



U.S. Fish & Wildlife Service - Pacific Region  
Columbia Basin Hatchery Review Team

## Columbia River Basin - Lower Snake River Region *Grande Ronde and Imnaha River Watersheds*



### Oregon Lower Snake River Compensation Plan State Operated Facilities

*Irrigon, Lookingglass, and Wallowa Fish Hatcheries*

### Assessments and Recommendations

Draft Report, Summary, December 2009

U.S. Fish and Wildlife Service (USFWS). 2009. *Oregon Lower Snake River Compensation Plan State Operated Hatcheries: Assessments and Recommendations. DRAFT Report, Summary, December 2009*. 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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Oregon LSRCP Hatcheries Assessments and Recommendations Report – December 2009

## 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 must 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 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 US Fish and Wildlife Service (Service) began, in October 2005, a four-year review of 21 salmon and steelhead hatcheries that the Service owns or operates in the Columbia River Basin. The review was expanded in 2008 to include three National Fish Hatcheries 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 conservation of naturally-spawning populations of salmon, steelhead and other aquatic species. The Service's review process is modeled after the Puget Sound and Coastal Washington Hatchery Reform Project which was completed in 2005 and subsequently expanded to the Columbia River<sup>1</sup>. The Service plans to complete its reviews by mid-2010.

The report presented here provides benefit/risk assessments and recommendations for salmon and steelhead propagation programs conducted at Lookingglass Fish Hatchery (FH), Irrigon FH, Wallowa FH, and associated satellite facilities where juvenile fish are released and/or adults are trapped for broodstock. Lookingglass, Wallowa, and Irrigon FHs are all operated by the Oregon Department of Fish and Wildlife (ODFW) in northeast Oregon. Programs at those three hatcheries operate cooperatively as part of the Lower Snake River Compensation Plan (LSRCP), a federally funded program to mitigate for fish losses associated with four "run-of-the-river" hydroelectric and transportation dams on the lower Snake River in Washington State. The report presented here is one of three reports for federal hatcheries operated by Washington, Oregon and Idaho as part of the LSRCP; complementary reports exist for hatcheries operated by Idaho and Washington.

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 Oregon: *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<sup>2</sup>, 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.<sup>3</sup>

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<sup>1</sup> [www.hatcheryreform.us](http://www.hatcheryreform.us)

<sup>2</sup> LSRCP comanagers in Oregon are the U.S. Fish and Wildlife Service, ODFW, Nez Perce Tribe, Confederated Tribes of the Umatilla Indian Reservation (CTUIR), Confederated Tribes of the Warm Springs Reservation (CTWSR), with comanaging input from the National Marine Fisheries Service (NOAA Fisheries).

<sup>3</sup> [www.fws.gov/Pacific/fisheries/HatcheryReview/](http://www.fws.gov/Pacific/fisheries/HatcheryReview/)

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## Lookingglass Fish Hatchery

**Facility overview:** Lookingglass FH is located on 22.5 acres 19 miles north of the town of Elgin, Oregon, adjacent to Lookingglass Creek, 2.2 miles upstream from the confluence with the Grande Ronde River (RM 86). The hatchery was constructed in 1982 as part of the LSRCP program to mitigate for the reduced abundance of spring Chinook and summer steelhead caused by the construction and operation of four federal dams on the lower Snake River. Lookingglass Hatchery is operated by ODFW and raises spring Chinook for the Grande Ronde and Imnaha rivers as part of the LSRCP.

## Lookingglass Creek Spring Chinook

**Program overview:** The Lookingglass Creek spring Chinook program currently operates as a reintroduction program to restore spring Chinook to Lookingglass Creek. The native population of spring Chinook in Lookingglass Creek is considered extirpated. In 2001, comanagers selected spring Chinook from Catherine Creek as the appropriate stock for reintroduction into Lookingglass Creek. Juvenile spring Chinook from the Catherine Creek hatchery program (see below) were first released into Lookingglass Creek in 2001, and adult spring Chinook from Catherine Creek were first released in 2004. The program is intended to ultimately operate as an integrated-harvest program with both hatchery and natural origin adults returning to Lookingglass Creek used for broodstock. The long-term goal of the program is to support harvests of spring Chinook within the Grande Ronde River watershed and contribute to the LSRCP mitigation goal of returning 5,860 hatchery-origin adult spring/summer Chinook from the Grande Ronde River basin to upstream of Lower Granite Dam. A directed harvest in Lookingglass Creek is allowed if escapement predictions to Lookingglass Creek exceed 620 adults. The broodstock goal is to annually collect 170 adult spring Chinook (85 females and 85 males) to yield approximately 286,000 green eggs and 250,000 yearling smolts for release into Lookingglass Creek. A maximum of 150,000 juvenile spring Chinook are reared at Lookingglass Hatchery and up 100,000 juveniles are transferred and reared at Irrigon FH. The proportion of the broodstock composed of hatchery and natural-origin fish follows a sliding scale that is a function of the predicted total number of adult Chinook expected to return to Lookingglass Creek. Based on that sliding scale, up to 450 hatchery-origin adults are passed annually upstream of the hatchery weir to spawn naturally in Lookingglass Creek.

**Benefits:** The number of hatchery-origin spring Chinook adults trapped at Lookingglass FH has increased continuously since 2004, from a low of  $n = 45$  adults in 2005 to a high of  $n = 305$  adults in 2009. The number of natural-origin spring Chinook increased from  $n = 50$  adult recruits in 2008 to approximately  $n = 101$  adult recruits in 2009. Unmarked adult spring Chinook (age 4 years), considered to be the natural-origin progeny of introduced Catherine Creek fish, first returned to Lookingglass Creek during the late spring and summer of 2008.

**Risks:** The current productivity and capacity of Lookingglass Creek upstream of the hatchery may not be sufficient to provide the desired number of natural-origin adults for a genetically integrated broodstock consisting of 170 adult spring Chinook. This latter limitation coupled with the existing sliding scale for passing hatchery-origin fish upstream to spawn naturally poses a long-term domestication risk to a future naturalized population in Lookingglass Creek, largely because hatchery-origin fish are expected to dominate natural-origin fish numerically on the spawning grounds under the current sliding scale and management scheme. Low stream flows and high water temperatures in Lookingglass Creek during the late summer and early fall pose fish health risks to adult spring Chinook adults held on station. The passage of hatchery-origin spring

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Chinook upstream of the weir poses disease risks to other stock of spring Chinook reared at Lookingglass Hatchery (see below) because Lookingglass Creek is the water source for the hatchery. The short-term rearing of Lookingglass spring Chinook fingerlings at Irrigon FH and subsequent transfer back to Lookingglass FH increases fish health risks at both facilities.

**Recommendations for current program:** The Review Team identified 31 program specific recommendations to reduce risks and/or improve benefits of the current Lookingglass Creek spring Chinook program at Lookingglass FH. These recommendations include: (a) modification of the current sliding scale so that it includes contingencies for not passing hatchery-origin fish upstream when the number of natural-origin adults achieves a threshold level of abundance, thus promoting establishment of a self-sustaining naturalized population; (b) improve treatment of the water supply at Lookingglass Hatchery to reduce disease risks to juvenile spring Chinook reared on station; (c) reduce juvenile rearing densities (DI) and water flow indices (FI) to maximum values of  $DI \leq 0.2$  and  $FI \leq 1.0$  to reduce fish health risks; (d) reduce the size of one or more programs at Lookingglass FH (see below) to preclude the need to transfer Lookingglass Creek spring Chinook juveniles to Irrigon FH for rearing; (e) investigate different types of shade covers used at other facilities and consider installing shade covers over the raceways at Lookingglass FH; and (f) replace the water intake screen at Lookingglass FH so that it complies with the screening criteria of NOAA Fisheries.

**Alternatives to current program:** The Review Team considered the pros and cons of six alternatives to the existing Lookingglass Creek spring Chinook program at Lookingglass FH, ranging from (a) the current program with full implementation of all program specific recommendations (Alternative 1) to (b) termination of all programs at Lookingglass FH and decommissioning the facility (Alternative 6). The Review Team recommends Alternative 4: expansion of the current Lookingglass spring Chinook program from 250,000 to 325,000 smolts. Implementation of this recommendation requires concurrent reductions in the sizes of the upper Grande Ronde and Imnaha River spring Chinook programs to accommodate the expanded Lookingglass Creek program. Implementation of these recommendations is intended to increase harvest mitigation benefits in Lookingglass Creek and the Grande Ronde River with little or no reductions in harvest elsewhere. Alternative 4 is intended to be implemented with all the recommendations for the current program (Alternative 1) but could be implemented with development of a stepping stone program (Alternative 2) or a segregated broodstock management strategy (Alternative 3) depending on comanager goals and priorities.

## Upper Grande Ronde River Spring Chinook

**Program overview:** The program currently operates as a conservation program to prevent extirpation of the endemic spring Chinook population in the upper Grande Ronde River. Under current conditions, the naturally spawning population would most likely become functionally extinct without hatchery intervention. The hatchery program is intended to eventually contribute to recreational and tribal harvests and the overall LSRCF mitigation goal to return 5,860 hatchery-origin adult spring/summer Chinook from the Grande Ronde River basin upstream of Ice Harbor Dam. Currently, the program consists of both “conventional” and “captive” components. The broodstock goal for the conventional program is to annually capture 170 adult spring Chinook (85 males and 85 females) to produce 250,000 yearling smolts for release into the upper Grande Ronde River. Adults are trapped for broodstock at the Upper Grande Ronde River Adult Collection Facility, located at RM 153 of the Grande Ronde River. Adult spring Chinook retained for broodstock are transported to the Lookingglass FH where they are held until sexually mature. Spawning of adults, egg incubation, hatching, and rearing of progeny fish to the yearling smolt

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stage occur at Lookingglass FH. Yearling smolts are transported to the upper Grande Ronde River acclimation facility (located at RM 170 of the Grande Ronde River) for acclimation and release. For the captive component, three to five (3-5) eyed eggs from each female parent of the conventional program are removed from the incubators at Lookingglass FH and transported to Wallowa FH (see below) for incubation and hatching. The resulting fry are reared to the yearling stage at Wallowa FH and then transported to Bonneville FH<sup>4</sup> (ODFW) for captive rearing to sexual maturity. The program attempts to raise a total of 300 captively-reared adults each brood year. Captively-reared adults are crossed and spawned between brood years to yield progeny that can be used as a “safety net” to backfill” progeny shortages of the conventional program. Natural-origin adults from this stock are incorporated within the broodstock annually, and hatchery origin adults are allowed to spawn naturally in the upper Grande Ronde River each year. All adults returning from the captive portion of the program are allowed to spawn naturally.

**Benefits:** The principle benefit of the program is maintenance of spring Chinook salmon in the upper Grande Ronde River and prevention of functional extirpation of the endemic, naturally spawning population. The program also confers research benefits for captive rearing technologies.

**Risks:** The program poses genetic, ecological, and demographic risks to the upper Grande Ronde River population of spring Chinook salmon. However, those risks are considered to be significantly lower than the demographic risk of extinction resulting from degraded habitat conditions in the upper Grande Ronde River.

**Recommendations for current program:** The Review Team identified nine specific recommendations to reduce risks and/or improve benefits of the current upper Grande Ronde River spring Chinook program at Lookingglass FH. These recommendations include: (a) evaluate and improve the efficiency of the adult weir in the upper Grande Ronde River, and (b) evaluate post-release survivals and smolt-to-adult return rates (SARs) of direct stream-released yearlings versus acclimated smolts to determine whether the former strategy is a viable alternative to acclimating two release groups over a protracted release period.

**Alternatives to current program:** The Review Team considered the pros and cons of four alternatives to the existing Upper Grande Ronde River Spring Chinook program at Lookingglass FH, 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 adult trap and juvenile acclimation facilities in the upper Grande Ronde River (Alternative 4). The Review Team recommends Alternative 2 in the near term: reduce the size of the upper Grande Ronde River program, focusing exclusively on conservation and maintaining the endemic spring Chinook population in the upper Grande Ronde River. Under this alternative, the desired size of the program would be reduced from an annual release of 250,000 smolts to 130,000 smolts with an annual broodstock size of 60 females and 60 males. The Team recommends continuation of the captive program as a “safety net” for the population. The recommended alternative would “free up” two raceways at Lookingglass FH that could be used to increase the size of the Lookingglass Creek spring Chinook program. This alternative recommended here implicitly assumes that aggressive actions to restore habitat and increase natural population viability would also occur. Over the long term, the size of the program could be increased in response to improved habitats, increased smolt-to-adult survivals, and restored harvest opportunities.

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<sup>4</sup> Bonneville Fish Hatchery is located along the lower Columbia River immediately downstream of Bonneville Dam.

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## Catherine Creek Spring Chinook

**Program overview:** The program currently operates primarily as a conservation program to maintain the endemic spring Chinook population in Catherine Creek, a major tributary to the Grande Ronde River. The immediate goal of the program is to maintain a naturally spawning population in Catherine Creek and ensure a high probability of population persistence into the future. The program is also intended to assist with restoration of spring Chinook salmon in the Grande Ronde River basin, including the reintroduction of spring Chinook to Lookingglass Creek. The program is intended to eventually contribute to recreational and tribal harvests and the overall LSRCP mitigation goal to return 5,860 hatchery-origin adult spring/summer Chinook from the Grande Ronde River basin upstream of Ice Harbor Dam. The broodstock goal is to annually capture 82 adult spring Chinook (41 males and 41 females) to produce 130,000 yearling smolts for release into Catherine Creek. Adults are trapped for broodstock at the Catherine Creek weir, located at RM 43 of Catherine Creek. Natural-origin Chinook from Catherine Creek are incorporated within the broodstock annually, and hatchery-origin adults are allowed to spawn naturally in Catherine Creek each year. A sliding scale has been developed to help determine the proportion of the broodstock and natural spawners composed of hatchery and natural-origin fish annually, based on the estimated adult escapement to Catherine Creek. Adult spring Chinook retained for broodstock are transported to the Lookingglass FH where they are held until sexually mature. Spawning of adults, egg incubation, hatching, and rearing of progeny fish to the yearling smolt stage occur at Lookingglass FH. Yearling smolts are transported to the Catherine Creek Acclimation Facility (located at RM 52 of Catherine Creek) for acclimation and release.

**Benefits:** The program is reducing the demographic risk of extinction and helping to maintain a naturally spawning population of spring Chinook in Catherine Creek. The program is providing fish for the reintroduction of “endemic” Grande Ronde River spring Chinook into Lookingglass Creek.

**Risks:** The high proportion of hatchery-origin spring Chinook spawning in Catherine Creek poses a genetic domestication risk to the natural population. The current sliding scale used to determine the proportion of natural and hatchery-origin adults passed upstream of the Catherine Creek weir results in upstream passage of hatchery-origin fish when the number of natural-origin fish exceeds the natural spawning escapement objective. Icy water conditions at the acclimation site in March and early April pose demographic risk (icing of water intake) and physiologic risks (cold shock) to juvenile spring Chinook prior to release. Continued outplanting Catherine Creek spring Chinook adults into Lookingglass and Indian creeks poses fish health and competition risks (i.e., ecological risks) to naturally spawning populations in those streams.

**Recommendations for current program:** The Review Team identified nine specific recommendations to reduce risks and/or improve benefits of the current Catherine Creek spring Chinook program at Lookingglass FH. These recommendations include: (a) modify the current sliding scale used for determining the proportion of hatchery and natural-origin fish passed upstream so that upstream passage of hatchery-origin fish is precluded when the number of natural-origin fish exceeds the natural spawning escapement objective ( $n = 750$  natural-origin adults); (b) discontinue outplanting adult spring Chinook into Indian Creek unless the activity can be justified and evaluated based upon specific goals for the program; (c) evaluate post-release survivals and smolt-to-adult return rates (SARs) of direct stream-released yearlings versus acclimated smolts to determine whether the former strategy is a viable alternative to acclimating two release groups over a protracted release period susceptible to icing.

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**Alternatives to current program:** The Review Team considered the pros and cons of four alternatives to the existing Catherine Creek Spring Chinook program at Lookingglass FH, 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 adult trap and juvenile acclimation facilities in Catherine Creek (Alternative 4). The Review Team recommends Alternative 1: continuation of the current program with implementation of all program-specific recommendations.

## Lostine-Wallowa River Spring Chinook

**Program overview:** The program currently operates primarily as a conservation program to maintain the endemic spring Chinook population in the Lostine River, a tributary to the Wallowa River which – in turn - is a major tributary to the Grande Ronde River. The immediate goal of the program is to maintain a naturally spawning population in the Lostine River and ensure a high probability of population persistence into the future. The program is intended to eventually contribute to recreational and tribal harvests and the overall LSRCP mitigation goal to return 5,860 hatchery-origin adult spring/summer Chinook from the Grande Ronde River basin upstream of Ice Harbor Dam. The broodstock goal is to annually capture 140 adult spring Chinook (70 males and 70 females) to produce 250,000 yearling smolts for release into the Lostine River, with jacks composing up to 10% of the male spawning contribution. Adults are trapped for broodstock at the Lostine River weir, located at RM 1.0 of the Lostine River. Natural-origin adults from the Lostine River are included within the broodstock annually. In addition, hatchery-origin adults are allowed to spawn naturally in the Lostine River each year. A sliding scale has been developed to help determine the proportion of the broodstock and natural spawners composed of hatchery and natural-origin fish annually based on the estimated adult escapement to the Lostine River. Up to 250, 100, and 100 hatchery-origin adults are outplanted annually into the Wallowa River, Bear Creek, and Prairie Creek, respectively. Adult spring Chinook retained for broodstock are transported to Lookingglass FH where they are held until sexually mature. Spawning of adults, egg incubation, hatching, and rearing of progeny fish to the yearling smolt stage occur at Lookingglass FH. Yearling smolts are transported to the Lostine River Acclimation Facility (RM 12) for acclimation and release.

**Benefits:** The program provides very limited harvest benefit in the Wallowa River. The program is reducing the demographic risk of extinction and is helping to maintain a naturally spawning population of spring Chinook in the Lostine River.

**Risks:** The high proportion of hatchery-origin spring Chinook spawning in the Lostine River poses a genetic domestication risk to the natural population. The current sliding scale used to determine the proportion of hatchery and natural-origin adults passed upstream of the weir in the Lostine River results in passage of hatchery-origin fish when the number of natural-origin fish exceeds the natural spawning escapement objective. The inefficiency of the temporary adult weir can also result in uncontrolled numbers of spring/summer Chinook passing upstream during higher water flows, further increasing genetic domestication risks. Icy water conditions at the acclimation site in March and early April pose demographic and physiologic risks to juvenile spring Chinook prior to release. Outplanting Lostine River spring/summer Chinook adults into the Wallowa River, Bear Creek, and Prairie Creek poses fish health and competition risks to naturally spawning populations in those recipient streams. Outplanting subyearling parr poses competition risks to natural-origin parr and, most likely, confers few or no benefits.

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**Recommendations for current program:** The Review Team identified 11 specific recommendations to reduce risks and/or improve benefits of the current Lostine-Wallowa River spring Chinook program at Lookingglass FH. These recommendations include: (a) modify the current sliding scale used to adjust the proportion of hatchery and natural-origin fish passed upstream to exclude passage of hatchery-origin fish when the number of natural-origin fish exceeds the natural spawning escapement objective ( $n = 1,000$  natural-origin adults); (b) discontinue outplanting adult spring Chinook into the Wallowa River, Bear Creek, and Prairie Creek unless the activity can be justified and evaluated based upon specific goals for the program; (c) construct a new permanent weir in the Lostine River; (d) evaluate post-release survivals and smolt-to-adult return rates (SARs) of direct stream-released yearlings versus acclimated smolts to determine whether the former strategy is a viable alternative to acclimating two release groups over a protracted release period when icing occurs; and (e) terminate the outplanting of subyearling parr unless the activity can be justified based upon specific goals for the program.

**Alternatives to current program:** The Review Team considered the pros and cons of seven alternatives to the existing Lostine-Wallowa River Spring Chinook program at Lookingglass FH, 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 adult trap and juvenile acclimation facilities in the Lostine River (Alternative 7). The Review Team recommends, in the short term, Alternative 1: continuation of the current program with implementation of all program-specific recommendations. These recommendations include construction of a new weir in the Lostine River. Over the long term, the Team supports development of the Northeast Oregon Hatchery (NEOH) on the Lostine River. The NEOH facility and a new weir would allow comanagers to increase the size of the Lostine-Wallowa River spring/summer Chinook program to provide harvest benefits. The NEOH would also relieve facility constraints at Lookingglass FH. If NEOH and a new weir are constructed, then the Team further recommends that comanagers consider converting the Lostine-Wallowa spring/summer Chinook program to a two-broodstock, stepping-stone program (Alternative 3). Absent a new NEOH facility, the comanagers may wish to reassess other programs at Lookingglass FH to determine whether they should be reduced and the Lostine spring/summer Chinook program increased (alternative 5).

## **Innaha River Spring Chinook**

**Program overview:** The program currently operates as an *integrated harvest and conservation* program to support recreational and tribal fisheries in the Innaha River while assisting with the conservation of the endemic Innaha River population of spring/summer Chinook. The program is intended to contribute to recreational and tribal harvests and the overall LSRCP mitigation goal to return 3,210 hatchery-origin adult spring/summer Chinook from the Innaha River to upstream of Lower Granite Dam on the mainstem Snake River. The current broodstock goal is to annually capture 216 adult spring/summer Chinook (108 males and 108 females) to yield 360,000 smolts for release in the Innaha River, with jacks composing up to 10% of the male spawning contribution. Adults are trapped for broodstock at the Innaha River weir and satellite facility, located at RM 49 of Innaha River. Natural-origin adults from the Innaha River are included with the broodstock annually, and hatchery-origin adults are allowed to spawn naturally in the Innaha River each year. A sliding scale has been developed to help determine the proportion of the broodstock and natural spawners composed of hatchery and natural-origin fish annually based on the estimated adult escapement to the Innaha River. Up to 500 hatchery-origin adults are outplanted annually into Big Sheep Creek and Lick Creek in the Big Sheep Creek watershed. Adult spring/summer Chinook retained for broodstock are transported to the Lookingglass FH

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where they are held until sexually mature. Spawning of adults, egg incubation, hatching, and rearing of progeny fish to the yearling smolt stage occur at Lookingglass FH. Yearling smolts are transported to the Imnaha River Acclimation Facility (RM 49) for acclimation and release.

**Benefits:** The Imnaha spring/summer Chinook program provides recreational and tribal harvest in the Imnaha River basin. ODFW opened spring/summer Chinook sport fishing in the Imnaha River from 2001-2005 and in 2008. Estimated sport harvest of spring/summer Chinook in the Imnaha River during those years averaged 164 fish (range = 22-302 fish). Estimated tribal harvest in the Imnaha River from 2001 through 2007 averaged 160 fish (range = 33-316 fish). The total number of hatchery-origin spring/summer Chinook adults trapped at the Imnaha River weir for the years 2000-2009 has ranged from 660 fish (2006) to 3,254 fish (2009). During that same time period, the number of natural-origin adults trapped at the weir has ranged from 131 fish (2006) to 1,390 fish (2001). The hatchery program has significantly increased the total number of spring/summer Chinook returning to the Imnaha River since the early 1990's, thereby reducing demographic risks of extirpation.

**Risks:** The high proportion of hatchery-origin spring Chinook spawning in the Imnaha River poses a genetic domestication risk to the natural population. Approximately 40% of the total number of adults returning to the weir site are able to migrate upstream before waters flows allow installation of the temporary weir. The mean and range of return date for natural origin fish are shifting to later dates, thus providing evidence of genetic effects of the hatchery program on the natural population. In addition, hatchery-origin adults pass upstream of the weir during periods of high flow in some years. The comparatively large number of hatchery origin fish spawning naturally also poses competition risks to the productivity (number of adult progeny recruits per adult spawner) of natural-origin fish. The current sliding scale used to determine the proportion of hatchery and natural-origin adults passed upstream of the weir in the Imnaha River results in passage of hatchery-origin fish even when the number of natural-origin fish meets or exceeds the natural spawning escapement objective. Outplanting hatchery-origin spring/summer Chinook adults into Big Sheep and Lick creeks poses genetic and ecological risks to the natural populations in those streams. Those risks are a concern because the status of the natural populations are largely unknown, and desired benefits or intended goals of those outplants have not been clearly identified.

**Recommendations for current program:** The Review Team identified 17 specific recommendations to reduce risks and/or improve benefits of the current Imnaha River spring/summer Chinook program. These recommendations include: (a) modify the current sliding scale used to adjust the proportion of hatchery and natural-origin fish passed upstream so that hatchery-origin fish are excluded from passage when the predicted number of natural-origin fish returning to the Imnaha River exceeds the natural spawning escapement objective ( $n = 1,000$  natural-origin adults); (b) discontinue outplanting adult Chinook into the Big Sheep and Lick creeks unless the activity can be justified and evaluated based upon specific goals for that portion of the program; (c) design and construct a new weir in the Imnaha River; (d) identify beneficial uses for trapped, hatchery-origin Chinook that exceed broodstock and natural spawning needs (e.g., direct subsistence to tribes, food banks, etc.); (e) maintain rearing and acclimation densities within desired guidelines for spring Chinook; (f) increase the capacity of the adult trap and holding pond at the Imnaha weir and satellite facility; (g) develop a monitoring program for Big Sheep and Lick creeks to evaluate whether the desired benefits from outplanting adults are achieved; and (h) increase public outreach opportunities at the Imnaha River satellite facility.

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**Alternatives to current program:** The Review Team considered the pros and cons of eight alternatives to the existing Imnaha River spring/summer Chinook program at Lookingglass FH, 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 Imnaha River satellite facility (Alternative 8). The recommendation slightly reduces production to 325,000 smolts annually to address facility constraints at Lookingglass FH and to meet the Team’s recommended alternatives for the other Grande Ronde Basin spring/summer Chinook programs. Given the Team’s current program recommendations to adjust the sliding scale to reduce the number of hatchery-origin fish passed upstream and to consider discontinuing the outplanting of adults if the activity cannot be justified (IR-SC2 and 3), this small program reduction should not significantly affect the programs harvest and conservation goals. Alternative 2 also includes implementation of Alternative 1 recommendations, including construction of a new weir on the Imnaha River to better meet broodstock management and natural spawning goals.

**Summary of recommended alternatives for spring Chinook programs at Lookingglass FH. The rearing capacity of Lookingglass FH is constrained by a total of 18 raceways. Each raceway can rear a maximum of 65,000 yearling spring Chinook smolts with respect to fish health guidelines.**

<b>Program</b>	<b>Proposed Short Term Size of Program: No. of smolts</b>	<b>No. of raceways required at Lookingglass FH</b>	<b>Recommended Alternative</b>
Lookingglass Creek Spring Chinook	325,000	5	Increase from 250,000 smolts to increase harvest and mitigation benefits in Lookingglass Creek and Grande Ronde River
Upper Grande Ronde River Spring Chinook	130,000	2	Reduce from 250,000 smolts, with focus on maintaining the endemic population. Continue captive rearing program.
Catherine Creek Spring Chinook	130,000	2	Maintain current program size.
Lostine River Spring Chinook	250,000	4	Maintain current program size and construct a new weir. Increase size of program if proposed NEOH facility is constructed.
Imnaha River Spring Chinook	325, 000	5	Reduce from 360,000 smolts, and construct a new weir.

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## *Irrigon and Wallowa Fish Hatcheries*

### **Irrigon FH**

**Facility overview:** Irrigon FH is located three miles west of Irrigon, Oregon, adjacent to the Columbia River and the reservoir pool behind John Day 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 in 1985 and is the primary LSRCP steelhead rearing facility in Oregon. The facility was designed to rear steelhead smolts for release into the Grande Ronde and Imnaha River systems. Irrigon FH receives eyed steelhead eggs from Wallowa Hatchery and rears them prior to transfer for release or acclimation

### **Wallowa FH**

**Facility overview:** Wallowa FH is located on 11 acres along Spring Creek (RM 0.5), a spring-fed tributary to the Wallowa River approximately one mile west of the town of Enterprise, Oregon. Wallowa FH began operation in 1920 as a resident trout hatchery. In 1985, the U.S. Army Corps of Engineers renovated the hatchery for rearing summer steelhead under the LSRCP. The main hatchery building includes an egg incubation area, office, bunkhouse, and storage area. The facility also includes a weir and fish ladder, a concrete adult holding pond, adult spawning facility, water diversion structure, two smolt acclimation ponds, a fish release pipeline, and domestic water system. Water rights for the entire hatchery total 23,813 gpm from several sources. The acclimation ponds receive water from Spring Creek.

### **Wallowa River Summer Steelhead**

**Program overview:** The program currently operates as a *segregated-harvest* program to support recreational and tribal fisheries in the Grande Ronde and Wallowa rivers. The LSRCP mitigation goal for the program is to return 9,184 hatchery-origin summer steelhead adults to the Snake River upstream of Ice Harbor Dam. The Wallowa hatchery steelhead stock was developed from adult steelhead trapped at Ice Harbor Dam in 1976 and Little Goose Dam in 1977-1978, with eyed eggs imported from Pahsimeroi Fish Hatchery (Idaho Department of Fish and Game) as the source of fish in 1979. Since 1979, the Wallow hatchery steelhead stock has been maintained from hatchery-origin adults trapped at the Wallowa FH, Big Canyon satellite facility – located at the confluence of Deer Creek and the Wallowa River just east of the town of Minam, Oregon, - and the Cottonwood Creek satellite facility in the lower Grande Ronde River (Washington Department of Fish and Wildlife). The current broodstock goal is to annually capture 450 adult summer steelhead (225 males and 225 females) to yield 800,000 smolts for release in the Wallowa River. The broodstock goal includes 90 fish trapped in the fall (45 males and 45 females) to yield 160,000 smolts and 360 adults trapped in the spring (180 males and 180 females) to yield 640,000 smolts. The two broodstocks and their resulting progeny are managed separately. Fall-returning fish are the descendants of fish originally caught by hook-and-line from the Lower Grande Ronde River during the early fall, 2002-2006. All offspring of fall-caught fish (160,000 smolts) and 50% of the offspring of spring-trapped fish (320,000 smolts) are acclimated and released at Wallowa FH. The remaining 320,000 smolt offspring of spring trapped fish are acclimated and released from the Big Canyon facility. Currently, all broodstock are collected at Wallowa FH. Hatchery-origin steelhead collected at the Big Canyon facility are stocked in local fishing ponds, released downstream in the Wallowa River (“recycled”) to increase harvest opportunities for anglers (100 fish total over

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several weeks), or transferred to Wallowa FH to supplement the program's broodstock if needed. However, "backfills" from Big Canyon have not occurred since the early 1990's. Spawning of adults and initial incubation of eggs occurs at Wallowa FH. Eyed eggs from all spawned adults ( $\approx$  1.02 M eggs) are transferred to Irrigon FH for hatching and rearing to the yearling smolt stage. Smolts are transferred from Irrigon FH to Wallowa FH and the Big Canyon facility for acclimation and release.

**Benefits:** The Wallowa hatchery steelhead program provides significant recreational and tribal harvests in the Grande Ronde River basin. Estimates of harvest of Wallowa steelhead in the Grande Ronde River basin for 1993/1994 through 2004/2005 averaged 2,381 fish (range 760-4,820) per year. Estimates of sport harvest (1993/1994-2004/2005) of Wallowa steelhead within the project area (outside the Grande Ronde River Basin) averaged 2,352 fish per year (759-3,874 fish/year). Annual estimated harvest (expanded from CWT recoveries) of Wallowa stock steelhead (for both release locations) within the project area for return years 2003-2005 averaged 6,724 fish per year (range = 4,394 to 8,694 fish/year). Approximately 9.3% of the total estimated harvest on Wallowa hatchery steelhead occurred outside the Snake River basin, 2003-2005.

**Risks:** The water alarm system at Irrigon FH is antiquated, thus posing demographic risks to the Wallowa hatchery stock reared there. The continued propagation and release of an introduced hatchery stock in the Grande Ronde River basin poses genetic and ecological risks to ESA-listed natural populations, although tagging data indicate very high homing fidelity within the Grande Ronde River basin of Wallowa steelhead back to release locations (Wallowa FH and Big Canyon facility). On the other hand, significant "out-of-basin" straying of Wallowa steelhead into the Deschutes and John Day rivers poses genetic and ecological risks to natural populations in those watersheds; approximately 6% of all returning Wallowa hatchery steelhead for return years 1993/94 through 2004/05 were recovered as "out-of-basin strays".

**Recommendations for current program:** The Review Team identified 23 specific recommendations to reduce risks and/or improve benefits of the current Wallowa hatchery steelhead program. These recommendations include: (a) continue to investigate alternative broodstocks and broodstock strategies to reduce straying risks outside the Grande Ronde River basin; (b) monitor escapement of steelhead into Joseph Creek and the Wenaha River within the Grande Ronde River basin to ensure that Wallowa hatchery steelhead compose less than 5% of the naturally-spawning steelhead in those two "refuge" streams; (c) discontinue the practice of "recycling" adult steelhead in the Wallowa River at the Big Canyon facility and find alternative benefits for those fish; (d) institute more stringent fish health protocols at Irrigon and Wallowa hatcheries to better control bacterial coldwater disease (e.g., by adopting the protocols used to control bacterial kidney disease); (e) update the water alarm systems at Irrigon FH; and (f) investigate options for de-icing the water intake, head, and tail screens at the Big Canyon satellite facility to reduce demographic risks to acclimated fish prior to release.

**Alternatives to current program:** The Review Team considered the pros and cons of five alternatives for the existing Wallowa hatchery steelhead 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 Wallowa FH and Big Canyon satellite facility (Alternative 5). The Review Team recommends Alternative 1: continuation of the current program with implementation of all program-specific recommendations. The current program provides significant harvest benefits and is currently meeting the mitigation requirements of the LSRCP. Consequently, the Team's recommendations largely reflect the need to control and reduce risks rather than change a program that is fundamentally meeting its intended benefits. The Team

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did discuss, at some length, the potential desirability of replacing the Wallowa hatchery stock with another stock (Alternatives 2 and 3), largely because other hatchery stocks of steelhead in the Snake River basin – including the Little Sheep Creek stock (see below), exhibit very low out-of-basin stray rates compared to the Wallowa hatchery stock. In the end, the Team favored investigation and evaluation of additional measures to monitor, control, and reduce straying risks of the current program rather than recommend replacement of the Wallowa hatchery stock at this time. However, some Team members strongly favored the latter alternative to phase out the Wallowa River stock and replace it with either (a) the Little Sheep Creek stock (Alternative 2) or (b) an endemic Grande Ronde River steelhead stock (Alternative 3).

## Little Sheep Creek Summer Steelhead

**Program overview:** The program currently operates as an *integrated-harvest* program to support recreational and tribal fisheries in the Imnaha River basin. The LSRCP mitigation goal for the program is to return 2,000 hatchery-origin summer steelhead adults to the Snake River upstream of Ice Harbor Dam. The Little Sheep Creek hatchery steelhead stock was developed from natural-origin adult steelhead trapped in Little Sheep Creek beginning in 1982. The current broodstock goal is to annually capture and spawn 134 adult summer steelhead (67 males and 67 females) in Little Sheep Creek to yield 215,000 smolts for release in the Imnaha River watershed. Adults are trapped and spawned at the Little Sheep Creek satellite facility. Hatchery-origin adults in excess of broodstock needs are either (a) passed upstream of the weir in Little Sheep Creek to supplement natural-origin spawners (via a sliding scale) with the objective of achieving a total spawning escapement of 250 fish or (b) outplanted into Big Sheep Creek. ODFW and NOAA Fisheries are currently conducting a genetic evaluation of the relative reproductive success of hatchery and natural-origin steelhead upstream of the weir in Little Sheep Creek. From 1999 through 2008, an average of 1,186 hatchery-origin steelhead adults per year (range = 42-2,030 fish/year) from Little Sheep Creek were outplanted into Big Sheep Creek. Unfertilized gametes collected at the Little Sheep Creek satellite facility are transported to Wallowa FH for fertilization and incubation to the eyed stage. Eyed eggs are transferred to Irrigon FH for final incubation, hatching, and rearing to the yearling smolt stage. Two groups of yearling steelhead are transferred from Irrigon FH and released in the Imnaha River basin: (1) 165,000 yearling smolts are acclimated and released at the Little Sheep Creek satellite facility and (2) 50,000 yearling smolts are direct stream-released into Big Sheep Creek.

**Benefits:** The Little Sheep Creek steelhead program provides important recreational and tribal harvest benefits in the Imnaha River basin. Estimates of harvest of Little Sheep Creek steelhead in the Imnaha River Basin for return years 1993/1994 through 2004/2005 averaged 183 fish per year (range = 24-397 fish/year). Estimates of harvest (1993/1994-2004/2005) of Little Sheep Creek steelhead, upstream of Ice Harbor Dam but outside the Imnaha River Basin, averaged 371 fish/year. Annual estimated harvest of Little Sheep Creek steelhead upstream of Ice Harbor Dam for return years 2003-2005 averaged 696 fish per year (range = 760 to 1,295 fish/year). Estimated harvest of Little Sheep Creek steelhead upstream of Ice Harbor Dam accounted for 66.4% of the total estimated harvest on the stock with 33.6% of the total harvest on hatchery-origin fish occurring downstream of Ice Harbor Dam in the Columbia and Snake rivers.

**Risks:** The proportion of naturally spawning Chinook composed of hatchery-origin fish exceeds the proportion of the broodstock composed of natural-origin fish, thus posing genetic domestication risks to the naturally spawning population in Little Sheep Creek. High egg loading and juvenile rearing densities in nursery tanks at Irrigon FH increase fish health risks. Outplanting large numbers of hatchery-origin adults into Big Sheep Creek each year (mean  $\approx$ 1000 fish/year

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since 1998), plus the annual outplanting of hatchery-origin smolts, most likely results in the number of hatchery origin adults substantially exceeding the number of natural origin adults spawning in Big Sheep Creek in most, if not all, years, thus posing a significant genetic domestication risk to the naturally spawning steelhead population in Big Sheep Creek.

**Recommendations for current program:** The Review Team identified 13 specific recommendations to reduce risks and/or improve benefits of the current Little Sheep Creek steelhead program. These recommendations include: (a) discontinue the release of smolts and adults into Big Sheep Creek unless the activity can be justified based upon specific goals for the program; (b) review and adjust the sliding scale for determining the number of hatchery-origin adults passed upstream of the weir in Little Sheep Creek, consistent with the research and conservation goals of the program; (c) reduce egg incubation and juvenile rearing densities from current levels to established fish health guidelines; (d) institute more stringent fish health protocols at the Little Sheep Creek satellite facility, Irrigon FH, and Wallowa FH to better control bacterial coldwater disease (e.g., by adopting protocols similar to those used to control bacterial kidney disease); (e) test steelhead juveniles for *IHN* virus and the parasite *Myxobolus cerebralis* (causative agent of whirling disease) two to four weeks prior to release from the Little Sheep Creek acclimation pond, (f) repair the concrete apron immediately downstream of the weir to prevent scouring and undercutting of the underlying stream bed before the problem worsens; (g) evaluate the extent of post-release residualism of steelhead smolts downstream of the weir in Little Sheep Creek; and (h) develop a monitoring and evaluation program for Big Sheep Creek to determine whether the intended benefits of outplanting adults and releasing smolts – benefits which need to be defined – are indeed being achieved.

**Alternatives to current program:** The Review Team considered the pros and cons of six alternatives for the Little Sheep Creek hatchery steelhead 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 Little Sheep Creek satellite facility (Alternative 6). The Review Team recommends Alternative 1: continuation of the current program with implementation of all program-specific recommendations. Implementation of Alternative 1 should maintain the genetic integrity of the broodstock, improve fish culture efficiency, decrease ecological and disease risks, and maintain the existing level of fishing opportunity for steelhead in the Imnaha River basin and in downstream fisheries. These recommendations emphasize the need to define goals for all management actions (e.g., outplanting 1,000 hatchery-origin adult steelhead in Big Sheep Creek annually) in terms of numeric outcomes that quantify intended benefits independent of, but consistent with, the mitigation goals of the overall program. The Review Team concluded also that the sliding scale for passing adult steelhead upstream of the weir on Little Sheep Creek needs to be adjusted so that the number of hatchery and natural-origin fish passed upstream are consistent with the research and conservation goals of the program. For example, the number of hatchery and natural-origin fish passed upstream of the weir should be as equal as possible to maximize the power and minimize bias of the experimental design to assess the relative reproductive success of hatchery and natural-origin fish.

## Conclusions

*(To be provided in the Final Report)*

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