery criteria established for the Tucannon River population and the Snake River spring/summer Chinook ESU." Additionally, the HGMP states that, "the goal of the program is the restoration and enhancement of spring Chinook salmon in the Tucannon River using supplementation with the indigenous stock. The HGMP also lists a preservation/conservation goal of conserving the genetic resources of the naturally reproducing Tucannon River spring Chinook population. However, those conservation goals are not quantified or prioritized.*

**Recommendation TR-SC1:** Restate and prioritize program goals in terms of long-term numeric outcomes for the following parameters: (a) natural population abundance and viability (conservation goals); (b) the total number of hatchery-origin fish returning to the Tucannon River (mitigation goal), and (c) the proportions and desired numbers of the preceding two groups of fish allocated for broodstock, natural-spawning escapement, and harvest. Both short-term and long-term goals need to be described. Short-term goals should be established that are attainable under current conditions. Benchmarks should also be established for measuring success towards meeting program goals and to provide guidance for future program actions. Based upon the information available, the Team has assumed that the immediate short-term goal of the program is to prevent extinction of the Tucannon River spring Chinook population. If this assumption is correct, then the size of the hatchery program should be adjusted to specifically address that goal (see below).

## *Broodstock Choice and Collection*

***Issue TR-SC2: An insufficient number of hatchery and natural-origin adults return to the Tucannon River to meet the current broodstock collection goal of 170 spring Chinook, composed of 50% natural-origin and 50% hatchery-origin fish.*** *Establishing a broodstock*

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[67] *The Review Team believes that the WDFW and the LSRCP office will be the logical parties to coordinate to implement most of the following recommendations.*

*collection goal of 170 fish as a first priority may result in "broodstock mining" of natural-origin fish and impede achievement of short-term conservation goals for the natural population. Three alternative recommendations are presented below, only one of which can be implemented, depending on comanager goals and priorities for spring Chinook in the Tucannon River.*

**Recommendation TR-SC2a:** If the principle short-term goal of the program is to prevent extinction and maintain a viable natural population in the Tucannon River, then the Team recommends that comanagers reduce the size of the program to approximately 100,000 smolts consistent with HSRG recommendations for a "primary" population. Under this strategy, the relative numbers of hatchery and natural-origin adults retained for broodstock would need to follow a sliding scale where the proportion of the broodstock composed of natural-origin fish (*pNOB*) would be reduced when the total number of natural-origin recruits available for broodstock was restricted by low numbers of returning adults. This adjusted "conservation" program should be consistent with HSRG guidelines for integrated hatchery populations of *primary* conservation value (i.e., *pHOS* <30% and *PNI* > 0.67). These guidelines can be achieved if mean *pHOS* is less than 25% and mean *pNOB* = 50% over continuously-running, four-year cycles (one salmon generation). To meet these guidelines, the deliberate passage of hatchery-origin spring Chinook upstream of the weir will need to be reduced (see Issue and Recommendation TR-SC3 below). Potentially reducing the proportion of the broodstock composed of natural-origin fish to less than 50% (e.g., pNOB = 25%) while maintaining PNI > 0.50 (e.g., by not passing any hatchery-origin fish upstream of the weir for several years) may be desirable while the naturally spawning population upstream of the weir stabilizes, assuming that sufficient numbers of natural-origin recruits are available to meet minimum natural-spawning escapement goals under a conservation strategy. These recommended actions would need to be closely monitored, consistent with ongoing efforts.

**Recommendation TR-SC2b:** If the principle short-term goal of the program is to maximize the total number of adult recruits (hatchery + natural-origin) to the Tucannon River each year while – at the same time - maintaining a naturally spawning population in the Tucannon River where conservation is still a goal but not necessarily the first priority, then the Team recommends that comanagers adjust the size of the program to 160,000 smolts consistent with HSRG recommendations for a "contributing" population. Under this latter strategy, the relative numbers of hatchery and natural origin fish used for broodstock and passed upstream to spawn naturally would both be equal (i.e., mean *pNOB* = mean *pHOS* = 50%). A sliding scale could be implemented where *pNOB* is greater than 50% in "high" return years but less than 50% in "low" return years for natural-origin recruits. Under this latter strategy, the number of hatchery fish passed upstream of the weir would never exceed the number natural-origin fish passed upstream unless the naturally spawning population is at high short-term risk of extinction.

**Recommendation TR-SC2c:** If the principle short-term goal of the program is to simply maximize the total number of adult recruits back to the Tucannon River with the LSRCP mitigation goal representing the first priority and conservation of the naturally spawning population representing a lower priority, then all hatchery and natural-origin adults necessary for achieving the mitigation goal should be retained for broodstock (n = 85 male:female pairs) and all remaining fish passed upstream to spawn naturally. Under this management option, no restrictions would be placed on pNOB or pHOS, and the relative proportions of hatchery and natural origin fish retained for broodstock and passed upstream would be approximately identical and equal to their relative proportions among all fish trapped at the weir. This

management strategy could result in no fish passed upstream of the weir in some years if the total number of trapped fish was less than the broodstock collection goal.

## *Hatchery and Natural Spawning, Adult Returns*

***Issue TR-SC3:.The composite natural spawning of hatchery- and natural-origin spring Chinook in the Tucannon River has a geometric mean recruit-to-spawner that is less than one (R/S<1.0).*** *The relatively large number of hatchery-origin spring Chinook spawning naturally in the Tucannon River (mean pHOS ≈ 47%) exceeds the HSRG guideline of pHOS < 30% for integrated hatchery programs. Moreover, the relatively large proportion of natural spawners composed of hatchery-origin fish is, most likely, (a) contributing to a mean R/S < 1.0 and (b) reducing R/S for natural-origin fish via competition effects with hatchery fish. The past management practice of allowing all hatchery-origin fish not retained for broodstock to spawn naturally upstream of the weir is a strategy that is not consistent with achieving a management goal of maintaining a viable natural population in the Tucannon River (see recommendation TR-SC2a). In addition, approximately 1/3 of all natural spawning of spring Chinook in the Tucannon River occurs downstream of the hatchery weir. Three alternative recommendations are presented below, only one of which can be implemented, depending on comanager goals and priorities for spring Chinook in the Tucannon River.*

**Recommendation TR-SC3 (Alternative A):** If the principle short-term goal of the program is to prevent extinction and maintain a viable natural population in the Tucannon River, then discontinue passing hatchery-origin spring Chinook upstream of the hatchery weir and manage that portion of the naturally spawning population as a natural population reserve. Monitor and evaluate recruit-to-spawner ratios for the natural population for at least one full generation (5-6 years) to determine whether the value of R/S increases with a different management strategy. A second generation of not passing hatchery-origin fish upstream should be investigated to determine whether the population upstream of the weir can achieve a level of self-sustainability with R/S > 1.0. Investigate also the feasibility of constructing a permanent weir in the lower Tucannon River, downstream from all natural spawning areas, to provide greater management control of the naturally-spawning population. Such a weir would also facilitate management of steelhead in the Tucannon River (see Tucannon River steelhead Issue and Recommendation TR-SS11). The Review Team concluded that the demographic risks of drastically reducing the "supplementation" component of the program upstream of the weir were minor - compared to the potential genetic and demographic benefits of such actions because that supplementation component could be reinstated at any time if such actions were necessary to prevent extinction of a naturally spawning population of spring Chinook in the upper Tucannon River. At the present time, the population dynamics of spring Chinook in the Tucannon River are dominated by hatchery-origin fish, thus masking the natural reproductive capabilities of the natural population. Surplus hatchery-origin fish trapped at the weir but not retained for broodstock can be provided to the tribes for subsistence or to food banks. A fishery on hatchery-origin spring Chinook downstream from the weir may also be possible in high return years.

**Recommendation TR-SC3 (Alternative B):** If the principle short-term goal of the program is to maximize the total number of adult recruits (hatchery + natural-origin) to the Tucannon River each each year while – at the same time - maintaining a naturally spawning population in the Tucannon River where conservation is still a goal but not necessarily the first priority,

then the relative numbers of hatchery and natural origin fish passed upstream to spawn naturally would both be equal (i.e., mean pNOB = mean pHOS = 50%). Under this strategy, the number of hatchery fish passed upstream of the weir would never exceed the number natural-origin fish passed upstream unless the naturally spawning population is at high short-term risk of extinction.

**Recommendation TR-SC3 (Alternative C):** If the principle short-term goal of the program is to maximize the total number of adult recruits back to the Tucannon River with the LSRCP mitigation goal representing the first priority and conservation of the naturally spawning population representing a lower priority, then all hatchery and natural-origin adults necessary for achieving the mitigation goal should be retained for broodstock (n = 85 male:female pairs) and all remaining fish passed upstream to spawn naturally. Under this management option, no restrictions would be placed on *pNOB* or *pHOS*, and the relative proportions of hatchery and natural origin fish passed upstream would be approximately equal to their relative proportions among the fish trapped at the weir. This management strategy could result in no fish passed upstream of the weir in some years if the total number of trapped fish was less than the broodstock collection goal.

## *Incubation and Rearing*

***Issue TR-SC4: Juvenile spring Chinook are given a medicated feed to help control bacterial kidney disease.*** *These treatments are given prophylactically (i.e. when the fish do not show clinical signs of disease). The U.S. Department of Agriculture and other federal agencies have published warnings and advisories regarding the biological risks and potential overuse of antibiotics.*

**Recommendation TR-SC4:** Re-evaluate the need for regularly scheduled prophylactic use of erythromycin feed with the goal of phasing out its use. Included in this phase-out could be a study that evaluates adult returns from erythromycin treated and untreated (control) juvenile groups.

## *Release and Outmigration*

***Issue TR-SC5: Currently, no fish-health examination of juvenile spring Chinook occurs before those fish are transferred from Tucannon FH to Curl Lake and/or released from Curl Lake into the Tucannon River. Spring Chinook juveniles are held on river water that contains migrating adult salmonids, a potential source of pathogen transmission to hatchery juveniles.*** *Pre-release exams, conducted 4-6 weeks before release or transfer, are required by USFWS fish health policy FW 713 and the Integrated Hatchery Operations Team (IHOT).*

**Recommendation TR-SC5:** Sample 60 fish of each brood 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%. Along with viral testing, juvenile spring Chinook should also be tested for bacteria and parasites which may be endemic to the Tucannon River. Potential, undetected infections with pathogens could be a factor in post-release survival and return rates.

## *Facilities/Operations*

***Lyons Ferry FH***
*See the Lyons Ferry FH Steelhead and Fall Chinook sections for facility issues and recommendations.*

***Tucannon FH***

*See Issue/recommendation TR-SS11 in the Tucannon River steelhead section regarding establishing a permanent weir at the location of the temporary weir.*

***Issue TR-SC6: Lack of shade covers over the raceway increases crowding of fish, particularly during the summer months, potentially increasing stress and disease risks to spring Chinook juveniles and other fish reared on station.*** *However, Tucannon FH receives limited sunlight due to its location and the spring Chinook are not reared at Tucannon FH during the summer.*

**Recommendation TR-SC6:** Consider the use of shade covers as one method to improve post-release survival.

***Issue TR-SC7: Although on-station predation is considered minimal, the facility lacks predator exclusion mechanisms such as bird netting and fencing around some of the ponds and raceways.***

**Recommendation TR-SC7:** Construct complete predator exclusion mechanisms around all rearing units (i.e. fencing and bird netting). Implementation of this recommendation could include the installation of shade covers.

***Issue TR-SC8: The intake diversion (sluice way) is being undermined and requires repair. Intake failure could result in a catastrophic loss to fish reared on station.***

**Recommendation TR-SC8:** Consult with the Service's Region 1 Engineering Division to repair the sluice way.

***Issue TR-SC9: Rainbow Lake is a water source for fish culture atTucannon FH. Rainbow Lake is also stocked with catchable trout to provide a recreational fishery. However, stocking rainbow trout in a water source for fish culture increases fish health risks to spring Chinook juvenives reared on that water at the hatchery.***

**Recommendation TR-SC9a:** In the near term, discontinue stocking catchable trout in Rainbow Lake until the water supply is modified (see following recommendation).

**Recommendation TR-SC9b:** Enclose the currently exposed water supply from the Tucannon River to Rainbow Lake. Reconfigure Rainbow Lake intake so that the water supply to the hatchery bypasses Rainbow Lake but the lake continues to fill with Tucannon River water so that a recreational fishery may continue. Configure plumbing to the hatchery so that, in an emergency, Rainbow Lake could be used for backup water.

***Issue TR-SC10: Rainbow Lake is part of the water supply for Tucannon FH[68]; however, its capacity has been reduced due to the accumulation of silt.*** *Silt accumulation in Rainbow Lake is also a potential harbinger for disease, including IHNV, parasite hosts and bacteria, posing a fish health risk to the fish reared on station at Tucannon FH.*

**Recommendation TR-SC10:** Dredge the accumulated silt from Rainbow Lake.

***Issue TR-SC11: The Lower Snake River Compensation Plan office is reviewing the ownership status of water rights associated with all comanager-operated facilities which divert water for fish culture.*** *Adequate documentation and reporting are required to maintain the right to divert water for beneficial uses.*

**Recommendation TR-SC11:** WDFW should work with the LSRCP office to ensure water diverted for fish culture is measured and reported correctly according to the applicable regulations.

## *Research, Monitoring, and Accountability*

*Also see issue and recommendation LF-FC23, 24, and 25 in the Lyons Ferry Fall Chinook section above.*

***Issue TR-SC12a: Disease may be contributing to poor smolt productivity of natural spawners in the Tucannon River****. Endemic parasites can significantly limit juvenile survival, especially if the stock has not developed an innate resistance. Natural-origin spring Chinook may historically have had some innate resistance to endemic parasites, particularly myxosporideans. However, the rearing of this stock on well water at Lyons Ferry FH and/or Tucannon FH would not select for fish with an inherited resistance for parasites endemic to Tucannon River. The parasite Nucleospora salmonis has been detected in a limited sampling of the spring Chinook juveniles at the Tucannon FH. This parasite debilitates the immune system of salmonids and is implicated in losses of juveniles in other Snake River programs. Currently, sampling for myxosporidean parasites is limited to M. cerebralis monitoring in the rainbow trout once every three years.*

***Issue TR-SC12b: If Tucannon River stocks carry an endemic parasite, stray fish could serve as vectors of the parasite to other basins****.*

**Recommendation TR-SC12:** Continue to investigate the causes of poor smolt productivity. Test for parasites, including *N. salmonis* , *C. shasta* and other myxosporideans, in Tucannon FH juveniles (rainbow trout and acclimated steelhead, spring Chinook) and adults returning to the Tucannon River.

***Issue TR-SC13: Spring Chinook have been observed at the Lyon Ferry hatchery trap outfall.*** *To date, the trap at Lyons Ferry FH has not been operated to collect spring Chinook; therefore, the origin of these fish has not been determined.*

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[68] *Tucannon River water travels into the lake and from the lake into the hatchery.*

**Recommendation TR-SC13:** Determine the origin of Spring Chinook observed at the Lyons Ferry FH outfall. Spring Chinook identified as Tucannon spring Chinook could be retained for broodstock to compensate for broodstock shortages at trapping sites on the Tucannon River, although the first priority for broodstock should be fish that homed back to the Tucannon River.

***Issue TR-SC14: Recruit per spawner(R/S) for naturally spawning Tucannon spring Chinook is less than one (R/S<1.0), and a significant number of hatchery-origin fish are spawning naturally each year in the Tucannon River.*** *The reproductive successes of hatchery and natural-origin fish passed upstream of the weir are unknown.*

**Recommendation TR-SC14:** Conduct a genetic pedigree analysis to compare the reproductive success of hatchery and natural-origin spring Chinook in the Tucannon River if hatchery fish continue to be passed upstream of the weir. Alternatively, use archived scale or tissue samples to conduct this study.

***Issue TR-SC15a: Tucannon spring Chinook reportedly have a high degree of straying upstream of Lower Granite Dam.*** *Approximately 57.1% of the returning PIT tagged hatchery-origin spring Chinook and 50.0% natural-origin PIT tagged spring Chinook originating in the Tucannon River were detected as strays at Lower Granite Dam. This straying may be posing a demographic risk to the spring Chinook population in the Tucannon River (by reducing SARs back to the Tucannon River) for both hatchery and natural-origin fish. Extensive straying may also be posing a genetic risk to naturally spawning populations upstream of Lower Granite Dam. Habitat effects, such as flooding of the lower Tucannon River by the pool behind Lower Monumental Dam, may reduce attraction water and contribute to straying by both hatchery and natural-origin fish. The hatchery program does not appear to be the cause of straying because both hatchery and natural-origin spring Chinook from the Tucannon River stray upstream of Lower Granite Dam at approximately the same rate.*

***Issue TR-SC15b: Preliminary stray information is based upon very few recoveries of PIT tagged fish****. The PIT tag level was 1,000 hatchery and 1,000 natural smolts. PIT tagging was increased in brood year 2005 to 5,000 total hatchery-origin fish as part of the size at release study.*

**Recommendation TR-SC15***:* Continue to investigate the degree, locations, and potential causes of straying. Increase the PIT tagging level to approximately 10,000 hatchery-origin smolts. PIT-tag all natural-origin smolts captured during smolt trap operations (≈3,000 smolts per year).

## *Education and Outreach*

*See the Lyons Ferry Fall Chinook section for Education and Outreach issues and recommendations regarding Lyons Ferry FH.*

***Issue TR-SC16: The Tucannon FH displays and handouts are outdated.*** *The existing Tucannon FH displays were installed in the 1980s to early 1990s 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: Information available to the public regarding the Tucannon FH and its associated programs could be improved.*** *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 hatchery programs at Tucannon FH should be made more readily available to the public (e.g. simple brochures, interactive web pages, etc.). For example, fishery benefits provided by each program 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, then the WDFW website for Tucannon FH should be linked to it.

# Alternatives to Current Program

The Review Team considered the benefits and risks of the existing spring Chinook program at Lyons Ferry FH and developed seven alternatives designed to reduce risks and/or increase benefits. The first alternative is the current program with all previously-described recommendations adopted. The last alternative is the "no hatchery" option. Following these descriptions of alternatives, the Review Team has identified recommended alternatives.

## *Alternative 1: Current program with recommendations*

Maintain the integrated conservation program in the Tucannon River upstream of the weir where the number of fish passed upstream of the weir depends on the number of natural-origin fish trapped at the weir. This alternative would also assess the viability of the naturally spawning population by suspending the passage of hatchery-origin adults upstream of the weir for at least one full generation. The feasibility of a permanent weir site in the lower Tucannon River downstream of the principal spawning areas would be investigated.

**Pros**

- Reduces *pHOS* to less than 25% for the naturally spawning population of spring Chinook in the Tucannon River.
- Reduces the number of natural-origin spring Chinook removed from the Tucannon River for broodstock (pNOB <50%).
- Reduces genetic and ecological risks posed by hatchery-origin fish spawning naturally.

- Expected to increase the productivity (R/S) of the naturally spawning population upstream of the weir.

- Prioritizes conservation goals for spring Chinook in the Tucannon River.

**Cons**

- Would reduce the likelihood that spring Chinook would be available for harvest in the Tucannon River in some years.

- May increase the demographic risk of extirpation of the naturally spawning Tucannon River population upstream of the weir if R/S of the natural population remains below 1.0 over several years.

- Would not allow all natural-origin fish to be available for broodstock if a permanent weir is not constructed in the lower River (approximately 33% of the natural spawning by spring Chinook occurs downstream of the current weir on the Tucannon River).

- Continues to pose disease transmission risks between Lyons Ferry FH and Tucannon FH and their associated river basins.

- Spring Chinook are not reared completely on Tucannon River water, potentially reducing productivity and local adaptation of the propagated stock.

## *Alternative 2: Rear spring Chinook full-term at Tucannon FH*

Maintain current program but rear spring Chinook for their entire captive life cycle at Tucannon FH. .

**Pros**

- Provides full-term rearing of Chinook on Tucannon River water.

- May reduce straying of returning adults.

- Frees up space at Lyons Ferry FH.

- Eliminates the need to transfer fish between facilities.

- Reduces the risk of disease transmission between Lyons Ferry FH and Tucannon FH.

- Reduces demographic risks to the hatchery stock resulting from the potential loss of the water supply at Lyons Ferry FH.

**Cons**

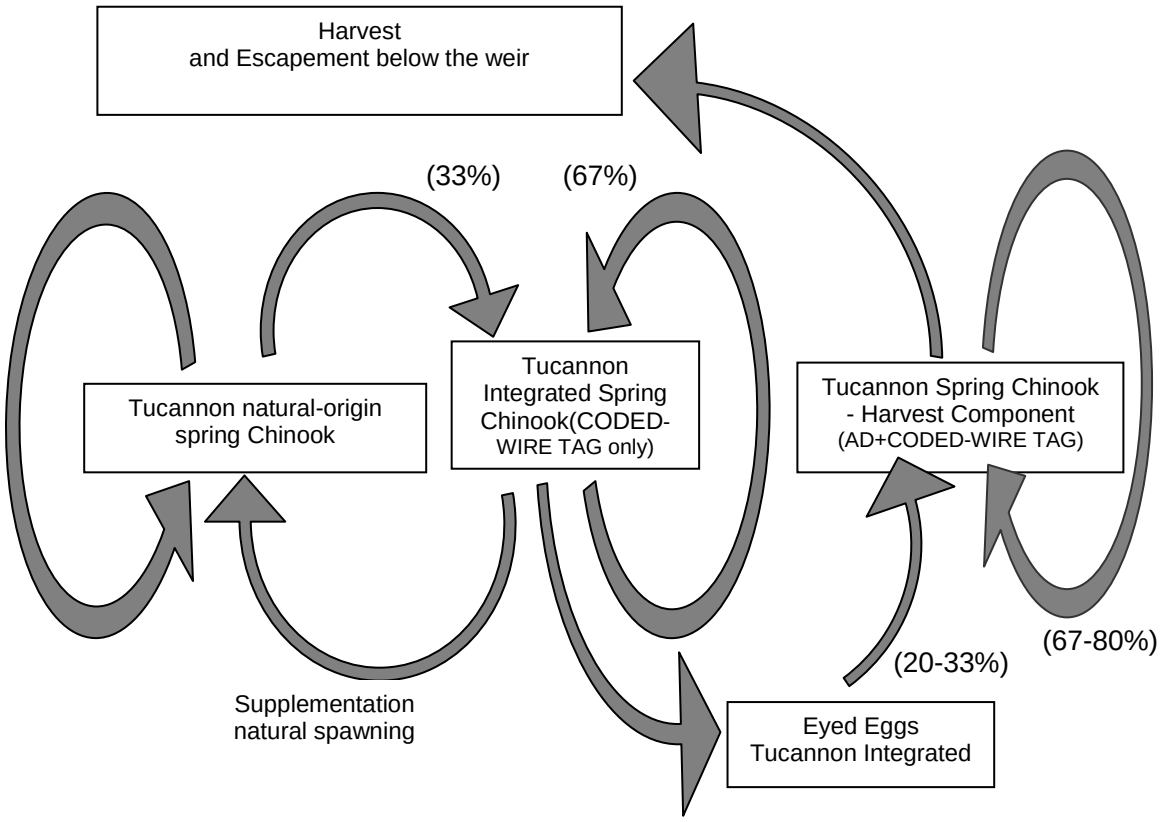
- Requires significant investment in facility infrastructure at Tucannon FH (e.g. well water or chilling for adult holding and juvenile rearing, additional rearing space, marking and tagging facilities).

- May increase fish health risks if the Tucannon spring Chinook are reared on Tucannon River water for an extended portion of their captive life cycle because the water source contains anadromous fish.

- May not reduce straying caused by the effects of the hydrosystem or other non-hatchery, environmental factors.

### *Alternative 3: Convert the current integrated program to a two-broodstock, stepping-stone program derived from the entire naturally-spawning population of spring Chinook in the Tucannon River, achieved by establishing a permanent weir downstream of all natural spawning areas*

Convert the Tucannon River spring Chinook program from an integrated to a stepping-stone program by (a) trapping natural-origin adults for the first integrated broodstock at a new weir constructed downstream of the entire spawning area and (b) using the returning adult progeny of this first broodstock as the primary source of fish for the second "harvest" broodstock. This two-broodstock approach could be accomplished at Tucannon/Lyons Ferry FHs by applying only coded-wire tags to the progeny of the first broodstock and applying 100% adipose fin clips to the progeny of the second "harvest" broodstock. The program size would be approximately 100,000 fish for the integrated component and approximately 150,000-200,000 for the harvest component. Continue to release progeny fish of the integrated component from Curl Lake and consider acclimating and releasing spring Chinook from the harvest component downstream of the weir. The harvest component could be released from the Tucannon River and/or from Lyons Ferry FH. The intent of this alternative is to meet the LSRCP mitigation goal of 1,152 adults back to the Tucannon River and to jointly work towards meeting both conservation and harvest goals for spring Chinook in the Tucannon River.




**Pros**

- Reduces *pHOS* in the naturally spawning population.
- Reduces the number of natural-origin spring Chinook used for broodstock.
- Is expected to increase the viability of the naturally spawning population.
- A weir in the lower Tucannon River would increase the number of natural-origin adult fish available for broodstock.
- May increase opportunities for establishing and achieving harvest goals by concentrating hatchery-origin spring Chinook downstream of the weir.
- If fish are released at Lyons Ferry FH, adult fish returning to Lyons Ferry FH could act as a genetic reserve for the Tucannon River population of Spring Chinook.

**Cons**

- Requires a significant investment in infrastructure to construct a permanent weir in the lower Tucannon River.

- The current geometric mean recruits-per-spawner for the natural-origin population may prohibit a stepping stone program from operating successfully.

- May not reduce the demographic risk of extirpation of the naturally spawning Tucannon River population upstream of the weir if R/S of the natural population remains below 1.0 over several years.

- Poses disease transmission risks between the Lyons Ferry FH and Tucannon FH and their associated river basins.

- The hatchery portion of the population would not rely completely on the Tucannon River water source, reducing local adaptation for the propagated stock.

## *Alternative 4: Manage spring Chinook upstream of the weir (existing or downstream location) as a natural population reserve and establish a segregated program for harvest with releases in the Tucannon River, Lyons Ferry FH, and/or the Palouse River arm*

This alternative would establish a segregated hatchery program for spring Chinook with harvest as the principal goal. The Tucannon River upstream of the weir would be managed as a natural population reserve where hatchery-origin fish would be excluded and only natural-origin fish would be allowed to spawn. The proposed segregated program would not necessarily have to be established in the Tucannon River, or even use Tucannon River spring Chinook as the broodstock source of the program. For example, spring Chinook could be released from Lyons Ferry FH or the Palouse arm to physically segregate hatchery-origin fish from natural spawning areas.

### Pros

- Reduces or eliminates *pHOS* in the natural population, especially if a permanent weir is constructed downstream of the natural spawning areas in the Tucannon River or if hatchery-origin fish are released at another location.

- Reduces genetic and ecological risks posed by hatchery-origin fish spawning naturally.

- Expected to increase the productivity (R/S) of the naturally spawning population upstream of the weir.

- Substantially reduces the demographic removal of natural-origin spring Chinook for broodstock.

- Potentially provides more fish available for harvest downstream of the weir or outside the Tucannon River Basin.

- May increase the potential for meeting harvest mitigation goals.

### Cons

- May require the use of an alternative broodstock if there are not enough Tucannon spring Chinook to establish a segregated program.

- May pose risks to local fish populations associated with the release of an out-of-basin stock if another broodstock is used or if an alternative release site is chosen (e.g. Lyons Ferry FH and Palouse arm).

- May require additional acclimation and recovery facilities.

- May significantly increase the demographic risk of extirpation of the naturally spawning Tucannon River population upstream of the weir if R/S of the natural population remains below 1.0 over several years.

- Poses disease transmission risks between the Lyons Ferry FH and Tucannon FH or other release locations and their associated river basins, if fish are reared at two separate locations on different water sources.

- Over the long-term, hatchery-origin fish from a segregated program will be susceptible to domestication effects, thus reducing the value of those fish as "genetic reserve" for the remnant natural population.

## *Alternative 5: Use Tucannon spring Chinook to reintroduce spring Chinook in Asotin Creek (can be combined with other alternatives)*

Use surplus hatchery-origin spring Chinook adults trapped in the Tucannon River as broodstock for producing juveniles for release into the Asotin River and/or for outplanting adults.

### Pros

- Provides a close source of fish that are within the same MPG for reintroduction into Asotin Creek.

- Provides a potential conservation benefit for surplus hatchery-origin adults removed at the Tucannon River weir.

- May accelerate the reestablishment of a naturally spawning population of Chinook in Asotin Creek.

- If successful, increases the viability of the Lower Snake River spring/summer Chinook MPG.

### Cons

- Requires additional rearing space and potential investments in facility infrastructure if more juvenile Chinook are reared and released (e.g. the development of an acclimation facility on Asotin Creek).

- Requires the availability of more hatchery-origin spring Chinook from the Tucannon River for broodstock to meet release objectives in both the Tucannon River and Asotin Creek.

- Fewer hatchery-origin fish returning to the Tucannon River may be available to spawn naturally in years where natural-origin returns are extremely low, which may pose a demographic risk to the Tucannon River spring Chinook population in some years.

- Poses a disease risk to any remnant, natural fish populations in Asotin Creek, including spring Chinook.

## *Alternative 6: Terminate the spring Chinook program and other programs at Tucannon FH and decommission the facility*

Decommission hatchery in favor of alternative mitigation strategies such as habitat restoration, passage improvements, or alternative hatchery production at another site.

**Pros**

- Eliminates hatchery origin spawners in the Tucannon River naturally spawning population.

- Eliminates removal of natural-origin spring Chinook from the Tucannon River.

- Potentially increases the viability of the natural spawning population in the Tucannon River if recruits-per-spawner increases above 1.0.

**Cons**

- Eliminates future harvest benefits of the program.

- Increases the demographic risk of extinction of the Tucannon River population if recruits per spawner of the natural population remains below 1.0.

- Displaces or eliminates other programs (e.g. rainbow trout) located at Tucannon FH.

## *Recommended Alternatives*

The Team recommends Alternative 3: convert the current integrated program of spring Chinook to a two-broodstock, stepping-stone program derived from the entire spring Chinook population in the Tucannon River. This alternative includes the establishment of a permanent weir in the lower Tucannon River downstream from the principal spawning areas for the entire population. This recommended alternative is intended to be implemented consistent with all recommendations in Alternative 1. The intent of this alternative is to develop specific management goals and objectives for the conservation of spring Chinook in the Tucannon River while also developing a harvest component to the program to (a) support Tribal and recreational fisheries and (b) more likely meet the LSRCP mitigation goal of 1,152 adults back to the Tucannon River by increasing the total number of smolts released.

Gametes from natural-origin adults trapped at a new weir constructed in the lower Tucannon River would be used to develop the integrated conservation component of the program, the size of which would be based annually on the total number of returning natural-origin fish. Short-term broodstock collection goals and program size for the conservation component upstream of the weir would be

adjusted and prioritized to levels that are consistent with the number of natural and hatchery-origin fish available. Broodstock and escapement protocols should meet HSRG guidelines for integrated hatchery populations of primary conservation value (i.e., *pHOS*<30% and *PNI*>0.67). These guidelines could be achieved if *pHOS* is less than 25% and the current broodstock strategy of *pNOB*=50% is retained.

To meet these guidelines, in the short-term, the deliberate passage of hatchery-origin spring Chinook upstream of the weir should be suspended. In addition, the number and proportion of hatchery and natural-origin fish retained for broodstock each year should be based on a sliding scale that is a function of the numbers and relative abundances of hatchery and natural-origin fish intercepted at the weir. Potentially reducing the proportion of the broodstock composed of natural-origin fish to a value less than 50% (e.g., *pNOB* = 25%) while maintaining PNI > 0.50 (i.e., pHOS < 25%) may be desirable as an interim short-term measure while the naturally spawning population upstream of the weir potentially develops and stabilizes after passage of hatchery-origin fish is terminated as a near-term management action. Fish produced from the integrated component would continue to be released from Curl Lake. These recommendations assume that the first priority of the program, as a short-term interim goal, is reducing demographic risks to the natural population. These recommended actions would need to be closely monitored, consistent with ongoing efforts.

The harvest component broodstock would be developed from returning hatchery-origin adults in excess of broodstock needs for achieving conservation objectives of the integrated broodstock. Both broodstock components of the program could be developed at Tucannon/Lyons Ferry FHs by differentially marking the juvenile offspring of the two components: progeny of the integrated conservation broodstock would be given coded-wire tags only, while progeny of the harvest broodstock component would be 100% adipose-fin clipped with a proportion given coded-wire tags for monitoring. Smolts representing the harvest component could be released at or downstream of the weir and should consider the development of acclimation facilities.

The Team's recommendation is intended to represent an alternative strategy to meet the near-term conservation goals for the Tucannon River spring Chinook population while developing a harvest component to meet fishery objectives in the area. The Team's recommended alternative is also meant to be consistent with the intent of the current *US v. Oregon* agreement.

The Team also recognizes that implementation of this recommended alternative would require a significant economic investment to develop a weir and acclimation facilities in the lower Tucannon River, but implementation of this alternative could be initiated at the existing weir at Tucannon FH until new downstream facilities were developed.

The Team agrees with comanagers that Tucannon River spring Chinook would be an appropriate stock for reintroduction of spring Chinook into Asotin Creek as part of a long-term recovery/rebuilding strategy. Availability of Tucannon River stock for the reintroduction into Asotin Creek would be based on the management strategy chosen for the Tucannon River population.

While the Team also considered Alternatives 1, 2, and 4, the Team did not recommend those alternatives because of several facility, biological, and logistic constraints associated with the desire to meet both conservation and mitigation goals. The Team also felt that the recommended alternative would be consistent with potential actions that may be taken in the future to address ICTRT recovery recommendations.

The Team did not recommend Alternative 6 because of (a) the long-term need to conserve Tucannon River spring Chinook and (b) to meet the management intent of the states and tribes under the current *US v Oregon* agreement.

# Lyons Ferry Hatchery Summer Steelhead

Operator: Washington Department of Fish and Wildlife

## Summary of Current Program

### *Goals*

- ***Harvest goal:*** Provide sport and tribal fishing opportunities for summer steelhead in the Snake River, its tributaries, including off-site mitigation in the Walla-Walla Basin and downstream in the Columbia River. There is currently no quantified "harvest" goal for this program separate from the LSRCP adult mitigation return goals. The intent of the program is "return" 630 adults to the project area around Lyons Ferry FH for harvest and broodstock collection, 875 adults to the Tucannon River for harvest, 750 adults to the Touchet River for harvest, and 900 adults to the Walla Walla River for harvest. In this case, harvest goals can be derived from return goals.

- ***Broodstock escapement goal:*** Collect 1,650 adult steelhead for broodstock and recovery of coded-wire tags (~150 fish/week over the time period 1 September and 15 November). Keep 400-450 for broodstock (approximately 200 females and 200 males) and return the remaining non-sacrificed steelhead to the river to be recycled in the fishery.

- ***Conservation goal:*** The program currently has no specific conservation goal.

- ***Escapement goal for natural-origin adults:*** Interim minimum abundance thresholds developed by the ICTRT for natural-origin steelhead in the project areas are listed below.

| | | | |
|---|---|---|---|
| Tucannon | A | Intermediate | 1,000 adults |
| Touchet | A | Intermediate | 1,000 adults |
| Walla Walla | A | Intermediate | 1,000 adults |

The recovery goals for steelhead in the Tucannon, Touchet and Walla Walla rivers equal the minimum abundance thresholds.

The interim restoration goals for steelhead are listed below (Snake River Salmon Recovery Plan):

| | |
|---|---|
| Tucannon | 1,823 - 3,400 adults |
| Touchet | 1,563 - 2,205 adults |
| Walla Walla | 1,875 -3,395 adults |

(pers. comm. Glen Mendel, WDFW, 2009)

- ***Research, education, and outreach goals:*** Provide accurate information and educational (I/E) opportunities for the public, media, schools, Tribal, State, and Federal agencies, and elected officials to enhance participation in understanding and the stewardship of Lyons Ferry FH and LSRCP programs.

## *Objectives*

- Collect 1,650 adult steelhead for broodstock and recovery of coded-wire tags (~150 fish/week over the time period 1 September and 15 November).
- Retain 400-450 adult steelhead for broodstock (approximately 200 females and 200 males).
- Return adult steelhead with no detected CWTs' back to the river to be recycled in the fishery.
- Spawn 106 females and 200 males to produce approximately 500,000 green eggs with the goal of obtaining 460,000 eyed eggs.
- Hatch and rear the resulting fish to approximately one year of age.
- Release 60,000 yearling smolts on-station at Lyons Ferry FH, 100,000 yearling smolts in the Tucannon River, 85,000 yearling smolts in the Touchet River, and 100,000 yearling smolts in the Walla Walla River. Total release objective = 345,000 smolts.

## *Program Description*

The Lyons Ferry steelhead stock was originally derived in the early 1980's from a combination of Wells (upper Columbia River) and Wallowa (Grande Ronde River basin) hatchery stocks. Fish are released at Lyons Ferry FH and in the Tucannon, Touchet and Walla Walla rivers. The Lyons Ferry FH stock of steelhead is considered "A" run. Other steelhead stocks that have provided fish for the Lyons Ferry program are Pahsimeroi, Oxbow, and Ringold stocks. Hatchery origin adults (mainly Wells and to a lesser extent Wallow stocks) were later trapped on site at Lyons Ferry FH to develop the Lyons Ferry FH stock of summer steelhead. A large number of returning hatchery origin adults are trapped each year at Lyons Ferry FH for broodstock (currently about 2,000 fish annually), most of which (1,000-1,200) are eventually returned to the Snake River to support fisheries after the fish are examined for the presence of coded-wire tags. The top portion of the caudal fin of released adult fish is clipped to document their presence in the fishery following release.

The hatchery currently produces 345,000 summer steelhead smolts for release into the Touchet, Tucannon, and Walla Walla rivers and at Lyons Ferry FH. All juvenile steelhead are marked with clipped adipose fins, and a portion of each release group receives left ventral fin clips and coded wire tags. Only steelhead with a clipped adipose fin may be retained for harvest as part of a mark-selective fishery in the Snake River.

# Assessment of Current Program

## *Operational Considerations*

Listed below are the principal operational components of the hatchery program that the Review Team considered as part of its review.

### Broodstock Choice and Collection

- The Lyons Ferry FH steelhead stock was originally derived in the early 1980's from a combination of Wells Hatchery and Wallowa Hatchery steelhead stocks released at Lyons Ferry FH, the Tucannon River, the Touchet River, and the Walla Walla River.

- NOAA Fisheries excluded this stock from any existing ESUs.

- The program is managed as segregated. Lyons Ferry FH steelhead (from all release sites), that are identified by a mark (adipose-fin clip and left ventral clip or adipose-fin clip only), are used for broodstock. Based on coded-wire tag recoveries, it is assumed that these adipose-fin clip only fish are Lyons Ferry stock.

- Broodstock are collected from adult returns to the hatchery. Based on coded-wire tag data, 40% of the trapped fish are from the on-station release at the hatchery, while 25%, 25% and 10% of the adult fish trapped at Lyons Ferry were released in the Touchet, Walla Walla, and Tucannon rivers, respectively.

- Lyons Ferry hatchery steelhead adults are trapped at the facility in the fall – September 1 through November 15. Before 2003, steelhead were collected from July through November; however, collection time was shortened to reduce the hatchery staff's work load. A study of the progeny of Lyon's Ferry steelhead returns, performed before broodstock collection was truncated, indicated that the progeny of steelhead collected September through November still contribute equally across the run's entire return time. No studies have been performed since broodstock collection was truncated.

- Steelhead and fall Chinook are collected for broodstock at the same times. This overlap often results in inadvertent inclusion of steelhead in the fall Chinook ponds.

### Hatchery and Natural Spawning, Adult Returns

- The intent of the program is "return" 630 adults to the project area around Lyons Ferry FH for harvest and broodstock collection, 875 adults to the Tucannon River for harvest, 750 adults to the Touchet River for harvest, and 900 adults to the Walla Walla River for harvest. In this case, harvest goals can be derived from return goals. These LSRCP mitigation goals were based on the assumption that two-thirds of returning adults would be caught downstream of the project area (presumed 2:1 recreational-to-commercial catch ratio), while one third of the returning adults would be available for recreational and tribal/commercial fisheries within the project area (presumed 1:1 catch ratio).

- "Endemic" steelhead programs exist on the Tucannon and Touchet rivers, respectively (see following two sections on those programs). As a result, steelhead from the endemic programs and Lyons Ferry steelhead are each released into the Tucannon and Touchet rivers. Lyons Ferry steelhead are distinguished from steelhead of the endemic programs by a clipped adipose fin.

- A temporary weir at RM 25 of the Tucannon weir is installed each year to trap broodstock for the endemic program. According to the 2008-2009 Annual Operating Plan (AOP) for the Lyons Ferry steelhead program, any steelhead not retained for broodstock for the endemic program are "passed upstream for natural spawning", including natural-origin (unclipped-untagged), endemic

Tucannon (unclipped but 100% tagged with CWTs), and Lyons Ferry stock steelhead (clipped adipose fins).

- Steelhead migrating upstream in the Tucannon River are also intercepted at the Tucannon FH weir at RM 36. Lyons Ferry steelhead are removed at the Tucannon FH weir, and only endemic and natural-origin steelhead are passed upstream at that point.

- Approximately 5% of the hatchery-origin steelhead trapped at the Tucannon FH weir are of Lyons Ferry origin. Lyons Ferry stock compose a much higher percentage of the hatchery-origin fish intercepted at the temporary trap in the lower river (RM 25).

- Results of a genetic analyses of steelhead populations in southeast Washington indicate that Lyons Ferry and Tucannon steelhead stocks have high genetic similarities, reinforcing WDFW's interpretations that significant genetic introgression has occurred between Lyons Ferry hatchery stock and the Tucannon endemic stock. (*see Research, Education and Outreach section below for a complete description*).

- Lyons Ferry steelhead released from Lyons Ferry FH do not appear to stray significantly to Columbia River tributaries. Less than 1% of all coded-wire tag recoveries from Lyons Ferry steelhead were in the Deschutes River upstream of Sherars Falls, a location that has historically received, and continues to receive, large numbers of stray steelhead from the Snake River. Based on the HGMP report of WDFW, an estimated annual mean ,of only 16 Lyons Ferry adult steelhead strayed into the Deschutes River for brood years 1987-2000. On the other hand, Wallowa Hatchery steelhead stray into the Deschutes River at a very high rate (see the Wallowa Hatchery steelhead program in the Oregon-LSRCP Hatchery Review Report).

- Lyons Ferry steelhead released into the Touchet River have been shown to stray into other Columbia and Snake River basin rivers. As noted previously, approximately 25% of the adult steelhead trapped at Lyons Ferry FH were fish that had been released in the Touchet River. WDFW believes that straying of Lyons Ferry steelhead from past releases in the Touchet River is environmentally related to low river flows and high water temperature**.**

- Lyons Ferry steelhead released into the Tucannon River have been detected upstream of Lower Granite Dam and remaining above the dam, although stray rate appears to be low (WDFW 2005 HGMP).

- Lyons Ferry stock released on-station at Lyons Ferry FH have been identified passing Lower Granite Dam and remaining above the dam. The steelhead may be overwintering above the dam and potentially straying to other tributaries, although stray rate appears to be low (WDFW 2005 HGMP).

- Starting in 2008, Lyons Ferry stock juvenile steelhead have been PIT tagged to help evaluate return and stray rates back to the hatchery and elsewhere, respectively (1,500 fish for the on-station release, and 3,500 fish each for releases in the Touchet, Walla Walla, and Tucannon Rivers).

- Spawning ground surveys occur annually in the Tucannon and Touchet rivers; however, turbid water in the winter and spring inhibit data collection.

- Based on a combination of spawning ground surveys and weir counts, the estimated annual spawning escapement for the Touchet River is approximately 400-500 adult steelhead: 5-20% of those fish are of hatchery origin, half of which are endemic Touchet River hatchery stock and half are Lyons Ferry stock. The estimated annual spawning escapement for the Tucannon River is 600-700 adult steelhead: 50% of those fish are endemic Tucannon River hatchery stock and 10-20% are Lyons Ferry stock.

- The estimated annual spawning escapement of steelhead in the Walla Walla River, upstream of Nursery Bridge, averaged 389 natural-origin (range = 224-722) and 14 hatchery-origin (range = 2-29) fish for the return years 1992-93 to 2000-01 (Table 4-6 of the 2004 Walla Walla River Subbasin Plan[69]). Video counts in 2001-02 and 2002-03 were 1,205 and 547 total steelhead, respectively. Video did not distinguish natural from hatchery origin, but based on previous counts at Nursery Bridge, the number of Lyons Ferry stock fish spawning in this area appears to be small.

- Weirs at Tucannon FH on the Tucannon River and at Dayton Pond on the Touchet River are used to control upstream passage of Lyons Ferry hatchery steelhead. The current management procedure is to only pass natural-origin and endemic-program, hatchery-origin steelhead upstream of the weirs; however, stream conditions (high flows) sometimes allow for uncontrolled passage. The Touchet River weir is more often not capable of controlling upstream passage compared to the Tucannon River weir. Recent modifications to the weirs (the addition of passage restriction panels) may improve control of fish passage.

- Lyons Ferry steelhead intercepted at the weirs on the Tucannon and Touchet rivers are recycled downstream to provide additional sport fishing opportunities. Natural spawning of hatchery steelhead can occur in those areas downstream of the weirs. For 2009, WDFW has received authorization to remove all Lyons Ferry steelhead returning to the Touchet River weir without recycling.

- The mitigation goal of the Lyons Ferry steelhead program, including the Cottonwood Creek program (see that section in this report) but excluding the endemic programs for the Touchet and Tucannon rivers, is to return 4,656 adult summer steelhead to the project area upstream of Lower Monumental Dam on the lower Snake River.

- Based on broodyears 1982-2003, the average smolt-to-adult return rate to the project area (harvest and returns to the hatchery) for the on-station release at Lyons Ferry FH was 1.7%.

- Based on broodyears 1987-2003, the average SAR to the project area for Lyons Ferry steelhead released into the Touchet River was 1.6%.

- Based on broodyears 1989-2003, the average SAR to the project area for Lyons Ferry steelhead released into the Tucannon River was 1.4%.

- Based on broodyears 1989-2003, the average SAR to the project area for Lyons Ferry steelhead released into the Walla Walla River was is 1.5%.

[69] *http://www.nwcouncil.org/fw/subbasinplanning/Default.htm*

- Releases have been reduced through the years in partial response to ESA concerns and documented smolt-to-adult return rates (SAR) back to the project area (upstream of Ice Harbor Dam) that far exceed the original SAR goal of 0.5%.

- Adult steelhead are trapped at Lyons Ferry FH from fish that swim volitionally into the fish ladder. Fish are held in large raceways adjacent to the trap until sorted and spawned.

- $CO_2$ is used to anesthetize adult steelhead for sorting, after which fish are retained or returned to the Snake River to support the fishery.

- MS-222 is used to anesthetize adult steelhead for spawning.

- Spawning occurs one day per week from mid-January through mid-February. Four to five spawn takes occur over this time period.

- Spawning protocols prescribe 2-to-1 male-to-female spawn ratio; milt from two males and eggs from one female are combined simultaneously. Each male is used only once. The two-to-one spawn ratio is intended to increase the genetic effective population size ($N_e$) of the hatchery-propagated population and to increase the fertilization rate.

- WDFW policy, as prescribed by the state legislature, limits options for surplus eggs (e.g., cannot dispose of eggs), thus inhibiting management options regarding potential benefits and risks.

- WDFW follows the Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State. Requirements include testing salmonid broodstock for regulated pathogens that are untreatable and can cause mortality (such as IHNV and other viruses). Tests for reportable pathogens, such as *R. salmoninarum*, other bacteria, and parasites (excluding *M. cerebralis*, a regulated pathogen) are not required for steelhead broodstocks by WDFW policy.

- All female steelhead are tested for viruses, including the IHN virus. Depending upon virology results, more females than required for broodstock may be collected because eggs from females with high levels of IHNV (_> $10^3$ plaque-forming units in cell culture tests) are destroyed.

- The number of female steelhead retained and spawned had been reduced recently to 106 females because of reduced incidence of IHN virus and increased egg survival over the past few years. The current objective is to obtain approximately 460,000 eyed eggs, which is lower than the previous objective of 520,000 eyed eggs.

- The downstream sections of the Walla Walla and Touchet rivers may be impassable to adult steelhead in August and September because of low flows and thermal barriers. Upstream migration of Lyons Ferry steelhead may be particularly impeded because that stock has a mean return time that is earlier than those for natural populations in the two rivers. Low flows and warm temperatures in the Walla Walla and Touchet rivers during the late summer might be a factor contributing to the high stray rates of Lyons Ferry steelhead that had been released in those two rivers. Low flows due to irrigation withdrawals may further prevent both hatchery and natural-origin steelhead from entering the Walla Walla and Touchet rivers until January of some years (Glen Mendel WDFW personal communication).

- Large numbers of birds nesting on artificial islands in Lake Wallula (near the mouths of the Snake and Walla Walla Rivers), in downstream reservoirs, and in the Columbia River Estuary consume large numbers of steelhead smolts, thus posing ecological and demographic risks to Lyons Ferry steelhead. Twenty to thirty percent of all PIT tagged steelhead originating in the Snake River are reported to be consumed by avian predators in the estuary.[70]

- The four mainstem Columbia River and two Snake River dams downstream from Lyons Ferry FH significantly reduce the survival of outmigrating juveniles and returning adults, thus inhibiting achievement of LSRCP mitigation goals on a consistent basis.

### Incubation and Rearing

- The average fecundity of Lyons Ferry steelhead is 4,750 eggs per female.

- Excess females and eggs are taken, relative to intended protocols, to compensate for the potential effects of IHN virus and coldwater disease on the resulting progeny.

- Fertilized eggs are water hardened in 100 ppm iodophore. They are incubated to the eyed-egg stage in down-welling, iso-incubation buckets (one bucket per female). Eggs are examined daily by hatchery personnel. Prophylactic treatment of eggs for the control of fungus includes daily treatment with formalin (1:600). Non-viable eggs and dead sac-fry are removed by hand picking with egg pickers or bulb-syringe.

- Eggs are shocked after development to the eyed-egg stage. After shocking, they are handpicked and weighed down in hatching baskets suspended over shallow troughs at 1 hatching basket per trough. Approximately 10,000 eggs (approximately the eggs from two females) are loaded in each basket. Eggs are enumerated for each female parent at the time of loading the hatching baskets. Formalin treatment is discontinued after the eggs eye up and are transferred to the hatching baskets.

- Forty-eight (48) hatching troughs are used for early incubation in the Lyons Ferry steelhead program. Water flow averages eight gallons per minute (6-10 gallons per minute) per trough. Maximum rearing densities in the shallow troughs are D.I. = 1.21 DI at 500 fish per pound prior to transfer to outside raceways.

- Egg incubation and rearing of fish occur in sediment free, 51-53 degree F (11 C) well water.

- Green-egg to eyed-egg survival averages 92% for Lyons Ferry steelhead, eyed egg-to-fry survival averages 97-98%, and fry-to-smolt survival averages 80-85%.

- After hatch and swim-up, the steelhead fry are transferred to five outside raceways at roughly 500 fish per pound in April (approximately 90,000-95,000 fish per raceway) and introduced to feed. They are reared in these raceways until marking (tagging is completed later) and transferred to one of the large fish-culture lakes (Lake One) at approximately 40 to 50 fish per pound.

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[70] *www.birdresearchnw.org. Dan Robie, OSU principal investigator.*

- Water flows in the raceways range from 500 to 1000 gallons per minute. Flow index in the raceways ranges from 0.03 at initial ponding (500 gpm) to 0.55 (1000 gpm) before the fish are transferred to Lake One or trucked and released as excess fry in a local resident-fish lake.

- Fry/fingerling are fed dry diet. Fry feeding starts at ~3 times daily (7 days per week) and is reduced to 1 time per day (weekdays only) as the fish increase in size. Range of feeding varies between 1.5 – 2.8% of fish body weight per day. Feed conversion is expected to fall in the range of 0.7:1.0 to 1.1:1.0 (dry feed) pounds fed to pounds of fish produced. Feeding frequency, percent body weight per day, and feed size are adjusted as fish increase in size in accordance with program goals.

- Excess fingerlings (up to 50,000) are reared and planted in nearby resident fish lakes (Sprague and Rock lakes). Excess numbers are determined at the time of marking (late August).

- The maximum rearing density in the raceways is DI = 0.02 (at 4.5 fish per pound). The maximum rearing density in the lake is DI < 0.002 (at 4.5 fish per pound).

- In August, the adipose fins of all Lyons Ferry steelhead are clipped, and the fish are transferred to Lake One. In mid-winter, some of those fish are transferred back to raceways to receive PIT tags, coded-wire tags, and left ventral-fin clips. Tagged fish are retained in the raceways until loaded onto transport trucks for transfer and release.

- Fish health checks occur at least monthly. Treatment for disease is provided by WDFW Fish Hatchery Specialists (hatchery staff) under the direction of the Fish Health Specialist. Sanitation maintenance includes cleaning each raceway once per week by brushing, and disinfecting equipment between raceways and/or between stocks on the hatchery site. Dead fish are removed from each raceway daily. The size and depth of the 2.1 acre lakes (e.g., Lake One) precludes cleaning other than yearly draining and drying during the summer when fish are removed. Water quality in the lakes is not affected by lack of cleaning because of low stocking density. Dead fish are rarely observed in the lakes.

- Coldwater disease is experienced annually after ponding in the raceways, resulting in a 3.5-4.5% loss of Lyons Ferry steelhead.

- Juvenile steelhead receive medicated feed (florfenicol) while in the raceways when fish mortalities due to coldwater disease increase. Through 2007, fish were treated with “fish pills” coated with florfenicol to provide a 15 mg drug/kg body-weight treatment for 10 days. In the last two years, this treatment is provided via florfenicol medicated feed at a lower dose of 10 mg/kg body-weight for 10 days, a less efficacious treatment. Disease abates in the raceways before marking occurs and is not a factor in the fish by the time they are transferred to the lake.

### Release and Outmigration

- All Lyons Ferry stock steelhead are released as yearling smolts, about 12-14 months after the parents were spawned.

- Pre-release fish health exams are not performed because the fish are reared on well water, as per the Washington Co-Managers Salmonid Disease Control Policy.

- All steelhead smolts for the program are planned for a release size of 4.5 fish per pound.

- Mean lengths of the steelhead smolts are estimated immediately prior to release. The average lengths of steelhead reared in Lake One and raceways are 220mm and 210-215, respectively. NOAA Fisheries guidelines under the ESA require the release of summer steelhead at lengths ranging from 180 to 250 mm. Coefficient of variation (CV) for the stock ranges from 8-11%.

- Lyons Ferry steelhead stock transferred for release in the Touchet River are acclimated and released from WDFW's Dayton Pond (river mile 52, downstream from the weir and below most of the natural spawning habitat for steelhead in the Touchet River). The Lyons Ferry stock steelhead transferred to the Tucannon River are direct-stream released at river mile 13, below the primary spawning habitat for steelhead in the Tucannon River. The Lyons Ferry steelhead are released directly into the Walla Walla River at river mile 35, downstream from most of the spawning habitat for steelhead. WDFW attempts to maintain significant separation between the release locations and where natural spawning is occurring.

- Steelhead produced in the large culture lakes (includes on-station releases and releases into the Tucannon and Touchet rivers) must be diverted to the release structure adjacent to the ladder/trap prior to release. The lakes are drawn down slowly by removing stop logs at the outlet. The fish volitionally swim into the outfall, down a pipe and into the release structure. The release structure consists of two 12' x 90' x 4' raceways. The fish come out of the pipe from the lake into the head end of the raceways and can go to either side. The fish, including those released on station, are pumped onto a fish distribution truck and then transported to the release site. Final fish release numbers are enumerated using the calibrated water displacement system of the fish transport units.

- A diesel powered fish pump is used to pump fish onto the fish transport trucks.

- Steelhead smolts are sampled at the release structure to estimate weight and length frequency distributions at the time of release.

- At times, during release of steelhead from the lakes, too many fish accumulate into the release structure. The extra fish must be removed and hauled back to the lake.

- To ensure that any potential loss is equally represented among the release sites, the steelhead from the lake are continuously divided up between trucks destined for each site, including the on-station release.

- The steelhead are released on-station shortly after the fall Chinook release.

## Facilities and Operations

Lyons Ferry FH

*See Lyons Ferry Fall Chinook section for additional information regarding Lyons Ferry FH Facilities and Operations.*

- Three rectangular concrete ponds are used to hold adult fish at Lyons Ferry FH. Each pond measures 83 x 10 x 5 feet deep (water depth). Adult steelhead are held in 2 ponds and spring Chinook and/or Touchet and Tucannon stock steelhead in the third pond. These ponds are enclosed over the middle one-third of the raceway length by the spawning building, where spawning occurs.

- Eleven banks of eight troughs each, each trough measuring 15 x 1 x 0.5 feet deep (water depth), are used to initially rear newly-hatched fry. Two banks of troughs are used to incubate eggs. All troughs operate on a two-pass serial reuse system. The upper four troughs of a bank receive well water directly, and the lower four troughs receive water as outflow from the upper four troughs.

- Steelhead are reared in raceways that measure 10 x 88 x 3.5 feet deep (water depth). Water flows into each raceway are maintained at 500-1000 gpm.

- Lyons Ferry steelhead are reared in one of three large, culture lakes, Lake One. The surface area of the lake is 2.1 acres. The three lakes receive a combined total of 3,500–4,200 gpm of water, providing good overall flow with no hydraulic problems.

- Water discharges from Lyons Ferry FH complies with all NPDES standards. However, spawning effluent wastewater is discharged directly into the Snake River without settling or treatment.

Dayton Acclimation Facility (Dayton Pond)

- The water right to the Dayton Acclimation Facility is 2,694 gpm (6 cfs) for the period of Jan 1st – May 15th of each year.

- Although this facility reports water flow in its Monthly Discharge Monitoring Reports as a requirement for its NPDES Permit, those reports do not appear to meet Service standards for documenting beneficial use.

- The facility is supplied with water from the Touchet River through a gravity water supply system, with the intake located at the weir/intake diversion dam just upstream of the pond. Water temperatures range from 34 to 52 F during the acclimation period.

- The total volume of the acclimation pond is 209,000 cubic feet.

- The water intake is adjacent to an intake for irrigation.

- The intake screen meets NOAA screening criteria.

- The facility has a high and low water alarm.

- Staff are on site 24 hours per day, seven days per week, when steelhead are being acclimated.

- There is no water run-off barrier or gutter between the parking lot and the pond. Water runoff from the parking lot, which is adjacent to the pond, drains directly into the pond via a continuous asphalt slope.

- The pond is equipped with a security perimeter fence but is not equipped with netting or fencing to exclude bird or mammal predators. According to WDFW, bird and mammal predation is not significant at this facility.

### Research, Education, and Outreach

- The Dayton Lab monitors, evaluates, and coordinates fishery services and research activities for the Lyons Ferry FH Complex.

- Starting in 2008, a portion of fish in all release groups of Lyons Ferry steelhead received PIT tags based on the number of fish in the release group and the expected number of adults that would return: 1,500 PIT-tagged fish for the on-station release group and 3,500 PIT-tagged fish for each of the Walla Walla, Tucannon, and Touchet release groups, respectively. Adult return data from these PIT tagged groups are analyzed separately and as an aggregate to estimate total adult returns relative to mitigation goals.

- In addition to the PIT tags, 20,000 steelhead are given coded-wire tags with a different code for each release site. Each representative release group is then held in one of 4 separate raceways.

- Coded-wire tag recoveries have not been adequate for estimating the number of adult steelhead returning to the Snake River. Recoveries are less than 5-10%, well below the 20% standard recommended by the Pacific States Marine Fisheries Commission.

- LSRCP comanagers are developing a standardized data management system (formats, data entry and reporting) for monitoring and evaluation.

- PIT tag interrogations occur at several locations in the mainstem Columbia and Snake rivers (e.g., Bonneville Dam, Lower Granite Dam), and include detectors at Lyons Ferry FH, instream on the Tucannon and Walla Walla rivers, and at the weirs on the Touchet and Tucannon rivers.

- Coded-wire tag data provide information regarding contribution to fisheries. PIT tags provide data on juvenile and adult survival both downstream and upstream through the Columbia River basin hydropower system and can be used for in-season harvest adjustments at upstream locations based on adult detections at Bonneville Dam and other dams downstream from the fishery areas.

- Mean size and time at release of steelhead smolts are based on NOAA fisheries guidelines and fish cultural experience.

- WDFW personnel operate a rotary screw trap in the Tucannon River to estimate the number of migrating natural steelhead smolts and other salmonids.

- As part of its annual broodstock collection and research activities, WDFW hatchery and evaluation staffs operate several adult steelhead traps in southeast Washington.

- Evaluation and fish management staffs conduct spawning ground surveys for steelhead in the Walla Walla, Touchet and Tucannon rivers, and Asotin Creek.

- WDFW personnel survey sport anglers within the LSRCP area of Washington in season to recover coded-wire tags from steelhead (September to April). Catch and fishing effort are not estimated from this survey; catch record cards are used to expand data obtained from recovery of coded-wire tags.

- WDFW historically conducted electrofishing surveys of stream index sites to (a) estimate the number and densities of natural-origin, juvenile steelhead, estimate population sizes for specific river reaches, and to estimate the number of residual hatchery steelhead that did not emigrate after release. In addition, mark/recapture tests were conducted to compare with standard electrofishing methods to examine bias in the estimates. These surveys have been discontinued due to the wide

variance in population estimates, and their relative lack of use as part of the hatchery evaluation program.

- Since 1998, WDFW's Dayton Lab and Fish Management staffs have periodically collected samples from southeast Washington summer steelhead populations (adult and juvenile) for genetic stock analyses. Samples have been collected from natural-origin steelhead in the Walla Walla, Touchet and Tucannon River basins, the Lyons Ferry hatchery stock, and steelhead in portions of the Grande Ronde River. During the fall of 2006, a summer steelhead genetics summary was assembled that includes data and results for most samples collected through 2005. Many natural-origin steelhead from the Tucannon River were genetically assigned to the Lyons Ferry stock indicating - with other genetic data - that Lyons Ferry hatchery steelhead have most likely made significant genetic contributions to the Tucannon River population via natural spawning and introgression. In contrast, the genetic data indicate little or no genetic introgression of Lyons Ferry hatchery steelhead in the Walla Wall River population, and relatively small amounts of introgression – if any – in the Touchet River population. The Walla Walla steelhead population appears the most distinct genetically among the Walla Walla, Touchet, Tucannon, and Lyons Ferry steelhead stocks, with the Touchet River population only slightly less distinct than the Walla Wall River population. These genetic results are very consistent with predictions based on field observations of naturally spawning fish.

- Up to100 adult steelhead carcasses are donated annually to the community college in Walla Walla for dissection in a biology class.

- Approximately 20 tourists visit the Dayton Acclimation Facility annually.

## *Benefit and Risk Assessment*

### *BENEFITS CONFERRED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY*

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to the propagated stock and local community,[71] the Review Team identified the following benefits of this hatchery program:

### Harvest Benefits

- Annual estimated harvest (expanded from coded-wire tag recoveries) of Lyons Ferry steelhead (for all release locations) within the project area averaged 3,069 (range = 1,565 to 4,161) fish for broodyears 2000-2003.

- Annual estimated harvest (expanded from coded-wire tag recoveries) of Lyons Ferry steelhead for broodyears 2000-2003 averaged, for each release location, 759 (range = 297-1,032) fish for the Touchet River, 788 (range = 325-1,138) fish for the Walla Walla River, 377 (range = 242-593) fish for on-station releases at Lyons Ferry FH, and 1,146 (range = 701-1,621) fish for the Tucannon River.

- The total estimated harvest (expanded from coded-wire tag recoveries) of Lyons Ferry steelhead within the Snake and Walla Walla rivers, and tributaries accounted for 75.7% of the total

[71] *See Section II, "Components of This Report", for a description of these potential benefits and risks.*

estimated number of harvested fish with the remaining 24.3% of the fish caught elsewhere, primarily in the mainstem Columbia River.

### Conservation Benefits

- None identified.

### Research, Education, Outreach and Cultural Benefits

- Ongoing hatchery evaluation of rearing protocols, disease histories, feed conversion, and growth and survival rates are used in adaptive management feedback loops to improve hatchery operations. The information is also communicated to the fisheries community and greater public through scientific and management forums.

- Lyons Ferry FH staff cosponsor fishing derbies and provide educational opportunities to school groups and other visitors.

#### *BENEFITS CONFERRED TO OTHER STOCKS, SPECIES, AND COMMUNITIES*

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to other species and stocks,[72] the Review Team identified the following benefits of this program:

### Harvest Benefits

- The program confers both sport and tribal harvest benefits in the Columbia River, downstream of the project area. Tribal harvest primarily occurs in zone 6 fisheries, between the Snake River confluence and Bonneville Dam, in the summer when summer Chinook, fall Chinook, and coho are also harvested.

- Annual estimated harvest (expanded from coded-wire tag recoveries) of Lyons Ferry steelhead (for all release locations) outside the project area, primarily on the mainstem Columbia River, averaged 783 (range = 324 to 1,132) fish for broodyears 2000-2003.

- Estimated harvest (expanded from coded-wire tag recoveries) of Lyons Ferry steelhead outside the project area accounted for 24.3% of the total estimated harvest on the stock (75.7% within the project area) for broodyears 2000-2003.

- Approximately 0.1%, 2.4%, and 21.8% of the total estimated harvest (expanded from coded-wire tag recoveries) of Lyons Ferry steelhead, (for all release locations for broodyears 200-2003) outside the project area occurred in the ocean, Columbia River net fisheries, and Columbia River sport fisheries, respectively.

### Conservation Benefits

- None identified.

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[72] *Ibid.*

### Research, Education, Outreach and Cultural Benefits

- Tribal harvest provides subsistence and cultural benefits to the Columbia River tribes.
- Hatchery staff provide educational opportunities offsite to other communities.

#### *RISKS POSED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY*

In the context of all possible genetic, demographic, ecological and other risks that a hatchery program can pose to the propagated stock,[73] the Review Team identified the following risks of the hatchery program:

### Genetic Risks

- Current spawning protocols that mix milt from two males simultaneously with eggs from each female could lead to some level of domestication selection due to sperm competition between males.
- The apparent genetic effective number of breeders is comparatively small to sustain the program over the long term.

### Demographic Risks

- High densities during early rearing, when the steelhead fry are in the shallow nursery troughs, may contribute to coldwater disease after the steelhead are transferred to the raceways.
- Lack of shade covers over the raceways concentrates fish in shaded areas along raceway walls during summer months, increasing effective densities, potential stress, and disease risks. This same risk does not apply to the large culture lakes.
- Crowding and loading of fish onto trucks for transportation to release sites poses risks that do not occur with on-station releases. This extra handling associated with transportation is a source of stress and can physically harm the fish which can reduce post-release survival.
- Transportation to release sites poses a demographic risk to the stock during transport and unknown physiological (stress) risks during transport and following release.
- Lyons Ferry FH was not designed to rear multiple stocks in lots of varying sizes. This creates the potential for exceeding maximum rearing densities in the steelhead raceways.

### Ecological Risks

- None identified, except for the increased risk of disease associated with artificial propagation.

### Physical Risks

- See the Lyons Ferry fall Chinook section

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[73] *Ibid.*

### Research, Education, Outreach and Cultural Risks

- Steelhead removed from Lake One, coded-wire and PIT tagged, then subsequently reared in raceways may not accurately represent the vast majority of the population that remains in the lake for the entire rearing period prior to release (lake versus raceway growth).

#### *RISKS POSED TO OTHER STOCKS, SPECIES, AND COMMUNITIES*

In the context of all possible genetic, demographic, ecological, and other risks that a hatchery program can pose to other stocks and species in a watershed,[74] the Review Team identified the following risks from the hatchery program:

### Genetic Risks

- Lyons Ferry steelhead released into the Tucannon River pose genetic risks to the natural population in the Tucannon River due to the high proportion of naturally spawning fish composed of Lyons Ferry steelhead. Interbreeding between Lyons Ferry and natural-origin steelhead in the Tucannon River is expected to reduce the productivity of the naturally spawning population.

- Outplanting Lyons Ferry steelhead into the Touchet and Walla Walla rivers poses genetic risks to natural populations; however, those risks are likely lower than in the Tucannon River which has a much greater proportion of spawning fish composed of Lyons Ferry steelhead.

### Demographic Risks

- Fisheries targeting Lyons Ferry steelhead pose demographic risks to hatchery-origin steelhead from the endemic Tucannon and Touchet river stocks, and natural-origin steelhead and local populations of redband rainbow trout, via incidental catch-and release hooking mortality.

- Fisheries targeting Lyons Ferry stock steelhead pose a demographic risk to bull trout.

- Lyons Ferry FH was not designed to rear multiple stocks of fish in lots of varying sizes. This situation increases fish health risks.

### Ecological Risks

- The discharge of untreated effluent water from the spawning area poses pathogen and water quality risks to fish and other species in the Snake River.

- The transfer and release of Lyons Ferry steelhead in the Tucannon, Touchet, and Walla Walla rivers pose ecological risks to natural-origin steelhead and local populations of redband rainbow trout in those areas. Ecological risks are believed to be greater for steelhead than salmon because of the propensity of hatchery-reared steelhead to residualize and complete their life cycles in freshwater.

- Residualized steelhead pose ecological risks to bull trout and other freshwater species.

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[74] *Ibid.*

- The collection and barging of steelhead smolts at mainstem Snake River and Columbia River dams results in stress (crowding and handling) and poses fish health risks to other populations of salmon and steelhead that are barged.

### Research, Education, Outreach and Cultural Risks

- None identified.

## Recommendations for Current Program[75]

The Review Team considered all the benefits and risks outlined in the preceding section. The Team concluded that some of the risks outlined in the preceding section were either minor or their probability of occurrence was small and, thus, did not warrant a proposed change or recommendation for the current program. The recommendations outlined below, in addition to potentially increasing benefits towards achieving program goals, address the identified risks or potential problems considered by the Review Team to warrant a potential modification to the current program. Preceding each numbered recommendation is a brief summary of the issue.

### *Program goals and objectives*

***Issue LF-SS1: Harvest of Lyons Ferry steelhead outside of the project area is much lower than the assumptions that were used historically to establish mitigation goals in terms of adult returns back to the Snake and Walla Walla rivers.*** *Current mitigation goals assumed historically that two-thirds of returning adults would be harvested outside the project area, primarily in the mainstem Columbia River (presumed 2:1 recreational-to-commercial catch ratio), while one-third of the returning adults would be available for recreational and tribal/commercial fisheries within the project area (i.e., Snake River basin). Harvest data (broodyears 2000-2003) indicates that approximately 25%, as opposed to the predicted 67%, of the returning Lyons Ferry steelhead are harvested outside the Snake River project area.*

**Recommendation LF-SS1:** Continue to adjust the size of the program based upon current and anticipated harvest regimes. Restate program goals in management documents based upon current conditions and harvest regimes.

### *Broodstock Choice and Collection*

*No issues identified.*

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[75] *The Review Team believes that the WDFW and the LSRCP office will be the logical parties to coordinate to implement most of the following recommendations.*

## *Hatchery and Natural Spawning, Adult Returns*

***Issue LF-SS2a: The pooled spawning of two males with one female reduces the genetic effective number of breeders relative to the total number of spawners and potentially imposes some level of artificial selection for life-history traits of males that are correlated with fertilization success under conditions of sperm competition.***

***Issue LF-SS2b: The presumed genetic effective number of breeders per year is lower than desired for a self-sustaining, genetically-closed population.***

**Recommendation LF-SS2:** Continue to spawn two males with every female, but subdivide the eggs of each female in approximately equal proportions and fertilize each subgroup separately with a different male. The two subgroups of eggs from a female can be combined after approximately one minute to increase fertilization rates, if desired.

***Issue LF-SS3: The proportion of adult steelhead composed of Lyons Ferry stock in the primary spawning area of the lower Tucannon River (downstream of river mile 36) exceeds genetic risk guidelines (5%).*** *Lyons Ferry steelhead captured at the temporary weir in the lower Tucannon River are returned to the river to support fisheries if they are not retained for retrieval of coded-wire tags. The estimated annual spawning escapement of steelhead in the Tucannon River is 600-800 fish with 60-70% of those fish of hatchery origin (10-20% are from the endemic Tucannon River stocks and 50% are from the Lyons Ferry stock). Genetic analyses with DNA markers indicate that significant genetic introgression has occurred between the Lyons Ferry hatchery stock and the naturally-spawning population in the Tucannon River.*

**Recommendation LF-SS3:** Either (a) reduce the proportion of naturally spawning steelhead composed of Lyons Ferry steelhead in the Tucannon River to less than 5%, or (b) discontinue the release of Lyons Ferry steelhead in the Tucannon River. Implementation of part "a" of this recommendation will require modifications to the temporary weir located in the lower river at river mile 25 (see Issue and Recommendation TR-SS11 in the Tucannon River steelhead section). The practice of "recycling" Lyons Ferry steelhead in the Tucannon River should also be discontinued to reduce the number of Lyons Ferry steelhead spawning naturally.

***Issue LF-SS4: Lyons Ferry steelhead compose greater than 5% of the adult steelhead that escape to the spawning grounds in the Touchet River*** *despite recent improvements to the weir to control upstream passage of hatchery-origin fish.*

**Recommendation LF-SS4:** Continue to monitor spawning escapement upstream of the Touchet River weir to ensure that Lyons Ferry stock steelhead compose less than 5% of the adult steelhead upstream of the weir. If this latter proportion continues to exceed 5%, then consider either (a) additional improvements to the weir or (b) reductions in the number of Lyons Ferry steelhead released into the Touchet River.

***Issue LF-SS5: The continued release of an "out-of-basin stock" into the Walla Walla River poses genetic and ecological risks to the naturally spawning steelhead population.*** *However, based upon data collected at Nursery Bridge, the proportion of hatchery-origin adults escaping to*

*the spawning grounds in the Walla Walla River, exclusive of the Touchet River, appears to be below the 5% threshold guideline for a segregated hatchery population.*

**Recommendation LF-SS5:** Continue to monitor the composition of steelhead spawning naturally (hatchery and natural) in the mainstem Walla Walla River to ensure that the 5% threshold is not exceeded.

## *Incubation and Rearing*

***Issue LF-SS6: All steelhead female broodstock are tested for IHN virus. The progeny from the females with virus titers of <$10^4$ pfu/ml (in the ovarian fluid) are kept for rearing. Management practices have improved adult returns so there is less need to keep excess progeny that may be infected with IHNV (i.e., risks of retaining infected fish outweigh the potential benefits of releasing them as smolts).***

**Recommendation LF-SS6:** If WDFW continues the individually test females for virus, then those data should be used to cull excess progeny.

***Issue LF-SS7a: Rearing densities in the indoor nursery troughs (max DI = 1.21) 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 the recommended maximum rearing density index (D.I.) for steelhead (D.I. <0.5). This protocol results in density indexes attaining D.I. = 1.21 in the indoor nursery troughs prior to transfer to the outdoor raceways.*

***Issue LF-SS7b: High rearing densities during early rearing may be contributing to the later onset of coldwater disease.*** *High early rearing densities can exacerbate infections, resulting in acute mortality that generally begins several months after hatching. At some hatcheries in the Pacific Northwest, outbreaks of coldwater disease have been significantly reduced when early rearing densities are lowered.*

**Recommendation LF-SS7:** Reduce rearing densities in the shallow troughs to a maximum of D.I. = 0.5 by either (a) increasing the number of troughs or other vessels (see LF-SS12), (b) by reducing the total number of Lyons Ferry steelhead reared, (c) by reducing the number of fish reared in other programs, or (d) by reducing the total number of stocks reared at Lyons Ferry FH.

***Issue LF-SS8: Coldwater disease causes 3.5-5% mortality annually among Lyons Ferry steelhead after they are ponded to the outside raceways****. The major pathogen problem in many northwest hatcheries, Flavobacterium psychrophilum - the bacterium causing coldwater disease - is transmitted vertically from adult females to her eggs and progeny and horizontally through the water via infected animals. This epizootiology complicates disease control. At Lyons Ferry FH, fish are treated with the chemical florfenicol if coldwater disease mortalities increase above background levels. Formerly, fish were fed pills coated with 15 mg florfenicol/kg of fish weight as prescribed by a veterinarian. New FDA regulations now designate the use of florfenicol medicated feed at 10 mg drug/kg fish weight with a Veterinary Feed Directive. At this lower dosage, the medicated feed is less effective in controlling disease and a second treatment may be needed, increasing the risk of developing drug-resistant forms*

*of F. psychrophilum. Further, delays in deliveries of the medicated feed after diagnosis of elevated coldwater disease can exacerbate mortalities.*

**Recommendation LF-SS8:** A strategy similar to the region-wide efforts used to control *Renibacterium salmoninarum* (causative agent of BKD) may be needed to control coldwater disease in NW hatcheries. The strategy to control BKD includes diagnostic testing of all female parents, antibiotic injections of adults while they are being held for broodstock, culling and or segregation of families that are the progeny of female parents at high risk of transmitting the bacteria, and rearing juvenile fish at reduced densities to reduce stress and the risk of horizontal transmission. WDFW and cooperators should 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. Studies could be set-up to investigate the effects of alternative rearing densities (e.g., D.I. = 0.2, 0.5, and 1.21) of fry in the nursery troughs to determine whether the incidence of coldwater disease is correlated with early rearing densities (see Issue LF-SS7). In addition, some hatcheries have found that saline rinses of eggs prior to fertilization improves eye-up and may reduce external loads of *F. psychrophilum on the surface of the eggs.* Communication with the USFWS Aquatic Animal Drug Approval Partnership Program (AADAP) and the newly-formed Working Group on Aquaculture Drugs, Chemicals and Biologics (AFS-Fish Culture Section) may help recapture efficacious antibiotic treatment of coldwater disease.

## *Release and Outmigration*

***Issue LF-SS9: Pre-release examinations - which include testing for virus, bacteria and parasites - are not done at the Lyons Ferry FH, Tucannon FH, or associated acclimation sites.*** *This practice increases the risk of releasing fish infected with endemic or vertically transmitted diseases. This situation could affect the future survival of released fish, and/or infected fish could serve as vectors for infecting other aquatic animals. Pre-release inspections, conducted 4-6 weeks before release or transfer, are required by USFWS fish health policy FW 713 and the Integrated Hatchery Operations Team (IHOT) Policy and Procedures.*

**Recommendation LF-SS9:** Sample 60 fish for pre-release inspections and testing for pathogens 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.

***Issue LF-SS10: Crowding, loading and transport of smolting fish onto trucks is stressful to fish and may affect post-release survival.*** *Fish within raceways and lakes are crowded and pumped into transport trucks for direct-stream release. The level of stress in the fish, and the oxygen content in raceways and lakes during crowding and loading of the trucks, has not been assessed.*

**Recommendation LF-SS10:** Assess the level of stress and oxygen content in the water in the raceways and lakes during crowding and loading, and assess post release survival 24 to 48 hours after release to resolve these uncertainties. Take actions based on results of studies to reduce stress points.

## *Facilities/Operations*

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

***Issue LF-SS11: The number of fish stocks reared at Lyons Ferry FH exceeds the design parameters of the facility.*** *This situation increases fish disease risks via a number of mechanisms including the likelihood that rearing densities will exceed fish health guidelines. The current number of stocks maintained at Lyons Ferry FH adds complexity to marking schedules and evaluation. Lyons Ferry FH, with its few, large rearing containers, was designed to produce a large number of a few stocks of fish. Endangered Species Act considerations have led to the development of multiple programs with different stocks. Additionally, Lyons Ferry FH is authorized under the LSRCP to rear catchable rainbow trout for Washington and Idaho lake fisheries. A total of seven anadromous fish stocks and two stocks of rainbow trout are reared at Lyons Ferry FH with different tag groups associated with different release locations, creating several lots of fish that must be reared separately.*

**Recommendation LF-SS11:** Reduce the number of stocks reared at Lyons Ferry FH or modify Lyons Ferry FH so that it can appropriately accommodate the current number of programs. One option may be for the LSRCP to support the rearing of rainbow trout at an existing Washington State trout hatchery. Potential modification to Lyons Ferry FH include:

- Dividing the three lakes into multiple rearing ponds.
- Dividing the adult holding containers.
- Expanding early rearing space (LF-SS12).
- Establishing water heating/chilling capacity to manipulate growth rate.

***Issue LF-SS12: Existing early rearing space is not sufficient for the numbers and types of fish reared at Lyons Ferry FH resulting in high densities during early rearing (see LF-SS7a).***

**Recommendation LF-SS12:** Consult with engineers to increase early rearing capacity at Lyons Ferry FH by modifying the existing, underutilized tank pad formerly used for supporting the captive broodstock program. Include multiple rearing vessels and, at a minimum, cover the area with a shed roof to provide shade and protection.

***Issue LF-SS13: Due to increased complexity of the programs at Lyons Ferry FH, the original infrastructure used for fish releases is inadequate and reduces flexibility in managing multiple small groups of fish.*** *The configuration of the release infrastructure requires excessive handling and pumping of fish.*

**Recommendation LF-SS13**: Consult with engineers to design improvements for fish release infrastructure.

***Issue LF-SS14: The discharge of untreated effluent water from the steelhead and spring Chinook spawning area directly into the Snake River poses a fish health risk and potential water quality risk to fish and other species downstream of Lyons Ferry FH.*** *The health risk is*

*increased because adult fish are transferred from other watersheds and may not maintain the same disease profile as adult fish trapped at Lyons Ferry FH.*

**Recommendation LF-SS14:** As a best management practice, investigate retaining or redirecting spawning effluent to the pollution abatement pond or to a special containment area with possible effluent disinfection.

**Dayton Acclimation Pond**

***Issue LF-SS15: The Lower Snake River Compensation Plan office is reviewing the ownership status of water rights associated with all comanager-operated facilities which divert water for fish culture.*** *Adequate documentation and reporting are required to maintain the right to divert water for beneficial uses.*

**Recommendation LF-SS15:** WDFW should work with the LSRCP office to ensure water diverted for fish culture is measured and reported correctly according to the applicable regulations.

## *Research, Monitoring, and Accountability*

*Also see issue and recommendation LF-FC23, 24, and 25 in the Lyons Ferry Fall Chinook section above.*

***Issue LF-SS16: Steelhead in the Tucannon River (natural-origin steelhead, 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.*** *Off-site releases of hatchery reared salmon and steelhead have generally demonstrated reduced homing abilities as returning adults. Current hatchery practices may be contributing to these stray rates, particularly the practice of outplanting fish from Lyons Ferry FH to other rivers.*

**Recommendation LF-SS16:** 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.

***Issue LF-SS17: Coded-wire tagged fish and fish carrying other types of marks or tags (e.g., PIT tags) may not accurately represent each release group from Lyons Ferry FH.*** *For example, steelhead removed from Lake One, coded-wire and PIT tagged, and then reared subsequently in raceways may not accurately represent their respective source groups at the time of release because tagged and untagged fish are subsequently reared in different containers (lake versus raceway).*

**Recommendation LF-SS17:** Ensure that tagged fish accurately represent each respective spawn group. For example, all spawn groups should be proportionately represented among tag groups and raceways. This recommendation applies also to any marking strategy, including PIT tags.

***Issue LF-SS18: Counts of the number of adult fish returning to the project area (harvest, hatchery and spawning grounds) are critical for evaluating program success.*** *The current sampling and recapture rate of coded-wire tagged fish does not meet coast-wide standards in all fisheries and does not accurately account for all harvested fish. Sampling rates are less than 5-10%, well below the 20% standard advocated by the Lower Snake River Compensation Plan Coordinator (20% of the fish harvested, according to catch record cards). The use of PIT tags is increasing to compensate for this inadequacy. The current number of PIT tag detector arrays may be insufficient to provide accurate estimates of the number of returning adults, escapement to the spawning grounds, and straying.*

**Recommendation LF-SS18:** WDFW should continue to work with comanagers to assess the mark-sampling program with the goal of increasing the percent of CWTs recovered in terminal fisheries. Alternatively, continue to use PIT tags in combination with coded-wire tags to compensate for the low recovery rate of fish with coded-wire tags.

### *Education and Outreach*

*See the Lyons Ferry Fall Chinook section for Education and Outreach issues and recommendations regarding Lyons Ferry FH.*

## Alternatives to Current Program

The Review Team considered the benefits and risks of the existing Lyons Ferry Hatchery Steelhead program at Lyons Ferry FH and developed five alternatives designed to reduce risks and/or increase benefits. The first alternative is the current program with all previously-described recommendations adopted. The last alternative is the "no hatchery" option. Following these descriptions of alternatives, the Review Team has identified recommended alternatives.

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

This alternative includes maintaining a *pHOS* of less than 5% in rivers where Lyons Ferry hatchery steelhead are outplanted, consistent with the management of natural populations native to those streams (Tucannon, Touchet, and Walla Walla rivers). For the Tucannon River, either (a) an efficient weir must be established in the Tucannon River below the primary spawning areas to prevent Lyons Ferry stock access to those areas or (b) the release of Lyons Ferry hatchery steelhead into the Tucannon River should be discontinued.

**Pros**

- Reduces the proportion of Lyons Ferry hatchery-origin adults spawning in principal spawning areas within the Tucannon, Touchet, and Walla Walla rivers.

- Maintains mitigation harvest opportunities on Lyons Ferry steelhead in the Walla Walla, Touchet, Tucannon, and Snake rivers.

- Weir improvements on the Touchet River are expected to reduce the proportion of naturally spawning steelhead composed of Lyons Ferry steelhead to below 5% in the natural spawning area upstream of the Touchet River weir.

**Cons**

- May not reduce the proportion of Lyons Ferry stock spawning in the Tucannon River to less than 5% without an efficient weir below the principal spawning area in the Tucannon River.
- Does not reduce the proportion of naturally spawning steelhead composed of Lyons Ferry hatchery-origin steelhead to below 5% in the natural spawning area downstream of the Touchet River weir or in the mainstem Walla Walla River.
- Requires a significant investment in infrastructure if an improved weir in the lower Tucannon River is constructed.
- Lyons Ferry steelhead released in the Touchet and Walla Walla rivers would be expected to continue straying to areas upstream of Lower Granite Dam.
- Additional monitoring in the Walla Walla River may be necessary to assure the proportion of Lyons Ferry stock in the natural spawning areas is less than 5%.
- Reduces harvest opportunity in the Tucannon River, particularly upstream of the temporary weir in the lower river.
- Continues disease transmission risks from Lyons Ferry steelhead to natural populations in the Touchet, Tucannon and Walla Walla rivers.

## *Alternative 2: Terminate all releases of Lyons Ferry steelhead in the Tucannon, Touchet, and Walla Walla rivers and replace with increased on-site releases of Lyons Ferry steelhead at Lyons Ferry FH and/or increase the size of endemic programs for the off station releases in the Tucannon and Touchet rivers*

This alternative would restrict releases of Lyons Ferry stock steelhead to Lyons Ferry FH. On-station releases could be increased to compensate for the termination of off-station releases (i.e. outplanting), or the additional space could be used for expanding the endemic programs for off-station releases. This alternative leaves open the option for expanding the Touchet and Tucannon river endemic programs and potential development of a new Walla Walla River endemic program or, as a another possibility, the option for reallocating mitigation resources to the release of steelhead at other sites (Grande Ronde River, etc.) depending on potential benefits versus risks.

**Pros**

- Eliminates Lyons Ferry steelhead spawning in principal spawning areas within the Tucannon, Touchet, and Walla Walla rivers (unless adult steelhead stray to those areas from on-station releases at Lyons Ferry FH).

- Maintains mitigation harvest opportunities on Lyons Ferry stock steelhead in the Snake River.

**Cons**

- Does not prevent Lyons Ferry steelhead from straying upstream of Lower Granite Dam.
- May reduce harvest opportunities in the lower Tucannon, Touchet, and Walla Walla rivers, especially if larger-sized endemic programs are not implemented.

## *Alternative 3: Terminate the Lyons Ferry steelhead program and replace with an indigenous Snake River stock for on-station releases at Lyons Ferry FH*

This alternative can be combined with some elements of alternatives 1 or 2. This alternative would replace the existing "out-of-basin" Lyons Ferry stock with another hatchery stock developed from steelhead indigenous to the Snake River. The goal of this alternative is to reduce straying risks consistent with "best management practices", improve productivity, while continuing to return sufficient numbers of adult steelhead to meet LSRCP mitigation goals for harvest. The Team did not thoroughly evaluate the pros and cons of specific alternative stocks; however, Tucannon River steelhead represent the closest indigenous stock geographically. The Team assumed formal discussions regarding indigenous stocks should be deferred to comanagers.

**Pros**

- Is expected to continue to provide harvest benefits in the lower Snake River of Washington.
- Reduces straying risks to natural populations in the lower Snake River.
- Reduces the number of stocks reared at Lyons Ferry FH if on-station releases are restricted to Tucannon and Touchet river stocks.

**Cons**

- Would terminate a hatchery stock that appears to be very successful at returning adults back to the Walla Walla, Touchet, Tucannon, and Snake rivers for harvest.
- Would require the development of a new hatchery stock or the expansion of an existing program (e.g., the endemic Tucannon River program).
- May increase fish health risks at Lyons Ferry Hatchery depending on the selected stock.

## *Alternative 4: Terminate the Lyons Ferry program (and stock) and increase the number of steelhead released at a location(s) upstream of Lower Granite Dam (e.g., Grande Ronde River, Little Salmon River)*

**Pros**

- Eliminates Lyons Ferry adults spawning in principal spawning areas within the Tucannon, Touchet, and Walla Walla rivers (unless straying occurs to these areas from on-station releases).
- Continues to provide harvest opportunities in the Snake River of Washington.
- Reduces the number of stocks reared at Lyons Ferry FH, thereby increasing the efficiency and capacity of available rearing space.

**Cons**

- Significantly reduces harvest opportunities in the lower Tucannon, Touchet, Walla Walla rivers (in Southeast Washington).
- Duration of harvest opportunities in the mainstem Snake River downstream from Lower Granite Dam is expected to be reduced because adult steelhead would be returning to upstream release locations.
- May require significant investments in infrastructure to create/modify facilities to accommodate this program.

## *Alternative 5: Terminate the Lyons Ferry steelhead program and use the space at Lyons Ferry FH for Chinook salmon and endemic steelhead programs*

**Pros**

- Increases the amount of rearing space available for other programs, including larger-sized endemic programs.
- Reduces the number of stocks reared at Lyons Ferry.

**Cons**

- Significantly reduces harvest opportunities in the lower Tucannon, Touchet, Walla Walla rivers unless larger-size endemic programs are implemented.
- May not meet LSRCP mitigation goals for Snake River steelhead upstream of Lower Granite Dam even if larger-sized endemic programs are implemented.

## *Recommended Alternatives*

***Short term goal*** **(0-15 years):** The Team favors the immediate implementation of Alternatives 2 and applicable elements of Alternative 1: (1) terminate off-station releases of Lyons Ferry steelhead in the Tucannon, Touchet and Walla Walla rivers; (2) expand the Tucannon and Touchet river endemic programs and/or increase the number of steelhead released on-site from Lyons Ferry Hatchery; and (3) implement all elements of Alternative 1 that apply to the on-station releases. Any increase in the on-

site release at Lyons Ferry FH should maintain a value of pHOS less than 5% in natural spawning areas with ESA-listed populations (e.g., Tucannon River). These short-term goals and recommendations are consistent with the recommendations for the endemic steelhead programs in the Tucannon and Touchet rivers (see following sections).

***Long-term goal* (15-50 years)*:*** Implement Alternative 3: Terminate the Lyons Ferry steelhead stock and replace with an indigenous Snake River stock for on-station releases at Lyons Ferry FH. The Team concluded that propagation of the out-of-basin Lyons Ferry stock in the lower Snake River is inconsistent with best management practices.

# Cottonwood Creek Summer Steelhead (Wallowa Hatchery stock)

Operator: Washington Department of Fish and Wildlife

## Summary of Current Program

### *Goals*

- ***Harvest goal:*** Provide sport and tribal fishing opportunities for summer steelhead in the lower Grande Ronde River. There is currently no quantified "harvest" goal for this program separate from the LSRCP adult mitigation return goals. The mitigation goal is to return 1,501 summer steelhead to the project area for harvest and broodstock collection.

- ***Broodstock escapement goal:*** Collect a minimum of 150 hatchery-origin (marked) adult steelhead (50 females and 100 males) for broodstock from March through April on Cottonwood Creek (tributary to the Grande Ronde River).

- ***Conservation goal:*** The program currently has no specific conservation goal.

- ***Escapement goal for natural-origin adults:*** None, although all hatchery-origin adult steelhead trapped on Cottonwood Creek in excess of broodstock needs are passed upstream of the adult trap and weir.

- ***Research, education, and outreach goals:*** Provide accurate information and educational (I/E) opportunities for the public, media, schools, Tribal, State, and Federal agencies, and elected officials to enhance participation in understanding and stewardship of Lyons Ferry FH and LSRCP programs.

### *Objectives*

- Trap adult steelhead on Cottonwood Creek at the adult weir facility. Collect eggs and milt from a minimum of 50 females and 50 males. Depending on virology tests, additional females may be retained for broodstock.

- Transport the gametes to Lyons Ferry FH, and fertilize the eggs 1 female to 1 male to yield approximately 220,000 fertilized eggs.

- Incubate and hatch the eggs at Lyons Ferry FH. Rear the resulting fish to yield 160,000 yearling pre-smolts.

- Transfer the yearling pre-smolts to the Cottonwood Creek acclimation pond adjacent to the confluence of Cottonwood Creek and the Grande Ronde River.

- Release 160,000 yearling smolts into the Grande Ronde River from the Cottonwood Creek Acclimation Facility.

## *Program Description*

The program was initiated in 1985 with the release of 250,000 Wallowa Hatchery (ODFW) steelhead smolts from the Cottonwood Creek Acclimation Pond. A permanent adult trapping and holding facility was installed in Cottonwood Creek to trap hatchery broodstock beginning in 1992. Since that time, hatchery-origin adults returning to Cottonwood Creek have been used almost exclusively for broodstock although ODFW did provide additional eyed eggs from the Wallowa Hatchery in some years after 1992 in order to reach program goals.

The Wallowa Hatchery stock of steelhead (currently used by both WDFW and ODFW) was originally derived in the early 1980's from trapping steelhead at Ice Harbor and Little Goose dams. The stock is therefore likely made up of both "A" and "B" run steelhead from the Snake River basin, and could include fish from Clearwater, Salmon and Grande Ronde basins.

The Wallowa Hatchery steelhead program was initiated to provide a sport fishery for summer steelhead in the Grande Ronde River (for both Oregon and Washington anglers). The Cottonwood Creek component of that program has been an extremely successful for supporting sport fisheries in the Grand Ronde River. The number of adult fish returning to the Grande Ronde River has consistently exceeded mitigation goals; thus warranting a reduction in the number of fish released from 250,000 yearling smolts to the current program of 160,000 yearling smolts (the reduction occurred in 2003). Due to successful smolt-to-adult survival, another program reduction may be an option to reduce the number of excess returning adults.

Adult steelhead are trapped at a weir on Cottonwood Creek beginning in March each year. This creek also supplies water to the Cottonwood Creek Acclimation Pond. Trapping of adult steelhead occurs from March through April. Unmarked steelhead and all marked, hatchery-origin steelhead not retained for spawning, are passed upstream to spawn naturally. All spawned carcasses are either transferred upstream of the trap and scattered in Cottonwood Creek for nutrient enhancement or transferred to Lyons Ferry FH to be buried. The adult trap and holding area on Cottonwood Creek is limited and, generally, no more than 300 adult steelhead can be held at any one time. Additional fish that arrive and are not needed for broodstock are also passed upstream. All coded-wire tagged fish are retained and are either spawned or sacrificed to obtain the tag information.

# Assessment of Current Program

## *Operational Considerations*

Listed below are the principal operational components of the hatchery program that the Review Team considered as part of its review.

### Broodstock Choice and Collection

- The Wallowa Stock (currently used by both WDFW and ODFW) steelhead was originally derived in the early 1980's from trapping steelhead at Ice Harbor and Little Goose dams. The stock is therefore likely made up of both "A" and "B" run steelhead from the Snake River basin, and could include fish from Clearwater, Salmon and Grande Ronde basins.

- A permanent adult trapping facility was installed in Cottonwood Creek to trap hatchery broodstock beginning in 1992. Since then, fish for this program have been collected at the Cottonwood Creek trap.

- Prior to 1992 and occasionally in following years (includes years where there was lack of water in Cottonwood Creek) WDFW received eggs from ODFW's Wallowa Hatchery in order to reach program goals.

- NOAA Fisheries excluded this stock from any existing ESUs for as part of ESA implementation.

- The program is managed as "segregated". Only hatchery-origin fish are used for broodstock with the goal of maintaining the Cottonwood Creek hatchery stock separate from natural populations in the Grande Ronde River. Hatchery-origin steelhead trapped in Cottonwood Creek ,identified by an adipose-fin clip + left ventral-fin clip or an adipose-fin clip only, are used for broodstock. Fish with an adipose-fin clip only are presumed to be strays from the Wallowa Hatchery based on recovery of coded wire tags.

- Steelhead adults are trapped at the Cottonwood Creek facility from March 1 through the end of April.

### Hatchery and Natural Spawning, Adult Returns

- This LSRCP mitigation goal was based on the assumption that two-thirds of returning adults would be caught downstream of the project area (presumed 2:1 recreational-to-commercial catch ratio), while one third of the returning adults would be available for recreational and tribal/commercial fisheries within the project area (presumed 1:1 catch ratio).

- The Wallowa steelhead stock (both from WDFW's Cottonwood Pond and ODFW's Wallowa Hatchery) has been identified as a stock that strays proportionately more than other hatchery stocks of steelhead in the Columbia River, particularly into the Deschutes and John Day rivers. Once in the Snake River, the Wallowa stock appears to have high homing fidelity back to the Cottonwood Acclimation Facility.

- The total mitigation goal for summer steelhead reared at Lyons Ferry FH (Lyons Ferry and Wallowa hatchery stocks, excluding the endemic programs) is to return 4,656 adult summer steelhead to the project area of the lower Snake River.

- Based on broodyears 1984-2003, the average smolt-to-adult return rate to the project area (harvest and returns to the adult trap) was 1.85%.

- The number of smolts released had been reduced from 250,000 to 160,000 smolts/year in partial response to ESA concerns and documented smolt-to-adult return rates (SAR) back to the project area (above Ice Harbor Dam) that far exceed the original SAR goal of 0.5%.

- All unmarked steelhead (assumed to be natural origin) and all hatchery-origin steelhead not retained for broodstock are passed upstream of the Cottonwood Creek adult trap. Approximately, 10-50 unmarked steelhead and 800-2,000 hatchery-origin steelhead are encountered at the trap and passed upstream annually. Additionally, high flows result in some uncontrolled passage of steelhead.

- Anadromous fish passed upstream of the trap in Cottonwood Creek can be infected with the IHN virus, serving as a potential source of infection to the adults held in the trap and the juveniles reared in the acclimation pond (the intake for the acclimation pond is located at the adult trap).

- Adults are collected throughout the run and held in the trap. Up to 300 adults are held in the trap before spawning.

- WDFW policy limits options for disposing or distributing surplus hatchery-origin steelhead. Currently, WDFW staff are not able to remove surplus adult steelhead from Cottonwood Creek unless those fish are used for a specific benefit (e.g. food banks, subsistence to the tribes, etc.).

- WDFW policy prohibits the disposal of surplus eggs, limiting options for spawning more adult fish but then an equal number of eggs from all families to increase the stock's effective population size.

- The natural spawning capacity of Cottonwood Creek for steelhead has not been estimated. Cottonwood Creek is a small stream and is not managed for escapement of natural-origin adults.

- All fish are spawned at the Cottonwood Creek trap site from the last week in March through the first two weeks of April, with the gametes transported to Lyons Ferry FH for fertilization, incubation, and rearing. The goal is to take all eggs within three egg takes.

- If low water flows in the creek do not allow returning adults access to the trap, two alternate strategies may be employed. First, the acclimation pond outlet creek can be modified to allow adult capture there. Second, excess adults from ODFW's Wallowa Hatchery may be used to provide eggs for this program, as occurred in 2005.

- One hundred males are collected for broodstock to ensure enough ripe males are available to achieve a 1:1 spawning ratio with 50 trapped females. Spawning protocol typically calls for a 1:1 female:male spawner ratio, combining milt and eggs from one male and one female in a container, but at times a 2:1 spawner ratio is necessary when there are an insufficient number of ripe males available. The intent is to increase the genetic diversity (effective population size Ne) of the hatchery-reared population, and ensure successful fertilization of eggs.

- MS-222 is used to anesthetize adult steelhead when spawning.

- Survival of gametes collected from steelhead trapped at Cottonwood Creek has increased substantially in recent years. This increase is attributed to a change in spawning protocols. Mortality to eye-up is now averaging about 5%, where it used to be 25-30%. Eggs were initially transported to Lyons Ferry FH without their ovarian fluid. Now eggs are shipped in zip lock bags with their ovarian fluid.

- Hatchery-origin steelhead trapped at the Cottonwood Creek facility have averaged 5,200 eggs per female (n= 561 females, 1997-2001 return years).

- WDFW follows the Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State. Requirements include testing salmonid broodstock for regulated pathogens that are untreatable and that cause serious mortality (such as IHNV and other viruses). In steelhead

broodstock, tests for reportable pathogens such as *R. salmoninarum*, other bacteria, and parasites (excluding *M. cerebralis*, a regulated pathogen) are not required by policy.

- All females are tested for viruses, including IHNV. Depending upon virology results, surplus females may be collected for broodstock because eggs from females with high levels of IHNV (_> $10^3$ plaque-forming units in cell culture tests) are destroyed.

- Due to reduced IHN virus detection, improved egg survival over the past few years, ESA concerns, and high smolt-to-adult return rates (SARs), the number of females spawned and the size of the program were reduced to 50 females to produce approximately 220,000 green eggs, respectively. This amount is lower than the previous objective of 400,000 eggs.

- Large numbers of birds - that have colonized artificial islands in the mainstem Columbia River (e.g. near the mouths of the Snake and Walla Walla Rivers and in downstream reservoirs) and in the Columbia River Estuary - consume significant numbers of juvenile steelhead, posing an ecological risk to Columbia and Snake River steelhead; for example, an estimated 23% of all PIT tagged Snake River steelhead are consumed by avian predators in the estuary.[76]

- The four lower Columbia River and four Snake River dams significantly reduce the survival of outmigrating juveniles and returning adults, posing a demographic risk to the return of sufficient numbers of adults for harvest on a consistent basis.

### Incubation and Rearing

- Eggs in excess to program needs are taken to compensate for the potential presence of IHN and coldwater disease during the rearing process.

- Surplus fingerlings (up to 50,000 fish) are reared and planted in area lakes (Sprague and Rock lakes). Excess is determined at the time of marking in late August.

- Fertilized eggs are water hardened in 100-ppm iodophor. They are incubated until the eyed-egg stage in down-welling iso-incubation buckets (one female per bucket). Eggs are examined daily by hatchery personnel. Prophylactic treatment of eggs for the control of fungus includes daily treatment with formalin (1:600). Non-viable eggs and sac-fry are removed by hand picking with egg pickers or bulb-syringe.

- After shocking, they are handpicked and weighed down in hatching baskets suspended over shallow troughs at 1 hatching basket per trough. Eggs from approximately 2 females are loaded in each basket (approx. 10,000 eyed eggs). Eggs are inventoried and identified by female parent. Formalin treatment is discontinued after the eggs eye up and are transferred to the hatching baskets.

- Cottonwood Creek steelhead fry are transferred to the shallow indoor nursery troughs after the Lyons Ferry steelhead are moved out of the incubation building in early April. Water flow to each trough averages 8 gallons per minute (range = 6-10 gpm). Maximum rearing densities in the shallow troughs are D.I. = 1.21 at 500 fish per pound before the fish are transferred to the outside raceways.

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[76] www.birdresearchnw.org. *Dan Robie, OSU principal investigator.*

- Incubation, as with rearing, occurs in sediment free, 51-53 degree F (11 C) well water.

- Green egg to eyed-egg survival rates have improved in recent years. Mortality from green egg to eye-up has decreased from 25% to only 5%.

- After hatch and swim-up, the steelhead are introduced to feed, and transferred to three outside raceways at roughly 500 fish per pound in mid-May (approximately 65,000-70,000 fish per raceway). They are reared in these raceways until marking, and all but 20,000 steelhead are transferred to Lake Three when they are between 40-50 fish per pound (August/early September). The 20,000 steelhead are retained in a raceway to receive additional marks/tags, used for estimating total returns, before they are moved into Lake 3 with the rest of the Cottonwood Creek fish.

- The flow in the raceways ranges from 500 to 1000 gallons per minute. Flow index in the raceways ranges from F.I. = 0.03 at initial ponding (500 gpm) to F.I. = 0.55 (1000 gpm) before the fish are transferred or released.

- Fry/fingerling are fed dry diets. Fry feeding starts at approximately three times daily (7 days per week) and is reduced to once per day (weekdays only) as the fish increase in size. Range of feeding varies between 1.5 – 2.8% of fish body weight per day. Feed conversion is expected to fall in the range of 0.7-1.1 pounds of feed per pound of fish. Feeding frequency, total feed per day as a percent of body weight (biomass), and feed size are adjusted as fish increase in size in accordance with program goals.

- Green-to-eyed-egg survival is approximately 95%, eyed egg-to-fry survival is 97-98%, and fry-to-smolt survival is 80-85%.

- The maximum rearing density in the raceways is D.I. = 0.02 at 4.5 fish per pound. The maximum rearing density in the lake is less than 0.002 lbs./$ft^3$ at 4.5 fish per pound.

- Fish health checks occur at least monthly. Treatment for disease is provided by WDFW Fish Hatchery Specialists (hatchery staff) under the direction of the Fish Health Specialist. Sanitation consists of raceway cleaning once per week by brushing, and disinfecting equipment between raceways and/or between stocks on the hatchery site. Dead fish are removed from the raceways daily. The size and depth of the 2.1 acre lakes precludes cleaning other than yearly draining and drying during the summer when fish are removed. Water quality in the lakes is not affected due to low stocking density. Dead fish are rarely observed in the lakes.

- High densities during early rearing (when the steelhead are in the shallow troughs) may contribute to coldwater disease later when the steelhead are reared in the raceways. Coldwater disease is experienced periodically, resulting in minor fish losses.

- When in the raceways, juvenile steelhead receive medicated feed (florfenicol) when fish mortalities due to coldwater disease become elevated. Through 2007, fish were treated with "fish pills" coated with florfenicol to provide a 15 mg drug/kg fish weight treatment for 10 days. In the last two years, this treatment is given as florfenicol medicated feed at a lower dose of 10 mg/kg fish weight for 10 days, a less efficacious treatment.

## Release and Outmigration

- Steelhead pre-smolts are transferred from Lake Three to the Cottonwood Acclimation Facility at six fish per pound in February. Lake Three is drained at Lyons Ferry FH to collect the steelhead for transport.

- Steelhead smolts are acclimated and released at 4.5fish per pound into the Grand Ronde River. After April 1, the outlet screen of the acclimation pond is removed to allow the steelhead to outmigrate volitionally. The steelhead smolts are allowed to outmigrate volitionally until May 1 at which time the pond is drained and the remaining fish are forced out. Feeding is reduced a couple of weeks before May 1 to encourage migration out of the pond.

- Sampling of smolts to estimate lengths for the released fish occurs immediately prior to volitional release, before April 1. The mean length of the steelhead is typically 205-210mm at release. NOAA Fisheries guidelines under the ESA require the release of summer steelhead at lengths ranging from 180 to 250 mm. The coefficient of variation (CV) for the stock ranges from 11-13%.

## Facilities and Operations

Lyons Ferry FH

*See Lyons Ferry Fall Chinook section for Lyons Ferry FH Facilities and Operations*

- Shallow troughs used for early rearing are 15'x'1 with .5' water depth. There are 11 batteries, each with 8 troughs. Two batteries are used for egg isolation. All the troughs operate on a two-pass serial reuse system: the upper four troughs of a battery receive fresh water and the lower four troughs receive water from the upper troughs.

- The raceways used for rearing steelhead are 10' x 88' with a 3.5' water depth. Flows are 500-1000 gpm.

- One of the three rearing lakes, Lake Three, is used for rearing Cottonwood Creek steelhead. The lake is 2.1 surface acres. The three large lakes receive 3,500 – 4,200 gpm total providing a good flow with no hydraulic problems.

Cottonwood Acclimation Facility

- Cottonwood Acclimation Facility has a water right of 2,694 gpm (6 cfs) for the period January 1st through July 1st. It is supplied with water from Cottonwood Creek through a gravity-feed water supply system. The intake for the pond is integrated into the adult trapping facility located ~ 0.10 miles upstream of the pond. Water temperatures range from 34 to 52 degrees F during operation of the facility.

- Low flows from Cottonwood Creek during dry years can lead to bacterial gill disease among fish in the acclimation pond, although only one outbreak has occurred (in 2005).

- The small capacity of the adult trap limits management options for dealing with adult steelhead. Given the large number of steelhead that return (>2,000), staff pass hatchery steelhead upstream in part to alleviate densities in the trap.

- The living quarters meets the Service's Region 1 safety standards.
- The water intake screens are 1/8" mesh and do not meet NOAA screening criteria (3/32").
- The facility has a low water alarm.
- Staff are on site 24 hours, seven days per week when steelhead smolts are acclimated and the adult trap is operated.
- Although a perimeter fence surrounds the acclimation pond for security, there is no bird wire or predation fencing; however, according to WDFW, bird and mammal predation are not a significant problem at this facility.
- The Team was unable to determine the owner of record for the water right(s) of this facility.
- Although this facility reports water flow in its Monthly Discharge Monitoring Reports as a requirement for its NPDES Permit, water diversions from Cottonwood Creek are not adequately measured and reported according to Service standards for documenting beneficial use and state standards for annual reporting.

### Research, Education, and Outreach

- The Dayton, Washington office of WDFW monitors, evaluates, and coordinates fishery services and research activities for the Lyons Ferry FH Complex, including the Cottonwood Creek steelhead program.
- Twenty thousand steelhead are coded-wire tagged and left-ventral fin clipped shortly after they are adipose-fin clipped. 6,000 of these steelhead are PIT tagged soon thereafter (2,000 of this 6,000 are for the ongoing comparative survival study for downstream passage of steelhead smolts for barged vs. unbarged fish at Lower Granite Dam). After three weeks, these 20,000 fish are transferred to Lake 3 with the rest of the Cottonwood Creek fish.
- Coded-wire tag recoveries in the Grande Ronde River have generally been close to the 20% recommended sample rate (20% of the fish harvested, according to catch record cards). This is in large part a result of coordinated efforts with Oregon Department of Fish and Wildlife.
- An initiative is being developed among LSRCP comanagers to standardize monitoring and evaluation and create a standardized data management system for data entry and reporting.
- PIT tag detections occur at both downstream and upstream passage facilities at mainstem dams and elsewhere. This includes detectors at the dams and at the outflow of the Cottonwood Acclimation Pond. There are no PIT tag arrays on the Grande Ronde River.
- Coded-wire tag data provides information regarding contribution to fisheries. PIT tag data provide juvenile and adult survival information through the Columbia River basin dams and can be used for in-season harvest adjustments based on adult detections at the dams.
- WDFW has a growing concern that, due to the success of the program and the resulting reductions in the number of fish released, the number of adult fish used as broodstock for the Cottonwood Creek program has been less than desired from a genetic perspective. This concern has led to

research into methods to increase the genetic effective population size of the Cottonwood Creek hatchery stock. Since 2006, a small-scale experiment has been conducted on the broodstock at Cottonwood Creek to examine the effects of partially spawning females, and then releasing them upstream to continue spawning naturally in the stream. Results from the past three years have been very encouraging, with additional information gained each year. In 2008, 13 treatment and 4 control redds were covered and 11 treatment and 2 control redds were excavated at a later date. High stream flows or lost flags prevented the excavation of all marked redds. Preliminary results show that 91% of the examined redds had growing embryos. High stream flows and turbid waters hampered the collection of more samples and more conclusive results, hence the desire to repeat the experiment for one more year. For better control of the fish in the stream, there is a proposal to only release experiment fish upstream to spawn. This alternative will make locating and marking redds from study fish considerably easier on survey crews. This spawning strategy should increase the genetic effective population size for the Cottonwood Creek hatchery stock by substantially increasing the total number of parents for each brood year. This research will also provide valuable insights into the spawning success of females after they are partially spawned artificially. If successful, this approach could become a valuable tool for the endemic programs in the Tucannon and Touchet Rivers where founding population size for each of these programs is low, and could be increased to more desirable levels (see Tucannon and Touchet River steelhead programs in subsequent sections of this report).

- Approximately 20 tourists visit the Cottonwood Acclimation Facility annually.

## *Benefit and Risk Assessment*

### *BENEFITS CONFERRED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY*

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to the propagated stock and local community,[77] the Review Team identified the following benefits of this hatchery program:

#### Harvest Benefits

- Annual estimated harvest (expanded from coded-wire tag recoveries) of Cottonwood Creek steelhead in the Snake and Grande Ronde rivers averaged 2,968 (range = 1,209 to 5,341) fish (86.5% of the total harvest on this stock) for broodyears 1997-2003.

#### Conservation Benefits

- None identified.

#### Research, Education, Outreach, and Cultural Benefits

- Ongoing evaluations by WDFW of rearing protocols, disease histories, feed conversion, and growth and survival rates are used in adaptive management feedback loops to improve hatchery operations. The information is also communicated to the fisheries community and greater public through scientific and management forums.

[77] *See Section II, "Components of This Report", for a description of these potential benefits and risks.*

- Lyons Ferry FH staff co-sponsor fishing derbies and provide educational opportunities to school groups and other visitors.

- The partial spawning and release experiment contributes to research regarding maintaining effective population sizes for the Cottonwood Creek program.

### *BENEFITS CONFERRED TO OTHER STOCKS, SPECIES, AND COMMUNITIES*

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to other species and stocks,[78] the Review Team identified the following benefits of this program:

#### Harvest Benefits

- The Cottonwood Creek steelhead program contributes to sport and tribal harvest downstream of the Snake River project area.

- Annual estimated harvest (expanded from coded-wire tag recoveries) of Cottonwood Creek steelhead averaged 479 (range = 196 to 1,054) fish (13.5% of the total harvest on this stock) downstream of the project area for broodyears 1997-2003. Of that 13.5%, 4.1% occurred in net fisheries targeting Chinook salmon and 9.4% in sport fisheries.

#### Conservation Benefits

- None identified.

#### Research, Education, Outreach and Cultural Benefits

- Tribal harvest provides subsistence and cultural benefits to the Columbia River tribes.

- The partial spawning and release experiment contributes to research regarding maintaining effective population sizes for small hatchery programs.

- Hatchery staff provide educational opportunities offsite to other communities.

### *RISKS POSED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY*

In the context of all possible genetic, demographic, ecological and other risks that a hatchery program can pose to the propagated stock,[79] the Review Team identified the following risks of the hatchery program:

#### Genetic Risks

- The effective number of breeders is less than desired for sustaining genetic diversity over the long term for many generations.

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[78] *Ibid.*
[79] *Ibid.*

### Demographic Risks

- High holding densities combined with the small capacity of the adult trap on Cottonwood Creek poses fish health risks to adult steelhead and potentially to their progeny.
- Inadequate predation control at the Cottonwood Acclimation Facility increases disease transmission risks and predation risks from outside sources.
- High densities during early rearing (when the steelhead are in the shallow troughs) increases coldwater disease risks at later life history stages when the steelhead are in raceways.
- Lack of shade covers over the hatchery raceways concentrates fish in shaded areas along raceway walls during summer months, increasing effective densities, potential stress, and disease risks.
- Crowding and loading fish onto trucks for transportation to release sites poses risks that do not occur with on-station releases. This extra handling associated with transportation can physically harm the fish, which can contribute to increased post-release mortality.
- Transportation to release sites poses a demographic risk to the stock during transport and unknown physiological (stress) risks during transport and following release.
- Lyons Ferry FH was not designed to rear multiple stocks of fish in lots of varying sizes. This situation creates opportunities for exceeding maximum rearing densities in raceways.

### Ecological Risks

- Deliberate passage of hatchery-origin steelhead upstream of the adult trap on Cottonwood Creek increases fish health risks to adult steelhead in the trap and juvenile steelhead in the Cottonwood Acclimation Pond, particularly for IHN virus.
- Amplification of disease within the Lyons Ferry FH poses a disease risk to the propagated stock.

### Physical Risks

- See the Lyons Ferry fall Chinook section.
- A safety railing is not present on the downstream side of the adult trap on Cottonwood Creek, thus posing a human safety risk.
- A security fence is not present around the adult trap on Cottonwood Creek to prevent unauthorized access, thus posing a human safety risk and a poaching risk.

### Research, Education, Outreach and Cultural Risks

- None identified.

### *RISKS POSED TO OTHER STOCKS, SPECIES, AND COMMUNITIES*

In the context of all possible genetic, demographic, ecological, and other risks that a hatchery program can pose to other stocks and species in a watershed,[80] the Review Team identified the following risks from the hatchery program:

#### Genetic Risks

- Maintaining a run of steelhead in Cottonwood Creek derived from the Wallowa Hatchery stock poses genetic straying risks to nearby natural populations of steelhead in the Grande Ronde River. Native populations of steelhead in nearby Joseph Creek and the Wenaha River are of special concern because they are managed as wild fish sanctuaries with no release of hatchery-origin fish.

- Cottonwood Creek steelhead released in the Grande Ronde River are recovered in areas outside the Grande Ronde River basin, including natural production reaches of the Deschutes and John Day rivers. Those stray fish pose genetic risks to other steelhead stocks in the Columbia River basin.

#### Demographic Risks

- Harvest targeting Cottonwood Creek steelhead poses a demographic and genetic risk to natural-origin steelhead and local populations of redband rainbow trout in the Grande Ronde River.

- Harvest targeting Cottonwood Creek steelhead poses a demographic risk to bull trout.

- Lyons Ferry FH was not designed to rear multiple stocks in lots of varying sizes. This situation increases the risk of high rearing densities that exceed guidelines.

#### Ecological Risks

- Cottonwood Creek steelhead pose ecological risks (e.g. competition, predation, disease) to natural-populations of redband rainbow trout and steelhead in nearby Joseph Creek and the Wenaha River. Potential residualization of hatchery-origin steelhead increases these risks.

- Passing large numbers of adult hatchery steelhead upstream of the weir in Cottonwood Creek poses fish health and competition risks to natural-origin steelhead returning to spawn in the creek.

- Allowing large numbers of steelhead passage above the weir in Cottonwood Creek may result in excessive organic material compared to what the small creek system is capable of handling and could result in substantial changes to the natural ecology of the creek.

- The collection and barging of steelhead smolts at mainstem Snake River and Columbia River dams poses a stress (crowding and handling) and overall fish health risk to other populations of salmon and steelhead that are co-collected for barging.

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[80] *Ibid.*

**Research, Education, Outreach and Cultural Risks**

- None identified.

# Recommendations for Current Program[81]

The Review Team considered all the benefits and risks outlined in the preceding section. The Team concluded that some of the risks outlined in the preceding section were either minor or their probability of occurrence was small and, thus, did not warrant a proposed change or recommendation for the current program. The recommendations outlined below, in addition to potentially increasing benefits towards achieving program goals, address the identified risks or potential problems considered by the Review Team to warrant a potential modification to the current program. Preceding each numbered recommendation is a brief summary of the issue.

## *Program goals and objectives*

***Issue CC-SS1: Harvest of steelhead downstream of the project area is much lower than the assumptions used to establish mitigation goals.*** *Current mitigation goals have been based on the assumption that two-thirds of returning adults would be caught downstream of the project area (presumed 2:1 recreational-to-commercial catch ratio), while one third of the returning adults would be available for recreational and tribal/commercial fisheries within the project area (presumed 1:1 catch ratio). Harvest data indicate that 85%, as opposed to 33%, of the returning Cottonwood Creek steelhead are harvested in the Snake River project area. The adult mitigation and harvest goal for Cottonwood Creek steelhead is 1,501 fish but the program is achieving an average return of 4,250 adult steelhead, with over 2,000 unharvested steelhead returning to the adult trap on Cottonwood Creek.*

**Recommendation CC-SS1:** Restate the return goal for the number of harvestable Cottonwood Creek steelhead or reduce the size of the program so that it is consistent with current harvest goals and is consistent with current and anticipated harvest regimes. Restate program goals in management documents based upon current and anticipated returns and harvest. For example, based on a 1.85% smolt-to-adult survival, a release of 81,000 smolts would be necessary to achieve a return of 1,501 adult steelhead to the project area.

***Issue CC-SS2a: Hatchery fish are passed upstream of the adult trap on Cottonwood Creek with no explicit goals or defined benefit, other than to reduce the density of adult fish in the trap.***

***Issue CC-SS2b: Anadromous fish passed upstream of the trap in Cottonwood Creek can be infected with the IHN virus and other pathogens, thus serving as a potential source of infection to the adults held in the trap and the juvenile steelhead reared in the acclimation pond (the intake for the acclimation pond is located at the adult trap).***

[81] *The Review Team believes that the WDFW and the LSRCP office will be the logical parties to coordinate to implement most of the following recommendations.*

***Issue CC-SS2c: The natural spawning of Cottonwood Creek steelhead in the Grande Ronde river basin may not be consistent with conservation goals for existing natural populations in adjacent watersheds (e.g., Joseph Creek, Wenaha River).***

**Recommendation CC-SS2a:** Define the desired benefits for passing adult steelhead upstream of the trap in Cottonwood Creek relative to known biological risks (disease transmission such as the IHN virus). If the risks of passing adult steelhead upstream at the trap exceed the realized benefits, then discontinue passing the steelhead upstream of the trap and identify other beneficial uses for surplus hatchery-origin fish that minimize biological risks (e.g. increase harvest retention, surplus fish to food banks, etc.). WDFW may also consider reducing the size of the program to reduce the number of fish returning to Cottonwood Creek relative to program needs. If WDFW can identify a conservation or ecosystem benefit of passing adult steelhead upstream, then the number of fish passed up stream should be consistent with the capacity of the habitat. If fish are passed upstream, a monitoring and evaluation program should be instituted to determine whether the desired benefits are indeed realized.

**Recommendation CC-SS2b**: Use IHNV genotyping to allow management decisions to occur in a timely manner and to prevent the spread of a new variant of IHNV, particularly to juvenile steelhead in the acclimation pond. The recent discovery of a new virus genotype of concern should be communicated to all fishery co-managers and aquaculture facilities (commercial, private, federal and state) so that appropriate biosecurity measures can be taken.

**Recommendation CC-SS2c**: For monitoring purposes, sample the steelhead juveniles for IHNV and other pathogens of interest two to four weeks prior to release from the acclimation pond. The minimum number of fish sampled should provide a 95% confidence level of detecting the pathogen if present in the population at a 5% prevalence of infection (i.e., 60 fish sample).

## *Broodstock Choice and Collection*

*No issues identified.*

## *Hatchery and Natural Spawning, Adult Returns*

***Issue CC-SS3: The genetic effective number of breeders per year is less than desired with respect to genetic guidelines for a self-sustaining, closed population.*** *The number of males and females spawned per year utilizing a 1:1 female:male spawning ratio most likely results in an effective population size that is less than 300 fish over one steelhead generation (three years). The effective population size for the hatchery broodstock over three years should be greater than 500 fish (Ne > 500) to minimize the loss of genetic variation due to small effective population size and genetic drift over multiple generations.*

**Recommendation CC-SS3:** Increase the minimum number of females and males spawned per year to 75 females and 150 males, respectively. Subdivide the eggs of each female in approximately two equal proportions and fertilize each subgroup separately with a different male. The two egg subgroups from each female can be combined ***after one minute*** before

water is added to increase overall fertilization rates to compensate for males with poor sperm quality. Any culling of surplus eggs should be done randomly across all full-sib families with the goal of obtaining approximately equal numbers of fertilized eggs from each female and male parent.

***Issue CC-SS4: The continued release of an out-of-basin fish into the Lower Grande Ronde River poses genetic and ecological risks to natural populations of steelhead in the Grande Ronde River basin.*** *Of special concern are populations in Joseph Creek and the Wenaha River, although the proportion of adult steelhead in those streams composed of stray hatchery-origin steelhead is unknown.*

**Recommendation CC-SS4:** Monitor natural escapement of steelhead in Joseph Creek and the Wenaha River to ensure that less than 5% of the naturally spawning populations are composed of hatchery-origin fish. This recommendation includes monitoring the selective fishery in the lower Wenaha River to estimate the proportion of natural versus hatchery-origin steelhead. If state and/or tribal LSRCP cooperators determine that the proportion of naturally spawning steelhead composed of hatchery-origin fish is greater than 5%, then comanagers should consider reducing the size of the hatchery program or converting it to an in-basin broodstock. This monitoring may include increasing the number of fish tagged to determine whether steelhead released from the Cottonwood Pond facility or the Wallowa Hatchery are straying to the spawning grounds.

***Issue CC-SS5: Cottonwood Creek steelhead released in the Grande Ronde River stray into areas of the lower Columbia River basin, including the upper reaches of the Deschutes and John Day rivers.*** *These strays pose a genetic risk to other steelhead stocks in the Columbia River basin.*

**Recommendation CC-SS5:** Coordinate with ODFW and Wallowa FH to research different broodstock management strategies (e.g. utilizing fall-returning versus production adults), other broodstock sources, and research different rearing and release strategies. Other broodstock sources may include in-basin endemic steelhead and Little Sheep Creek steelhead. See the Review Team's Oregon LSRCP report for further details.

## *Incubation and Rearing*

***Issue CC-SS6: All steelhead female broodstock are tested for IHNV. The progeny from the females with virus titers of <$10^4$ pfu/ml (in the ovarian fluid) are kept for rearing. Management practices have improved adult returns so there is less need to keep excess progeny to compensate for potential fish losses resulting from IHNV infection.***

**Recommendation CC-SS6:** Cull progeny from all females that are positive for IHNV.

***Issue CC-SS7a: Rearing densities in the indoor nursery tanks (max. D.I. ≈ 1.20 in the shallow troughs) 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 until outdoor space is available.*

***Issue CC-SS7b: High rearing densities during early rearing may be contributing to the later onset of coldwater disease.*** *High early rearing densities can exacerbate infections, resulting in acute mortality that generally begins several months after hatching. At some hatcheries in the Pacific Northwest, outbreaks of coldwater disease have been significantly reduced when early rearing densities were lowered.*

**Recommendation CC-SS7:** Reduce rearing densities in the shallow troughs to a maximum D.I. = 0.5 by increasing the number of nursery tanks or intermediate rearing tanks (see LF-SS12), reducing the total number of Lyons Ferry steelhead reared, reducing the number of fish reared in other programs, or reducing the total number of stocks reared at Lyons Ferry FH.

***Issue CC-SS8: Coldwater disease causes mortality among Cottonwood Creek steelhead, occurring after the fish are ponded to the raceways.*** *The major pathogen problem at many salmon hatcheries in the Pacific Northwest is Flavobacterium psychrophilum, the bacterium causing coldwater disease. These bacteria are transmitted vertically from female parents to progeny and horizontally through the water via infected animals. This epizootiology complicates disease control. At Lyons Ferry FH, fish are treated with florfenicol if coldwater disease mortalities are elevated. Formerly, fish were fed pills coated with 15 mg florfenicol/kg of fish weight as prescribed by a veterinarian. New FDA regulations now designate the use of florfenicol medicated feed at 10 mg drug/kg fish weight with a Veterinary Feed Directive. At this lower dosage, the medicated feed is less effective in controlling disease and a second treatment may be needed, increasing the possibility of developing drug-resistant forms of F. psychrophilum. Further, delays in deliveries of the medicated feed after diagnosis of elevated coldwater disease can exacerbate mortalities.*

**Recommendation CC-SS8:** A strategy similar to the regionwide efforts used to control *Renibacterium salmoninarum* (causative agent of bacterial kidney disease or BKD) may be needed to control coldwater disease in Northwest hatcheries. This recommended strategy could include broodstock testing, antibiotic injections of adults, culling/segregation of progeny from highly infected fish and/or reduced rearing densities of juvenile fish. Hatchery staff should 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. Hatchery staff may wish to 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 (see Issue LF-SS7). In addition, some hatcheries have found that saline rinses of eggs prior to fertilization improves eye-up and may reduce external loads of *F. psychrophilum.* Communication with the USFWS Aquatic Animal Drug Approval Partnership Program (AADAP) and the newly-formed Working Group on Aquaculture Drugs, Chemicals and Biologics (AFS-Fish Culture Section) may help recapture efficacious antibiotic treatment of coldwater disease.

## *Release and Outmigration*

***Issue CC-SS9:*** *Pre-release exams - which include testing for virus, bacteria and parasites - are not conducted at the Lyons Ferry FH Complex and associated acclimation sites**.*** *Absence of pre-release fish health examinations increases the risk that fish will be released with endemic or vertically transmitted diseases. This situation could affect their future survival, and/or infected fish could serve as vectors for infecting other aquatic animals outside the hatchery. Pre-*

*release inspections, conducted 4-6 weeks before release or transfer, are required by USFWS fish health policy FW 713 and the Integrated Hatchery Operations Team (IHOT) Policy and Procedures.*

**Recommendation CC-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 of 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.

***Issue CC-SS10: Anadromous fish passed upstream of the trap in Cottonwood Creek can be infected with the IHN virus, serving as a potential source of infection to adult steelhead held in the trap and to the juveniles reared in the acclimation pond (the intake for the acclimation pond is located at the adult trap).***

**Recommendation CC-SS10:** Sample steelhead juveniles for IHNV and other pathogens of interest 2 – 4 weeks prior to release from the acclimation pond. The minimum number of fish sampled should provide 95% confidence of detecting pathogens if present in the population at a 5% prevalence of infection (i.e., 60 fish sample). If IHNV is found, DNA genotyping should be done to determine the strain.

## *Facilities/Operations*

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

**Cottonwood Acclimation Facility**

***Issue CC-SS11: The adult trap on Cottonwood Creek has no hand railing on the downstream side of the trap, posing a safety risk to staff and visitors.***

**Recommendation CC-SS11:** Install a hand railing that can be removed to provide access to the trap as needed.

***Issue CC-SS12: High holding densities combined with the small size of the adult trap on Cottonwood Creek may increase stress and pose fish health risks and mortality to the adult steelhead or their progeny.*** *The size of the adult trap is insufficient to accommodate the current run size and satisfy current management strategies. Currently, over 2,000 hatchery-origin steelhead return to Cottonwood Creek annually. Current protocols are to collect steelhead at the trap and either hold them for broodstock or pass them upstream.*

**Recommendation CC-SS12:** Consult with engineers to redesign the trap to meet program needs.

***Issue CC-SS13: Security for the adult trap is limited.*** *Currently, no security fence is present to prevent unauthorized access to the trap. The absence of a security fence poses human safety risks and increases the risk of poaching or vandalism.*

**Recommendation CC-SS13:** Construct a security fence around the adult trap facility.

***Issue CC-SS14: The water intake screen for the Cottonwood Acclimation Facility does not comply with current NOAA Fisheries ESA screening criteria. The screen mesh is 1/8"; however, NOAA requires 3/32" mesh. NOAA criteria also include parameters for water approach velocity, sweeping velocity, and screen angle.***

**Recommendation CC-SS14:** Replace the water intake screen for the Cottonwood Acclimation Facility so that it complies with NOAA Fisheries criteria. Additional modifications may also be necessary with the smaller mesh size (e.g., installation of revolving drum screens) to prevent debris accumulation that could obstruct the water supply.

***Issue CC-SS15: The Lower Snake River Compensation Plan office is reviewing the ownership status of water rights associated with all comanager-operated facilities which divert water for fish culture.*** *Adequate documentation and reporting are required to maintain the right to divert water for beneficial uses.*

**Recommendation CC-SS15:** WDFW should work with the LSRCP office to ensure water diverted for fish culture is measured and reported correctly according to the applicable regulations.

## *Research, Monitoring, and Accountability*

*See CC-SS4 and 5 above. Also see issue and recommendation LF-FC23, 24, and 25 in the Lyons Ferry Fall Chinook section above.*

## *Education and Outreach*

*See the Lyons Ferry Fall Chinook section for Education and Outreach issues and recommendations regarding Lyons Ferry FH.*

# Alternatives to Current Program

The Review Team considered the benefits and risks of the existing Cottonwood Creek hatchery steelhead program at Lyons Ferry FH and developed seven alternatives designed to reduce risks and/or increase benefits. The first alternative is the current program with all previously-described recommendations adopted. The last alternative is the "no hatchery" option. Following these descriptions of alternatives, the Review Team has identified recommended alternatives.

## *Alternative 1: Current program with recommendations*

Continue the current Cottonwood Creek hatchery steelhead program with implementation of all recommendations. These recommendations include: reviewing and restating the goals of the program and/or making adjustments in the size of the program; discontinuing the practice of passing surplus adult fish upstream of the Cottonwood Creek trap unless a measurable benefit can be defined as a goal of passage; reviewing operations and facilities to improve fish health; developing spawning protocols that maintain an adequate effective breeding population size; and continuing to monitor and reduce straying into mid-Columbia tributaries.

**Pros**

- Maintains mitigation harvest opportunities on hatchery-origin steelhead in the lower Grande Ronde and Snake rivers.
- Contributes to sport and tribal harvest downstream of the Snake River project area.

**Cons**

- Contributes to straying risks to natural populations in the Deschutes and John Day river basins.
- Large numbers of hatchery-origin steelhead returning to the Lower Grande Ronde River pose unknown genetic risks to the natural populations of steelhead in the Grande Ronde River Basin (e.g., Joseph Creek, Wenaha River).

## *Alternative 2: Replace the segregated Cottonwood Creek hatchery steelhead stock with an endemic stock from the Lower Grande Ronde River (e.g. Joseph Creek)*

The intent of this alternative is to reduce straying risks within the Lower Grande Ronde River while continuing to return sufficient numbers of hatchery-origin steelhead to satisfy the harvest and mitigation goals. If both the Oregon (Wallowa FH) and Washington (Cottonwood Creek) programs transitioned to a single, in-basin stock, then within-basin straying risks would be reduced and straying outside the basin into the Deschutes and John Day rivers may similarly be reduced due to the increased homing fidelity of an indigenous stock in the Grande Ronde River.

**Pros**

- May reduce straying to natural populations in the upper Deschutes and John Day rivers.
- Reduces genetic risks associated with use of Wallowa stocks on natural populations in the Grande Ronde River.

**Cons**

- Would require establishment of major infrastructure in Joseph Creek and/or other tributaries to trap wild fish for broodstock.
- May reduce harvest opportunity in a large portion of the Grande Ronde River in Washington while an endemic stock is developed.
- Poses a broodstock mining risk to a natural population that is serving as the source of broodstock for the endemic Grande Ronde River hatchery stock.

## *Alternative 3: Replace Cottonwood Creek hatchery steelhead with the Lyons Ferry steelhead*

The primary intent of this alternative is to reduce straying into the Deschutes and John Day rivers while continuing to support harvest in the Grande Ronde River.

**Pros**

- Resolves the issue of small genetic effective size of the population.
- Reduces the number of fish stocks reared at Lyons Ferry FH.
- May reduce straying issues in the Deschutes and John Day.
- Program could transition fairly quickly.
- Should continue to provide a significant harvest benefit.

**Cons**

- The Lyons Ferry stock is an out-of-basin composite stock that poses genetic risks to natural-origin steelhead in the Grande Ronde Basin.
- Stray rates of Lyons Ferry steelhead release in the Grande Ronde River are unknown.

## *Alternative 4: Increase the size of the Cottonwood Creek steelhead program to compensate for reductions or terminations in the number of Lyons Ferry steelhead released elsewhere*

The Review Team has recommended reducing the number of Lyons Ferry steelhead released in other locations (e.g., Tucannon River). Alternative 4 would increase the number of steelhead released at Cottonwood Creek to compensate for those reductions elsewhere.

**Pros**

- Could meet some of the lost mitigation harvest opportunities if Lyons Ferry stock was reduced or eliminated.
- Reduces the number of fish stocks reared at Lyons Ferry FH if releases of Lyons Ferry steelhead are terminated.
- May simplify rearing pond and space management at Lyons Ferry FH.

**Cons**

- Would increase the number of adult steelhead intercepted at the Cottonwood Creek trap.
- Would increase the number of hatchery-origin steelhead from the Snake River that stray into the Deschutes and John Day river basins.
- May increase genetic risks to natural populations in the Grande Ronde River.

## *Alternative 5: Rear Cottonwood Creek hatchery steelhead at Irrigon FH*

Continue to collect adults and release juvenile steelhead at the Cottonwood Acclimation Facility but transfer the rearing from Lyons Ferry FH to Irrigon FH.

**Pros**

- Frees up rearing space at Lyons Ferry FH. This enables reductions in rearing densities, especially during early rearing, for other steelhead programs at Lyons Ferry FH.
- Maintains harvest opportunities in the Grande Ronde River.

**Cons**

- Requires considerable interstate comanager coordination.
- Requires either expansion of rearing space or reductions to other programs at Irrigon FH.
- May reduce steelhead harvest opportunities for both Washington and Oregon if other steelhead programs are reduced at Irrigon FH.

- Continues to contribute to, or may increase, the number of steelhead straying into the Deschutes and John Day river basins.

## *Alternative 6: Discontinue the Cottonwood Creek hatchery steelhead program and increase the Wallowa Hatchery steelhead program*

Discontinue broodstock collection and release of hatchery steelhead at Cottonwood Creek. Increase the number of Wallowa Hatchery steelhead released into the Grande Ronde Basin by approximately 100,000 to 160,000 smolts. This alternative may require expansion of Wallowa FH or Irrigon FH facilities to accommodate the increased number of fish reared.

### Pros

- Frees up rearing space at Lyons Ferry FH. This enables reductions in rearing densities, especially during early rearing, for other steelhead programs at Lyons Ferry FH.
- Maintains steelhead harvest opportunities in the Grande Ronde River.
- Reduces the number of steelhead stocks reared at Lyons Ferry FH, simplifying fish culture.

### Cons

- Requires substantial infrastructure improvements at Wallowa FH if rearing were to occur there.
- Requires either expansion of rearing space or reductions to other programs at Irrigon FH.
- May displace the resident trout program if rearing were to occur at Wallowa FH.
- May reduce steelhead harvest opportunities within Washington due to the change in release locations from Cottonwood Creek in Washington to the Wallowa FH in Oregon.
- May reduce steelhead harvest opportunities for both Washington and Oregon if other steelhead programs are reduced at Irrigon FH.
- Continues to contribute to or may increase the number of hatchery-origin steelhead from the Grande Ronde River that stray into the Deschutes and John Day river basins.
- Increases the risk of disseminating the parasite *Myxobolus cerebralis*, the causative agent of whirling disease, from the Wallowa FH where the parasite is present to other steelhead populations. Of special concern are the natural populations in the Deschutes and John Day river basins.

## *Alternative 7: Terminate the program and decommission the Cottonwood Creek and Acclimation Facilities*

Decommission the use hatchery fish for mitigation in favor of alternative mitigation strategies such as habitat restoration, passage improvements, or alternative hatchery production at another site.

**Pros**

- Frees up rearing space at Lyons Ferry FH. This enables reductions in rearing densities (esp. early rearing) for the other steelhead programs on station.

- Reduces the number of steelhead stocks reared at Lyons Ferry FH, simplifying fish culture practices.

**Cons**

- Significantly reduces steelhead harvest opportunities in the lower Grande Ronde River in Washington.

- Eliminates a program considered to be very successful by anglers with high smolt-to-adult survival.

## *Recommended Alternatives*

In reviewing the Cottonwood Creek steelhead program, team members had concerns related to the impacts of this program both in the lower Grande Ronde River where ESA listed populations of steelhead occur in other tributaries (e.g., Joseph Creek and the Wenaha River) and in downstream areas where hatchery fish from this program stray into natural spawning areas (Deschutes and John Day rivers). In spite of the relatively small size of the Cottonwood Creek program and fairly high harvest, large numbers of surplus adults (>2,000) are trapped and passed upstream at the Cottonwood Creek adult facility or allowed to remain in the lower Grande Ronde River. The stock of fish propagated and released for the Cottonwood Creek program, the Wallowa Hatchery stock, has a significantly greater tendency to stray into downstream tributaries of the Columbia River, including the Deschutes and John Day rivers, than other hatchery stocks of steelhead released into the Snake River. The Wallowa Hatchery stock is a composite, hatchery-maintained stock derived from a mixture of steelhead trapped at the lower Snake River Dams and is not included in the threatened Snake River Steelhead DPS. Straying and spawning by Wallowa Hatchery stock fish poses biological risks to other ESA-listed populations.

After reviewing alternatives, the Team favors Alternative 1: maintain the current program with implementation of all recommendations.

Recommendations include:

- Review the goals of the program, restate those goals based on current knowledge, conditions, and intended benefits, and adjust the size of the program and protocols consistent with those goals;

- Remove surplus adult steelhead at the Cottonwood Creek Facility and provide them for identified beneficial uses;

- Review operations and facilities to improve fish health and personnel safety concerns;

- Develop spawning protocols that maintain an adequate effective breeding population size. The team recognizes the quandary of potentially reducing the program size while maintaining an effective breeding population larger than the current number of spawners. Implementation of

this recommendation may require changes in agency (WDFW) policy that are more consistent with providing realizable benefits while reducing biological and ecosystem risks.

- Continue to research different broodstock management strategies, other broodstock sources, and research different rearing and release strategies to address straying of Cottonwood Creek and Wallowa Hatchery stock into tributaries of the mid-Columbia River.

The intent of this alternative is to develop specific management goals and objectives for achieving the harvest goals for Tribal and recreational fisheries and obtain the LSRCP mitigation goal of 1,501 adult steelhead back to the lower Grande Ronde River. At the same time, co-managers recognize that they need to address the causes of straying into downstream areas.

Some team members felt that development of an endemic stock (Alternative 2) should be evaluated as an attempt to improve returns and reduce straying concerns. However, this approach would require collecting broodstock from one or more of the ESA-listed natural populations of the lower Grande Ronde River to support a harvest mitigation program. This approach creates a number of additional biological risks including the development of a propagated stock with a small number of founding parents, demographic risks to the source populations by removing adult fish for hatchery broodstock, and uncertainty regarding the effectiveness of an endemic hatchery stock to reduce straying. As a consequence, the team did not support this option at the present time.

Alternative 3 (replacing Cottonwood Creek steelhead with Wallowa Hatchery steelhead) represents an option under consideration by the comanagers. This alternative was not supported by the Team because it is inconsistent with the long-term recommendation for the Lyons Ferry hatchery program. Furthermore, the Lyons Ferry Hatchery stock poses many of the same risks as the Cottonwood Creek and Wallowa Hatchery stocks to natural populations within and outside the Grande Ronde River.

Alternatives 4 and 6 (increase the size of the Cottonwood Creek and Wallowa Hatchery programs, respectively) might exacerbate straying issues already inherent in the present programs by increasing the number of fish released. In addition, these alternatives are not consistent with recovery goals.

Two team members gave Alternative 7 moderately high ratings because of the straying issues, the large number of surplus adults returning to Cottonwood Creek, and the observation that large numbers of adult steelhead returning to the Wallowa FH in Oregon also support fisheries in the lower Grande Ronde River of Washington. However, the Team did not recommend Alternative 7 because of its very high success at achieving harvest and mitigation goals, and the long-term need to continue to meet the management intent of the states and tribes under the current *US v Oregon* agreement.

Alternative 1 addresses the straying and surplus adult issues by urging co-managers to review and restate goals, and to make adjustments in program size or operations as more information becomes available. WDFW should continue to evaluate the straying issue and participate with ODFW in research designed to control straying, including changing broodstocks or rearing protocols if research so indicates as the solution.

***Long-term goal* (15-50 years)*:*** In the long run, the Review Team recommends terminating the current stock derived from the Wallowa Hatchery stock and replacing it with an endemic stock from within the Lower Snake River Major Population Group (MPG). The Team prefers a locally adapted stock appropriate for the MPG that poses lower straying risks than the current stocks propagated at Cottonwood Creek and Wallowa FH.

# Touchet River Summer Steelhead

Operator: Washington Department of Fish and Wildlife

## Summary of Current Program

### *Goals*

- ***Harvest goal:*** None. This is a research program to test the efficacy of developing an endemic broodstock program to replace the outplanting of Lyons Ferry steelhead in the Touchet River.

- ***Broodstock escapement goal:*** 16 natural-origin females and 20 natural-origin males.

- ***Conservation goal:*** None at this time. This program was initially set up as a research program to evaluate the efficacy of an endemic program to meet comanager goals. The long-term intent of this program, if successful, is to reduce genetic and ecological risks to the natural population of steelhead in the Touchet River by replacing the outplanting of Lyons Ferry steelhead. Natural-origin steelhead in the Touchet River are included in the ESA listing of the *Mid-Columbia River Steelhead DPS* as a threatened species.

- ***Escapement goal for natural-origin adults:*** None associated with the hatchery program. However, the Snake River Salmon Recovery Board (Dec 2006) identified restoration goals previously proposed by various agencies and tribes for steelhead populations within the Touchet River as follows: 1998 Salmon and Steelhead Inventory by WDFW (600 natural-origin adults/year) and LSRCP (812 adults/year). Also, the ICTRT has established an interim annual abundance threshold of 1,000 natural-origin adults per year.

- ***Research, education, and outreach goals:*** Determine whether Touchet River steelhead can replace the Lyons Ferry stock as the broodstock used for all steelhead releases into the Touchet River.

### *Objectives*

- Collect and spawn 16 natural-origin females and 20 natural-origin males to produce approximately 65,000 green eggs which results in approximately 50,000 yearling smolts for release in the Touchet River at RM 55 (Baileysburg Bridge).

- Transfer adults retained for broodstock to Lyons Ferry FH. Adults are spawned at Lyons Ferry FH. Males are live spawned and returned to the Touchet River. Females are kill-spawned.

- Pass all hatchery-origin steelhead from the endemic program upstream of the weir in the Touchet River to spawn naturally.

- Rear Touchet River steelhead to the smolt stage at Lyons Ferry FH. Develop and test culture protocols that result in one-year old smolts of the desired size and condition factor.

- Transfer and direct release 50,000 hatchery-origin smolts upstream of the weir in the Touchet River.

- Use PIT tags and other tags to evaluate smolt-to-adult return rates back to Bonneville Dam, McNary Dam, and the Touchet River.

## *Program Description*

From the inception of the LSRCP, releases of hatchery summer steelhead into the Touchet and Tucannon rivers have consisted of non-native origin steelhead (Wells, Wallowa, and Lyons Ferry hatchery stocks). While steady progress occurred toward meeting the LSRCP mitigation goals in both rivers, natural populations of steelhead throughout the Columbia and Snake river basins declined alarmingly, resulting in the implementation Endangered Species Act (ESA) protections by NOAA Fisheries in the late 1990s, including the Mid-Columbia River and Snake River summer steelhead *Distinct Population Segments* (DPS's). In 1999, NOAA Fisheries ruled that continued release of Lyons Ferry Hatchery steelhead in the Touchet and Tucannon rivers jeopardized ESA listed natural populations of summer steelhead in those rivers. As a result of that ruling, endemic broodstock programs were initiated by WDFW and the co-managers to assess the feasibility of creating new broodstocks for use in the Touchet and Tucannon rivers. WDFW proposed that these new endemic stock programs - if proven successful - could be used in combination with, or eventually replace, the outplanting of Lyons Ferry summer steelhead in each river, thereby reducing risk to the natural populations in the respective rivers.

The two endemic stock programs began in 2000 under a 5-year study plan by trapping natural origin summer steelhead from each river for broodstock. These actions were approved through submission of Hatchery and Genetic Management Plans to NOAA Fisheries under the provisions of Section 4(d) of the ESA. Since that time, a relatively small proportion (N < 40 fish for each river) of the total number of natural origin fish returning to each river have been trapped, retained for broodstock, transported, and spawned at Lyons Ferry FH. Progeny have been reared at Lyons Ferry FH, and then released as smolts into the respective rivers from which their parents originated. Smolt to-adult return rates (SARs) from the first few years of the programs were not encouraging; although performance was based on very limited adult capture and/or tag data. WDFW and the co-managers agreed that additional years were needed to evaluate each program.

The goal of this program is to determine whether an endemic steelhead program can be developed that will yield sufficient numbers of returning adults to meet LSRCP mitigation goals, harvest goals, and conservation goals for steelhead in the Touchet River. If WDFW and comanagers conclude that an expanded endemic program would largely meet those desired benefits while reducing risks to the ESA listed natural population, then WDFW would most likely terminate the outplanting of Lyons Ferry steelhead for meeting LSRCP adult return goals for hatchery-origin steelhead in the Touchet River. The main purpose of an expanded endemic program would be to meet the LSRCP mitigation and harvest goals for hatchery-origin steelhead in the Touchet River, as originally designed under the LSRCP program, while reducing genetic and ecological risks to natural populations. The endemic program could also serve a conservation role as needed or desired.

The term "endemic" implies that all hatchery-origin fish from the Touchet River summer steelhead program can trace their ancestry to natural-origin adults trapped in the Touchet River. Adult steelhead are trapped in the Touchet River at the Dayton Pond Acclimation Facility (AF) intake structure and transferred to Lyons Ferry FH for holding and spawning. Their progeny are transported and released

directly into the North Fork of the Touchet River as yearlings each spring. [Lyons Ferry FH Complex Annual Operations Plan 2008-2009, P 22]

# Assessment of Current Program

## *Operational Considerations*

Listed below are the principal operational components of the hatchery program that the Review Team considered as part of its review.

### Broodstock Choice and Collection

- Only natural-origin Touchet River steelhead are collected for broodstock. All adult, hatchery-origin progeny of the hatchery program are passed upstream above Dayton trap to spawn naturally.

- Broodstock are collected from February through March at the Dayton trap on the Touchet River. This represents only the early part of the run. Natural returns occur from mid-February through mid-May. Broodstock are collected early to increase time at the hatchery in order to increase the potential for creating a one-year old smolt with the appropriate size at release.

- Touchet River steelhead, as part of the mid-Columbia ESU, are listed as threatened under the Endangered Species Act.

### Hatchery and Natural Spawning, Adult Returns

- There is no harvest goal associated with the program at the present time. If successful, however, the primary purpose of this program will be to provide harvest mitigation in the Touchet River as originally designed under the LSRCP program. Subsistence harvest in tribal fisheries is allowed on all steelhead in the Columbia and Snake river basins. However, the Touchet River endemic steelhead program currently has no harvest goal.

- A long-term objective is to increase collection of endemic stock (hatchery and natural origin) adult steelhead to release sufficient numbers of smolts to meet the adult return goal (750) of the Lyons Ferry hatchery stock in the Touchet River. In this case, LSRCP adult mitigation return goals are equivalent to harvest goals. This LSRCP mitigation goal was based on the assumption that two-thirds of returning adults would be caught downstream of the project area (presumed 2:1 recreational-to-commercial catch ratio), while one third of the returning adults would be available for recreational and tribal/commercial fisheries within the project area (presumed 1:1 catch ratio).

- Current survival estimates indicate that 15 spawned females should provide enough eggs to meet the smolt release objectives of the endemic program. Therefore, WDFW evaluation staff target collecting 16 natural-origin females and 20 natural-origin males for the broodstock, with all other natural-origin fish passed upstream to spawn naturally. Lyons Ferry stock hatchery steelhead are removed from the Touchet River at the trap. Touchet River endemic stock hatchery steelhead are passed upstream of the trap to spawn naturally in the Touchet River.

- Tribal harvest of steelhead occurs in the lower Columbia River.

- The proportion of endemic hatchery-origin to natural-origin adult steelhead to the Dayton trap ranges from approximately 5-20%.

- Based on a combination of spawning ground surveys and weir counts, the estimated annual spawning escapement for the entire Touchet River is approximately 400-500 adult steelhead, with 5-20% of those fish of hatchery origin, approximately half of which are endemic Touchet River hatchery stock and half are Lyons Ferry FH stock. The recovery goal is 1,000 natural-origin adults.

- Estimated smolt to adult (upstream of McNary Dam) survival rate of PIT tagged fish from the endemic hatchery program averaged 0.30% for the 2004-2006 smolt migration years (2003-2005 brood years).

- PIT tag data indicate that 50% of the hatchery-origin Touchet River stock detected at McNary Dam are straying into the Snake River upstream of Ice Harbor Dam. It is unknown how many adult fish fall back below the dam or migrate into tributaries upstream of the dam.

- All Touchet River endemic hatchery steelhead are released unmarked (no fin clips) and must be released if incidentally caught in recreational fisheries.

- Touchet and Tucannon summer steelhead have been documented as stray fish in the area upstream Lower Granite Dam for many years. Steelhead from the Touchet and Tucannon endemic programs have received PIT tags since 2001 (WDFW 2008 draft report on Touchet and Tucannon River summer steelhead).

- Spawning ground surveys occur in the Tucannon and Touchet River; however, turbid conditions often limit the information obtained.

- Weirs on the Tucannon and Touchet rivers are used to prevent upstream passage of Lyons Ferry stock hatchery steelhead. The goal is to only pass natural-origin and endemic program-origin steelhead above the weirs; however, stream conditions (high flows) allow for uncontrolled passage above the weirs. The Touchet River more often is not capable of controlling upstream passage compared to the Tucannon River. Recent modifications to the weirs (passage panels) may improve control of fish passage.

- Based on broodyear 2005, the smolt-to-adult return rate is approximately 0.5%. In previous years, the SARs were lower, likely affected by size and time at release. The steelhead are size graded as juveniles to allow compensatory growth of the slower growing fish. SARs are significantly lower for smaller-sized fish at release. Touchet River steelhead released at a smaller size have about a 0.2% SAR while the larger size fish have an SAR of about 0.7%.

- From 2000-2007, on average 15 females (12-18) and 15 males (7-19) were spawned annually.

- Adult males are PIT tagged when they are collected for broodstock at the trap. Males are used to cross-fertilize eggs from each female in a 2x2 factorial mating design, and the PIT tags allow hatchery staff to track the number of times they are used during spawning.

- Adults are transferred and held in an adult holding raceway at Lyons Ferry FH prior to spawning.

- Touchet and Tucannon stock are held in the same adult holding raceway, separated by a bar rack. Touchet stock are held downstream of the Tucannon stock due to the increased prevalence of IHNV in Touchet stock; however, the risk of transmission of IHNV (or other pathogens) between stocks is present with this arrangement (shared water). The adult holding pond is split because there is limited space for holding multiple stocks of adults at Lyons Ferry FH.

- Females are kill-spawned and males are live-spawned. Spawned-out males are transported and passed upstream of the weir on the Touchet River. The males are held until all spawning is complete, then transferred back to the Touchet River and released above the weir.

- MS-222 is used to anesthetize adult steelhead during spawning.

- Spawning occurs from mid-March through mid-April on a weekly basis. Four to seven spawn takes occur over this time period.

- The steelhead are spawned according to a 2x2 factorial cross.

- WDFW follows the Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State. Requirements include testing salmonid broodstock for regulated pathogens that are untreatable and that cause serious mortality such as IHNV and other viruses. For steelhead broodstock, tests for reportable pathogens such as *Renibacterium salmoninarum* (causative agent of bacterial kidney disease), other bacteria, and parasites – except for *Myxobolus cerebralis*, a regulated pathogen - are not required by policy.

- All females are tested for viruses, including IHNV.

- The four Columbia River dams significantly reduce the survival of outmigrating juveniles and returning adults, posing a demographic risk to the return of sufficient numbers of adults for harvest on a consistent basis.

### Incubation and Rearing

- The fecundity of Touchet River stock steelhead averages about 5,000 eggs per female.

- Eggs from IHNV-positive females are quarantined from other eggs and, after hatch, are outplanted as "buttoned-up" (absorption of yolk sac is complete) unfed fry at Baileysburg Bridge on the North Fork of the Touchet River (RM 55.2), or at the confluence of the South Fork/North Fork Touchet ( RM 56). Outplanting unfed fry from IHN females is considered low risk. This protocol is followed because Touchet River steelhead are included with the ESA listing of the Snake River steelhead ESU.

- Fertilized eggs are water hardened in 100-ppm iodophore. They are incubated until the eyed-egg stage in down-welling iso-incubation buckets (one female per bucket). Eggs are examined daily by hatchery personnel. Prophylactic treatment of eggs for the control of fungus includes daily treatment with formalin (1:600). Non-viable eggs and dead sac-fry are removed by hand picking with egg pickers or bulb-syringe.

- After shocking, the eggs are handpicked and weighed down in hatching baskets suspended over shallow troughs at 1 hatching basket per trough. Eggs from approximately 2 females are loaded in each basket (approx. 10,000 eyed eggs). Eggs are inventoried and identified by female parent. Formalin treatment is discontinued after the eggs eye up and are transferred to the hatching baskets.

- One battery of eight troughs is used for early incubation in the Touchet River stock program. Water flow averages 8 gallons per minute (range = 6-10 gallons per minute). Maximum rearing densities in the shallow troughs are D.I. = 1.15 (at 700 fish per pound).

- During early rearing, feed rate and frequency are manipulated to accelerate growth rate of steelhead fry from the later spawn groups (egg takes) to achieve a mean size that is close to the mean size of early take progeny before they are transferred to the intermediate tanks.

- Steelhead fry are transferred to two indoor intermediate tanks (4x27x2 feet in depth) in June. The flow for the intermediate tanks is 60 gpm. The maximum rearing density in the intermediate tanks is D.I. = 0.33 (at 175 fish per pound).

- When the juvenile steelhead are moved outside, the coefficient of variation in the population increases to 12%.

- Fish rear in intermediate tanks until August or when fish reach 150-200 fish per pound, at which time they are transferred to one 10 x 88 foot outdoor raceway.

- Water flow in the raceways ranges from 500 to 1000 gpm. Flow index in the raceways ranges from F.I. = 0.03 at initial ponding (500 gpm) to F.I. = 0.55 (1000 gpm) before the fish are transferred for release.

- The maximum rearing density in the raceways is D.I. = 0.24 (at 4.5 fish per pound).

- In January, at 30-35 fish per pound, the steelhead juveniles are coded-wire tagged. After the steelhead are tagged, they are size graded and split into two 10 x 88 foot raceways, one containing the smaller sized group, and the other containing the larger sized group. The two groups then receive PIT tags proportionate to the number of steelhead in each size group.

- Due to the wild characteristics of the stock, shade covers, camouflage netting, and aquamats are used to mimic a more natural environment and prevent the steelhead from seeing staff feeding the fish. Lyons Ferry FH staff have found that Touchet River stock steelhead don't feed well if they can see the person feeding.

- Fin erosion occurs in the Touchet River stock while in the raceways (more so than the Lyons Ferry stock), even though they are at comparatively low rearing densities. Differences in levels of fin erosion could be stock or environment related (Lyons Ferry steelhead are reared in Lake One).

- Steelhead fry and fingerlings are fed a dry diet. Fry feeding starts at ~3-8 times daily (7 days per week) and is reduced for the larger-sized group of fish after the fish are graded into separate raceways. Range of feeding varies between 1.5 – 3.5% of the fishes' body weight per day. Feed conversion is expected to fall in the range of 0.8:1.0 to 1.5:1.0 pounds of dry feed to pounds of

fish produced. Feeding frequency, percent body weight per day, and feed size are adjusted as fish increase in size in accordance with program goals.

- From 2000-2007, green-egg-to-fry survival averaged 89% (47.7%-100%) with survival most often above 90%. Fry-to-smolt survival averaged 90% (70.4%-100.00%). In 2007, fry-to-smolt was reduced to 70.4% survival because of the loss of more than 20,000 fish caused by overcrowding during the PIT tagging operation.

- Incubation, as with rearing, occurs in sediment free, 51-53 degrees F ($11^{O}$ C) well water.

- Fish health checks occur at least monthly. Treatment for disease is provided by WDFW Fish Hatchery Specialists (hatchery staff) under the direction of the Fish Health Specialist. Sanitation consists of raceway cleaning once per week by brushing, and disinfecting equipment between raceways and/or between stocks on the hatchery site. Dead fish are removed from the raceways daily.

- Unlike the other steelhead stocks at Lyons Ferry FH, the Touchet River stock experiences few problems with coldwater disease. These fish are reared at lower densities than the other stocks.

### Release and Outmigration

- Most Touchet River steelhead are released as yearling smolts, about 12 months after the parents were initially spawned. Beginning with BY2008, approximately 6,000 of the smaller-sized steelhead are reared for two years prior to release as 2-year old smolts. See the research section below.

- All one-year-old steelhead smolts are planned for a release size of 4.5 fish per pound.

- Sampling to estimate fish lengths occurs immediately prior to transfer and direct-stream release. The mean length of the one-year-old release group is 205-210mm. NOAA Fisheries guidelines under the ESA require the release of summer steelhead at lengths ranging from 180 to 250 mm. At release, the coefficient of variation ranges from 13-18%.

- Steelhead smolts are direct stream released into the Touchet River at Baileysburg Bridge (river mile 57.2), roughly 1.5 miles upstream from the Dayton Acclimation Facility. Direct-stream releases have occurred here every year to date. Release dates have varied from mid-April to early May depending on stream flow conditions and expected size of fish at release.

- Between 2001 and 2008, the average number of steelhead released was 48,450 (range = 31,400 - 59,000) fish per year.

- WDFW believes that many of the released smolts never emigrate from the Touchet River because of death immediately following release, residualism, or residualism followed by death prior to the following spring (WDFW 2008 draft report on Touchet and Tucannon River summer steelhead).

- A minimum of 2.8% (range 0.1%-4.7%) of the released Touchet River steelhead are estimated to have residualized in the Touchet River (2001 through 2005).

- Large bird colonies on artificial islands near the mouths of the Snake and Walla Walla Rivers and in the Columbia River Estuary consume significant numbers of juvenile steelhead. Based on PIT

tag recoveries, approximately 23% of all juvenile steelhead originating in the Snake River are estimated to be consumed by avian predators in the estuary.[82]

### Facilities and Operations

Dayton Acclimation Facility (Touchet River weir/intake diversion dam and adult trap)

- The Touchet River weir has limited control of upstream passage when water flows are high. In 2008, the weir was modified with a plastic curtain to impede upstream passage of adult steelhead during high water flows; however the flaps only cover approximately 2/3 of the weir. In 2009, the plastic curtain was washed out during high flows.

- A trap has been operated at the Dayton Acclimation Facility since 2001. A new trap was installed in 2008 to improve adult collection.

- In 2009, WDFW plans to install a cover over the adult holding area to improve security and install an additional walkway at the intake diversion to improve safety during high flows.

### Research, Education, and Outreach

- To estimate smolt-to-adult survival and to identify hatchery-origin steelhead during broodstock collection and management of upstream passage, all Touchet River endemic stock steelhead are coded-wire tagged with no external fin clips. In addition, 8,000-10,000 fish receive PIT tags to provide an alternate means to estimate smolt-to-adult survivals for program evaluation.

- Over the last few years, evaluation staff have annually PIT tagged portions of the Touchet River endemic stock group (by size) prior to release. PIT tags are being used to document smolt-to-adult survival rates. Return rates and survival of fish released according to program objectives have been nearly twice those of fish released at later dates and sometimes at a smaller size. Achieving minimum size requirements for release size in one year has been difficult for the Touchet River steelhead program. Implementation of a two-year smolt program on a portion of the population is currently underway. These latter fish are reared in other rearing containers currently not being used for the other priority stocks at Lyons Ferry FH. This research will continue for two to three years, and will continue to use PIT tags to compare smolt-to-adult return rates for the one and two-year smolt programs.

- An initiative is currently under development among LSRCP comanagers to standardize monitoring and evaluation, and create a standardized data management system for data entry and reporting.

- Lyons Ferry FH and Dayton Pond work to provide accurate information and educational (I/E) opportunities for the public, media, schools, Tribal, State, and federal agencies, and elected officials to enhance participation in understanding the stewardship mission of Lyons Ferry FH and LSRCP programs. The Dayton Lab monitors, evaluates, and coordinates fishery services and research activities for the Lyons Ferry FH Complex.

[82] www.birdresearchnw.org. *Dan Robie, OSU principal investigator.*

## *Benefit and Risk Assessment*

### *BENEFITS CONFERRED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY*

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to the propagated stock and local community,[83] the Review Team identified the following benefits of this hatchery program:

#### Harvest Benefits

- No harvest benefit is intended from this program.
- Unmarked steelhead may contribute to the recreational fishery in the Touchet River as catch and release fish.

#### Conservation Benefits

- The program provides an indirect conservation benefit via the research component of the program.

#### Research, Education, Outreach and Cultural Benefits

- The program is providing valuable information regarding logistic constraints of developing endemic hatchery programs for steelhead. These benefits include the development of culture protocols that increase survival and growth rates in captivity prior to smolting and release.
- Evaluates nontraditional steelhead rearing techniques (e.g. two-year-old smolt program) that may be necessary for endemic steelhead programs that use natural-origin adults for broodstock.

### *BENEFITS CONFERRED TO OTHER STOCKS, SPECIES, AND COMMUNITIES*

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to other species and stocks,[84] the Review Team identified the following benefits of this program:

#### Harvest Benefits

- Touchet River stock steelhead may be harvested incidentally in non-selective fisheries downstream of the Touchet River, primarily in zone 6 tribal gillnet fisheries, between Bonneville and McNary dams. Coded-wire tag recoveries on non-adipose fin clipped fish are limited.
- Unmarked steelhead may contribute to recreational fisheries downstream in the mainstem Columbia River as catch and release fish.

#### Conservation Benefits

- None identified.

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[83] *See Section II, "Components of This Report", for a description of these potential benefits and risks.*
[84] *Ibid.*

### Research, Education, Outreach and Cultural Benefits

- Contributes to the body of research regarding the development of endemic hatchery programs for steelhead and the use of nontraditional rearing techniques, including the potential use of hatchery propagation for the restoration of wild steelhead populations.

#### *RISKS POSED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY*

In the context of all possible genetic, demographic, ecological and other risks that a hatchery program can pose to the propagated stock,[85] the Review Team identified the following risks of the hatchery program:

### Genetic Risks

- The comparatively small effective breeding number of the broodstock (mean $N_b$ = 28) coupled with the deliberate upstream passage of hatchery-origin adult steelhead from this program poses a genetic risk to the natural population by potentially reducing the effective population size of the natural population by successful reproduction of large number hatchery-origin fish representing a small number of parents (a.k.a. *Ryman-Laikre Effect*).

- Utilizing only the early portion of the Touchet 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. This issue is correlated with the preceding issue.

- Limited control (at the weir) of upstream passage of adult hatchery-origin steelhead (both Touchet and Lyons Ferry stock) during high flows increases genetic and ecological risks to the natural population of steelhead in the Touchet River steelhead population.

- As a consequence of the preceding risks, current broodstock management practices coupled with upstream passage of "endemic" hatchery-origin fish for natural spawning are expected to reduce genetic variation in the natural population.

### Demographic Risks

- Crowding, loading and transportation of adults at the Touchet River trap poses fish health risks and potential mortality to the adults and progeny.

- High densities during early rearing (when the steelhead are in the shallow troughs) increases fish health risks.

- Crowding and loading of juvenile fish onto trucks for transportation to release sites poses risks that do not occur with on-station releases. This extra handling associated with transportation may physically harm the fish, which may be contributing to increased post-release mortality.

- Transportation to release sites poses a demographic risk to the stock during transport and unknown physiological (stress) risks during transport and following release.

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[85] *Ibid.*

- Lyons Ferry FH was not designed to rear multiple stocks in lots of varying sizes. This creates the potential for exceeding guidelines for maximum rearing densities in raceways.

### Ecological Risks

- Potential amplification of disease within the hatchery poses a disease risk to the propagated stock.
- Adult male steelhead held for broodstock and returned to the Touchet River may transmit diseases from Lyons Ferry FH to natural populations in the Touchet River.
- The release of fry that are progeny of IHN virus positive females may pose fish health risks to the Touchet River natural population, although the risk is considered low due to egg disinfection.
- Touchet River hatchery-origin steelhead are held in the same adult holding pond as Tucannon stock steelhead, thus posing reciprocal fish health risks to both stocks. Of special concern is the transmission of the IHN virus between stocks.
- Residualized hatchery-origin steelhead in the Touchet River pose ecological risks to the natural population.

### Physical Risks

- See the Lyons Ferry fall Chinook section

### Research, Education, Outreach and Cultural Risks

- None identified.

#### *RISKS POSED TO OTHER STOCKS, SPECIES, AND COMMUNITIES*

In the context of all possible genetic, demographic, ecological, and other risks that a hatchery program can pose to other stocks and species in a watershed,[86] the Review Team identified the following risks from the hatchery program:

### Genetic Risks

- Spawning early returning steelhead may increase stray rates of progeny due to the amplification of an early return time of their progeny when access to the Touchet River is limited because lower sections of the Walla Walla River can be impassable during low flows in August and September. Straying of returning adults poses genetic and ecological risks to other steelhead stocks.
- The practice of direct-stream releasing (outplanting) endemic stock Touchet River steelhead may increase their stray rates, posing genetic and ecological risks to other steelhead stocks.
- Touchet River hatchery-origin steelhead strays upstream of Ice Harbor Dam pose genetic and ecological risks to other steelhead stocks.

[86] *Ibid.*

### Demographic Risks

- Lyons Ferry FH was not designed to rear multiple stocks in lots of varying sizes. This situation increases the likelihood that guidelines for maximum rearing densities will be exceeded in raceways.

- Operation of the weir and adult trap on the Touchet River poses passage and stress risks to other endemic fish species within the Touchet River.

### Ecological Risks

*Also see the genetic risks section above.*

- Hatching eggs of IHNV-positive females may pose fish health risks to other fish reared on station at Lyons Ferry FH; however, the risk is considered low due to egg disinfection and isolated rearing.

- Touchet steelhead are held in the same adult holding pond as Tucannon steelhead, posing a fish health risk to both stocks. Of special concern is the transmission of the IHN virus.

- Hatchery-origin steelhead that residualize in the Touchet River pose ecological risks to other species including bull trout.

### Research, Education, Outreach and Cultural Risks

- None identified.

# Recommendations for Current Program[87]

The Review Team considered all the benefits and risks outlined in the preceding section. The Team concluded that some of the risks outlined in the preceding section were either minor or their probability of occurrence was small and, thus, did not warrant a proposed change or recommendation for the current program. The recommendations outlined below, in addition to potentially increasing benefits towards achieving program goals, address the identified risks or potential problems considered by the Review Team to warrant a potential modification to the current program. Preceding each numbered recommendation is a brief summary of the issue.

## *Program goals and objectives*

***Issue TT-SS1: According to the Touchet River steelhead Hatchery Genetic Management Plan (HGMP), the short-term goal of the program is to "evaluate the capability of developing an endemic Touchet River hatchery stock that can replace the Lyons Ferry stock for meeting harvest mitigation goals while, at the same time, reducing genetic and demographic risks to***

[87] *The Review Team believes that the WDFW and the LSRCP office will be the logical parties to coordinate to implement most of the following recommendations.*

***the natural population of steelhead in the Touchet River**." The Team further understands an additional intent for the program under US v Oregon is supplementation to restore or rebuild the naturally spawning population in the upper Touchet River via natural spawning supplementation by hatchery-origin fish. The Team concluded that the current size and scope of the program are consistent with the **research goal** of the program but not consistent 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. Consequently, the deliberate passage of hatchery-origin adult fish upstream of the weir to spawn naturally would appear to directly conflict with the Team's understood purpose of the current program to **"evaluate the capability of developing an endemic Touchet River hatchery stock that can replace the Lyons Ferry stock for meeting harvest mitigation goals while, at the same time, reducing genetic and demographic risks to the natural population of steelhead in the Touchet River."** If the immediate short-term research goal of the program is achieved, then the endemic program could be expanded with new long-term goals (e.g., harvest, conservation, or both) and new operational objectives for achieving them.*

**Recommendation TT-SS1:** Clearly define the specific goal and purpose of the current endemic broodstock program, and restrict management actions to only those operations that directly support the initial or primary goal of the program (i.e., research)**.** New goals can be established after the current short-term research goals are achieved.

***Issue TT-SS2: A substantial amount of information and knowledge has been acquired to determine whether Touchet River steelhead can potentially replace the Lyons Ferry stock for meeting harvest mitigation goals in the project area; however, no action appears to have been taken based upon that information for achieving the research goal of the program.***

**Recommendation TR-SS2:** Use the existing information to establish new objectives and protocols for determining whether Touchet River steelhead can potentially replace Lyons Ferry steelhead (e.g., expansion of the Touchet River program?) or establish new goals consistent with the preceding recommendation.

## *Broodstock Choice and Collection*

***Issue TT-SS3: Utilizing only the early portion of the steelhead run in the Touchet River for broodstock, then deliberately passing hatchery-origin progeny of those adult steelhead upstream of the weir to spawn naturally may, over the long term, impose artificial selection for earlier run timing in the natural population**. Touchet River steelhead return from late February through May; however, only adults trapped during February through mid-April 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 TT-SS3:** Collect steelhead for broodstock from the entire spectrum of the run and adjust culture protocols accordingly (see below). Continue to investigate rearing two-year-old steelhead smolts, especially for the later spawn takes and slower growing juvenile steelhead (see TT-SS10).

## *Hatchery and Natural Spawning, Adult Returns*

***Issue TT-SS4. 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 Touchet River stock are passed upstream to spawn naturally in the Touchet 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 for the broodstock is only Ne = 28.3 adults, and hatchery-origin fish compose up to 20% of the naturally spawning population upstream of the weir.*

**Recommendation TT-SS4**: 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 objective 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* = 0.50 and would double the effective number of breeders for the broodstock. Expanding the size of the endemic program by including F1 hatchery-origin fish in the spawning matrices would be consistent with the research goal of determining whether the endemic program could replace the Lyons Ferry Hatchery stock for meeting mitigation and harvest goals.

***Issue TT-SS5: Selectively spawning early returning steelhead may increase stray rates due to the amplification of an early return time of their progeny when access to the Touchet River is limited because lower sections of the Walla Walla River may be impassable in August and September.*** *Potential increased rates of straying poses genetic and ecological risks to other steelhead stocks.*

**Recommendation TT-SS5:** Collect steelhead for broodstock from the entire spectrum of the run and adjust culture protocols accordingly for achieving desired size at release of hatchery-origin smolts.

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

***Issue TT-SS6b: Adult male steelhead transported and utilized multiple times during spawning, then returned to the Touchet River experience excessive stress, increasing fish health risks.***

**Recommendation TT-SS6:** Discontinue the return and release of adult male steelhead from Lyons Ferry FH to the Touchet River.

## *Incubation and Rearing*

***Issue TT-SS7: Rearing densities in the indoor "shallow troughs" (max D.I. = 1.15) 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 TT-SS7:** Reduce rearing densities in the shallow troughs to a maximum D.I. = 0.5 by increasing the number of nursery rearing troughs 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.

## *Release and Outmigration*

***Issue TT-SS8: Outplanting fry that are progeny of IHN virus positive females may pose fish health risks to the natural population in the Touchet River.*** *Although the risk of transmission of the IHN virus from female parent to progeny is considered low due to egg disinfection, the release of those fish still poses fish health risks to natural populations of steelhead with little or no expected benefit. Studies indicate that outplants at the subyearling fry stage have extremely low survivals to adulthood and may actually pose significant ecological risks by displacing natural-origin fry which are generally smaller at the time of outplanting.*[88,89]

**Recommendation TT-SS8:** Discontinue outplanting fry.

***Issue TT-SS9: Pre-release fish health exams, which include testing for virus, bacteria and parasites, are not conducted at the Lyons Ferry FH Complex and associated acclimation sites.*** *This situation increases the risk that endemic or vertically transmitted diseases might be undetected in released juvenile steelhead. The release of infected fish could affect their future survival and/or infected fish could serve as vectors for infecting other aquatic animals. Pre-release inspections 4-6 weeks before release or transfer are required by USFWS fish health policy FW 713 and Integrated Hatchery Operations Team (IHOT) Policy and Procedures.*

**Recommendation TT-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 of detecting pathogens at the minimum pathogen prevalence level of 5%. Additional testing for non-reportable pathogens, such as *Flavobacterium psychrophilum* and *Nucleospora salmonis*, may be informative for co-managers.

***Issue TT-SS10: Smolt-to-adult returns (SAR's) for larger-sized steelhead smolts released into the Touchet River are higher than those for smaller sized smolts (0.7% versus 0.2%, respectively).*** *Additionally, steelhead of smaller size at release increases the risk of steelhead to residualize. Current hatchery practices are to utilize only broodstock from the earlier portion of the run in order to increase size at release; however, this practice poses genetic and ecological risks (see recommendation TT-SS4).*

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[88] *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*
[89] *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.*

**Recommendation TT-SS10:** Continue to investigate the production of two-year-old smolts and/or the use of heated water to accelerate incubation growth rates for progeny of later-spawned individuals.

## *Facilities/Operations*

**Touchet River Trap**

***Issue TT-SS11a: Periodic high flows at the time when adult steelhead are returning to the Touchet River may limit broodstock collection throughout the run.*** *Modifications to the Touchet River weir have improved, but trapping limitations remain.*

***Issue TT-SS11b: Limited control of upstream passage of adult hatchery-origin steelhead (both Touchet and Lyons Ferry stock) during high water flows poses genetic and ecological risks to the natural population of steelhead in the Touchet River.***

**Recommendation TT-SS11:** Continue to improve the trapping efficiency of the weir for controlling upstream passage of adult steelhead.

**Lyons Ferry FH**

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

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

**Recommendation TT-SS12:** Modify existing holding facilities or build new holding ponds so that the two stocks can be held separately on first pass water.

## *Research, Monitoring, and Accountability*

***Issue TT-SS13: Touchet River steelhead stray upstream of Ice Harbor dam.*** *Off-site releases of hatchery-reared salmon and steelhead have consistently demonstrated reduced homing fidelity among returning adults.[90] Although water flows and temperature in the pools behind dams on the Columbia and Snake rivers may be principal factors influencing stray rates, current hatchery practices may also be contributing to those stray rates (e.g., direct outplanting into the Touchet River from Lyons Ferry FH). Facilities at mainstem dams to accommodate passage of migrating adults both upstream and downstream may also be inadequate.*

**Recommendation TT-SS13a:** Continue to investigate the degree of homing and straying and experiment with rearing and release strategies to reduce straying. Investigate the feasibility of building a small steelhead incubation and rearing facility (hatchery) on the Touchet River to increase homing and reduce straying as part of the research program.

[90] *Evenson (1992), Vander Haegen (1995), Johnson (1990)*

**Recommendation TT-SS13b**: Continue to investigate safe passage of adult steelhead, both upstream and downstream of mainstem dams.

***Issue TT-SS14: Releasing Touchet River steelhead and Lyons Ferry steelhead according to different protocols complicates comparison of the performance of the two stocks relative to the research goal of the program.*** *Lyons Ferry steelhead are acclimated in the Dayton Pond prior to release, whereas Touchet River steelhead are directly released from the transport truck into the Touchet River upstream of the adult weir.*

**Recommendation TT-SS14:** Evaluate rearing and release strategies to maximize the return of the endemic stock (e.g. acclimation, volitional release, size-at-release). If other alternatives are not available, discontinue the use of the Dayton Pond AF for releasing Lyons Ferry steelhead and use the pond for acclimating Touchet River steelhead prior to release. Based on purpose of the Touchet River program , the Team concluded that Touchet River steelhead smolts should have a higher priority than Lyons Ferry steelhead for acclimation in the Dayton Pond. Lyons Ferry steelhead can be directly released downstream from the Dayton Pond AF if the Lyons Ferry steelhead program continues.

***Issue TT-SS15: Current marking and tagging practices are suitable for achieving current program objectives.*** *Touchet River steelhead are unmarked but coded-wire tagged so that the hatchery fish can be distinguished from natural-origin fish when they return to the trap. In addition, 8,000-10,000 steelhead are PIT tagged to monitor survival and straying.*

**Recommendation TT-SS15:** Continue the current marking and tagging practices. Consider increasing the number of steelhead PIT tagged to 10,000-15,000 smolts so that smolt-to-adult return rates can be estimated with greater accuracy because return rates for steelhead from the endemic program vary considerably and are, at times, very low.

### *Education and Outreach*

*See the Lyons Ferry Fall Chinook section for Education and Outreach issues and recommendations regarding Lyons Ferry FH.*

## Alternatives to Current Program

The Review Team considered the benefits and risks of the existing endemic Touchet River steelhead program at Lyons Ferry FH and developed five alternatives designed to reduce risks and/or increase benefits. The first alternative is the current program with all previously-described recommendations adopted. The last alternative is the "no hatchery" option. Following these descriptions of alternatives, the Review Team has identified recommended alternatives.

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

Continue the current endemic summer steelhead program on the Touchet River with implementation of all recommendations. Clearly define the specific goals and purpose of the current endemic

broodstock program and restrict management actions to only those operations that directly support those goals**.** Collect adult steelhead from throughout the natural run time, and discontinue the deliberate passing of endemic Touchet River hatchery-origin steelhead upstream of the weir while continuing to pass upstream all natural origin steelhead not retained for broodstock. Continue to investigate the degree of homing and straying and experiment with rearing and release strategies to reduce straying.

**Pros**

- Responds to the need for continued research to work out culture protocols that will optimize smolt to adult return rates for progeny of natural-origin steelhead.
- Promotes development of a local broodstock to replace the Lyons Ferry steelhead in the Touchet River, potentially reducing genetic and ecological risks to the ESA-listed population.
- A successful endemic hatchery stock could – in the long run - serve as a potential genetic reserve for the listed Touchet River population, thereby reducing the demographic risks of extinction, contributing to the recovery of the *Mid-Columbia Steelhead DPS*, and assisting with achieving conservation goals for the Touchet River population of steelhead if the research program is successful and the program is expanded.

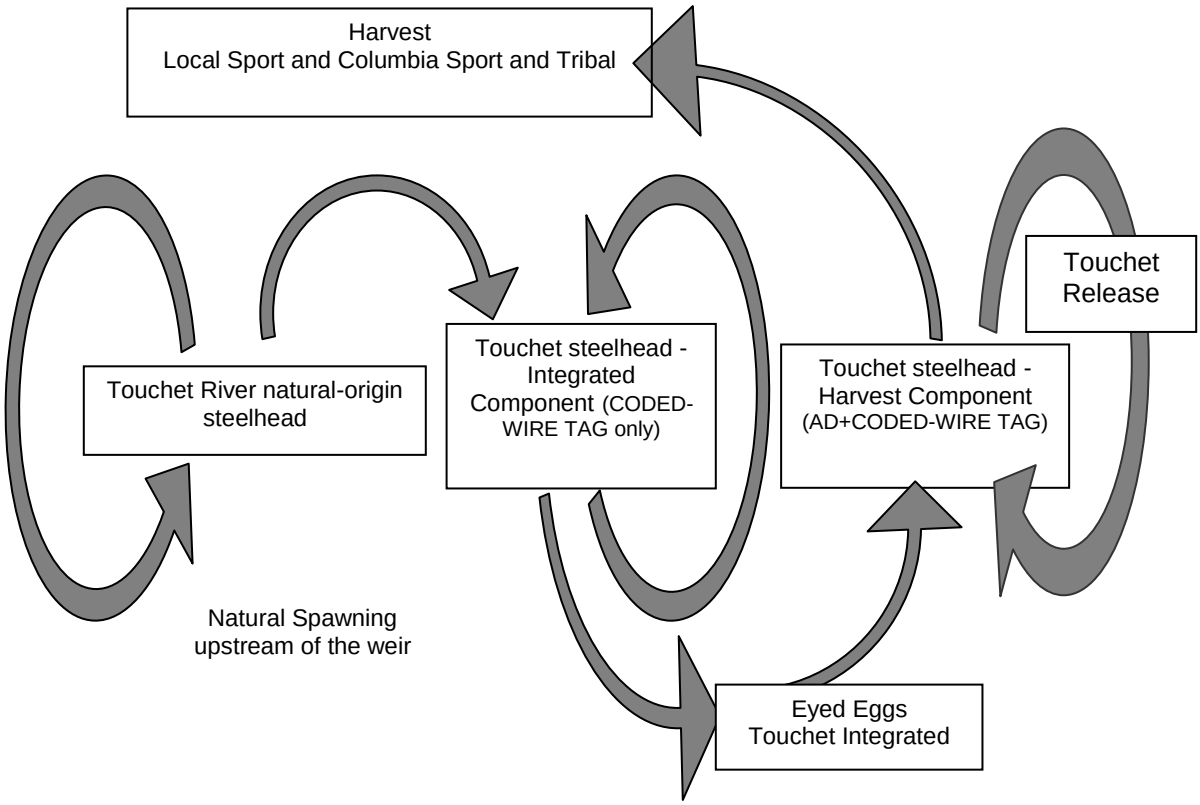
**Cons**

- Maintains the risk of transporting pathogens, including IHNV, from Lyons Ferry FH to the Touchet River.
- Reduces slightly the number of fish available for harvest by utilizing space at Lyons Ferry FH that could be used for harvest program fish (e.g. Lyons Ferry stock).
- Reduces slightly the number of natural-origin steelhead spawning naturally upstream of the Touchet River weir.
- Complicates rearing space issues at Lyons Ferry FH.

## *Alternative 2: Expand the Touchet River endemic steelhead program by creating a two-stage, stepping-stone broodstock program for harvest and conservation*

Use endemic hatchery-origin steelhead returning to the Touchet River as broodstock and cross with natural-origin steelhead (HxW, WxH) from the Touchet River trap to create a larger integrated broodstock with *pNOB* = 0.5. Use hatchery-origin adults in surplus of broodstock needs for a second broodstock (HxH) to produce fish available for harvest. Such a two-stage, stepping-stone program would produce fish for harvest (progeny of HxH fish) and fish with potential conservation benefits (progeny of HxW and WxH fish). The integrated component of the program would provide conservation benefits by serving as a genetic repository and acting as a demographic buffer for the natural population (i.e. egg bank). This alternative program could be accomplished at Lyons Ferry FH by differentially marking and tagging the progeny for each of the two broodstocks where the integrated conservation component (progeny of HxW and WxH broodstock) would be coded-wire tag-

only and the harvest component (progeny of HxH broodstock) would be 100% adipose-fin clipped with a portion given a coded-wire tag for monitoring. WDFW should establish management goals of *pNOB* = 0.5 for the first broodstock and *pHOS* = 0.0 for the proportion of naturally spawning fish composed of hatchery-origin fish. As local broodstock collection ability increases over the long term and the endemic programs expands, phase out the release of Lyons Ferry steelhead into the Touchet River and replace with the Touchet River stock for harvest purposes where only the progeny of HxH adults would be marked for harvest.




## Pros

- Contributes to sport and tribal fisheries in the Touchet, Walla Walla, and Columbia rivers.
- Promotes development of a local broodstock to replace Lyons Ferry stock in the Touchet River, potentially reducing genetic and ecological risks to the listed steelhead stock.
- Serves as a genetic reserve for the listed Touchet River population and a conservation program for the natural population of steelhead in the Touchet River population upstream of the weir.
- Reduces the demographic risk of extinction and potentially contributes to the recovery of the Mid-Columbia River steelhead DPS.

## Cons

- Further complicates the rearing of steelhead at Lyons Ferry FH which already has space limitations.

- Requires additional improvements to the weir on the Touchet River for conservation benefits to be fully realized.
- The risk of transporting pathogens, including IHNV, from Lyons Ferry FH to the Touchet River would still exist.
- Temporarily reduces the number of fish available for harvest by utilizing space at Lyons Ferry FH that could be used for harvest program fish (Lyons Ferry stock) until the Touchet population is large enough to support harvest.
- Reduces the number of natural-origin steelhead spawning upstream of the weir on the Touchet River.
- Incidental take limitations of ESA-listed steelhead in the Touchet River steelhead may limit harvest opportunity for hatchery-origin steelhead that are marked for harvest.
- Could increase the number of steelhead that stray upstream of Ice Harbor Dam.

## *Alternative 3: Expand the Touchet River endemic steelhead program by creating a segregated-harvest program downstream of the weir and manage the population upstream of the weir for natural reproduction only*

Manage the endemic hatchery population as a genetically-segregated stock for harvest by retaining all unmarked, hatchery-origin fish for broodstock while passing only natural-origin adults upstream of the weir in the Touchet River. This alternative would require modifying the current weir so that it is more efficient at excluding upstream passage of hatchery-origin steelhead.

### Pros

- Maintains current harvest benefits if smolt-to-adult survival is equal to or greater than the current Lyons Ferry FH steelhead stock.
- Reduces hatchery influence on the natural population of steelhead in the Touchet River upstream of the weir.
- Over the long-term, the program is not dependent on the natural population as a broodstock source, eliminating any direct take of natural-origin steelhead for broodstock.

### Cons

- Exclusion of natural-origin adult steelhead from the broodstock would increase domestication risks of the hatchery stock over time, thereby decreasing potential conservation benefits and increasing biological risks to the natural population after several generations.
- Increased cost of improving the efficiency of the weir to further exclude hatchery-origin steelhead from upstream passage.

- The weir would still have to be operated to preclude hatchery fish from migrating upstream.
- Maintains the risk of transporting pathogens, including IHNV, from Lyons Ferry FH to the Touchet River.
- Incidental take limitations of ESA-listed natural-origin Touchet River steelhead may limit harvest opportunity for hatchery-origin steelhead in the Touchet River.
- Could increase the number of steelhead that stray upstream of Ice Harbor Dam.

## *Alternative 4. Establish a rearing facility on the Touchet River*

Move production of the Touchet River steelhead program from Lyons Ferry FH to the Touchet River. This could begin as a temporary facility with potential for establishing a permanent rearing site if the current research program indicates that the endemic Touchet River steelhead program can be expanded or developed to meet comanager harvest and/or conservation goals.

**Pros**

- Reduces the number of stocks reared at Lyons Ferry FH.
- Eliminates the potential for transporting pathogens, including IHNV, from Lyons Ferry FH to the Touchet River.
- Frees up rearing space at Lyons Ferry FH and reduces potential costs associated with modifying the facility to properly accommodate the Touchet River steelhead program.
- May reduce straying of hatchery-origin Touchet River steelhead since they will no longer be reared at Lyons Ferry FH.

**Cons**

- Costs associated with infrastructure needs and supplemental water sources at the Dayton Ponds/Lab and the Touchet River Trap.

## *Alternative 5: Terminate the Touchet River endemic steelhead program*

Terminate the program in favor of alternative mitigation strategies such as habitat restoration, passage improvements, or alternative hatchery production at another site.

**Pros**

- Eliminates a hatchery influence on the natural population of steelhead in the Touchet River upstream of the weir if the weir is modified so that it is an effective exclusion mechanism, or if releases of Lyons Ferry steelhead are discontinued and straying of hatchery fish into the Touchet River is limited.

- Reduces the number of stocks reared at Lyons Ferry FH and increases the rearing space available for other Lyons Ferry FH programs.

**Cons**

- Continued cost associated with operating the weir to monitor the natural steelhead population and preclude hatchery-origin steelhead from migrating upstream if Lyons Ferry steelhead continue to be released into the Touchet River.

- Reduces sport harvest opportunities in the Touchet and Walla Walla rivers if the number of Lyons Ferry steelhead released into the Touchet River is reduced or eliminated in response to ESA restrictions.

- Concludes a research program to determine whether releases of Lyons Ferry steelhead could be replaced by the release of steelhead derived from the natural population in the Touchet River before alternative culture and management strategies can be evaluated for increasing survival and reducing straying risks of endemic Touchet River hatchery-origin fish.

## *Recommended Alternatives*

The Team recommends Alternative 2: phase-out or terminate the release of Lyons Ferry hatchery steelhead in the Touchet River and expand the current integrated endemic program for steelhead to a two-stage, stepping-stone program. 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 Touchet 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 outplanting of non-native Lyons Ferry steelhead. The Review Team concluded that adult return rates back to the Touchet River from the current endemic program are sufficient to expand the program consistent with research goals because hatchery-origin adults in excess of current broodstock needs are trapped and passed upstream. The Review Team recommends expanding the size of the current program by crossing hatchery and natural-origin adults, and then using returning adult progeny from those crosses as broodstock to produce fish that can be harvested. This alternative program would also provide conservation benefits. A second broodstock could be developed, based on adult returns from the first broodstock, to support Tribal and recreational fisheries. However, continued improvements in smolt-to-adult return rates (SARs) for the endemic program in the Touchet River may be necessary before this latter second stage broodstock can be developed. Adult returns from both broodstocks 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 goal of providing 750 hatchery-origin steelhead for harvest in the Touchet River.

The size of the integrated conservation component of the program would be based annually on the number of natural-origin adult steelhead available for broodstock. 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 (natural-female x hatchery-male, and hatchery-female x natural male) in each of the spawning matrices so that all progeny had at least one

natural-origin parent. This spawning protocol would result in a value of *pNOB* = 0.5 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-hatchery-female. x F2-hatchery-male, and F2-hatchery-female x F1-hatchery male). 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 2nd 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 to maintain a viable natural population.

The number of adults spawned for the second broodstock would be based on the 750-adult mitigation goal and the expected or predicted smolt-to-adult return rates back to the Touchet River. For example, assuming a 0.30% smolt-to-adult return rate (SAR) back to the Touchet River (unpublished data, WDFW), approximately 250,000 smolts from the second broodstock would need to be released into the Touchet River to achieve the mitigation return goal of 750 adult steelhead, and approximately 80 females (160 adults total) would need to be retained for broodstock to produce 250,000 smolts. These latter broodstock and smolt release numbers may exceed culture facilities currently available at Lyons Ferry Hatchery and may create concerns regarding ecological (competition) risks to natural origin smolts in the Touchet River.

Consequently, the Team recommends implementation of modified culture protocols that are expected to increase smolt-to-adult return rates from the current average of 0.30% (most recent estimated rates are approximately 0.5%), including the use of heated water during egg incubation or early rearing to increase mean size at release. As smolt-to-adult return rates increase and a second broodstock and the proposed "stepping stone" program develop, a greater proportion of the second broodstock could be composed of F1-hatchery fish that are progeny 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 Lyons Ferry Fish Hatchery 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 direct released while the integrated component could be released from the acclimation pond if the pond was not of sufficient size to acclimate both groups of fish simultaneously.

The Team's recommendation is intended to meet near-term conservation goals for the Touchet River population of steelhead by phasing out the release of Lyons Ferry steelhead in the Touchet River and developing the integrated component of the stepping stone program that serves as a genetic repository and demographic buffer for the natural population. The second component of the program is intended to meet harvest and fishery management goals in the area and is consistent with LSRCP mitigation goals. 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. For example, if the need for a supplementation program develops (i.e. demographic risks to the natural population outweigh the genetic risks), the integrated component could be used for such a purpose.

The Team recognizes that Alternative 2 will require a significant investment to expand or modify culture facilities at Lyons Ferry Hatchery, particularly to accelerate the growth of Touchet River steelhead or rear a portion of each brood year for two years to achieve the desired size at release. On the other hand, the Team's recommendation could be initiated at a smaller scale than currently required to meet the 750 adult-return mitigation goal for steelhead in the Touchet River.

If comanagers conclude that implementing Alternative 2 is premature at this time, then the Team recommends implementation of Alternative 1 and Alternative 4: continuation of the current research program with implementation of all program specific recommendations and potential development of a rearing facility on the Touchet River to improve SARs. Currently, Lyons Ferry steelhead are acclimated and released from the acclimation pond in Dayton, and steelhead from the endemic program are direct released upstream of the weir. The Team believes that, as part of the continued research program, the release of Lyons Ferry steelhead in the Touchet River should be suspended or transferred to a downstream location and the acclimation pond used to acclimate steelhead smolts from the endemic program to determine if that simple change will result in an increase in SARs. The Team's recommendations also 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 to eventually replace the release of Lyons Ferry steelhead in the Touchet River.

The Team did not support development of a new, segregated hatchery program for steelhead in the Touchet River (Alternative 3), largely because it would inevitably create risks 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 in the future. The Team also believed that termination of the current endemic program (Alternative 5) was premature from a research perspective because many options for potentially improving SARs had not yet been tested.

# Tucannon River Summer Steelhead

Operator: Washington Department of Fish and Wildlife

## Summary of Current Program

### *Goals*

- ***Harvest goal:*** None. This is a research program to test the efficacy of developing an endemic broodstock program to replace the outplanting of Lyons Ferry steelhead in the Tucannon River.

- ***Broodstock escapement goal:*** 15 natural-origin females and 21 natural-origin males.

- ***Conservation goal:*** None at this time. This program was initially set up as a research program to evaluate the efficacy of an endemic program to meet comanager goals. The long-term intent of this program is to reduce genetic and ecological risks to the natural population of steelhead in the Tucannon River by replacing the outplanting of Lyons Ferry steelhead. Natural-origin steelhead in the Tucannon River are included in the ESA listing of the *Mid-Columbia River Steelhead DPS* as a threatened species.

- ***Escapement goal for natural-origin adults:*** None associated with the hatchery program. However, the ICTRT has established an interim annual abundance threshold of 1,000 natural-origin adults for the Tucannon River steelhead population.

- ***Research, education, and outreach goals:*** Determine whether Tucannon River steelhead can replace the Lyons Ferry stock as the broodstock used for all steelhead releases into the Tucannon River to meet mitigation and harvest goals while reducing risks to ESA-listed natural populations.

### *Objectives*

- Collect and spawn 15 natural-origin females and 21 natural-origin males to produce approximately 65,000 green eggs to yield approximately 50,000 yearling smolts for release in the Tucannon River.

- Pass all hatchery-origin adult steelhead from the endemic program upstream of two collection weirs in the Tucannon River to spawn naturally.

- Transfer adult steelhead retained for broodstock to Lyons Ferry FH. Adults are spawned at Lyons Ferry FH. Males are live spawned and returned to the Tucannon River. Females are kill-spawned.

- Rear the resulting progeny to the smolt stage at Lyons Ferry FH. Develop and test culture protocols that result in one-year old smolts of the desired size and condition factor.

- Transfer pre-smolts to Tucannon FH for acclimation for 1-2 months prior to release.

- Release 50,000 smolts at RM 42 (Camp Wooton Bridge, one mile upstream of Curl Lake) of the Tucannon River after transportation from Tucannon FH.

- Use PIT tags and other tags to evaluate smolt-to-adult return rates back to Bonneville Dam, McNary Dam, and the Tucannon River.

## *Program Description*

From the inception of the LSRCP, releases of hatchery summer steelhead into the Touchet and Tucannon rivers have consisted of non-native origin steelhead (Wells, Wallowa, and Lyons Ferry hatchery stocks). While steady progress occurred toward meeting the LSRCP mitigation goals in both rivers, natural populations of steelhead throughout the Columbia and Snake river basins declined alarmingly, resulting in the implementation Endangered Species Act (ESA) protections by NOAA Fisheries in the late 1990s, including the Mid-Columbia River and Snake River summer steelhead *Distinct Population Segments* (DPS's). In 1999, NOAA Fisheries ruled that continued release of Lyons Ferry Hatchery steelhead in the Touchet and Tucannon rivers jeopardized ESA listed natural populations of summer steelhead in those rivers. As a result of that ruling, endemic broodstock programs were initiated by WDFW and the co-managers to assess the feasibility of creating new broodstocks for use in the Touchet and Tucannon rivers. WDFW proposed that these new endemic stock programs - if proven successful - could be used in combination with, or eventually replace, the outplanting of Lyons Ferry summer steelhead in each river, thereby reducing risks to the natural populations in the respective rivers.

The two endemic stock programs began in 2000 under a 5-year study plan by trapping natural origin summer steelhead from each river for broodstock. These actions were approved through submission of Hatchery and Genetic Management Plans to NOAA Fisheries under the provisions of Section 4(d) of the ESA. Since that time, a relatively small proportion (N < 40 fish for each river) of the total number of natural origin fish returning to each river have been trapped, retained for broodstock, transported, and spawned at Lyons Ferry FH. Progeny have been reared at Lyons Ferry FH, and then released as smolts into the respective rivers from which their parents originated. Smolt-to-adult return rates (SARs) from the first few years of the programs were not encouraging; although performance was based on very limited adult capture and/or tag data. WDFW and the co-managers agreed that additional years were needed to evaluate each program.

The goal of this program is to determine whether an endemic steelhead program can be developed that will yield sufficient numbers of returning adults to meet LSRCP mitigation goals, harvest goals, and conservation goals for steelhead in the Tucannon River. If WDFW and comanagers conclude that an expanded endemic program would largely meet those desired benefits while reducing risks to the ESA listed natural population, then WDFW would most likely terminate the outplanting of Lyons Ferry steelhead for meeting LSRCP adult return goals for hatchery-origin steelhead in the Tucannon River. The main purpose of an expanded endemic program would be to meet the LSRCP mitigation and harvest goals for hatchery-origin steelhead in the Tucannon River, as originally designed under the LSRCP program, while reducing genetic and ecological risks to natural populations. The endemic program could also serve a conservation role as needed or desired.

The term "endemic" implies that all hatchery-origin fish from the Tucannon River summer steelhead program can trace their ancestry to natural-origin adults trapped in the Tucannon River. Adult steelhead are trapped in the Tucannon River at a permanent weir located at RM 35 and a temporary weir at RM 24. Adult steelhead retained for broodstock are transferred to Lyons Ferry FH for holding and spawning. Their progeny are transported to Tucannon FH for 1-2 months of acclimation and then released directly into the Tucannon River at RM 42 at the Camp Wooton Bridge.

# Assessment of Current Program

## *Operational Considerations*

Listed below are the principal operational components of the hatchery program that the Review Team considered as part of its review.

### Broodstock Choice and Collection

- The long-term goal of this program, if the initial research demonstrates feasibility, is to expand the endemic-hatchery program to a size sufficient to meet the LSRCP mitigation goal of returning 875 hatchery-origin adult steelhead back to the Tucannon River. In this case, LSRCP adult mitigation return goals are equivalent to harvest goals. This LSRCP mitigation goal was based on the assumption that two-thirds of returning adults would be caught downstream of the project area (presumed 2:1 recreational-to-commercial catch ratio), while one third of the returning adults would be available for recreational and tribal/commercial fisheries within the project area (presumed 1:1 recreational:tribal catch ratio).

- Current program goals can be reached by spawning 13 to 14 females. More than 14 males are collected to ensure sufficient numbers that are sexually mature. Males are live spawned, and all adult males are returned to the Tucannon River and released at the adult trap. Therefore, WDFW retains 15 natural-origin females and 21 natural-origin males for broodstock from the Tucannon River, with all other natural origin fish passed upstream to spawn naturally. Lyons Ferry hatchery steelhead collected at the trap are opercle punched and passed downstream to be recycled in the fishery. All hatchery-origin steelhead from the endemic program are passed upstream of the trap to spawn naturally in the Tucannon River.

- The current protocol is to collect only natural-origin steelhead from the Tucannon River for broodstock. Hatchery-origin adults from the endemic program are passed upstream of the trap to spawn naturally. In 2008, only one pair of natural-origin steelhead was collected for broodstock, resulting in a release of only 2,400 fish, all as subyearling fry; no release of yearlings occurred in 2009.

- WDFW managers have indicated that all fish will be released as parr or fingerlings in the upper Tucannon River if less than 8,000 fish are available for release, (progeny of ≈ 3 adult females). According to WDFW, a minimum of 8,000 fish are required at release for evaluations to occur.

- Two traps are used for collecting broodstock from the Tucannon River. A permanent trap is located at river mile 35, and a temporary trap is installed annually, approximately 11 miles downstream from Tucannon FH at river mile 24. This temporary trap is used to collect the majority of the broodstock because the area between the lower trap and Tucannon FH is the primary spawning area in the lower Tucannon River.

- Broodstock are collected from February through March. This period encompasses only the early part of the run. Natural-origin steelhead return from mid-February through mid-May. Broodstock are collected during the early portion of the run to provide sufficient time for their progeny to achieve the desired smolt size at one year of age prior to release.

- Tucannon River steelhead, including hatchery –origin fish from the endemic program, are included with the Snake River summer steelhead DPS which is listed as *threatened* under the Endangered Species Act.

### Hatchery and Natural Spawning, Adult Returns

- No directed harvest occurs on Tucannon River steelhead at the present time. Subsistence harvest in tribal fisheries can occur on all steelhead in the Columbia and Snake river basins. However, there is currently no "harvest goal" for this program.

- Tribal harvest of marked and unmarked steelhead occurs in the lower Columbia River.

- Endemic hatchery and natural-origin adult steelhead compose approximately equal proportions (50%) of the adult steelhead intercepted at the permanent trap just upstream from the Tucannon FH, with Lyons Ferry steelhead composing less than 5 of the intercepted steelhead. Lyons Ferry steelhead compose a much greater proportion of the adult steelhead intercepted at the downstream, temporary trap.

- PIT tag data indicate that, on average, 52% of all hatchery-origin steelhead from the Tucannon River endemic stock pass upstream of Lower Granite Dam. Natural-origin steelhead show a similar percentage based on PIT tag data. Of the total number steelhead that ascend Lower Granite Dam, approximately 20% of those fish fall back below the dam after overwintering upstream of the dam.

- Summer steelhead from the Touchet and Tucannon rivers have been documented upstream of Lower Granite Dam for years. Those fish have been documented recently spawning in Asotin Creek and other tributaries to the Snake River upstream of Lower Granite Dam.

- Steelhead from the endemic Touchet and Tucannon river programs have been given PIT tags since 2001.

- Approximately 55% (27 of 49) of natural origin steelhead trapped at the temporary weir in the Tucannon River were retained for broodstock in 2006 and transported to Lyons Ferry FH.

- Spawning ground surveys occur in the Tucannon River; however, turbid water conditions often limit the information obtained.

- Estimated smolt-to-adult return rates of PIT-tagged natural-origin smolts upstream of McNary Dam averaged 1.75% for the 1999-2006 smolt migration years (Table 1 of WDFW 2008 draft evaluation report).

- Estimated smolt-to-adult returns of hatchery-origin smolts from the endemic Tucannon River program averaged 0.66 % for the 2004-2006 release years (Table 2 of WDFW 2008 draft evaluation report).

- Based on a combination of spawning ground surveys and weir counts, the estimated annual spawning escapement to the Tucannon River is approximately 600-800 adult steelhead, of which 60-70% are hatchery origin from both the endemic and Lyons Ferry FH stocks. The recovery goal is a geometric mean of 1,000 natural-origin adults per year.

- Weirs on the Tucannon and Touchet rivers are used to control upstream passage of Lyons Ferry hatchery steelhead. The current management protocol is to remove Lyons Ferry steelhead at the weirs and pass natural-origin steelhead not retained for broodstock and all endemic hatchery-origin steelhead upstream of the weirs; however, adult steelhead can swim past the weirs during high water flows. This uncontrolled passage is a greater problem on the Touchet River than the Tucannon River. Recent modifications to the weirs (installation of suspended panels over tops of the weirs) have improved control of fish passage. Hatchery staff estimate that trapping efficiencies have increased from around 50% to 90-95% for adult steelhead based on carcasses recovered upstream of the weir. During high water flows when the weir panels swing out, adult steelhead may be able to swim under the panels or jump over the weir structure.

- Genetic studies of summer steelhead in southeast Washington indicate that the Lyons Ferry and Tucannon River steelhead populations have high genetic similarities, supporting WDFW's interpretations that Lyons Ferry hatchery steelhead have most likely reproduced successfully in the Tucannon River and significant genetic introgression with the naturally spawning population has occurred (*see Research, Education and Outreach section under Lyons Ferry stock steelhead for a complete description*).

- Based on broodyear 2005, the smolt-to-adult return rate for Tucannon River hatchery steelhead is approximately 1.3%. In previous years, the SARs were lower, likely affected by size and time at release. During the initial years of the program, SARs were largely a function of size at release.

- From 2000-2008, an average of 13 females (1-16) and 15 males (1-25) were spawned annually.

- Adult males are PIT tagged when they are retained for broodstock to track the number of times they are used during spawning.

- Adults are transferred and held in an adult holding raceway at Lyons Ferry FH prior to spawning.

- Adult steelhead collected for broodstock from the Touchet and Tucannon rivers are held in the same adult holding raceway, separated by a bar rack, at Lyons Ferry FH. Adult fish from the Touchet River are held downstream of fish from the Tucannon River due to the increased prevalence of IHNV in the Touchet River stock; however, transmission of IHNV or other pathogens, between the two stocks is still possible. Only one adult holding pond is used for both groups of fish because of limited space for holding broodstock at Lyons Ferry FH.

- Females are kill spawned and males are live spawned. When all spawning is complete, males are transported back to the Tucannon River and released upstream of the permanent weir on the Tucannon River.

- MS-222 is used to anesthetize adult steelhead when spawning.

- Spawning occurs from early-March through mid-April on a weekly basis. Four to seven spawn takes occur over this time period.

- Adult steelhead are spawned two females x two males according to a 2x2 factorial mating design.

- WDFW follows the Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State. Requirements include testing salmonid broodstock for regulated pathogens like

IHNV and other viruses that are untreatable and cause serious mortality. Tests for reportable pathogens such as *Renibacterium salmoninarum*, other bacteria, and parasites (excluding *M. cerebralis*, a regulated pathogen) are not required for adult steelhead retained for broodstock by WDFW policy.

- All adult female steelhead are tested for viruses, including IHNV.

- The four Columbia River and two Snake River dams significantly reduce the survival of outmigrating juveniles and returning adults, posing a demographic risk to the return of sufficient numbers of natural-origin adults for broodstock and natural spawning.

### Incubation and Rearing

- The fecundity of Tucannon stock steelhead averages about 5,000 eggs per female.

- IHNV was first detected among adult steelhead from the Tucannon in 2009. The WDFW policy for the progeny of IHNV-positive females has been to quarantine the eggs during incubation and, after hatch, outplant the fish as "buttoned-up" (absorption of yolk sac complete), unfed fry near the Cumming Creek Bridge which is approximately one mile downstream of the Tucannon FH (RM 34.7). Outplanting unfed fry from IHNV-positive females is considered low risk because the eggs are disinfected during water hardening and virus outbreaks among juvenile steelhead at Lyons Ferry FH are rare (an IHNV outbreak at Lyons Ferry FH last occurred in 1992 among the Lyons Ferry hatchery steelhead).

- Fertilized eggs are water hardened in 100-ppm iodophore. They are incubated until the eyed-egg stage in down-welling iso-incubation buckets (one female per bucket). Prophylactic treatment of eggs for the control of fungus includes daily treatment with formalin (1:600). Non-viable eggs and sac-fry are removed by hand picking with egg pickers or bulb-syringe.

- After shocking, the eggs are handpicked and weighed down in hatching baskets suspended over shallow troughs at one hatching basket per trough. Eggs from approximately two females are loaded in each basket (approx. 10,000 eyed eggs). Eggs are inventoried and identified by female parent. Formalin treatment is discontinued after the eggs achieve the eyed stage of development and are transferred to the hatching baskets.

- One battery of eight troughs is used for early rearing of steelhead fry for the Tucannon River program. Water flow averages 8 gallons per minute (range = 6-10 gpm). The maximum rearing density in the shallow troughs is D.I. = 1.15 (at 700 fish per pound).

- During early rearing, feed rate and frequency are manipulated to accelerate the growth rate of fish from the later egg takes to achieve a mean size of those fish that is close to the mean size of fish from the early egg takes before those fish are transferred to the intermediate rearing tanks.

- Steelhead fry are transferred from the early rearing troughs in June to two indoor intermediate tanks, each tank measuring 4 ft. x 27 ft. x 2 ft. deep. Water flows in the intermediate tanks are 60 gpm. The maximum rearing density in the intermediate tanks is D.I. = 0.33 (at 175 fish per pound).

- Fish are reared in the intermediate tanks until August or when they reach 150-200 fish per pound, at which time they are transferred to one, 10 x 88 foot outdoor raceway.

- The coefficient of variation for the population increases to approximately 0.10 after the fish are transferred to the outside raceway.

- Water flow in the raceways ranges from 500 to 1000 gallons per minute. Flow index in the raceways ranges from F.I. = 0.03 at initial ponding (at 500 gpm) to F.I. = 0.55 (at 1000 gpm) before the fish are transferred for release.

- The maximum rearing density in the raceway is D.I. = 0.2 (at 4.5 fish per pound).

- The steelhead juveniles are given coded-wire tags in January of each year when they are approximately 30-35 fish per pound. After they are tagged, the juvenile steelhead are size graded and split into two 10 x 88 foot raceways, one raceway containing the smaller sized group, and the other raceway containing the larger sized group. The two groups then receive PIT tags proportionate to the number of steelhead in each size group.

- Fry and fingerling steelhead are fed dry diets. Feeding of fry is initiated at approximately 3 to 8 times daily (7 days per week) and is reduced for the larger-sized group of fish after the fish are graded into separate raceways. Range of feeding varies between 1.5 – 3.5% of the fishes' body weight per day. Feed conversion is expected to be 0.8:1.0 to 1.2:1.0 pounds of dry feed to pounds of fish produced. Feeding frequency, percent body weight per day, and feed size are adjusted as fish increase in size in accordance with program goals.

- At Lyons Ferry FH, incubation and rearing occurs in sediment free, 51-53 degree F ($11^{o}$ C) well water.

- Steelhead pre-smolts are transferred from Lyons Ferry FH to Tucannon FH in February at six fish per pound for two months of acclimation prior to release. The larger sized steelhead are acclimated in a 15 x 136 x 5 foot deep raceway at 800 gpm. The smaller sized steelhead are reared in two 10 x 80 x 3 foot deep raceways at 250 gpm per raceway. The maximum densities for the larger and smaller ponds, immediately prior to transfer and direct-stream release, are D.I. = 0.01 and D.I. = 0.02, respectively. The maximum flow indices are F.I. = 0.11 and F.I. = 0.15, respectively.

- Water temperatures in the raceways at Tucannon FH average 45 degrees F (range = 40-50 degrees F) while the steelhead are on station.

- Based on broodyears 2000-2007, green egg-to- fry survival is approximately 90%, and fry-to-smolt survival is approximately 93%.

- Fish health checks of juvenile steelhead occur at least monthly. Treatment for disease is provided by WDFW Fish Hatchery Specialists (hatchery staff) under the direction of the Fish Health Specialist. Sanitation consists of raceway cleaning once per week by brushing, and disinfecting equipment between raceways and/or between stocks on the hatchery site. Dead fish are removed from the raceways daily.

- Coldwater disease can be experienced after ponding to the raceways.

- When in the raceways, juvenile steelhead receive medicated feed (florfenicol) when fish mortalities due to coldwater disease become elevated. In 2006, fish were treated with "fish pills" coated with florfenicol to provide 15 mg drug/kg fish for 10 days. Disease incidence decreases in

the raceways before marking occurs, and is not a factor by the time they are transferred to Tucannon FH.

- Hatchery staff indicate that the juvenile steelhead from the endemic Tucannon River population appear more "domesticated" than the Touchet River stock based on behavior when these fish are at Lyons Ferry FH.

- The "better performance" or more "domesticated behavior" of Tucannon River steelhead compared to Touchet River steelhead is consistent with genetic studies that indicate a closer genetic similarity between Tucannon River and Lyons Ferry hatchery steelhead than between Lyons Ferry and Touchet River steelhead.

### Release and Outmigration

- All Tucannon River steelhead are released as yearling smolts, about 12 months after the parents were initially spawned.

- All steelhead smolts for the program are planned for a release size of 4.5 fish per pound.

- Sampling to estimate mean lengths and ranges occurs immediately prior to transfer and direct-stream release from Tucannon FH to the Tucannon River. The mean length of Tucannon River steelhead is 210-215mm at the time of release. NOAA Fisheries guidelines under the ESA require the release of summer steelhead at lengths ranging from 180 to 250 mm. At release, the coefficient of variation for those fish ranges from 0.11-0.14.

- Steelhead smolts are transferred from Tucannon FH and direct-stream released into the Tucannon River at Camp Wooten Bridge (river mile 42). Until 2007, steelhead smolts were released directly below the Curl Lake intake (river mile 41), upstream of Tucannon FH. However, the river changed course during a winter storm, and the pool below the intake is no longer a good release point. Release occurs in mid-April.

- Residualism of endemic hatchery-origin steelhead in the Tucannon River averaged 7.7 % (range = 6.0 to 9.9%) from 2001 through 2008.

- No pre-release fish health exams are performed.

- The number of smolts released averaged 55,559 (range = 43,000-65,200) fish, 2001-2008.

- Large numbers of nesting birds on artificial islands near the mouths of the Snake and Walla Walla Rivers, in downstream pools behind dams, and in the Columbia River estuary consume large numbers of juvenile steelhead: approximately 23% of all PIT tagged steelhead from the Snake River are consumed by avian predators in the estuary.[91]

### Facilities and Operations

*Lyons Ferry FH (see Lyons Ferry fall Chinook and steelhead programs), Tucannon FH (see the spring Chinook program)*

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[91] www.birdresearchnw.org. *Dan Robie, OSU principal investigator.*

### Research, Education, and Outreach

- All Tucannon River endemic stock steelhead are given coded-wire tags with no external fin clips. In addition, 8,000-10,000 fish are PIT tagged for monitoring passage and to provide an alternate means to calculate smolt-to-adult survivals for program evaluation.

- PIT tags are used to document smolt-to-adult return rates. Results to date have shown that fish released consistent with program goals for size and release time returned at nearly twice the rate as those released later than desired and sometimes at a smaller size. In recent years, smolt-to-adult return rates for the two groups have been more similar.

- LSRCP comanagers are developing standardized monitoring and evaluation protocols and are creating a standardized data management system.

- Lyons Ferry FH and Tucannon FH work to provide accurate information and educational (I/E) opportunities for the public, media, schools, Tribal, State, and Federal agencies, and elected officials to enhance participation in understanding and stewardship of Lyons Ferry FH, Tucannon FH and LSRCP programs. The WDFW office in Dayton monitors, evaluates, and coordinates fishery services and research activities for the Lyons Ferry FH Complex.

## *Benefit and Risk Assessment*

#### *BENEFITS CONFERRED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY*

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to the propagated stock and local community,[92] the Review Team identified the following benefits of this hatchery program:

### Harvest Benefits

- None identified. The program is intended to provide research benefits. Unmarked steelhead may contribute to the recreational fishery in the Tucannon River as catch and release fish.

### Conservation Benefits

- The program may be providing an indirect, but undocumented, demographic benefit by allowing hatchery-origin adults to spawn naturally upstream of the weir.

### Research, Education, Outreach and Cultural Benefits

- The program is testing whether an endemic hatchery program for steelhead can provide long-term harvest benefits. However, smolt-to-adult return rates of endemic Tucannon River steelhead have been well below those for Lyons Ferry steelhead released in the Tucannon River and natural-origin steelhead smolts from the Tucannon River.

[92] *See Section II, "Components of This Report", for a description of these potential benefits and risks.*

### *BENEFITS CONFERRED TO OTHER STOCKS, SPECIES, AND COMMUNITIES*

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to other species and stocks,[93] the Review Team identified the following benefits of this program:

#### Harvest Benefits

- Tucannon River stock steelhead may be harvested in non-selective fisheries downstream of the Tucannon River, primarily in zone 6 tribal gillnet fisheries, between Bonneville and McNary dams. Coded-wire tag recoveries on non-adipose fin clipped fish are extremely limited.

- Unmarked steelhead may contribute to recreational fisheries as catch and release fish downstream of the project area.

#### Conservation Benefits

- None identified.

#### Research, Education, Outreach and Cultural Benefits

- Contributes to the body of research regarding the development of endemic hatchery programs for harvest, regarding the use of nontraditional rearing techniques; and regarding the use of hatchery propagation for the restoration of wild steelhead populations.

### *RISKS POSED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY*

In the context of all possible genetic, demographic, ecological and other risks that a hatchery program can pose to the propagated stock,[94] the Review Team identified the following risks of the hatchery program:

#### Genetic Risks

- The comparatively small effective breeding number of the broodstock (mean $N_b$ <36) coupled with the deliberate upstream passage of hatchery-origin adult steelhead from the endemic program poses a genetic risk to the natural population via potential natural reproduction and genetic swamping by hatchery-origin fish representing a small number of parents (*Ryman-Laikre Effect*).

- 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. This issue is correlated with the preceding issue.

- As a consequence of the two preceding risks, broodstock management practices coupled with upstream passage of hatchery fish for natural spawning, are expected to reduce genetic variation in the natural population.

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[93] *Ibid.*
[94] *Ibid.*

- Use of a local stock may have less detrimental effects to the ESA-listed natural population of steelhead in the Tucannon River than the Lyons Ferry hatchery stock currently released in the Tucannon River.

**Demographic Risks**

- Inefficient adult capture at the lower and upper weirs reduces the potential for meeting broodstock collection goals.

- Crowding, loading, and transportation of adults at the Tucannon River traps pose fish health risks and potential mortality to the adults and progeny.

- High densities during early rearing, when steelhead fry are in the shallow troughs, increases fish health risks.

- Crowding and loading of juvenile fish onto trucks for transportation to release sites poses risks that do not occur with on-station releases. This extra handling associated with transportation may physically harm the fish, which may be contributing to increased post-release mortality.

- Transportation to release sites poses a demographic risk to the stock during transport and unknown physiological (stress) risks during transport and following release.

- Limited control (at the weirs) of upstream passage of adult hatchery-origin steelhead (both Tucannon and Lyons Ferry stock) during high water flows poses genetic and ecological risks to the natural population of steelhead in the Tucannon River.

- The location of the permanent weir upstream of 40% of the primary spawning habitat in the Tucannon River, and the inefficient temporary weir downstream of the primary spawning area, restrict the management of the proportion of hatchery steelhead on the spawning grounds, posing genetic and ecological risks to the natural-origin population.

- Lyons Ferry FH was not designed to rear multiple stocks in lots of varying sizes. This situation creates the potential for exceeding maximum rearing densities in the raceways.

## Ecological Risks

- Amplification of disease within the hatchery poses a disease risk to the propagated stock.

- 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.

- The release of fry that are progeny of IHN virus positive females poses fish health risks to the natural population in the Tucannon River, although the risk is considered low due to disinfection of eggs during water hardening.

- Adult steelhead retained for broodstock from the Tucannon and Touchet rivers are held in the same adult holding pond at Lyons Ferry FH, posing a fish health risk to both stocks. Of special concern is the transmission of the IHN virus.

- Residualized, hatchery-origin steelhead pose ecological risks to the natural population of steelhead in the Tucannon River.

### Physical Risks

- See the Lyons Ferry fall Chinook and Tucannon spring Chinook sections.

### Research, Education, Outreach and Cultural Risks

- None identified.

#### *RISKS POSED TO OTHER STOCKS, SPECIES, AND COMMUNITIES*

In the context of all possible genetic, demographic, ecological, and other risks that a hatchery program can pose to other stocks and species in a watershed,[95] the Review Team identified the following risks from the hatchery program:

### Genetic Risks

- Stray, hatchery-origin steelhead from the Tucannon River to upstream of Lower Granite Dam pose genetic risks to other populations of steelhead.

- The direct release (outplanting) of hatchery-origin steelhead into the Tucannon River may increase their stray rates, posing genetic and ecological risks to other steelhead populations.

### Demographic Risks

- Lyons Ferry FH was not designed to rear multiple stocks in lots of varying sizes. This creates the potential for exceeding maximum rearing densities in the raceways.

- Operation of weirs and traps for spring Chinook and steelhead in the Tucannon River poses demographic risks to other endemic fish species within the Tucannon River Basin.

### Ecological Risks

*See the genetic risks section above.*

- Rearing progeny of IHN virus positive females may pose fish health risks to other fish reared on station at Lyons Ferry FH; however, the risk is considered low due to egg disinfection and isolated rearing.

- Tucannon River steelhead are held in the same adult holding pond as Touchet River steelhead, posing a fish health risk to both stocks. Of special concern is the transmission of the IHN virus.

- Residualized hatchery-origin steelhead pose ecological risks to other species including bull trout.

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[95] *Ibid.*

- The collection and barging of steelhead smolts at mainstem Snake River and Columbia River dams poses a stress (crowding and handling) and overall fish health risk to other populations of salmon and steelhead that are co-collected for barging.

### Research, Education, Outreach and Cultural Risks

- None identified

## Recommendations for Current Program[96]

The Review Team considered all the benefits and risks outlined in the preceding section. The Team concluded that some of the risks outlined in the preceding section were either minor or their probability of occurrence was small and, thus, did not warrant a proposed change or recommendation for the current program. The recommendations outlined below, in addition to potentially increasing benefits towards achieving program goals, address the identified risks or potential problems considered by the Review Team to warrant a potential modification to the current program. Preceding each numbered recommendation is a brief summary of the issue.

### *Program goals and objectives*

***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 purpose of the current endemic broodstock program, and restrict management actions to only those operations that directly support the specific short-term research goal of the program**.** New goals can be established after the current short-term research goals are achieved.

***Issue TR-SS2: A substantial amount of information and knowledge has been acquired to determine whether Tucannon River steelhead can potentially replace the Lyons Ferry stock for***

[96] *The Review Team believes that the WDFW and the LSRCP office will be the logical parties to coordinate to implement most of the following recommendations.*

***meeting harvest mitigation goals in the project area; however, no action has been taken based upon that information for achieving the research goal of the program.***

**Recommendation TR-SS2:** Use the existing information to establish new objectives and protocols for determining whether Tucannon River steelhead can potentially replace Lyons Ferry steelhead (e.g., expansion of the Tucannon River program?) or establish new goals consistent with the preceding recommendation.

## *Broodstock Choice and Collection*

***Issue TR-SS3: Utilizing only the early portion of the steelhead run in the Tucannon River for broodstock, then deliberately passing hatchery-origin progeny of those adult steelhead upstream of the weir 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-SS3:** Collect steelhead for broodstock from the entire spectrum of the run. Investigate rearing two-year –old steelhead smolts, especially for the later spawn takes and slower growing juvenile steelhead or for the entire year class.

## *Hatchery and Natural Spawning, Adult Returns*

***Issue TR-SS4. 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 of the temporary weir and Tucannon FH weir 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 for the broodstock 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-SS4**: Discontinue passing hatchery-origin steelhead upstream of the existing weirs (or the proposed new permanent weir, TR-SS11) 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 objective 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* = 0.5 and would double the effective number of breeders for the broodstock. Expanding the size of the endemic program by including F1 hatchery-origin fish in the spawning matrices would be consistent with the research goal of determining whether the endemic program could replace the Lyons Ferry Hatchery stock for meeting mitigation and harvest goals.

***Issue TR-SS5a: 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-SS5b: Adult male steelhead transported and utilized multiple times during spawning, then returned to the Tucannon River experience excessive stress, increasing fish health risks.***

**Recommendation TR-SS5:** Discontinue the return and release of adult male steelhead from Lyons Ferry FH to the Tucannon River.

## *Incubation and Rearing*

***See Issue LF-SS8 and Issue CC-SS8.***

***Issue TR-SS6: Rearing densities in the indoor "shallow troughs" (max D.I. = 1.15) 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-SS6:** Reduce rearing densities in the shallow troughs to a maximum of D.I. = 0.5 by increasing the number of nursery rearing troughs 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.

## *Release and Outmigration*

***Issue TR-SS7: Outplanting fry that are progeny of IHN virus positive females may pose fish health risks to the natural population in the Tucannon River.*** *Although the risk of transmission of the IHN virus from female parent to progeny is considered low due to egg disinfection, the release of those fish still poses fish health risks to natural populations of steelhead with little or no expected benefit. Studies indicate that outplants at the subyearling fry stage have 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.*[97,98]

**Recommendation TR-SS7:** Discontinue outplanting 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.

***Issue TR-SS8: Pre-release fish health exams, which include testing for virus, bacteria and parasites are not conducted at the Lyons Ferry FH Complex and associated acclimation sites.*** *This*

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[97] *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*
[98] *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.*

*situation increases the risk that endemic or vertically transmitted diseases might be undetected in released juvenile steelhead. The release of infected fish could affect their future survival and/or infected fish could serve as vectors for infecting other aquatic animals. Pre-release inspections, done 4-6 weeks before release or transfer are required by USFWS fish health policy FW 713 and Integrated Hatchery Operations Team (IHOT) Policy and Procedures.*

**Recommendation TR-SS8:** 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.

***Issue TR-SS9: WDFW managers have indicated that when less than 8,000 smolts are expected to be available for release (the progeny of approximately three females), the fish will not be reared full term but will be released as parr or fingerlings in the upper Tucannon River.*** *In general, subyearling fry have extremely low survivals to adulthood but can 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.*[99]

**Recommendation TR-SS9:** When the number of trapped natural-origin adults is substantially less than broodstock objectives, either release the adults to spawn naturally or release their hatchery-produced progeny as smolts according to current program guidelines. Contingency planning may be desirable for situations where either broodstock or escapement objectives cannot be met.[100]

## *Facilities/Operations*

**Tucannon FH and Trap**
*(See the Tucannon spring Chinook section for additional facility issues and recommendations)*

***Issue TR-SS10: The temporary weir located downstream of a primary spawning area for steelhead in the Tucannon river is ineffective at collecting sufficient numbers of natural-origin and endemic hatchery-origin steelhead for broodstock. Similarly, the weir is ineffective at excluding Lyons Ferry steelhead from natural spawning areas upstream.*** *Recent modifications have increased the trapping efficiency of the upstream permanent weir from approximately 50% capture to 90-95% capture. However, approximately 40% of the natural spawning of steelhead occurs in the stream reach between the two weirs and insufficient numbers of adults are available at the upper weir to meet broodstock needs.*

**Recommendation TR-SS10:** Investigate the feasibility of constructing a permanent weir in the lower Tucannon River, below the primary spawning areas. A permanent weir in the lower

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[99] *Same as previous two footnotes.*
[100] *Contingency plans ,must weigh benefits versus risks when logistic constraints or other factors prevent implementation of approved protocols. In the end, decisions based on contingency planning must be based on the best scientific information available and not based on non-verifiable assumptions. Pre-planning for contingencies allows the implementation of decisions that are scientifically defensible.*

river would also provide a site for collecting spring Chinook broodstock (see Issue and Recommendation TR-SC3 in the Tucannon River spring Chinook section).

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

***Issue TR-SS11: Tucannon and Touchet river steelhead stocks are held in the same adult holding pond at Lyons Ferry FH.*** *The two stocks are separated by a grated partition that allows free flow of water between sections. Holding two stocks of steelhead in the same pond increases the potential for disease transmission between the two stocks.*

**Recommendation TR-SS11:** Modify existing holding facilities or build new holding ponds so that the two stocks can be held separately on first pass water.

## *Research, Monitoring, and Accountability*

***Issue TR-SS12: Tucannon River steelhead have a high level of straying upstream of Little Goose and Lower Granite dams.*** *Although water flows and temperatures in the pools behind dams in the Columbia and Snake rivers may be the principle factors influencing stray rates, current hatchery practices may also be contributing to those stray rates. Facilities at mainstem dams to accommodate passage of migrating adults both upstream and downstream may also be inadequate.*

**Recommendation TR-SS12a:** 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 as part of the research program.

**Recommendation TT-SS12b**: Continue to investigate safe passage of adult steelhead, both upstream and downstream of mainstem dams.

***Issue TR-SS13: Current marking and tagging practices are suitable for achieving current program objectives****. Tucannon River steelhead are unmarked but coded- tagged so that the hatchery fish can be distinguished from natural-origin fish when they return to the trap. In addition, 8,000-10,000 steelhead are PIT tagged to monitor survival and straying.*

**Recommendation TR-SS13:** Continue the current marking and tagging practices. Consider increasing the number of steelhead PIT tagged to 10,000-15,000 smolts so that smolt-to-adult return rates can be estimated with greater accuracy because return rates for steelhead from the endemic program vary considerably and are, at times, very low.

***Issue TR-SS14: Current hatchery practices are to utilize only broodstock from the earlier portion of the run in order to increase size at release; however, this practice poses genetic and ecological risks (see recommendation TR-SS4).***

**Recommendation TR-SS14:** Investigate options for rearing two-year-old smolts and/or the use of heated water to accelerate incubation and early growth rates of the progeny of later-spawned adults.

### *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.*

## Alternatives to Current Program

The Review Team considered the benefits and risks of the existing Tucannon River summer steelhead program at Lyons Ferry FH and Tucannon FH and developed five alternatives designed to reduce risks and/or increase benefits. The first alternative is the current program with all previously-described recommendations adopted. The last alternative is the "no hatchery" option. Following these descriptions of alternatives, the Review Team has identified recommended alternatives.

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

Continue the current endemic summer steelhead program on the Tucannon River with implementation of all recommendations. Clearly define the specific goals and purpose of the current endemic broodstock program and restrict management actions to only those operations that directly support those goals**.** Collect adult steelhead from throughout the natural run time, and discontinue passing all hatchery-origin steelhead (including endemic Tucannon River fish) upstream of the weir while continuing to pass upstream all natural-origin steelhead not retained for broodstock. This alternative includes the construction of a new weir downstream of the lower natural spawning area. In the interim, no hatchery-origin steelhead should be passed above the upper weir.

**Pros**

- Promotes development of a local broodstock to replace Lyons Ferry steelhead in the Tucannon River, potentially reducing genetic and ecological risks to the ESA-listed population.

- A successful endemic hatchery stock could – in the long run - serve as a potential genetic reserve for the listed Tucannon River population, thereby reducing the demographic risks of extinction, contributing to the recovery of the *Mid-Columbia Steelhead DPS*, and assisting with achieving conservation goals for the Tucannon River population of steelhead if the research program is successful and the program is expanded.

**Cons**

- Maintains the risk of transporting pathogens, including IHNV, from Lyons Ferry FH to the Tucannon River.

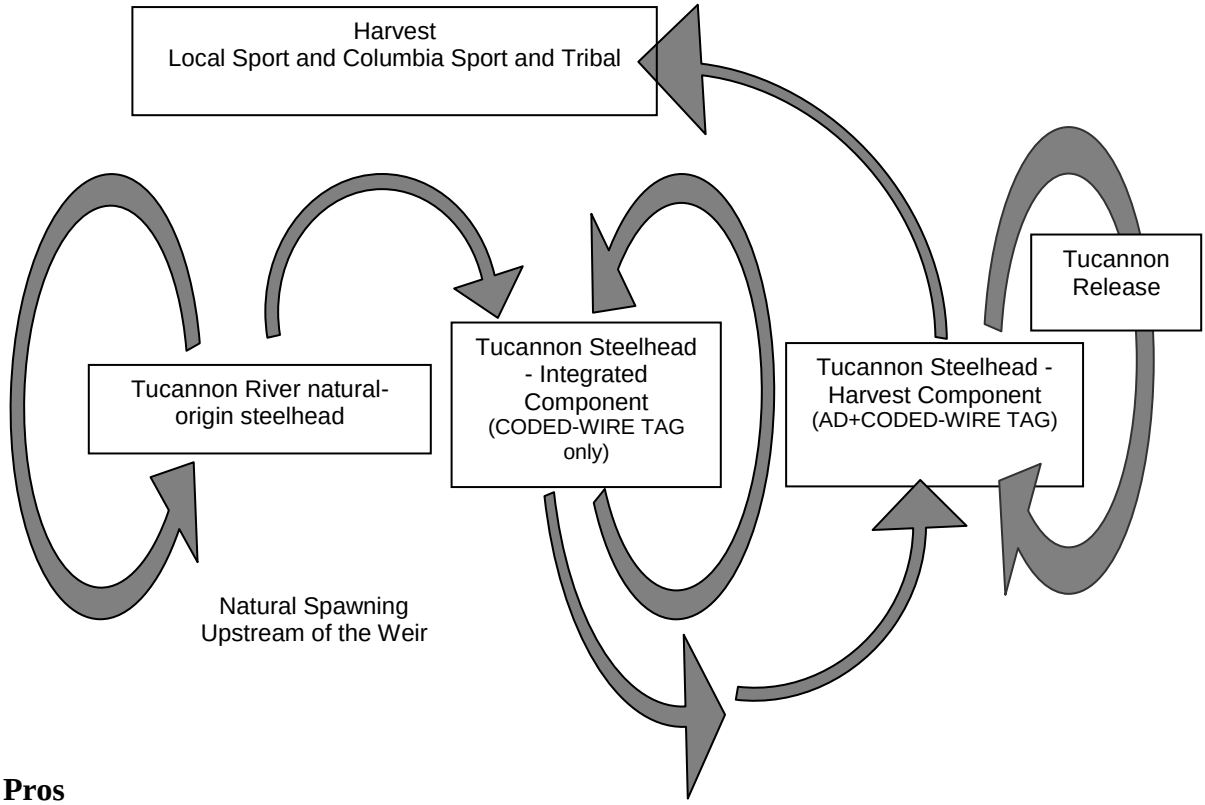
- Eliminates harvest opportunities for hatchery-origin steelhead above the lower weir location.

- Reduces slightly the number of fish available for harvest by utilizing space at Lyons Ferry FH that could be used for harvest program fish (e.g. Lyons Ferry stock).

- Reduces slightly the number of natural-origin steelhead spawning naturally in the Tucannon River.

## *Alternative 2: Expand the Tucannon River endemic steelhead program by creating a two-stage, stepping-stone broodstock program for harvest and conservation*

Use endemic hatchery-origin steelhead returning to the Tucannon River as broodstock and cross with natural-origin steelhead (HxW, WxH) from the Tucannon River traps to create a larger integrated broodstock with *pNOB* = 0.5. Use hatchery-origin adults in surplus of broodstock needs for a second broodstock (HxH) to produce fish available for harvest. Such a two-stage, stepping-stone program would produce fish for harvest (progeny of HxH fish) and fish with potential conservation benefits (progeny of HxW and WxH fish). The integrated component of the program would provide conservation benefits by serving as a genetic repository and acting as a demographic buffer for the natural population (i.e. egg bank). This alternative program could be accomplished at Lyons Ferry FH by differentially marking and tagging the progeny for each of the two broodstocks where the integrated conservation component (progeny of HxW and WxH broodstock) would be coded-wire tag-only and the harvest component (progeny of HxH broodstock) would be 100% adipose-fin clipped with a portion given a coded-wire tag for monitoring. WDFW should establish management goals, of *pNOB* = 0.5 for the first broodstock and a *pHOS* = 0.0 for the proportion of naturally spawning fish composed of hatchery-origin fish. As local broodstock collection ability increases over the long term and the endemic program expands, phase out the release of Lyons Ferry steelhead into the Tucannon River and replace with the Tucannon River stock for harvest purposes where only the progeny of HxH adults would be marked for harvest. This alternative would require replacing the temporary weir with a permanent weir in the lower Tucannon River.




**Pros**

- Contributes to sport and tribal fisheries in the Tucannon, Snake, and Columbia rivers.
- Promotes development of a local broodstock to replace Lyons Ferry stock in the Tucannon River, potentially reducing genetic and ecological risks to the listed steelhead stock.
- Serves as a genetic reserve for the listed Tucannon River population and a conservation program for the natural population of steelhead in the Tucannon River population upstream of the upper weir.
- Reduces the demographic risk of extinction and potentially contributes to the recovery of the Snake River steelhead DPS.

**Cons**

- Further complicates the rearing of steelhead at the Lyons Ferry FH that already has space limitations.
- The risk of transporting pathogens, including IHNV, from Lyons Ferry FH to the Tucannon River would still exist.
- Temporarily reduces the number of fish available for harvest by utilizing space at Lyons Ferry FH that could be used for harvest program fish (Lyons Ferry stock) until the Tucannon population is large enough to support harvest.

- Reduces the number of natural-origin steelhead spawning naturally in the Tucannon River.
- Incidental take limitations of ESA-listed steelhead in the Tucannon River may limit harvest opportunity for hatchery-origin steelhead that are marked for harvest.
- Eliminates harvest opportunities for hatchery-origin steelhead above the lower weir location.

## *Alternative 3: Expand the Tucannon River endemic steelhead program by creating a segregated-harvest program downstream of the weir and manage the population upstream of the lower weir for natural reproduction only*

Manage the endemic hatchery population as a genetically-segregated stock for harvest by retaining all unmarked, hatchery-origin fish for broodstock while passing only natural-origin adults upstream of the weir in the Tucannon River. This alternative would require replacing the temporary weir with a permanent weir in the lower Tucannon River.

### Pros

- Provides harvest benefits in the area downstream of the weir.
- Reduces hatchery influence on the natural population of steelhead in the Tucannon River upstream of a new weir in the lower Tucannon River.
- Over the long-term, the program is not dependent on the natural population as a broodstock source, eliminating any direct take of natural-origin steelhead for broodstock.

### Cons

- Exclusion of natural-origin adult steelhead from the broodstock would increase domestication risks of the hatchery stock over time, thereby decreasing potential conservation benefits and increasing biological risks to the natural population after several generations.
- Increased cost associated with modifications to the lower weir to exclude hatchery-origin steelhead from the upper Tucannon River.
- The weir would still have to be operated to preclude hatchery fish from migrating upstream.
- Eliminates harvest opportunities for hatchery-origin steelhead upstream of the lower weir location.
- Maintains the risk of transporting pathogens, including IHNV, from Lyons Ferry FH to the Tucannon River.
- Incidental take limitations of ESA-listed natural-origin Tucannon River steelhead may limit harvest opportunity for hatchery-origin steelhead in the lower Tucannon River.
- Could increase the number of steelhead that stray above Little Goose and Lower Granite dams.

## *Alternative 4: Rear Tucannon endemic steelhead to full term at Tucannon FH*

Make necessary improvements to the Tucannon FH to rear Tucannon endemic steelhead for their complete captive rearing cycle.

### Pros

- Reduces the number of stocks reared at Lyons Ferry FH.
- Eliminates the potential for transporting pathogens, including IHNV, from Lyons Ferry FH to the Tucannon River.
- Frees up rearing space at Lyons Ferry FH and reduces potential costs associated with modifying the facility to properly accommodate the Tucannon River steelhead program.
- May reduce straying of hatchery-origin Tucannon River steelhead since they will no longer be reared at Lyons Ferry FH.

### Cons

- Costs associated with significant modification in infrastructure at Tucannon FH to accommodate the program.

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

Terminate the program in favor of alternative mitigation strategies such as habitat restoration, passage improvements, or alternative hatchery production at another site.

### Pros

- Eliminates a hatchery influence on the natural population of steelhead in the Tucannon River upstream of the weir in the lower Tucannon River if the weir is modified so that it is an effective exclusion mechanism, or if the releases of Lyons Ferry steelhead are discontinued and straying of hatchery fish into the Tucannon River is limited.
- Reduces the number of stocks reared at Lyons Ferry FH and increases the rearing space available for other Lyons Ferry FH programs.

### Cons

- Continued cost associated with operating the upper weir to monitor the natural steelhead population and preclude hatchery-origin steelhead from migrating upstream if Lyons Ferry steelhead continue to be released into the Touchet River.
- Cost associated with modifications to the lower weir to exclude hatchery-origin steelhead from the upper Tucannon River.

- Reduces harvest opportunities in the Tucannon River if the number of Lyons Ferry steelhead released into the Tucannon River is reduced or eliminated in response to ESA restrictions.

- Concludes a research program to determine whether releases of Lyons Ferry steelhead could be replaced by the release of steelhead derived from the natural population in the Tucannon River before alternative culture and management strategies can be evaluated for increasing survival and reducing straying risks of endemic Tucannon River hatchery-origin fish.

## *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 outplanting of non-native Lyons Ferry steelhead. The Review Team concluded that adult return rates back to the Tucannon River from the current endemic program are sufficient to expand the program consistent with research goals because hatchery-origin adults in excess of current broodstock needs are trapped and passed upstream. The Review Team recommends expanding the size of the current program by crossing hatchery and natural-origin adults, and then using returning adult progeny from those crosses as broodstock to produce fish that can be harvested. This alternative program would also provide conservation benefits. A second broodstock could be developed, based on adult returns from the first broodstock, to support Tribal and recreational fisheries. Adult returns from both broodstocks 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 providing 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 (natural-female x hatchery-male, and hatchery-female x natural male) in each of the spawning matrices so that all progeny had at least one natural-origin parent. This spawning protocol would result in a value of *pNOB* = 0.5% 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 (F1-hatchery-female. x F2-hatchery-male, and F2-hatchery-female x F1-hatchery male). 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 of steelhead by phasing out the release of Lyons Ferry steelhead in the Tucannon River and developing the integrated component of the stepping stone program that serves as a genetic repository and demographic buffer for the natural population. The second component of the program is intended to meet harvest and fishery management goals in the area and is consistent with 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. For example, if the need for a supplementation program develops (i.e. demographic risks to the natural population outweigh the genetic risks), the integrated component could be used for such a purpose.

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 with the existing weir at the Tucannon Hatchery and the temporary weir downstream until such facilities are developed.

If comanagers 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 to eventually replace the release of Lyons Ferry steelhead in the Tucannon River.

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 in the future. The Team further assumed that the comanagers had good reasons for not rearing steelhead full-term at Tucannon Hatchery (Alternative 4). The Team also believed that termination of the current endemic program was premature from a research perspective (Alternative 5).

# Spokane Rainbow Trout

Operator: Washington Department of Fish and Wildlife

## Summary of Current Program

### *Goals*

- ***Harvest goal:*** The goal of the trout programs at Lyons Ferry FH and Tucannon FH is to compensate for the loss of 67,500 angler-days of fishing in both Washington and Idaho and to partially mitigate for reduced survival of resident fishes resulting from the construction and operation of the four lower Snake River dams. The program has no quantified harvest goal other than providing angler-days of fishing. The Spokane Rainbow Trout program provides fish for release primarily in lakes and ponds of Washington and Idaho.

- ***Broodstock escapement goal:*** Not applicable. Eggs for the trout program are received from WDFW's Spokane FH.

- ***Conservation goal:*** None.

- ***Escapement goal for natural-origin adults:*** Not applicable.

- ***Research, education, and outreach goals:*** Provide accurate information and educational (I/E) opportunities for the public, media, schools, Tribal, State, and Federal agencies, and elected officials to enhance participation in understanding and stewardship of Lyons Ferry FH and LSRCP programs. The Dayton office of WDFW monitors, evaluates, and coordinates fishery services and research activities for the Lyons Ferry FH Complex. The Idaho Department of Fish and Game (IDFG) office in Lewiston, Idaho is responsible for monitoring fisheries on rainbow trout from Lyons Ferry FH and released in Idaho.

### *Objectives*

***Lyons Ferry FH***

- Transfer 320,000 eyed rainbow trout eggs from the Spokane Trout Hatchery to Lyons Ferry FH.

- Hatch the eyed eggs and rear 160,000 rainbow trout to the sub-yearling fry stage at 68-80 fish per pound (fpp). Transfer 160,000 rainbow trout fry to IDFG in April or May for outplanting in lakes and ponds in northern Idaho.

- Rear 99,000 rainbow trout to the "catchable" yearling stage (2.5 fpp) and 500 rainbow trout to the "jumbo" stage (1 fpp).

- Outplant 99,000 yearling rainbow trout and 500 "jumbo" rainbow trout into various lakes in southeast Washington in February and March.

***Tucannon FH***

- Transfer 180,000 eyed rainbow trout eggs from the Spokane Trout Hatchery to Tucannon FH.
- Hatch the eggs and rear 137,400 rainbow trout to the "catchable" yearling stage and 4,100 rainbow trout to the "jumbo" yearling stage.
- Outplant 4,100 "jumbo" rainbow trout to various lakes in southeast Washington in February through May.
- Outplant 137,400 catchable rainbow trout to various lakes in southeast Washington in April through July.

## *Program Description*

WDFW manages two hatcheries to produce resident trout for the LSRCP Program. This is a segregated hatchery program intended to support recreational fisheries on rainbow trout. When originally proposed, the trout program was to produce 233,000 trout at 2.5 fish per pound for a total of about 93,000 pounds. However, this production goal was adjusted to 86,000 pounds due to habitat mitigation efforts. Under the LSRCP program, Lyons Ferry FH was designed to rear 45,000 pounds of trout; the Tucannon FH was designed to rear 41,000 pounds of trout. Eggs for the trout program are received from WDFW's Spokane FH. IDFG receives 160,000 Spokane stock rainbow trout fry and transports these fish to designated Idaho waters (inland lakes and ponds) in April or May, at around 60-80 fish per pound. About 99,000 Spokane stock rainbow trout catchables from Lyons Ferry FH (@ 2.5 fish per pound) and 500 jumbos (@ 1 fish per pound) are planted into various lakes in southeast Washington. Planting begins in February and is completed in March. At the Tucannon FH, approximately 137,400 Spokane stock rainbow trout are planted into various lakes in southeast Washington as catchables. Planting typically begins in April, and is completed sometime in July. The jumbo trout (usually around 4,100) are planted during February through May each year, supplementing catchable plants. The Lyons Ferry FH and Tucannon FH trout releases in Washington are into impounded waters (non-anadromous) that are primarily located in the Walla Walla, Snake, and Tucannon rivers, and Asotin Creek Watersheds. Watersheds currently targeted by the rainbow trout program include landlocked or screened lakes that have no access for anadromous salmon or steelhead.

# Assessment of Current Program

## *Operational Considerations*

Listed below are the principal operational components of the hatchery program that the Review Team considered as part of its review.

### Broodstock Choice and Collection

- Broodstock for the program are managed at the Spokane Fish Hatchery.

- Broodstock are periodically inspected for virus.
- One male is spawned with two females.
- Eggs are taken from only one year class (three or four year olds).
- Fish are spawned over a four week period; eggs representing each spawn take are provided for the Lyons Ferry FH Spokane rainbow trout program.

### Incubation and Rearing

- Eyed eggs received from Spokane Hatchery hatch in baskets at Lyons Ferry FH or Tucannon FH. Hatched fry drop into troughs where they remain for 4-8 weeks after feeding commences. Feeding is initiated after the majority of the fry have completely absorbed their yolk sacs.
- Fry are transferred to intermediate inside tanks at Lyons Ferry FH 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. Fish are ponded into two raceways at 85,000 fish/raceway (D.I. = 0.09). Fish densities are at D.I. = 0.27 at the time of release.
- At Lyons Ferry FH, raceways are supplied with oxygenated water from the hatchery's central degassing building. Approximately 1,000-gpm (23 minute exchange rate) of water enters each north side raceway through secondary degassing cans. The north side of the hatchery has historically been used to raise steelhead.
- Raceways are cleaned three times a week by brushing to remove accumulated uneaten feed and fecal material. Feeding is by hand.
- At Tucannon FH, rainbow trout (catchable program) are reared for 16 months until transported off station and outplanted. Fish are initially reared inside the hatchery building, then transferred outside to the round concrete ponds, and then into an earthen pond from April to June.
- During early rearing at Tucannon FH, prior to transfer to the earthen pond, the density index is held below 0.4. (D.I. < 0.4) in the indoor troughs and circular ponds. At time of distribution, fish are flushed from the earthen pond to the lower raceway where they are pumped out for distribution to various lakes. The earthen pond is dried out from June until August and new fish are transferred into the pond in September. Infestations of *Ichthyophtherius* and *Trichodina* external parasites (from Rainbow Lake hosts) can necessitate formalin treatments.
- In order to meet size at release targets, the hatchery staff feed the trout at a high feeding rate during the warmer months before the fish go off feed for one month due to low temperatures during the winter.
- Controlling predation by otters has been a challenge for hatchery staff. Otters climb over an electric fence to feed in the earthen pond and can remove as many as 20,000 fish a year.
- Fry/fingerling are fed an appropriate commercial dry or moist steelhead/salmon diet. Fry feeding starts at ~8 times daily and is reduced as the fish increase in size. Range of feeding varies between 0.5 – 2.8% body weight/day. Feed conversion (pound of feed to pound of gain) is expected to range from 1.1:1 for dry feed to 1.4:1 for moist feed.

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

- Eyed eggs, fry, and larger juveniles 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 and the loss documented. Fry and larger juveniles are monitored throughout rearing, with necessary treatments based on mortality rates.

- Program protocols require the release of only disease-free fish.

- Coldwater disease occurs annually and causes significant losses of fish in the raceways at Lyons Ferry FH.

- In the summer, the Tucannon FH operates on well/spring water because the Rainbow Lake water supply causes outbreaks of the *Ichthyophtherius* parasite and columnaris disease *(Flexibacter columnaris)*. Rainbow Lake water is not used until October, although the water from the lake is plumbed to all units in the hatchery.

### Release and Outmigration

- About 99,000 Spokane stock rainbow trout catchables (@ 2.5 fish per pound) and 500 jumbos (@ 1 fish per pound) are planted by Lyons Ferry FH fish transport drivers into various lakes in southeast Washington. Planting begins in February and is completed in March.

- At the Tucannon FH, approximately 137,400 Spokane stock rainbow trout are planted into various lakes in southeast Washington as catchables. Planting typically begins in April, and is completed sometime in July. The jumbo trout (usually around 4,100 fish) are planted in February through May each year, supplementing catchable plants.

- After the spring Chinook are released, Curl pond is stocked with resident trout for public fishing.

- WDFW has a policy that no rainbow trout will be released into waters containing anadromous fish even under an emergency situation.

- Fish Health requirements only allows the release of healthy fish.

#### Facilities and Operations

*See the Lyons Ferry fall Chinook, Lyons Ferry hatchery steelhead, and Tucannon spring Chinook sections.*

### Research, Education, and Outreach

- WDFW Fish Management staff conduct angler counts and fishermen interviews.

- Vertical transmission studies on *Flavobacterium psychrophilum*, the causative agent of bacterial coldwater disease, have been conducted by the WDFW Fish Health Specialist. Brood adult rainbow trout at the Spokane FH are injected with florfenicol or erythromycin prior to spawning in an attempt to reduce vertical transmission of the coldwater disease bacterium to the progeny. Progeny of the treated adults are reared at both Tucannon FH and at Lyons Ferry FH to ascertain efficacy of treatment. Neither antibiotic proved efficacious in reducing coldwater disease among the progeny. The following year, all three-year-old female rainbow trout were injected with florfenicol, with the same results, i.e., coldwater disease remained unabated among the progeny.

## *Benefit and Risk Assessment*

### *BENEFITS CONFERRED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY*

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to the propagated stock and local community,[101] the Review Team identified the following benefits of this hatchery program:

#### Harvest Benefits

- Limited harvest data exists for the rainbow trout program. The WDFW Tucannon Lakes Fishery Monitoring Report for 2003 (Mendal and Trump) stated the angler effort was 38,116 angler-hours and 19,749 angler-days. The report further states "This partial fishing season estimate of angler days exceeded 29% of the LSRCP mitigation goal of 67,500 angler days for southeast Washington".

- The IDFG has no harvest data for rainbow trout provided by Lyons Ferry FH.

#### Conservation Benefits

- None identified.

#### Research, Education, Outreach and Cultural Benefits

- Hatchery staff provide educational and outreach opportunities on-site.

- The Tucannon Lakes recreational fishery provides an estimated 1:8.9 cost-benefit ratio (Tucannon Lakes Fishery Monitoring Report for 2003).

### *BENEFITS CONFERRED TO OTHER STOCKS, SPECIES, AND COMMUNITIES*

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to other species and stocks,[102] the Review Team identified the following benefits of this program:

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[101] *See Section II, "Components of This Report", for a description of these potential benefits and risks.*
[102] *Ibid.*

### Harvest Benefits

- Anglers benefit in areas throughout southeast Washington and north Idaho where rainbow trout are planted.

### Conservation Benefits

- None identified.

### Research, Education, Outreach and Cultural Benefits

- Hatchery staff provide educational and outreach opportunities to the public.

#### *RISKS POSED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY*

In the context of all possible genetic, demographic, ecological and other risks that a hatchery program can pose to the propagated stock,[103] the Review Team identified the following risks of the hatchery program:

### Genetic Risks

- None Identified.

### Demographic Risks

- Fish may be stressed and/or losses can occur during transport.

- Fish reared in uncovered rearing units at Lyons Ferry FH and Tucannon FH are subject to potential bird predation and bird-vectored disease.

### Ecological Risks

- None identified

### Physical Risks

- None identified

### Research, Education, Outreach and Cultural Risks

- None identified

#### *RISKS POSED TO OTHER STOCKS, SPECIES, AND COMMUNITIES*

In the context of all possible genetic, demographic, ecological, and other risks that a hatchery program can pose to other stocks and species in a watershed,[104] the Review Team identified the following risks from the hatchery program:

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[103] *Ibid.*

### Genetic Risks

- Lyons Ferry rainbow trout (Spokane stock) are biologically fertile and may pose a risk of inter breeding with natural populations of rainbow trout (e.g., fish escaping from Tucannon Lakes into the Tucannon River).

- Fish transferred to Idaho are placed in landlocked lakes and reservoirs managed for put-and-take fisheries and pose no known risk to anadromous fishes.

### Demographic Risks

- Rearing rainbow trout at Lyons Ferry FH increases demands for rearing space and water for anadromous fish.

- Amplification of coldwater disease among rainbow trout at Tucannon FH increases pathogen risks to steelhead on station and to fish downstream of the facility.

### Ecological Risks

- Rainbow trout stocked into the Tucannon Lakes may escape into the Tucannon River and may compete with other freshwater fishes, including juvenile salmon and steelhead.

- Disease epizootics during rearing increase fish health risks to anadromous salmon and steelhead on station.

- Rainbow trout pose a competition risk to other trout stocks and species where fish are outplanted.

### Research, Education, Outreach and Cultural Risks

- None identified.

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[104] *Ibid.*

# Recommendations for Current Program[105]

The Review Team considered all the benefits and risks outlined in the preceding section. The Team concluded that some of the risks outlined in the preceding section were either minor or their probability of occurrence was small and, thus, did not warrant a proposed change or recommendation for the current program. The recommendations outlined below, in addition to potentially increasing benefits towards achieving program goals, address the identified risks or potential problems considered by the Review Team to warrant a potential modification to the current program. Preceding each numbered recommendation is a brief summary of the issue.

## *Program goals and objectives*

*No issues identified.*

## *Broodstock Choice and Collection*

*No issues identified.*

## *Hatchery and Natural Spawning, Adult Returns*

*Not applicable.*

## *Incubation and Rearing*

***Issue LF-RT1: Coldwater disease is an annual problem among rainbow trout when they reach 100- to 200 fish per pound. Antibiotic injections of female broodstock at Spokane FH did not reduce the incidence of coldwater disease at Lyons Ferry FH or Tucannon FH.***

**Recommendation LF-RT1:** Investigate the use of another hatchery stock of rainbow trout with fewer documented problems with coldwater disease. Consider additional rinsing and disinfection of eggs as per the protocols developed by the Warm Springs Hatchery (California Fish & Game) where ovarian fluid is drained and the eggs are rinsed with 0.9% saline before fertilization. After fertilization, rinse and disinfect eggs in 100 ppm iodophor.

***See Issues LF-SS7 and LF-SS8 (or Issues CC-SS7 and CC-SS8).***

## *Release and Outmigration*

***Issue LF-RT2: 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.*

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[105] *The Review Team believes that the WDFW and the LSRCP office will be the logical parties to coordinate to implement most of the following recommendations.*

*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 and the Integrated Hatchery Operation Team (IHOT) Policy and Procedures.*

**Recommendation LF-RT2:** 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.

### *Facilities/Operations*

***Issue LF-RT3: Fish reared in outside circular tanks at Lyons Ferry FH are subject to bird predation.***

**Recommendation LF-RT3:** Install covers or totally enclose the tank pad (see LF-SS12).

### *Research, Monitoring, and Accountability*

***Issue LF-RT4:*** *Limited data exists regarding the program's ability to meet LSRCP mitigation goals. WDFW has extrapolated data from two lakes in the Tucannon River watershed to several other lakes in southeast Washington to estimate harvest effort in relation to LSRCP mitigation goals; however, IDFG has not performed a similar assessment for the lakes stocked in Idaho.*

**Recommendation LF-RT4:** IDFG should develop a monitoring program to determine if the Spokane rainbow trout program is meeting LSRCP mitigation goals. WDFW should continue to make efforts to monitor the program on a periodic basis.

*Refer to Program Goals and Objectives Issue and Recommendation LF-RT1 and LF-RT3.*

### *Education and Outreach*

*Refer to the Lyons Ferry Fall Chinook section.*

## Alternatives to Current Program

The Review Team considered the benefits and risks of the existing Spokane rainbow trout program at Lyons Ferry FH and developed three alternatives designed to reduce risks and/or increase benefits. The first alternative is the current program with all previously-described recommendations adopted. The last alternative is the "no program" option. Following these descriptions of alternatives, the Review Team has identified recommended alternatives.

## *Alternative 1: Current program with recommendations*

This alternative represents the current Spokane stock rainbow trout program at Lyons Ferry FH with implementation of all recommendations. These recommendations include increased monitoring and evaluation efforts by WDFW and IDFG to determine if the program's LSRCP mitigation goals are being met.

**Pros**

- Maintains the program at its current level.
- Develops important resident trout fishery data for effective management of the program.

**Cons**

- Increases the cost of monitoring and evaluation activities for the program.

## *Alternative 2: Transfer the Spokane rainbow trout to an WDFW inland trout facility*

**Pros**

- Frees up rearing space and water at Lyons Ferry FH for the existing anadromous programs.
- Reduces disease risks at Lyons Ferry FH and Tucannon FH resulting from the culture of rainbow trout.

**Cons**

- May increase costs of the program if improvements are required at another facility to accommodate the Spokane rainbow trout program.
- May increase the cost of transporting fish to their release locations.

## *Alternative 3: Terminate the program*

**Pros**

- Frees up rearing space and water at Lyons Ferry FH for existing anadromous programs.
- Reduces operational costs associated with rearing and transport of fish.
- Reduces disease risks at Lyons Ferry FH and Tucannon FH resulting from the culture of rainbow trout.

**Cons**

- Reduces or eliminates rainbow trout harvest opportunities in the inland waters where these fish are released.

- Does not meet the LSRCP goal to mitigate for lost fishing opportunities due to the construction and operation of the four lower Snake River dams.

## *Recommended Alternatives*

The Review Team recommends Alternative 2: transfer the Spokane rainbow trout program to a WDFW inland trout facility. Based on the review of all the other production programs at Lyons Ferry FH and the limited rearing space and water available, the Spokane rainbow trout program should be conducted at one of the WDFW inland trout facilities. For the Lyons Ferry FH, the Review Team has made specific recommendations regarding reducing early rearing densities for steelhead. Transfer of the Spokane rainbow trout program will free up early rearing space for steelhead and other anadromous fish programs. In addition, coldwater disease has been an issue for both Lyons Ferry steelhead and the Spokane rainbow trout. Transfer of the rainbow trout program to another facility will facilitate increased control for bacterial coldwater disease among steelhead at Lyons Ferry FH. The transfer of the program to a WDFW inland trout hatchery will provide continued harvest opportunities for a very popular trout fishery.

# Kamloops Rainbow Trout

Operator: Washington Department of Fish and Wildlife

## Summary of Current Program

### *Goals*

- ***Harvest goal:*** The goal of the trout programs at Lyons Ferry FH and Tucannon FH is to compensate for the loss of 67,500 angler-days of fishing in Washington and Idaho and to mitigate for reduced survival of resident fishes resulting from the construction and operation of the four lower Snake River dams. The program has no quantified harvest goal other than providing angler-days of fishing. The Kamloops Rainbow Trout program provides fish for release in the lower Salmon and lower Clearwater rivers in Idaho.

- ***Broodstock escapement goal:*** Not applicable. Eggs for the trout program are received from IDFG's Hayspur FH.

- ***Conservation goal:*** None.

- ***Escapement goal for natural-origin adults:*** Not applicable.

- ***Research, education, and outreach goals:*** Annual hook-and-line monitoring is conducted in the lower Clearwater and Salmon rivers to determine the relative contribution of program fish to the creel and to collect stomachs from trout for subsequent diet analysis. Sampling generally occurs during the month of August.

### *Objectives*

- Transfer 65,000 triploid eyed eggs (Kamloops rainbow trout strain) from Hayspur FH (IDFG) to Tucannon FH in January.

- Hatch the eggs and rear the fry at Tucannon FH to 75 fpp.

- Transfer 52,000 triploid Kamloops rainbow trout at 75 fpp from Tucannon FH to Lyons Ferry FH in July.

- Rear triploid Kamloops rainbow trout at Lyons Ferry FH to 15 fpp.

- Outplant 50,000 triploid Kamloops rainbow trout fingerlings from Lyons Ferry FH to the lower 100 miles (161 km) of the Salmon River and the lower 70 miles (113 km) of the Clearwater River in Idaho.

### *Program Description*

WDFW manages two hatcheries to produce resident trout for the LSRCP Program. Triploid eyed eggs from Kamloops rainbow trout are transferred from Hayspur FH (IDFG) to Tucannon FH in January of

each year. The eggs are hatched, and the fry are reared to 75 fpp. Those fry (n ≈ 52,000) are then transferred to Lyons Ferry FH in July of each year and reared in raceways. In August or September, the adipose fins of all fish are clipped and either the right or left ventral fin is also clipped (alternating years). In October, after approximately three months of rearing at Lyons Ferry FH, IDFG transports and plants the entire group of fish (n ≈ 50,000) in the lower Salmon River and the lower Clearwater River at 15 fish per pound.

# Assessment of Current Program

## *Operational Considerations*

Listed below are the principal operational components of the hatchery program that the Review Team considered as part of its review.

### Broodstock Choice and Collection

- Not applicable

### Incubation and Rearing

- IDFG provides 65,000 triploid, Kamloops rainbow trout eyed eggs to WDFW for incubation and rearing to the subyearling fingerling stage in support of Idaho's resident trout program. These eggs are shipped from Hayspur FH to the Tucannon FH in January each year.

- Eyed eggs hatch from baskets at Tucannon FH, and the hatched fry drop into troughs where they remain for 4-8 weeks after feeding commences. Early rearing and feeding protocols are the same as those for Spokane rainbow trout (see preceding program).

- At Tucannon FH, after initial rearing in troughs, the fry are transferred to outside circular tanks for intermediate rearing. In July, when the fish reach 75 fish per pound, they are transferred to Lyons Ferry FH for final rearing and marking.

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

- Eyed eggs, fry, and larger juveniles 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 daily by bulb-syringe and the loss documented. Fry and larger juveniles are monitored throughout rearing, with necessary treatments based on mortality rates.

- To reduce problems with coldwater disease, fish numbers are limited to 8,000 fish/trough during early rearing. Fish are hand fed twice/day to control growth to further reduce problems with

coldwater disease. Maintaining fish densities below D.I. = 0.5 is standard procedure at Tucannon FH.

- Rearing temperatures range from 48 to 54°F.

### Release and Outmigration

- In October, IDFG transports and plants the entire population (usually around 50,000 fish) in Idaho Rivers (lower Salmon River and lower Clearwater River) at 15 fish per pound.

### Facilities and Operations

*See the Lyons Ferry fall Chinook, Lyons Ferry hatchery steelhead, and Tucannon spring Chinook sections.*

### Research, Education, and Outreach

*See the Spokane Rainbow Trout program section.*

## *Benefit and Risk Assessment*

#### *BENEFITS CONFERRED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY*

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to the propagated stock and local community,[106] the Review Team identified the following benefits of this hatchery program:

### Harvest Benefits

- Although IDFG samples the lower Clearwater and lower Salmon rivers to determine the presence/absence of program fish, harvest benefits have not been documented.

### Conservation Benefits

- None identified.

### Research, Education, Outreach and Cultural Benefits

- Annual hook-and-line monitoring is conducted in the lower Clearwater and Salmon rivers to determine the relative contribution of program fish to the creel and to collect stomachs for subsequent diet analysis. Sampling generally occurs during the month of August.

#### *BENEFITS CONFERRED TO OTHER STOCKS, SPECIES, AND COMMUNITIES*

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to other species and stocks,[107] the Review Team identified the following benefits of this program:

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[106] *See Section II, "Components of This Report", for a description of these potential benefits and risks.*

### Harvest Benefits

- None identified. The program supports resident trout fisheries in the lower Clearwater and lower Salmon rivers.

### Conservation Benefits

- None identified.

### Research, Education, Outreach and Cultural Benefits

- IDFG staff provide educational and outreach opportunities to the public.

#### *RISKS POSED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY*

In the context of all possible genetic, demographic, ecological and other risks that a hatchery program can pose to the propagated stock,[108] the Review Team identified the following risks of the hatchery program:

### Genetic Risks

- None identified.

### Demographic Risks

- The absence of covers over the circular tanks at Tucannon FH increases bird predation risks.

- Rainbow trout stocked in Rainbow Lake above Tucannon FH pose a disease risk to other fish on station via the water supply to the hatchery.

### Ecological Risks

- None identified.

### Physical Risks

- Fish may be stressed and/or losses can occur during transport.

### Research, Education, Outreach and Cultural Risks

- None identified.

#### *RISKS POSED TO OTHER STOCKS, SPECIES, AND COMMUNITIES*

In the context of all possible genetic, demographic, ecological, and other risks that a hatchery program can pose to other stocks and species in a watershed, the Review Team identified the following risks from the hatchery program:

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[107] *Ibid.*
[108] *Ibid.*

### Genetic Risks

- Triploid rainbow trout are not 100% sterile (but nearly so) and, thus, pose a very small genetic risk to natural populations of rainbow trout and steelhead in the Clearwater and Salmon rivers.

### Demographic Risks

- The rainbow trout program places a demand on rearing space and water supply in competition with the anadromous program.

- Amplification of coldwater disease in Kamloops trout held at Tucannon FH may pose risks to fish downstream of the facility.

### Ecological Risks

- Kamloops rainbow trout stocked in the Clearwater and Salmon rivers pose predation and competition risks to juvenile salmon and steelhead. Predation risks to subyearling fall Chinook are a particular concern.

- Disease outbreaks pose a fish health risk to other stocks on station and to other trout stocks where the fish are outplanted.

### Research, Education, Outreach and Cultural Risks

- None identified.

## Recommendations for Current Program[109]

The Review Team considered all the benefits and risks outlined in the preceding section. The Team concluded that some of the risks outlined in the preceding section were either minor or their probability of occurrence was small and, thus, did not warrant a proposed change or recommendation for the current program. The recommendations outlined below, in addition to potentially increasing benefits towards achieving program goals, address the identified risks or potential problems considered by the Review Team to warrant a potential modification to the current program. Preceding each numbered recommendation is a brief summary of the issue.

### *Program goals and objectives*

*No issues identified.*

[109] *The Review Team believes that the WDFW and the LSRCP office will be the logical parties to coordinate to implement most of the following recommendations.*

## *Broodstock Choice and Collection*

*No issues identified.*

## *Hatchery and Natural Spawning, Adult Returns*

*No issues identified.*

## *Incubation and Rearing*

*No issues identified.*

## *Release and Outmigration*

***Issue LF-RT5: Kamloops rainbow trout stocked in the lower Salmon and lower Clearwater rivers may prey on anadromous stocks (i.e. fall Chinook in lower Clearwater River).***

**Recommendation LF-RT5:** Increase sampling efforts to determine the extent of predation on anadromous fish, particularly fall Chinook juveniles. If the predation is determined to be significant, then discontinue stocking anadromous waters and seek a stocking location (landlocked waters) absent anadromous fish.

***Issue LF-RT6: Pre-release fish health exams - which include testing for virus, bacteria and parasites - are not conducted at Lyons Ferry FH.*** *This situation increases the risk that released juvenile rainbow trout will be infected with endemic or vertically transmitted diseases at some undetected level. The potential presence of pathogens among released fish 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 and the Integrated Hatchery Operation Team (IHOT) Policy and Procedures.*

**Recommendation LF-RT6:** Sample 60 fish for pre-release fish health 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.

## *Facilities/Operations*

*See Recommendation LF-RT4 and LF-SS12 to install a cover or enclosure over the tank pad at Lyons Ferry FH.*

## *Research, Monitoring, and Accountability*

*Refer to Program Goals and Objectives Issue and Recommendation LF-RT5 and LF-RT7.*

***Issue LF-RT7: Although IDFG samples harvested fish in the lower Clearwater and lower Salmon rivers to determine the presence/absence of program fish, sport fishery contribution data specific for this program are not available.***

**Recommendation LF-RT7:** Establish a monitoring program to determine fishery contribution of Kamloops rainbow trout in Idaho waters to determine whether the program is meeting LSRCP mitigation goals. If fishery contributions are low, consider moving the programs to lakes or reservoirs to increase harvest benefits and reduce ecological risks to juvenile salmon and steelhead in anadromous waters (see also Recommendation LF-RT6 below).

### *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.*

## Alternatives to Current Program

The Review Team considered the benefits and risks of the existing Kamloops rainbow trout program at Lyons Ferry FH and developed three alternatives designed to reduce risks and/or increase benefits. The first alternative is the current program with all previously-described recommendations adopted. The last alternative is the "no hatchery" option. Following these descriptions of alternatives, the Review Team has identified recommended alternatives.

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

This alternative represents the current rainbow trout program at Lyons Ferry FH with implementation of all recommendations. These recommendations include increase fishery monitoring efforts to determine if LSRCP mitigation goals are being met and increased monitoring of harvested fish to determine if predation of anadromous fish is significant.

**Pros**

- Generates data to better understand effects of the program on anadromous fish.
- Maintains the program at its current level.
- Develops important resident trout fishery data for effective management of the program.

**Cons**

- Increases the cost of monitoring and evaluation activities for the program.

## *Alternative 2: Transfer Kamloops rainbow trout program to another facility*

Discontinue rainbow trout production at Lyons Ferry FH and Tucannon FH and move production to another facility.

**Pros**

- Frees up rearing space and water at Lyons Ferry FH for existing anadromous programs.
- Reduces disease risks at Lyons Ferry FH and Tucannon FH resulting from the culture of rainbow trout.

**Cons**

- May increase costs of the program if improvements are required at another facility to accommodate the Kamloops rainbow trout program.
- May increase the cost of transporting fish to their release locations.

## *Alternative 3: Terminate the program*

**Pros**

- Frees up rearing space and water at Lyons Ferry FH for existing anadromous programs.
- Reduces operational costs associated with rearing and transport of fish.
- Reduces disease risks at Lyons Ferry FH and Tucannon FH resulting from the culture of rainbow trout.
- Eliminates predation risks on fall Chinook by hatchery-origin Kamloops rainbow trout released in the lower Salmon and lower Clearwater rivers.

**Cons**

- Reduces or eliminates rainbow trout harvest opportunities in the waters where these fish are released.
- Does not meet LSRCP goal to mitigate for lost fishing opportunities due to the construction and operation of the four lower Snake River dams.

## *Recommended Alternatives*

The review team recommends Alternative 2: transfer Kamloops rainbow trout program to another facility. Based on the review of all the other production programs at Lyons Ferry and Tucannon FHs, the transfer of the rainbow trout program to another facility would free up resources that could be used for existing anadromous programs at both facilities. It also eliminates any fish health risks associated

with this program, simplifies the overall fish culture process at Lyons Ferry and Tucannon FHs, and maintains a recreational harvest opportunity on resident rainbow trout in southeast Washington and northern Idaho.

# VI. Conclusions

The Review Team concluded that the Lyons Ferry FH fall Chinook program and the Cottonwood Creek steelhead program are providing very significant conservation and harvest benefits, respectively. In contrast, the Tucannon River spring Chinook program is providing little documented benefits.

The Team also concluded that the segregated hatchery steelhead programs with Lyons Ferry steelhead were providing substantial fishery benefits in the Tucannon, Touchet, and Walla Walla rivers, but those programs also posed significant risks to natural populations both within and outside the Snake River Basin. Releases of Lyons Ferry steelhead into the Tucannon River have resulted in a high proportion of hatchery fish on the natural spawning grounds downstream of the permanent weir in the Tucannon River. While the risks of releasing Lyons Ferry steelhead into the Touchet and Walla Walla rivers were considered lower than those in the Tucannon River, Lyons Ferry steelhead still pose risks to natural populations within those two rivers. Propagation and release of Wallowa stock steelhead at Cottonwood Creek in the lower Grande Ronde River appear to pose only minor biological risks to natural populations within the Grande Ronde River; however, the Wallowa stock strays at a relatively high rate into the Deschutes and John Day rivers, thus posing genetic and demographic risks to natural populations in those latter rivers.

The Review Team concluded that termination of off-site releases of Lyons Ferry steelhead into the Tucannon, Touchet, and Walla Walla rivers would reduce the risks to natural populations and that expansion of on-station (Lyons Ferry FH) releases and/or increases in the size of the Touchet and Tucannon River endemic steelhead programs should be implemented to meet the harvest benefits currently being realized by the existing Lyons Ferry steelhead program. The Team also concluded that the Lyons Ferry stock should be replaced in the long-term with a stock indigenous to the Snake River Basin. The Team also concluded that the steelhead program at Cottonwood Creek should continue to be assessed and reduced in size if straying into the Deschutes and John Day rivers occurs at levels that pose a risk to natural populations in those latter two rivers. The Team also felt that managers should assess development of an endemic Grande Ronde River stock that may reduce the risks of straying both within and outside the Grande Ronde River Basin but only if this latter alternative proved feasible relative to the viability and biological status of natural populations within the Grande Ronde River Basin.

The Review Team concluded that the deliberate passage of hatchery-origin adults upstream of weirs in the Tucannon and Touchet rivers, as part of the endemic Tucannon and Touchet river steelhead programs, was inconsistent with the stated management goal of those programs (i.e., to test the efficacy of developing endemic hatchery programs to replace the Lyons Ferry steelhead stock). The current small effective breeding numbers for each broodstock, coupled with the deliberate upstream passage of hatchery-origin progeny and difficulties to collect adult steelhead across the entire temporal period of the run, poses a significant genetic risk to the natural populations upstream of the respective weirs. The Team further concluded that the recent adult return rates back to both basins from the endemic programs were sufficient to expand the programs with the long-term goal to establish a two-broodstock, "stepping-stone" hatchery program for each endemic population in each river. Such programs could have both harvest and conservation goals. Recent improvements to the Touchet River weir and additional improvements to the lower Tucannon River weir would be critical to expanding the size of the endemic programs. In addition, the continued assessment of straying of hatchery origin steelhead from both endemic programs to upstream of Lower Granite Dam should be continued to (a) investigate the level and causes of straying and (b) identify potential management solutions.

The Review Team concluded that the low recruit-to-spawner ratio for naturally spawning spring Chinook (a) inhibits the development of an integrated hatchery program in the Tucannon River and (b) places the natural population at significant risk of local extirpation. Significant numbers of adult hatchery and natural-origin spring Chinook from the Tucannon River bypass the Tucannon River and migrate upstream of Lower Granite Dam. WDFW staff suggested that the cause of this straying may be water flow problems in the backwaters of the Snake River behind Lower Monumental Dam at the confluence of the Tucannon River. The Team concluded that a permanent weir should be constructed in the lower Tucannon River to meet comanager goals and recommended the development of a two-stage stepping-stone program for the entire Tucannon River population with specific management goals identified for conservation and harvest. In addition, the continued assessment of straying to upstream of Lower Granite Dam for the program should be continued to investigate the level and causes of straying, and to identify potential management solutions.

The Review Team concluded that the current fall Chinook broodstock collections at Lyons Ferry FH and Lower Granite Dam will not be sufficient at current adult return levels to meet the goal of integrating (30%) natural-origin fish into the broodstock. The program may also pose a long-term genetic risk to recovery of the natural Snake River population if hatchery-origin fish continue to compose a very high proportion of naturally spawning fish as the abundance of the population continues to increase in the Snake River. Broodstock collection at only the two current sites (Lyons Ferry FH and Lower Granite Dam) will also inhibit the long-term development of spatial structure and diversity among natural spawning locations in the Hells Canyon area of the Snake River, the lower mainstem Snake River, and the Clearwater River. The Team concluded that, in the near-term, an early returning stock could be developed for the Clearwater River (Middle Fork) consistent with the long-term goals of the Nez Perce Tribe, and that the feasibility of developing additional localized stocks in the lower mainstem Clearwater River and Hells Canyon reach of the Snake River should be long-term goals.

The Review Team concluded that the rainbow trout programs (Spokane and Kamloops) provided significant harvest benefits but recommended the rearing of those fish at other facilities (e.g., a WDFW trout hatchery) to reduce disease risks at Lyons Ferry and Tucannon FHs and free up rearing space for salmon and steelhead at those latter two facilities.

# Appendices

# Appendix A: All-H Analyzer (AHA) output for salmon and steelhead stocks in the Lower Snake Mainstem, Grande Ronde, Tucannon, and Touchet River Watersheds

Available from the Pacific Region Federal Hatchery Review website, www.fws.gov/pacific/fisheries/hatcheryreview/reports.html/

# Appendix B: Washington LSRCP Facilities Briefing Document

Available from the Pacific Region Federal Hatchery Review website, www.fws.gov/pacific/fisheries/hatcheryreview/reports.html/

# Appendix C: Comments on Draft Report and Review Team Responses

Available from the Pacific Region Federal Hatchery Review website, www.fws.gov/pacific/fisheries/hatcheryreview/reports.html/

# Appendix D. Complete Text of Comment Letters Received from Stakeholders

Available from the Pacific Region Federal Hatchery Review website, www.fws.gov/pacific/fisheries/hatcheryreview/reports.html/

# Appendix E: Washington LSRCP Facilities Operations and Maintenance Costs Summary

Available from the Pacific Region Federal Hatchery Review website, www.fws.gov/pacific/fisheries/hatcheryreview/reports.html/

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**www.fws.gov/pacific/Fisheries/Hatcheryreview/**

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**March 2011**