



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, Summary

March 2011

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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.

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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 Project¹.

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 comanagers², 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

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/

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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 ($\approx 1,600$ females) to yield 4.6 million eyed eggs. Surplus adults collected in excess of broodstock needs are returned to the Snake River

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.

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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

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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.

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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.

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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

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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

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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).

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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 $SAR \approx 1.6\%$). 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

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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 \approx 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 \approx 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).

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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

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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 ($\approx 52,000$) 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

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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.

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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.

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