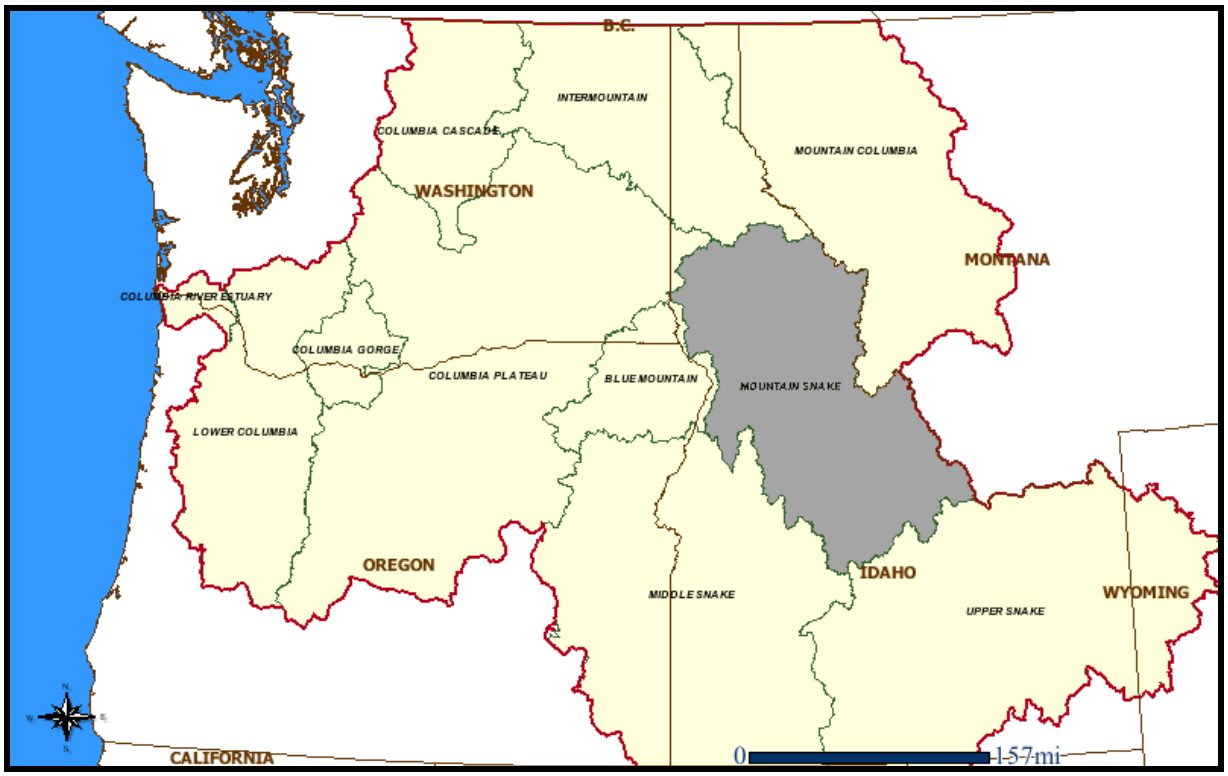
U.S. Fish & Wildlife Service - Pacific Region

Columbia Basin Hatchery Review Team

Columbia River Basin, Mountain Snake Province

Clearwater and Salmon River Watersheds



Dworshak, Kooskia and Hagerman National Fish Hatcheries

Assessments and Recommendations

Final Report

June 2009

Please cite as:

U.S. Fish and Wildlife Service (USFWS). 2009. *Dworshak, Kooskia, and Hagerman National Fish Hatcheries: Assessments and Recommendations. Final Report, June 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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Summary[1]

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 U.S. Fish & 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 goal of this review is to ensure that Service hatcheries are operated in accordance with best scientific principles, and contribute to sustainable fisheries and the conservation of naturally-spawning populations of salmon, steelhead and other aquatic species. The Service's review process is modeled after the recent Puget Sound and Coastal Washington Hatchery Reform Project[2]. The Service plans to complete its reviews by early 2010.

The report presented here provides benefit/risk assessments and recommendations for salmon and steelhead propagation programs conducted at hatchery facilities in Idaho owned and/or operated by the Service: Dworshak, Kooskia and Hagerman National Fish Hatcheries (NFHs).[3] Dworshak and Kooskia NFHs are located within the Clearwater River watershed in north central Idaho. Hagerman NFH is located in the Thousand Springs area of the Snake River near Hagerman, Idaho. The Service owns four additional hatcheries in Idaho that are operated by Idaho Department of Fish and Game (IDFG): Clearwater, Magic Valley, Sawtooth and McCall fish hatcheries. Programs at these latter four hatcheries will be reviewed in a subsequent report. Programs at all seven at hatcheries (3 NFHs, 4 state-operated hatcheries) operate cooperatively within 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 Review Team considered, as a foundation for its assessments, four characteristics of each salmonid stock in the Clearwater and Salmon River watersheds: *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 cooperators[4], as a foundation for assessing the benefits and risks of the Service's hatchery programs.

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[1] *This report is intended to be a scientific review of Dworshak, Kooskia and Hagerman National Fish Hatcheries. The assessments and conclusions presented throughout this report are those of the Review Team and are not necessarily the policy position of the U.S. Fish and Wildlife Service.*

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

[3] *Dworshak NFH was constructed by the Army Corps of Engineers and the Corps continues to fund Dworshak mitigation program as part of the Federal Columbia River Power System.*

[4] *LSRCP cooperators in Idaho are the U.S. Fish and Wildlife Service, Idaho Department of Fish and Game, Nez Perce Tribe, and the Shoshone-Bannock Tribes, with comanaging input from the National Marine Fisheries Service (NOAA Fisheries).*

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.[5]

Dworshak NFH

Facility Overview: Dworshak National Fish Hatchery (NFH) is located at river mile 40 (rkm 65) of the Clearwater River at the confluence of the North Fork Clearwater River, 75 miles (121 km) upstream from Lower Granite Dam, and 523 miles (842 km) upstream from the mouth of the Columbia River. The hatchery was constructed by the Army Corps of Engineers in 1969 to mitigate for fish losses, particularly steelhead, resulting from the construction and operation of Dworshak Dam, a 600-foot high water storage and hydroelectric dam two miles upstream from the hatchery on the North Fork Clearwater River. The principle water source for fish culture at Dworshak NFH is the North Fork Clearwater River, the intake for which is located immediately adjacent to the adult fish ladder into the hatchery. Facility operations, maintenance, fish health, and monitoring and evaluation at Dworshak NFH are 100% funded by the U.S. Army Corps of Engineers via a direct agreement with the Bonneville Power Administration (BPA). The LSRCP funds a spring Chinook program at Dworshak NFH to mitigate for fish losses associated with four hydroelectric dams on the lower Snake River in Washington State.

Summer Steelhead (*B-run)*

Program overview: The steelhead program at Dworshak NFH operates as a *segregated harvest* program within the Clearwater River watershed with returning hatchery-origin adults used exclusively for broodstock. The North Fork Clearwater River was historically one of the most productive rivers for steelhead and spring Chinook in the Columbia River basin, but Dworshak Dam totally blocks upstream migration of anadromous fish. The broodstock objective at Dworshak NFH is to collect 3,000-4,000 adults at the hatchery and spawn a minimum of 1,100 females and 1,100 males pairwise with an on-station release of 1.2 million yearling smolts into the Clearwater River. In addition, Dworshak NFH outplants 300,000 smolts into Clear Creek at Kooskia NFH, 400,000 smolts into the South Fork (S.F.) Clearwater River, and 100,000 smolts each into Newsome Creek and the American River within the upper S.F. Clearwater River watershed. The hatchery also provides 1.3-1.4 million fertilized green eggs to the Clearwater Fish Hatchery for subsequent transfer and outplanting of yearling smolts in the Salmon River basin. Dworshak NFH also provides 1.2-1.3 million eyed eggs to the Clearwater Fish Hatchery for direct outplanting of smolts into the S.F. Clearwater River. These latter two transfers of eggs to Clearwater Fish Hatchery are part of the LSRCP. All releases of steelhead within the Clearwater River basin, both on-station and outplants into Clear Creek and the S.F. Clearwater River, support recreational and tribal fisheries in the Clearwater River, the lower Columbia River, and the Snake River.

Benefits: Steelhead from Dworshak NFH provide significant harvest benefits to recreational and tribal fishers in the Clearwater River. From 2000 to 2006, the sport fishery harvested an estimated 12,230-30,168 fish per year in the Clearwater River. During those same years, the tribal fishery harvested an estimated 1,000-1,470 fish per year in the North Fork of the Clearwater River. The sport harvest data reflect steelhead released on station and outplanted throughout the Clearwater River Basin. Relative harvest benefits and adult return rates for on-station releases versus outplanting sites have not been accurately quantified. Based on recovery of coded wire tags for

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

steelhead released on station from Dworshak NFH (brood years 1980 through 2001), approximately 28% of the recaptured adults were caught in gillnet fisheries in the mainstem Columbia River, 27% percent were caught in sport fisheries in the Columbia and Snake River basins, and 45% were recaptured at Dworshak NFH or other hatcheries. Less than 1% of coded wire tags were recovered elsewhere. The Dworshak NFH B-run steelhead stock serves as a genetic repository for the North Fork Clearwater River population, a genetically unique stock within the Columbia River basin, but the naturally-spawning population was extirpated after construction of Dworshak Dam. As a result, the hatchery program confers a significant long-term conservation benefit.

Risks: Continued propagation of Dworshak NFH B-run steelhead as a genetically-segregated hatchery stock, for which only hatchery-origin adults are used for broodstock, poses a domestication risk to the population as a genetic repository for the extirpated North Fork Clearwater steelhead population. The use of pumped water from the North Fork Clearwater River, immediately adjacent to the adult entry ladder into the hatchery, creates several disease risks to fish reared on station. These risks include (a) extended rearing of steelhead juveniles in the indoor nursery tanks prior to transfer to outside ponds as a means to reduce fish susceptibility to IHN virus shed from adult fish returning to the hatchery into the hatchery's water supply and (b) the use of re-use (recirculated) water to yield steelhead smolts of the desired target size at one year of age. The continued outplanting of Dworshak B-run steelhead into Clear Creek and the South Fork Clearwater River poses biological risks to natural populations and inhibits local adaptation of both hatchery-origin and natural-origin fish.

Recommendations for current program: The Review Team identified 30 specific recommendations to reduce risks and/or improve benefits of the current summer steelhead program at Dworshak NFH. These recommendations include: (a) replacement of pumped water from the North Fork Clearwater River (in the immediate vicinity of the hatchery ladder) with gravity-feed water from Dworshak Reservoir to reduce fish health risks; (b) construction of a smolt acclimation pond at Kooskia NFH to replace the direct outplanting of smolts into Clear Creek, thereby reducing straying risks and increasing opportunities to recapture unharvested adults; and (c) development of local *segregated* broodstocks for the South Fork Clearwater River and Kooskia NFH, derived from hatchery-origin adults returning to those locations, to allow termination of the annual outplants from Dworshak NFH. The Review Team also recommends reduction of rearing densities in the indoor nursery tanks at Dworshak NFH from an upper density index (DI) value of DI = 0.75 to DI = 0.50 by increasing the number of nursery tanks, decreasing the total number of steelhead smolts reared on station, or transferring juveniles to outdoor rearing ponds at a smaller mean size *if* the current river water supply to those ponds is replaced with reservoir water. The Review Team also acknowledges the high desirability, but significant logistic difficulty, of developing a genetically-integrated natural spawning component for the Dworshak NFH steelhead stock whereby natural-origin adults would be included in the broodstock to reduce domestication risks to the hatchery stock.

Alternatives to Current Program: The Review Team considered the pros and cons of seven alternatives to the existing summer steelhead program, ranging from (a) the current program with full implementation of all program specific recommendations (Alternative 1) to (b) termination of all programs at Dworshak NFH and decommissioning the facility (Alternative 7). The Review Team recommends continuation of the existing program with implementation of all recommendations (Alternative 1). The Review Team noted several merits of rearing only steelhead or spring Chinook at Dworshak NFH (see below) and rearing the other species at Clearwater Fish Hatchery (Alternatives 3 and 4, respectively), but the absence of smolt-release

and adult-recapture capabilities at the latter hatchery precluded further consideration of those alternatives. As a *long-term* goal, the Review Team recommends continuation of the current program (Alternative 1) but developing a naturally-spawning component to the program whereby natural-origin adults could be included with the broodstock to reduce long-term domestication risks to the Dworshak NFH steelhead stock.

Spring Chinook

Program overview: The program operates as a *segregated harvest* program within the Clearwater River watershed with returning hatchery-origin adults used exclusively for broodstock. The broodstock objective at Dworshak NFH is to collect 1,200 adults and spawn a minimum of 500 females with an on-station release of 1.05 million yearling smolts into the Clearwater River. Adult collection, egg incubation, rearing, and release all occur on station at the hatchery. The Dworshak NFH stock of spring Chinook originated ancestrally from the Rapid River Hatchery stock with some genetic contribution from the Carson NFH stock. Native populations of spring Chinook in the Clearwater River were extirpated in the mid-1900's by Lewiston Dam (1927-1973) which blocked all upstream migration of Chinook salmon into the Clearwater River.

Benefits: Spring Chinook released from Dworshak NFH, Kooskia NFH and Clearwater Fish Hatchery in the Clearwater River have provided variable harvest benefits, but those benefits have not been accurately quantified for each hatchery. For example, the total estimated annual sport harvest of spring Chinook in the Clearwater River ranged from 0 to 14,752 fish, and the tribal harvest ranged from 0 to 3,144 fish, for the 20 year period, 1987-2006. The 20-year average was 1,517 and 581 fish in sport and tribal harvests, respectively. Based on the available information, sport harvest of Dworshak NFH spring Chinook in the Clearwater River for return years 2001 through 2005 averaged 3,668 fish per year (range = 606 to 8,355 fish) and composed an average of 45.1% of the spring Chinook salmon harvested in the Clearwater River. As available, excess adults trapped at the hatchery are provided to the Nez Perce Tribe for subsistence and ceremonial purposes. Based on recovery of coded wire tags for spring Chinook released from Dworshak NFH (brood years 1985 through 2002), approximately 7% of the recaptured adults were caught in gillnet fisheries in the mainstem Columbia River, 15% percent were caught in sport fisheries in the Columbia and Snake River basins, 7% were caught in Columbia River treaty and ceremonial fisheries, and 71% were recaptured at Dworshak NFH or other hatcheries. Less than 1% of coded wire tags were recovered elsewhere. PIT tagged fish provide a research benefit for assessing downstream survival passage at hydroelectric dams and comparing survival estimates of volitional passage through the hydropower system versus barging around Snake and lower Columbia River dams.

Risks: The use of pumped water from the North Fork Clearwater River, immediately adjacent to the adult entry ladder into the hatchery, poses disease risks to spring Chinook reared on station. Greater than 20% of all coded-wire tags recoveries for adult spring Chinook originating from Dworshak NFH occur outside the mainstem migration corridor of the Columbia and Snake Rivers; those high stray rates pose genetic risks to other spring Chinook stocks in the Columbia River basin.

Recommendations for Current Program: In addition to the facility recommendations identified under the Dworshak NFH steelhead program, the Review Team identified 11 program specific recommendations to reduce risks and/or improve benefits of the current spring Chinook program at Dworshak NFH. These recommendations include: (a) reducing the total number of adult spring Chinook retained for broodstock by approximately 20% to the maximum number of fish

(approximately 1,000 adults) needed to meet program objectives; (b) quantification of homing and straying rates of spring Chinook released from Dworshak NFH, including evaluations to correlate stray rates with variable fish culture practices; and (c) elimination of backfilling broodstock shortages with eyed eggs from other hatcheries (e.g. Rapid River Hatchery) to maximize local adaptations and homing fidelity of the spring Chinook stock propagated at Dworshak NFH.

Alternatives to Current Program: The Review Team considered the pros and cons of six alternatives to the existing spring Chinook program, ranging from (a) the current program with full implementation of all program specific recommendations (Alternative 1) to (b) termination of all programs at Dworshak NFH and decommissioning the facility (Alternative 6). The Review Team recommends continuation of the existing program with implementation of all recommendations (Alternative 1). The Review Team noted several merits of rearing only steelhead or spring Chinook at Dworshak NFH and rearing the other species at Clearwater Fish Hatchery (Alternatives 3 and 4, respectively); however, the absence of smolt-release and adult-recapture capabilities at Clearwater Hatchery precluded further consideration of those alternatives. Overall, the spring Chinook program at Dworshak NFH appears to be an important component for achieving fisheries management and LSRCP mitigation goals for spring Chinook within the Clearwater River basin. Additional monitoring and evaluation based on recovery of coded-wire tags (or PIT tags) is necessary to further quantify benefits and risks of the program.

Kooskia NFH

Facility Overview: Kooskia NFH is located on Clear Creek, a tributary to the Clearwater River (Middle Fork) at river mile 77 (rkm 124). The hatchery and its programs are 100% funded by the U.S. Fish & Wildlife Service. Kooskia NFH was authorized by Congress in 1961 and construction began in 1966. Fish production began in 1969. The purpose of the hatchery is to mitigate for reduced tribal and sport fisheries in the Clearwater River resulting from water development projects in the Columbia River basin. Kooskia NFH currently supports a spring Chinook program and releases up to 650,000 yearling smolts annually into Clear Creek.

Kooskia NFH is currently entering a period of transition. Recent adoption (May 2007) of the *Snake River Basin Adjudication Agreement* transfers operation and management of the facility from the U.S. Fish & Wildlife Service to the Nez Perce Tribe. The Service will continue to own the hatchery as a National Fish Hatchery, but day-to-day operations will transition to the Tribe. An annual cooperative agreement between the Service and the Tribe currently governs operations and management of Kooskia NFH. The Service currently transfers funds to the Tribe to pay the salaries of the Tribal employees. All other hatchery expenses are paid directly by the Service. This arrangement is anticipated to continue into the foreseeable future.

Spring Chinook

Program overview: The program operates as a *segregated harvest* program within the Clearwater River watershed with returning hatchery-origin adults used exclusively for broodstock. The broodstock objective at Kooskia NFH is to collect 600 adults and spawn a minimum of 265 females and 265 males with an on-station release of 600,000 yearling smolts into Clear Creek. Adults are trapped at Kooskia NFH, May through July, and are transported to Dworshak NFH for holding and spawning. Adults cannot be held and spawned at Kooskia NFH because Clear Creek water is too warm during the summer months to hold spring Chinook. Adults are spawned at Dworshak NFH; the fertilized eggs are incubated to the eyed stage there, and the eyed eggs are

then transferred to Kooskia NFH for incubation, hatch, and subsequent rearing of juveniles to the yearling smolt stage prior to release into Clear Creek. The Kooskia NFH stock originated primarily from the Carson NFH stock with some genetic contribution from the Rapid River Hatchery stock. Native populations of spring Chinook in the Clearwater River were extirpated in the mid-1900's by Lewiston Dam (1927-1973) which blocked all upstream migration of Chinook salmon into the Clearwater River. The spring Chinook program at Kooskia NFH participates in a collaborative research project known as the Idaho Supplementation Studies (ISS). These studies are evaluating the efficacy of hatchery-origin Chinook to spawn naturally and increase the abundance of natural-origin smolts and adult recruits.

Benefits: See harvest benefits for Dworshak NFH spring Chinook. Based on recovery of coded-wire tags for spring Chinook released from Kooskia NFH (brood years 1988 through 2002), approximately 9% of the recaptured adults were caught in gillnet fisheries in the mainstem Columbia River, 12% percent were caught in sport fisheries in the Columbia and Snake River basins, 4% were caught in Columbia River treaty and ceremonial fisheries, and 75% were recaptured at Kooskia NFH or other hatcheries. Less than 1% of coded wire tags were recovered elsewhere. ISS studies conducted at Kooskia NFH provide a research benefit.

Risks: Spring Chinook juveniles at Kooskia NFH are reared on chilled, recirculated (reuse) well water. Dependence on mechanical chillers and reuse water poses demographic and fish health risks, respectively, to the hatchery stock. High spring flows in Clear Creek causes debris, rocks, sand, and silt to block the water intake entrance and can prevent water from entering the hatchery. Debris-laden water in Clear Creek during high spring flows, and icing of the water intake structure during winter, pose demographic risks to fish reared on station when outdoor rearing vessels are supplied with creek water. Clear Creek water carries the parasite *Icthyophtherius* (*Ich*) sp., and the use of this surface water for fish culture and aerosols resulting from sprinkler irrigation of the hatchery grounds increases fish health risks to fish on station. The facility switches from chilled, reuse well water to Clear Creek water when the temperature of the creek water drops below 50 degrees F., usually near the end of October. Yearling pre-smolts are redistributed among Burrows' Ponds and raceways starting in January to reduce rearing densities, and those ponds and raceways are supplied with single-pass Clear Creek water for acclimation and imprinting of smolts prior to release. Approximately 11% of the coded-wire tag recoveries for Kooskia NFH spring Chinook occur outside the migration corridor to the hatchery, thus posing genetic straying risks to other stocks in the Columbia River basin.

Recommendations for current program: The Review Team identified 21 specific recommendations to reduce risks and/or improve benefits of the current spring Chinook program at Kooskia NFH. These recommendations include: (a) investigating the feasibility of expanding the well field for the hatchery or installing chillers for surface water to provide sufficient water of the correct temperature to hold and spawn adult broodstock during the summer; (b) disinfection of Clear Creek water (e.g., via ozone treatment) prior to use for fish culture to reduce fish health risks of *Icthyophtherius* sp.; (c) investigate options for improving the intake structure for Clear Creek water to reduce debris buildup in the spring and icing during the winter; and (d) minimize or eliminate the use of aerial sprinklers for irrigation of hatchery grounds to reduce potential aerial discharge of *Icthyophtherius* sp.

Alternatives to Current Program: The Review Team considered the pros and cons of six alternatives to the existing spring Chinook program, ranging from (a) the current program with full implementation of all program specific recommendations (Alternative 1) to (b) termination of all programs at Kooskia NFH and decommissioning the facility (Alternative 6). The Review Team

recommends replacing the existing on-station spring Chinook program with a reintroduction and harvest coho program (Alternative 2). The Team concluded that coho salmon, fall Chinook and steelhead are better suited for the culture conditions at Kooskia NFH than spring Chinook. The team favored coho salmon because (a) the Nez Perce Tribe has initiated a coho reintroduction program in the Clearwater River Basin (see below), but the success of the program has been hindered by the absence of a locally-adapted, self-sustaining hatchery stock within the watershed, and (b) large steelhead and Chinook hatchery programs already exist within the Clearwater River. The Review Team concluded that a self-sustaining coho program could be established at Kooskia NFH based on recent returns of adult coho salmon back to Kooskia NFH; for example, more than 300 adult coho returned to Kooskia NFH in the fall of 2007, and 765 adult coho (+ 564 age 2 males or "jacks") returned in 2008. Under this recommended alternative, the Review Team believes that spring Chinook could continue to be released from Kooskia NFH in reduced numbers if rearing space is available at another facility. The long-term goal would be to maintain a localized broodstock of coho salmon at Kooskia NFH to support harvest and reestablishment of natural populations within the Clearwater River basin consistent with the Nez Perce Tribe's master plan for coho salmon.

Clearwater River Coho

Program overview: Coho salmon were extirpated from the Clearwater River by Lewiston Dam (1927-1973) in the mid-1900's. Coho were subsequently declared *extinct* in the Snake River basin in 1986. Overharvest in lower Columbia River fisheries and reduced smolt-to-adult survivals associated with eight hydroelectric dams in the Snake and lower Columbia rivers are considered the principle factors resulting in the extirpation of coho salmon in the Snake River. The Nez Perce Tribe began reintroducing coho salmon to the Clearwater River in 1995. Currently, 550,000 coho smolts are imported annually from Eagle Creek NFH; 275,000 of which are released into Clear Creek at Kooskia NFH and the other 275,000 smolts are released directly into Lapwai Creek. The program also has a local broodstock goal of trapping 502 adult coho at Dworshak and Kooskia NFHs to produce 280,000 smolts for acclimation at Kooskia NFH and release into Clear Creek (for a total release of 555,000 smolts into Clear Creek). Adult holding, spawning, and juvenile rearing for the Clearwater River broodstock program occur currently at Dworshak NFH. Coho reared at Dworshak NFH are transferred as yearlings to Kooskia NFH during the first week of April for a four to six week acclimation period prior to volitional release as smolts into Clear Creek. Broodstock shortages from adult returns to the Clearwater River are backfilled with additional smolts from Eagle Creek NFH. In 2008, a total of 997 adult coho (excluding age 2 males or "jacks") were captured within the Clearwater River basin: 765 coho at Kooskia NFH, 228 coho at Dworshak NFH, and four coho at Nez Perce Tribal Hatchery.

Benefits: Conservation and harvest benefits of the coho reintroduction program have not yet been realized. Nevertheless, the program is returning significant numbers of hatchery origin adult coho back to the Clearwater River that could serve as the foundation for developing a localized, Clearwater River hatchery population. The program provides research and education benefits to the Nez Perce Tribe.

Risks: The continued importation of coho smolts from lower Columbia River hatcheries (i.e., Eagle Creek NFH) impedes establishment of a self-sustaining, locally-adapted hatchery population within the Clearwater River. Coho smolts imported from Eagle Creek NFH are not differentially marked or tagged relative to the hatchery-produced progeny of adult coho that return and are

trapped in the Clearwater Basin, impeding further the establishment of a self-sustaining locally-adapted hatchery population.

Recommendations for Current Program: The Review Team identified ten specific recommendations to reduce risks and/or improve benefits of the coho reintroduction program in the Clearwater River. First, the Team recommends reprioritization of the goals and objectives of the coho reintroduction program. To date, the program has been managed in a manner that attempts to establish a local hatchery stock, naturally spawning populations, and harvestable fish simultaneously. These three goals need to be addressed sequentially, not simultaneously. The first priority for reintroducing coho salmon to the Clearwater Basin should be establishment of a self-sustaining hatchery population of coho salmon in the Clearwater River with all broodstock collection occurring at Dworshak NFH, Kooskia NFH or Nez Perce Tribal Hatchery. The Nez Perce Tribal Hatchery, as proposed for future modification, is identified in the Master Plan as the primary location for the long-term propagation of hatchery-origin coho salmon in the Clearwater River basin. However, replacement of the spring Chinook program at Kooskia NFH with a coho program, as recommended by the Review Team, would allow the immediate on-station rearing and production of 550,000 smolts that are currently imported annually from Eagle Creek NFH. The importation of smolts from Eagle Creek NFH should be terminated as soon as possible. Releasing coho salmon for either harvest or natural spawning should only occur after a self-sustaining, locally-adapted hatchery stock has been established within the Clearwater River basin.

Alternatives to Current Program: The Review Team considered the pros and cons of only two alternatives for the existing coho reintroduction program: continuation of the program with implementation of all program specific recommendations (Alternative 1) or termination of the program (Alternative 2). The Review Team recommends, as a short-term goal (1-5 years), continuation of the current program (Alternative 1) with implementation of all recommendations. Implementation of Alternative 1 here for coho salmon could be part of the recommended alternative for Kooskia NFH where the on-station rearing of spring Chinook would be replaced with a coho program. The Team assumes that a minimum of 600,000 coho smolts, the current size of the spring Chinook program, could be reared at Kooskia NFH. As a long-term goal (5-15 years), the Team recommends implementation of the Coho Master Plan of the Nez Perce Tribe but only after a self-sustaining hatchery population has been established within the Clearwater Basin.

Hagerman NFH

Facility Overview: The Hagerman National Fish Hatchery is located near Hagerman, Idaho about 30 miles (48 km) west of Twin Falls, Idaho in the Thousand Springs area of the Snake River. Hagerman NFH was authorized by 46 Stat, 371 on May 21, 1930. Construction began in 1932, and fish production began in 1933. The initial purpose of the hatchery was to rear rainbow trout for stocking in Idaho, eastern Oregon, and northern Nevada. In the late 1970's, the hatchery became part of the LSRCP which was authorized by the Water Resources Development Act of 1976, Public Law 94-587, to mitigate for fish and wildlife losses caused by the construction of four dams on the lower Snake River in Washington. The primary responsibility of the hatchery was changed from rearing “catchable” rainbow trout to rearing steelhead smolts as part of the LSRCP. The hatchery operates currently under cooperative program management between the Service and IDFG. The hatchery currently rears steelhead smolts from eyed eggs obtained from other hatcheries and then transports and releases those smolts into the Salmon River basin. The current mitigation goal for the hatchery is to return 13,600 adult steelhead upstream of Lower Granite Dam on the Snake River to support harvest in the Snake River basin.

Summer Steelhead (B-run)

Program overview: The program operates as a *segregated harvest* outplanting program within the Salmon River watershed. Hagerman NFH receives 215,000 Dworshak NFH B-run steelhead eyed eggs annually from the Clearwater Fish Hatchery. Adult steelhead are trapped and spawned at Dworshak NFH. The fertilized eggs are transferred to Clearwater Fish Hatchery for incubation to the eyed stage prior to transfer to Hagerman NFH. Fish are hatched and reared at Hagerman NFH. The hatchery transports and releases 100,000 yearling steelhead smolts annually into the East Fork Salmon River and 100,000 yearling smolts into the Little Salmon River.

Benefits: The harvest benefit of releasing Dworshak NFH B-run steelhead into the Little Salmon and East Fork Salmon rivers from Hagerman NFH has not been accurately quantified. Those releases began in 2004, and fish released from 2004 to 2007 were not given coded-wire tags.

Risks: Yearling Dworshak steelhead exhibit significantly increasing mortality at Hagerman NFH during the four months (December-April) immediately prior to transport and release into the Salmon River. Those mortalities are stock specific and are not exhibited by Sawtooth A-run steelhead reared on station (see below). Stock-specific susceptibility to the parasite *Nucleospora salmonis* - which is in the water supply of the hatchery - and water chemistry at Hagerman NFH – which is quite different from the water chemistry of the North Fork Clearwater River – have been hypothesized as the cause of mortality of Dworshak steelhead yearlings at Hagerman NFH. Outplanting of Dworshak NFH B-run steelhead into the Salmon River basin poses genetic risks to ESA-listed natural populations, particularly in the East Fork Salmon River which supports a *biologically significant* population for which IDFG conducts a conservation hatchery program. In addition, straying risks of Dworshak B-run steelhead outplanted in the Salmon River basin have not been adequately assessed. These latter risks are particularly a concern for native populations of B-run steelhead in the South and Middle Forks of the Salmon River where steelhead are managed as natural population reserves.

Recommendations for current program: The Review Team identified 26 specific recommendations to reduce risks and/or improve benefits of the current B-run summer steelhead program at Dworshak NFH. These recommendations include: (a) additional research to identify the cause of juvenile mortality during the four months prior to transport and release into the Salmon River, (b) releasing Dworshak steelhead only at locations where smolts can be acclimated and non-harvested adults recaptured (e.g., Pahsimeroi Fish Hatchery) to reduce genetic risks to natural populations; and (c) development of a self-sustaining, local hatchery broodstock program derived from recaptured adults returning to the Salmon River.

Alternatives to Current Program: The Review Team considered the pros and cons of seven alternatives to the existing B-run summer steelhead program, ranging from (a) the current program with full implementation of all program specific recommendations (Alternative 1) to (b) termination of all programs at Hagerman NFH and decommissioning the facility (Alternative 7). The Review Team recommends termination of the existing B-run summer steelhead program at Hagerman NFH but retention of the ongoing A-run steelhead program (Alternative 6). The Review Team concluded that the risks of rearing Dworshak B-run steelhead at Hagerman NFH and releasing those fish into the Salmon River outweigh the potential harvest benefits (currently undocumented). The Review Team concluded that greater harvest benefits and contribution to LSRCP mitigation goals would be achieved by rearing only A-run steelhead at Hagerman NFH (see below).

A-run Steelhead

Program overview: The program operates as a *segregated harvest* program within the Salmon River watershed. Hagerman NFH receives 1.15 million eyed eggs from Sawtooth Hatchery and 215,000 eyed eggs from Pahsimeroi Hatchery. Adult steelhead are trapped and spawned at the latter two hatcheries, and the resulting fertilized eggs are incubated at Sawtooth Hatchery prior to transfer as eyed eggs to Hagerman NFH. Fish from the two source hatcheries are hatched and reared separately at Hagerman NFH prior to transport and release as yearling smolts into the Salmon River basin. The majority of Sawtooth A-run steelhead (810,000 smolts) are released into the upper Salmon River at Sawtooth Hatchery to maintain the hatchery stock and support downstream fisheries. An additional 240,000 Sawtooth steelhead smolts are released into the Yankee Fork of the Salmon River. Pahsimeroi steelhead (200,000 yearling smolts) are released into the Little Salmon River. – ***Stock ancestries:*** A-run steelhead propagated at Sawtooth and Pahsimeroi hatcheries originated from adult steelhead trapped in the Hells Canyon region of the Snake River. A hatchery broodstock was developed initially at the Pahsimeroi Fish Hatchery from adult steelhead trapped in the Hells Canyon region, 1966-1970. The Pahsimeroi Hatchery stock was then used to establish the A-run steelhead program at Oxbow and Sawtooth Fish Hatcheries in the Hells Canyon region of the Snake River and the Stanley Basin of the upper Salmon River, respectively. As a result, adult steelhead returning to the Sawtooth, Pahsimeroi, and Oxbow hatcheries have common ancestral origins but are largely propagated as three separate stocks. NOAA Fisheries excludes fish of the three hatchery stocks from the *Snake River Summer Steelhead Distinct Population Segment* (DPS) which is currently listed as *threatened* under the ESA.

Benefits: Specific harvest contributions of A-run steelhead reared at Hagerman NFH have not yet been quantified. However, based on limited data used to estimate returns upstream of Lower Granite Dam, A-run steelhead reared at Hagerman NFH and released into the Salmon River exhibited a mean smolt-to-adult return rate of 0.72% (BY 1992-2000). This mean return rate translates into a predicted mean return of 8,640 adult steelhead based on an annual release of 1.2 million smolts into the Salmon River basin. Although estimated harvest contributions of each hatchery stock to fisheries in the Salmon River basin are not yet available, fishery biologists have concluded that hatchery-origin A-run steelhead released into the Salmon River contribute significantly to recreational fisheries. For example, IDFG estimated that approximately 33,000 steelhead were harvested by anglers in Idaho during the fall-spring fishing seasons of 2000-2001, with approximately 18,000, 12,000, and 3,000 steelhead caught in the Salmon, Clearwater, and mainstem Snake rivers, respectively. The vast majority of fish harvested in the Salmon River were believed to be A-run steelhead based on preliminary data. The release of A-run steelhead in the Yankee Fork may be contributing to the maintenance of a naturally spawning population in that tributary, although that outcome is not an explicit goal of the program.

Risks: Because of their common origins, broodstock shortages at Sawtooth and Pahsimeroi hatcheries have – in the past - each been "backfilled" with eggs or fish from the other hatchery or with eggs or fish from Oxbow Hatchery. Mutual backfilling of egg shortages among Sawtooth, Pahsimeroi, and Oxbow fish hatcheries inhibits development of locally-adapted broodstocks at each of the three facilities where returning adults are trapped for broodstock. Backfilling, in the long run, is expected to reduce smolt-to-adult return rates, increase stray rates, and reduce desired benefits (e.g., harvest). - Multiple transport of fish and eggs among adult steelhead trapping locations (Sawtooth, Pahsimeroi, and Oxbow Fish Hatcheries) and three steelhead rearing locations in the Snake River Valley (Hagerman NFH, Magic Valley Fish Hatchery, and Niagara Springs Fish Hatchery) increases demographic risks due to repeated handling and transportation.

Rearing multiple stocks at multiple facilities creates a "criss-cross" network of egg and fish transfers among broodstock collection facilities, rearing facilities, and release locations that increases fish culture and transportation risks.

Recommendations for current program: The Review Team identified 12 specific recommendations to reduce risks and/or improve benefits of the current A-run summer steelhead program at Hagerman NFH. These recommendations include: (a) discontinue rearing Pahsimeroi A-run steelhead at Hagerman NFH, and rear only Sawtooth A-run steelhead - representing all egg takes from Sawtooth Hatchery - at Hagerman NFH to minimize culture risks and maximize culture and transportation efficiencies; (b) terminate, as a future management policy, backfilling egg take shortages at Sawtooth and Pahsimeroi fish hatcheries and manage Sawtooth A-run steelhead, Pahsimeroi A-run steelhead, and Oxbow A-run steelhead as three reproductively distinct hatchery stocks to maximize local adaptations and individual stock viabilities; and (c) restrict the release of Sawtooth A-run steelhead to the upper Salmon River upstream of the confluence of the East Fork Salmon River, with the Sawtooth Hatchery site serving as the first priority for release (to maximize adult returns back to the hatchery) when the total number of Sawtooth Hatchery smolts available for release is less than the sum of all release objectives for that stock.

Alternatives to Current Program: The Review Team considered the pros and cons of four alternatives to the existing A-run summer steelhead program, ranging from (a) the current program with full implementation of all program specific recommendations (Alternative 1) to (b) termination of all programs at Hagerman NFH and decommissioning the facility (Alternative 4). The Review Team recommends continuation of the current A-run steelhead program with full implementation of all recommendations (Alternative 1). Implementation of Alternative 1 for the A-run steelhead program and the recommended alternative for the B-run program (Alternative 6) would result in the following actions: (1) the rearing of all Sawtooth A-run steelhead for the Salmon River at Hagerman NFH; (2) the rearing of all Pahsimeroi A-run steelhead at Magic Valley Fish Hatchery (LSRCP portion) and Niagara Springs Fish Hatchery (Idaho Power mitigation portion); and (c) termination of the rearing of Dworshak B-run steelhead at Hagerman NFH. Implementation of Alternative 1 would not change the number of A-run steelhead smolts released in the upper Salmon River upstream of the confluence of the East Fork Salmon River (1.28M smolts), but those released fish would be restricted to progeny of adults trapped at Sawtooth Fish Hatchery with no "backfilling" of egg shortages with eggs from either Pahsimeroi or Oxbow fish hatcheries.

Rainbow trout

Program overview: The program operates as a *segregated harvest* program for outplanting triploid rainbow trout in southern Idaho. This is an *in-kind* exchange program with IDFG whereby Hagerman NFH rears rainbow trout and releases them in local area waters in southern Idaho, while IDFG stocks rainbow trout from the Nampa State Fish Hatchery directly into Dworshak Reservoir as partial fishery mitigation for Dworshak Dam. Hagerman NFH initially receives 150,000 eyed triploid eggs from Hayspur State Fish Hatchery in late December each year. The following May, 90,000, 5-inch fish are transported and released into various local waters to support IDFG "put, grow, and take fisheries". During the following fall, 40,000 9-inch catchable rainbow trout fish are released into local reservoirs. The program uses 12 raceways dedicated to rainbow trout culture at Hagerman NFH.

Benefits: Local harvest benefits are not adequately documented. Anecdotal information indicates rainbow trout released into Little Camas Reservoir and Lake Walcott make significant

contributions to their respective fisheries. A harvest evaluation report from IDFG is pending for catchable rainbow trout released into Lake Walcott.

Risks: The rearing of rainbow trout increases fish health risks at Hagerman NFH. A disease outbreak among Hayspur rainbow trout (fall release, group) in 2007 resulted in a 40% loss of fish, with daily mortalities ranging from 0.1% to 3.5% beginning in April 2007 and continuing through the fall. These fish had infections of *Nucleospora salmonis*, *Gyrodactylis*, and *Costia*, although clinical signs indicated another, undetermined disease agent was involved. The rearing of rainbow trout at Hagerman NFH with a continuing declining water supply may jeopardize the rainbow trout program or create culture conflicts with the steelhead programs.

Recommendations for current program: The Review Team identified three specific recommendations for the rainbow trout program at Hagerman NFH: (a) establish a *Memorandum of Agreement* (MOA) with the Army Corps of Engineers and IDFG that defines the mitigation exchange agreement and responsibilities of Hagerman NFH[6], (b) establish a water inflow threshold which triggers a reduction in the number, time, and/or size at release of rainbow trout reared at Hagerman NFH if the water supply continues to decline, and (c) purchase eyed triploid eggs from a commercial vendor in late March or early April after the hatchery has begun transporting steelhead yearlings off-station to minimize water-use conflicts with the steelhead programs.

Overall recommendation: The Review Team acknowledges that Hagerman NFH is a particularly good facility for rearing resident rainbow trout. However, the Army Corps of Engineers and IDFG should re-assess the need for the rainbow trout program based on current management goals for Dworshak Dam mitigation. The Team supports continuation of the program if the two parties determine that the program is viable and provides intended benefits. However, the Team feels that rearing steelhead for release into the Salmon River should take precedence at Hagerman NFH. The Team recommends that the Service continue to assess the carrying capacity of Hagerman NFH, especially given the declining water supply, so that the rainbow trout program does not affect or pose risks to the steelhead programs on station.

Conclusions

In general, Dworshak, Kooskia, and Hagerman NFHs are providing significant fishery benefits that outweigh risks associated with those programs. Indeed, programs at all three hatcheries are conferring valuable fishery benefits to both sport and tribal fishers in the Salmon and Clearwater rivers. Nevertheless, current management of those three hatcheries to meet comanager goals for harvest often conflict with the physical constraints of the facilities, conservation goals for natural populations, and/or the biological constraints of the fish themselves. For example, water quantity and temperature constraints at Kooskia NFH impose fish culture risks for spring Chinook at that facility. The Review Team concluded that rearing another species at Kooskia NFH, specifically coho salmon, would reduce fish culture risks, contribute to the Nez Perce Tribe's program for reintroducing coho salmon to the Clearwater River, and provide future harvest opportunities that currently do not exist. Such a change would not preclude the continued release of spring Chinook smolts at Kooskia NFH with rearing occurring at Dworshak NFH. The Team also concluded that the annual transfer and rearing of Dworshak B-run steelhead at Hagerman NFH, followed by the outplanting of those fish into the East

[6] *The Service has begun negotiations on a new MOA with the Walla Walla district of the Army Corps of Engineers, and this new MOA will clarify Dworshak Dam mitigation responsibilities, including rainbow trout.*

Fork Salmon River, increases fish health risks at the latter hatchery and poses biological risks to natural populations in the upper Salmon River, particularly in the East Fork. Rearing multiple stocks of steelhead at multiple facilities in southern Idaho for direct release at multiple sites in the Salmon River increases fish culture risks at each facility and is inconsistent with development of local adaptations, minimizing straying, and maximizing the viability of each hatchery stock. The direct outplanting of Dworshak B-run steelhead into the South Fork Clearwater River and Clear Creek - without facilities or strategies for recapturing non-harvested adults – increases biological risks compared to on-station releases from hatcheries or satellite acclimation facilities that can trap returning adults. Disease risks at Dworshak NFH are particularly acute and would be reduced substantially if gravity-feed water from Dworshak Reservoir could be used for fish culture instead of pumped water from the North Fork Clearwater River at the hatchery site downstream from Dworshak Dam. The declining water supply at Hagerman NFH, due to decreasing output from the Eastern Snake Plain aquifer, is expected to reduce the carrying capacity of the hatchery and increasingly limit the ability of the facility to meet its mitigation goal for steelhead. All of the Team's recommendations are intended to reduce the aforementioned risks while maintain current fishery benefits.

I. Introduction

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

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

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

This internal review is modeled after the recent Puget Sound and Coastal Washington Hatchery Reform Project conducted by the Hatchery Scientific Review Group (HSRG).[7] That project provided a solid template and operational tools (e.g. software spreadsheets, population dynamic models) for reviewing Service hatcheries in the Columbia River Basin. Much of the background information necessary for reviewing hatcheries in the Columbia River Basin has already been compiled in Hatchery and Genetic Management Plans (HGMPs),[8] Comprehensive Hatchery Management Plans (CHMPs),[9] and the Artificial Propagation Review and Evaluation (APRE)[10] database developed by the Northwest Power and Conservation Council (NWPCC).

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[7] *For more information on this project, and for all project publications, see www.hatcheryreform.org and www.hatcheryreform.us.*

[8] *For more information on HGMPs, visit www.nwr.noaa.gov/Salmon-Harvest-Hatcheries/Hatcheries/Hatchery-and-Genetic-Management-Plans.cfm.*

[9] *For more information on CHMPs, visit www.fws.gov/pacific/Fisheries/CHMP.htm.*

[10] *For more information on APRE, visit www.nwcouncil.org/fw/apre/.*

Based on the recommendations of a Hatchery Review Working Group (Working Group),[11] the Service's Assistant Regional Director for Fisheries (ARD) assembled a Columbia Basin Hatchery Review Team (Review Team). This Review Team, comprised of Service and other federal agency scientists, has adapted the HSRG's scientific framework, principles and hatchery review tools for reviewing each federal hatchery program and facility. The Team provides continuity with the HSRG because the two co-chairs served on the HSRG and the Hatchery Reform Policy Coordinating Committee, respectively. The Service has contracted for project facilitation with Long Live the Kings (LLTK), a non-profit organization devoted to restoring wild salmon to the waters of the Pacific Northwest. LLTK has provided facilitation, communications and coordination for the Puget Sound and coastal Washington hatchery review process.

Review Team members for the review presented here in this report include:

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

With early contributions from:

- **Ray Brunson**, Fish Health Biologist, USFWS, Olympia Fish Health Center, Olympia, Washington.
- **Ron Hardy,** Director, Aquatic Research Institute, University of Idaho, Hagerman, Idaho.
- **Larry Telles**, Fishery Biologist and Deputy Manager, USFWS, Quilcene NFH, Quilcene, Washington.
- **Dave Zajac**, Fish and Wildlife Biologist, USFWS, Western Washington Fish and Wildlife Office, Lacey, Washington.

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

Team support members include:

- **Michael Schmidt** (Facilitator), Fish Program Coordinator, Long Live the Kings, Seattle, Washington.
- **Cheri Anderson** (Outreach), Information and Education Manager, USFWS, Spring Creek NFH, Underwood, Oregon.

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

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

Following this pilot review, the Service adjusted the process for reviewing federal hatcheries that support artificial propagation programs for four regions: Lower Columbia River, Mid-Columbia River, Snake River, and the Olympic Peninsula (Fig. 1). Facilities in those regions include five NFHs in the Lower Columbia River region (Eagle Creek, Carson, Little White Salmon, Willard and Spring Creek NFHs); three NFHs in the Mid-Columbia River region (Leavenworth, Entiat and Winthrop NFHs); three NFHs in the Snake River region: (Dworshak, Kooskia and Hagerman NFHs), three NFHs in the Olympic Peninsula region (Makah, Quilcene, and Quinault NFHs), and nine federally-owned hatcheries operated by the states of Idaho, Oregon, or Washington as part of the Lower Snake River Compensation Plan (LSRCP). The report presented here reviews programs at Dworshak, Kooskia, and Hagerman NFHs that release fish in the Clearwater and Salmon river basins of Idaho (Fig. 2). The Service plans to complete reviews of all National Fish Hatcheries by June 2009 and all federally owned facilities in the Snake River region by June 2010.

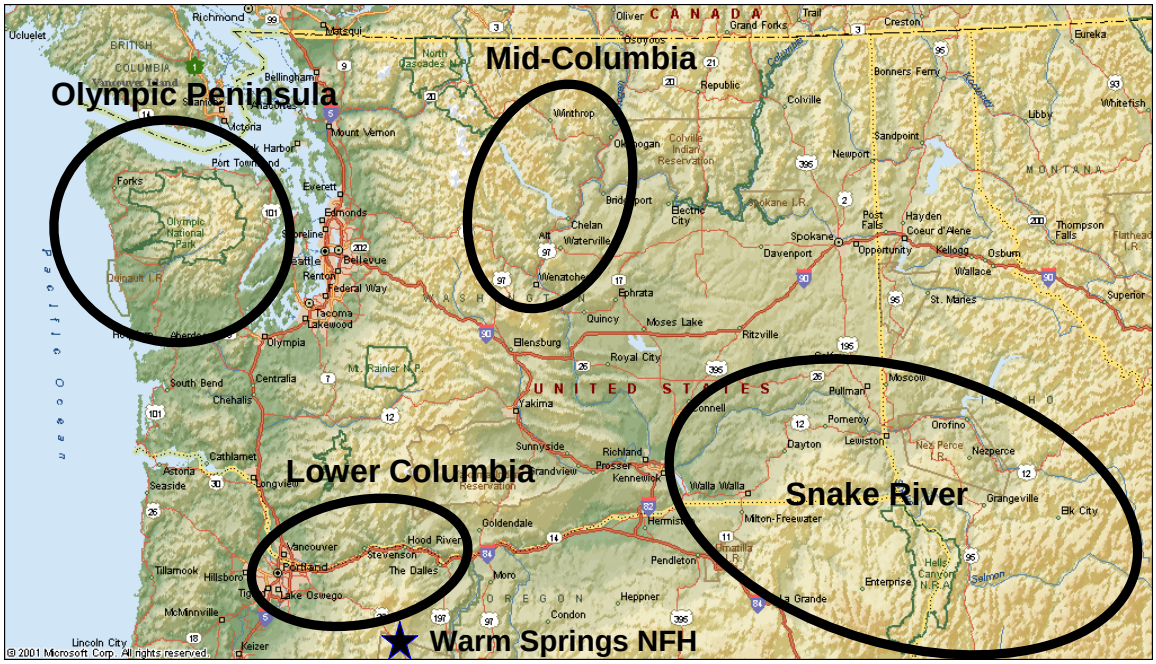

Figure 1. Regions of the Pacific Region Hatchery Review Project

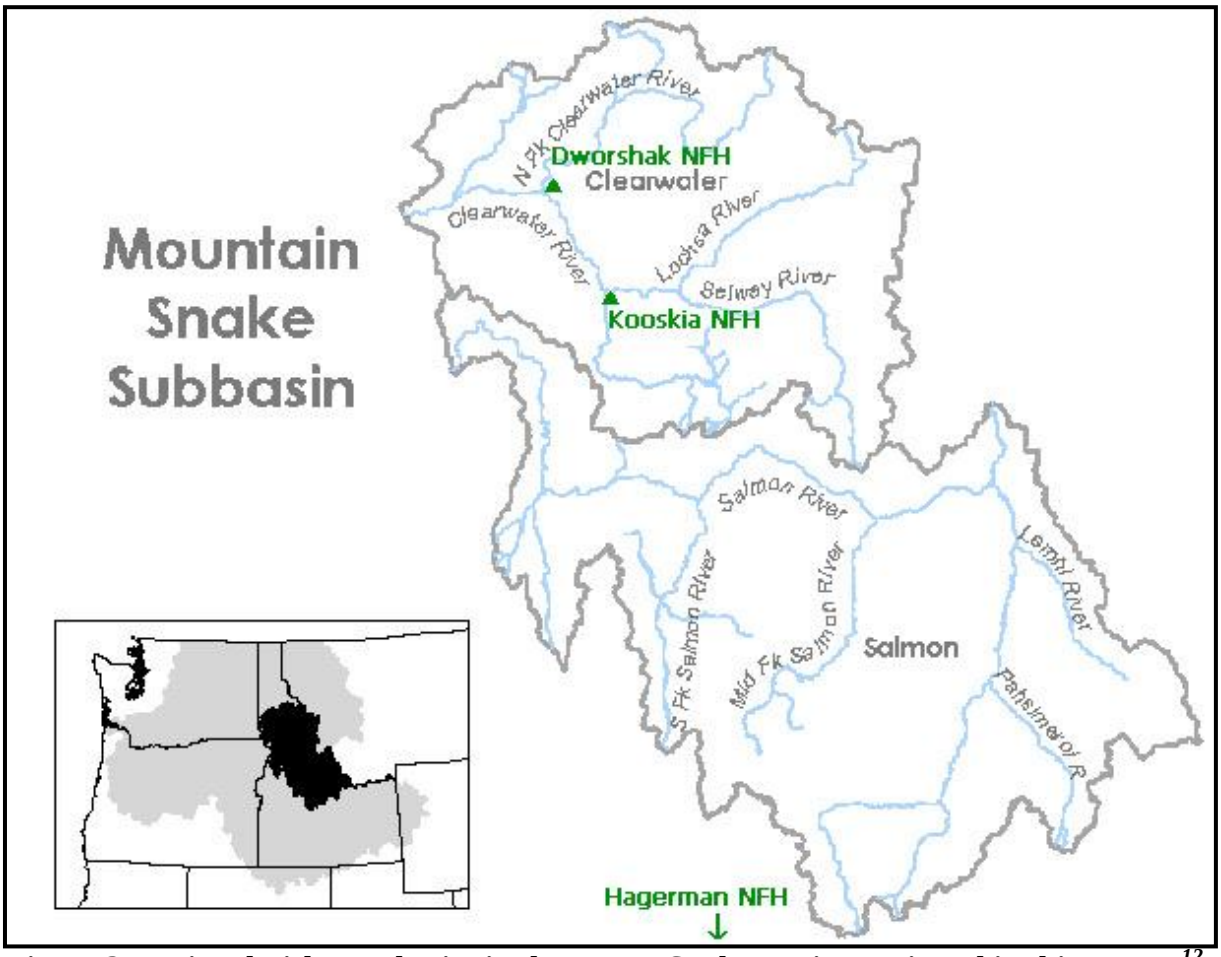

Figure 2. National Fish Hatcheries in the Lower Snake Region reviewed in this report [12]

[12] *Modified figure from APRE Columbia Gorge Province Report- http://www.nwcouncil.org/fw/apre/provincereports/Mountain%20Snake%20Province%20Report.doc*

II. Components of this Report

This report provides assessments and recommendations developed from a comprehensive review of current propagation programs at Dworshak, Kooskia and Hagerman NFHs. Recommendations presented herein are based on the best scientific information available at the time of the review. This information includes peer-reviewed scientific information in published works (scientific journals, etc.), agency reports, and pertinent information directly accessible via electronic download[13]. In its review, the Team followed three fundamental principles it adopted from the HSRG (Mobrand et al. 2005[14]): (1) hatchery programs need to have well-defined goals in terms of desired benefits; (2) they must be scientifically defensible; and (3) they need to have programmatic flexibility to respond adaptively to new information.

The Review Team reviewed a large number of background documents, toured the three NFHs and associated watersheds, and received presentations on a variety of Clearwater and Snake River watershed salmonid management issues. The Team met with biologists representing the cooperators and stakeholders to discuss the purpose of the review, hatchery operations, stock goals, and specific issues the cooperators and stakeholders wanted the Review Team to consider. Workshops for gathering that information used the All-H Analyzer (AHA) decision support tool[15] to document goals, premises and explore alternatives (Appendix A). All source documents not readily available to the general public are accessible via the Service's hatchery review website[16]. Appendix B of this report summarizes the hatchery information on which the review and recommendations are based.

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

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[13] *Two primary sources of information were the Clearwater and Salmon river subbasin plans developed by the Northwest Power and Conservation Council (http://www.nwcouncil.org/fw/subbasinplanning/) and the Draft Snake River Salmon and Steelhead Recovery Plan (http://www.idahosalmonrecovery.net/).*

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

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

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

Watershed Overview

The following report contains background overviews of the Clearwater and Snake River watersheds. Those overviews include information on geography, fisheries, conservation, habitat, and the current status of each salmonid stock within the respective watersheds. Information on the status and hatchery propagation of each stock is summarized in a table for quick reference.

Stock Status

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

Biological significance is a measure of the biological uniqueness of a particular stock relative to other stocks of the same species. This measure considers the genetic origins of the stock (e.g. native or non-native), biological attributes that are unique or shared with other stocks (e.g. life history, physiological, or genetic attributes), and the extent to which the stock may be considered one component of a larger population structure, including population subdivisions within the stock. In general, a stock is defined as *low*, *medium* or *high* biological significance depending on its level of uniqueness and the ability of other stocks to potentially replace it in the occupying habitat if local extirpation were to occur. Stocks with *high* biological significance usually have one or more unique biological characteristics that may reflect local adaptations and would be difficult to replace by other stocks of the same species. Consequently, biological significance is not based on the degree to which the stock may be considered essential for recovery or harvest of a particular species, but rather on its own innate biological attributes within the watershed in which the stock occurs. For example, a particular stock or population may be abundant and productive and, therefore, considered to have high *management* significance for harvest or recovery. However, that stock would not necessarily be considered to have high *biological* significance unless (a) it possessed biological attributes not shared by other stocks of the same species or (b) all other stocks within the region or DPS/ESU[19] were substantially less viable. This approach thus distinguishes the *evolutionary legacy* of a stock within a particular watershed from co-manager decisions regarding the potential *management value* of that

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

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

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

stock. In this context, *biological significance* ratings are based on the factors described by Mobrand et al. (2005)[20].

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

Habitat conditions for a particular stock are assessed quantitatively through estimates of the *capacity* and *productivity* of the environment under current conditions to support returning adult spawners and juvenile fish (assessed via spawner-recruit models). In this context, premises regarding habitat refer primarily to natural populations and the specific watersheds in which hatcheries are located. These premises are important for assessing the ability of the local habitat and watershed to support self-sustaining natural populations and genetically *integrated* hatchery broodstocks, including assessment of risks posed by hatchery-origin fish spawning naturally. The productivity and capacity of a watershed are difficult to estimate directly, but the *Ecosystem Diagnosis and Treatment* (EDT) model attempts to predict those parameters for a "focal species" based on empirical estimates of a variety of habitat parameters (www.mobrand.com/MBI/edt.html). Where available, the Review Team relied on HSRG (2009) estimates of current and future habitat conditions (productivity and capacity) for each salmonid stock in the pertinent watersheds associated with a Service hatchery.[24] Habitat and capacity parameters can also be adjusted iteratively in spawner-recruit population dynamic models to yield results that best fit empirical estimates of total adult returns and/or smolt output under current conditions (Appendix A). This latter approach allows cooperators and others to evaluate potential alternative strategies for improving long-term population viabilities via habitat enhancements or other management actions.

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

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

[22] *http://www.idahosalmonrecovery.net/)*

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

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

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

Hatchery Programs

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

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

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

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

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

Operational Considerations

The Review Team considered all components of each hatchery program. Major features and issues of each program were summarized into the following subcategories: (a) program goals and objectives; (b) broodstock choice and collection; (c) hatchery and natural spawning, including adult returns; (d)

incubation and rearing; (e) release and outmigration; (f) facilities and operations; (g) research, monitoring, and accountability, and (h) education and outreach.

Benefit and Risk Assessment

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

Benefits considered include:

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

Risks considered include:

Genetic Risks

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

Demographic Risks

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

Ecological Risks

- Competition, predation, and disease transfer from hatchery-origin adults and juveniles of the propagated stock to naturally spawning populations of the same species or stock in target and non-target watersheds.

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

Physical Risks

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

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

Recommendations

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

Alternatives

The review team then identified several alternatives to the current program, as suggested by cooperators or inferred from long term goals for salmonid stocks within the region, with an overall assessment of the value and merits (pros and cons) of those potential alternatives relative to the current program. By default, the following alternatives were included in each assessment: (a) the current program with full implementation of all recommendations and (b) termination of the current program and decommission of the hatchery in favor of alternative mitigation strategies (e.g., habitat restoration, construction of a new hatchery elsewhere, etc). The Team then selected a recommended alternative, or combination of alternatives, that the Team concluded would provide the greatest benefit-risk ratio in support of long-term harvest and conservation goals.

III. Clearwater River Watershed

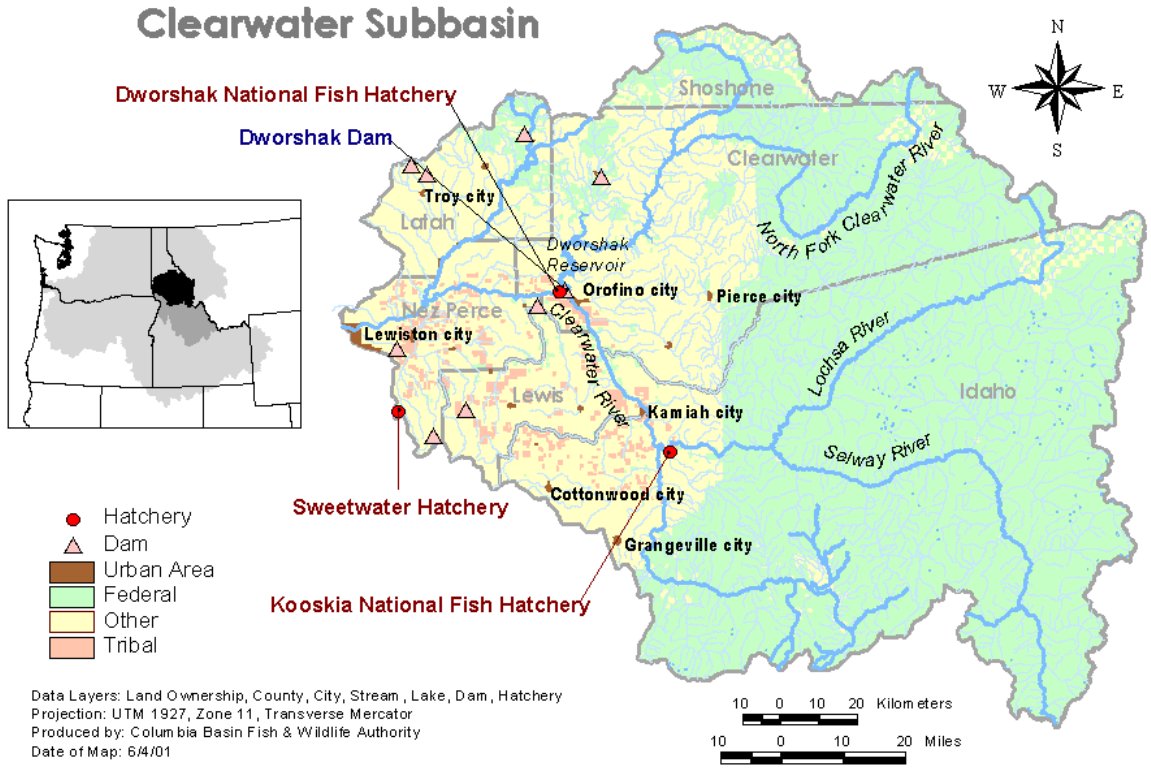

Figure 3. Clearwater River Watershed[25]

[25] *Modified figure from: Artificial Production Review and Evaluation, Mountain Snake Province-level report < http://www.nwcouncil.org/fw/apre/provincereports/Mountain%20Snake%20Province%20Report.doc>.*

Clearwater River Overview

Watershed Description[26]

The Clearwater River is a major tributary to the Snake River in northern Idaho. This river subbasin is a region of mountains, plateaus, and deep canyons within the northern Rocky Mountain geographic province. The Clearwater River drains 9,645 square miles (24,980 km^2). The subbasin extends approximately 100 miles (161 km) north to south and 120 miles (193 km) east to west. Four major tributaries drain into the mainstem Clearwater River: the Lochsa, Selway, South Fork Clearwater, and North Fork Clearwater rivers. The Idaho–Montana border follows the upper watershed boundaries of the Lochsa, Selway, and eastern portion of the North Fork Clearwater rivers in the Bitterroot Mountains. The Clearwater River enters the Snake River at Lewiston, Idaho, 139 river miles (224 rkm) upstream of the confluence of the Snake and Columbia rivers.

The eastern half of the drainage is mainly national forest, while the western half is largely private land including corporate timber holdings. State lands are also scattered throughout this area. The Nez Perce Reservation makes up approximately 13% of the drainage from Lewiston, Idaho to the South Fork Clearwater River. Sixty-three miles of the mainstem Clearwater River and 11 miles of the South Fork Clearwater River are included within the boundary of the Reservation. The entire drainage exists within the historic homeland of the Nez Perce Tribe, including those portions ceded in the treaties of 1855 and 1863.[27]

Dworshak Dam, constructed 1969-1973, is a high rise water storage and hydroelectric dam that impounds the North Fork Clearwater River two miles upstream of its confluence with the mainstem Clearwater River. It is currently the only major dam or water impoundment in the watershed. Dworshak Dam blocks all upstream migration of salmon and steelhead into the North Fork of the Clearwater River. This tributary was one of the most productive rivers historically for spring Chinook and steelhead in the Columbia River basin. However, spring Chinook had already been extirpated from the Clearwater River basin by Lewiston Dam (1927-1973) when construction of Dworshak Dam was initiated in 1969. Habitat surveys conducted by the U.S. Fish and Wildlife Service in 1962 indicated that the North Fork Clearwater River provided potential spawning habitat for 109,000 steelhead redds and 74,000 Chinook salmon redds. Dworshak Reservoir at full pool inundates 16,970 acres (26.5 $miles^2$ or 69 km^2) of terrestrial and riverine habitats.

Fisheries[28]

Tribal and recreational fisheries on salmon and steelhead in the Clearwater River are supported by artificial propagation programs at three federally-owned hatcheries in the watershed: Dworshak NFH, Kooskia NFH, and Clearwater Fish Hatchery (FH). Spring Chinook salmon and steelhead are the principal species propagated. In addition, natural populations of rainbow trout and westslope cutthroat trout support very important recreational fisheries in the watershed, particularly in the Lochsa, Selway,

[26] *NWPCC Clearwater River Subbasin Plan, http://www.nwcouncil.org/fw/subbasinplanning/clearwater/plan/.*

[27] *www.nezperce.org/content/RezInfo/NPreservation.htm.*

[28] *IDFG 2007-2012 Fish Management Plan, CRFPO 2005 annual stock assessment report, Adult spring Chinook salmon returns to DNFH and KNFH in 2000 and predictions for 2007, IDFG unpublished data, Hanson Report 06-49, SPCH Sport Harvest Clearwater River 2000, IDFG.*

and upper North Fork Clearwater rivers. Bull trout and mountain whitefish are common and support recreational fisheries in all of the waters occupied by salmon and steelhead in the Clearwater drainage. The current status of natural populations of steelhead and Chinook salmon in the Clearwater River preclude significant fisheries on natural populations (see *Conservation* section below). In addition, hatchery-origin rainbow trout are stocked in Dworshak Reservoir to support recreational lake fisheries as partial fishery mitigation for Dworshak Dam. Additional recreational fisheries occur on kokanee, smallmouth and largemouth bass, crappie, bluegill sunfish and bullheads, mostly in reservoirs. A naturalized population of introduced kokanee supports an important recreational fishery in Dworshak Reservoir.

Spring Chinook Salmon

Spring Chinook have been reintroduced into the Clearwater River via hatchery propagation (see *Conservation* section below). Most of the spring Chinook areas in the Clearwater River basin are identified as "anadromous fish management" which emphasizes harvest opportunities on hatchery-origin fish while rebuilding natural populations via hatchery fish supplementation. Spring Chinook from Dworshak NFH, Kooskia NFH and Clearwater FH are harvested primarily in the Clearwater River, Columbia River sport fisheries, Columbia River gillnet fisheries, and tribal ceremonial and subsistence fisheries, with a few fish occasionally harvested in the ocean.

Sport and tribal harvest for spring Chinook in the Clearwater River has been highly variable and has been allowed only intermittently since 2000 depending on total predicted or estimated run size. For example, sport harvest ranged from 0 to 14,752 and tribal harvest ranged from 0 to 3,144 fish for the 20 year period, 1987-2006. The 20 year average was 1,517 and 581 fish in the sport and tribal harvests, respectively. Since 2000, harvest has occurred more regularly, ranging from approximately 500 to 15,000 fish and from 300 to 3,100 fish annually in recreational and tribal fisheries, respectively (2000 through 2006).

Analyses of coded-wire tag (CWT) recoveries from spring Chinook originating in the Snake River basin indicate that harvest rates on these fish in the ocean are generally less than 1%. In contrast, marine harvest rates on fall Chinook can be as high as 50%.

Steelhead

Hatchery programs in the Clearwater River support a very popular sport fishery for steelhead. The estimated number of steelhead harvested each year, 2001-2007, in the Clearwater River ranged from approximately 18,000 to over 30,000 fish, of which an estimated 13,000 to 25,000 fish were from Dworshak NFH, and 1,300 to 8,000 fish were from the Clearwater FH. During those years, an estimated 6,000 to 9,500 anglers fished for steelhead in the Clearwater River with an estimated 26,000 to 38,000 angler-hours fished per year.

Resident Trout

Tributaries to the Clearwater River provide outstanding recreational fishing for westslope cutthroat trout, bull trout, and resident rainbow trout. These popular fisheries are mostly restricted to catch-and-release angling or very limited harvests to protect native trout populations. These fisheries occur primarily in tributaries to the Selway and Lochsa rivers, and in the N.F. Clearwater River upstream of Dworshak Dam. Introduced kokanee, the land-locked form of sockeye salmon, also support important resident fisheries in Dworshak reservoir.

Conservation[29]

Several species and "races" of salmonid fishes are native to the Clearwater River. These include spring/summer Chinook, fall Chinook, coho salmon, steelhead (and rainbow trout), westslope cutthroat trout, and bull trout. Native populations of spring/summer Chinook and coho salmon are considered extirpated in the Clearwater River. Fall Chinook, steelhead, and bull trout in the Clearwater River are all listed as *threatened* species under the U.S. Endangered Species Act. Westslope cutthroat trout are not listed but have undergone a 12-month status review, resulting in a finding of "not warranted" in response to a petition to list under the ESA. The Clearwater River Subbasin Plan of the Northwest Power and Conservation Council (NWPCC) classifies spring/summer Chinook, fall Chinook, and steelhead as "focal species" within the watershed.

Spring/summer Chinook

In 1927, Island Power and Light Company built a hydroelectric dam (Lewiston Dam) on the Clearwater River at RM 4 near Lewiston, Idaho. Inadequate adult fish passage at the dam's one fishway virtually eliminated Chinook runs into the basin. Steelhead were able to negotiate the ladder, but the population declined greatly. In 1939, the Island Power and Light Company dam's ownership transferred to Washington Water Power Company, which constructed two additional fishways. Improvements were made to the three fishways in the mid-1960's. In 1973, as part of the Lower Granite Lock and Dam Project, the dam was removed to allow barge access to Lewiston.

Although native populations of spring/summer Chinook salmon were extirpated in the Clearwater River by the blockage imposed by Lewiston Dam, naturalized populations have been reestablished in some portions of the subbasin as a result of reintroduction efforts. The Rapid River FH stock and Carson NFH stock were the primary sources used to initially establish hatchery-supported runs of spring Chinook in the Clearwater River basin. Of the two stocks, the Rapid River stock is believed to have been much more successful based on adult returns. This latter stock originated from adults trapped at Hells Canyon Dam in the Snake River and is believed to represent ancestral native populations that historically inhabited the Snake River upstream of three hydroelectric dams in Hells Canyon. Genetic data are consistent with the presumption that existing natural populations of spring Chinook salmon in the Clearwater River are derived from reintroduced Snake River stocks. Re-introduction of spring Chinook salmon following removal of the Lewiston Dam has resulted in naturally reproducing populations in Lolo Creek and the Lochsa, Selway and South Fork Clearwater rivers. NOAA Fisheries does not include spring/summer Chinook in the Clearwater River with the *Snake River Spring/Summer Chinook Salmon ESU* which is currently listed as a threatened species under the ESA.

Aerial surveys of spring Chinook salmon redds in the Clearwater subbasin have been conducted since 1966. Number of redds counted from 1966 to 2000 has ranged from 18 to 407 in index areas (Table 44 of the NWPCC Subbasin Plan for the Clearwater River[30]). An estimated mean of 1,832 spring Chinook salmon spawned naturally in the Clearwater River basin, 1994-2002, based on redd count data (Table 3 of the Clearwater River Subbasin Plan).

Fall Chinook

[29] *NWPCC Clearwater River Subbasin Plan, http://www.nwcouncil.org/fw/subbasinplanning/clearwater/plan/.*
[30] *Ibid.*

A naturally spawning population of fall Chinook currently exists in the lower Clearwater River. This population may be the result of recent hatchery supplementation efforts and natural recolonization by Snake River stock(s). Fall Chinook salmon upstream of Lower Granite Dam (including the Clearwater River) are considered part of a single genetic population designated by NOAA Fisheries as one evolutionarily significant unit (*Snake River Fall Chinook Salmon ESU*).

Steelhead

In 1910, Grangeville Electric Light and Power Company built a hydroelectric dam (Harpster Dam) on the South Fork of the Clearwater River at RM 20. In 1937, Washington Water Power Company acquired the dam. Limited steelhead migration past the dam via a fishway was possible from 1935 to 1949. High river flows in 1949 destroyed the fishway, and upstream fish passage was impossible for approximately 14 years until removal of the dam in 1963. Steelhead populations upstream of Harpster Dam were extirpated. The extent to which native populations of rainbow/redband trout may have maintained non-anadromous populations upstream of Harpster Dam is unknown. Lewiston Dam (1927-1973) on the mainstem Clearwater River was not a barrier to upstream migration of steelhead.

Steelhead in the Snake River Basin are often classified as “A-run” and “B-run” steelhead. B-run steelhead generally return later in the year and at a larger mean size and age than A-run steelhead. Both A-run and B-run steelhead exist in the Clearwater River and are included in the *Snake River Steelhead ESU*. A-run steelhead spawn in tributaries of the lower Clearwater River, Middle Fork Clearwater River, and lower portions of the South Fork Clearwater River and tributaries. B-run steelhead spawn in the Lochsa, Selway, and upper South Fork Clearwater rivers. Lola Creek is considered a mix of both “A” and “B” run fish. The Lochsa, Selway and Potlatch rivers are managed as native steelhead reserves with no releases of hatchery-origin steelhead. Natural populations of steelhead in the Clearwater River are currently classified as *threatened* under the ESA.

B-run steelhead were native historically to the North Fork Clearwater River, but natural populations were extirpated by Dworshak Dam. B-run steelhead derived ancestrally from native populations in the North Fork Clearwater River are now maintained and propagated at Dworshak NFH.

Steelhead from Dworshak NFH have been outplanted into the South Fork Clearwater River and Lolo Creek since 1977. The number and proportion of hatchery-origin steelhead spawning naturally in those outplanted areas are unknown. Spawning surveys indicate spawning is occurring throughout Lolo Creek and its tributaries, including Yakus, Eldorado, Yoosa, Hemlock and Musselshell creeks (FWS Reference #SR-022).

Coho salmon

Coho salmon were declared *extinct* from the Snake River in 1986. Clearwater River coho were extirpated as a result of Lewiston Dam on the Snake River.

Efforts to enhance natural populations of coho salmon in the Clearwater River were initiated in 1962 by IDFG under the auspices of the Columbia River Fisheries Department Program. Over 11 million eggs were planted into two controlled-flow hatching channels on the Red River and Crooked River within the South Fork Clearwater subbasin. Fry releases occurred within mainstem channels and South Fork tributaries. Subsequent adult returns were poor. The project was discontinued in 1968 because of the poor return rates; however, upstream-migrating coho were still counted over Lewiston Dam until its removal in 1972-73.

Current reintroduction efforts for coho salmon in the Clearwater River were initiated in 1995 by the Nez Perce Tribe. Broodstock from Willard NFH and Eagle Creek NFH have been used to stock eyed eggs, fry, parr, and smolts into tributaries of the lower mainstem Clearwater River and South Fork Clearwater River. Stocking locations and life stages have varied among years, with coho releases occurring at least one year in each of the Potlatch River, Lapwai Creek, Mission Creek, Quartz Creek, Cottonwood Creek, Big Canyon Creek, Orofino Creek, Lolo Creek, Meadow Creek in the Selway River sub-basin, and Meadow Creek in the South Fork Clearwater sub-basin. Recent reintroduction efforts have been focused in Lapwai Creek, Potlatch River, Eldorado Creek, and Meadow Creek (Selway River) with both parr and smolt outplants.

Bull trout

Bull trout are distributed throughout most of the river and associated tributary systems within the Clearwater subbasin. Relatively contiguous distributions of bull trout exist in the South Fork, Selway, and Upper North Fork rivers. Bull trout are widely distributed in the Lochsa River but are absent from many tributaries in the lower half of the drainage. Bull trout occur also in Lolo Creek and Clear Creek. Bull trout inhabit the North Fork Clearwater and Little North Fork Clearwater rivers upstream of Dworshak Reservoir. Bull trout also occupy Dworshak Reservoir and may spend extensive amounts of time feeding in the Reservoir. Bull trout are essentially absent from tributaries of the lower Clearwater River.

Pacific Lamprey

Pacific lamprey are considered an endangered species by the state of Idaho. Throughout their range in the Columbia River Basin, Pacific lamprey have declined to only a remnant of their pre-1940s abundance. Counts of upstream migrating Pacific lamprey at lower Snake River dams were over 30,000 fish in the late 1960s but have declined to less than 500 fish in recent years. Approximately 3% of the lamprey passing Bonneville Dam are counted at Lower Granite Dam and are considered extremely depressed in the Clearwater River based on adult counts at Lower Granite Dam.

Other species

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

Habitat[31]

The abundance of salmon and steelhead in the Clearwater River is limited by three primary factors: (1) marine survival and anthropogenic factors outside the Clearwater River (e.g., dams, harvest); (2) reduced habitat carrying capacity and fish survival within the subbasin due to land management activities that affect hydrology, levels of sedimentation, and water quality; and (3) complete blockage of the North Fork Clearwater River by Dworshak Dam. Nearly 60% of steelhead within the Clearwater River sub-basin occurred historically in the N.F. Clearwater River. The North Fork also provided excellent spawning and rearing habitat for spring Chinook salmon.

[31] *Ibid.*

Spring Chinook

The majority of historical Chinook salmon spawning habitat is thought to have occurred in the North, South, and Middle Forks of the Clearwater River with less than 10% of spawning occurring in the mainstem Clearwater River. Within the lower Clearwater River, spring Chinook are thought to have spawned primarily in Lolo Creek and Potlatch River.

Habitat within the Clearwater River subbasin has an estimated capacity to produce approximately 3.5 million spring Chinook smolts based on assessments reported in the NWPCC Subbasin Plan. However only 14% of that carrying capacity is currently realized.

Chapman (1981) modeled "pristine production" of Chinook salmon (race not clearly defined, presumably spring and fall) from the Clearwater subbasin, estimating that 1.8 million smolts were produced historically resulting in an estimated 94,169 adults returning to the mouth of the Columbia River annually. Of those fish, 63,617 originated from tributaries and 30,552 were from the mainstem.

Very little habitat currently accessible to salmon and steelhead within the Clearwater River basin has been classified as excellent for spring Chinook. Excellent habitat is typically limited to the highest elevation headwater streams within the Lochsa and Upper Selway rivers. The North Fork Clearwater River, prior to blockage by Dworshak Dam, historically provided excellent spawning and rearing habitat for spring Chinook salmon. Habitat considered "good" and "fair" for spring Chinook is widely intermixed throughout the majority of the accessible reaches of the Lochsa, South Fork Clearwater,and Selway rivers. Poor habitat conditions for spring Chinook are generally associated with lower mainstem reaches of major tributaries and the mainstem Clearwater River.

Steelhead

Excellent steelhead habitat exists in the Upper Selway River and tributaries to the lower Selway and Lochsa rivers. The mainstem Lochsa River, mainstem Selway River (upstream of the wilderness boundary), and most of the tributaries to the South Fork Clearwater River provide "good" steelhead habitat. "Excellent" steelhead habitat exists within drainages of the South Fork Clearwater River originating within the Gospel Hump Wilderness Area. The lower Clearwater River, Middle Fork of the Clearwater River, and Lolo Creek largely represent fair to poor steelhead habitat, although Big Canyon Creek and portions of Lolo Creek do provide "good" habitat for steelhead.

Fall Chinook

Spawning habitat is not considered a limiting factor for recovery of fall Chinook in the lower Clearwater River based on the vast amount of suitable habitat available and documented redd counts since 1988. Cold water temperatures during winter, coupled with cold water releases from Dworshak Dam during the summer, cause a significant proportion of juvenile fall Chinook salmon in the Clearwater River to not reach their typical smolt size or migrate seaward as subyearlings, the typical life history pattern of fall Chinook. Consequently, juvenile fall Chinook in the Clearwater River outmigrate as both subyearlings and yearlings.

Coho salmon

The historic occurrence of native populations of coho in specific tributaries of the Clearwater River is not well documented. The Nez Perce Tribe's Office of Legal Counsel documented the historical presence of 'cuhlii or kallay' (coho) in their language and records. Specifically, the Potlatch River, Fish Creek and Lolo Creek are believed to have supported native populations of coho salmon.

Reviews of historical documents and interviews of residents support tribal records that the Potlatch River supported historic runs of Chinook, steelhead and coho during the late 1800s and early 1900s (Clearwater National Forest 1997).[32] The lower portion of the South Fork Clearwater River is also believed to have supported coho salmon based on anecdotal accounts (Paradis et al. 1999)[33], but those populations would have been extirpated by construction of Harpster Dam in 1910. Tribal elders of the Nez Perce Tribe report that coho salmon were present in the mainstem Clearwater River as well as several tributaries, including the North Fork Clearwater River, Lochsa River, Selway River, and South Fork Clearwater River (Paul Kucera, Nez Perce Tribe Department of Fisheries Resources Management, pers. comm.).

Current Status of Salmonid Stocks

Fish Biologists associated with the Lower Snake River Compensation Plan (LSRCP) have identified 17 principal salmonid stocks in the Clearwater River watershed. Native populations of spring Chinook and coho salmon in the Clearwater River are considered extirpated. An introduced-naturalized population of kokanee is included here because of its fishery importance within the Clearwater River basin.

Spring Chinook

- Dworshak NFH spring Chinook salmon (segregated)
- Clear Creek hatchery spring Chinook salmon (segregated hatchery, Kooskia NFH)
- Lochsa-Selway River spring Chinook (natural + segregated hatchery; Clearwater FH[34])
- South Fork Clearwater River spring Chinook salmon (natural + segregated hatchery; Clearwater FH[35])
- Lolo Creek spring Chinook salmon (natural + integrated hatchery; Nez Perce Tribal Hatchery)

Fall Chinook

- Clearwater (Snake) River fall Chinook salmon (natural + segregated hatchery; Lyons Ferry Hatchery and Nez Perce Tribal Hatchery)

Coho

- Clearwater River coho salmon (segregated hatchery; Dworshak, Kooskia, and Eagle Creek NFHs)

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[32] *Clearwater National Forest. 1997. Clearwater Subbasin Ecosystem Analysis at the Watershed* Scale*. Orofino, ID; as cited by the NWPCC 2003 Clearwater River Subbasin Plan.*

[33] *Paradis, W. J.; Lentz, H. S.; Mays, D.; Blair, S. and Lake, L. (1999). South Fork Clearwater River Biological Assessment. Nez Perce National Forest; as cited by the NWPCC 2003 Clearwater River Subbasin Plan.*

[34] *Broodstock collection and smolt releases occur at the Powell satellite facility.*

[35] *Broodstock collection and smolt releases occur at the Red River and Crooked River satellite facilities in the upper South Fork Clearwater River drainage.*

Steelhead

Clearwater River Steelhead Major Population Group (MPG)

- Dworshak NFH (*B-run*) summer steelhead (segregated)
- South Fork Clearwater River (*B-run*) summer steelhead (natural + segregated hatchery; Dworshak NFH and Clearwater FH)
- Lochsa River (*B-run*) summer steelhead (natural)
- Selway River (*B-run*) summer steelhead (natural)
- Lower Clearwater River, lower South Fork Clearwater River, Potlatch River, and lower Lolo Creek (*A-run*) summer steelhead (natural)
- Upper Lolo Creek (*B-run*) summer steelhead (natural + segregated hatchery; Dworshak NFH and Clearwater FH)

Resident (non-anadromous) populations

- Clearwater River resident rainbow/redband trout (natural)
- Clearwater River westslope cutthroat trout (natural)
- Clearwater River bull trout (natural)
- Dworshak Reservoir kokanee (naturalized)

The following tables summarize the current status and management premises of salmonid stocks in the Clearwater River. The principal sources of information for these tables were the Clearwater River Sub-Basin Plans of the Northwest Power and Conservation Council[36] and the Draft Salmon and Steelhead Recovery Plans for Idaho.[37] Additional information was obtained from Hatchery and Genetic Management Plans and various documents produced by the Interior Columbia Technical Recovery Team (ICTRT).[38]

NOAA Fisheries excludes spring Chinook salmon in the Clearwater River from the *Snake River Spring/Summer Chinook Salmon ESU*. As a result, spring Chinook in the Clearwater River are not protected as a threatened or endangered species under the ESA.

On the other hand, NOAA Fisheries does include steelhead in the Clearwater River with the *Snake River Summer Steelhead DPS* which is listed as a threatened species under the ESA. For the purposes of recovery planning, NOAA Fisheries classifies steelhead in the Clearwater River as a *major population group* (MPG) composed of six demographically independent populations: (1) Lower Clearwater Mainstem, (2) Lolo Creek, (3) South Fork Clearwater River, (4) Lochsa River, (5) Selway River, and (6) North Fork Clearwater River. Steelhead in the N.F. Clearwater River were extirpated by the construction of Dworshak Dam which blocked all upstream migration of salmon and steelhead. However, the N.F. Clearwater stock has subsequently been maintained continuously since 1969 at Dworshak NFH and is referred to as "Dworshak NFH (B-run) steelhead" throughout this report.

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[36] *NWPCC Clearwater River Subbasin Plan, http://www.nwcouncil.org/fw/subbasinplanning/clearwater/plan/.*

[37] *www.idahosalmonrecovery.net/index.html*

[38] *www.nwfsc.noaa.gov/trt/*

Table 1. Dworshak NFH spring Chinook (Dworshak NFH)

Management Premises and Goals	
ESA Status	*Not Listed.* Native populations of spring Chinook in the Clearwater River are considered extirpated due historical blockage by Lewiston Dam (1927-1973). NOAA Fisheries currently excludes all spring Chinook in the Clearwater River from the *Snake River Spring/Summer Chinook Salmon ESU*, which is currently listed as *threatened* under the ESA. The HSRG (2009) classified this population as *stabilizing*.
Biological Significance	*Low.* Dworshak NFH spring Chinook represent an introduced hatchery population derived ancestrally from the Rapid River FH stock with some potential genetic influence from the Carson NFH stock.
Population Viability	*Medium.* Smolt to adult survivals, including harvest, ranged from 0.10% to 0.86%.(average = 0.46%) for broodyears 1996-2000 with a mean adult recruit per adult spawner of approximately R/S = 4.0. The HSRG (2009) estimated a mean overall R/S = 7.0 based on current conditions.
Habitat	*Low.* Habitat in the North Fork Clearwater River is completely blocked by Dworshak Dam.Prior to blockage by Dworshak Dam, habitat in the North Fork Clearwater provided excellent spawning and rearing habitat for spring Chinook. The North Fork Clearwater River could historically accommodate 74,000 Chinook salmon redds prior to construction of Dworshak Dam. Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers. (See also habitat description for Clearwater River spring Chinook).
Harvest	*Low to High.* Harvest of hatchery produced spring Chinook (from Dworshak NFH, Kooskia NFH, and Clearwater Hatchery combined) is highly variable. Annual sport harvests ranged from 0 to approximately 14,700 fish (average = 1,517 fish), and tribal harvests ranged from 0 to approximately 3,200 fish/year (average = 581 fish/year) for the 20 year period, 1987-2006. Hatchery origin spring Chinook are also harvested in lower Columbia River gillnet, sport and tribal fisheries. Marine harvest rates on Clearwater River spring Chinook are less than 1% based on coded wire tag recoveries.
Hatchery Program	
Facilities	Dworshak NFH.
Type	Segregated. Only hatchery-origin fish trapped at Dworshak NFH are used for broodstock.
Authorization and Funding	Lower Snake River Compensation Plan.
Primary Purpose	Harvest. Dworshak NFH has an on-station release objective of 1.05 million yearling smolts per year.
Secondary Purposes	None.
Broodstock Origin(s)	Hatchery-origin spring Chinook from Carson NFH and Rapid River Fish Hatchery.

Table 2. Clear Creek hatchery spring Chinook (Kooskia NFH)

Management Premises and Goals	
ESA Status	*Not Listed.* Native populations of spring Chinook in the Clearwater River are considered extirpated due historical blockage by Lewiston Dam (1927-1973). NOAA Fisheries currently excludes spring Chinook in the Clearwater River from the *Snake River Spring/Summer Chinook Salmon ESU,* which is listed as a threatened species under the ESA. The HSRG (2009) classified this population as *stabilizing* with respect to its contribution to the future abundance of spring Chinook in the Clearwater River.
Biological Significance	*Low.* Kooskia NFH spring Chinook represent an introduced hatchery population derived ancestrally from the Rapid River Hatchery and Carson NFH stocks.
Population Viability	*Medium.* Smolt-to-adult return rates to the hatchery and fisheries for Kooskia NFH spring Chinook returning averaged 0.64% (1996 through 2000 broodyears) which translates into a mean recruit per spawner of approximately R/S = 5.5. The HSRG (2009) estimated a mean overall R/S = 7.0 for hatchery-produced smolts, based on current conditions. The HSRG (2009) estimated the habitat productivity and capacity for the lower Clearwater River, including the Middle Fork, North Fork, and Clear Creek (excluding the South Fork and Lolo Creek) as R/S = 1.3 and 250 returning adults, respectively.
Habitat	*Low.* Low flows and high temperatures in Clear Creek during the summer months limits natural production. Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers.
Harvest	*Low to High.* Harvest of hatchery produced spring Chinook (from Dworshak NFH, Kooskia NFH, and Clearwater Hatchery combined) is highly variable. Sport harvest ranged from 0 to approximately 14,700 fish (average = 1,517 fish), and tribal harvest ranged from 0 to approximately 3,200 fish (average = 581 fish) for the 20 year period, 1987-2006. Hatchery origin spring Chinook are also harvested in lower Columbia River gillnet, sport and tribal fisheries. Marine harvest rates on Clearwater River spring Chinook is less than 1% based on coded wire tag recoveries.
Hatchery Program	
Facilities	Kooskia NFH.
Type	*Segregated.* Only hatchery-origin fish trapped at Kooskia NFH are used for broodstock.
Authorization and Funding	Authorized on August 31, 1961, by 75 Statute 255; USFWS funded. Further program modification is anticipated as part of the Snake River Basin Adjudication agreement, which transfers operation of Kooskia NFH to the Nez Perce Tribe.
Primary Purpose	*Harvest.* Kooskia NFH has a release objective of 600,000 yearling smolts per year.
Secondary Purposes	Natural production of smolts in Clear Creek via supplementation. Kooskia NFH and Clear Creek participate in the Idaho Supplementation Studies funded by BPA.
Broodstock Origin(s)	Hatchery-origin spring Chinook from Carson NFH, Rapid River FH, and Dworshak NFH.

Table 3. Lochsa-Selway River spring Chinook (Clearwater FH)

Management Premises and Goals	
ESA Status	*Not Listed.* Native populations of spring Chinook in the Clearwater River are considered extirpated due historical blockage by Lewiston Dam (1927-1973). NOAA Fisheries currently excludes spring Chinook in the Clearwater River from the *Snake River Spring/Summer Chinook Salmon ESU,* which is listed as a threatened species under the ESA. The HSRG (2009) classified the Lochsa River population as *contributing*, and the upper and lower Selway River populations as *stabilizing* but recommended *contributing* for the upper Selway population with respect to their contributions to the future abundance of spring Chinook in the Clearwater River.
Biological Significance	*Low.* Spring Chinook salmon returning to the Lochsa and Selway rivers represent an introduced stock. The majority of fish currently returning to the two rivers are of hatchery-origin. Some natural reproduction and colonization are presumed to have occurred as the result of successful reproduction by hatchery-origin fish. Hatchery-origin fish used for spring Chinook salmon reintroductions in the Clearwater River were obtained primarily from the Rapid River Hatchery. Initially however, spring Chinook stocks imported for restoration came from Carson NFH, Little White Salmon NFH, or other spring Chinook captured at Bonneville Dam. Genetic data support broodstock records that natural-origin spring Chinook in the Clearwater River subbasin are derived primarily from introduced Snake River stocks. Overall, reintroduction of spring Chinook salmon following removal of the Lewiston Dam has resulted in naturally reproducing populations in Lolo Creek, the Lochsa, Selway, and South Fork Clearwater rivers.
Population Viability	*Low.* The majority of spring Chinook spawning naturally in the Lochsa and Selway rivers are believed to be of hatchery-origin. Current natural spawning estimate for spring Chinook in the entire Clearwater River basin is approximately 1,800 fish. The HSRG (2009) estimated the habitat productivity and capacity for the Lochsa River as R/S = 1.3 and 940 natural-origin adults, respectively, 1.3 and 600 adults, respectively for the upper Selway River, and 1.3 and 400 adults for the lower Selway River, respectively. The HSRG (2009) estimated a mean overall R/S = 6.0 for hatchery-origin smolts released into the Lochsa River, R/S = 3.17 for hatchery-origin smolts released into the lower Selway River, and R/S = 0.9 and 0.7 for hatchery-origin parr released in the upper and lower Selway rivers, respectively, based on current conditions.
Habitat	*Medium to High.* Very little habitat within the Clearwater River subbasin has been defined as excellent for spring Chinook salmon. Excellent habitat is typically limited to the highest elevation headwater streams within the Lochsa and Upper Selway rivers. However, if not blocked by Dworshak Dam, the North Fork Clearwater River would provide substantial amounts of excellent spring Chinook habitat. Good and fair spring Chinook salmon habitat is widely intermixed and found throughout the majority of the usable mainstem and tributary reaches of the Lochsa, South Fork Clearwater, and Selway rivers. Relatively contiguous distributions of spring/summer Chinook salmon exist in Lolo Creek, Middle Fork Clearwater, South Fork Clearwater, and Selway rivers. Spring/summer Chinook salmon are absent from many tributaries in the Lochsa River drainage, but found in Pete King and Fish Creeks, and most tributaries upstream of, and including, Warm Springs Creek. Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers.
Harvest	*Low to High.* Harvest data are not available specifically for spring Chinook reared at the Clearwater Fish Hatchery and released into the Lochsa and Selway rivers. Harvests of

	spring Chinook in the Clearwater River Basin harvest have varied greatly from zero to over 21,000 fish. Hatchery fish are also harvested in the lower Columbia River gillnet, sport and tribal fisheries. Analyses of coded-wire tag (CWT) recoveries from Snake River spring Chinook salmon during the intensive ocean fisheries of the 1980s indicated that harvest rate of these fish in the ocean was less than 1%.
Hatchery Program	
Facilities	Clearwater Fish Hatchery (spawning, egg incubation, and rearing) and Powell satellite facility (broodstock collection and smolt acclimation) in the upper Lochsa River.
Type	*Segregated* (currently), with *Integrated* as a goal.
Authorization and Funding	Lower Snake River Compensation Plan.
Primary Purpose	*Harvest*. IDFG releases 400,000 marked yearling spring Chinook smolts annually at the Powell satellite facility (April release) located at the headwaters of the Lochsa River at the confluence of Brushy Fork Creek and Colt Killed Creek. An additional 335,000 pre-smolt release in September was discontinued in 2008 but will be replaced with a 300,000 smolt release (700,000 smolts total). Both release groups were progeny of adults trapped at the Powell facility in the upper Lochsa River. In 2008, the Nez Perce Tribe released approximately 300,000 yearling smolts (April release) into the lower Selway River, which replaced a July 2007 release of 300,000 subyearling parr. Releases in the lower Selway River in 2008 were the progeny of hatchery-origin adults trapped in the S.F. Clearwater River, whereas fish released in 2007 were the progeny of adults trapped at Dworshak NFH and Rapid River Fish Hatchery (2007).
Secondary Purposes	*Conservation/Reintroduction (Supplementation)*. The Nez Perce Tribe releases approximately 400,000 spring Chinook subyearling parr (June release) into Meadow Creek in the lower Selway River and another 300,000 subyearling parr (July release) into the upper Selway River. These parr releases have been the progeny of adults trapped in the South Fork Clearwater River, Dworshak NFH, Nez Perce Tribal Hatchery, and Rapid River Fish Hatchery, although the desired source of fish for these releases are adults trapped at the Powell satellite facility.
Broodstock Origin(s)	Rapid River Hatchery stock and Carson NFH stock. Broodstock are now collected at satellite facilities on South Fork Clearwater (Red and Crooked Rivers) and Lochsa rivers (Powell trap), although backfilling from Rapid River Hatchery and Dworshak NFH still occurs.

Table 4. South Fork Clearwater River spring Chinook (Clearwater FH)

Management Premises and Goals	
ESA Status	*Not Listed.* Native populations of spring Chinook in the Clearwater River are considered extirpated due historical blockage by Lewiston Dam (1927-1973). NOAA Fisheries excludes spring Chinook in the Clearwater River from the *Snake River Spring/Summer Chinook Salmon ESU,* which is listed as a threatened species under the ESA. The HSRG

	(2009) classified this population as *contributing* with respect to its contribution to the future abundance of spring Chinook in the Clearwater River.
Biological Significance	*Low.* Spring Chinook salmon returning to the South Fork Clearwater River represent an introduced stock. The majority of fish currently returning to the S.F. Clearwater River are of hatchery-origin. Some natural reproduction and colonization are presumed to have occurred as the result of successful reproduction by hatchery-origin fish. Hatchery-origin fish used for spring Chinook salmon reintroductions in the Clearwater River were obtained primarily from the Rapid River Hatchery. Initially however, spring Chinook stocks imported for restoration came from Carson NFH, Little White Salmon NFH, or other spring Chinook captured at Bonneville Dam. Genetic data support broodstock records that natural-origin spring Chinook in the Clearwater River subbasin are derived primarily from introduced Snake River stocks. Overall, reintroduction of spring Chinook salmon following removal of Lewiston Dam has resulted in naturally reproducing populations in Lolo Creek, the Lochsa, Selway, and South Fork Clearwater rivers.
Population Viability	*Low.* The majority of spring Chinook spawning naturally in the South Fork of the Clearwater River are believed to be of hatchery-origin. Current natural spawning estimate for spring Chinook in the entire Clearwater River basin is approximately 1,800 fish. The HSRG (2009) estimated the habitat productivity and capacity for the South Fork Clearwater River as R/S = 1.3 and 2,500 natural-origin adults, respectively. The HSRG (2009) estimated a mean overall R/S = 4.0 and R/S = 1.0 for hatchery-origin smolts and pre-smolts, respectively, released into the South Fork Clearwater River.
Habitat	*Low to Medium.* Very little habitat within the Clearwater River subbasin has been defined as excellent for spring Chinook salmon. Excellent habitat is typically limited to the highest elevation headwater streams within the Lochsa and Upper Selway rivers. However, if not blocked by Dworshak Dam, the North Fork Clearwater River would provide substantial amounts of excellent spring Chinook habitat. Good and fair spring Chinook salmon habitat is widely intermixed and found throughout the majority of the usable mainstem and tributary reaches of the Lochsa, South Fork Clearwater, and Selway rivers. Relatively contiguous distributions of spring/summer Chinook salmon exist in Lolo Creek, Middle Fork Clearwater, South Fork Clearwater, and Selway rivers. Spring/summer Chinook salmon are absent from many tributaries in the Lochsa River drainage, but found in Pete King and Fish Creeks, and most tributaries upstream of, and including, Warm Springs Creek. Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers.
Harvest	*Low to High.* Harvest data are not available specifically for spring Chinook reared at the Clearwater Fish Hatchery and released into the Lochsa and Selway rivers. Harvests of spring Chinook in the Clearwater River Basin harvest have varied greatly from zero to over 21,000 fish. Hatchery fish are also harvested in the lower Columbia River gillnet, sport and tribal fisheries. Analyses of coded-wire tag (CWT) recoveries from Snake River spring Chinook salmon during the intensive ocean fisheries of the 1980s indicated that harvest rate of these fish in the ocean was less than 1%.
Hatchery Program	
Facilities	Clearwater Fish Hatchery (spawning, egg incubation, and rearing), and Red River and Crooked River satellite facilities (smolt acclimation and broodstock collection).
Type	*Segregated* (currently), with *integrated* as a goal.

Authorization and Funding	Lower Snake River Compensation Plan.
Primary Purpose	*Harvest.* IDFG releases 400,000 and 700,000 yearling smolts (April release) annually at the Red River and Crooked River satellite facilities, respectively. These releases are the progeny of adults trapped at those two satellite facilities with backfilling from the Rapid River Fish Hatchery.
Secondary Purposes	*Conservation/Reintroduction (Supplementation)*. The Nez Perce Tribe releases 75,000 pre-smolts (October release) annually into Newsome Creek (Nez Perce satellite facility).
Broodstock Origin(s)	Rapid River Hatchery stock and Carson NFH stock. Broodstock are now collected at satellite facilities on South Fork Clearwater (Red and Crooked Rivers), although backfilling from Rapid River Hatchery still occurs.

Table 5. Lolo Creek spring Chinook (Nez Perce Tribal Hatchery)

Management Premises and Goals	
ESA Status	*Not Listed.* Native populations of spring Chinook in the Clearwater River are considered extirpated due historical blockage by Lewiston Dam (1927-1973). NOAA Fisheries currently excludes spring Chinook in the Clearwater River from the *Snake River Spring/Summer Chinook Salmon ESU,* which is listed as threatened under the ESA. The HSRG (2009) classified this population as *contributing* with respect to its contribution to the future abundance of spring Chinook in the Clearwater River.
Biological Significance	*Low.* Spring Chinook salmon returning to Lolo Creek represent an introduced stock. The majority of fish currently returning to Lolo Creek are of hatchery-origin. Some natural reproduction and colonization are presumed to have occurred as the result of successful reproduction by hatchery-origin fish. Overall, reintroduction of spring Chinook salmon following removal of the Lewiston Dam has resulted in naturally reproducing populations in Lolo Creek, the Lochsa, Selway, and South Fork Clearwater rivers.
Population Viability	*Low.* The majority of spring Chinook spawning naturally in Lolo Creek are believed to be of hatchery-origin. Current natural spawning estimate for spring Chinook in the entire Clearwater River basin is approximately 1,800 fish. The HSRG (2009) estimated the habitat productivity and capacity for Lolo Creek as R/S = 1.3 and 1,500 natural-origin adults, respectively. The HSRG (2009) estimated a mean overall R/S = 1.0 for hatchery-origin pre-smolts released into Lolo Creek.
Habitat	*Low.* The majority of natural spawning occurs within the mainstem of Lolo Creek from Whiteman Creek to Dutchman Creek; some minor spawning has occurred in Eldorado Creek to White Creek (see also *Habitat* description for Lolo Creek summer steelhead, Table XX). Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers.
Harvest	*Low to High.* Harvest data are not available specifically for spring Chinook reared at the Nez Perce Tribal Hatchery and released into Lolo Creek. Harvests of spring Chinook in the

	Clearwater River Basin harvest have varied greatly from zero to over 21,000 fish. Hatchery fish are also harvested in the lower Columbia River gillnet, sport and tribal fisheries. Analyses of coded-wire tag (CWT) recoveries from Snake River spring Chinook salmon during the intensive ocean fisheries of the 1980s indicated that harvest rate of these fish in the ocean was less than 1%.
Hatchery Program	
Facilities	Nez Perce Tribal Hatchery and Yoosa Pond satellite facility.
Type	*Segregated* (currently), with *integrated* as a goal.
Authorization and Funding	Lower Snake River Compensation Plan.
Primary Purpose	*Conservation/Reintroduction (Supplementation)*. The Nez Perce Tribe releases 150,000 pre-smolts (October release) annually into Yolo Creek. These fish are the progeny of adults trapped in Yolo Creek, although backfilling from other locations can occur.
Secondary Purposes	*Harvest.*
Broodstock Origin(s)	Rapid River Hatchery stock and Carson NFH stock. Broodstock are now collected from adults trapped in Yolo Creek and Nez Perce Tribal Hatchery.

Table 6. Clearwater (Snake) River fall Chinook (Lyons Ferry FH and Nez Perce Tribal Hatchery)

Management Premises and Goals	
ESA Status	*Threatened*. Native populations of fall Chinook in the Clearwater River were extirpated by blockage at Lewiston Dam (1927-1973). Recolonization of naturally-spawning populations from the Snake River is currently ongoing. NOAA Fisheries includes fall Chinook in the Clearwater River with the *Snake River Fall Chinook ESU*, which is currently listed as a threatened species under the ESA. Fall Chinook in the Clearwater River are currently considered part of a single Snake River fall Chinook population. The HSRG (2009) classified this population as *primary* with respect to ESA recovery.
Biological Significance	*Medium to High.* Reintroduction of fall Chinook in the Clearwater River began in 1960. A total of approximately 6.7 million fall Chinook were released by IDFG into the upper Clearwater River subbasin from 1960-1967, mainly through eyed-egg plants in artificial spawning channels along the Selway River. Due to insignificant returns of fall Chinook (maximum of 122 adults in 1966), the original reintroduction program was considered unsuccessful and terminated in 1968. Fall Chinook in the lower Clearwater subbasin are presumed currently to be the progeny of recent hatchery supplementation efforts and natural recolonization (straying) from the mainstem Snake River. Fall Chinook within the Clearwater River subbasin are considered an important metapopulation component of the Snake River ESU, a geographically widespread population inhabiting the mainstem Snake

	River from its confluence with the Columbia River to Hells Canyon Dam, and occurring also in the lower reaches of the Clearwater, Salmon, Grande Ronde, Imnaha, and Tucannon rivers. Within this ESU, the Nez Perce Tribe recognizes – based on historic accounts - "early" fall Chinook that spawned primarily in October and have a life history similar to that of "summer" Chinook in the mid-to-upper Columbia River. No known populations of early- fall Chinook remain in the Snake River basin, but water temperature profiles indicate that late September and early October would be favorable spawning times for this life history in the lower Selway, Lochsa, South Fork Clearwater, and mainstem Clearwater rivers upstream of the confluence of the North Fork. In addition, fall Chinook in the Clearwater River appear to be evolving a yearling (stream-type) outmigration life history (as opposed to the natural sub-yearling, or ocean-type, life history) because of cold-water releases from Dworshak Reservoir. This natural evolutionary process in response to current habitat perturbations increases the potential biological significance of a separate Clearwater population of fall Chinook salmon within the *Snake River Fall Chinook ESU*.
Population Viability	*Low.* Fall Chinook in the Clearwater and Snake rivers do not currently meet the viability criteria of NOAA Fisheries for ESA recovery. This population also does not meet the criteria for a "maintained" population. Hatchery fish released in the Clearwater River for current reintroduction efforts first returned as adults in 1999 with hatchery fish constituting 43% and 60% of carcasses in 1999 and 2000, respectively. The number of redds observed have recently increased from a range of four to 36 redds during 1988-1995, to an average of 533 redds for the period 2003-2007 . The ICTRT recovery targets for the entire Snake River fall Chinook population (and ESU) are a mean return of 3,500 natural-origin adults and R/S = 1.25, respectively. The HSRG (2009) estimated the habitat productivity and capacity for the Snake River fall Chinook population as R/S = 2.2 and 8,250 natural-origin adults, respectively. The HSRG (2009) estimated a mean overall R/S = 3.0 and 6.0 for hatchery-origin subyearling and yearling fall Chinook, respectively, released into the Snake River (all releases).
Habitat	*Medium to High.* The ICTRT determined that there are five major spawning areas for Snake River fall Chinook salmon: (1) mainstem Snake River from Hells Canyon Dam to the mouth of the Salmon River and including the lower mainstems of the Imnaha and Salmon rivers; (2) mainstem Snake River from the mouth of the Salmon River to the upper end of Lower Granite Reservoir; (3) Grande Ronde River; (4) Clearwater River; and (5) Tucannon River. Spawning habitat is not a limiting factor for fall Chinook in the lower Clearwater River (up to 95,000 redd potential). Spawning of fall Chinook in the Clearwater subbasin occurs principally in the mainstem below the confluence of the North Fork. However, adults spawn throughout the mainstem Clearwater River and portions of the South Fork. Because of cold water temperatures, many juvenile fall Chinook in the Clearwater River do not reach smolt size or migrate seaward during their first year as subyearlings. Releasing cool water from Dworshak Reservoir to augment summer flows and temperature may cause juvenile fall Chinook to rear an extra year in freshwater, thus outmigrating as yearlings instead of subyearlings. The manipulation of water flows from Dworshak Reservoir represents a potential limiting factor to reestablishment of a viable fall Chinook population in the lower Clearwater River (downstream from the North Fork). Designated critical habitat for fall Chinook includes the mainstem Clearwater River from the Snake River upstream to Lolo Creek, the North Fork Clearwater River (downstream from Dworshak Dam), and all other river reaches presently or historically accessible to fall Chinook in the lower Clearwater River. Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers.
Harvest	*Medium.* Coded-wire tag recoveries indicate that 21% of the tags were recovered in

	commercial (Canada 9%) and in-river (Columbia 12%) fisheries (BY1989-1994).
Hatchery Program	
Facilities	Lyons Ferry Hatchery, Nez Perce Tribal Hatchery, Lower Granite Dam, and Big Canyon Creek, North Lapwai Valley, Luke's Gulch, and Cedar Flats Acclimation facilities.
Type	*Segregated* (currently), with *integrated* as the goal.
Authorization and Funding	Lower Snake River Compensation Plan and Bonneville Power Administration.
Primary Purpose	*Conservation/Reintroduction (Supplementation).* 500,000 sub-yearling and 150,000 yearling fall Chinook from Lyons Ferry Hatchery are acclimated and released at the Big Canyon Creek facility on the mainstem Clearwater River in June and April, respectively. In addition, the Nez Perce Tribal Hatchery has targeted release objectives 500,000 subyearlings on-station (June release), 500,000 subyearlings acclimated and released from the North Lapwai Valley Acclimation Facility, and 200,000 subyearlings each from the Luke's Gulch (S.F. Clearwater River) and Cedar Flats (Selway River) facilities, respectively. Releases from Luke's Gulch and Cedar Flats are intended to restore "early fall Chinook" to the S.F. Clearwater and Selway rivers, respectively. All release objectives of the Nez Perce Tribal Hatchery were met in 2008 except that 100,000 subyearlings (instead of 200,000) were each released from the Luke's Gulch and Cedar Flats facilities, respectively. An additional 98,400 subyearlings with PIT tags, reared at Dworshak NFH from eyed eggs obtained from Lyons Ferry FH, were released at Big Canyon Creek in 2008 for transportation/spill studies. Adults trapped at Lower Granite Dam and the Nez Perce Tribal Hatchery are the broodstock sources for fish reared at the Nez Perce Tribal Hatchery.
Secondary Purposes	Harvest.
Broodstock Origin(s)	Lyons Ferry Hatchery stock. The origin of the Lyons Ferry Hatchery stock was natural-origin fall Chinook trapped at Ice Harbor Dam, 1977-1993, and Lower Granite Dam beginning in 1990.

Table 7. Clearwater River coho salmon (Dworshak, Kooskia and Eagle Creek NFHs)

Management Premises and Goals	
ESA Status	*Not listed.* Coho salmon were extirpated from the Clearwater River by Lewiston Dam (1927-1973). Coho salmon were declared *extinct* in the Snake River in 1986.
Biological Significance	*Low.* All adult coho returning to the Clearwater River are the result of recent transfers from lower Columbia River hatcheries (Eagle Creek NFH)
Population	*Low.* No self-sustaining hatchery or natural populations of coho salmon have yet been

Viability	established in the Clearwater River as the result of reintroductions from lower Columbia River hatcheries. Adult coho counts at Lower Granite Dam averaged more than 2,100 fish, 2003-2007 (maximum of 3,898 adults in 2004). The HSRG (2009) estimated the habitat productivity and capacity for coho salmon in the Clearwater River as R/S = 1.5 and 1,000 natural-origin adults, respectively. The HSRG (2009) estimated R/S = 4.0 for hatchery-origin coho released in the Clearwater River.
Habitat	*Low.* Coho salmon were likely present historically within the larger mainstem Clearwater River tributaries and, depending on water flows, likely ascended some of the smaller tributaries for spawning. The Potlatch River, Fish Creek and Lolo Creek likely supported coho populations historically. Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers.
Harvest	*Low.* No directed harvest on coho salmon occurs currently in the Clearwater River.
Hatchery Program	
Facilities	Clearwater Fish Hatchery, Dworshak NFH, Kooskia NFH, and Eagle Creek NFH (lower Columbia River)
Type	*Segregated.*
Authorization and Funding	Pacific Coast restoration funds through CRITFC with funding from Bonneville Power Administration. Culture activities at Eagle Creek NFH in support of this program are funded by NOAA Fisheries via the Mitchell Act.
Primary Purpose	*Conservation/Reintroduction.*
Secondary Purposes	*Harvest* (long-term goal).
Broodstock Origin(s)	Eagle Creek NFH and Willard NFH. These populations are considered "early-returning" coho stocks and were derived historically from coho salmon native to the Toutle River, Washington, and other lower Columbia River tributaries.

Table 8. Dworshak NFH (North Fork Clearwater River) B-run summer steelhead (Dworshak NFH)

Management Premises and Goals	
ESA Status	*Threatened.* NOAA Fisheries includes Dworshak NFH steelhead with the *Snake River Summer Steelhead DPS* which is listed as a threatened species under ESA. The HSRG (2009) classified this population as *contributing* with respect to ESA recovery of the DPS.
Biological Significance	*High*. Dworshak NFH steelhead represent one of the most genetically distinctive stocks of steelhead in the Columbia River basin. The hatchery program aims to conserve and perpetuate this unique population, derived from fish native to the North Fork Clearwater

	River. Natural populations of steelhead in the N.F. Clearwater River were extirpated by Dworshak Dam in the late 1960's and early 1970's. B-run steelhead have been documented in only two subbasins in the Columbia River system, the Salmon and Clearwater rivers.
Population Viability	*High* (as a hatchery population). The N.F. Clearwater River population of steelhead is extirpated but is maintained artificially as a hatchery population. Mean number of adult recruits per adult spawner (R/S) is approximately R/S = 10. The HSRG (2009) estimated a mean R/S = 35.0 for this hatchery-propagated stock.
Habitat	*Low.* An estimated 50 to 60 percent of the steelhead entering the Clearwater River spawned in the North Fork Clearwater River and its tributaries prior to construction of Dworshak Dam in 1969. The North Fork Clearwater River could historically accommodate 109,000 steelhead redds.
Harvest	*High*. Summer steelhead released from Dworshak NFH, including fish outplanted into the South Fork Clearwater River from Dworshak NFH and Clearwater Hatchery, contribute significantly to sport and tribal fisheries in the Clearwater River,. From 2000 to 2006, the sport fishery harvested an estimated 12,230 to 30,168 fish per year in the Clearwater River, and the tribal fishery harvested an estimated 1,000 to 1,470 fish per year in the North Fork of the Clearwater River. Dworshak NFH steelhead are also harvested in various fisheries in the lower Columbia and Snake River. The annual harvest rate for Idaho-origin B-run steelhead in mainstem Columbia and Snake River fisheries ranged from 3.4 and 34.6% (mean = 13.2%) in 1996-2005 (US v Oregon Technical Advisory Committee data reports).
Hatchery Program	
Facilities	Dworshak NFH.
Type	*Segregated*. Only hatchery-origin adults trapped at Dworshak NFH are used for broodstock.
Authorization and Funding	Army Corps of Engineers through Congressional authorization.
Primary Purpose	*Harvest*. 1.2 million smolts are released onsite annually from the hatchery. An additional 300,000 smolts are outplanted annually into Clear Creek immediately downstream from Kooskia NFH, and 600,000 smolts are outplanted into the South Fork Clearwater River (3 sites). In support of LSRCP programs, Dworshak NFH also collects and transfers approximately 2.5-2.7 million eggs (fertilized or eyed) to Clearwater Anadromous Fish Hatchery for subsequent rearing and eventual outplanting as smolts into the S.F. Clearwater River (793,000 smolts), Lolo Creek (50,000 smolts), and Salmon River basin (891,000 smolts).
Secondary Purposes	*Conservation*. Although the steelhead program at Dworshak NFH was initially established to maintain sport and tribal fisheries as mitigation for Dworshak Dam, maintaining the genetically unique North Fork Clearwater River stock is considered a high management priority.
Broodstock Origin(s)	Natural-origin adults trapped in the North Fork Clearwater River during construction of Dworshak Dam.

Table 9. South Fork Clearwater River B-run summer steelhead (Dworshak NFH and Clearwater FH)

Management Premises and Goals	
ESA Status	*Threatened.* NOAA Fisheries includes steelhead in the South Fork Clearwater River with the *Snake River Summer Steelhead DPS* which is listed as a threatened species under ESA. The HSRG (2009) classified this population as *stabilizing* with respect to ESA recovery of the DPS.
Biological Significance	*Low.* Native populations of steelhead in the South Fork Clearwater River upstream of river mile 22 are believed to have been extirpated by Harpster Dam. This dam completely blocked upstream migration of salmon and steelhead after its construction in 1910. The dam was removed in 1963. Since that time, large numbers of hatchery steelhead have been released in the South Fork Clearwater River drainage. From 1969 through 2005, totals of approximately 17.5 million eyed eggs, 17.9 million fry and subyearling presmolts, 9.7 million smolts, and 11,000 adults have been released at various locations within the subbasin. Dworshak NFH B-run steelhead have been the principle source for those releases. Steelhead populations in the South Fork Clearwater River are widely distributed and hatchery-origin fish have been released throughout the watershed. The extent to which native populations may have been maintained by resident fish is unknown.
Population Viability	*Low.* The South Fork Clearwater River population does not currently meet NOAA Fisheries viability criteria for ESA recovery. Also, the population does not currently meet the criteria for a "maintained" population. Out-of-basin factors resulting in low smolt-to-adult returns (SARs) and compromised habitat within the South Fork sub-basin are factors contributing to the low viability of steelhead. The most recent 13-year SAR adjusted and delimited (at 750 spawners) geometric mean of returns per spawner was 0.85 (Document SR-016 on public website). The HSRG (2009) estimated the habitat productivity and capacity for B-run steelhead in the S.F. Clearwater River as R/S = 1.5 and 350 natural-origin adults, respectively. The HSRG (2009) estimated R/S = 35.0 for hatchery-origin steelhead (Dworshak origin) released in the S.F. Clearwater River.
Habitat	*Low.* The South Fork Clearwater River watershed has changed substantially since human activities began in the 19th century. Prior to the construction of Harpster Dam in 1910, steelhead spawned primarily in the lower canyon portions of mainstem tributaries such as Newsome Creek, American River, Red River, Crooked River, and low gradient reaches along the mainstem South Fork Clearwater River. Historic spawning distributions of steelhead most likely included Tenmile, Johns, Meadow, and Mill creeks. Low order streams and accessible headwater portions of high order streams provided early rearing habitat. Harpster Dam, constructed at river mile 22, completely blocked upstream passage of steelhead from 1911 to 1935 and from 1949 to 1963. A fish ladder was installed at the dam in 1935, and it provided some passage opportunity until 1949 when it was destroyed by high river flows. Mining, road building, and agricultural developments in the lower subbasin are, currently, the primary factors responsible for altered steelhead habitat in the South Fork Clearwater River. Historic impacts from dredge mining and increased sediment loads from road system, including channelization, have impaired fish habitat in many areas. On the other hand, Johns, Tenmile, and Silver creeks and the upper portion of the Crooked River have high quality habitat with little or no road development. Potential spawning areas are abundant in the South Fork Clearwater River, but habitat alternations significantly inhibit steelhead productivity. For example, sedimentation from historic hydraulic mining is a principal factor affecting fish populations within much of the South Fork Clearwater drainage. Fish passage, water flows and temperature in the downstream migration corridor

	have been greatly impacted by dams on the Snake and Columbia rivers, thus contributing to low smolt-to-adult survivals.
Harvest	*High for hatchery fish*. Dworshak NFH steelhead are outplanted annually in the S.F. Clearwater River, and those fish support intensive recreational fisheries as returning adult fish. Most smolts are released as part of the Lower Snake River Compensation Program for harvest augmentation, mitigating for the impacts of the four lower Snake River dams. Releases of other life stages were done primarily for supplementation and reintroduction programs. *Low for natural fish.* Within the Clearwater River and other areas of the Columbia and Snake River basins, sport harvest on steelhead is restricted to marked hatchery fish. In the mainstem Columbia River, steelhead fisheries are regulated within limits of Biological Opinion outlining take of steelhead in gillnet fisheries targeting fall Chinook. The strategy since 1998 has been to limit the harvest rates on steelhead in the Columbia River to no more than 17% of the total number of steelhead migrating upstream (treaty Indian harvest rate < 15%, non-treaty fisheries <2%).
Hatchery Program	
Facilities	Dworshak NFH, Clearwater Fish Hatchery.
Type	Segregated. All steelhead released in the S.F. Clearwater River are the progeny of hatchery-origin adults trapped at Dworshak NFH.
Authorization and Funding	Lower Snake River Compensation Plan and Army Corps of Engineers.
Primary Purpose	Harvest. 400,000 marked (adipose fin clipped) yearling smolts from Dworshak NFH are outplanted annually into the mainstem S.F. Clearwater River. In addition, a total of 510,000 marked Dworshak B-run steelhead smolts from Clearwater Fish Hatchery are outplanted annually at the following locations: mainstem S.F. Clearwater River (260,000 smolts), Crooked River (150,000 smolts), Red River (100,000 smolts).
Secondary Purposes	*Restoration/supplementation* of natural populations (U.S. vs. Oregon agreement). A total of 200,000 unmarked yearling smolts from Dworshak NFH are outplanted annually at the following locations: Newsome Creek (100,000 smolts) and American River (100,000 smolts). In addition, a total of 333,000 Dworshak B-run steelhead smolts from Clearwater Fish Hatchery are outplanted annually at the following locations: Crooked River (83,000 smolts), Red River (150,000 smolts), Meadow Creek (25,000 smolts), Mill Creek (25,000 smolts).
Broodstock Origin(s)	Same as Dworshak NFH (B-run) summer steelhead.

Table 10. Lochsa River (B-run) summer steelhead (Natural)

Management Premises and Goals	
ESA Status	*Threatened.* NOAA Fisheries includes steelhead in the Lochsa River with the Snake River Summer Steelhead DPS, which is listed as a threatened species under ESA. The HSRG (2009) classified this population as *primary* with respect to ESA recovery of the DPS.
Biological Significance	*High.* Steelhead in the Lochsa River represent native B-run populations. IDFG manages steelhead in the Lochsa River for natural reproduction only with no releases of hatchery steelhead.
Population Viability	*Low.* The Lochsa River population does not currently meet NOAA Fisheries viability criteria for ESA recovery. Also, the population does not currently meet the criteria for a "maintained" population. Juvenile steelhead rearing has been documented in most of the Lochsa River drainage that is accessible to adult migration. Juvenile steelhead production is considered very low, primarily due to out-of-basin factors associated with low smolt-to-adult returns (SARs) but also because of habitat conditions in several sub-basins. The HSRG (2009) estimated the habitat productivity and capacity for B-run steelhead in the Lochsa River as R/S = 2.5 and 2,000 natural-origin adults, respectively.
Habitat	*Medium to High.* Habitat conditions range from near-pristine to moderately degraded, with the majority of the habitat in good to excellent condition. Habitat degradation in the Lochsa River drainage occurs primarily from high levels of sediment loading in some of the tributaries due to granitic geologies, past wildfires, road systems, logging, and landslides. The mainstem Lochsa River is functioning near its natural potential but is impaired slightly from deleterious effects associated with State Highway 12 which parallels the stream. Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers.
Harvest	*Low.* Within the Clearwater River and other areas of the Columbia and Snake River basins, sport harvest on steelhead is restricted to marked hatchery fish. In the mainstem Columbia River steelhead fisheries are regulated within limits of Biological Opinion outlining take of steelhead in gillnet fisheries targeting fall Chinook. The strategy since 1998 has been to limit the harvest rates on fisheries in the Columbia River to no more than 17% (treaty Indian < 15%, non-Indian fisheries <2%)-in document SR-010.

Table 11. Selway River (B-run) summer steelhead (Natural)

Management Premises and Goals	
ESA Status	*Threatened.* NOAA Fisheries includes steelhead in the Selway River with the *Snake River Summer Steelhead DPS*, which is listed as a threatened species under ESA. The HSRG (2009) classified this population as *primary* with respect to ESA recovery of the DPS.
Biological Significance	*High.* Steelhead in the Selway River represent native B-run populations. IDFG manages steelhead in the Selway River for natural reproduction only with no releases of hatchery steelhead.

Population Viability	*Low.* The Selway River population does not currently meet NOAA Fisheries viability criteria for ESA recovery. Also, the population does not currently meet the criteria for a "maintained" population. Out-of-basin factors associated with low smolt-to-adult returns (SARs) are the primary causes of low viability. The HSRG (2009) estimated the habitat productivity and capacity for B-run steelhead in the Selway River as R/S = 2.5 and 2,500 natural-origin adults, respectively.
Habitat	*High.* The Selway River drainage is predominantly forested, federal land, of which approximately 90% is designated as wilderness. Few anthropogenic impacts exist within the wilderness boundary. In the non-wilderness portion of the drainage, steelhead habitat has been degraded by the development, maintenance, and use of recreational sites and riparian roads, and by sediment loads originating from logging roads. Large woody debris is lacking or reduced at the mouths of many tributaries to the Selway River due to culvert and bridge maintenance practices. Most streams are functioning at or near their potential, with little opportunity for improvement. However, the historic (pre-1900) distribution of steelhead in the Selway River is unknown. Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers, thus contributing to low smolt-to-adult survivals.
Harvest	*Low.* Within the Clearwater River and other areas of the Columbia and Snake River basins, sport harvest of steelhead is restricted to marked hatchery fish. In the mainstem Columbia River steelhead fisheries are regulated within limits of Biological Opinion outlining take of steelhead in gillnet fisheries targeting fall Chinook. The strategy since 1998 has been to limit the harvest rates on fisheries in the Columbia River to no more than 17% (treaty Indian < 15%, non-Indian fisheries <2%)-in document SR-010.

Table 12. Lower Clearwater River, lower South Fork Clearwater River, Potlatch River, and lower Lolo Creek (A-run) summer steelhead (Natural)

Management Premises and Goals	
ESA Status	*Threatened.* NOAA Fisheries includes steelhead in the lower Clearwater River with the Snake River Summer Steelhead DPS, which is listed as a threatened species under ESA. The HSRG (2009) classified this population as *primary* with respect to ESA recovery of the DPS.
Biological Significance	*Medium to High.* Wild A-run steelhead within the Clearwater River subbasin occur only in the lower mainstem tributaries, South Fork Clearwater tributaries upstream to Butcher Creek, the Potlatch River, and Maggie Creek in the Middle Fork Clearwater River. No outplanting of A-run steelhead trout has occurred within the Clearwater River subbasin. Interbreeding of natural-origin A-run and hatchery-origin B-run steelhead is believed to be minimal due to differences in spawn timing.
Population Viability	*Low*. The Clearwater River Mainstem population does not currently meet NOAA Fisheries viability criteria for ESA recovery. The population also does not currently meet the criteria for a "maintained" population. No hatchery production of A-run steelhead occurs or is planned for the Clearwater basin. The HSRG (2009) estimated the habitat productivity and capacity for A-run steelhead in the lower Clearwater River as R/S = 5.2 and 1,430

	natural-origin adults, respectively.
Habitat	*Low.* The watersheds occupied by A-run steelhead in the Clearwater River are the lowest in elevation for the *Snake River Summer Steelhead DPS*. This area is also the most developed region of Idaho still accessible to steelhead. The primary fish-producing areas for this subpopulation are Big Canyon Creek, Little Canyon Creek, and the Potlatch River. The Lower Clearwater River and Middle Fork are characterized by fair to poor steelhead habitat. Notable exceptions are Big Canyon Creek and portions of Lolo Creek which are characterized as "good" steelhead habitat. Most tributaries in this area have three distinct sections consisting of a mountainous plateau at higher elevations, a steep canyon that forms an anadromous salmonid passage barrier at mid-elevations, and an alluvial valley in the lower reaches. With the exception of the Potlatch River and Orofino Creek, the tributaries in this area have intermittent summer flows during most years. Nearly all of the streams in this region have water temperatures that approach or exceed lethal limits for steelhead in the lower reaches. Fish densities are generally low throughout this population, except for a few areas where streams are fed by perennial groundwater sources. Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers.
Harvest	*Low.* Within the Clearwater River and other areas of the Columbia and Snake River basins, sport harvest on steelhead is restricted to marked hatchery fish. In the mainstem Columbia River steelhead fisheries are regulated within limits of Biological Opinion outlining take of steelhead in gillnet fisheries targeting fall Chinook.

Table 13. Lolo Creek (B-run) summer steelhead (Natural + Hatchery)

Management Premises and Goals	
ESA Status	*Threatened.* NOAA fisheries includes steelhead in Lolo Creek with the *Snake River Summer Steelhead DPS*, which is listed as a threatened species under the ESA. The HSRG (2009) classified this population as *contributing* with respect to ESA recovery of the DPS.
Biological Significance	*Low to Medium.* Lolo Creek supports both A-run and B-run steelhead. A steep-gradient narrow canyon approximately 15 miles upstream of the mouth of Lolo Creek separates upper and lower spawning areas. The lower area is thought to be used by A-run fish (see Table 12) and the upper area by B-run fish. The B-run population may have been significantly influenced by Dworshak NFH steelhead which have been outplanted into Lolo Creek intermittently since 1977. Fry were released in six years (1977-1983), fingerlings in five years (1985-1991), smolts in six years (1989-2005) and adults in 6 years (1978-2002 period).
Population Viability	*Low.* The Lolo Creek population does not currently meet NOAA Fisheries viability criteria for ESA recovery. The population also does not currently meet the criteria for a "maintained" population. The population is sustained predominantly by B-run fish; A-run fish occupy only the lower 10 to 15 miles of Lolo Creek. The HSRG (2009) estimated the habitat productivity and capacity for B-run steelhead in Lolo Creek as R/S = 2.0 and 500 natural-origin adults, respectively. The HSRG (2009) estimated R/S = 35.0 for hatchery-origin steelhead (Dworshak origin) released in Lolo Creek.

Habitat	*Low.* The Lolo Creek drainage is predominantly forested mountains, with some private agricultural lands in the middle and lower reaches of the drainage. Much of the lower 15 miles of mainstem Lolo Creek flows through a steep canyon. Habitat conditions in the drainage have been altered by farming, mining, livestock grazing, timber harvest, and road building. The primary anthropogenic changes affecting fish production are the residual effects of mining, aggressive removal of wood from streams, elevated sediment loadings, and elevated water temperatures. High summer water temperatures, channel instability from channelization, and decreased quantity and quality of spawning and rearing habitats are caused by road developments. Habitat conditions are at or near their natural potential in much of the lower 14 miles of Lolo Creek, where it flows through a canyon. Portions of the lower 30 miles of Lolo Creek are heavily impacted by livestock grazing where the stream channels are not confined by steep canyons. High fish densities were found in the canyon section. High summer water temperatures are a potential threat to production in the lower mainstem of Lolo Creek. Lolo Creek will require an active restoration strategy because of the high levels of anthropogenic disturbance in this watershed and its departure from proper functioning habitat conditions. Actions required to improve steelhead production in the Lolo Creek drainage include reduction of cattle grazing impacts; reductions in sediment loading from road construction, maintenance, and operations; restoration of degraded riparian areas; and possibly the use of artificial structures to substitute for large woody debris that was removed from the system. Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers.
Harvest	*Low.* Within the Clearwater River and other areas of the Columbia and Snake River basins, sport harvest on steelhead is restricted to marked hatchery fish. In the mainstem Columbia River steelhead fisheries are regulated within limits of Biological Opinion outlining take of steelhead in gillnet fisheries targeting fall Chinook.
Hatchery Program	
Facilities	Dworshak NFH, Clearwater Fish Hatchery.
Type	*Segregated.* All steelhead released into Lolo Creek are the progeny of hatchery-origin adults trapped at Dworshak NFH.
Authorization and Funding	LSRCP.
Primary Purpose	*Restoration/supplementation* of natural populations (U.S. vs. Oregon agreement). 50,000 unmarked Dworshak B-run steelhead smolts from Clearwater Fish Hatchery are outplanted annually into Lolo Creek.
Secondary Purposes	*Harvest.*
Broodstock Origin(s)	Same as Dworshak NFH (B-run) summer steelhead.

Table 14. Clearwater River resident rainbow/redband trout (Natural)

Management Premises and Goals	
ESA Status	*Not listed.*
Biological Significance	*Medium to High.* Redband trout are thought to represent the resident form of steelhead trout in areas where they coexist (or coexisted historically), although natural populations exist in areas outside the historic range of steelhead. In the North Fork Clearwater River drainage, where steelhead have been excluded by Dworshak dam, potential hybridization with stocked rainbow trout leaves the current distribution of native redband trout in question.
Population Viability	*Medium*. Although redband trout likely existed historically throughout the Clearwater subbasin, little is known about the current distribution or status of redband trout populations in the Clearwater River subbasin. One reason for the lack of information is the inability to distinguish juvenile steelhead and resident redband trout phenotypically. In addition, potential coexistence of native populations and naturalized trout populations from hatchery introductions confounds information on redband trout population
Habitat	*Medium to High.* The distribution and habitat characteristics for redband trout are presumed to be similar to those for B-run steelhead in the Clearwater River drainage.
Harvest	*Low on natural fish.* Resident trout fisheries occur primarily in the Lochsa River, Selway River, and Dworshak Reservoir. The resident trout fishery in Dworshak Reservoir is considered a substantial fishery resource in the Clearwater River subbasin. Originally the Dworshak Reservoir fishery was comprised primarily of rainbow trout stocked as part of the Dworshak Dam fisheries mitigation requirement. From 1972 through 1980, rainbow trout dominated the fishery in Dworshak Reservoir, with angler use averaging about 88,000 angler-hours annually (Idaho Department of Water Resources 2000). Smallmouth bass and kokanee were subsequently introduced to the reservoir, and by the 1980s, kokanee had replaced rainbow trout as the dominant fishery. Hatchery reared rainbow trout still dominate the creel of shoreline anglers in the reservoir. Beginning in 2000, all hatchery rainbow stocked in the reservoir are sterile (triploid) to minimize risk of hybridization with native cutthroat trout and redband trout

Table 15. Clearwater River westslope cutthroat trout (Natural)

Management Premises and Goals	
ESA Status	*Not listed.* The U.S. Fish and Wildlife Service ruled in August, 2003 that westslope cutthroat trout did not warrant listing as a threatened or endangered species after conducting a one year rangewide status review.
Biological Significance	*Medium to High.* Westslope cutthroat trout exhibit resident, fluvial, and adfluvial life histories within the Clearwater River subbasin. Despite widespread stocking of hatchery-origin rainbow trout and natural hybridization, areas exist within the Clearwater River subbasin where essentially pure native westslope populations are relatively common. More recent investigations suggest that introgression between westslope cutthroat trout and introduced rainbow trout in the North Fork Clearwater River may be widespread and

	substantial in some areas.
Population Viability	*Medium to High*. Three primary factors have been identified which have contributed to the decline of westslope cutthroat populations: non-native fish introductions (e.g., rainbow trout, brook trout), angling mortality, and habitat disruption. Natural hybridization with introduced rainbow trout is considered the greatest threat to the conservation of native westslope cutthroat trout populations in northern Idaho. Available status information indicates that westslope cutthroat trout populations throughout the Lochsa and Selway rivers have relatively high viabilities as self-sustaining natural populations. Data collected by IDFG suggest that westslope cutthroat trout in the Selway River subbasin have experienced slight declines in the abundance of large fluvial individuals over the past two decades. Smolt traps operated in the Lochsa River regularly catch juvenile westslope cutthroat. Westslope cutthroat trout are defined as present–depressed in all areas of the Lolo Creek, the South Fork, and Middle Fork of the Clearwater River.
Habitat	*Medium to High.* Westslope cutthroat trout are widespread in all portions of the Clearwater River subbasin except in the Lower Clearwater River. The majority of the subbasin appears to provide adequate habitat for maintenance of relatively strong populations of westslope cutthroat trout based on their current distribution and status, Dworshak Reservoir eliminated about 717,000 square yards of spawning habitat within the pool area that was suitable for resident trout and anadromous fish.
Harvest	*Low* Recreational fisheries for westslope cutthroat trout are restricted to catch-and-release only in most waters.

Table 16. Clearwater River bull trout (Natural)

Management Premises and Goals	
ESA Status	*Threatened.* Bull trout were listed as a threatened species rangewide in June 1998 (63 FR 31647).
Biological Significance	*Medium*. Bull trout exhibit adfluvial, fluvial, and resident life history patterns within the Clearwater River subbasin. No unique biological attributes of bull trout in the Clearwater River relative to populations elsewhere have been identified.
Population Viability	*Medium to High*. The Clearwater River population of bull trout is considered one of the "core" populations for recovery of the species. Based on available status information, strongly viable bull trout populations exist in the Little North Fork Clearwater drainage, the upper reaches of Meadow Creek in the Lower Selway River, and the Upper Selway River. Viable populations of bull trout in the South Fork Clearwater River are scattered and limited to headwater portions of the Crooked and Red Rivers, and Johns, Newsome, and Tenmile creeks. The Selway River supports a significant metapopulation of fluvial and resident bull trout that are widely distributed through the subbasin in variable densities. Fishing Creek supports the only strongly viable population in the Lochsa River and contains both resident and fluvial forms. The current size of the Fishing Creek population is considered "low" to "moderate" based on the quantity and quality of suitable habitat. Connectivity between the Lochsa and Selway subbasins is high, and regular exchange of

	bull trout between these areas is likely, thus adding to the overall metapopulation structure of this latter region. Dworshak Dam has likely fragmented bull trout populations in the Clearwater River: the trap at the base of Dworshak Dam catches subadult and adult bull trout every year in the spring, and bull trout are present in the lower Clearwater River. However, whether fish in the lower Clearwater River originated from Dworshak Reservoir is unknown. Hybridization and competition with introduced brook trout is a common problem is some areas of the Clearwater River basin Historic abundance and trend data are scarce because bull trout were considered a nuisance species (Clearwater subbasin Bull Trout Technical Advisory Team 1998a,, and few records of their status were maintained.
Habitat	*Medium to High*. The general habitat conditions for bull trout in the Clearwater River drainage are similar to those for westslope cutthroat trout, although bull trout have more specific habitat requirements, particularly related to the need for colder water temperatures. Idaho's conservation plan for bull trout identified ten subbasins in the Clearwater River as key watersheds for bull trout. Relatively contiguous distributions of bull trout exist in the South Fork, Selway, and Upper North Fork Clearwater rivers. Although bull trout are widely distributed in the Lochsa River, they are absent from many tributary systems in the lower half of that drainage. Bull trout are sparsely distributed in Lolo Creek and the Middle Fork Clearwater Rive, using the mainstem reaches of Lolo Creek and upper reaches of Clear Creek for spawning/rearing, and the Middle Fork Clearwater River for migration. Bull trout in inhabit the North Fork Clearwater River upstream of Dworshak Reservoir, and they also occupy Dworshak Reservoir where some bull trout may spend extensive amounts of time feeding. With the exception of the mainstem Clearwater River, bull trout are largely absent from tributaries in the Lower Clearwater River.
Harvest	*Low.* Recreational fishing for bull trout is restricted to catch and release only.

Table 17. Dworshak Reservoir kokanee (Naturalized)

Management Premises and Goals	
ESA Status	*Not listed.*
Biological Significance	*Low.* Kokanee are a landlocked form of sockeye salmon and are not native to the Clearwater River subbasin. Kokanee were first stocked into Dworshak Reservoir in 1972. Four sources of fish were initially used, but the early spawning strain from Anderson Ranch Reservoir, Idaho, now populates the reservoir.
Population Viability	*High*. A self-sustaining, naturalized population of kokanee has become established in Dworshak Reservoir and the N.F. Clearwater River. Kokanee are unique in their ability to build high population numbers in a drawdown reservoir like Dworshak Reservoir. Winter water releases from Dworshak Dam result in significant entrainment of kokanee and high fluctuations in annual population abundance. Water releases during the summer result in substantially less kokanee entrainment because fish are more active and tend not to be congregated near the dam. Kokanee spawner counts also fluctuate widely with the change in reservoir populations and entrainment loss. Strobe lights are being tested near Dworshak Dam as a method to reduce kokanee entrainment.

Habitat	*High.* Kokanee spawn during September in tributary streams of the North Fork Clearwater River as far as 140 km upstream of the reservoir. Spawning and rearing habitat for kokanee are considered excellent. Fish losses associated with entrainment during reservoir drawdowns is the primary factor affecting the abundance and productivity of kokanee in Dworshak Reservoir and the North Fork Clearwater River.
Harvest	*High.* Kokanee provide a highly desirable and popular sport fishery in Dworshak Reservoir. IDFG considers kokanee a substantial fishery resource in the Clearwater River subbasin. In high abundance years, over 200,000 kokanee have been harvested in Dworshak Reservoir. Kokanee were first stocked into Dworshak Reservoir in 1972. From 1972 through 1980, hatchery-origin rainbow trout dominated the fishery in Dworshak Reservoir. However, by the 1980s, kokanee had replaced rainbow trout as the dominant fishery in the reservoir. Kokanee abundance and harvest within the Reservoir fluctuates widely (as much as 50 fold) due to entrainment losses into the dam

Other Species of Concern

Table 18. Non-salmonid fish species native to the Clearwater River watershed.

Common name	Scientific Name
Bridgelip Sucker	*Catostomus columbianus*
Chiselmouth	*Acrocheilus alutaceus*
Largescale sucker	*Catostomus macroheilus*
Longnose dace	*Rhinichthys cataractae*
Sculpins	*Cottus sp.* (4 species)
Mountain whitefish	*Prosopium williamsoni*
Northern pikeminnow	*Ptychocheilus oregonensis*
Pacific lamprey[39]	*Lampetra tridentata*
Peamouth	*Mylocheilus caurinus*
Redside shiner	*Richardsonius balteatus*
Sandroller	*Percopsis transmontana*
Speckled dace	*Rhinichthys osculus*

Avian predators commonly observed include gulls, bald eagle, osprey, great blue heron and kingfisher. River otters also occur in the Clearwater River and have the potential to prey on program fish.

Salmon and Steelhead Hatcheries in the Watershed[40]

Dworshak National Fish Hatchery (U.S. Fish & Wildlife Service, Army Corps of Engineers, and LSRCP)

Dworshak NFH is located at river mile 40 (rkm 65) of the Clearwater River at the confluence of the North Fork Clearwater River. The hatchery was included in the authorization for the Dworshak Dam and Reservoir and constructed by the Army Corps of Engineers (ACOE) between 1966 and 1970 to mitigate for the loss of the wild run of the North Fork Clearwater River "B-Run" summer steelhead (*Oncorhynchus mykiss*) caused by the construction and operation of the dam and reservoir. Dworshak Dam, constructed by the U.S. Army Corps of Engineers (COE), was authorized under the "Rivers and Harbor Act of 1962 - Flood Control Act of 1962" (Public Law 87-847, October 23, 1962). The construction of Dworshak Dam completely blocked access by salmon and steelhead to all but the lower 1.5 miles of the North Fork Clearwater River immediately downstream from the Dam. Operations of the hatchery was authorized by a 1969 ACOE *Memorandum of Understanding* with the U.S. Fish and Wildlife Service.

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

[40] *See Figure 3.*

Facility operations, maintenance, fish health, and monitoring and evaluation at Dworshak NFH for steelhead and rainbow trout are 100% funded by the U.S. Army Corps of Engineers. The LSRCP and Bonneville Power Administration (BPA) fund a spring Chinook program at Dworshak NFH to mitigate for fish losses resulting from the construction and operation of four "run-of-the-river" hydroelectric dams on the lower Snake River in Washington State.

The current personnel plan for the hatchery lists 23 full-time employees. The annual operation and maintenance (O&M) budget (FY2008) for the hatchery was $2,385,000 from the Army Corps of Engineers (Dworshak Dam mitigation) plus $472,432, from the LSRCP and BPA. Approximately $220,000 was spent on marking and tagging Dworshak NFH program fish in 2008. Additional monitoring and evaluation (M&E) costs include $1.3 million distributed among the operating agencies for all LSRCP programs. Additionally, $70,360 and $90,000 (FY2008) were provided by the LSRCP and Army Corps, respectively, for fish health monitoring. Capital improvements to Dworshak NFH totaled $600,000 for 2004- 2008.

Kooskia National Fish Hatchery (U.S. Fish & Wildlife Service and Nez Perce Tribe)

Kooskia NFH is located on Clear Creek, a tributary to the Middle Fork Clearwater River at river mile 77 (rkm 124). The hatchery and its programs are 100% funded by the U.S. Fish & Wildlife Service.

Kooskia NFH was authorized by Congress on August 31, 1961 (75 Statute 255) to rear spring Chinook salmon for release into the Clearwater River Basin. Construction began in 1966, and fish production began in 1969. The purpose of the hatchery is to mitigate for reduced tribal and sport fisheries in the Clearwater River resulting from water development projects in the Columbia River basin. Because Kooskia NFH is directly funded by the U.S. Fish & Wildlife Service and not by reimbursable funds from another agency, the hatchery programs at Kooskia NFH are somewhat more flexible than programs funded as part of specific mitigation agreements (e.g., Army Corps of Engineers) although compliance with the U.S. vs. Oregon comanager agreement and other regional/national directives apply. Kooskia NFH currently supports a spring Chinook program and releases up to 650,000 yearling smolts annually into Clear Creek.

The current personnel plan for the hatchery lists 1 Service and 3 tribal full-time employees. The annual operation and maintenance (O&M) budget (FY2008) for the hatchery was $433,195 from the U.S. Fish and Wildlife Service. Approximately $50,000 was spent on marking and tagging Kooksia NFH program fish in 2008. Additional monitoring and evaluation (M&E) costs include $1.3 million distributed among the operating agencies for all LSRCP programs. Additionally, $54,000 (FY2008) from the U.S. Fish and Wildlife Service were allocated for fish health monitoring. Capital improvements to Kooskia NFH totaled $213,088 for FY2004- 2007.

Kooskia NFH is currently entering a period of transition. Recent adoption (May 2007) of the *Snake River Basin Adjudication Agreement* transfers operation and management of the facility from the U.S. Fish & Wildlife Service to the Nez Perce Tribe. The Service will continue to own the hatchery as a National Fish Hatchery, but day-to-day operations will transition to the Tribe. An annual cooperative agreement between the Service and the Tribe currently governs operations and management of Kooskia NFH. The Service currently transfers funds to the Tribe to pay the salaries of the Tribal employees. All other hatchery expenses are paid directly by the Service. This arrangement is anticipated to continue into the foreseeable future.

Clearwater Fish Hatchery (Idaho Department of Fish & Game and LSRCP)

Clearwater FH was built under the LSRCP Program, as authorized by the Water Resources Development Act of 1976, Public Law 94-587, to offset fish losses caused by the construction and operation of four hydropower dams on the lower Snake River. The hatchery is located at confluence of the North Fork and mainstem Clearwater rivers, at river mile 40 (rkm 65) on the Clearwater River, 70 miles (121 km) upstream from Lower Granite Dam and 523 miles (842 km) upstream from the mouth of the Columbia River. The hatchery was completed and became operational in 1990.

The hatchery includes three satellite facilities for releasing juvenile Chinook salmon and capturing adult fish for broodstock: (1) Powell satellite facility, located near the community of Powell at the confluence of Walton Creek and the Lochsa River; (2) Red River satellite facility, a tributary to the South Fork Clearwater River at river mile 63 (rkm 101), and (3) Crooked River satellite facility, also a tributary to the South Fork Clearwater River at river mile 58 (rkm 94). These satellite facilities are currently used to trap adult spring Chinook salmon for broodstock and release their hatchery produced progeny into the respective watersheds. Egg incubation and rearing of spring Chinook occurs at the Clearwater FH, but the hatchery itself does not have the capability to release fish or capture adult fish for broodstock.

In addition to spring Chinook, the Clearwater FH rears Dworshak NFH steelhead – obtained as fertilized or eyed eggs from Dworshak NFH – for release into the South Fork Clearwater River or transfer to Hagerman NFH and Magic Valle FH for eventual release into the Salmon River. Clearwater FH does not collect or trap adult steelhead to meet broodstock needs. Adult trapping associated with the production of eggs for incubation and rearing at the Clearwater FH occurs at the Dworshak NFH. Clearwater FH's three satellite facilities (Red River, Crooked River, and Powell) also have adult trapping and holding capabilities but are not used currently to trap adult steelhead for broodstock.

The current personnel plan for the hatchery lists eight full-time employees. The annual operation and maintenance (O&M) budget (FY2009) for the hatchery is $1566,235 from the LSRCP and BPA. Total costs to Idaho Department of Fish and Game (IDFG) for monitoring and evaluation (M&E) of Idaho LSRCP activities in FY2009 were approximately $1,447,258 and include ~$700,00 for tagging and marking. Capital improvements to Clearwater FH totaled $189,765 during the period 2004- 2008.

Nez Perce Tribal Fish Hatchery (Nez Perce Tribe)

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

Big Canyon Fall Chinook Acclimation Project

The Nez Perce Tribe operates and maintains three satellite facilities (developed since 1996) for releasing fall Chinook smolts originating from Lyons Ferry FH: two facilities on the Snake River and one facility at the confluence of Big Canyon Creek and the Clearwater River. Up to 150,000 yearling

fall Chinook smolts are acclimated and released annually at each facility. Up to 1.8 million subyearlings per year have also been acclimated and released among the three satellite facilities. Fish released from the three satellite facilities are uniquely marked, and returning adults are allowed to ascend upstream of Lower Granite Dam to spawn naturally.

Dworshak NFH B-run Steelhead

Operator: U.S. Fish & Wildlife Service

Summary of Current Program

The propagation of steelhead at Dworshak NFH is funded by the Army Corps of Engineers (ACOE) to mitigate for the loss of natural populations and habitat caused by the construction and operation of Dworshak Dam. In addition, Dworshak NFH participates in the Lower Snake River Compensation Plan (LSRCP) by providing fertilized steelhead eggs for incubation and rearing at LSRCP facilities. The assessments and recommendations presented here for Dworshak NFH B-run steelhead are directed primarily at the ACOE's Dworshak Dam mitigation program that is managed by the Service. LSRCP Dworshak B-run steelhead programs are assessed in separate reports for Hagerman NFH (this volume), and the LSRCP report for Clearwater and Magic Valley fish hatcheries (separate volume). Nevertheless, some overlap in broodstock collection occurs between the two programs, as indicated below.

Goals

- ***Harvest goal***: The total harvest goal for "B-run" steelhead in the Clearwater River, which includes fish originating from Dworshak NFH, is 12,642 fish per year under current conditions.[41] The long-term future harvest goal for B-run steelhead in the Clearwater River is 25,000-74,000 fish per year.[Ibid.] A specific harvest goal for the steelhead program at Dworshak NFH has not been established. However, the Service has established a total adult return goal of 30,000 Dworshak NFH B-run steelhead to the Columbia River below Lower Granite Dam with 20,000 of those steelhead returning to the Clearwater River. Of those returning adults, approximately 1,850 to 2,500 fish are required for broodstock at Dworshak NFH to support Dworshak mitigation obligations, and an additional 1,150 to 1,500 adults are required to provide fertilized or eyed eggs for the LSRCP program (≈ 4,000 adults in total). If the Service's return goal of 20,000 Dworshak NFH steelhead back to the Clearwater River is achieved, then approximately 15,000 of those fish would be harvestable. The actual Army Corps of Engineers mitigation goal was to rear and release the estimated number of offspring (smolts) that would have been produced from the mean number of adult steelhead returning to the Dworshak Dam site from 1967 through 1971.

- ***Broodstock escapement goal***: Trap 1,850 to 2,500 hatchery-origin adult steelhead returning to Dworshak NFH annually to meet Dworshak Dam mitigation obligations. A minimum of approximately 620 females are necessary to meet egg take objectives (approximately 6,700 eggs/female) for the program, and a minimum of 740 females need to be trapped to account for pre-spawning mortality and inviable eggs. However, additional broodstock must be collected to obtain a minimum of approximately 620 males because adult females outnumber males by approximately a 2.3 to 1.0 ratio. In addition, Dworshak NFH needs to trap and retain 1,150-1,500 steelhead broodstock annually to provide gametes and fertilized eggs to Clearwater FH for

[41] *NWPCC Clearwater River Subbasin Plan, Table 3. http://www.nwcouncil.org/fw/subbasinplanning/clearwater/plan/.*

LSRCP programs. Overall, a total of 3,000-4,000 adult steelhead need to be trapped and retained for broodstock annually at Dworshak NFH to meet broodstock objectives for both programs.

- ***Conservation goal***: Conserve and perpetuate the unique North Fork Clearwater River B-run summer steelhead population. Dworshak NFH B-run steelhead are included with the Snake River Steelhead ESU which is listed as threatened under ESA.

- ***Escapement goal for natural-origin adults***: The hatchery program has no established escapement goal for natural-origin adult steelhead in the Clearwater River. Dworshak Dam, approximately two miles upstream of Dworshak NFH, prevents upstream passage of all anadromous fish in the North Fork Clearwater River.

- ***Research, education, and outreach goals***: Provide accurate information and educational (I&E) opportunities for the public, media, schools, and tribal, state, and federal agencies; provide elected officials opportunities to enhance understanding and stewardship of Dworshak NFH and U.S. Fish & Wildlife Service programs. The Service's Idaho Fishery Research Office (Ahsahka, ID) monitors, evaluates, and coordinates fishery services and research activities for the Dworshak Fisheries Complex.

Objectives

- Trap 1,850 to 2,500 adult steelhead (minimum ≈740 females) annually.

- Spawn approximately 620-680 females and 620-680 males pairwise to obtain a total egg take of approximately 4.0-4.3 M green eggs annually, assuming a mean fecundity of approximately 6,700 eggs per female.

- Obtain 2.8 M eyed eggs for on station hatching and rearing to the yearling smolt stage.

- Release 1.2 million yearling smolts on station at Dworshak NFH into the Clearwater River. Truck and outplant 300,000 smolts into Clear Creek (Kooskia NFH), 400,000 smolts into the lower South Fork Clearwater River at the "Red House" release site, and 200,000 smolts with unclipped adipose fins into tributaries of the upper South Fork Clearwater River (100,000 smolts each into Newsome Creek and American River, respectively). A total of approximately 900,000 smolts are released off-station.

- ***LSRCP* objective**: Trap and spawn an additional 1,150-1,500 adults to provide (a) 1.3 million fertilized green eggs for immediate transfer to Clearwater Fish Hatchery and (b) 1.4 million fertilized green eggs for incubation at Dworshak NFH with subsequent transfer as eyed eggs to Clearwater Fish Hatchery.[42]

[42] *See the Hagerman NFH B-run steelhead section in this report, and the B-run steelhead sections for Clearwater and Magic Valley fish hatcheries in the Idaho-LSRCP Fish Hatcheries Assessments and Recommendations Report.*

Program Description

The intent of the steelhead mitigation program at Dworshak NFH is to return 20,000 adult steelhead to the mouth of the Clearwater River annually while perpetuating and maintaining the unique genetic characteristics of the North Fork Clearwater B-Run summer steelhead population (Miller 1987; U.S. Fish and Wildlife Service 2002a). Genetic studies in the 1970's identified Dworshak NFH B-run steelhead (N.F. Clearwater River origin) as one of the most genetically distinct populations of steelhead in the Columbia River Basin. Returning natural-origin adult fish from this population were blocked from their original spawning grounds after the construction and closure of Dworshak Dam in 1969. Dworshak NFH was constructed to mitigate for those habitat losses and maintain the native population.

Prior to 1985, all steelhead were released directly from the hatchery. As adult returns back to the hatchery increased during the early 1980's, the sport fishery became increasingly concentrated in the lower Clearwater River immediately downstream from the hatchery, causing significant traffic and congestion problems. Harvest success subsequently decreased due to presumed increased harassment of the fish. These events resulted in substantially more fish returning back to the hatchery than required for broodstock, thus creating additional problems at the hatchery. A task force was formed in 1983 to review the fishery management problems with a final recommendation to release approximately 50% of the hatchery-produced smolts upstream of the hatchery in the mainstem areas of the Clearwater River (e.g., Clear Creek, South Fork Clearwater River). These outplants have continued and are considered part of the mitigation releases authorized and funded by the Army Corps of Engineers.

Dworshak NFH B-run steelhead enter the Columbia River in August through September, usually later than "A" run fish which have a smaller mean size. Dworshak NFH steelhead may reach the Snake and Clearwater rivers during the fall months, then over-winter, prior to entering the hatchery in late winter and early spring. The Dworshak NFH trap is operated during the fall to ensure inclusion of sufficient early arriving steelhead (~500 adults) into the hatchery gene pool. The trap is closed after 500 steelhead are trapped and is reopened from February through April to capture broodstock from the middle and late portions of the run.

Adults retained for broodstock are comprised of three life history classes: I-, II-, and III-"salt" fish, referring to the number of complete years that have elapsed between outmigration as smolts to the ocean and return as adults (ages 2, 3, and 4 years, respectively). Mean length at maturity is approximately 91 cm (36 inches) and 82 cm (33 inches) for males and females, respectively. From 1983 to 2000, all summer steelhead smolts released from Dworshak NFH were adipose-fin clipped to identify them as hatchery fish. In 2000, the Service entered into an agreement with the Nez Perce Tribe through the U.S. vs. Oregon process to release 100,000 unclipped steelhead smolts marked with blank coded-wire tags to ensure adequate escapement of unharvested fish into traditional tribal fishing areas that could potentially support natural populations. In 2004, the 100,000 unclipped, blank coded-wire tag releases were replaced with 200,000 unclipped smolts released into two tributaries of the South Fork Clearwater (100,000 smolts each in Newsome Creek and American River). Dworshak NFH B-run steelhead are propagated as a genetically segregated broodstock with no natural-origin fish included, or available, for broodstock.

Assessment of Current Program

Operational Considerations

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

Broodstock Choice and Collection

- Dworshak operates an adult fish ladder to capture steelhead from the entire spectrum of the run. This includes the adult returns to Dworshak NFH in the fall of each year (October–December), and mid-winter through spring (February–April).

- Starting about October 1 each year, 500 steelhead are captured as part of the early adult return; the collection of the mid-to-late returning adults begins in February for collecting an additional 1,350-2,000 adults for the Dworshak steelhead mitigation program.

- The 500 steelhead collected in the fall are only used to produce offspring for on-station releases from Dworshak NFH.

- An additional 1,150-1,500 adults are collected during the peak of the run in March (approximately March 1-31) to provide fertilized and eyed eggs to the Clearwater FH in support of LSRCP steelhead programs.

- Approximately 400,000 smolts, or about 20 percent of the total number of smolts released at Dworshak NFH, are from the 500 adults trapped in the fall.

- Adult steelhead trapped in the fall are held in a separate adult holding pond. These fall-collected fish are spawned in the first two to three egg takes for producing each brood year, separate from the middle and late returning steelhead that are collected for broodstock in the late winter and early spring.

- The progeny of fall-trapped fish are given a different coded wire tag code than the progeny of fish trapped in the winter and spring. Although spawn dates of parents and progeny are positively correlated, progeny of each spawn group are distributed among most spawn groups as returning adults. Twelve to 13 spawn takes occur each year, beginning in late January and ending in late April.

- At the first sign of fungus, the adult steelhead broodstock are treated with a standing bath of formalin (5 gallons dripped into pond over one hour). The first application time and the number of treatments/week depends on fungus levels but once treatment has begun, formalin is applied at least once per week (and up to three times per week) through spawning.

- In the past, when adult steelhead numbers returning to Dworshak NFH were below the number required to meet the egg take goal, steelhead trapped at Kooskia NFH (Clear Creek weir) were spawned to provide additional eggs at Dworshak NFH. However, 1995 was the last year that steelhead eggs collected at Kooskia NFH were transferred to Dworshak NFH to meet egg take goals.

- Adult steelhead with clipped adipose fins collected at Kooskia NFH represent returning adults from a 300,000 outplanted release from Dworshak NFH. Those returning adults at Kooskia NFH are not retained for broodstock but are outplanted into the South Fork Clearwater Basin, primarily the mainstem South Fork Clearwater River, to support harvest. Unmarked adults trapped at Kooskia NFH are passed above the weir on Clear Creek. The Clear Creek weir is operated from February – April to control and assess upstream migration of steelhead.

- Surplus adult steelhead entering Dworshak NFH in the spring are usually out-planted to the lower South Fork Clearwater Basin at the "red house" release site to provide additional fishing opportunities and further distribute fishing activities on hatchery-origin fish

Hatchery and Natural Spawning, Adult Returns

- The mean hatchery smolt-to-adult return rate back to Dworshak NFH for the return years 1993 – 2002 was 0.37%.

- B-run steelhead spend 1-3 years in saltwater environments before returning to spawn, with over 90 percent having spent two years. Due to differing lengths of ocean residence, B-run and A-run steelhead can be based on size with B-run fish averaging 75-100 mm longer than A-run fish.

- Spawning of steelhead usually begins the last week of January and ends the first week of May. Steelhead trapped from throughout the run produce progeny for on-station releases at Dworshak NFH. Between 100,000 and 300,000 fertilized eggs are retained from each spawn take (12-13 spawn takes per year) for on-station releases.

- Fall-collected adult steelhead produce offspring released only at Dworshak NFH program.

- For the fall collected steelhead, Gonadotrophic Releasing Hormone (GNRHa) is used to ensure an adequate number of males are sexually mature for spawning during the first two takes in January. Typically, 70 males are injected two weeks prior to spawning.

- The fish ladder entering the hatchery is opened intermittently each week to allow entry of only the number of adults needed for spawning the following week.

- Female steelhead returning to Dworshak NFH usually outnumber males 2.3 to 1 in their return ratio, or approximately 3 females for every 1-2 males. Based on a mean fecundity of 6,700 eggs per female, approximately 630 females are needed to provide sufficient numbers of eggs to meet the on-station smolt release objective at Dworshak NFH (1.2 million smolts) and the outplanting objectives in Clear Creek (300,000 smolts) and the South Fork Clearwater River (600,000 smolts). However, the total number of steelhead (males + females) required for broodstock annually to (a) meet these Dworshak mitigation smolt release obligations and (b) provided sufficient numbers of males for pairwise spawning (1 female: 1 male) is 1,850 to 2,500 fish because of pre-spawning mortality and a skewed sex ratio among adults where females outnumber males by approximately 2.3 to 1.

- In order to provide fertilized steelhead eggs for the LSRCP programs, approximately 1,200-1,500 adult steelhead are retained for broodstock and spawned in addition to the approximately 1,850-2,500 adult steelhead retained for broodstock to meet Dworshak mitigation objectives.

- Sexually mature fish are spawned each week until the egg take target for that week is reached.

- Adult steelhead of all ages are spawned, including two-year-old males and females. Most fish are 3 to 4 years old with some 5 year-old fish included.

- Fish are anesthetized with carbon dioxide at spawning so that surplus adults can be used for human consumption.

- Adult health certification examinations are done to ascertain viral, bacterial, and parasite infections and to provide a brood health profile for the progeny. The Idaho Fish Health Center (USFWS) tests for relevant pathogens, including the parasites *Myxobolus cerebralis* and *Ceratomyxa shasta*.

- Natural spawning of B-run steelhead in the Clearwater River is poorly documented. Wild/natural steelhead in two S.F. Clearwater River tributaries (Crooked and Red Rivers) were below a critical population threshold, based on redd counts 1991-1999, and are considered functionally extinct. Aerial surveys of the Crooked River (via helicopter) revealed approximately 200 redds in 1990, 50 redds in 1991, 20 redds in 1992, 4 redds in 1993, 3 redds in 1994, 4 redds in 1995 and none in 1996.[43]

- Abundance of natural origin B-run steelhead in the Clearwater River in recent years has been moderately variable, the most recent 10-year geometric mean number of natural spawners was estimated to be 272 fish based on a mathematical partitioning among watersheds of the number of unmarked B-run steelhead counted at Lower Granite Dam (NOAA Fisheries draft salmon and steelhead recovery plan for Idaho[44]). During the period 1986-1998, the estimated number of adult recruits (R) per spawner (S) for B-run steelhead in the Clearwater River ranged from R/S = 0.24 (1990) to R/S = 6.63 (1998). The most recent 13-year geometric mean smolt-to-adult return (SAR) rate was 0.85% (SR-016). The abundance of natural origin steelhead spawners ranged from approximately 100 to 1,600 fish, 1986-2004 (Figure 2 of SR-016).

- From 2000 to 2006, the sport fishery harvested an estimated 12,230 to 30,168 fish per year in the Clearwater River, and the tribal fishery harvested an estimated 1,000 to 1,470 fish per year in the North Fork of the Clearwater River.

- Recent five-year average for code-wire tag recovery data from Dworshak NFH indicate significant contribution to Columbia River gillnet fisheries (≈600 fish/year).

- Straying of Dworshak NFH B-run steelhead has not been identified as significant or a risk. Less than 1% of coded wire tags for Dworshak NFH steelhead are recovered outside the migration corridor or terminal fishery areas. This homing fidelity is substantially higher than other Snake River hatchery stocks of steelhead (e.g., Wallowa Hatchery steelhead) which stray at very high rates into other watersheds, thus posing significant biological risks to native populations (e.g., steelhead and native rainbow trout in the Deschutes River, Oregon).

- In addition, for the LSRCP Clearwater Fish Hatchery program, fertilized eggs from adults that return early-to-mid March are used to produce fish reared at Clearwater FH for outplanting in the South Fork Clearwater River, and fertilized eggs from adults that return late March to early April are transferred to Clearwater FH on the day of spawning, incubated to the eyed stage, and

[43] *IDFG 1996. Evaluation and Monitoring of Wild/Natural Steelhead Production. Report to Bonneville Power Administration*

[44] *http://www.idahosalmonrecovery.net/index.html*

then transferred as eyed eggs from Clearwater FH to Hagerman NFH and Magic Valley FH for ultimate release in the Salmon River.

Incubation and Rearing

- Water to the nursery building at Dworshak NFH is supplied from cold (41-45°F) and warm water lines coming out of Dworshak Reservoir. These water lines are the main source of water for all rearing at the Clearwater Hatchery. At Dworshak NFH, cold water from the reservoir is heated to an average of 54ºF for early rearing (incubation and nursery rearing) to accelerate hatch and initial growth of steelhead. Water from Dworshak Reservoir is not exposed to anadromous fish, thus reducing fish health risks to juvenile fish in the nursery building. Water flows to the hatching trays and jars are maintained at approximately 3-4 gpm.

- Heated water to the trays, jars, and nursery tanks is single pass water only and, in contrast to the outdoor Burrows ponds (see Rearing section below), is not reused (recirculated) because of past problems with *Icthyophthirius*.

- Eggs are placed in Heath incubator trays at approximately 6,700 eggs per tray (one female per tray) and water-hardened in buffered iodophor for 30 minutes.

- Eggs and fish resulting from each spawn take are maintained separately throughout rearing until release.

- Incubating eggs are shocked, enumerated and placed into hatching jars (16,500 eggs/jar) at the eyed stage or, because of space constraints, returned to Heath trays at 4,000–6,000 eggs per tray. Only eyed eggs from the last three spawn dates (takes 10-12) are reloaded into incubation trays.

- Formalin treatments are administered to the incubating eggs three days per week to control fungus.

- From 2003-2007, survival rates were 93.5% from fertilization (green egg stage) to eyed eggs, and 92.6% from eyed eggs to hatch and transfer to the indoor nursery tanks. Hatching occurs from mid-February (spawn take 1) thru June (spawn take 12).

- The hatching jars drain directly into the nursery tanks. As the fry swim up in the jars, they are carried with the water flow into the tanks for initial rearing. Fry from spawn takes 10 thru 12 (the last three spawn takes) are moved into nursery tanks after fry from the first two spawn takes (1 and 2) are transferred to outside ponds,.

- The water supply to the incubation building is sufficient to meet all needs for egg incubation and early rearing of hatched fry. The flow index for the rectangular nursery tanks is F.I. = 1.5 [lbs./(mean length)(gpm)] at maximum loading. However, rearing space in the nursery tanks is limited, and density indexes up to a maximum value of 0.75 are used to determine loading capacities of hatched fry in each tank (capacity of each tank is 680 gallons). There are 128 nursery tanks in the incubation building.

- Each nursery tank is stocked at an initial density of approximately 16,500 fry/tank (D.I. = 0.07). Density indices in the tanks reach 0.5 -0.75 prior to transfer to outdoor Burrows ponds when mean size reaches approximately 85 fish per pound. Steelhead of this size and larger have reduced susceptibility to infectious hematopoietic necrosis virus (IHNV). This virus is present in

the N.F. Clearwater River (downstream from Dworshak Dam), which is the water source for the outdoor Burrows' rearing ponds.

- Coldwater disease is a recurring problem for steelhead in the juvenile nursery tanks and is assumed by the Idaho Fish Health Center to be exacerbated by high early rearing densities.

- Fish in the indoor nursery tanks have, on occasion, required antibiotic treatment to control infections of pathogenic bacteria (e.g., *Pseudomonas* sp.). However, these antibiotic treatments have been rare.

- Approximately 550 temperature units (TUs) are required for incubation to hatching/swim-up. Swim-up fry have a mean length of 1.05 inches (≈2,500 fish per pound).

- Nitrogen gas levels are tested if gas bubble disease is suspected in the nursery. This has been an issue only when the degassing structure for the tank water has not been properly cleaned and maintained.

- The fish are transferred to the outside Burrows' ponds from late May to August when they are approximately 80-85 fish per pound (mean length approximately 3 inches) for final rearing prior to release the following April. Prior to ponding outside, steelhead in the nursery tanks are gradually acclimated from their indoor rearing temperature of 54° F to about 43ºF.

- Water from the N.F. Clearwater River (40 to 50ºF) is used for outdoor rearing in the Burrows' ponds. This water is a source of fish pathogens from anadromous salmonids because the pump house is immediately upstream of the fish ladder leading into the adult holding ponds.

- The 84 Burrows' ponds have a volume of 22,000 gallons/pond and are stocked with fingerlings at a density of 25,000–33,000 fish/pond, for a total of approximately 2.2–2.3 million fish.

- Fish are mass marked with a clipped adipose fin when they are transferred from the indoor nursery tanks to the outside Burrows ponds (late May to August). Representative fish are subsequently tagged with coded-wire tags after ponding, usually in September but sometimes in October or November. Tagging with passive integrative transponder (PIT) tags is usually done in January or February a few month prior to release.

- IHNV kills significant numbers of juvenile steelhead, beginning in June and continuing through September and October after tagging. For brood year 2006, monthly mortalities up to 6.9% in August 2007 were attributed to the virus. Chronic coldwater disease further exacerbates IHN.

- From November until March/April, approximately two-thirds of the steelhead in the Burrows' ponds (the middle and late spawn takes) are on a heated water re-use system (systems 1 and 2) at approximately 52 ºF. In these Burrows' ponds, water reuse and heating is used during the colder months of November through March enabling the fish to grow at a rate that will allow them to achieve the appropriate size at release the following spring. Fish resulting from the first one-third of the egg takes are not on reuse water. The reuse system adds 10% new water during each recycle (90% of the water is filtered and recirculated) to make up for various water losses in each system. Three fish ponding systems exist outdoors, and each is independent of the others for controlling temperatures when reuse and heated water are available. The heated water (via reuse) is necessary to obtain a 200 mm smolt at release, although fish health can deteriorate

while the fish are on reuse water. For Dworshak NFH B-run steelhead, smaller fish (<180 mm FL) emigrate at a lower rate and residualize (fail to outmigrate from Clearwater River) at a much higher rate compared to medium (180–200 mm FL) or larger fish (>200 mm FL).

- The re-use of water (systems 1 and 2) in the Burrows ponds promotes infections of *Ichthyophthirius* sp. *(Ich*) in the steelhead juveniles. Before going on reuse water in November, steelhead are treated with 166 ppm formalin as a precaution to inhibit infestations. Regularly scheduled treatment for *Ich* usually begins after detection of the parasite and consists of twice-weekly applications of formalin dripped for 12 hours into raceways to maintain a concentration of 25-50 ppm over 24 hours. Single-pass water is used beginning one month prior to release, at which time problems with *Ich* cease, and formalin is no longer required except on an "as needed" basis to treat other parasites. Lowering water temperatures from 54-56 F to 52 F significantly reduces problems with *Ich*.

- Sodium and potassium salts (8 ppm) must be added to the reuse water to control nitrite toxicity (*methemoglobinemia*), otherwise steelhead juveniles do not smolt and may die. The salts are added as soon as the reuse water system is started. Salt concentrations in the reuse system are measured every other day. The salt pumps run constantly and are adjusted accordingly throughout the reuse cycle.

- The survival rate from the fingerling stage at time of transfer to the outdoor Burrows ponds to the smolt stage at the time of release averaged 88.3% for brood years 2002 -2006.

- Maximum density indices range from D.I. = 0.20-0.25 in the Burrows' ponds.

- Minimum dissolved oxygen level is 6 ppm in the nursery building and 7-8 ppm in the Burrows' ponds. An oxygen level of 6 ppm is considered below optimum for maintaining healthy fish at this early life stage. Oxygen is monitored when fish are given a chemical treatment for disease. There is no regular schedule to check oxygen.

- The Idaho Fish Health Center conducts fish health exams on each stock and brood year class on a monthly basis (or more, as necessary).

- Growth is suppressed during summer months as a result of the cold water discharges from Dworshak Dam.

- For BY 2008, Dworshak NFH will provide 2.58 million green eggs (for the LSRCP program) to Clearwater FH for the Hagerman NFH, Clearwater Hatchery, and Magic Valley Hatchery B-run steelhead programs. 1.33 million of the green eggs are collected for the Hagerman and Magic Valley programs for releases of Dworshak steelhead in the Salmon River basin. Hagerman NFH will receive 215,000 eyed eggs (for a 200,000 smolt release) and Magic Valley FH will receive 830,000 eyed eggs (for a 750,000 smolt release). The remaining green eggs (1.25 million) are for the Clearwater program for a 843,000 smolt release in various locations in the South Fork Clearwater River)][45]

Release and Outmigration

[45] *From the Comanagers Draft 2008 Clearwater River Annual Operations Plan (AOP).*

- Nearly 2.1 million summer steelhead smolts are released into the Clearwater River basin each year;

- All but 200,000 released steelhead are given adipose-fin-clips. The unclipped fish are released into Newsome Creek and American River, and/or other South Fork Clearwater River tributaries, to support tribal fisheries and natural spawning supplementation in those designated areas under U.S. vs. Oregon agreements.

- Of the remaining steelhead smolts released annually, six groups of 30,000 fish each are coded-wire tagged and receive a left ventral fin clip to allow evaluation of various aspects of the production program such as the rearing systems, release sites, size at release, and return timing of adults.

- In addition, about 1,500 are PIT-tagged to monitor emigration. Starting with release year 2008, an additional 20,000 steelhead will be PIT-tagged as part of the Army Corps of Engineers evaluation program, and an additional 8,000 will be PIT tagged for the *Comparative Survival Studies* that are evaluating relative smolt-to-adult survivals for barged vs. non-barged fish.

- Pre-release fish health exams test for all relevant pathogens, including the causative agents of whirling disease and ceratomyxosis.

- Fish are released at a mean size between 180 mm and 200 mm fork length to reduce freshwater residualization and potential predation on Chinook juveniles after release.

- Steelhead are typically released in mid-April over a two week period. First, about 1.0 million summer steelhead smolts are trucked upstream approximately 35 miles for release into Clear Creek and the South Fork Clearwater River Basin. The next week, about 1.1 million smolts are released directly from Dworshak NFH into the mainstem Clearwater River. On-station releases occur during daylight from 7:30 am to 3:30 pm daily.

Facilities and Operations

- Dworshak NFH uses a mechanical and electrical water reuse and reconditioning system for the Burrows' Ponds (steelhead program), employing particle filtration, biological nitrification, pollution control, monitoring facilities, alarm system, water chillers, heaters, and numerous pumps.

- There are four adult holding ponds. These ponds and the ladder are operated on single-pass river water.

- The incubation/nursery building has space limitations necessitating higher than desired steelhead rearing densities in the nursery tanks.

- The facility uses reuse water in the Burrows' ponds for 3 to 4 months each year to provide warmer water necessary to achieve the desired size at release (≈ 200 mm) at one year of age. One of the three reuse systems (system 3) is degraded and difficult to clean; therefore, the earlier takes of steelhead are reared in Burrows ponds associated with this system and are kept on single pass water unless the warmer reuse water is needed to meet target release size goals.

- The presence of *Ichthyophthirius* requires the use of formalin for the fish on reuse systems 1 and 2. The use of formalin in a reuse system can kill the beneficial bacteria in the reuse system that converts ammonia into a nontoxic oxidized form (nitrate). System 1 was rehabilitated in 2006. Although not recommended, treatment in 2007 began after the steelhead fry were put into the Burrows ponds, and this caused damage to their gills. In most years, formalin treatment begins when the steelhead are put on reuse water, beginning in November and continuing through as long as one month before release. However, lower water temperatures (from 54-56 F to 52 F) significantly reduces problems with *Ich*.

- Cleaning-waste effluent water (and single pass rearing water) from Burrows' ponds is discharged directly into the Clearwater River without going through a settling pond.

- Dworshak NFH has 26 buildings; four administrative-office buildings, four residences, 11 buildings used for fish culture and maintenance, and six storage buildings. There are currently no plans for any additional construction, although improvements, maintenance and rehabilitation of existing buildings are performed on a regularly scheduled basis.

- The facility has 84 Burrows' ponds and 40 8'x80' concrete raceways (outdoor). The Burrows ponds are used for rearing steelhead.

- Thirty of the 8'x80' raceways are used for rearing spring Chinook (15 raceways each in "A" and "B" banks, respectively. The remaining 10 raceways are used to rear coho (see review section for Clearwater coho program) Raceways for the spring Chinook program are operated on single-pass river water. Cleaning wastes from the Chinook raceways pass through a settling pond prior to discharge at the confluence of the North Fork and mainstem Clearwater rivers.

- All water use and reuse systems at Dworshak NFH, including effectiveness of the settling ponds, are currently being evaluated by The Fresh Water Institute.

- No meters currently exist to effectively measure the quantity of both inflow and discharge water at Dworshak NFH. Consequently, total water volume into and out of the hatchery is not known precisely. Total water use into the facility is based on the pumping capacities of the water intake pumps.

- The facility utilizes monitoring facilities, an alarm system, water chillers, heaters, and numerous pumps.

- Water supply lines from Dworshak Dam and reservoir (42-inch diameter warm water pipe from the reservoir epilimnion and a 24-inch diameter cold water pipe from the reservoir hypolimnion) enter a distribution box, from which a 24-inch diameter warm water line and a 14-inch diameter cold water line extend to Dworshak NFH. The two supply lines enter Dworshak NFH at a valve pit where the two pipes join and continue into a 30-inch diameter supply line. This latter pipe supplies water to the nursery building and Mechanical Buildings I and II. The water can be heated in Mechanical Building I and II or chilled in the incubation room.

- Because of the two species reared at Dworshak —steelhead and spring Chinook —both warm and cold water are needed at the same time for various rearing and incubation needs. Two temperature options (54˚F and 43˚F) are available for egg incubation in approximately one-half of the incubators and for initial growth of fry in a limited number of the tanks in the nursery.

- Three large traveling water screens are installed in the main pump house. These screens are installed behind trash racks. The traveling water screens remove small debris that could cause damage to the six main pumps that supply river water to the hatchery. The screen is stainless steel wire mesh with a 3/8-inch square opening. The trash rack has a 2-foot by 3-inch opening. The screens are backwashed daily using high-pressure water. This is normally done manually but can be done by a timer and/or a pressure regulator. All three screens were completely rebuilt in 1999 and 2000

- The screens operate all year depending upon water requirements and pumping needs for fish production.

- At least two of the four main pumps are in use at all times. At least four pumps are required to operate the reuse system. At times, all six pumps are operated for a short period of time. Last year, two of the six river pumps failed.

- The hatchery currently does not maintain an offline backup pump for ready exchange in the event an online pump fails.

- Routine maintenance of pumps includes lubricating various components on a scheduled time and daily inspections. All three screens were completely rebuilt in 1999 and 2000.

- Dworshak NFH operates a fish ladder and adult holding pond to capture returning adult steelhead and spring Chinook that volitionally enter the facility.

- The incubation room uses single-pass reservoir water with three temperatures available: heated, chilled, and ambient. Water from the incubation room drains into the outside raw water channel that supplies the adult holding ponds and storm drain prior to discharge into the North Fork Clearwater River immediately downstream of the ladder. Water from the egg incubation and adult spawning areas is untreated except for screens in the spawning area to prevent drainage of eggs.

- Inflow water pipes for the indoor nursery tanks are packed with interior coke rings to break up the water flow and strip out saturated nitrogen. and prevent gas bubble disease

- A new NPDS permit was issued in November of 2007. The facility is currently meeting discharge requirements under the new permit. However, hatchery staff are concerned that the facility may exceed discharge limits when at full biomass capacity. Under this new permit, 13 discharge points require sampling and analysis of water quality.

- The river water temperature in the North Fork Clearwater is very low (43 degrees) in the summer months when Dworshak Dam discharges cold water to satisfy a court-mandated, outcome to control water temperatures in the lower Snake River as a result of NOAA Fisheries' Biological Opinion regarding the effects of the Columbia River hydropower system on ESA listed salmon and steelhead.

- The river water intake for the hatchery is near the fish ladder entrance into the facility, and anadromous fish are present in the water source (N.F. Clearwater River) for the outdoor Burrows ponds and raceways. Anadromous fish in the vicinity of the water intake have tested positive for

IHN virus by the Idaho Fish Health Center. Those fish and the intake river water have been postulated as the primary source of IHN Virus infection and other diseases at Dworshak NFH.

- The roof of the incubation building leaks and sags.
- The water intake screens are 3/8" mesh and do not comply with NOAA Fisheries ESA screening criteria.
- The schematics for underground structures at the facility are outdated and incorrect.
- Shade covers are not present over the outdoor Burrows' ponds and raceways.
- The crowder in the adult handling pond is antiquated and breaks often.
- The facility has predator control fencing around all outdoor ponds and raceways and precludes herons and other predatory birds, although osprey occasionally become entrapped.

Research, Education, and Outreach

- Hatchery personnel and the Information and Education (I&E) staff maintain active outreach to the public, private groups, news media, and state and federal partners.
- The hatchery's website frequently updates information and graphics.
- The hatchery hosts an annual Kids' Fishing Day and Open House event each June.
- The hatchery staff collaborate with other state and federal agencies and partners to host special events such as National Wildlife Refuge Week, Earth Day, Lewis and Clark Bicentennial activities, and other regional and local events.
- The hatchery maintains a small visitor center with hands-on interactive education materials.
- Hatchery staff participate in local advisory and community outreach forums and groups
- The hatchery staff work with university (e.g., University of Idaho) and federal agency (e.g., USGS) scientists to conduct research on effects of artificial culture on fish physiology and the biological interactions between hatchery and wild steelhead in the Clearwater River.
- Since 1999, the Idaho FRO has investigated factors related to freshwater residualization of steelhead in the Clearwater River.
- Starting with release year 2008 Dworshak NFH put in 20,000 PIT tags for evaluation independent of any outside study, this program is planned to continue into the future. Also in 2008, CSS PIT tagged 8,000 steelhead in addition to the 20,000 we tagged. The CSS study is also planned to continue into the future.
- Differentially marked and tagged groups of fish allow evaluations of the various fish rearing systems, release sites, sizes at release, and return rates and timing of adults.

- About 1,500 summer steelhead were released annually from Dworshak NFH with PIT tags prior to release year 2008 to monitor emigration rates through Snake and Columbia river dams. Beginning with release year 2008, the Idaho FRO pit tagged 20,000 smolts, and the *Comparative Survival Study* (CSS) pit tagged an additional 8,000 smolts.

- The Idaho FRO and hatchery staff have conducted many studies including the effects of various fish cultural methods on size variability of summer steelhead at the time release, the effects of three dry starter feeds on juvenile growth rates, and the effects of manipulating growth rate and the use of enhanced diets to stimulate smoltification in summer steelhead

Benefit and Risk Assessment[46]

BENEFITS CONFERRED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

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

Harvest Benefits

- The program confers significant sport and tribal harvest benefits. Based on coded-wire tag recovery data starting in 1980 through brood year 2001, approximately 28% of recaptured Dworshak B steelhead released from Dworshak NFH were caught in gillnet fisheries in the mainstem Columbia River, 27% percent were caught in sport fisheries in the Columbia and Snake River basins, and 45% were recaptured at Dworshak NFH or other hatcheries.[47]. Less than 1% of the reported tags were recovered elsewhere. From 2000 – 2006, the sport fishery harvested an estimated 12,230 - 30,168 fish per year in the Clearwater River, and the tribal fishery harvested an estimated 1,000 – 1,470 fish per year in the North Fork of the Clearwater River. The sport harvest data reflect steelhead released on station from Dworshak NFH and outplanted throughout the Clearwater River Basin from both Dworshak NFH, and Clearwater FH. Relative harvest benefits and adult return rates for on-station releases vs. numerous outplant sites have not been quantified.

- Dworshak NFH B-run steelhead reared at Clearwater FH and outplanted into the S.F. Clearwater River have provided an estimated 3,104 fish harvested per year (range 1,072 to 7,600) for 2000/2001 through 2006/2007 seasons.

- Anglers fished an estimated 30,895 hours per year (range 25,787 to 37,667) for 2001/2002 through 2006/2007 steelhead seasons in the Clearwater River.

- Adult steelhead trapped at the hatchery in excess of broodstock needs are outplanted in the Clearwater River basin by the Nez Perce Tribe for harvest (earlier returns) and natural spawning (later returns).

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

[47] *Pastor, S.M. 2009. Annual stock assessment-CWT (USFWS). Columbia River Fisheries Program Office, Vancouver, WA. www.fws.gov/columbiariver*

Conservation Benefits

- Dworshak NFH B-run steelhead program serves as the genetic repository for the North Fork Clearwater population of steelhead, which has been shown to be genetically unique within the Columbia River basin. Consequently, this stock has high biological significance within the *Snake River Steelhead ESU*.

- The hatchery program reduces the extinction risk for the *Snake River Steelhead ESU*.

Research, Education, Outreach and Cultural Benefits

- Tribal harvests and surplus adults trapped at Dworshak NFH provide a cultural benefit to Columbia River tribes.

- Tagged smolts from this program are used to help assess downstream passage of steelhead smolts through the hydropower system of the Snake and Columbia rivers.

- Dworshak NFH is located on the Lewis and Clark Trail, thus providing outreach opportunities regarding the historic and cultural significance of salmon and steelhead resources in the region.

- Dworshak NFH has provided numerous research opportunities for the USFWS, NOAA Fisheries, USGS, the University of Idaho, and other researchers. In 2007, the hatchery received 11 requests for cooperative research projects at Dworshak NFH.

- The Idaho Fishery Resource Office (USFWS) in Ahsahka, Idaho maintains an active monitoring and evaluation program assessing adult returns, age class composition, run timing, mean fecundities, and other biodata for Dworshak NFH steelhead.

Benefits Conferred to Other Stocks, Species, and Communities

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

Harvest Benefits

- Over 40% of the CWT recoveries of returning adult Dworshak NFH B-run steelhead, released as smolts from Dworshak NFH, are captured in Columbia River gillnet fisheries downstream of the Clearwater River, thus conferring a harvest benefit to downriver communities. Those gillnet fisheries primarily target *upriver bright* fall Chinook. The program also provides sport fishery benefits on the Columbia River.

- From 1996 through 2005, the overall harvest rate on adult B-run steelhead in the mainstem Columbia River has ranged from 3.4% to 34.6%, averaging 13.2%. The mainstem harvest rate on A-run steelhead has ranged from 2.5% to 10.4%, averaging 5.3%. B-run steelhead are harvested at a higher rate than A-run steelhead because run timing of B-run steelhead overlaps with the run-timings of hatchery-origin coho and fall Chinook, and B-run steelhead are more

susceptible to gill net fisheries targeting salmon than A-run steelhead because of the larger mean size of the former.[48]

Conservation Benefits

- None identified.

Research, Education, Outreach and Cultural Benefits

- Tribal harvest provides a cultural benefit to the Columbia River tribes.
- Results from research studies at Dworshak NFH have broad application throughout the region and nationally.
- Hatchery staff provide educational opportunities offsite to other communities.

RISKS POSED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

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

Genetic Risks

- Continued propagation of Dworshak NFH B-run steelhead as a genetically-segregated hatchery stock poses a domestication risk to the population as a genetic repository for the extirpated North Fork Clearwater steelhead population.
- The number of fertilized eggs from each spawn take retained for on-station releases at Dworshak NFH generally follow a *uniform* temporal distribution that does not reflect the actual temporal distribution of steelhead spawned at the hatchery. This number of fish spawned in each spawn take is more "bell-shaped" such that the majority of eggs are collected from the middle spawn takes (early to late March) but a significant proportion of those eggs from the middle spawn takes are eventually transferred to the Clearwater Fish Hatchery for outplanting of smolts in the S.F. Clearwater River or Salmon River. Consequently, some level of artificial selection is occurring for on-station releases at Dworshak NFH that under-represents the middle portion of the spawning distribution of adults, is occurring, which poses unknown genetic risks to the population.[49]

Demographic Risks

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[48] *Pete Hassemer, IDFG, pers. communication.*

[49] *The hatchery staff understand this risk and establishes spawn take objectives to minimize it. In addition, the Review Team concluded that the genetic benefits of maintaining a broad temporal distribution of spawn timing for this "genetic repository" stock outweigh risks related to "uniform selective breeding" for spawn timing. Although current spawning protocols may reduce slightly genetic adaptations to the hatchery environment, these protocols are expected to increase the likelihood of maintaining low frequency genes into future generations.*

- The use of formalin to control the parasite *Ichthyophthirius* (*Ich*) in the Burrows ponds poses a demographic risk to steelhead reared on station. Formalin kills the detoxifying bacteria (*Nitrosomonas* and *Nitrobacter*) used in the water reuse system's biological filters.

- Lack of shade covers over the Burrows' Ponds concentrates fish in shaded areas along pond walls, increasing effective densities, potential stress, and disease risks.

- A leaky roof in the nursery building prevents the indoor nursery tanks from drying completely, thus impeding their disinfection and increasing fish health risks.

- The facility's location above four Columbia River and four Snake River dams significantly reduces the survival of outmigrating juveniles and returning adults, posing a demographic risk to the return of sufficient numbers of adults for harvest and broodstock on a consistent basis.

Ecological Risks

- The presence of adult salmon and steelhead in the immediate vicinity of the main water supply for the hatchery (N.F. Clearwater River) poses a disease risk to the propagated stock.

- The use of 90% reuse water for two thirds of the steelhead reared on station further increases disease risks to the stock because of increased difficulties controlling fish pathogens in the reuse system.

Physical Risks

- The current physical condition of the roof in the nursery building poses a human health and safety risk.

Research, Education, Outreach and Cultural Risks

- None identified.

RISKS POSED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

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

Genetic Risks

- Steelhead outplanted into the South Fork Clearwater River and Clear Creek pose unknown genetic and straying risks to natural populations of steelhead and rainbow/redband trout in the Clearwater River basin. For example, the extent that steelhead outplanted into Clear Creek stray into the Lochsa and Selway rivers as returning adults is unknown.

Demographic Risks

- None identified.

Ecological Risks

- Amplification of disease within the hatchery poses a disease risk to fish populations in the Clearwater River.
- Discharge of water from the Burrows ponds directly into the Clearwater River without suspended solid settling or treatment poses an ecological risk to aquatic organisms immediately downstream of the facility.
- The collection and barging of steelhead smolts at mainstem Snake River and Columbia River dams poses a fish health risk to other populations of salmon and steelhead that are co-collected for barging.
- Adult steelhead outplanted to various sites in the Clearwater River basin pose a fish health risk to natural fish populations in those areas.
- Adult hatchery-origin steelhead returning to the North Fork Clearwater River, but precluded from entering the hatchery, remain in the general vicinity of the hatchery's water supply and, thus, pose a fish health risk to fish reared on station.
- Overall, steelhead released from Dworshak NFH have a very low stray rate outside the Clearwater River basin and those risks are considered low.

Research, Education, Outreach and Cultural Risks

- The current practice of continuously exporting steelhead eggs from Dworshak NFH and the Clearwater River Basin, rearing those eggs and fish at facilities where they are susceptible to disease (Hagerman NFH and Magic Valley FH), and then outplanting the resulting smolts into the Salmon River is (a) inconsistent with the principles of local adaptation and "hatchery reform" and (b) contradicts public outreach that emphasizes the conservation of native salmon and steelhead populations in their indigenous habitats.

Recommendations for Current Program[50]

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

[50] *The Review Team believes that Dworshak Hatchery Evaluation Team—as a whole, in task teams and/or with outside assistance and expertise—will be the logical body to implement most of the following recommendations.*

Program goals and objectives

Issue DW1: Program goals for Dworshak NFH B-run steelhead, as established by the Army Corps of Engineers, are not fully expressed in terms of numeric outcomes that quantify intended benefits. *This hatchery program lacks specific numeric goals for harvest, although providing fish for harvest is a primary purpose of the program. In lieu of no adult return goal associated with the hatchery mitigation program for fish losses resulting from construction of Dworshak Dam, the Service established an adult return goal 20,000 hatchery-origin steelhead back to the Clearwater River for fish produced at Dworshak NFH. However, no numeric harvest goals within the Clearwater basin resulting from on-station releases at Dworshak NFH, have been identified.*

Recommendation DW1: Restate program goals to identify the number of harvestable adult B-run steelhead released directly from Dworshak NFH for harvest in the Clearwater River basin. For example, based on the Service's return goal to the Clearwater River (20,000 adults) and broodstock needs (3,000-4,000 adults), the harvest goal could be as high as 16,000 adults, assuming 100% survival from lower Granite Dam to the fishery and hatchery.

Issue DW2: Current conditions affecting the survival of salmon and steelhead in the Snake and Columbia rivers (operation of the hydropower system, habitat, harvest, and ESA listings) downstream from Dworshak NFH differ from the assumptions that were used to establish the Service's adult return goals for Dworshak B-run steelhead in the Clearwater River. *These different conditions inhibit consistent achievement of the Service's goals of annually returning, from Dworshak NFH, 30,000 adult steelhead to the mouth of the Columbia River and 20,000 adult steelhead to the Clearwater River.*

Recommendation DW2: The Service should continue to work through various regional processes such as (a) implementation of the mainstem *Federal Columbia River Power System* Biological Opinion to improve migration survival, (b) *US vs. OR* discussions to address harvest issues, (c) NOAA Fisheries to complete ESA consultations on hatchery mitigation programs, and (d) local watershed groups to continue improving habitat to allow the Service and cooperators to meet Service goals and other mitigation goals (e.g., LSRCP) on a consistent basis. This recommendation should include reexamination of current approaches for contributing 30,000 adult steelhead to the Columbia River and 20,000 adult steelhead to the Clearwater River to determine whether the current hatchery program should be modified to account for existing conditions and facility capabilities at Dworshak NFH.

Broodstock Choice and Collection

Issue DW3: During broodstock collection, the fish ladder into the hatchery is closed periodically or "pulsed" to leave fish in the river for harvest. The extent to which pulsing the ladder increases disease risks to juvenile fish in the hatchery and stray rates to natural spawning areas for steelhead in the Clearwater River is unknown. *Leaving hatchery steelhead in the N.F. Clearwater River in the general vicinity of the hatchery's water supply increases fish health risks to juvenile fish on station (see also issue DW11).*

Recommendation DW3: Evaluate the harvest benefits of pulsing the ladder versus ecological and disease risks associated with large numbers of fish remaining in the river in the immediate vicinity of the water intake for the hatchery. When evaluating benefits and risks, consider

options – including the benefits and risks of those options - if the ladder were kept open continuously from October through May versus the current mode of operation. Perform a ladder operation study to assess straying and spawning behavior of Dworshak NFH hatchery fish. This could include a radio-tagging study of adult fish captured at the hatchery and then released back into the Clearwater River. Similar studies were conducted at Little White Salmon NFH[51]. If straying of hatchery fish into natural spawning areas of listed steelhead exceeds the 5% guideline established by NOAA fisheries, then change the ladder operations to evaluate whether the 5% guideline can be met.

Hatchery and Natural Spawning, Adult Returns

Issue DW4: Approximately 1.3-1.4 million fertilized green eggs from Dworshak NFH steelhead are transferred to Clearwater FH for eventual outplanting in the Salmon River basin as part of the Lower Snake River Compensation Plan (LSRCP). The annual transfer and releases of Dworshak NFH B-run steelhead into the Salmon River are inconsistent with the principles of local adaptation and managing hatchery stocks for maximum viability. *These transfers also pose genetic and ecological risks to ESA listed natural populations in the Salmon River (e.g., natural populations in the East, South, and Middle Forks of the Salmon River). In addition, neither the Clearwater Hatchery nor Dworshak NFH have the space to rear those outplanted fish. Instead, those fish are reared at Hagerman NFH and Magic Valley State Hatchery in the Hagerman Valley, the water sources for which pose culture problems and increased disease risks to steelhead from the Clearwater River (see Hagerman NFH section of this report).*

Recommendation DW4: Discontinue steelhead egg takes at Dworshak NFH for LSRCP programs that involve the transfer and outplanting of Dworshak B-run steelhead into the Salmon River basin. Continue to work with the LSRCP program to assess potential alternative strategies and broodstock needs for appropriate use of Dworshak B-run steelhead at LSRCP facilities to meet LSRCP mitigation goals. [Refer to Recommendation HA3 for Hagerman NFH B-run steelhead and the recommended alternative (Alternative 2) for that program. Refer also to the recommended alternatives for Clearwater Fish Hatchery and Magic Valley Fish Hatchery in the Idaho LSRCP Report.]

Issue DW5: Approximately 3,000 to 4,000 fish are trapped currently for broodstock each year (1,850-2,500 for Dworshak NFH mitigation and 1,150-1,500 for LSRCP mitigation); however, only 1200 females need to be trapped to meet all egg take requirements for all release programs. *Excess broodstock are taken because females outnumber males by a ratio of approximately 2.3 to 1 (3 females: 1-2 males), and the hatchery spawns all adults pairwise (1 female: 1 male). Approximately 62% of the crosses are required to produce fish for on-station rearing, while 38% are required for egg transfers to Clearwater Hatchery. Egg transfers to Clearwater Hatchery eventually result in fish that are outplanted in the S.F. Clearwater River or the Salmon River. Consequently, those latter fish do not contribute to adult returns back to Dworshak NFH, and genetic concerns regarding minimum effective number of breeders do not apply.*

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[51] *Engle et al. 2005 and 2006. Assessments to Determine the Effect of Current and Alternate Ladder Operations on Brood Stock Collection and Behavior of Hatchery Fall Chinook Salmon at Little White Salmon National Fish Hatchery During 2004-05. U.S. Fish & Wildlife Service, Columbia River Fisheries Program Office, Vancouver, WA.*

Recommendation DW5: Consider reducing the total number of fish retained for broodstock to achieve a spawning ratio of 2 females to 1 male for adult steelhead retained for the Clearwater Hatchery programs. Although the current spawning protocol is consistent with genetic management guidelines, strict pairwise spawning is not necessary to produce fish for harvest in outplanted areas (e.g., Salmon River). Reducing the total number of fish retained for broodstock is expected to reduce labor and provide additional fish for harvest or direct surplusing to tribes. Adult steelhead spawned for on-station releases at Dworshak NFH should continue to implement pairwise spawning of males and females to maximize the genetic effective number of breeders (N_b) contributing to future generations of steelhead at Dworshak NFH.[52]

Issue DW6: Adult steelhead spawned at Dworshak NFH are collected and spawned as two distinct groups, and levels of gene flow between those two groups over multiple generations have not been quantified. *Dworshak NFH collects approximately 15% of its broodstock in the fall (October-December) and the remaining broodstock (85%) in the late winter through spring (February-May). Under current spawning protocols, all fall-collected fish are spawned amongst themselves (spawn takes 1 through 3)and all spring-collected fish are spawned amongst themselves (spawn takes 4 and higher) with no cross-spawning between the two groups of fish. Consequently, the hatchery program may be inadvertently selecting for two separate sub-populations if little or no gene flow occurs between them. At the present time, the progeny of fall-trapped adults are given a different coded-wire tag code than the progeny of adults trapped in the winter and spring.*

Recommendation DW6: Continue the current tagging protocols for the progeny of fall-trapped fish and the progeny of winter/spring-trapped fish, and determine the amount of gene flow between the two groups over multiple generations. The Team believes that this recommendation can be implemented by simply collating existing coded wire tag data and determining the annual proportion of fall-trapped fish that were the progeny of winter/spring-trapped fish of the previous generation, and vice versa. At least 10% of the fish collected each fall for broodstock should be the progeny of winter/spring-collected adults to meet minimum gene flow guidelines to prevent genetic divergence between the two groups of fish. Genetic-DNA analyses may provide additional insights regarding the long-term effects of current spawning protocols.

Issue DW7: Exclusive use of hatchery-origin adults for broodstock (segregated program) poses a domestication genetic risk to the Dworshak NFH steelhead population. This population represents the ancestral genetic legacy of the North Fork Clearwater River with high biological significance. *Goal No. 1 from the Service's (2004) Comprehensive Hatchery Management Plan (CHMP) for Dworshak NFH states the following: "Conserve and perpetuate the unique North Fork Clearwater River 'B-Run' summer steelhead population."*

Recommendation DW7: The Service and comanagers should discuss long-term genetic conservation goals for the Dworshak NFH population of B-run steelhead (derived ancestrally from populations native to the N.F. Clearwater River) and investigate potential options for establishing a natural spawning component whereby natural-origin adults could be included in the broodstock annually to reduce domestication risks. Althought such actions would be

[52] *The genetic effective number of breeders per year: $N_b = 4N_mN_f/(N_m + N_f)$, where N_m and N_f are the numbers of male and female spawners, respectively.*

incapable of duplicating the environmental conditions of the North Fork Clearwater River, the goal would be to add a natural reproduction component to the life history of the stock to maintain some genetic ability to reproduce naturally with respect to spawning behaviors, redd site selection, redd construction, and other biological factors related to reproductive fitness under natural conditions. One possible approach is to identify existing streams for reintroduction; another possible approach is to develop an artificial spawning channel or "engineered" stream (Brannon 2006)[53]. This recommendation reflects one of the stated goals of the program and the Service's stewardship responsibilities.

Incubation and Rearing

Issue DW8: The current number of fish reared on-station program (2.8 million green eggs and 2.1M smolts), coupled with the length of time that fry are retained in the nursery building, results in the total capacity of the nursery tanks to be exceeded relative to the Hatchery Review Team's recommended rearing density index (D.I.) guidelines for steelhead (D.I. < 0.5). *At maximum loading, the nursery tanks reach rearing densities of D.I.=0.75 which increases disease risks. Although rare, bacterial infections of Pseudomonas and coldwater disease do occur. Fry are retained in the nursery tanks for an extended period to increase their size which reduces their susceptibility to IHNV after ponding to the outside Burrow ponds. The ponds are supplied with river water that is exposed to adult salmon and steelhead staging near the ladder and hatchery intake for the hatchery.*

Recommendation DW8: To achieve a rearing density no greater than 0.5 DI, either (a) increase the nursery rearing space, or (b) reduce the number of smolts produced on station. Alternatively, increasing the water supply from Dworshak Reservoir to provide sufficient water to the outdoor Burrows ponds (see Recommendation DW11) would reduce risks to IHNV substantially, thus allowing transfer of fry from the indoor nursery tanks to the outdoor ponds at a smaller size mean size when rearing densities approach D.I. = 0.5. The Service may also wish to evaluate rearing constraints and fish health concerns under current protocols; for example, the hatchery could conduct an early rearing density study (refer also to Recommendation DW10 regarding steelhead outplants).

Issue DW9: Oxygen levels in the juvenile nursery tanks can be as low as 6 ppm which is substantially less than the desired saturation level (8-10 ppm). Maintaining oxygen levels at or near saturation are critical to promoting good fish health throughout the incubation and rearing phase. At the present time, oxygen levels are measured only when fish are treated for disease.

Recommendation DW9: Develop a standard operating procedure (SOP) for monitoring oxygen levels on a routine basis (e.g., weekly). Manage densities and flow indices to achieve desired oxygen levels.

[53] *Brannon, E.L. Engineering the future for wild salmon and steelhead. Pages 175-192 in R.T. Lackey, D.H. Lach, and S.L. Duncan, editors. Salmon 2100: the future of wild Pacific salmon. American Fisheries Society, Bethesda, Maryland.*

Release and Outmigration

Issue DW10: Currently, 600,000 Dworshak NFH B-run steelhead smolts, reared at Dworshak NFH, are outplanted to several sites in the South Fork Clearwater Basin for harvest and supplementation. The continued outplanting of fish from Dworshak NFH is inconsistent with the principles of local adaptation and precludes potential development of a localized South Fork Clearwater broodstock to meet harvest goals in the South Fork*. In addition, the majority of those fish are released in the lower reaches of the S.F. Clearwater River to support terminal fisheries, but no facilities exist in those reaches to recapture unharvested adults. The potential natural spawning of unharvested hatchery-origin steelhead poses unknown genetic and ecological risks to natural populations. Those continued outplants appear also to be inconsistent with conservation goals for steelhead in the S.F. Clearwater River, and they are also inconsistent with the ESA population designations of the ICTRT and NOAA Fisheries.*

Recommendation DW10a: Phase out the direct outplanting of Dworshak NFH B-run steelhead into the upper South Fork Clearwater River (e.g., upstream of the Red Houser release site).

Recommendation DW10b: (i) Increase the number of steelhead smolts released at Dworshak NFH and/or (ii) release steelhead smolts from locations where they can be acclimated and returning adults can be recaptured (e.g. Red and Crooked rivers and at Dworshak NFH) and/or (iii) develop new satellite facilities in the S.F. Clearwater River for acclimating smolts prior to release and for recapturing unharvested hatchery-origin adults (e.g., at the Red House release site). If conservation and viability of naturally-spawning populations of steelhead in the South Fork are comanager goals or priorities, then hatchery-origin steelhead (i.e., from a segregated hatchery program) should constitute no more than 5% of the total number of naturally-spawning fish, as per NOAA Fisheries and HSRG guidelines. The Team recognizes the economic costs and logistic difficulties of establishing new satellite facilities, including the monitoring needed to evaluate such programs.

Recommendation DW10c: Develop a localized broodstock of South Fork B-run steelhead derived from adult returns to the South Fork Clearwater River and associated satellite facilities described in Recommendation DW10b. If B-run steelhead from Dworshak NFH continue to be outplanted in the S.F. Clearwater River, then those fish should be differentially marked from smolts representing the progeny of adults returning to and trapped in the South Fork. A local South Fork broodstock could be developed and managed as a segregated or integrated population relative to naturally spawning populations in the South Fork Clearwater River (see also recommendations of the HSRG).

Issue DW11: Currently, 300,000 smolts are transferred from Dworshak NFH and directly released into Clear Creek 150 feet below the weir at Kooskia NFH*. The direct outplanting of smolts each year from Dworshak NFH into Clear Creek is not a "best management practice" because it prevents local adaptation of the population to Kooskia NFH and its geographic location within the Clearwater River basin. The scientific literature indicates that outplanting of salmon and steelhead juveniles reduces smolt-to-adult survival rates and homing fidelity compared to fish released "on-station" from facilities where adults are collected for*

broodstock.[54] *Continued outplanting of steelhead juveniles in Clear Creek increases straying risks to natural populations.*

Recommendation DW11a: All unharvested and marked, hatchery-origin steelhead returning to Clear Creek should be removed at the Kooskia NFH weir.

Recommendation DW11b: Develop an acclimation pond at Kooskia NFH from which smolts can be released. Although onsite rearing of spring Chinook and steelhead is impeded by water quantity and quality from Clear Creek during the summer months, water availability may not be a problem for acclimating steelhead smolts in March prior to release in April.

Recommendation DW11c: Use marked steelhead adults returning to the weir at Kooskia NFH to develop a locally adapted broodstock. The resulting eyed eggs and progeny could be hatched and reared, respectively, at Dworshak NFH. If a local broodstock is established, then any Dworshak B steelhead outplanted from Dworshak NFH should be differentially marked to distinguish them from the new Kooskia NFH stock.[55]

Facilities/Operations

Issue DW12a: Dworshak NFH uses water pumped from the N.F. Clearwater River below Dworshak Dam as its water supply for the outdoor raceways and Burrows ponds. The fish ladder into the hatchery is in the immediate vicinity of the water intake for the pumps. The concentration of steelhead and salmon adults near the water intake poses disease risks to fish reared on station. *Horizontal transmission of IHN virus from adults to juvenile fish at Dworshak NFH has been documented. In addition, spring Chinook returning to Dworshak NFH exhibit a high prevalence of INH virus, and juvenile steelhead on station die annually from IHNV during the period that spring Chinook return to the hatchery (May-August).*

Issue DW12b: The use of reuse water to rear steelhead to the smolt stage further increases disease risks. *Reuse water is required to increase water temperatures and accelerate the growth of steelhead during the winter months so that they achieve the desired size at smoltification at one year of age.*

Issue DW12c: Parasitic infections of Ich are a recurring problem when steelhead are on the reuse system. The standard treatment for Ich is formalin; however, formalin also kills the nitrifying bacteria that are an essential component biological filtration and the reuse system.

Recommendation DW12: Replace pumped water from the North Fork Clearwater River below the dam with gravity-fed water from Dworshak Reservoir. This would solve several inherent problems, including the presence of adult anadromous fish in the vicinity of the water

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[54] *Hatchery Scientific Review Group (HSRG). 2009. White paper No. 7: Outplanting and net pen release of hatchey-origin fish. Available at: http://www.hatcheryreform.us/*

[55] *These recommendations are consistent with best management practices of developing a locally adapted broodstock intended to maximize the survival and homing fidelity of released fish. They are also consistent with the long-term goal of maximizing the viability of salmon and steelhead populations – both hatchery and wild – as opposed to the historical practice of distributing fish and eggs among watershed for achieving short-term objectives. The Team strongly supports a monitoring and evaluation component that guides management activities.*

intake for the hatchery (Issue DW3) and high rearing densities in the nursery building prior to transfer to the outdoor Burrows ponds (Issue DW8). It would also eliminate the need for the water reuse system and the need to heat water, and it would replace many large water pumps (see also Issues DW14 and DW17) with gravity-feed pipelines. If replacing the current pump system with a gravity-feed system from the reservoir is not feasible, then the river water supply to the hatchery should be disinfected (e.g., ozone treatment) and equipped with temperature controls. The gravity-feed option is preferred because it reduces mechanical complexity compared to a disinfection system. In addition, continuation of the pumped water system with disinfection represents greater risk of catastrophic fish losses on station. [56] In the near term, the Service should investigate alternatives that would reduce the prevalence of adult anadromous fish from the area around the intake (e.g., Recommendation DW3).

Issue DW13: Untreated water from the nursery building, Burrows ponds, and cleaning water from the Burrows ponds is discharged directly into the Clearwater River. *Direct discharge of unsettled effluent poses ecological and water quality risks to aquatic species in the Clearwater River.*

Recommendation DW13: Construct a pollution abatement system or settling pond to remove dissolved solids from the hatchery effluent water prior to discharge into the Clearwater River.[57] As required in the NPDES permit, ensure a Quality Assurance Plan and a Best Management Plan are written to address NPDES operations.

Issue DW14: The roof over the nursery building leaks, and the roof supports are deformed, thus posing a human health and safety risk. *The inability to completely dry the nursery tanks between different groups of fish creates a culture environment for the continued growth of bacteria such as Pseudomonas.*

Recommendation DW14: Replace the roof immediately. The roof has been identified as a priority project. The Army Corps of Engineers did not have sufficient funds to replace the roof in 2008. This issue has been identified by the hatchery as an employee safety concern that is scheduled to be addressed in 2009.

Issue DW15: No offline backup pumps are available for quick exchange if one of the main pumps supplying river water to the hatchery fails. The absence of an offline back-up pump increases the risk of catastrophic fish losses.

Recommendation DW15: Purchase one or more backup pumps to have on site for immediate replacement if an operating pump fails.

Issue DW16: Lack of shade covers over the raceways and Burrows' Ponds increases crowding and the effective density of fish, particularly during the summer months, thus increasing stress and disease risks to juvenile fish.

Recommendation DW16: Construct shade covers over the raceways and Burrows' ponds.

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[56] *Issue/recommendation may be influenced by the results of the Freshwater Institute evaluation.*

[57] *Ibid.*

Issue DW17: The water management and reuse system at Dworshak NFH is complex, has changed over the years, and institutional knowledge of its structure and function have been lost.

Recommendation DW17: Develop an updated engineering schematic of the water systems and an updated water reuse system *standard operating procedure* (SOP) at Dworshak NFH.[58]

Issue DW18: The water intake screen for the hatchery does not comply with current NOAA Fisheries ESA screening criteria. The screen mesh is 3/8"; however, NOAA requires 3/32" mesh. NOAA criteria also include parameters for water approach velocity, sweeping velocity, and screen angle.

Recommendation DW18: Replace the water intake screen for the hatchery so that it complies with NOAA Fisheries criteria.

Issue DW19: A Standard Operation Plan, including a preventative maintenance program and schedule, do not exist currently at Dworshak NFH. *Facility maintenance has suffered and institutional knowledge has been lost when employees retire or transfer to other facilities. In addition, standard operations and maintenance have not been adequately documented. A Standard Operation Plan and Maintenance Program represent "Best Management Practices" for hatcheries. However, the Service has recently initiated a formal preventative maintenance program using Maintenance Pro software. Standard Operational Plans for all operations will be developed as time allows.*

Recommendation DW19: Continue to develop Standard Operation Plans and a Maintenance Program for Dworshak NFH.

Research, Monitoring, and Accountability

Also see the Clearwater Spring Chinook at Dworshak NFH Research, Monitoring and Accountability section.

Issue DW20: Dworshak NFH currently does not have an adequate database for tracking maintenance needs, long-term facility needs, and managing assets*. The facility is owned and funded by the Army Corps of Engineers and is not included in the Service's SAMMS database which tracks maintenance, costs, and identifies Service needs.(The system documents the current condition, life cycle and replacement costs of assets to help manage property assets and identify maintenance needs).*

Recommendation DW20: To be consistent with other Service facilities, develop an adequate database (e.g., SAMMS or Army Corps of Engineers database) for tracking, prioritizing, and coordinating maintenance needs and managing assets.

Issue DW21: The Monitoring and Evaluation (M&E) program for Dworshak NFH is not well documented.

[58] *Ibid.*

Recommendation DW21: Develop a clearly-defined and well-documented long-term M&E program. Such a long-term program should be established for assessing annual benefits (e.g., contributions to harvest) and short-term and long-term risks of the program (e.g., straying). Proposed or planned M&E activities should be reviewed annually prior to tagging and ponding of each broodyear.

Issue DW22: The extent to which Dworshak NFH B-run steelhead spawn successfully in outplanted areas is largely unknown *Without understanding the productivity of hatchery-origin adults, opportunities for potentially integrating natural origin adults into the Dworshak NFH steelhead broodstock are unknown (see Recommendation DW7). Supplementation components of the program would benefit from utilizing naturally spawning returns to the supplemented reaches instead of constantly relying on outplanting from Dworshak NFH. In addition, outplanting steelhead from Dworshak NFH throughout the Clearwater Basin poses unquantified genetic risks to natural populations.*

Recommendation DW22: Increase smolt trapping and monitoring of natural reproduction to establish population estimates in outplanted streams. Collect fin tissue samples non-invasively from natural-origin smolts for genetic analysis to determine genetic similarities to Dworshak NFH B-run steelhead.

Issue DW23: **Dworshak NFH has a well-developed** ***coded-wire tagging program to assess survival of various rearing and release strategies. In addition, coded-wire tagged fish are required to accurately represent all progeny groups released from Dworshak NFH.*** *For example, beginning with brood year 2008, a total of 180,000 juvenile steelhead - representing six tag groups of 30,000 fish each - will receive coded-wire tags (CWT) and left ventral fin clips. These tagged fish will be reared in 12 of 82 Burrows ponds , which should be sufficient in representing the population. However it is important to note that fish in different raceways or ponds can differ with respect to mean age and size, and the pond environments can differ with respect to flow index, flow pattern, and other environmental factors (e.g., light incidence). Furthermore, fish are spawned from throughout the entire adult return to ensure that most segments of the run are represented in the resulting progeny. This procedure usually results in many different spawn "takes". The fish are ponded by take/hatch date into a series of raceways that, when fully populated, can differ in mean age and size between raceways. Because of these complications, continued attention is required for the tagging program. Post-release monitoring of each release group using coded-wire tags requires that the tag group as a whole needs to represent the entire population.*

Recommendation DW23: Hatchery staff should continue to consult with the Idaho Fishery Resource Office and the Columbia River Fisheries Program Office coded-wire tagging team to ensure that the tagging strategies accurately represents the entire population of progeny from all spawn groups for a particular brood year. For example, all spawn groups should be proportionately represented among tag groups and raceways. The tagging and evaluation program, as a best management practice, needs to continue to accurately represent the population under evaluation. The principles of statistical experimental design and power analysis need to be an integral part of the tagging program.

Issue DW24: The PIT tag program for Dworshak mitigation steelhead in 2008 includes 20,000 (COE funding) fish to assess juvenile and adult migration survival and 8,000 fish (Comparative Survival Study (CSS)) for comparing smolt-to-adult return rates (SARs) of

fish transported downstream in barges versus SARs for juvenile fish negotiating the passage systems at each dam on the Columbia and Snake Rivers. PIT tagging and monitoring are required to continue evaluating post-release migration and survival.

Recommendation DW24: Continue to implement and refine the PIT tag program to monitor migration and survival of steelhead, and to assist with in-season harvest management of returning fish. Annual monitoring and evaluation of survivals and harvest contributions are essential for assessing benefits and risks.

Issue DW25: Recovery of coded-wire tags (CWT) from harvested fish in terminal fishery areas in the Clearwater River basin is inadequate for assessing benefits and risks, particularly in natural spawning areas where fish have been outplanted. *A coast-wide CWT goal of 20% recovery of all CWTs from returning adult fish has been advocated by the LSRCP Coordinator.*

Recommendation DW25: The Service should continue to work with cooperators to assess the mark-sampling program. This recommendation includes development of tag-recovery strategies designed to assess the benefits and risks of outplanting programs in Clear Creek and the S.F. Clearwater River (see also Recommendation DW22).

Issue DW26: Data obtained from releases and recovery of coded-wire tags from Dworshak mitigation steelhead is not consistently reported in a timely manner by the Idaho FRO, inhibiting adaptive management based on the most current information. *Both the Idaho FRO management of cwt recoveries at Dworshak NFH and the state/tribal programs for recovery and data entry of cwt's in ocean and in-river fisheries and recoveries at other locations needs consistent, annual reporting. The Pacific Salmon Commission's Data Standards Work Group Report states, under Specifications and Definitions for the Exchange of Coded-Wire Tag Data for the North American Pacific Coast, that "Preliminary (Recovery) data for the current calendar year should be reported no later than JANUARY 31 of the following year."*

Recommendation DW26: The Service should continue to work with their mark representative to develop a data management plan that incorporates tagging goals and objectives, data management, and annual reporting requirements of coded-wire tag data at both the program and regional levels for the purpose of monitoring and evaluating benefits and risks of the hatchery program.

Issue DW27: Dworshak NFH, Kooskia NFH, and the Service's Idaho Fisheries Resource Office (Idaho FRO; Orofino, ID) do not participate fully in a centralized Service maintained Monitoring and Evaluation database program. *Exclusion of data in a Service maintained database from Dworshak and Kooskia NFHs inhibits system-wide hatchery evaluations and the sharing of information with other data systems such as Stream Net. Staff at all National Fish Hatcheries in the Columbia River basin - except those at Dworshak and Kooskia NFHs – create, maintain, and submit the necessary data files for the Columbia River information System (CRiS), maintained by the Columbia River Fisheries Program Office (Vancouver, WA,) or the Regional Mark Information System (RMIS,) maintained by the Western Washington Fish and Wildlife Office.*

Recommendation DW27: Dworshak NFH, Kooskia NFH, and the Idaho FRO should participate fully in a Service maintained database, including creation and submission of the desired data files within the desired annual time frames. A Service maintained data base should function as the database repository of all Service data and facilitate data management between all Service offices. Use of central database files and programs achieves the following multiple purposes: (1) greatly reduces the amount of effort expended to meet reporting requirements, (2) increases the quality and consistency of data collected at different hatcheries at different times, (3) facilitates development of common software usable at many facilities, (4) provides a single software platform on which to build effective evaluation tools that can be used by hatcheries, fisheries offices, and the regional office, and (5) facilitates the exchange of information with other agencies. [59] Minimum annual reporting requirements for the hatcheries include the fish removal file to track adult returns, egg activity files, and distribution files to track transfers and releases. An age composition of returning fish also needs to be reported annually by the Idaho FRO.

Education and Outreach

Issue DW28: Dworshak NFH has a well-developed education and outreach program. *This program has been innovative and proactive with respect to providing benefits to the local community and region.*

Recommendation DW28: Continue support for existing education and outreach efforts, including evaluation of the effectiveness of those efforts.

Issue DW29: Signage providing directions to the hatchery and at the entrance of the facility is inadequate. Additionally, existing signage does not identify U.S. Fish & Wildlife Service and the Nez Perce Tribe as co-operators of the facility.

Recommendation DW29: Establish appropriate signage that identifies all comanagers and cooperators that contribute personnel and/or funding for the facility (e.g., Army Corps of Engineers, U.S. Fish and Wildlife Service, Nez Perce Tribe, Bonneville Power Administration, etc.). Volunteer work or contributions from any hatchery "friends" group could also be acknowledged as an outreach benefit.

Issue DW30: Access to progress reports and publications regarding Dworshak NFH, the Idaho Fisheries Resource Office, and the Idaho Fish Health Center is limited*. The public is provided access to reports and publications for facilities in other regions via regularly updated web sites.*

Recommendation DW30: Provide public access to reports and publications accessible to the public via the Dworshak NFH Complex web site and the LSRCP web site.

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[59] The CriS database is based on software initially developed over 20 years ago (DOS version of Dbase III). It has a proven record for providing a straightforward and standardized method for tracking large amounts of fish culture and adult return data obtained at many facilities over multiple years and multiple fish generations. The U.S. Fish & Wildlife Service Hatchery Review Team does recognize, though, that this software should be updated to a user-friendly standardized, region-wide format for all region-wide Service programs.

Alternatives to Current Program[60]

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

Alternative 1: Current program with recommendations

Implement current program with implementation of all recommendations. This includes increasing nursery rearing space, reducing the number of smolts reared on station, or transferring juveniles from the nursery tanks to the outdoor Burrows ponds at a smaller mean size after expansion of the gravity feed waterlines from Dworshak Reservoir. It also includes termination of direct outplants of steelhead from Dworshak NFH into the S.F. Clearwater River and potential development of a separate broodstock program for that watershed.

Pros

- Maintains the unique North Fork Clearwater River steelhead stock.
- Contributes to harvest in the Clearwater River and to downstream fisheries.
- Mitigates for loss of fisheries associated with construction of Dworshak Dam and contributes to the LSRCP mitigation goal.
- Is consistent with the original intent of Dworshak NFH.
- Could provide additional outdoor rearing space for coho or spring Chinook if the number of steelhead reared and released on station is reduced.

Cons

- Domestication of the Dworshak NFH steelhead stock is expected to continue if a naturalized population is not established from which natural-origin adult recruits can be obtained for broodstock.
- Would reduce harvest in the South Fork Clearwater Basin if outplanting is reduced or terminated, and a localized S.F. Clearwater River broodstock is not established.

Alternative 2: Reduce the steelhead program at Dworshak NFH to the minimum size necessary for meeting genetic conservation concerns

[60] *Alternatives presented here are intended to be consistent with those in the companion report for LSRCP hatcheries operated by Idaho Department of Fish and Game*

(approximately 500 pairs of adults per year), and increase the size of the spring Chinook and/or coho programs.

Spawning a total of 500 adult pairs per year for on-station rearing of steelhead smolts would reduce the total number of steelhead reared on station annually from approximately 2.3 to 1.5 million smolts.

Pros

- Consistent with the recommendation to discontinue transfers of Dworshak NFH steelhead to the Salmon River basin.
- Could reduce the direct outplanting of coho smolts transferred from lower Columbia River hatcheries to the Clearwater River by providing additional rearing and acclimation space at Dworshak NFH.
- Reduces steelhead rearing densities in the indoor nursery tanks to levels more consistent with the density index guidelines (DI < 0.5) for steelhead and rainbow trout.
- Increasing the size of the spring Chinook program would be consistent with mitigation goals because of increased numbers of spring Chinook adults returning to the Clearwater River basin.
- Provide rearing space for spring Chinook if programmatic changes were made toward rearing another stock at Kooskia NFH (see recommended alternative for Kooskia NFH).

Cons

- Current pump capacities for intake water would require some of the coho (or spring Chinook) to be reared on reuse water.
- Would reduce the number of hatchery-origin steelhead available for harvest in the Clearwater River and downstream fisheries.

Alternative 3: Rear North Fork Clearwater Steelhead at Clearwater Fish Hatchery and spring Chinook at Dworshak NFH

At the present time, Dworshak NFH and Clearwater Fish Hatchery both rear steelhead and spring Chinook to the smolt stage for direct release (Dworshak NFH only) or offsite releases (both hatcheries). This alternative would move all rearing of steelhead to Clearwater Fish Hatchery, and the rearing of all spring Chinook to Dworshak NFH. Steelhead reared at Clearwater Fish Hatchery would be released into the North Fork Clearwater River. Approximately 3.2 million spring Chinook could be reared at Dworshak NFH with unlimited chilled water in the incubation room and single pass water only to the outdoor raceways and Burrow's Ponds Approximately 1.5 million steelhead could be reared to the smolt stage at Clearwater Fish Hatchery

Pros

- Simplifies fish culture and disease management practices by rearing fewer stocks at each hatchery.

- Prevents epizootic losses of steelhead juveniles by removing them from Dworshak's water supply which contains IHNV and other pathogens that are transmitted by anadromous adults from June to September. IHN is a significant source of mortality to juvenile steelhead during the summer months.

- Reduces or eliminates the need for heated reuse water at Dworshak NFH, further reducing disease risks to fish on station.

- Reduces the risk of cross-contamination of pathogens between species (e.g. IHNV) and between the two hatcheries.

- Maintains fishing opportunity for the North Fork Clearwater strain of steelhead and spring Chinook in the Clearwater River and in downriver fisheries.

Cons

- This alternative may require additional incubation and early rearing space, and more water. If anything, it reduces the efficiency of using the existing rearing space since rearing both steelhead and spring Chinook, which have different life cycles, utilize different areas of the facility during different time periods.

- Adult collection and juvenile releases for both species would still have to occur at Dworshak NFH unless adult collection and release capabilities were established at Clearwater FH and/or the Clearwater FH satellite facilities were used exclusively for collection of broodstock.

- Reduced imprinting may also occur if steelhead are reared on reservoir water upstream of Dworshak Dam (water source for Clearwater FH) but smolts are transferred and released from Dworshak NFH because Clearwater FH does not have direct release and adult collection capabilities.

- May increase disease risks to spring Chinook released at satellite facilities in the Lochsa (Powell River) and S.F. Clearwater (Red and Crooked rivers) rivers after being reared at Dworshak NFH instead of Clearwater FH, although spring Chinook are more resistant than steelhead to IHNV which is prevalent in the N.F. Clearwater River below Dworshak Dam.

- Current pump capabilities of intake water at Dworshak NFH would require some of the spring Chinook and/or coho to be reared on reuse water.

- This alternative would not be consistent with the original mitigation intent of Dworshak NFH (steelhead) and Clearwater Fish Hatchery (spring Chinook).

- The program changes would require a new and different agreement with the Army Corps of Engineers for facilities operations and maintains.

Alternative 4: Rear spring Chinook at Clearwater Fish Hatchery and North Fork Clearwater B-run Steelhead at Dworshak NFH

This alternative would move all rearing of spring Chinook to Clearwater Fish Hatchery and all rearing of North Fork Clearwater steelhead to Dworshak NFH. With expanded nursery rearing capacity and

increased use of heated water, approximately 2.7 million B-run steelhead could be reared at Dworshak NFH compared to 2.3 million that are currently reared at Dworshak NFH. Approximately 3.0 million spring Chinook could be reared at Clearwater Fish Hatchery.

Pros

- Simplifies fish culture and disease management practices by rearing fewer stocks at each hatchery (same pro as Alternative 3).
- Reduces the potential of horizontal transmission of pathogens (e.g. IHNV) between species (same pro as Alternative 3).
- Maintains fishing opportunity for North Fork Clearwater strain of steelhead and spring Chinook in the Clearwater River and in downriver fisheries (same as Alternative 3).
- Improves spring Chinook fish health by relying exclusively on reservoir water behind Dworshak Dam rather than N.F. Clearwater below Dworshak Dam where the presence of anadromous fish increases fish health risks (e.g., prevalence of IHNV) to fish reared at Dworshak NFH.
- This alternative would be consistent with the original mitigation intent of Dworshak NFH (steelhead) and Clearwater Fish Hatchery (spring Chinook).

Cons

- This alternative may require additional incubation and early rearing space, and more water. If anything, it reduces the efficiency of using the existing rearing space since rearing both steelhead and spring Chinook, which have different life cycles, utilize different areas of the facility during different time periods.
- Adult collection and juvenile releases for both species would still have to occur at Dworshak NFH unless adult collection and release capabilities were established at Clearwater FH and/or the Clearwater FH satellite facilities were used exclusively for collection of broodstock.
- Reduced imprinting of spring Chinook released into the N.F. Clearwater River may also occur if they are reared on reservoir water from upstream of Dworshak Dam (water source for Clearwater FH) but smolts are transferred and released from Dworshak NFH because Clearwater FH does not have direct release and adult collection capabilities.
- If N.F. Clearwater River water downstream from Dworshak Dam continues to be used at Dworshak NFH, disease risks to steelhead reared on station would remain or increase because steelhead juveniles are highly susceptible to IHNV.
- Steelhead would continue to be reared on reuse water at Dworshak NFH and a larger program might necessitate more reuse water.
- Increasing the number of Clearwater B steelhead reared on station compounds the overcrowding issue in the nursery building.
- The program changes would require a new and different agreement with the Army Corps of Engineers for facilities operations and maintains.

Alternative 5: Maintain on-station releases at Dworshak NFH and work with cooperators to develop an integrated local broodstock of South Fork B-run steelhead for conservation purposes.

Under this alternative, outplanting of steelhead from Dworshak NFH into the South Fork Clearwater River would be terminated and an integrated hatchery program derived from natural origin adults trapped in the South Fork Clearwater River would replace those outplants.

Pros

- Establishes a locally adapted broodstock for the South Fork Clearwater Basin.
- Contributes to the conservation of the native South Fork B-run steelhead
- Contributes to future harvest in the South Fork Clearwater Basin after some level of recovery of natural populations is achieved to begin compensating for the discontinued release of North Fork B-run steelhead.

Cons

- Would require adult collection capabilities in the South Fork Clearwater River.
- Could be mining a small population.
- Natural populations may currently not be of sufficient abundance to support an integrated hatchery program that could provide fish for harvest and, at the same time, meet the conservation needs of naturally spawning populations.

Alternative 6: Discontinue the North Fork Clearwater B-run Steelhead program in favor of spring Chinook, coho or conservation programs

This eliminates the rearing of North Fork B-run steelhead at both Dworshak NFH and Clearwater Fish Hatchery.

Pros

- Allows Dworshak NFH and Clearwater FH to be devoted to the production of spring Chinook and coho.
- Allows Dworshak NFH to be used for conservation programs.
- Would eliminate the need for reuse of the Burrows' Ponds if fish production was not increased or expanded.

Cons

- Eliminates fishing opportunity of North Fork B-run steelhead in the Clearwater River and in downriver fisheries.

- Severely impacts the ability to meet Army Corps of Engineers and LSRCP mitigation goals.
- Results in the extirpation of the North Fork Clearwater B-run steelhead stock.

Alternative 7: Terminate the B-run steelhead, spring Chinook and coho programs and decommission the facility

Pros

- Eliminates risks associated with fish produced at Dworshak NFH.
- Eliminates the discharge of untreated or unsettled effluent from Dworshak NFH.

Cons

- Eliminates fishing opportunity of North Fork B-run steelhead in the Clearwater River and in downriver fisheries.
- Reduces fishing opportunity of spring Chinook in the Clearwater River and in downriver fisheries.
- Would require Clearwater Fish Hatchery to develop adult collection capabilities at the hatchery and/or satellite facilities if they continued production at the facility.
- Severely impacts the ability to meet Army Corps of Engineers and LSRCP mitigation goals.
- Results in the extirpation of the North Fork Clearwater B-run steelhead stock.

Recommended Alternatives

Alternatives 3 and 4 were not given serious consideration at the present time because of the major infrastructure modifications that would be necessary at the Clearwater Fish Hatchery to allow on-station releases into the N.F. Clearwater River and capture of returning adult fish for broodstock. The use of Clearwater Hatchery satellite facilities for collection of steelhead adults may not require extensive modification.

The original purpose for Dworshak NFH was to mitigate for loss of steelhead spawning habitat in the North Fork Clearwater River. Dworshak NFH maintains a unique stock of steelhead (North Fork Clearwater River) that would most likely have been lost without artificial propagation at the hatchery. This original purpose has not changed as one of the primary missions of Dworshak NFH. Therefore, the Team recommends:

Short Term Recommendation (0 to 5 years): Implement Alternative 1: Maintain the current program with implementation of the recommendations identified by the team.

Long Term Recommendation (5 to 20+ years):

a) Maintain the current steelhead program (Alternative 1) at Dworshak NFH to mitigate for lost habitat upstream of Dworshak Dam.

b) Develop a separate, localized broodstock and hatchery program for the South Fork Clearwater River to eliminate the desire to continually outplant steelhead from Dworshak NFH (Recommendation 9c).

c) Investigate the potential for developing a naturally spawning population of North Fork Clearwater steelhead somewhere in the Clearwater Basin (Recommendation DW7). The goal here would be to identify spawning habitat that could inevitably provide natural-origin steelhead to incorporate into the hatchery broodstock to reduce the domestication risks associated with the current program. Virtually all historic spawning habitat for steelhead in the North Fork Clearwater River is no longer accessible. The risk of domestication from using only hatchery-origin adult steelhead for broodstock is inconsistent with the goal of preserving the genetic characteristics of the North Fork steelhead population. Several options could be considered:

> i) Investigate the habitat capabilities of tributaries to Dworshak reservoir as possible spawning areas for steelhead that could be trapped and hauled above the dam. Dworshak Dam is an impassable barrier, however, historic habitat may exist above Dworshak Dam. Other programs have utilized historic habitat above dams for natural production (Cowlitz and Lewis River in the lower Columbia River).
>
> ii) An artificial spawning channel could be developed in which hatchery-origin fish would be allowed to spawn naturally, and natural-origin smolts collected for differential marking or tagging prior to release. Those differentially-tagged fish would have a high priority for broodstock as returning adults.
>
> iii) One or more isolated tributaries in the Clearwater Basin outside the N.F. Clearwater River could be managed strictly for supplementation and natural spawning of North Fork Clearwater steelhead. Natural-origin adults returning to this stream could be integrated into the steelhead broodstock at Dworshak NFH.

Dworshak NFH Spring Chinook

Operator: U.S. Fish & Wildlife Service

Summary of Current Program

Goals

- ***Harvest goal***: The total harvest goal for spring Chinook in the Clearwater River under current conditions is 5,170 adults.[61] The long-term future harvest goal for spring Chinook in the Clearwater River is 45,000 adults.[Ibid.] A specific harvest goal for the spring Chinook program at Dworshak NFH has not been established. The purpose of this program is to mitigate for reduced tribal and sport fishing harvests in the Clearwater River that were impacted by the construction of the four hydropower dams on the lower Snake River. The total mitigation goal of the Lower Snake River Compensation Plan (LSRCP) for spring Chinook at Dworshak NFH is 9,135 hatchery-origin adults returning upstream of Lower Granite Dam. Based on this mitigation goal and current broodstock needs at Dworshak NFH (≈ 1200 adults), the program can provide approximately 7,000 spring Chinook salmon for harvest *if* the mitigation goal is achieved *and* assuming 90% survival of returning adults from Lower Granite Dam to the hatchery.

- ***Broodstock escapement goal***: Collect 1,200 adults annually for broodstock.

- ***Conservation goal:*** The spring Chinook program at Dworshak NFH currently has no conservation goal.

- ***Escapement goal for natural-origin adults***: The spring Chinook program at Dworshak NFH has no specific escapement goal for natural-origin spring Chinook in the Clearwater River.

- ***Research, education, and outreach goals:*** Provide accurate information and educational (I/E) opportunities for the public, media, schools, Tribal, State, and Federal agencies, and elected officials to enhance participation in understanding and stewardship of Dworshak NFH and U.S. Fish & Wildlife Service programs. The Idaho Fishery Resource Office (FRO) at the hatchery monitors, evaluates, and coordinates fishery services and research activities for the Dworshak Fisheries Complex.

Objectives

- Trap up to 1,200 adult spring Chinook for broodstock annually.

- Spawn 500 - 600 females and 500 - 600 males, depending on mean age and size of adult females, to yield up 2 million green eggs.

- Rear and release 1.05 million smolts directly from the hatchery into the North Fork Clearwater River.

[61] *NWPCC Clearwater River Subbasin Plan, http://www.nwcouncil.org/fw/subbasinplanning/clearwater/plan/.*

- Provide periodic transfers of fertilized or eyed eggs to other programs (e.g., 60,000 eggs to tribes).

Program Description

In June 1982, under the LSRCP, Dworshak NFH was expanded from its primary function as a steelhead mitigation facility to include spring Chinook salmon. The spring Chinook program at Dworshak NFH was intended to compensate for reduced sport and tribal fisheries in the Clearwater River resulting from the construction and operation of four hydropower dams on the lower Snake River. The mitigation goal calls for the return of 9,135 adult spring Chinook upstream of Lower Granite Dam.

Prior to 1987, spring Chinook reared and released at Dworshak NFH were derived from Carson, Little White Salmon, and Leavenworth NFH stocks. After 1987, spring Chinook were obtained from the Rapid River Hatchery[62] on the Little Salmon River and other sources within the Snake River basin.. Genetic analyses confirm that existing naturally spawning spring Chinook salmon in the Clearwater River subbasin are derived from reintroduced Snake River stocks. Currently, hatchery spring Chinook are released from Dworshak NFH for harvest mitigation and outplanted natural spawning areas to supplement natural production.

[62] *The Rapid River Hatchery stock of spring Chinook was derived from adults trapped immediately downstream of the Hells Canyon complex of dams in the Snake River. The genetic origins of those spring Chinook most likely represented several populations native to the upper Snake River and tributaries (e.g., Boise, Payette, and Weiser Rivers between Hells Canyon and Shoshone Falls.*

Assessment of Current Program

Operational Considerations

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

Broodstock Choice and Collection

- The Dworshak NFH spring Chinook program was initially started with fertilized eggs from the Leavenworth, Little White Salmon and Carson NFH programs, all of which represent the "Carson" spring Chinook stock. Fish resulting from those transfers represented all smolt releases from 1983 to 1986.

- The Chinook programs for brood years 1985 and 1986 consisted entirely of eggs that had been transferred from Rapid River State Fish Hatchery, which used spring Chinook returning to the Snake River at Hells Canyon Dam. Thus, smolts released in 1987 and 1988 were entirely Rapid River Hatchery stock (upper Snake River origins), shifting the program away from using the Lower Columbia River Carson Chinook stock.

- Since 1989, Dworshak NFH spring Chinook have been propagated primarily from adult returns back to the hatchery and primarily represent the descendants of the Rapid River stock.

- Dworshak operates a fish ladder at its facility to capture returning adult spring Chinook salmon. The ladder is usually opened for brood stock collection from late May through mid-September.

- Dworshak NFH collects 1,200 adults for brood stock. This number is sufficient to account for deviations from a 50:50 sex ratio, pre-spawning mortality of adults held for broodstock, a desired proportion of three-year old males (jacks) in the broodstock, and culling of full-sib families based on levels of *Renibacterium salmoninarum* (causative agent of bacterial kidney disease, BKD) in the female parents to reduce disease risks.

- The total egg take goal for the current program is 2.0M green eggs. However, based on an 85% egg-to-smolt survival, only 1.24 million eggs are needed to produce 1.05 smolts. Mean fecundity of females is approximately 3,500 eggs, so 355 females need to be successfully spawned to yield 1.24 M green eggs. However, over the past five years, eggs from as many as 30 females per year have been culled to reduce the vertical transmission of BKD to their progeny. Overall, a minimum of 405 females need to be trapped for broodstock each year to also account for a 5% pre-spawning mortality.

Hatchery and Natural Spawning, Adult Returns

- Native populations in the Clearwater River basin are believed to be extirpated because of the former blockage caused by Lewiston Dam. Reintroduction of spring Chinook salmon following removal of the Lewiston Dam has resulted in naturally reproducing populations in Lolo Creek and mainstem/tributary reaches of the Lochsa, Selway, and South Fork Clearwater Rivers.

- This LSRCP mitigation goal of 9,135 adults was calculated based on a catch, downstream of Lower Granite, to escapement, upstream of Lower Granite, ratio of 4:1 (commercial catch of 3:1 and sport catch 1:1).

- Natural populations of spring Chinook salmon in the Clearwater River basin are not listed under the ESA by NOAA Fisheries.

- Good and fair quality habitat for spring Chinook is widely intermixed throughout the majority of the usable mainstem and tributary reaches of the Lochsa River, and upper and lower Selway River, and South Fork Clearwater River. Poor habitat conditions for spring Chinook exist within lower mainstem reaches of major tributaries (Lolo Creek, Lochsa, Selway and South Fork Clearwater rivers) and the mainstem Clearwater River.

- Current natural spawning estimate for spring Chinook in the entire Clearwater watershed is 1,832 fish. The 24-year goal is to achieve a natural spawning escapement of 10,000 spring Chinook throughout the Clearwater River (November 2003 Clearwater Subbasin Fish Management Plan).

- Spring Chinook released from Dworshak NFH have, in the past, exhibited a relatively high stray rate compared to other hatchery stocks of spring Chinook (Pastor 2004[63]). Approximately 29% of coded-wire tags recovered within the Columbia River basin were from areas outside the migration corridor and hatchery (data for broodyears 1986-1993). For broodyears 1986-1993,, approximately 15% of all coded-wire tag recoveries occurred in the Deschutes River. Spring Chinook from Dworshak NFH have also been recovered on spawning grounds in the upper Columbia River (Pastor 2004).

- The actual sex ratio of females to males among returning adults is unknown. Sufficient numbers of adult fish are trapped and retained for broodstock to ensure a 1:1 female:male spawning ratio.

- Spawning protocols are strictly pairwise between males and females. No “backup” males are used, and each male is spawned with only one female. Fish are spawned randomly on each spawn day, and jacks (primarily three-year old males) are used as they are randomly taken on the spawning rack. There are no plans to spawn a male with more than one female unless the number of males is extremely low and insufficient to achieve strict pairwise mating.

- There is no standard protocol (e.g., % males composed of jacks) for incorporating jacks when spawning; jacks are randomly included in the broodstock as they are taken from the adult holding pond and spawning rack.

- From 2000-2007, 2-10% of all spawned males were age-3 jacks.

- Most hatchery fish from the Clearwater basin have been marked by the removal of the adipose fin. Occasionally, unmarked adults (identified by the presence of an adipose fin) enter the hatchery. Unmarked spring Chinook are used for broodstock or placed with marked fish for adult outplanting.

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[63] *Pastor, S. 2004. An evaluation of fresh water recoveries of fish released from National Fish Hatcheries in the Columbia River Basin, and observations of straying. Pages 87-98 in M.J. Nickum, P.M. Mazik, J.G. Nickum, and D.D. MacKinlay, editors. Propagated fish in resource management. American Fisheries Society Symposium 44, Bethesda, Maryland.*

- There have only been a few years when there were surplus spring Chinook adults in excess of broodstock needs at Dworshak NFH. In those cases, excess adults were given to the Nez Perce Tribe for outplanting into tributaries in the upper Clearwater River basin. Outplanting has occurred at seven sites: in the Selway River, the South Fork Clearwater River, and Lochsa River. A prioritized list of adult outplanting sites is reported in the annual operating plan (AOP) for hatchery programs in the Clearwater River. In the past, excess fish have also been used as broodstock to provide eggs or fish for other state or tribal hatchery programs (Kooskia NFH and Clearwater FH) and "backfilling" could occur in the future

- Adult spring Chinook retained for broodstock receive antibiotic injections (erythromycin) to control BKD and reduce transmission of its causative agent, *R. salmoninarum* to developing eggs of maturing females.The testing of female broodstock by the enzyme-linked immunosorbent assay (ELISA) for prevalence of *R. salmoninarum* and the associated culling of fertilized eggs from high titer females, have effectively reduced BKD among juvenile Chinook salmon reared at Dworshak NFH. As a result, prophylactic feeding of medicated feeds has been deemed unnecessary and was discontinued in 1998.

- MS-222 is used to anesthetize adult spring Chinook prior to spawning.

- Harvest of hatchery produced spring Chinook from Dworshak and Kooskia NFH in the Clearwater River is highly variable depending on overall smolt-to-adult survivals and marine ocean conditions. Sport harvests ranged from 0 to 14,752 fish, and tribal harvests ranged from 0 to 3,144 fish for the 20 year period, 1987-2006. The 20 year average was 1,517 and 581 fish harvested in sport and tribal harvests, respectively.

- Creel surveys conducted by IDFG in the Clearwater River during the 2000 spring Chinook fishery (May 5 through July 4), estimated that anglers spent an estimated 78,940 hours to catch 4,867 Chinook, of which 4,384 were harvested and 483 released. Over 80% of the fish harvested were caught in the Dworshak Dam tailrace (N.F. Clearwater River). The season average catch rate was 16.2 hours per fish.

- Recent five-year average for code-wire tag recovery data from Dworshak NFH also indicate significant contribution to Columbia River sport fisheries (~ 900 fish) and Columbia River gillnet fisheries (~ 900 fish).

Incubation and Rearing

- Dworshak NFH has 58 Heath incubator stacks containing a total of 435 incubator trays. Each stack has 54°F water available for incubation of spring Chinook eggs. A maximum of 15 stacks can be supplied with chilled water (40° F) for incubating Chinook eggs.

- Spring Chinook eggs from each female are initially loaded into separate trays (1 female/tray) or approximately 3,500 green eggs/tray. After culling of eggs from high titer females based on ELISA testing for *R. salmoninarum*, retained eggs are enumerated and reloaded at 5,000 eggs/tray. Water flow for the trays is approximately 5 gallons/minute. The minimum dissolved oxygen is 6-7 ppm, as measured in the bottom tray of the stacks.

- Prior to 2003, eyed eggs were shipped from Dworshak NFH to Kooskia NFH for hatch and initial rearing because of colder water temperatures at the latter facility. However, water chillers

were installed in the incubator room at Dworshak NFH in 2003, and transfer of eyed eggs to Kooskia NFH no longer occurs.

- Installation of water chillers in the incubation room at Dworshak NFH increases the incubation time and yields yearling smolts of the desired size at the time of release. Without chilling, daily feed rations would need to be restricted to retard growth, and such restrictions may be inconsistent with water temperatures and metabolism.

- Eggs in incubator banks A/B at Dworshak NFH are chilled to approximately 40ºF. Because the chiller has the capacity to only chill two incubator stacks, eggs in C/D incubator banks are maintained at approximately 45ºF.

- Eye-up of eggs on 45ºF water occurs approximately 43 days after fertilization. Eye-up of eggs on chilled water (40ºF) takes place approximately 70 days after fertilization. Upon eye-up, eggs are shocked and enumerated using an electronic egg picker and counter (Van Gaalen Model N-100).

- Incubation water is chilled to increase, by approximately 27 days, the total number of days that eggs are incubated to allow sufficient time to release the previous brood year and clean outdoor raceways before transfer of newly-hatched fry to those raceways. In contrast to steelhead, spring Chinook are transferred directly from the hatching trays to the outdoor raceways.

- Prior to 2003, swim-up fry from Dworshak NFH but hatched at Kooskia NFH were initially ponded in nursery tanks at approximately 83% yolk absorption. The fertilized eggs and fry had experienced approximately 1,370 temperature units when they were moved from the incubator trays to the nursery tanks.

- Since 2005, all incubation has occurred at Dworshak NFH, and hatched fry are loaded directly from the hatching trays to the outdoor raceways at approximately 100,000 fry/raceway. The fish in those initial raceways are later split among additional raceways to a final rearing density of 30,000 to 35,000 fish per raceway. Splitting of the Chinook in each raceway among additional raceways occurs when they are adipose-fin clipped and coded-wire tagged in the summer following initial ponding.

- When initially loading the raceways, the density index is approximately D.I. = 0.05-0.07. Water temperature is about 41 degrees F. At the time of marking and tagging, the juveniles are then partitioned into additional raceways to achieve their final numbers. Density index at the time of splitting is about D.I. = 0.25. After splitting, the density index decreases to approximately D.I. = 0.08. At the time of release, density index reaches approximately D.I. = 0.25.

- The use of single pass water in the outdoor raceways reduces problems with external parasites such as *Ichthyophthirius* compared to steelhead which are reared on reuse water at Dworshak NFH. If necessary, formalin is used to treat parasites (e.g., *Costia* sp.).

- Unlike steelhead reared at Dworshak NFH, IHNV in spring Chinook has occurred only once since 1996 and is not considered a problem for fish reared on station.

Release and Outmigration

- Spring Chinook yearlings are reared to approximately 20 fish per pound at Dworshak NFH and released directly from the hatchery into the North Fork Clearwater River at the end of March each year.

- Dworshak NFH releases approximately 1.05 million spring Chinook salmon smolts each year.

- Based on studies conducted in the mid-1990's (see Research, Monitoring and Evaluation section), smolt releases are generally scheduled between the last week in March and the first 10 days in April. The precise release days are determined by monitoring flows in the Clearwater and Snake Rivers and scheduling release days during a rising hydrograph. Releases occur over a two-day period and take place in the late afternoon and evening in order to reduce avian predation. Smolts are released into the North Fork of the Clearwater River and arrangements are made with the Corp of Engineers to schedule an increase in water discharge from Dworshak Reservoir to facilitate moving the smolts out of the North Fork and into the mainstem Clearwater River. Additional environmental factors favoring days of release include increased river turbidity and "new moon" to provide cover from predators.

- Night releases are performed to reduce predation on release groups. Release occurs over two consecutive evenings.

- Spring Chinook released from Dworshak NFH have been included in the *Comparative Survival Studies* (CSS) in the Snake River basin.[64]. Post-release survival of spring Chinook smolts to Lower Granite Dam averaged approximately 65% (range ~20%-80%) from all Snake River hatcheries in 1997 through 2004, but survivals from Dworshak NFH were generally higher than the other CSS hatcheries (Rapid River FH, Catherine Creek, McCall FH, Imnaha FH). In general, 30 to 60 days are required for all spring Chinook smolts released from Dworshak NFH to pass downstream of Lower Granite Dam (based on 2003-2007 PIT tag data).

- Smolt-to-adult return rates for Dworshak NFH spring Chinook averaged 0.62% (ranged = 0.21% to 1.18%) for release years 1997-2003.

Facilities and Operations

Refer to the Facilities and Operations section under Operational Considerations for the Dworshak NFH B-run Steelhead program.

Research, Education, and Outreach

- Since 1993, all spring Chinook released from Dworshak NFH have had a clipped adipose fin to identify them as hatchery fish. The mark facilitates selective fisheries and evaluation of the status of naturally spawning populations. In addition, at least two groups of 60,000 fish each receive coded-wire tags with separate codes to represent the two separate banks of Chinook raceways at Dworshak NFH.

- Since 1996, the spring Chinook salmon program at Dworshak NFH has cooperated with the U.S. Fish & Wildlife Service's Columbia River Fishery Program Office (Vancouver, WA) and Fish

[64] *Comparative Survival Study of PIT-Tagged Spring/Summer Chinook and Steelhead In the Columbia River Basin, Ten-Year Retrospective Summary Report, BPA (8/31/2007).*

Passage Center (Portland, OR) in the Comparative Survival Study by providing a minimum of 50,000 smolts per year for PIT-tagging. In 2007, 105,000 spring Chinook juveniles at Dworshak NFH were PIT tagged prior to release. The smolts are released at Dworshak NFH and provide information on survival during emigration to the ocean, including comparative return survivals of fish transported downstream in barges vs. non-transported fish that volitionally negotiate the fish passage facilities at each mainstem dam during their downstream migrations in the Snake and Columbia rivers. For the past several years, PIT tag monitoring of returning adults at ladders at each dam have been used by fishery managers and the staff at Dworshak NFH to construct in-season estimates of harvestable surpluses of returning adult Chinook salmon not needed for broodstock.

- A study of post-release survival and return rates conducted in the mid-1990's indicated that spring Chinook yearlings released during the first two weeks in April had significantly greater smolt-to-adult survival rates than fish released during the last two weeks in April and the first two weeks in May. Based on those results and practical experience, smolt releases are generally scheduled currently for the period between the last week in March and the first 10 days in April.

- A number of evaluation studies have been conducted at Dworshak NFH over the past 20 years. Recent studies include: (1) an evaluation of the survival effects of different rearing densities of spring Chinook; (2) an evaluation of various methods of marking and tagging adult spring Chinook salmon and steelhead for broodstock management; and (3) a comparison of release time on downstream emigration success and adult returns of spring Chinook salmon, as described previously. Results from these and other studies have been used to refine hatchery management and fish culture at Dworshak NFH.

- The outreach program at Dworshak National Fish Hatchery is very active and offers a year-round public outreach and education programs. One goal of the outreach program is to promote awareness of Dworshak National Fish Hatchery and the mission of the U.S. Fish & Wildlife Service. Another goal is to provide information to the public regarding the life cycles of anadromous fish in the Columbia River Basin, primarily steelhead trout and spring Chinook salmon in the Clearwater River. Outreach goals are met through a variety of on-site and off-site activities, including hatchery tours, school programs, information booths and presentations, and an annual open house and free fishing day for the local community.

Benefit and Risk Assessment[65]

BENEFITS CONFERRED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

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

Harvest Benefits

- The harvest benefit for Dworshak NFH spring Chinook has not been accurately quantified. Collectively, harvest of hatchery produced spring Chinook from Dworshak NFH, Kooskia NFH and Clearwater Fish Hatchery in the Clearwater River is highly variable. For example sport harvest ranged from 0 to 14,752 and tribal harvest ranged from 0 to 3,144 for the 20 year period,

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

1987-2006. The 20-year average was 1,517 sport and 581 tribal harvest. Based on the available information, for return years 2001 through 2005, sport harvest of Dworshak NFH spring Chinook in the Clearwater River averaged 3,668 fish per year (range 606 to 8,355) and comprised an average of 45% of the spring Chinook salmon harvested in the Clearwater River. Based on coded-wire tag recovery data starting in 1985 through brood year 2002, approximately 7% of recaptured spring Chinook salmon released from Dworshak NFH were caught in gillnet fisheries in the mainstem Columbia River, 15% percent were caught in sport fisheries in the Columbia and Snake River basins, 7% in Columbia River treaty and ceremonial fisheries, and 71% were recaptured at Dworshak NFH or other hatcheries. Less than 1% of the coded wire tags are recovered elsewhere. [66]

- As available, excess adults trapped at the hatchery are provided to the Nez Perce Tribe for subsistence and ceremonial purposes.

Conservation Benefits

- Periodically, surplus spring Chinook adults returning to Dworshak NFH are used for reintroduction programs of the Nez Perce Tribe. Reintroduction programs take place in the mainstem/tributary reaches of the Lochsa, Selway, and South Fork Clearwater Rivers. The spring Chinook program at the Clearwater Hatchery specifically targets those areas for broodstock collection and juvenile releases.

Research, Education, Outreach and Cultural Benefits

- Tribal harvest and surplus adults trapped at hatchery provide a cultural benefit to Columbia River tribes.

- Tagged fish are used to assess survival passage at hydroelectric dams and comparative survival of volitional passage versus barging around the dams.

- The geographic location of Dworshak NFH on the Lewis and Clark Trail offers additional outreach opportunities of historical and cultural significance.

- Dworshak NFH has provided numerous research opportunities USFWS, NOAA Fisheries, U.S. Geological Survey, University of Idaho and other biologists. In 2007, 11 requests were received for cooperative research projects at Dworshak NFH.

- The Idaho Fishery Resource Office (USFWS) in Ahsahka, Idaho maintains an active monitoring and evaluation program assessing adult returns, age class composition, run timing, mean fecundities, and other biodata for Dworshak NFH spring Chinook.

- An active Friends of Dworshak NFH group engages the community and arranges events at the facility.

BENEFITS CONFERRED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

[66] *Pastor, S.M. 2009. Annual stock assessment-CWT (USFWS). Columbia River Fisheries Program Office, Vancouver, WA. www.fws.gov/columbiariver*

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

Harvest Benefits

- Harvest benefits are minimal outside of the Snake River Basin. Less than 1% of the total harvest of Snake River spring Chinook occurs in ocean fisheries. Based on an estimated interception rate of spring Chinook in the Columbia River, approximately 45% of the total harvest occurs in the Columbia River (BY1996-2000).

Conservation Benefits

- None identified.

Research, Education, Outreach and Cultural Benefits

- Results of past studies from Dworshak NFH have broad application throughout the region.

- Hatchery staff provide educational opportunities offsite to other communities. In-classroom presentations are provided to schools in Orofino, Nez Perce, Kamiah and Kooskia. Staff also participates in county fairs and environmental events in Latah, Nez Perch and Idaho Counties as well as Clearwater County

RISKS POSED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

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

Genetic Risks

- None identified based on current program and protocols. The potential importation of fish or eggs from Rapid River Hatchery would be inconsistent with current management policies and could reduce overall return rates and contributions to fisheries and the hatchery. The possibility for resumption of such transfers still exists because of contingency language in the current U.S. vs. Oregon agreement.

Demographic Risks

- Failure of one or more water intake pumps during peak water use poses a demographic risk of fish loss. This risk is further increased because of the absence of an offline back-up pump on station.

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

- The facility's location above four Columbia River and four Snake River dams significantly reduces the survival of outmigrating juveniles and returning adults, posing a demographic risk to the population in low marine survival years. The cumulative mortality imposed by eight

mainstem dams further threatens the return of sufficient numbers of adult spring Chinook for harvest and broodstock on a consistent basis.

Ecological Risks

- The very close proximity of the water intake for the hatchery and the return fish ladder into the facility poses a disease risk to spring Chinook reared on station due to the potential shedding of pathogens by anadromous fish returning to the hatchery.

Physical Risks

- A deteriorating roof and supports in the hatchery building pose a human health and safety risk.

Research, Education, Outreach and Cultural Risks

- None identified.

RISKS POSED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

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

Genetic Risks

- Approximately 29% of all coded-wire tags recoveries for adult spring Chinook originating from Dworshak NFH occur outside the mainstem migration corridor migration corridor of the Columbia and Snake Rivers, posing a genetic straying risk to other spring Chinook stocks in the Columbia River basin

Demographic Risks

- None identified.

Ecological Risks

- Discharge of untreated water and amplification of disease within the hatchery pose ecological risks to aquatic organisms downstream.

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

Research, Education, Outreach and Cultural Risks

- None identified.

Recommendations for Current Program[67]

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

Program goals and objectives

Issue DW31: Program goals for Dworshak NFH spring Chinook are not fully expressed in terms of numeric outcomes that quantify intended benefits. *This hatchery program lacks specific numeric goals for harvest although providing fish for harvest is a primary purpose of the program. The proportional Snake River spring Chinook mitigation goal for adult returns from Dworshak NFH upstream of Lower Granite Dam is 9,135 fish, but no numeric harvest goals within the Clearwater basin, or for on-station releases from Dworshak NFH, have been identified.*

Recommendation DW31: Restate program goals to identify the number of harvestable adult spring Chinook from Dworshak NFH for the Clearwater River basin. For example, based on the mitigation goal (9,135 adults) and broodstock needs, the harvest goal could be as high as 7,022 adult fish, assuming 90% survival from Lower Granite Dams to the fishery and hatchery.

Issue DW32: Current conditions affecting the survival of salmon and steelhead in the Snake and Columbia rivers (operation of the hydropower system, habitat, harvest, and ESA listings) downstream from Dworshak NFH differ from the assumptions that were used to establish LSRCP mitigation goals. *These different conditions inhibit consistent achievement of Dworshak NFH's contribution (9,135 adult spring Chinook) towards meeting the LSRCP mitigation goal of 58,700 adult spring/summer Chinook returning annually upstream of Lower Granite Dam, as developed initially by the Army Corps of Engineers in the mid-1970's.*

Recommendation DW32: Continue to work through various regional processes such as (a) implementation of the mainstem *Federal Columbia River Power System* Biological Opinion to improve migration survival, (b) *US vs. OR* discussions to address harvest issues, (c) NOAA Fisheries to complete ESA consultations on hatchery mitigation programs, and (d) local watershed groups to continue improving habitat, to allow the Service and cooperators meet Army Corps of Engineers and LSRCP mitigation goals on a consistent basis. Reexamine current approaches for contributing 9,135 adult spring Chinook to the LSRCP mitigation goal of 58,700 adult spring/summer Chinook (upstream of Lower Granite Dam) to determine

[67] *The Review Team believes that Dworshak Hatchery Evaluation Team—as a whole, in task teams and/or with outside assistance and expertise—will be the logical body to implement most of the following recommendations.*

whether the current hatchery program should be modified to account for existing conditions and capabilities at Dworshak NFH.

Broodstock Choice and Collection

Issue DW33: The number of spring Chinook collected for broodstock is above the number necessary to meet the 1.4 million egg-take goal.*-Currently, 1200 adults is the collection goal for a 1.05 million yearling smolt release. Assuming a 5% pre-spawning mortality of fish held for broodstock, a maximum 8% loss of fertilized eggs due to culling of high risk females for bacterial kidney disease (BKD), an average fecundity is 3,500 eggs per female, and an 85% eyed egg to smolt survival, approximately 406 females total would need to be retained for broodstock to produce 1.05 M smolts (1.42M eggs at 3,500 egg/female).*

Recommendation DW33: Reduce adult collection goal to approximately 820 adults consistent with obtaining approximately 410 females to provide a minimum of 1.4 million eggs sufficient to produce 1.05 million smolts. The most recent comanager goal to retain 1,000 spring Chinook adults during 2008 is more consistent with the Team's recommendation.

Issue DW34: *In the past, Rapid River stock was used to "backfill" for broodstock shortages. Backfilling is inconsistent with the principles of local adaptation and managing hatchery stocks for maximum viability. Additionally, backfilling of egg shortages substantially increases straying risks because juvenile fish are released into watersheds different from the source population and watershed to which parental fish homed and returned*

Recommendation DW34: Eliminate backfilling of the spring Chinook broodstock at Dworshak NFH to maintain a locally-adapted stock at Dworshak NFH and minimize straying risks to natural populations in the Columbia and Snake rivers. If other stocks are used to meet harvest or mitigation agreements in the Clearwater River, then (a) the imported fish should be differentially marked or tagged, (b) released on station (i.e., not outplanted) to maximize recapture rates as returning adults, and (c) excluded from the Dworshak NFH broodstock.

Hatchery and Natural Spawning, Adult Returns

Issue DW35: Stray rates for Dworshak NFH spring Chinook into tributaries downstream of the hatchery in the Columbia basin are high compared to other hatchery stocks of spring Chinook, thus posing a genetic risk to natural populations in other watersheds. *For example, for broodyears (BY) 1986-1993, 15% of all code-wire tag recoveries for Dworshak NFH spring Chinook occurred in the Deschutes River. However, for BY 1996-2000, straying rates were less than those observed for BY 1986-1993.*

Recommendation DW35: The Idaho Fisheries Resource Office should quantify homing and straying of spring Chinook released from Dworshak NFH. Attempts should be made to correlate variable stray rates with factors that may contribute to straying including variable fish culture practices (e.g., level of backfilling, mean size at release, etc.), water management practices, and barging vs. volitional transport of smolts through the hydropower system. Straying risks to other populations in the Clearwater, Snake and Columbia rivers should be assessed.

Issue DW36: MS-222 is currently used to anesthetize most of the spring Chinook during spawning. This precludes the use of these carcasses for nutrient enhancement of streams and other beneficial uses that could result in immediate consumption by wildlife. *The U.S. Food and Drug Administration has not approved MS-222 for use on animals that could be consumed by humans or other animals within 30 days of use.*

Recommendation DW36: Consider an alternative method of anesthetizing broodstock at the time of spawning. Alternatives to MS-222 include, but are not limited to, electro-anesthesia and carbon dioxide (CO_2), including . CO_2 and oxygen used together. Currently, CO_2 (FDA-approved) is used by the hatchery for select groups of fish destined for outplanting and bear/eagle rehabilitation programs; however, Dworshak should research the feasibility of electro-anesthesia as a alternative for MS-222 and CO_2. Electro-anesthesia is successfully used for large broodstock programs at other hatcheries to reduce chemical use, alleviate safety concerns and to increase the number of carcasses suitable for other uses.

Incubation and Rearing

Issue DW37: Exposure of anadromous fish to the water supply (N.F. Clearwater River) for Dworshak NFH increases disease risks for spring Chinook reared on station. Reliance on pumped water for rearing spring Chinook increases demographic risks of fish losses.

Recommendation DW37: Investigate options to increase the amount of gravity-feed water available from Dworshak Reservoir. The long term benefit of developing an adequate water supply from Dworshak reservoir may significantly reduce current power costs required to pump water to the facility, increase operational efficiencies, increase fish health, produce a higher quality smolt, more efficiently meet appropriate fish size at release, and increase survival.

Release and Outmigration

No specific issues were identified related to the release and outmigration of spring Chinook from Dworshak NFH.

Facilities/Operations

Refer to the Facilities/Operations section under Recommendations for the Dworshak NFH B-run Steelhead program.

Research, Monitoring, and Accountability

Issue DW38: Dworshak NFH has a well-developed coded-wire tagging program to assess survival of various rearing and release strategies. In addition, coded-wire tagged fish need to accurately represent all progeny groups released from Dworshak NFH. Currently, 120,000 fish in four of the thirty raceways of spring Chinook are coded-wire tagged. *Because fish in different raceways can differ (e.g., mean age and size) and the pond environments can differ slightly (e.g., flow index and flow pattern), the practice of tagging fish in four raceways needs to be assessed to ensure that the entire brood year of fish is represented. In most NFH salmon*

and steelhead programs, fish are spawned from throughout the entire adult return to ensure that most segments of the run are represented in the resulting progeny. This procedure usually results in many different spawn "takes". The fish are ponded by take/hatch date into a series of raceways that, when fully populated, can differ in mean age and size between raceways. Post-release monitoring of each release group using coded-wire tags requires that the tags represent the entire population.

Recommendation DW38: Continue to consult with the Idaho Fishery Resource Office to insure that the tagging strategy accurately represents the entire population of progeny from all spawn groups for a particular brood year.

Issue DW39: The PIT tag program for spring Chinook (greater than 50,000/year) currently depends on funding from the Comparative Survival Study (CSS) which compares smolt-to-adult return rates (SARs) of fish transported downstream in barges versus SARs for juvenile fish negotiating the passage systems at each dam on the Columbia and Snake Rivers. Once the CSS study is complete, funding for the PIT tag program will cease. PIT tagging and monitoring are required to continue evaluating post-release migration and survival of spring Chinook released from Dworshak NFH.

Recommendation DW39: Continue to implement and refine the PIT tag program to monitor migration and survival of spring Chinook, and to assist with in-season harvest management of returning fish. The PIT tagging program should be consistent with (a) regional goals and objectives and (b) concurrent goals and objectives for the hatchery program.

Issue DW40: Recovery of coded-wire tags (CWT) from harvested fish in terminal fishery areas in the Clearwater River basin *is inadequate. Harvest benefits associated with the spring Chinook program at Dworshak NFH cannot be accurately distinguished from those for Kooskia NFH and Clearwater Anadromous Fish Hatchery. This latter deficiency is true also for the spring Chinook programs at Kooskia NFH and Clearwater Fish Hatchery, A coast-wide CWT goal of 20% recovery of all CWTs from returning adult fish has been advocated by the LSRCP Coordinator.*

Recommendation DW40: The Service should continue to work with cooperators to assess the mark sampling program, improve CWT recovery rates, and quantify the harvest benefits separately for the spring Chinook programs at Dworshak NFH, Kooksia NFH, and Clearwater Fish Hatchery.

Issue DW41: Data obtained from recovery of coded-wire tags by the Service and LSRCP cooperators are not reported within the required time frames, inhibiting adaptive management based on the most current information. *The Pacific Salmon Commission's Data Standards Work Group Report states, under Specifications and Definitions for the Exchange of Coded-Wire Tag Data for the North American Pacific Coast, state that "Preliminary (Recovery) data for the current calendar year should be reported no later than JANUARY 31 of the following year."*

Recommendation DW41: The Service should develop a data management plan that incorporates tagging goals and objectives, data management, and annual reporting requirements of coded-wire tag data at both the program and regional levels. This could be

incorporated into the cooperative agreements between the LSRCP office and cooperators (i.e. IDFG and tribes).

Refer to Issues and Recommendations DW25 and 26 in the Dworshak NFH B-run steelhead section as they also pertain to the Dworshak NFH spring Chinook program.

Education and Outreach

Refer to the Education and Outreach section under Recommendations for the Dworshak NFH B-run Steelhead program.

Alternatives to Current Program[68]

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

Alternative 1: Current program with recommendations.

Pros

- Maintains fishing opportunity for highly valued spring Chinook in the Clearwater River Basin and downstream fisheries. The program has contributed to harvest for eight consecutive years.
- Supports tribal harvest priorities for the Clearwater River Basin
- Consistent with LSRCP mitigation responsibilities for the Clearwater River Basin.
- Continues a program in which is healthy, has performed well on-station, and has been self-sustaining with adult returns back to the hatchery in recent years.

Cons

- Competes with the N.F. Clearwater steelhead program for water and space.
- Complicates fish culture activities at Dworshak NFH because, in concert with the steelhead program, increases the number of species and programs maintained on station throughout the year.

[68] *Alternatives presented here are intended to be consistent with those in the companion report for LSRCP hatcheries operated by Idaho Department of Fish and Game.*

Alternative 2: Increase the size of the spring Chinook program and reduce the size of the steelhead program (see Alternative 2 under Dworshak NFH steelhead program).

- Same pros and cons as Alternative 2 under the Dworshak NFH B-run steelhead program.
- Additonal pro: Spring Chinook are a high priority species for the Nez Perce Tribe in the Clearwater River.

Alternative 3: Rear Dworshak NFH spring Chinook and North Fork Clearwater steelhead at Clearwater Fish Hatchery (see Alternative 3 under Dworshak NFH steelhead program).

- Same pros and cons as Alternative 3 under the Dworshak NFH B-run steelhead program.

Alternative 4: Rear spring Chinook at Clearwater Fish Hatchery and North Fork Clearwater Steelhead at Dworshak NFH (see Alternative 4 under Dworshak NFH steelhead program).

- Same pros and cons as Alternative 4 under the Dworshak NFH B-run steelhead program.

Alternative 5: Discontinue the spring Chinook program and (a) increase the size of the steelhead and/or coho programs or (b) develop one or more conservation programs to assist with restoration and recovery of native species.

Pros

- Allows Dworshak NFH to be devoted to the propagation and maintenance of the N.F. Clearwater River strain of steelhead consistent with the original purpose of the hatchery.
- Provides more fish rearing space to assist the Nez Perce Tribe with their coho reintroduction program in the Clearwater River.
- Allows Dworshak NFH to be used for conservation programs of high priority.

Cons

- Reduces harvest opportunities for spring Chinook in the Clearwater River and in downriver fisheries.

- Significantly reduces the ability of the U.S. Fish & Wildlife Service to meet LSRCP mitigation goals for spring-summer Chinook in the Snake River.

Alternative 6: Terminate the steelhead, spring Chinook and coho programs at Dworshak NFH and decommission the facility

- Same pros and cons as Alternative 4 under the Dworshak NFH steelhead program.

Recommended Alternatives

Short and Long Term Recommendations: Implement Alternative 1: Current program with recommendations.

The Dworshak NFH spring Chinook program is a congressionally mandated program that provides significant fishery benefits in the Clearwater River. The program is also a major component of developing locally-adapted broodstocks of spring Chinook within the Clearwater River basin as part of the much larger efforts to reintroduce these fish after native populations were believed to have been extirpated upstream of Lewiston Dam. The continued exclusion from Dworshak NFH of imported eggs and fish from other hatcheries outside the basin (e.g., from Rapid River Hatchery) is expected to further enhance within-basin homing and reduce stray rates outside the basin. Evidence suggests that stray rates decreased since the imports and backfilling from Rapid River Hatchery were discontinued, but this conjecture needs to be explicitly evaluated (see Recommendation DW34). Overall, the Dworshak NFH spring Chinook program appears to be an essential component for achieving harvest goals for spring Chinook within the Clearwater River basin. It is also an essential component for achieving mitigation goals for spring Chinook as part of the LSRCP. Additional monitoring and evaluation based on recovery of coded-wire tags (or PIT tags) is necessary to further quantify benefits and risks of the program.

As noted for the steelhead program at Dworshak NFH, Alternatives 3 and 4 were not given further consideration at the present time because of the major infrastructure modifications that would be necessary at Clearwater Fish Hatchery to allow on-station releases into the N.F. Clearwater River and capture of returning adult fish for broodstock.

Kooskia NFH Spring Chinook

Operator: U.S. Fish & Wildlife Service

Summary of Current Program

Goals

- ***Harvest goal***: The total harvest goal for spring Chinook in the Clearwater River under current conditions is 5,170 adults.[69] The long-term future harvest goal for spring Chinook in the Clearwater River is 45,000 adults.[Ibid.] A specific harvest goal for the spring Chinook program at Kooskia NFH has not been established. The total adult return goal for the program is 3,000 fish.[Ibid.] The primary purpose of this hatchery program is to produce spring Chinook salmon for harvest in sport and tribal fisheries. No mitigation goal under the Lower Snake River Compensation Plan (LSRCP) has been established for the number of adult fish returning upstream of Lower Granite Dam because Kooskia NFH spring Chinook program is not part of the LSRCP. Based on a total adult return goal of 3,000 adults and assuming a 90% survival back to the hatchery for broodstock (≈ 800 adults required for broodstock), approximately 1,900 Kooskia NFH spring Chinook would be available for harvest.

- ***Broodstock escapement goal***: Collect and retain 800 spring Chinook adults annually for broodstock from among fish returning to Kooskia NFH. Surplus adult fish are outplanted into natural habitat areas that are below carrying capacity for spring Chinook.

- ***Conservation goal***: No program-specific conservation goal exists at this time. The program is conducted in a manner consistent with permitting requirements and obligations under the U.S. Endangered Species Act. r

- ***Escapement goal for natural-origin adults***: Unmarked spring Chinook intercepted at the hatchery weir are currently passed upstream in Clear Creek. Specific escapement goals for Clear Creek will be established as part of the proposed reintroduction program.

- ***Research, education, and outreach goals:*** Provide accurate information and educational opportunities to enhance participation in, understanding and stewardship of Kooskia NFH and Service programs. Spring Chinook at Kooskia NFH are included in the Idaho Supplementation Studies (ISS) which, in the Clearwater River Basin, are assessing the ability of hatchery-origin fish to restore naturally-spawning populations of Chinook salmon.

Objectives

- Trap and retain a minimum of 600 adult spring Chinook (300 females) for broodstock annually, which includes sufficient numbers of fish to compensate for pre-spawning mortality, unequal sex ratio, and culling of fertilized eggs from female parents at high risk of transmitting *Renibacterium salmoninarum* (causative agent of bacterial kidney disease, BKD).

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[69] *NWPCC Clearwater River Subbasin Plan, Table 3. http://www.nwcouncil.org/fw/subbasinplanning/clearwater/plan/.*

- Spawn a minimum of 265 females and 265 males pairwise to yield a minimum of 925,000 green eggs.
- Produce 725,000 eyed eggs after culling eggs from females with high values for *R. salmoninarum*, as measured by ELISA (enzyme-linked immunosorbent assay). Fertilized eggs from 0-50 females were culled for the years 2002 – 2007 because of high risk of infection.
- Release 600,000 smolts at 20 fish per pound directly from the hatchery into Clear Creek. The release generally occurs at the end of March through the first week of April.

Program Description

At the present time, approximately 600 adult spring Chinook returning to Kooskia NFH are trapped and retained for broodstock with the objective of producing approximately 600,000 progeny smolts for release. No broodstock, fish, or eyed eggs have been imported to Kooskia NFH from elsewhere in many years. The stock is considered self sufficient and "locally-adapted" to Kooskia NFH and the general area representing the confluence of Clear Creek and the Middle Fork of the Clearwater River.

Although the primary purpose of the spring Chinook program at Kooskia NFH is to support harvest, the program also participates in a collaborative research project known as the Idaho Supplementation Studies (ISS). These studies are evaluating the benefits and risks of allowing hatchery-origin Chinook salmon to spawn naturally to increase the abundance of natural-origin fish. Evaluating restoration of natural populations is the purpose of the ISS in the Clearwater River. Experimentally, the research examines responses in natural productivity of Chinook salmon in treatment (i.e., Clear Creek) and control streams over three study phases. Phase I addressed collected baseline data concurrent with the establishment of locally-adapted hatchery broodstocks (e.g., at Kooskia NFH). Phase II had two components: (1) natural interbreeding of hatchery and wild fish in traditional spawning areas to supplement natural production, and (2) artificial crossing of hatchery and wild fish in hatcheries to produce juvenile fish that are outplanted (at various life stages) to natural rearing areas. In Phase III, outplanting juvenile fish is terminated, hatchery-origin adults returning from juvenile ISS releases are allowed to spawn naturally, and natural reproduction (e.g., smolt production) and productivity (e.g., R/S) measures are monitored for one to two generations after the final adult treatments. The ISS is now in Phase III and is funded through 2009, although monitoring is proposed through 2012. Further program modifications are planned in the near future with the anticipated finalization of the Snake River Basin Adjudication agreement which would transfer operation of Kooskia NFH to the Nez Perce Tribe.

Assessment of Current Program

Operational Considerations

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

Broodstock Choice and Collection

- The Kooskia NFH spring Chinook salmon program was started with several stocks from the Lower Columbia River and fish from the Rapid River Fish Hatchery in Idaho. Smolt releases from Kooskia NFH in 1973 through 1980 had a very strong influence from the Carson NFH stock. Egg transfers representing the "Carson stock" (from Dworshak NFH) in 1985 and 1986 resulted in smolt releases in 1987 and 1988 of mixed origins, referred to as the "Clearwater stock". Because the Kooskia NFH spring Chinook program was already derived primarily from fish and eggs of Carson NFH ancestry, the existing "Kooskia stock" (1989 and later) is still considered largely of Carson NFH origin (i.e. a "Carson-derived stock"). In contrast, spring Chinook propagated at Dworshak NFH are largely considered a "Rapid River" derived stock. Genetic and life history data all support a biological and management distinction between the existing Dworshak and Kooskia NFH stocks of spring Chinook (Appendix B, and references therein).

- Neither natural nor hatchery populations of spring Chinook salmon in the Clearwater River Basin are included with the Snake River Spring-Summer Chinook ESU that is currently listed as threatened under the U.S. Endangered Species Act. Genetic analyses confirm that existing naturally spawning spring Chinook salmon in the Clearwater River subbasin are derived from reintroduced stocks. Although spring Chinook within the Clearwater River basin are excluded from the Snake River ESU, they are considered an important resource for restoring natural populations to an area from which they had been extirpated.

- Starting with broodyear 2009, the Nez Perce Tribe has proposed a supplementation program for Clear Creek to reestablish a naturally spawning population derived from the Kooskia NFH stock.

- Kooskia NFH stock has been managed as a segregated hatchery stock since 1986, only using adipose-fin clipped hatchery fish returning to the facility for broodstock.

- If insufficient numbers of adult spring Chinook return to Kooskia NFH to meet broodstock objectives, then fish or eyed eggs from other stocks (e.g., Dworshak NFH, Clearwater State Hatchery or Rapid River State Hatchery) can be imported, but they are differentially marked prior to release so that they are not spawned as part of the Kooskia NFH broodstock when they return as adults.

- Spring Chinook propagated at Kooskia NFH have higher homing fidelity than Dworshak NFH spring Chinook. Estimated stray rates for Kooskia and Dworshak NFH spring Chinook (broodyears 1986-1993) were 11% and 29%, respectively, based on recovery of coded-wire tags (Pastor 2004). Of that 11% for Kooskia NFH, 5% occurred in the Deschutes River, 4% occurred at Wells Dam in the upper Columbia, and the remaining 2% occurred at several locations (Pastor 2004).

- A minimum of 265 females need to be trapped and retained for broodstock each year to meet the release objective of 600,000 yearling smolts assuming a 10% pre-spawning mortality and 85% green egg to smolt survival after eggs from females at high risk for BKD are culled. Survival has averaged 87% from time of ponding to release for brood years 1999-2005.

Hatchery and Natural Spawning, Adult Returns

- Adult spring Chinook trapped at Kooskia NFH are trucked to Dworshak NFH once or twice a week for holding and eventual spawning after water temperatures in Clear Creek reach 60 degrees F. Water temperatures in Clear Creek over the past ten years averaged 55.4, 65.7, and 65.5 degrees F. in June, July, and August, respectively.

- Spring Chinook transported to Dworshak NFH are held in large outdoor adult holding ponds. The holding ponds are checked daily for mortalities, and dead fish are removed when observed. Formalin treatments are administered as one hour bath at 167 ppm, 1-3 times per week to control fungus.

- Adult females are injected with erythromycin (20mg/kg) approximately 21 days prior to spawning.

- Spawning of adults and incubation of fertilized eggs to the eyed stage takes place at Dworshak NFH.

- Although there have not been fish surplused for a number of years, surplus hatchery spring Chinook salmon are available for outplanting in under seeded habitat in the Clearwater basin. The disposition of surplus adults is determined and coordinated through the NPT and the IDFG.

- Jacks (3-year old males) are included in the broodstock in proportion to occurrence, not to exceed 10% of all males spawned.

- Spawning protocols specify a pairwise 1:1 male:female spawning ratio, or as close as possible depending on the relative numbers of males and females retained for broodstock.

- The current mean number of spring Chinook spawning naturally in the entire Clearwater River watershed (hatchery and wild fish spawning naturally based on redd counts) is estimated to be 1,832 fish per year (1994-2002). The comanager goal is 10,000 naturally spawning spring Chinook salmon in the Clearwater River basin by 2027 (November 2003 Clearwater Subbasin Fish Management Plan).

- Kooskia NFH spring Chinook are released upstream of the weir in Clear Creek to spawn naturally as part of the Idaho Supplementation Studies (ISS). In 2004, 32 and 29 natural-origin (unclipped adipose fins) males and females, respectively, were passed upstream in Clear Creek. In 2005, 6 males and 3 females and, in 2006, 7 males and 9 females – all of which were natural origin - were passed upstream. During that same time period, a total of 82 hatchery-origin adults were passed upstream to spawn naturally. Redd counts for those years were 56, 12, and 42 in 2004, 2005, and 2006, respectively. The cause of the very low number of counted redds in 2005 is unknown. No smolt outmigration data (e.g., via a rotary screw trap) were collected in 2005 or 2006. The cause of the very low number of counted redds in 2005 is unknown. In 2006, debris damaged the trap and collection was terminated in April of 2006. Densities of brood year 2004 juvenile Chinook from direct underwater observation in ISS streams conducted in 2005 show a density of 0.01 /100m² for Clear Creek, lowest of all ISS streams.(Idaho Supplementation Studies – IDFG Report Number 07-24 June 2007)

- MS-222 is used to anesthetize the adults.

- Carcasses are unfit for human consumption because of the use of MS-222 for anesthesia and are used for Washington or Idaho State bear research/capture programs, university research, or raptor recovery and rehabilitation programs.

- Kooskia spring Chinook salmon contribute to fisheries in the Clearwater River and Clear Creek. From 2002 – 2006, the average return has been 1,405 fish. Harvest contribution in the Clearwater basin for tribal fisheries averaged 17.9% (251 fish) and sport harvest, 30.1% (424 fish), and 52 % (732 fish-actual count) returned to the hatchery. Smolt to adult survival rate for Kooskia NFH spring Chinook returning the hatchery and fisheries averaged 0.357 from 1988 through 2003.

- There was minimal sport and tribal harvest of Kooskia NFH spring Chinook from 1989-2000. 2001 and 2002 indicates substantial harvest in sport and tribal fisheries.

- Recent five-year average for code-wire tag recovery data from Kooskia NFH also indicate significant contribution to Columbia River sport fisheries (~ 400 fish) and Columbia River gillnet fisheries (~ 500 fish).

Incubation and Rearing

- The water supply is Clear Creek and two production wells (max 500 gpm combined). Well water is limited and Clear Creek water is warm and limited during the summer months. The hatchery operates a water reuse system to control water temperatures in the summer, by using chilled well water as the makeup water source.

- Because of warm surface water in Clear Creek, spring Chinook adults returning to Kooskia NFH are shipped to Dworshak NFH, spawned, and their eggs incubated until eyed-egg stage. Eggs are then shipped to Kooskia NFH after eye-up and enumeration.

- Fertilized eggs are incubated to the eyed stage at Dworshak NFH. To synchronize development and hatch, fertilized eggs from the earlier spawn takes are incubated on chilled water (40ºF), which results in hatching approximately 70 days after spawning. Eggs from the later takes are incubated on 45ºF water which requires approximately 43 days for hatching to occur. Upon eye-up, eggs are shocked and enumerated using an electronic egg picker and counter (Van Gaalen Model N-100).

- Spring Chinook eggs from each female are initially loaded into separate incubation trays = (≈3,500 eggs/tray). After families of eggs with high risk for bacterial kidney disease are culled based on ELISA testing of female parents, retained eggs are shocked, dead eggs removed, and live eggs are enumerated and returned to the incubation trays at ≈5,000 eggs/tray. Eyed eggs are then shipped to Kooskia NFH in lots of 5,000 for final incubation, hatch, and rearing. Water flow to the incubation trays is approximately 5 gallons/minute.

- Eyed-eggs used to be incubated in chilled well water at approximately 38ºF. Beginning with broodyear (BY) 2000,. Clear Creek water is used for egg incubation from November to February instead of chilled well water. The use of Clear Creek water serves two purposes: (1) incubation temperatures follow natural stream temperatures, and (2) the use of creek water conserves energy by not operating well pumps or chillers.

- Infestations of the parasite *Icthyophtherius* (*Ich*) sp. are experienced annually. The parasite occurs naturally in Clear Creek and the use of this water in the incubation building, after the eggs hatch, can induce infections that are carried with the fry to the outside ponds. If chilled well water is used immediately after hatch of the eggs, no infestations occur during subsequent rearing. However, problems exist with the chiller, and creek water is often used during early rearing after hatch before the switch to reuse well water occurs in the Burrows ponds.

- When *Ich* is detected, fish are treated with 25-50 ppm formalin (a 12 hour drip, effective strength maintained through a 24 hour duration in the raceways) throughout the summer, as needed, to control infestations. Adequate and ongoing formalin treatment of the fish while on reuse well water during the summer minimizes fish mortalities. Problems with *Ich* are significantly reduced when water temperatures are below 50 degrees F; consequently, creek water is used in the Burrows Ponds during winter.

- A water reuse system for egg incubation is on site but is currently not in use because it needs repair.

- Nursery rearing of hatched fry takes place in the outside nursery tanks and begins with single-pass well water, which is replaced by a bio-filtered reuse system after two weeks. When fry outgrow their tanks, which occurs at approximately 250 fish per pound, they are enumerated and transferred to six Burrows' Ponds where they remain during the summer months (June-October) on chilled reuse well water. The reuse system and chiller reduce water temperatures to approximately 50°F, and the use of well water reduces the probability that *Ichthyophthirius* (*Ich*) will be introduced into reuse system for the Burrows' Ponds. These ponds are switched to single-pass creek water typically around late October.

- Chinook juveniles are adipose-fin clipped and coded-wire tagged during the last week of July.

- Chinook yearlings are redistributed among additional Burrows' Ponds and raceways starting in January to reduce rearing densities. The Burrows' Ponds and raceways operate on single-pass water from Clear Creek, January through April, for acclimation prior to release.

- Density indexes in the raceways average D.I. = 0.2 to 0.3, and flow indexes average F.I. = 0.8 to 1.9. Culture guidelines at Kooskia NFH specify a maximum rearing density of D.I. = 0.4 for spring Chinook which is higher than most other NFH spring Chinook programs in the Columbia River basin.

Release and Outmigration

- Spring Chinook smolts are released from Kooskia NFH directly into Clear Creek during March and April. All releases are made on an increasing hydrograph (water flows) to assist with emigration.

- Release size averages 18-20 fish per pound.

Facilities and Operations

- Kooskia NFH has an active NPDES compliance permit and a best management practices plan. Staff at Kooskia NFH records effluent flows monthly, and samples effluent biannually to maintain permit compliance.

- 12 Raceways and 6 Burrows' ponds are used for outdoor rearing. Only the Burrows' ponds are equipped with shade covers. Neither the raceways nor Burrows ponds have fencing to control predators (e.g., birds, mink).

- Contingency plans for releasing fish during the summer months (e.g., in response to an emergency situation like a pump or chiller failure) are not present at Kooskia NFH. If such a situation arose, fish would have to be released into the high temperatures of Clear Creek.

- Kooskia NFH relies on 90% reuse well water and makeup chilled well water (mid-50 degrees) in the Burrows' ponds during the summer months. One chiller is used to maintain temperatures near 50 degrees F, and an older chiller is on station as a backup. The facility switches to Clear Creek water when the river water drops below 50 degrees, usually near the end of October.

- Burrows ponds and nursery tanks are supplied with reuse water. The raceways rely on single-pass water from Clear Creek.

- The spacing between vertical bars on a new, recently installed permanent weir were initially too narrow to allow free passage of downstream migrating steelhead and spring Chinook smolts. Downstream migrating juveniles were impinged when they got caught sideways between the bars. The weir was then modified by removing every other vertical bar to correct the problem. The modification enables some jacks to now pass upstream through the weir bars.

- The water intake structure from Clear Creek creates mechanical problems during high water flows in the spring and during sub-freezing water temperatures in winter. High spring flows can cause debris, rocks, sand, and silt to block the water intake entrance and prevent water from entering the hatchery. During severe winter conditions, hatchery personnel work 24 hours a day (in 8-hour shifts) to physically remove ice and slush from the water intake screens.

- The water intake screen from Clear Creek has 3/8 inch square openings which is not in compliance with NOAA Fisheries' ESA screening criteria. The Hatchery Review Team understands that the USFWS has a deferred maintenance project to replace the screens.

- All Burrows Ponds and Raceways at Kooskia NFH are discharged to an offline settling pond during cleaning

- Until recently, the backup electrical generator for the chillers and water pumps did not always start automatically in response to power failures, thus posing a demographic risk of catastrophic fish loss. However, a new automatic transfer switch was installed in fiscal year 2008. This new switch will automatically start the generator during complete power outages or undervolt (brownout) conditions. Previous failure of the generator to start was traced to a faulty starter. The starter has been replaced.

- Bull trout, although not in high abundance, are sometimes trapped in the Kooskia NFH weir on Clear Creek,. Bull trout are handled in accordance with the terms and conditions of the 1999 biological opinion. Unmarked adult steelhead, believed to be naturally produced, (10 to 61 fish per year, 1994-2002) are also captured at the weir and are passed upstream.

Research, Education, and Outreach

- Spring Chinook released from Kooskia NFH have been 100% adipose-fin clipped since 1994, except for approximately 50,000 smolts released annually with either left ventral or right ventral fin clips for the Idaho Supplementation Studies (ISS). See section on "Hatchery and Natural spawning, Adult returns" previously described here as part of the Operational Considerations.

- At least one group of 60,000 fish receives coded-wire tags each year to estimate contributions of Kooskia NFH spring Chinook to ocean and downriver commercial, sport, and tribal fisheries. Coded-wire tags also assist with research, monitoring and evaluation studies. In 2007, 178,500 spring Chinook released from Kooskia NFH were coded-wire tagged.

- At the present time, contributions of Dworshak NFH, Clearwater FH, and Kooskia NFH to the harvest of spring Chinook cannot be distinguished because of inadequate sampling and recovery of coded-wire tags.

- PIT tags have been used at Kooskia NFH since 1989 to evaluate time of return of adults and smolt-to-adult return rates to Lower Snake and Lower Columbia River dams. Presently, 10,000 smolts are PIT tagged annually.

- The Information and Education (I&E) staff at Dworshak NFH provides program support for Kooskia NFH.

- Coded-wire tag information for recoveries at Kooskia NFH rack have not been reported to the Service's Columbia River Fisheries Program Office (Vancouver, WA) or the Regional Mark Information System since broodyear 1994.

- Dworshak NFH, Kooskia NFH and the Idaho Fisheries Resource Office do not participate fully in the USFWS Columbia River information System (CRiS) database, managed out of the Columbia River Fisheries Program Office (Vancouver, WA). Hatchery staff at all National Fish Hatcheries in the Columbia River basin, with the exception of Dworshak NFH and Kooskia NFH, generate and maintain the required data files for CRiS.

Benefit and Risk Assessment[70]

BENEFITS CONFERRED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

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

Harvest Benefits

- The harvest benefit for Kooskia NFH has not been accurately quantified. Collectively, harvest of hatchery produced spring Chinook from Dworshak, Kooskia NFH and Clearwater FH in the Clearwater River is highly variable. For example, sport harvest ranged from 0 to 14,752 fish, and tribal harvest ranged from 0 to 3,144 fish, for the 20 year period 1987-2006. The 20-year average was 1,517 and 581 spring Chinook in the sport and tribal harvests, respectively, in the

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

Clearwater River. Based on coded-wire tag recovery data starting in 1988 through brood year 2002, approximately 9% of recaptured spring Chinook salmon released from Kooskia NFH are caught in gillnet fisheries in the mainstem Columbia River, 12% percent are caught in sport fisheries in the Columbia and Snake River basins, 4% in Columbia River treaty and ceremonial fisheries, and 75% are recaptured at Kooskia NFH or other hatcheries. Less than 1% of coded wire tags are recovered elsewhere. [71]

Conservation Benefits

- The spring Chinook program at Kooskia NFH currently provides no specific conservation benefit. The proposed Clear Creek supplementation-reintroduction project will provide a natural spawning component to the existing Kooskia NFH stock, potentially increasing the abundance and local adaptation of the Kooskia NFH stock.

- Although there have not been surpluses of spring Chinook adults returning to Kooskia NFH for several years, the Nez Perce Tribe plans to use surplus adults to assist with reintroduction programs in the Selway River, and other locations in the Clearwater basin if additional fish are available.

Research, Education, Outreach and Cultural Benefits

- Tribal harvest and surplus adults trapped at hatchery provide a cultural benefit to Columbia River tribes.

- Kooskia NFH is located on the Lewis and Clark Trail, thus providing education and outreach opportunities of historical and cultural value.

- The Idaho Fishery Resource Office (USFWS) in Ahsahka, Idaho maintains an active monitoring and evaluation program assessing adult returns, age class composition, run timing, mean fecundities, and other biodata for spring Chinook returning to the Kooskia NFH.

Benefits Conferred to Other Stocks, Species, and Communities

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

Harvest Benefits

- Harvest benefits are minimal outside of the Snake River Basin. Less than 1% of the total harvest of Snake River spring Chinook occurs in ocean fisheries. Based on an estimated interception rate of spring Chinook in the Columbia River, approximately 63% of the total harvest occurs in the Columbia River (BY1996-2000).

Conservation Benefits

- None identified.

[71] *Pastor, S.M. 2009. Annual stock assessment-CWT (USFWS). Columbia River Fisheries Program Office, Vancouver, WA. www.fws.gov/columbiariver*

Research, Education, Outreach and Cultural Benefits

- None identified.

RISKS POSED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

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

Genetic Risks

- None identified.

Demographic Risks

- Dependence on reuse water poses a fish health risk to spring Chinook reared on station.
- Dependence on mechanical water chillers that could fail poses a demographic risk to spring Chinook reared on station.
- Debris-laden water flows in Clear Creek during the late winter and spring and icing of the intake structure and raceways during winter poses a demographic risk of major fish losses due to blocked water flows into the outdoor rearing vessels.
- The trucking of adult broodstock from Kooskia NFH to Dworshak NFH for holding and spawning increases the demographic risks of broodstock losses to the Kooskia NFH stock of spring Chinook.
- The facility's location above four Columbia River and four Snake River dams significantly reduces the survival of outmigrating juveniles and returning adults, posing a demographic (and genetic) risk to the Kooskia stock of spring Chinook because of insufficient numbers of adults available for broodstock on a consistent basis. This risk increases substantially when insufficient numbers of adults return in two (or more) consecutive years.

Ecological Risks

- Spring Chinook and steelhead adults in Clear Creek near the water intake structure for the hatchery increases disease risks to spring Chinook in reared on surface water.

Physical Risks

- Manual removal of debris from the Clear Creek weir poses a human health and safety risks to hatchery personnel. Incorrect counterbalancing of the weir screen panels prevents the weir from opening correctly under debris loads, necessitating manual cleaning.
- Manual removal of ice from the Clear Creek water intake during winter poses a human health and safety risk to hatchery personnel.

Research, Education, Outreach and Cultural Risks

- None identified.

RISKS POSED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

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

Genetic Risks

- Approximately 11% of the coded-wire tag recoveries for Kooskia NFH spring Chinook occur outside the migration corridor to the hatchery, thus posing a genetic straying risk to other stocks in the Columbia River basin.

Demographic Risks

- None identified.

Ecological Risks

- Amplification of disease and pathogens within the hatchery (e.g., *Ich*) poses an ecological risk to fish populations downstream from the hatchery.
- High stray rates to tributaries in the Columbia River pose ecological risks to natural populations.
- The collection and barging of spring Chinook smolts at mainstem Snake River and Columbia River dams poses a stress (crowding and handling) and overall fish health risk to other populations of salmon and steelhead that are co-collected for barging.

Research, Education, Outreach and Cultural Risks

- None identified.

Recommendations for Current Program[72]

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

[72] *The Review Team believes that the Kooskia Hatchery Evaluation Team—as a whole, in task teams and/or with outside assistance and expertise—will be the logical body to implement most of the following recommendations.*

considered by the Review Team to warrant a potential modification to the current program. Preceding each numbered recommendation is a brief summary of the issue.

Program goals and objectives

Issue KO1: Program goals for Kooskia NFH spring Chinook are not fully expressed in terms of numeric outcomes that quantify intended benefits. *This hatchery program lacks specific numeric goals for harvest, although providing fish for harvest is a primary purpose of the program.*

Recommendation KO1: Restate program goals to identify the number of harvestable adult spring Chinook from Kooskia NFH for the Clearwater River basin.

Issue KO2: Current conditions affecting the survival of salmon and steelhead in the Snake and Columbia rivers (operation of the hydropower system, habitat, harvest, and ESA listings) downstream from Kooskia NFH differ from those when the hatchery was built in the late 1960's. Current conditions inhibit consistent achievement of adult return and mitigation goals for spring Chinook at Kooskia NFH.

Recommendation KO2: Continue to work through various regional processes such as (a) implementation of the mainstem *Federal Columbia River Power System* Biological Opinion to improve migration survival, (b) *US vs. OR* discussions to address harvest issues, (c) NOAA Fisheries to complete ESA consultations on hatchery mitigation programs, and (d) local watershed groups to continue improving habitat, to allow the Service and cooperators to meet mitigation goals on a consistent basis.

Broodstock Choice and Collection

Issue KO3: *Under current protocols, if the number of spring Chinook collected at Kooskia NFH is insufficient to meet broodstock needs, fish (or eggs) representing other stocks (Dworshak NFH, Clearwater State Hatchery or Rapid River State Hatchery) may be imported to supplement on-station releases of hatchery-produced smolts. Although not a specified requirement, imported fish are differentially marked prior to release so that they are not spawned – as returning adults - as part of the Kooskia NFH broodstock. Imported fish are expected to exhibit higher strays and lower smolt-to-adult return rates back to the point of release than fish representing the locally adapted Kooskia NFH stock.*

Recommendation KO3a: Do not import fish or eggs from other facilities or stocks to compensate for adult returns that do not meet broodstock objectives at Kooskia NFH.

Recommendation KO3b: If adult returns are substantially below broodstock needs and other stocks are used to meet on-station release objectives or other commitments, all imported fish should be differentially marked or tagged prior to release to distinguish them from Kooskia NFH fish as returning adults. No imported fish should be used for broodstock at Kooskia NFH except as an emergency conservation or broodstock restoration measure. Additionally, all imported smolts should be released at Kooskia NFH so they can be recaptured as returning adults.

Hatchery and Natural Spawning, Adult Returns

Issue KO4: Stray rates for Kooskia NFH spring Chinook in the Columbia River Basin are high, compared to other hatchery stocks of spring Chinook, thus posing a genetic straying risk to other stocks. *For broodyears 1986-1993, 5% of all coded-wire tag recoveries for Kooskia NFH spring Chinook occurred in the Deschutes River and 4% of all coded-wire tags were collected at Wells Dam in the upper Columbia River. However, the stray rates for brood years 1996-2000 are not as high as those for brood years 1986-1993.*

Recommendation KO4: The Idaho Fisheries Resource Office should quantify homing and straying of spring Chinook released from Kooskia NFH. Attempts should be made to correlate variable stray rates with factors that may contribute to straying including variable fish culture practices (e.g., level of backfilling, mean size at release, etc.), water management practices, and barging vs. volitional transport of smolts through the hydropower system. Straying risks to other populations in the Clearwater, Snake and Columbia rivers should be assessed.

Issue KO5: MS-222 is currently used to anesthetize spring Chinook during spawning. This precludes the use of carcasses for nutrient enhancement of streams and other beneficial uses that could result in immediate consumption by humans or game animals. *The U.S. Food and Drug Administration has not approved MS-222 for use on animals that could be consumed by humans or other animals within 21 days of use.*

Recommendation KO5: Develop an alternative method of anesthetizing broodstock at the time of spawning. Alternatives include but are not limited to electro-anesthesia and carbon dioxide.

Issue KO6: High water temperatures in Clear Creek during the summer precludes use of the adult pond for holding spring Chinook broodstock. Adults trapped at Kooskia NFH are transferred to Dworshak NFH, spawned, and the resulting fertilized eggs are incubated at Dworshak NFH to the eyed stage. Eyed eggs are then transferred to Kooskia NFH for final incubation and hatch prior to ponding.

Recommendation KO6: Investigate expanding the well field to provide ground water, if feasible, for holding broodstock and spawning at Kooskia NFH. If additional ground water is not available, then other options could be investigated such as heat exchangers, evaporative coolers/chillers, or some combination thereof to allow for adult holding and spawning on site.

Incubation and Rearing

Issue KO7: The use of Clear Creek water during egg incubation increases the risk of Ichthyophthirius (Ich) infection and other diseases when the fish hatch.

Recommendation KO7: Switch from surface water to chilled well water before the fertilized eggs hatch and maintain the fish on well water through early fry rearing. Alternatively, use chilled well water for all of incubation instead of Clear Creek water. If necessary, purchase and install a new water chiller (50 gpm) for incubation. If Clear Creek water continues to be used for incubation, then a disinfection unit may be required to prevent future disease outbreaks.

Issue KO8: The cost of electricity for operating the facility's main water chiller for single-pass well water is high (>$6,000/month).

Recommendation KO8: Investigate alternatives to the current method of chilling well water for incubation (e.g., use of heat exchanger, separate smaller chiller) and consider rehabilitation of the incubation water reuse system to reduce electricity costs and wear on the main chiller.

Issue KO9: Limited water availability and temperature fluctuations associated with surface water (Clear Creek) pose a fish health risk to spring Chinook. *Ich infections occur annually, well water is currently limited, and the temperature of Clear Creek water exceeds maximum guidelines for spring Chinook during the summer months. The hatchery depends on a water reuse system with well water makeup because of limited water availability. A water chiller also needs to be used to reduce the temperature of the reuse water to the desired temperature for spring Chinook during the summer.*

Recommendation KO9: Investigate installation of an UV disinfection system for the reuse water supply for the ponds. Reuse water supplied to the ponds has a low volume of suspended solids; therefore, free swimming *Ich* could be reduced or eliminated via UV treatment, thus reducing dependence on formalin. A disinfection unit may also be more reliable mechanically than a chiller [Note: The Team considered and rejected the concept of establishing an additional water supply from the maintem Clearwater River because of temperature issues and rejected the potential addition of new wells due to water flow limitations of the aquifer beneath Kooskia NFH].

Issue KO10: Rearing densities for spring Chinook at Kooskia NFH attain levels greater than D.I. = 0.4 in the outdoor nursery tanks during May each year. *In June, fish are transferred to Burrows ponds which immediately reduces densities to approximately D.I = 0.06. The general culture guideline used by the Hatchery Review Team for spring Chinook is a maximum rearing density of D.I. = 0.2.*

Recommendation KO10: The hatchery staff, Nez Perce Tribe, Idaho Fisheries Research Office, and Idaho Fish Health Center should collaboratively investigate options for reducing rearing densities, and determine the rearing density and water flow indexes necessary to achieve optimum health and survival of Kooskia NFH spring Chinook, both on station and following release, for meeting program goals for harvest and escapement back to the hatchery.

Release and Outmigration

Refer to Issues and Recommendations KO2, KO3, and related issues and recommendations in the Research, Monitoring and Accountability section.

Facilities/Operations

Issue KO11: The water intake design and location for the hatchery creates problems with debris buildup during high water flow in spring and icing problems during winter*. The debris and ice can block the intake, posing a demographic risk of major fish losses on station. The need to manually remove ice from the water intake 24 hours/day during severe winter conditions further poses a human health and safety risk to hatchery personnel.*

Recommendation KO11: Investigate options for improving the water intake structure to reduce debris buildup and icing. For example, alternative types of screens that use electric heating elements to de-ice the intake structure during winter could reduce demographic and physical risks to fish on station.

Issue KO12: The water intake screen does not comply with current NOAA Fisheries ESA screening criteria. The screen mesh is 3/8"; however, NOAA's criteria specify 3/32" mesh. NOAA Fisheries criteria also include parameters associated with approach velocity, sweeping velocity, and screen angle.

Recommendation KO12: Replace the water intake screen so that it complies with NOAA Fisheries ESA criteria (couple with Recommendation KO11).

Issue KO13: Surface water intake during the summer can dewater Clear Creek during low flows*. The use of aerial sprinklers for grass irrigation during the summer may contribute to this problem. In addition, the use of aerial sprinklers for irrigation and the potential aerosol transmission of Ich increases disease risks to fish in outdoor ponds.*

Recommendation KO13: Minimize or eliminate the use of aerial sprinklers for irrigation and use alternative methods (drip irrigation, micro spray, and/or xeric landscaping as alternatives) to conserve water during the summer.

Issue KO14: The shade cover over the adult holding pond needs maintenance to prevent further deterioration.

Recommendation KO14: Rehabilitate the pole barn roof over the adult holding pond. [Note: This task was completed in July 2008.]

Research, Monitoring, and Accountability

Issue KO15: Coded-wire tagged fish may not accurately represent all progeny groups released from Kooskia NFH. Currently, 60,000 fish in one raceway of spring Chinook are coded-wire tagged. *Because the fish in different raceways can differ with respect to mean size and age, and the pond environments can differ with respect to flow index, flow pattern, direct sunlight, etc., the practice of tagging fish in just one raceway may not accurately represent the entire population for a brood year. In most NFH programs, salmon are spawned throughout the adult return to ensure that most segments of the run are represented in the resulting progeny. This procedure usually results in many different spawn "takes" of varying ages at the time of release. The fry are ponded by take/hatch date into a series of raceways that, when fully populated, differ in age and size of fish (initially) between raceways. Monitoring and evaluation using coded-wire tags requires that the tags accurately represent the entire population at the time of release.*

Recommendation KO15: Consult with the Idaho Fishery Resource Office and Nez Perce Tribe to ensure that the tagging strategy accurately represents the entire population of progeny from all spawn groups for each brood year. For example, all spawn groups should be proportionately represented among tag groups and raceways.

Issue KO16: The proposed release of 50,000 spring Chinook without clipped adipose fins will result in hatchery-origin fish that are indistinguishable from natural-origin fish, including natural-origin progeny of hatchery fish that spawn successfully. *Starting with broodyear 2009, a supplementation program has been proposed in which hatchery-origin spring Chinook returning to Kooskia NFH will be allowed to spawn naturally in Clear Creek as part of the Idaho Supplementation Studies. If 50,000 spring Chinook are released without adipose-fin clips, then evaluation of the supplementation program will be compromised.*

Recommendation KO16: Apply a secondary mark or tag, such as a coded-wire tag, to all unclipped spring Chinook released from Kooskia NFH so that unclipped hatchery and natural-origin fish can be distinguished. This would allow proper evaluation of the supplementation program.

Issue KO17: *Starting with release year 2007 the, Service tagged 10,000 spring Chinook juveniles at Kooskia NFH with PIT tags (Service funding) prior to release to evaluate juvenile and adult migration through the Snake and Columbia rivers .*

Recommendation KO17:. Continue to implement and refine a PIT tag program to monitor migration and survival of spring Chinook released from Kooskia NFH, and to assist with in-season harvest management of returning fish. The PIT tagging program should be consistent with (a) regional goals and objectives and (b) concurrent goals and objectives for the hatchery program. [Note: The Service has provided a significant amount of base funds to Kooskia NFH and the Idaho Fishery Resource Office (USFWS, Ahsahka, ID) for PIT tagging spring Chinook at Kooskia NFH.]

Issue KO18: (Same as issue/recommendation DW39 for Dworshak NFH) Recovery of coded-wire tags (CWT) from harvested fish in terminal fishery areas in the Clearwater River basin *is inadequate. Harvest benefits associated with the spring Chinook program at Kooskia NFH cannot be accurately distinguished from those for Dworshak NFH and Clearwater Anadromous Fish Hatchery, A coast-wide CWT goal of 20% recovery of all CWTs from returning adult fish has been advocated by the LSRCP Coordinator.*

Recommendation KO18: The Service should continue to work with cooperators to assess the mark sampling program, improve CWT recovery rates, and quantify the harvest benefits separately for the spring Chinook programs at Dworshak NFH, Kooskia NFH, and Clearwater Fish Hatchery.

Issue KO19: (Same as issue/recommendation DW25 for Dworshak NFH) Data obtained from releases and recovery of coded-wire tags from Kooskia mitigation spring Chinook is not reported in a timely manner, inhibiting adaptive management based on the most current information. *The Pacific Salmon Commission's Data Standards Work Group Report states, under Specifications and Definitions for the Exchange of Coded-Wire Tag Data for the North American Pacific Coast, that "Preliminary (Recovery) data for the current calendar year should be reported no later than JANUARY 31 of the following year."*

Recommendation KO19: The Service and Nez Perce Tribe should continue to work with their mark representative to develop a data management plan that incorporates tagging goals and objectives, data management, and annual reporting requirements of coded-wire tag data at both the program and regional levels.

Issue KO20: (Same as issue/recommendation DW26 for Dworshak NFH) Dworshak NFH, Kooskia NFH, and the Service's Idaho Fisheries Resource Office (Idaho FRO; Orofino, ID) do not participate fully in a centralized Service maintained database program. *Exclusion of data in a Service maintained database from Dworshak and Kooskia NFHs inhibits system-wide hatchery evaluations and the sharing of information with other data systems such as Stream Net. Staff at all National Fish Hatcheries in the Columbia River basin - except those at Dworshak and Kooskia NFHs – create, maintain, and submit the necessary data files for the Columbia River information System (CRiS) maintained by the Columbia River Fishery Program Office (Vancouver, WA) and the Regional Mark Information System (RMIS) maintained by the Western Washington Fish and Wildlife Office (Lacey, WA).*

Recommendation KO20: Dworshak NFH, Kooskia NFH, and the Idaho FRO should participate fully in a Service maintained database, including creation and submission of the desired data files within the desired time frames. A Service maintained data base should function as the database repository of all Service data and facilitate data management between all Service offices. Use of central database files and programs achieves the following multiple purposes: (1) greatly reduces the amount of effort expended to meet reporting requirements, (2) increases the quality and consistency of data collected at different hatcheries at different times, (3) facilitates development of common software usable at many facilities, (4) provides a single software platform on which to build effective evaluation tools that can be used by hatcheries, fisheries offices, and the regional office, and (5) facilitates the exchange of information with other agencies.[73] Minimum annual reporting requirements for the hatcheries include the fish removal file to track adult returns, egg activity files, and distribution files to track transfers and releases. An age composition of returning fish also needs to be reported annually by the Idaho FRO. These data requirements will continue to exist whether the facility is operated by the Service or the Nez Perce Tribe.

Education and Outreach

Issue KO21: Access to progress reports and publications regarding Kooskia NFH, the Idaho Fisheries Resource Office and the Idaho Fish Health Center is limited*. The public is provided access to reports and publications for facilities in other regions via regularly updated web sites.*

Recommendation KO21: Provide public access to reports and publications via the Kooskia NFH Complex web site and the LSRCP web site.

[73] *The CriS database is based on software initially developed over 20 years ago (DOS version of Dbase III)., It provides a straightforward and standardized method for tracking large amounts of fish culture and adult return data obtained at many facilities over multiple years and multiple fish generations. The U.S. Fish & Wildlife Service Hatchery Review Team does recognize, though, that this software should be updated to a user-friendly, standardized, region-wide format for all Service hatcheries.*

Alternatives to Current Program[74]

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

Alternative 1: Current program with recommendations.

Implement current program with implementation of all recommendations. This includes reducing rearing densities of juveniles in the nursery tanks and expanding the well field, if feasible, to provide additional water within desired temperatures for spring Chinook during the summer months.

Pros

- Maintains tribal, sport, and commercial harvest opportunity of highly valued spring Chinook in the Clearwater Basin and downriver fisheries.
- Spring Chinook at Kooskia NFH is a high priority program for the Nez Perce Tribe.
- Kooskia NFH spring Chinook provides a potential backup broodstock for Dworshak NFH in support of sport and tribal fisheries in the Clearwater River.

Cons

- Spring Chinook are difficult to rear at Kooskia NFH due to the water temperature extremes and pathogen load found in Clear Creek, the primary water source at the hatchery.
- Spring Chinook are particularly susceptible to bacteria kidney disease (BKD) and to prevent vertical transmission of its causative agent, *R. salmoninarum*, to their progeny, the broodstock adults require injections of antibiotic before spawning and ELISA testing at spawning so that eggs from females with high levels of the bacterium can be culled.
- Spring Chinook adults cannot be held for broodstock at Kooskia NFH and must be transferred to Dworshak NFH for holding and spawning. The transfer increases stress and may amplify bacterial kidney disease and other disease risks.
- The culture of spring Chinook at Kooskia NFH requires the use of a reuse water system and chillers. This results in high electricity costs and an increased risk of catastrophic fish losses.

[74] *Alternatives presented here are intended to be consistent with those in the companion report for LSRCP hatcheries operated by Idaho Department of Fish and Game.*

Alternative 2: Replace onsite rearing of spring Chinook with a reintroduction and harvest coho program.

Terminate or transfer onsite rearing of spring Chinook to another facility and implement a coho reintroduction and harvest program utilizing existing stocks (e.g. Eagle Creek NFH coho). Approximately 600,000+ coho smolts could be reared at Kooskia NFH.

Pros

- Coho are more tolerant than spring Chinook of the water temperature extremes experienced at Kooskia NFH.
- Coho are more resistant to BKD and IHNV and the adults require little to no fish health intervention (formalin, antibiotic injections) compared to spring Chinook.
- The timing of the rearing cycle of coho is more suitable to water conditions at Kooskia NFH than that of spring Chinook. In general, the hydrological cycle at Kooskia NFH related to water quality and quantity is more compatible for coho salmon than spring Chinook.
- Incubation water would not need to be chilled.
- In contrast to spring Chinook, adults could be trapped and held for broodstock at Kooskia NFH without transport to Dworshak NFH.
- Adult spring Chinook could continue to be trapped and smolts released at Kooskia NFH if rearing space is available elsewhere.
- A localized broodstock could be developed from adult collection and smolt release.
- Potential decreased reliance on out-of-basin transfers of coho from lower Columbia River hatcheries (i.e., Eagle Creek NFH) for reintroduction activities in the Clearwater River.
- The adult trapping facilities at Kooskia NFH would provide research opportunities to monitor and evaluate the biological transition and adaptation of a downriver coho stock to an upriver stock in the Snake River.
- A coho program at Kooskia NFH would be consistent with tribal interests for reintroducing coho in the Clearwater Basin.
- Clear Creek may be more suitable for supporting a naturalized population of coho than it would for supporting a naturalized population of spring Chinook.
- A coho program at Kooskia NFH would provide additional annual harvest opportunities in October and November after the Chinook harvest ends in August.

Cons

- Reduces tribal, sport and commercial harvest opportunities of highly valued spring Chinook in the Clearwater Basin and downriver fisheries.

- Coho are a lower priority species than spring Chinook for the Nez Perce Tribe. Spring Chinook are highly valued among tribal members.

- Kooskia NFH spring Chinook provides potential backup broodstock for Dworshak NFH in support of sport and tribal fisheries in the Clearwater River.

- Low water flow at time of coho return in September and October may inhibit attraction and broodstock collection, although more than 1,329 coho (457 females, 308 full-size males, and 564 "jacks") were trapped at Kooskia NFH in 2008

- *Ich* infections could still be an issue during summer months.

Alternative 3: Replace the Kooskia NFH spring Chinook program with fall Chinook harvest program.

Terminate the spring Chinook program and utilize Kooskia NFH as a satellite rearing location to support Nez Perce Tribal Hatchery with consideration for supplemental broodstock collection to provide additional supplemental harvest opportunities in the long term. Approximately 1.5-2 million fall Chinook (subyearling release) could be reared at Kooskia NFH.

Pros

- Fall Chinook smolt and outmigrate as subyearlings within a few months after hatching and would not be exposed to the summer water temperature extremes or water shortages experienced at Kooskia NFH.

- The timing of the rearing cycle for fall Chinook is more suitable to conditions at Kooskia NFH than that of spring Chinook.

- Water would not need to be chilled, and the well water and reuse system would not be required during juvenile rearing, greatly reducing energy costs and the risk of catastrophic fish losses.

- Fall Chinook would require little to no formalin to treat for Ichthyophthirius (*Ich)* because fish would be released before Ich would normally be a problem.

- Fall Chinook adults, in contrast to spring Chinook, could be trapped and held for broodstock at Kooskia NFH.

- Potential decreased reliance on out-of-basin transfers (i.e. Lyons Ferry) of fall Chinook for a currently ongoing supplementation program to restore naturally spawning fall Chinook in the Clearwater River.

- From a research perspective, the hatchery and weir would provide an opportunity to assess and monitor the biological transition of a downriver fall Chinook stock to an upriver stock.

- Supports tribal interests for reintroducing fall Chinook in the Clearwater Basin.

- Provides potential future harvest opportunity in September and October after the spring Chinook harvest ends in August.

Cons

- For broodstock collection, low water flow and low water temperatures in November at the time fall Chinook return would likely inhibit migration up Clear Creek to the adult trap. An "early-returning" fall Chinook stock may have to be developed for this alternative.
- Reduces tribal, sport, and commercial harvest opportunity of highly valued spring Chinook in the Clearwater Basin and downriver fisheries.
- The Kooskia NFH spring Chinook program is a highly valued, on-reservation program.
- Habitat for fall Chinook is more suitable near the existing fall Chinook rearing location at the Nez Perce Tribal Hatchery.
- Supplemental broodstock collection at Kooskia is dependent on the further establishment of an earlier run of fall Chinook at the Nez Perce Tribal Hatchery since cool water temperatures in the middle fork of the Clearwater River are too low at the time most fall Chinook migrate upstream for fall Chinook to access Clear Creek.
- Kooskia NFH spring Chinook provides potential backup broodstock for Dworshak NFH in support of sport and tribal fisheries in the Clearwater River.

Alternative 4: Replace the Kooskia NFH spring Chinook program with a steelhead program derived from Dworshak NFH steelhead.

Approximately 300,000-400,000 steelhead could be reared to the yearling smolt stage at Kooskia NFH.

Pros

- Steelhead are more resistant to BKD and the adults require little to no fish health intervention (formalin, antibiotic injections) compared with spring Chinook.
- In contrast to spring Chinook, adults could be trapped and held for broodstock at Kooskia NFH without transport to Dworshak NFH.
- Timing of returning steelhead adults is more suitable to conditions at Kooskia NFH than for spring Chinook.
- A localized broodstock could be developed from adult collection and smolt release,.
- Provides increased terminal fishing opportunity in Clear Creek.
- Consistent with recommendation DW11c, to develop a locally adapted broodstock from B-run steelhead returns to Kooskia NFH.

Cons

- Requires similar rearing conditions to those for spring Chinook

- Reduces tribal, sport, and commercial harvest opportunity of highly valued spring Chinook in the Clearwater Basin and downriver fisheries.

- Increased steelhead production is currently inconsistent with the Nez Perce Tribal management strategy to reintroduce spring Chinook in the Clearwater Basin. In accordance with the agreement under the Snake River water adjudication proceeding, the Service has agreed that future priorities for Kooskia NFH are determined by the Nez Perce Tribe.

- Kooskia NFH spring Chinook provides potential backup broodstock for Dworshak NFH in support of sport and tribal fisheries in the Clearwater River.

Alternative 5: Use Kooskia NFH as a satellite facility within the Clearwater River basin for broodstock collection, egg incubation, potential hatch and early rearing of fry, and acclimation and release of smolts during the fall, winter, and spring months with no or very limited on-station rearing of fish during the summer months.

Because of water quality and quantity problems at Kooskia NFH during the summer months, on-station rearing of spring Chinook would be terminated, and the hatchery would instead be used as a satellite facility to assist with broodstock collection and smolt releases for species reared elsewhere in the Clearwater Basin (i.e., Dworshak NFH, Clearwater FH, Nez Perce Tribal Hatchery). Spring Chinook, coho or steelhead smolts, or some combination thereof, could be acclimated and released at Kooskia NFH with returning adults trapped for broodstock and spawned there. Eggs would be incubated to at least the eyed stage and either transferred directly to other facilities for hatch or hatched at Kooskia NFH with the resulting fry transferred elsewhere for rearing during the summer months.

Pros

- May allow for the continued maintenance of the Kooskia NFH spring Chinook stock.

- Matches fish culture capabilities to the quality and quantity of water available at different times of the year.

- Improves fish health as fish will be absent from the facility when rearing conditions are poor.

- Broodstock collection and smolt releases at Kooskia NFH would promote local adaptation of stocks to the vicinity of the Middle Fork Clearwater River in support of harvest and reintroduction programs (e.g., coho)

- Reduces the need for chemical treatments to maintain fish health.

- Improves flexibility for use of facility in management of hatchery stocks.

- Allows for major maintenance to occur during the summer months when fish are not reared at the facility.

- Would reduce electricity consumption significantly.

Cons

- Requires fish rearing space at other facilities in the Clearwater River basin. This may reduce the total number of spring Chinook smolts (or other species to accommodate more spring Chinook) unless rearing capacity is increased at other facilities (i.e., Nez Perce Tribal Hatchery, Dworshak NFH, and Clearwater FH).

- Increases fish health risks because of transporting fish between facilities.

- Does not address problems associated with adult recapture of spring Chinook at Kooskia NFH because spring Chinook are trapped for broodstock during the summer months. This alternative would still require implementation of recommendation KO6: "Investigate expanding the well field to provide ground water for holding broodstock and spawning at Kooskia NFH.

- May require implementation of other recommendations associated with Alternative 1 and the culture of spring Chinook program depending upon the strategy implemented.

Alternative 6: Terminate the spring Chinook program and coho program and decommission the facility

Pros

- Discontinues an expensive spring Chinook program that is difficult to operate at Kooskia NFH.

- Eliminates the need for capital improvements at Kooskia NFH.

Cons

- Reduces tribal, sport, and commercial harvest opportunity of highly-valued spring Chinook in the Clearwater Basin and downriver fisheries.

- Terminates a highly valued, on reservation program of the Nez Perce Tribe.

- In accordance with the agreement under the Snake River water adjudication proceeding, the Service has agreed that future priorities for Kooskia NFH are determined by the Nez Perce Tribe. Terminating the program and decommissioning the facility is inconsistent with tribe's current intentions for Kooskia NFH.

- Eliminates a potential backup broodstock source for Dworshak NFH.

Recommended Alternatives

Fish culture challenges at Kooskia NFH limit the ability to fully achieve program goals and objectives for spring Chinook.

The team believes that coho salmon, fall Chinook and steelhead are better suited for the culture conditions at Kooskia NFH than spring Chinook. The team excluded fall Chinook because they were not native to the upper Clearwater Basin and favored coho over steelhead because (a) the Nez Perce

Tribe desires to reintroduce coho into the Clearwater Basin, and (b) large steelhead programs already exist at Dworshak NFH and Clearwater FH. Propagation of another species at Kooskia NFH would reduce the total number of hatchery-origin spring Chinook released in the Clearwater Basin.

Short Term (0-5 years): Implement Alternative 2 for coho. Replace the on-station spring Chinook program with a reintroduction and harvest coho program. Establishment of a coho program at Kooskia NFH should rely primarily on adult coho returning to the hatchery. In 2008, more that 1,300 coho salmon returned to Kooskia NFH.

If rearing space is available at another facility, implement a variation of Alternative 5 for spring Chinook; that is, continue to release spring Chinook at Kooskia NFH, but at reduced levels, and use the facility to capture returning adults for broodstock. Incubation and rearing would occur at another facility in the Clearwater River Basin. Spring Chinook smolts could be released directly into Clear Creek (e.g., as is done now for steelhead), or an acclimation and release pond could be constructed at Kooskia NFH to prevent conflicts with the coho program. To some extent, this recommendation switches the current operational roles of coho and spring Chinook at Kooskia NFH.

Long Term (5-15 years): Maintain a localized broodstock of coho at Kooskia NFH for harvest and reintroduction throughout the Clearwater Basin. Implement the Nez Perce Tribe's master plan for coho in the Clearwater Basin, which may transfer some of the rearing responsibilities for coho to the Nez Perce Tribal Hatchery. These actions may allow Kooskia NFH to rear stocks of high biological value in the long term.

Clearwater Coho, Dworshak NFH and Kooskia NFH

Operator: Nez Perce Tribe and U.S. Fish & Wildlife Service

Summary of Current Program

Goals

- ***Harvest goal:*** The harvest goal for coho salmon in the Clearwater River under current conditions is zero fish.[75] The long-term harvest goal under future conditions has not been determined.[Ibid.] The purpose of the program is to reintroduce and restore coho salmon to the Clearwater River basin at levels of abundance and productivity sufficient to support sustainable runs and harvest based on an annual escapement of 14,000 coho salmon to the basin. (Nez Perce Tribe Coho Master Plan Clearwater River Basin 2004).

- ***Broodstock escapement goal*: Phase 1:** Achieve a sustainable return of at least 954 hatchery-origin coho representing a *Clearwater Localized Stock* (CLS) to meet broodstock needs at Clearwater Fish Hatchery (452 adult coho, but discontinued in 2007 due to funding constraints) and Dworshak National Fish Hatchery (502 adult coho). **Phase 2:** Achieve a sustainable return of an additional 1,404 adult coho to provide broodstock for the Nez Perce Tribal Hatchery should Phase II be implemented. (Nez Perce Tribe Coho Master Plan Clearwater River Basin 2004, p. 23). The long-term goal is to achieve an escapement of 2,000 adult coho for the hatchery programs and an additional 12,000 adult coho for harvest and natural spawning escapement.

- ***Conservation goal*:** Reintroduce and restore coho salmon to the Clearwater River subbasin at levels of abundance and productivity sufficient to support sustainable runs and harvest, with an annual total return of 14,000 coho salmon to the Clearwater River. (Nez Perce Tribe Coho Master Plan Clearwater River Basin 2004, p. ii)

- ***Escapement goal for natural-origin adults*:** The current Phase I reintroduction plan does not include escapement of natural-origin adults; establishment of a self-sustaining, localized hatchery broodstock within the Clearwater River subbasin is the primary goal at the present time. However, the ultimate goal of the coho reintroduction program is establishment of natural populations within the Clearwater River Subbasin in concert with a hatchery program to sustain tribal and recreational fisheries. A comprehensive evaluation of natural reproduction is planned in order to determine whether hatchery-origin coho salmon returning to the Clearwater River are capable of reproducing successfully under natural conditions. If natural reproduction is documented, the Nez Perce Tribe could implement Phase II wherein the reestablishment of natural reproduction is the primary goal. (Nez Perce Tribe Coho Master Plan Clearwater River Basin 2004, p24).

- ***Research, education, and outreach goals*:** Monitor and evaluate the ability to achieve the goals of Phase I of the Nez Perce Tribe Master Plan for coho in the Clearwater River basin. These research activities include establishment of baseline smolt production and productivity estimates for naturally spawning coho in Clear and Lolo creeks, and establishment of

[75] *NWPCC Clearwater River Subbasin Plan, Table 3. http://www.nwcouncil.org/fw/subbasinplanning/clearwater/plan/.*

measures of competition between (a) coho and (b) spring Chinook and steelhead in Clear and Lolo creeks.

Objectives

- **Phase I , before BY2006**
  - Release 1.1 million juvenile coho salmon throughout the Clearwater Basin as described below.
  - Transport 550,000 coho smolts from Eagle Creek NFH for direct release at several sites in Lapwai Creek (275,000 smolts) and Potlatch River (275,000 smolts).
  - Trap and spawn sufficient numbers of adults (n > 954 adults) returning to the Clearwater and Snake rivers to yield 638,000 "green" eggs. Adult collection sites include Dworshak NFH, Kooskia NFH (Clear Creek), Potlach River weir, Lapwai Creek weir, and Lyons Ferry Fish Hatchery.
  - Incubate the first 308,000 fertilized eggs collected from returning adults at Dworshak NFH. Transport the resulting fish as pre-smolts to Kooskia NFH for a four to six week acclimation period prior to release as smolts into Clear Creek. The release goal is 280,000 smolts.
  - Incubate and rear the next 330,000 eggs and resulting fish, respectively – representing the progeny of adult coho returning to the Clearwater River - at Clearwater FH for a sub-yearling pre-smolt release of 270,000 coho into Lolo Creek in late September or early October with the goal that returning adults will spawn naturally in Lolo Creek (supplementation component of program).
  - Import additional eyed eggs from Eagle Creek NFH and incubate at Clearwater FH or Dworshak NFH if adult returns to the Clearwater and Snake rivers do not provide sufficient numbers of broodstock to meet egg take objectives. For example, 100,000 eyed eggs were imported from Eagle Creek NFH for BY2007. Those imported eggs were in addition to the 550,000 smolts that Eagle Creek NFH is currently obligated to provide to the Nez Perce Tribe.
  - Any collected eggs in excess of the 638,000 total egg take objective may be shipped to Eagle Creek NFH for hatch and rearing prior to transfer back to the Clearwater River as smolts for release in Lapwai Creek and the Potlatch River.
- **Phase I, after BY2006**
  - Release 830,000 juvenile coho salmon throughout the Clearwater Basin as described below.
  - Import 550,000 smolts from Eagle Creek NFH and release directly into Clear Creek (275,000 smolts) at Kooskia NFH and Lapwai Creek (275,000 smolts).
  - Trap up to 502 returning coho adults at Dworshak and Kooskia NFHs to yield 280,000 smolts for acclimation at Kooskia NFH and release into Clear Creek.
  - Note: Due to funding cuts in the Pacific Coastal Salmon Recovery Fund, the Nez Perce Tribe was forced to discontinue (a) rearing coho salmon at Clearwater Hatchery and the trapping of

452 adults to produce 270,000 pre-smolts for acclimation and release into Lolo Creek, and (b) operate weirs on the Potlatch River and Lapwai Creek for broodstock collection and monitoring; therefore, the Potlatch smolt release will be transferred to Clear Creek to facilitate future broodstock collection at Kooskia NFH.

- **Phase II**
  - Expand facilities at the Nez Perce Tribal Hatchery Site 1705 to rear approximately 688,000 smolts (from 1,404 adults) annually for use in a rotating supplementation schedule.
  - Monitor adult returns, natural reproduction and productivity of coho salmon in several Clearwater River tributaries.
  - Determine the optimum balance of natural reproduction escapement and number of hatchery-origin fish released annually to achieve harvest and natural population restoration goals in the Clearwater River. Additional details will be developed as the result of research, monitoring, and evaluation during Phase I.

Program Description

In 1994, the Nez Perce Tribe began reintroducing coho salmon in the Clearwater River basin by securing fertilized eggs through *U.S. v. Oregon*. By 1998, this agreement provided an annual transfer of 550,000 coho salmon smolts from lower Columbia River hatcheries to the Clearwater River. In 1998, the Northwest Power and Conservation Council (NWPCC) recommended the Bonneville Power Administration to fund the development of a Master Plan to guide this reintroduction effort.

The Nez Perce Tribe initiated coho salmon restoration in the Clearwater River in 1995 by releasing 630,000 coho salmon parr in five streams. At that time, those fish were the first coho salmon in the Snake River Basin in 30 years. In 1997, 92 returning coho adults were observed at Lower Granite Dam. Those were the first coho adults to return to the Snake River since extirpation of natural populations.

Adult coho from lower Columbia River hatcheries (e.g., Eagle Creek NFH) and returning adults to the Snake and Clearwater Rivers have been used to provide eyed eggs, fry, parr, and smolts for release into tributaries of the lower main stem Clearwater, Middle Fork Clearwater, and South Fork Clearwater rivers. Primary reintroduction efforts have been focused in Lapwai Creek, Potlatch River, Clear Creek (Kooskia NFH acclimation and release), Eldorado/Lolo Creek, Meadow Creek (SF Clearwater River), and Meadow Creek (Selway River).

The Nez Perce Tribe proposed a two phase approach for reintroducing coho salmon in the Clearwater River. The primary goal of Phase I is to establish a localized Clearwater River coho salmon hatchery broodstock and meet broodstock needs with returning adult coho to a level that is viable and self-sustaining. The primary goal of Phase II is to establish naturally spawning populations of coho salmon in the Clearwater River Subbasin sufficient to support harvest.

The two-phase approach was necessary because of several uncertainties regarding the likelihood of success. Those uncertainties relate to (a) the ability to reestablish self-sustaining natural populations of coho salmon 500 miles upstream from the ocean with transplanted hatchery fish from lower Columbia River hatcheries; (b) the mortality effects associated with eight mainstem hydroelectric dams; and (c)

whether reduced harvests in lower Columbia River fisheries would be sufficient to allow sufficient escapement back to the Snake and Clearwater rivers.

Artificial propagation of coho salmon in the Clearwater River is authorized under the Nez Perce Tribal Hatchery program, the Mitchell Act, and U.S. vs. Oregon proceedings.

Assessment of Current Program

Operational Considerations

Listed below are the principal operational components of the hatchery program and related information that the Review Team considered as part of its review. Most of this information was obtained from the Nez Perce Tribe's master plan for coho and the Annual Operations Plan (AOP) for the Clearwater River

Broodstock Choice and Collection

- The intent of the program is to transition from relying on broodstocks from Lower Columbia hatcheries for eggs or smolts to relying on adult coho returning to the Clearwater River basin for broodstock.

- Adult coho are collected at several places in the Clearwater and Snake rivers to meet broodstock needs. In 2007, a total of 520 adult coho salmon were captured within the Clearwater River basin: 21 at Nez Perce Tribal Hatchery, 305 at the Kooskia NFH weir on Clear Creek, and 194 at Dworshak NFH. 41 adult coho were also collected at Lyons Ferry Hatchery in the Snake River basin. Coho salmon trapped at Lyons Ferry Hatchery are considered "strays" because coho are not released there, although the hatchery is on the migratory route for coho returning to the Clearwater Basin.

- Surplus adult coho continue to be collected and spawned at Eagle Creek NFH and other Columbia River hatcheries to backfill broodstock needs on the Clearwater and Snake rivers to compensate for deficient adult returns to the Clearwater River. These latter transfers are in addition to the scheduled 550,000 smolt transfer from Eagle Creek NFH to the Clearwater Basin.

- The USFWS operates a fish ladder on the North Fork of the Clearwater River at Dworshak National Fish Hatchery and an adult weir and ladder at Kooskia National Fish Hatchery to trap adult coho salmon from October through mid-December.

- Beginning on October 1, , the Dworshak NFH ladder is open 24 hours a day for approximately two to three weeks until the USFWS collects approximately 500 steelhead for its fall collection. Once the steelhead goal is met, the ladder is opened a few days a week (24 to 48 hours) to allow for additional coho salmon collection. Fish in the ladder are sorted weekly, and coho salmon are placed in an adult holding pond until spawned. The ladder is opened intermittently to minimize capture of steelhead. Approximately five times as many steelhead as coho enter the ladder at Dworshak NFH when it is open, and all captured steelhead beyond the 500 needed for

broodstock must be hauled back down river. For example, 2000 steelhead and 200-400 coho were collected in 2007.

- Past trapping of coho adults in Lapwai Creek and Potlatch River generally began in late September when adult traps and weirs were installed. These trapping activities were suspended in 2007 because of insufficient funds to operate the weirs.

Hatchery and Natural Spawning, Adult Returns

- The Service can hold up to 500 adult coho salmon at Dworshak NFH.

- Spawning occurs from mid-October through mid-December. Once a week, ripe females are each spawned with at least one male. In most cases, a 1:1 male to female ratio is maintained

- Adult coho returns (age 3 males and females) to the Kooskia NFH weir on Clear Creek increased from 2005 to 2008: 58 adult coho were trapped in 2005, 130 in 2006, 305 in 2007, and 765 adult coho (+ 564 age 2 males or "jacks") in 2008. Adult returns to Dworshak NFH for 2005, 2006, 2007, and 2008 were 100, 194, 194, and 228 age 3 adults, respectively.

- 182 coho salmon redds were observed in tributaries of the Clearwater River during the fall of 2005 by aerial and ground surveys: Potlatch River (54 redds), Lapwai Creek (115 redds), Cottonwood Creek (0 redds), Big Canyon Creek (0 redds), Lolo Creek (4 redds), Clear Creek (7 redds), Meadow Creek, Selway River (0 redds), S.F. Clearwater River (2 redds), Meadow Creek, S.F. Clearwater River (0 redds), and Asotin Creek (0 redds).

- To date, the primary focus of reintroduction efforts has been development of a hatchery-propagated Clearwater Localized Stock (CLS) of coho salmon. Hence, substantial effort has been expended in attempting to capture all returning adult coho salmon for broodstock. However, weirs on the Potlatch River and Lolo Creek are not 100% efficient, and redd surveys have documented coho salmon redds in these locations, thus demonstrating that adult coho salmon returning from release of lower Columbia River juveniles are capable of constructing redds. However, natural reproduction productivity cannot be estimated because the total number of adults potentially spawning in each stream is unknown.

Incubation and Rearing

- The USFWS provides space for hatching and rearing up to 320,000 coho salmon at Dworshak NFH, and space for final rearing and acclimation for 280,000 coho salmon smolts at Kooskia NFH after transfer from Dworshak NFH.

- At Dworshak NFH, newly-hatched fry are transferred to indoor nursery tanks and reared indoors until those tanks are needed for steelhead, at which time the coho are typically 600-800 fish per pound (fpp) and are moved to outdoor concrete raceways and reared to the smolt stage (20 fpp; final D.I.= 0.29; final F.I. = 0.58).

- At Dworshak NFH, 10 raceways in the adult holding pond area are used for the Nez Perce Tribal coho program. These raceways are operated on single-pass river water. They were initially constructed for rearing rainbow trout.

- The Nez Perce Tribe is responsible for all phases of fish culture. This includes cleaning, feeding, sampling, treating, hauling and releasing. In addition, the Tribe is responsible for purchasing fish tags, coordinating all fish marking, and data reporting.

- Progeny of adults spawned at Dworshak NFH are reared at Dworshak NFH and transferred as yearlings to Kooskia NFH during the first week of April (as soon as spring Chinook are released from Kooskia NFH) for a four to six week acclimation period prior to a volitional release as smolts into Clear Creek.

- For collecting broodstock in 2004, adult traps and temporary weirs were installed at trapping sites in late September. Trapping began at Dworshak NFH at about the same time. Adult coho returning to the Clearwater River in 2004 yielded approximately 640,000 eyed eggs. The release objective at Kooskia NFH was 280,000 smolts; however, an outbreak of bacterial coldwater disease resulted in significant mortalities at Dworshak NFH and only 190,000 coho smolts (BY 2004) were released into Clear Creek at Kooskia NFH (May 1, 2006).

- A positive correlation between rearing densities and mortality caused by coldwater disease exists for coho reared at Dworshak NFH. When rearing densities of coho are maintained at D.I.< 0.2, coho express fewer fish health problems than the steelhead and are relatively unaffected by IHN virus.

- Prior to BY2006, coho reared at Clearwater Fish Hatchery were transported off-station at the presmolt stage (50 fpp) in late September and early October and released as subyearling pre-smolts because of water limitations at Clearwater Hatchery. This component of the program has been discontinued because of funding cuts.

Release and Outmigration

- Prior to 2007, Eagle Creek NFH provided approximately 550,000 coho smolts to the Nez Perce Tribe for transfer and direct release into several sites on Lapwai Creek and Potlatch River. A total 238,912 coho smolts (BY2003) were hauled and directly released into the Potlatch River on March 7, 2005, and 267,088 coho were destined for released into Lapwai Creek on March 9, 2005; however, due to low flows in Lapwai Creek, the majority of those latter fish were outplanted into the mainstem Clearwater River and Clear Creek on March 9 and 10, 2005.

- In 2007 and 2008, 550,000 smolts were transferred from Eagle Creek NFH for direct stream release in mid-March into Clear Creek (275,000 smolts) and Lapwai Creek (275,000 smolts). The Potlach River smolt release (275,000) has been discontinued and those fish are now released in Clear Creek to facilitate broodstock collection at Kooskia NFH.

- The Annual Operating Plan (AOP) for 2007 shows, for both the Clear Creek and Lapwai Creek releases, that 25,000 smolts were released with clipped adipose fins, 50,000 smolts carried coded wire tags, and 1,500 smolts carried PIT tags. For 2008 releases, the plan was to have similar mark and tag groups; however, marking and tagging did not occur, and all coho from Eagle Creek NFH were transferred and released into Clear and Lapwai creeks unmarked.

- Coho are reared at Dworshak NFH, acclimated at Kooskia NFH, and then released as smolts (approx 280,000) into Clear Creek in late April, early May. Approximately 100,000 of these fish receive CWTs, and 1,500 receive PIT tags. A total of 287,000 BY2003 coho salmon smolts were released from Kooskia NFH on April 25, 2005.

- Prior to 2008, coho pre-smolts reared at Clearwater Fish Hatchery were direct stream released at 50 fpp into Lolo Creek. This component of the program has been discontinued.

Facilities and Operations

- See Facilities and Operations sections for N.F. Clearwater River steelhead program, Dworshak NFH, and Clearwater Spring Chinook program, Kooskia NFH.

Research, Education, and Outreach

- See Research, Education and Outreach sections for N.F. Clearwater Steelhead program, Dworshak NFH, and Clearwater Spring Chinook program, Kooskia NFH sections.

- 550,000 unmarked (no AD fin clips) coho are released annually into the Clearwater River basin.

- The Nez Perce Tribe has developed an extensive *Research, Monitoring, and Evaluation* (RM&E) plan for the coho restoration program so that operations could be adaptively managed to optimize hatchery and natural production, and minimize deleterious ecological impacts. However, funding limitations have resulted in changes to the proposed program, and the RM&E program is not currently funded fully.

- Objectives of the RM&E program: (1) Determine if program targets for contribution rates of hatchery fish are being achieved and can be improved; (2). Determine the increases in natural production that results from supplementation of coho salmon in the Clearwater River subbasin, and relate levels of natural reproduction to limiting factors; (3) Monitor genetic profiles of introduced coho salmon stock from lower Columbia River hatcheries, Clearwater River broodstock developed from returns of hatchery-origin adults, and natural-origin coho adults returning to the Clearwater River; (4) Monitor ecological interactions between coho and other species; (5). Effectively communicate monitoring and evaluation program approach and findings to resource managers.

- The USFWS provides fish health monitoring for the coho program.

- Lolo Creek and Meadow Creek (S.F. Clearwater River) have been used as secondary streams to monitor natural reproduction. These streams have rotary screw traps operated by the Nez Perce Tribal Hatchery (NPTH) Monitoring and Evaluation project. However, the lack of adult returns at Lolo Creek and Meadow Creek has precluded subsequent monitoring of natural reproduction.

Benefit and Risk Assessment[76]

BENEFITS CONFERRED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

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

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

Harvest Benefits

- Harvest benefits are not yet realized. The long-term goal of the program is to return 12,000 adult coho to the Clearwater River basin for harvest and natural escapement.

Conservation Benefits

- Conservation benefits are not yet realized. The long-term goal is to return 12,000 adult coho to the Clearwater River basin for harvest and natural escapement.

- Escapement goals for hatchery-origin coho back to the Clearwater River basin have not yet been met; consequently, the program continues to rely on out-of-basin broodstock from lower Columbia River hatcheries (e.g., Eagle Creek NFH). The current priority is to develop a localized, self-sustaining, hatchery broodstock (2,000 adults per year) within the Clearwater River basin.

- Reintroduction of coho salmon to native habitats would assist with restoring salmonid ecosystems to historical conditions.

Research, Education, Outreach and Cultural Benefits

- The program provides information regarding the feasibility of reestablishing coho salmon to the Clearwater River.

- The program is providing cultural benefits to the Nez Perce Tribe. It currently provides research, education and community benefits and has the long-term goal of providing harvest benefits.

BENEFITS CONFERRED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

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

Harvest Benefits

- Harvest benefits are not yet realized. However, a successful coho program would likely make significant contributions to lower Columbia and ocean fisheries.

Conservation Benefits

- Decaying coho carcasses provide nutrient benefits to streams in which hatchery-origin coho return.

Research, Education, Outreach and Cultural Benefits

- Results obtained from the reintroduction program can be used to guide reintroduction efforts elsewhere.

RISKS POSED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

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

Genetic Risks

- The continued importation of fish from lower Columbia River hatcheries impedes achievement of the phase one goal of establishing a self-sustaining, locally-adapted hatchery propagated stock within the Clearwater River basin. Coho smolts imported from lower Columbia River hatcheries are not differentially marked or tagged to distinguish them from hatchery-produced offspring of adult coho returning to the Clearwater Basin; consequently, the process of creating a localized population is impeded.

Demographic Risks

- Intermittent operation of the fish ladder at Dworshak NFH is most likely reducing the total number of coho collected for broodstock and may be differentially selecting for a particular part of the run.

- The risk of coldwater disease at Dworshak NFH increases when rearing densities exceed recommended guidelines.

- Long distance transport of coho smolts from lower Columbia River hatcheries to the Clearwater River basin increases the risk of stress-related mortality and post-release delayed mortality. For example, the mean smolt survival to Lower Granite Dam ranged from 56.2% to 75% for fish acclimated and released at Kooskia NFH, versus 8.6% and 24.2% for fish transported from Eagle Creek NFH and released directly into the Potlatch River and Lapwai Creek, respectively.

- Long distance transport of coho smolts from lower Columbia River hatcheries (e.g. Eagle Creek NFH) without temporary holding and acclimation in the Clearwater River basin prior to release prevents assessment of transport mortality and smolt quality. These direct releases without acclimation further inhibit the ability to determine whether low smolt-to-adult return rates are due to release location, broodstock origin, or the transport process itself. However, with new funding from Mitchell Act, the Columbia River Fishery Program Office (USFWS, Vancouver, WA) will PIT tag 10,000 coho at Eagle Creek NFH destined for release in the Clearwater River and the Nez Perce Tribe will PIT tag 5,000 fish at Dworshak NFH in the spring 2009.

- The facility's location above four Columbia River and four Snake River dams significantly reduces the survival of outmigrating juveniles and returning adults, posing a demographic risk to the return of sufficient numbers of adults to meet harvest and broodstock goals on a consistent basis.

Ecological Risks

- Imported fish from the lower Columbia River compete with the offspring of adults that return and spawn naturally or artificially in the Clearwater River basin.

Physical Risks

- None identified.

Research, Education, Outreach and Cultural Risks

- Lack of funding prevents the planned monitoring and evaluation plan from being implemented and reduces the likelihood of success of the program.

- Coho released in the Clearwater Basin are not adequately marked to evaluate the reintroduction program.

- Record keeping for the coho program is inadequate. The Annual Operating Plan (AOP) process for the Clearwater River has improved necessary documentation of activities; however, unplanned actions still occur sporadically and some planned actions (e.g., broodstock collection, egg take, etc.) are not always well documented. Additionally, data regarding survival of fish or eggs is not well tracked or recorded after the fish or eggs leave their hatchery of origin.

- Lack of adequate smolt-trapping prevents assessment of natural reproductive success in supplementation streams.

Risks Posed to Other Stocks, Species, and Communities

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

Genetic Risks

- Straying risks to other stocks of coho have not yet been quantified.

Demographic Risks

- Continued outplants of coho salmon juveniles from lower Columbia River hatcheries poses some disease risks to natural fish populations of other salmonid species in the Clearwater River.

Ecological Risks

- Ecological risks to ESA listed steelhead in the Clearwater River have been raised as a potential concern.

- Straying risks to other watersheds have not been quantified.

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

Research, Education, Outreach and Cultural Risks

- None identified.

Recommendations for Current Program

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

Program goals and objectives

Issue CC1: Separate numeric goals for harvest versus natural spawning escapement in the Clearwater River basin have not been established. *The long-term goal is to establish a total adult return of 14,000 coho to the Clearwater Basin, with about 2,000 coho for hatchery broodstock. The remaining 12,000 coho would go to harvest and natural escapement.*

Recommendation CC1: Establish separate harvest, broodstock, and natural spawning escapement goals for coho in the Clearwater River basin.

Issue CC2: The goals and objectives of Phase I of the Master Plan have not been met. Phase I of the master plan included off-station releases and adult recoveries with weirs. This approach complicated the establishment of self-sustaining, hatchery propagated runs back to the Clearwater Basin.

Recommendation CC2: Reassess the current approach toward meeting goals and objectives of Phase I. As a first priority for reintroducing coho salmon to the Clearwater Basin**,** establish a self-sustaining hatchery-propagated run of coho salmon in the Clearwater River, with broodstock collection, rearing and release at Dworshak NFH, Kooskia NFH and/or Nez Perce Tribal Hatchery. Achievement of this goal should not be hindered by the continued importation of fish from lower Columbia River hatcheries (e.g., Eagle Creek NFH) or the outplanting of juvenile coho into areas where little or no opportunity exists to collect returning adult fish for broodstock (see Recommendation CC3 below). The Nez Perce Tribal Hatchery, as proposed for future modification, is identified in the Master Plan as the primary location for the long-term propagation of coho salmon in the Clearwater River basin. Achievement of this goal would eliminate the need for imports from lower Columbia River hatcheries. (see also the Recommended Alternative for Kooskia NFH under the spring Chinook program).

Broodstock Choice and Collection

Issue CC3: Collection of coho salmon for broodstock within the Clearwater River basin is currently limited. *Dworshak NFH has been the primary location for collecting broodstock, but the fish ladder is only opened intermittently after collection of steelhead broodstock in the fall is complete. This intermittent operation of the fish ladder limits the ability to collect sufficient number of coho broodstock to meet Phase I goals of the program. Additionally, low water*

flows in Clear Creek during the early fall when coho return to Kooskia NFH may limit the ability to collect broodstock there. However, 1,329 adult coho (457 females, 308 full-size males, and 564 "jacks") were trapped at Kooskia NFH in 2008.

Recommendation CC3a: Use Kooskia NFH as the primary location for collecting coho broodstock and operate the fish ladder at Dworshak NFH for collecting coho only to supplement, as needed, adults collected for broodstock at Kooskia NFH until a self-sustaining broodstock is established at Kooskia NFH. [Note: The Nez Perce Tribe and Dworshak NFH Complex have already implemented this recommendation in coordination with other comanagers.]

Recommendation CC3b Discontinue retaining adult coho trapped at Lyons Ferry FH for broodstock. Adult coho trapped at Lyons Ferry FH represent stray fish released in the Clearwater River, and the use of stray fish for broodstock should be discontinued. Adult coho trapped at Lyons Ferry FH should be surplused to the tribes or food banks.

Hatchery and Natural Spawning, Adult Returns

No specific issues were identified that are not covered in other categories.

Incubation and Rearing

Issue CC4**: **Juvenile rearing densities at Dworshak NFH, particularly during early rearing in the indoor nursery tanks, exceed culture guidelines for coho salmon.

Recommendation CC4: Maintain coho rearing densities of D.I.<0.2 D.I. for the indoor nursery tanks and D.I. <0.3 for the outside raceways.

***Issue CC5:** The continued importation of fish from lower Columbia River hatcheries impedes achievement of the Phase One goal of establishing a self-sustaining hatchery propagated population of coho salmon in the Clearwater Basin.*

Recommendation CC5: Reduce the total number of smolts released into the Clearwater River and/or provide additional incubation and rearing space at Dworshak NFH, Kooskia NFH, and/or Nez Perce Tribal Hatchery for rearing the progeny of adult coho trapped within the Clearwater River. The progeny of adult coho trapped within the Clearwater River should replace the 550,000 smolts currently imported annually from Eagle Creek NFH. Maintaining the same smolt-release objectives under this recommendation would reduce spring Chinook and/or steelhead production at Dworshak NFH or Kooskia NFH (see recommended alternative for Kooskia NFH). However, discontinuing smolt outplants (275,000 smolts) into Lapwai Creek (Recommendation CC7b below) would reduce the amount of additional rearing space required for coho at Dworshak NFH or Kooskia NFH by approximately 50% in lieu of importing fish from Eagle Creek NFH. The Service should continue to support development of Nez Perce Tribal Hatchery Phase II.

***Issue CC6:** "Standard Operating Procedures" (SOPs) have not been established for the culture and rearing of coho salmon at Dworshak NFH as part of the cooperative agreement between the*

Nez Perce Tribe and the Service. The Service is responsible for providing facilities, and the Nez Perce Tribe is responsible for the culture and husbandry of coho salmon at Dworshak NFH.

Recommendation CC6: Establish and document standard operating procedures for the culture and rearing of coho salmon at Dworshak NFH as part of the cooperative agreement between the Service and the Nez Perce Tribe.

Release and Outmigration

Issue CC7: *The continued importation of fish from lower Columbia River hatcheries impedes achievement of the Phase One goal of establishing a self-sustaining hatchery propagated population of coho salmon in the Clearwater Basin. In addition, offsite-releases and direct outplanting of juveniles into streams without adult recapture capabilities reduces the likelihood of meeting broodstock collection goals under Phase I.*

Recommendation CC7a: Phase out the direct release of coho salmon juveniles from lower Columbia hatcheries into the Clearwater Basin (see Recommendation CC5).

Recommendation CC7b: Release all hatchery-origin coho from Dworshak NFH, Kooskia NFH, and/or Nez Perce Tribal Hatchery to maximize the number of returning adult fish that can be captured for developing a localized broodstock. This includes discontinuing direct stream releases or outplants of coho into Lapwai Creek until the goals of Phase I are achieved and implementation of Phase II is initiated. After a localized, self-sustaining hatchery population has been established within the Clearwater River (Phase I), activities to establish naturally spawning populations of coho in the Clearwater River basin can be resumed.

Issue CC8: Coho released in the Clearwater Basin from different release sites cannot be distinguished by release location.

Recommendation CC8: Ensure that a representative group of fish at each release location has a unique mark and/or tag. For example, 10,000 PIT tags could be applied to each unique release group. Alternatively, an external fin clip and/or coded-wire tag could be used.

Facilities/Operations

See the Facilities/Operations sections for steelhead at Dworshak NFH and spring Chinook at Kooskia NFH.

Research, Monitoring, and Accountability

Issue CC9: Coho released in the Clearwater River basin are not adequately marked or tagged to evaluate the reintroduction program. *For example, currently 550,000 unmarked hatchery coho from Eagle Creek NFH are released into Clear Creek and Lapwai Creek (275,000 smolts each).*

Recommendation CC9: All hatchery-origin coho released into the Clearwater River should carry a distinguishing mark or tag so that they can be distinguished from natural-origin coho. Current harvest rates for coho salmon in marine and lower Columbia River fisheries are substantially less than historical levels, thus facilitating upriver escapement of hatchery-origin fish. See also Recommendation CC7.

Issue CC10: The Clearwater coho program is under funded *The Clearwater coho program is funded by Mitchell Act, BPA, and the Pacific Coastal Salmon Recovery Fund. Funding levels have been insufficient to support the program as laid out in the Nez Perce Tribe's Clearwater Coho Master Plan. Due to insufficient funds, the program has been partially implemented and monitoring and evaluation activities have not been adequately supported.*

Recommendation CC10: Continue to support existing funding sources, including Mitchell Act support. The Service should encourage BPA funding of the Nez Perce Tribe's Clearwater Coho Master Plan, including recommendations described in this report. Restored funding related to recent budget cuts should emphasize increased monitoring and evaluation that are needed to assess the program.

Issue CC11: A critical component of fish culture programs is accurate and timely reporting of data collected during routing operations (e.g., daily mortalities, pond inventories, marking and tagging, monthly growth rates, feed conversion efficiencies, environmental parameters such as oxygen, ammonia, etc.). These data do not appear to be readily available for coho reared at Dworshak NFH.

Recommendation CC11: The Service should work with the Nez Perce Tribe to develop standard data reporting protocols that are consistent with protocols in use at NFHs (see also Recommendation KO19 and KO20). See also Issue and Recommendation DW26 under Dworshak NFH spring Chinook program.

Education and Outreach

See the Education and Outreach sections under Dworshak NFH B-run steelhead and Kooskia NFH spring Chinook.

Alternatives to Current Program[77]

The Review Team considered the benefits and risks of the existing coho program as currently implemented in the Clearwater River basin, including Dworshak and Kooskia NFHs. The Team developed two alternatives designed to reduce risks and/or increase benefits. The first alternative is the current program with all previously-described recommendations adopted. The last alternative is the "no hatchery" option. Following these descriptions of alternatives, the Review Team has identified recommended alternatives.

Alternative 1: Current program with recommendations

The primary goal of the current reintroduction program (Phase I) is to establish a self-sustaining hatchery population of coho salmon in the Clearwater River basin. Current objectives specify a total release of 830,000 smolts: 555,000 into Clear Creek and 275,000 into Lapwai Creek. If Recommendation CC5 is implemented, then smolt outplants into Lapwai Creek (275,000 smolts) would be discontinued and the total number of coho released in the Clearwater River would be reduced to 555,000 smolts into Clear Creek until a self-sustaining broodstock was established at Kooskia NFH.

Approximately 1,000 adult coho are needed to produce 555,000 smolts.[78]. Meeting these goals and objectives would require a minimum 0.18% smolt-to-adult return rate back to adult trapping facilities on the Clearwater River to maintain a total release of 550,000 smolts into Clear Creek. Achieving this latter objective may require increased broodstock collection at Dworshak NFH if less than 1000 adult coho return to Kooskia NFH.

Pros

- Increases the diversity of salmonid species in the Clearwater River
- .Offers the potential of achieving future harvest benefits from coho when fisheries for Chinook salmon (spring, summer, fall) are closed or declining.
- Reintroducing coho salmon to the Clearwater River, if successful, could be an important source of stream nutrients derived from carcasses.
- Coho have several culture advantages over steelhead and spring Chinook, particularly related to lower disease risks for bacterial kidney disease (BKD) and IHN virus.
- Provides a research, cultural, and education benefit to the Nez Perce Tribe.

Cons

[77] *Alternatives presented here are intended to be consistent with those in the companion report for LSRCP hatcheries operated by Idaho Department of Fish and Game.*

[78] *Based on current objectives that require trapping 502 adults to produce 280,000 smolts for release into Clear Creek.*

- Elimination of imports and direct stream releases from Eagle Creek NFH will inevitably require additional culture space for coho at Dworshak or Kooskia NFH, thus reducing the number of spring Chinook or steelhead reared on station.

- Increased trapping of coho broodstock at Dworshak NFH may increase demographic risks to returning steelhead (i.e., because of increased handling and sorting of adults). At the present time, steelhead returning to Dworshak NFH in the fall far outnumber returning coho.

- Coho salmon are a lower priority species for harvest to the Nez Perce Tribe than are spring Chinook.

- Coho salmon are a lower priority species for harvest to recreational anglers than are steelhead.

- Coho salmon are not included with long-term hatchery mitigation agreements in the Snake River.

- Long-term funding for this program may need to be resolved.

Alternative 2: Discontinue the coho program.

Pros

- Reduces potential conflicts for space and water with steelhead and spring Chinook at Dworshak and Kooskia NFHs

- Allows Dworshak and Kooskia to emphasize species of primary harvest importance to the Nez Perce Tribe and recreational anglers in the Clearwater River: spring Chinook and steelhead, respectively.

Cons

- Eliminates a potential future conservation benefit to salmonid ecosystems in the Clearwater River.

- Eliminates a potential future harvest benefit on coho salmon during the early fall months after fisheries on Chinook salmon are closed or declining.

- Eliminates a research, cultural, and education benefit to the Nez Perce Tribe.

Recommended Alternatives

A specific facility or group of facilities within the Clearwater Basin must be designated for broodstock collection, rearing, and release to establish a self-sustaining hatchery population of coho salmon within the Clearwater River basin as the first priority goal of the reintroduction program.

Short Term Goal (0-5 years): Implement Alternative 1: Current program with recommendations. Implementation of Alternative 1 here could be combined with the recommended alternative for Kooskia NFH (Alternative 2) which would replace the current spring Chinook program with a self-

sustaining, coho program (600,000 smolts with on-station rearing and release) and establishment of a locally-adapted, Clearwater broodstock for supporting harvest and reestablishment of naturally spawning populations within the sub-basin. The Review Team did discuss alternatives that would use facilities other than Kooskia NFH for establishing a localized hatchery population of coho salmon for the Clearwater River, but those alternatives were not considered because of existing priorities and constraints at those other facilities. If a self-sustaining coho program of 600,000 smolts can be achieved at Kooskia NFH, then many of the recommendations described here for coho at Dworshak NFH may not be necessary. However, the ability to develop a self-sustaining coho population at Kooskia NFH, compatible with the temperature and flow hydrology of Clear Creek, is a major uncertainty that needs to be resolved. Adult returns back to Kooskia NFH in 2008 (greater than 1,300 fish) support the Review Team's recommendations.

Long Term Goal (5-15 years): Implement the Master Plan of the Nez Perce Tribe with appropriate modifications to the M&E portion of the plan that will allow hatchery and natural-origin coho to be distinguished throughout the basin. The M&E program for the coho reintroduction program in the Wenatchee River basin is a model that could be used for the Clearwater River basin. The program in the future could include the Nez Perce Tribal Hatchery and Clearwater Anadromous Fish Hatchery as part of an updated Master Plan to accomplish reintroduction goals for coho in the Clearwater River.

IV. Salmon River Watershed

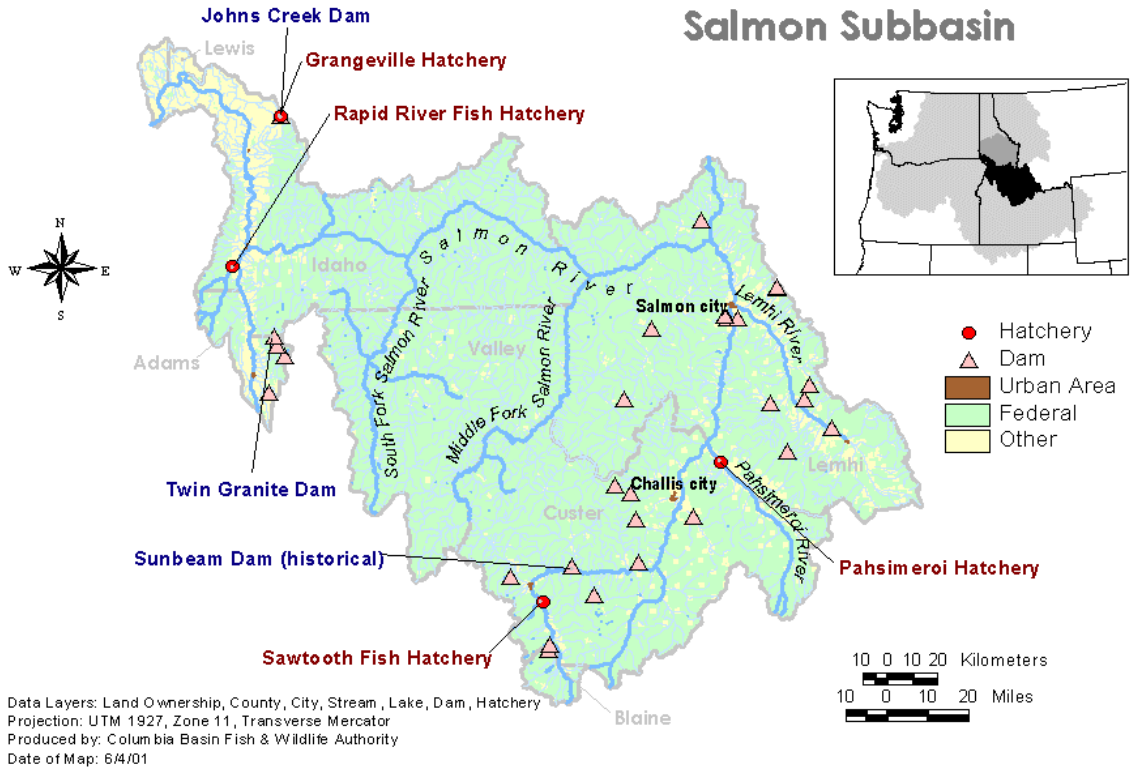

Figure 4. Salmon River Watershed[79]

[79] *APRE Columbia Gorge Province Report- http://www.nwcouncil.org/fw/apre/provincereports/Mountain%20Snake%20Province%20Report.doc*

Salmon River Overview

Watershed Description[80]

The Salmon River is one of the largest subbasins in the Columbia River basin. The subbasin covers approximately 13,984 square miles (36,217 square km), or 16.7% of the land area of Idaho and 6% of the land area of the Columbia River basin. The Salmon River originates in the Salmon Mountains of south-central Idaho and flows 410 miles (660 km) north and west through central Idaho to join the Snake River in lower Hells Canyon. Most of the subbasin is characterized by mountain ranges and river valleys. Elevations range from 898 feet (274 m) at the mouth of the Salmon River to the peak of Mount Borah at 12,661 ft (3,859 m). The subbasin encompasses some of the most pristine terrestrial and freshwater ecosystems within the Columbia River basin, including the *Frank Church River-of-No-Return Wilderness Area,* the largest contiguous area of protected wilderness in the continental United States. Despite comprising only 6% of the land area of the Columbia River basin, the Salmon River subbasin provides more anadromous fish spawning area than any other subbasin.

Fisheries

Spring/Summer Chinook Salmon

Hatchery-origin spring and summer Chinook salmon support major tribal and recreational fisheries in the Salmon River subbasin.

The most consistent harvests for spring/summer Chinook over the past two decades have occurred in the Little Salmon River in fisheries targeting spring Chinook returning to the Rapid River FH. Sport and tribal harvests combined ranged from approximately 3,000 to 9,500 fish/year for 2000-2003 (Salmon River Sub-Basin Plan) and from 50 to 6,000 fish/year for 1993-1999 (IDFG Report 07-03).

Salmon fishing in the South Fork Salmon River contributed approximately one-third of the total harvest of Chinook salmon in Idaho prior to 1965. Annual recreational harvests in the early 1960's ranged from approximately 1,700 to 3,900 wild salmon annually. Recreational fishing for wild salmon in the South Fork was suspended in 1965 because of landslides and silting that significantly impacted the viability of natural populations. Shoshone-Bannock Tribal ceremonial and subsistence fisheries on wild fish have continued at a reduced level.

Hatchery propagation of summer Chinook salmon in the South Fork Salmon River began in 1980 as part of the Lower Snake River Compensation Plan (LSRCP). From 1981-1986, the Shoshone-Bannock Tribes curtailed fishing in the South Fork Salmon River to allow natural populations to rebuild. Fishing by the Shoshone-Bannock Tribes was re-initiated in 1987 for both hatchery and natural-origin summer Chinook. Recreational fishing for summer Chinook, supported by returns of hatchery fish, were reinitiated in 1997, the first year since 1964 that recreational fisheries on summer Chinook had occurred in the South Fork Salmon River. Both tribal and recreational fisheries on summer Chinook have continued in the South Fork since 1997. The number of summer Chinook harvested annually by the Shoshone-Bannock Tribes in the South Fork, 1987-2008, ranged from zero to 1,359 hatchery fish and from zero to 313 wild fish. The Shoshone Bannock Tribes consider the South Fork Salmon River

[80] *NWPCC Salmon River Subbasin Plan, http://www.nwcouncil.org/fw/subbasinplanning/salmon/plan/.*

as their most consistent tribal fishery since 1992. The number of recreational fishers on the South Fork Salmon River during the period 1997 to 2007 ranged from 1,812 to 14,996 anglers/year, harvesting 364 to 6,843 fish/year.

Spring Chinook salmon have been propagated in the upper Salmon River at the Sawtooth FH near Stanley, Idaho since 1986. However, recreational fisheries on spring Chinook in the upper Salmon River were not permitted until 2008 because adult returns were lower than desired.

Steelhead

Hatchery-origin steelhead support important recreational and tribal fisheries in the Salmon River basin. Steelhead are propagated and released from the Sawtooth FH near Stanley, Idaho and from the Pahsimeroi FH on the Pahsimeroi River. In addition, steelhead are outplanted to several locations in the mainstem Salmon River upstream from the North Fork and into the Little Salmon River to support fisheries in those areas. Steelhead from Dworshak NFH in the Clearwater River basin are also outplanted into the upper Salmon and Little Salmon rivers to support "quality fisheries" on "large fish".[81]. The Shoshone-Bannock Tribes harvest about 300 steelhead per year in the East Fork, Yankee Fork Salmon River, and Upper Salmon River.

Resident trout

Native westslope cutthroat trout, resident rainbow-redband trout, bull trout, and several introduced species (brook trout, brown trout, and kokanee) support recreational fisheries in lakes and streams throughout the Salmon River basin.

Conservation[82]

Fall Chinook salmon

Fall Chinook salmon spawn annually in the lower mainstem reach of the Salmon River, but only a few redds (zero to 31 redds/year, 1992-2005[83]) are typically observed. Moreover, these redds are rarely seen more than a few miles upstream of the Snake River. These fish are not considered a distinct population but, rather, part of the spawning aggregation in the Hells Canyon region of the mainstem Snake River. These latter fish represent one of several spawning aggregations of the *Snake River Fall Chinook ESU*, which is currently listed as a threatened species under the ESA. The Interior Columbia Technical Recovery Team (ICTRT) found moderate extinction risk to the ESU for productivity, and moderately high extinction risks for abundance, spatial structure, and diversity.

Spring/Summer Chinook salmon

Native populations of spring and summer-run Chinook salmon are widely distributed throughout the Salmon River subbasin. Chinook salmon in the Salmon River upstream of Stanley, Idaho migrate

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[81] *Steelhead in Idaho are classified as "A-run" and "B-run" fish. B-run fish return to freshwater at a larger mean size and age than A-run fish. A-run fish are propagated at the Sawtooth and Pahsimeroi hatcheries within the Salmon River basin whereas B-run fish of hatchery origin largely represent the North Fork Clearwater River population that is propagated at Dworshak NFH.*

[82] *NWPCC Salmon River Subbasin Plan, http://www.nwcouncil.org/fw/subbasinplanning/salmon/plan/.*

[83] *Garcia, A., and 4 coauthors. 2006. Fall Chinook Spawning Ground surveys in the Snake River upstream of Lower Granite Dam. Annual Report, 2005-2006. Bonneville Power Administration, Portland, OR.*

farther inland (1,450 km or 900 miles) and to a higher altitude (over 1830 m or 6000 feet above sea level) to spawn than any other population of Chinook salmon outside of Alaska or British Columbia.

The ICTRT identified five major population groups (MPGs) within the Snake River spring/summer Chinook Salmon ESU; three of those MPGs occur within the Salmon River Basin (Table 19). Within those three MPGs, the ICTRT identified 22 demographically-independent populations based on genetics, geographic distribution of spawners, life history characteristics, demographics, and habitat use. None of the three MPGs currently satisfy NOAA Fisheries viability criteria for recovery.

Table 19. Demographically independent populations of Spring/Summer Chinook Salmon within three Major Population Groups for the Salmon River[84]

Major Population Groups (MPG) **Demographically Independent Pop.**	**Chinook Run Type**	**Potential Intrinsic Size**	**Threshold abundance for recovery**
South Fork Salmon River MPG			
Little Salmon River	Spr/Sum.	Intermediate	750
South Fork Salmon River mainstem	Summer	Large	1,000
Secesh River	Summer	Intermediate	750
East Fork, South Fork Salmon River	Summer	Large	1,000
Middle Fork Salmon River MPG			
Chamberlain Creek	Spring	Intermediate	750
Big Creek	Spr/Sum	Large	1,000
Camas Creek	Spring	Basic	500
Loon Creek	Spr/Sum	Basic	500
Sulphur Creek	Spring	Basic	500
Bear Valley Creek	Spring	Intermediate	750
Marsh Creek	Spring	Basic	500
Middle Fork Salmon River (lower), Mouth to Indian Creek	Spring	Basic	500
Middle Fork Salmon River (upper), Indian Creek and upstream.	Spring	Intermediate	750
Upper Salmon River MPG			
Panther Creek	Extirpated	Intermediate	750
North Fork Salmon River	Spring	Basic	500
Lemhi River	Spring	Very Large	2,000
Pahsimeroi River	Summer	Large	1,000
East Fork Salmon River	Spr/Sum	Large	1,000
Yankee Fork Salmon River	Spring	Basic	500
Valley Creek	Spring	Basic	500
Upper Salmon River mainstem, Lemhi R. to Redfish Lake Creek	Spr/sum	Very Large	2,000
Upper Salmon River watershed, upstream of Redfish Lake Creek	Spring	Large	1,000

[84] *As identified by the Interior Columbia River Technical Recovery Team (ICTRT). Potential population sizes and threshold abundances for recovery are based on "historical intrinsic potential" of the respective habitats and geographic locations.*

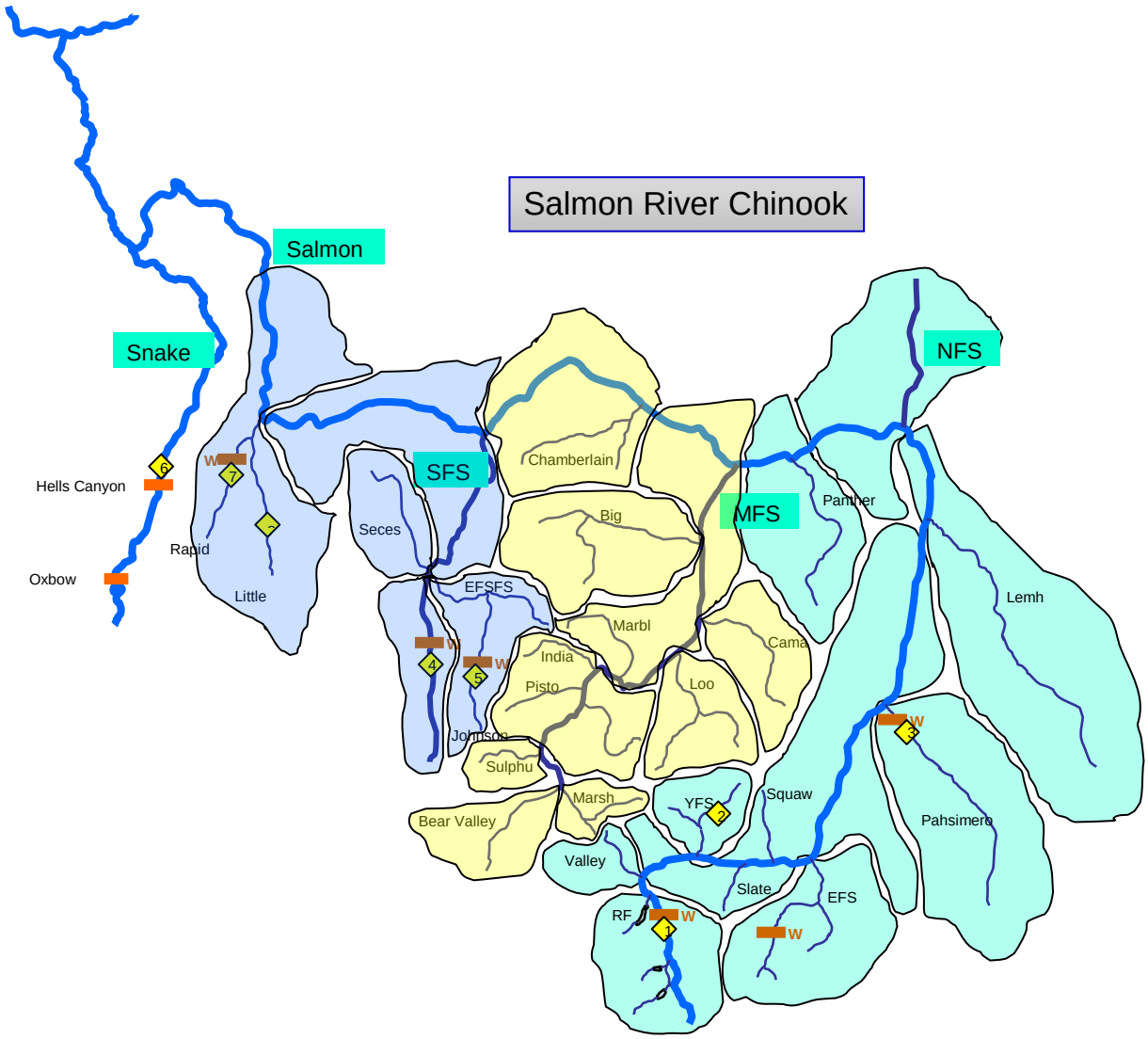

Figure 5. Geographic boundaries of three Major Population Groups of spring/summer Chinook salmon within the Salmon River subbasin, including 22 demographically independent populations within the three MPGs.[85]

Sockeye salmon

In response to a petition received from the Shoshone-Bannock Tribes in 1991 and a subsequent status review, NOAA Fisheries listed Snake River sockeye salmon as an endangered species under the U.S. Endangered Species Act. Several criteria were used for identifying these fish as a distinct *Evolutionary Significant Unit* (ESU), including their distinction as the lowest latitude, farthest inland (> 1,400 km), and highest altitude (> 1,980 m) native population of sockeye salmon globally. At the time of listing, Redfish Lake - located in the upper Salmon River basin - contained the only remaining population of sockeye salmon in the Snake River basin. The entire mainstem Salmon River was designated as

[85] *As identified by the Interior Columbia Technical Recovery Team (ICTRT). Figure provided courtesy of Paul Kline, IDFG.*

critical habitat for sockeye salmon on December 28, 1993, but all spawning and rearing habitat is located in the upper Salmon River near Stanley, Idaho.

Steelhead

All steelhead (*Oncorhynchus mykiss)* in Idaho are considered summer-run steelhead, determined by time of entry into the Columbia River. Two life-history strategies for Snake River steelhead have been recognized: A-run" and "B-run". A-run steelhead generally spend one year in the ocean and return to fresh water during the summer. B-run steelhead commonly spend two years in the ocean before returning to fresh water in late summer or autumn. Because of these variations, the mean adult size of B-run steelhead exceeds the mean adult size of A-run steelhead. Native populations of B-run steelhead occur in the Middle and South Forks of the Salmon River; native populations of A-run steelhead occur elsewhere in the Salmon River. The East Fork Salmon River is considered to have been the upper historical limit of steelhead. All natural-origin steelhead in the Salmon River are considered part of the *Snake River Steelhead DPS* which is currently listed as a threatened species under the ESA. NOAA Fisheries excludes all hatchery origin steelhead released in the Salmon River (Sawtooth, Pahsimeroi, Oxbow, and Dworshak hatchery stocks) from the listed Snake River DPS. The ICTRT classified natural populations of steelhead within the Salmon River as one *Major Population Group* (MPG) composed of 12 demographically independent populations (Table 20).

Table 20. Demographically independent populations of steelhead within the *Salmon River Major Population Group* (*MPG*)[86]

Demographically Independent Populations	Steelhead Run Type	Potential Intrinsic Size	Threshold abundance for recovery
Little Salmon River	A	Intermediate	1,000
Secesh River	B	Basic	500
South Fork Salmon River	B	Intermediate	1,000
Chamberlain Creek	A	Intermediate	1,000
Lower Middle Fork Salmon River	B	Large	1500
Upper Middle Fork Salmon River	B	Large	1500
Panther Creek	A	Intermediate	1,000
North Fork Salmon River	A	Basic	500
Lemhi River	A	Intermediate	1,000
Pahsimeroi River	A	Intermediate	1,000
East Fork Salmon River	A	Intermediate	1,000
Upper Salmon River Mainstem	A	Intermediate	1,000

[86] *As identified by the Interior Columbia River Technical Recovery Team (ICTRT). Potential population sizes and threshold abundances for recovery are based on "historical intrinsic potential" of the respective habitats and geographic locations.*

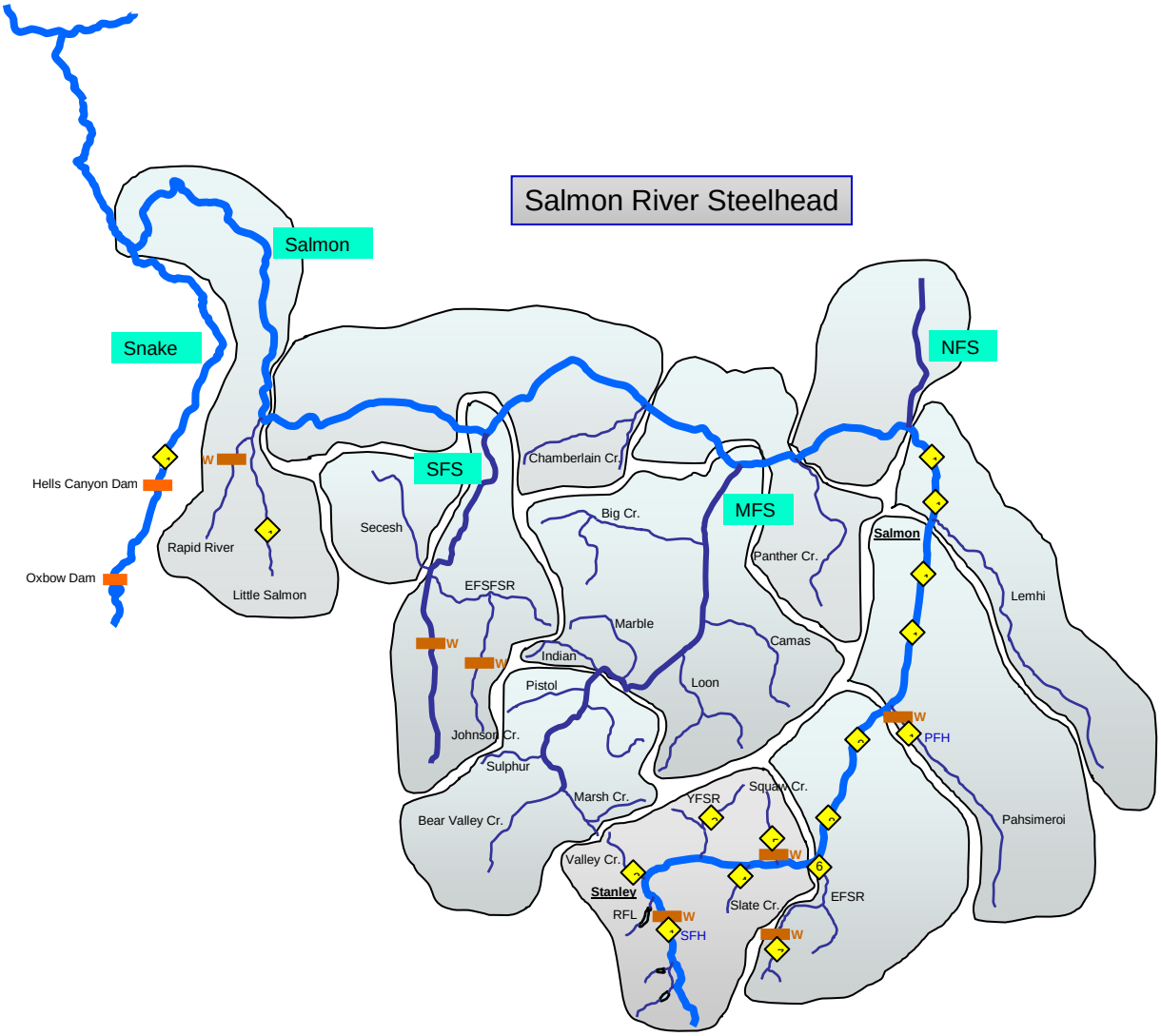

Figure 6. Geographic boundaries of 12 demographically independent populations of steelhead within the Salmon River Major Population Group[87]

Bull trout

Bull trout are well distributed throughout most of the Salmon River basin in 125 identified local populations located within 10 core areas. Seasonal barriers isolate many small populations, and some populations in the subbasin are locally depressed. The U.S. Fish & Wildlife Service listed bull trout as a threatened species range wide on November 1, 1999 (64 FR 58910). In general, information on specific populations is extremely limited, although bull trout are particularly common and locally abundant throughout wilderness tributaries of the Salmon River.

Twenty-eight local populations of bull trout have been identified in the core area represented by the Middle Fork Salmon River. Within this core area, Bear Valley Creek contains one of the strongest bull

[87] *As identified by the ICTRT. Figure provided courtesy of Paul Kline, IDFG*

trout populations in the Pacific Northwest. Bull trout are widely distributed in the South Fork Salmon River watershed with highest numbers in the East Fork of the South Fork and Secesh rivers. The lower mainstem Salmon River provides for migration, adult and subadult foraging, rearing, and wintering habitat. Slate, John Day, and Partridge creeks contain spawning and rearing bull trout. The Little Salmon River provides for foraging/adult rearing habitat and connectivity between local populations in the core area. Hard, Lake, and Boulder creeks and Rapid River contain spawning and rearing bull trout. Since 1973, the number of bull trout migrating upstream in the Rapid River ranged from 112 adults in 1998 to 359 adults in 2001.

Bull trout spawn in several tributaries in the Middle Salmon-Chamberlain Creek area, including Chamberlain, Sabe, Bargamin, Warren, and East Fork Fall, Wind River, California, Big Squaw, and Sheep creeks. Bull trout spawning and rearing occur in the upper reaches of these creeks, and subadult and adult rearing occurs in the remainder of the drainages. Bull trout in the Middle Salmon-Panther Creek area have been documented in several streams including Allison, Poison, McKim, Cow, Iron, Twelvemile, Lake, Williams, Carmen, Freeman, Moose, Sheep, Twin Boulder, East Boulder, Pine, Spring, Indian, Corral, McConn, Squaw, Hat, and Owl creeks, the mainstem Salmon and North Fork Salmon rivers, and in multiple streams in the Panther Creek drainage. Fluvial bull trout are present in the Lemhi River, although most bull trout represent isolated resident populations because of loss of connectivity and migration barriers.

Bull trout in the Pahsimeroi watershed are found in most of the tributaries that drain the eastern, southern, and northeastern portion of the area. Bull trout occur in most tributaries of the Pahsimeroi River but tend to be isolated due to water withdrawals. High densities of bull trout have been documented in tributaries to the East Fork Salmon River in Big Boulder, Herd, and Warm Spring creeks. Mainstem Challis Creek contains bull trout; however, bull trout occupancy is unknown in its tributaries. West Fork Morgan Creek and several tributaries contain bull trout.

Both resident and migratory or fluvial bull trout are present in the Sawtooth Valley. Snorkel inventories for bull trout in the Yankee Fork Salmon River detected the greatest densities of fish in slow water habitats near headwater reaches.

Known threats to bull trout include natural hybridization with introduced brook trout and loss of habitat connectivity due to water withdrawals and low flows during the late summer and early fall when spawning occurs. Naturalized populations of brook trout in Valley Creek (upper Salmon River), Secesh River (S.F. Salmon River), and lower Salmon River tributaries (French, Elkhorn, and Slate creeks) pose a displacement and hybridization threat to native populations of bull trout. However, the actual extent of cross breeding between bull and brook trout in the Salmon River basin is unknown, thereby precluding quantification of the risks that hybridization poses to bull trout. Seasonal barriers associated with water withdrawals isolate many small populations of bull trout, and some bull trout populations in the subbasin are locally depressed. Connectivity between populations is limited by flow and water quality issues in some mainstem areas and by diversions in some tributaries.

Habitat[88]

The Salmon River subbasin provides an estimated 2,184 km (1,357 miles) of good to excellent stream habitat for Chinook salmon and 4,879 km (3,032 miles) of good to excellent stream habitat for steelhead. Habitat rated good to excellent for Chinook salmon is most abundant in the Upper Salmon,

[88] *NWPCC Salmon River Subbasin Plan, http://www.nwcouncil.org/fw/subbasinplanning/salmon/plan/.*

Upper Middle Fork Salmon, South Fork Salmon, and Lower Middle Fork Salmon River watersheds. Physical blockages, agriculture dewatering, and water quality limitations in some areas of the Upper Salmon River, Pahsimeroi River, Lemhi River, Middle Fork Salmon River, Panther Creek, South Fork Salmon River and Little Salmon River inhibit or prevent access by Chinook salmon. Good to excellent habitat for steelhead is common in each major watershed, with excellent habitat particularly abundant in the Upper and Lower Middle Forks, Chamberlain Creek, and Middle Fork Salmon River watersheds.

The Little Salmon River, excluding Rapid River, has limited capability to support self-sustaining natural populations of salmon and steelhead. Perturbed riparian habitat, decreased recruitment of large woody debris, and stream encroachment from roads and land development have led to increased water temperatures during the summer months, thereby restricting rearing habitat for salmonid fishes. Secondary factors affecting the natural productivity of salmon and steelhead in the Little Salmon River are increased fine sediments, loss of access to historic habitat, and presence of brook trout. Sedimentation affects 21% of the total stream length of the Little Salmon River.

Current Status of Salmonid Stocks

The Interior Columbia Technical Recovery Team (ICTRT), in collaboration with comanagers from IDFG, Nez Perce Tribe, and the Shoshone-Bannock Tribes, have identified 22 demographically independent natural populations of spring/summer Chinook composing three major population groups (MPGs) within the Salmon River watershed. Similarly, the ICTRT and comanagers have identified 12 demographically independent natural populations of summer steelhead composing one MPG within the Salmon River. Fall Chinook, sockeye salmon, and three species of resident trout are also native to the Salmon River watershed. These designated populations are listed below, and whether they exist strictly as natural populations or include a hatchery component. Also listed are *segregated* hatchery populations that are managed as distinct populations.

Fall Chinook salmon

- Snake/Salmon River fall Chinook salmon (natural + hatchery)

Spring/Summer Chinook salmon

South Fork Salmon River MPG

- Little Salmon and Lower Salmon River spring/summer Chinook (natural)
- South Fork Salmon River summer Chinook (natural + hatchery)
- Secesh River summer Chinook (natural)
- East Fork, S.F. Salmon River summer Chinook (natural + hatchery)

Middle Fork Salmon River MPG

- Chamberlain Creek spring Chinook (natural)
- Big Creek spring/summer Chinook (natural)
- Camas Creek spring Chinook (natural)

- Loon Creek spring/summer Chinook (natural)
- Sulphur Creek spring Chinook (natural)
- Bear Valley Creek spring Chinook (natural)
- Marsh Creek spring Chinook (natural)
- Middle Fork Salmon River lower mainstem spring Chinook (natural)
- Middle Fork Salmon River upper mainstem spring Chinook (natural)

Upper Salmon River MPG

- Panther Creek spring/summer Chinook (extirpated)
- North Fork Salmon River spring Chinook (natural)
- Lemhi River spring Chinook (natural)
- Pahsimeroi River summer Chinook (natural + hatchery)
- East Fork Salmon River spring/summer Chinook (natural + hatchery)
- Yankee Fork Salmon River spring Chinook (natural + hatchery)
- Valley Creek (natural)
- Upper Salmon River mainstem (lower) spring/summer Chinook (natural)
- Upper Salmon River mainstem (upper) spring Chinook (natural + hatchery)

Hatchery populations (segregated)

- Rapid River FH spring Chinook

Sockeye salmon

- Snake River / Redfish Lake sockeye salmon (natural + hatchery)

Steelhead

Salmon River MPG

- Little Salmon River (A-run) summer steelhead (natural)
- South Fork Salmon River (B-run) summer steelhead (natural).
- Lower Middle Fork Salmon River (B-run) summer steelhead (natural)
- Upper Middle Fork Salmon River (B-run) summer steelhead (natural)
- Chamberlain Creek (A-run) summer steelhead (natural)
- Panther Creek (A-run) summer steelhead (natural)
- North Fork Salmon River (A-run) summer steelhead (natural)
- Lemhi River (A-run) summer steelhead (natural)

- Pahsimeroi River (A-run) summer steelhead (natural)
- East Fork Salmon River (A-run) summer steelhead (natural + hatchery)
- Upper mainstem Salmon River (A-run) summer steelhead (natural)

Hatchery populations (segregated)

- Pahsimeroi Hatchery (A-run) summer steelhead (segregated hatchery)
- Sawtooth Hatchery (A-run) summer steelhead (segregated hatchery)

Hatchery populations (out-of-basin)

- Dworshak NFH (B-run) summer steelhead (segregated hatchery)
- Oxbow Hatchery (A-run) summer steelhead (segregated hatchery)

Nonanadromous (Resident) Trout

- Salmon River rainbow/redband trout (natural)
- Salmon River westslope cutthroat trout (natural)
- Salmon River bull trout (natural)

The following tables summarize the current status and management premises of salmonid populations occurring within the Salmon River basin (see list above).. Habitat assessments were obtained primarily from the Northwest Power and Conservation Council subbasin planning documents (http://www.nwcouncil.org/fw/subbasinplanning/. Viability ratings for ESA listed salmon and steelhead stocks were obtained primarily from the Draft Salmon and Steelhead Recovery Plans for Idaho (http://www.idahosalmonrecovery.net/) and various documents produced by the ICTRT and assembled by NOAA Fisheries (www.nwfsc.noaa.gov/trt/).

Table 21. Snake River fall Chinook, Salmon River component (Natural)

Management Premises and Goals	
ESA Status	*Threatened.* NOAA Fisheries includes fall Chinook spawning in the lower Salmon River with the *Snake River Fall Chinook Salmon ESU*. This ESU was listed as a threatened species on April 22, 1992 (57 FR 14653). The HSRG (2009) classified the Snake River fall Chinook population as *primary* with respect to ESA recovery.
Biological Significance	*High.* The *Snake River Fall Chinook Salmon ESU* consists of a single major population group and independent population: the Lower Snake River Mainstem population. This population occupies the Snake River from its confluence with the Columbia River to Hells Canyon Dam, and includes spawning habitat in the lower reaches of the Clearwater, Imnaha, Grande Ronde, Salmon, and Tucannon rivers.
Population Viability	*Low.* Historical abundance of Snake River fall Chinook salmon prior to 1938 is not known. Idaho Power Company estimated that, prior to hydropower development of the Snake River, between 288,000 and 450,000 adults returned annually to the Snake River. NOAA Fisheries estimated that annual returns to the Snake River were likely between 416,000 and 650,000 adult fall Chinook salmon per year. Recent counts of natural-origin adult fall Chinook at Lower Granite Dam ranged from 78 to 1,000 fish (average = 489 fish), 1975-2000. Numbers of *natural-origin* Snake River fall Chinook salmon have increased recently, with estimates at Lower Granite Dam of 627, 1,722, 3,659, 6,630 6,607, 4,333, 6,366, 3,427, 3,677, and 2,273 adult fish from 1998 through 2007, respectively. The Snake River fall Chinook ESU does not currently meet the viability criteria of NOAA Fisheries for ESA recovery. The HSRG (2009) estimated the habitat productivity and capacity for the Snake River fall Chinook population as R/S_{max} = 2.2 and C = 8,250 natural-origin adults, respectively.
Habitat	*Low.* The historic distribution of Snake River fall Chinook salmon extended from the mouth of the Snake River to a natural barrier at Shoshone Falls (RM 615). The construction of Swan Falls Dam in 1901 eliminated the upper 385 miles of the historic range of the species. With the construction of the Hells Canyon complex and the four lower Snake River dams from the late 1950s though mid-1970s, the spawning habitat for fall Chinook salmon in the mainstem Snake River was further reduced to its present state: approximately 100 miles of free flowing Snake River between Hells Canyon Dam and Lower Granite Reservoir, including the lower reaches of major tributaries. Currently, fall Chinook in the Salmon subbasin use only the lower reach of the mainstem Salmon River. The Salmon River is limited in its ability to produce fall Chinook Salmon because of naturally cool water temperatures through the winter/spring incubation/development period. Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers.
Harvest	None in the Salmon River. Harvest or exploitation rates for Snake River fall Chinook intercepted in mixed-stock fisheries are not well documented. The HSRG (2009) used the following exploitation rates provided by NOAA Fisheries. Marine: 31%; Lower Columbia (below Bonneville Dam): 6%; Upper Columbia (above Bonneville Dam); 19%; Terminal (Snake River): 0%. Those component exploitation rates yield a total exploitation rate of 47.5%.

Table 22. Little Salmon and Lower Salmon River spring/summer Chinook (Natural)

Management Premises and Goals	
ESA Status	*Threatened.* NOAA Fisheries includes natural-origin spring Chinook in the Little Salmon and lower Salmon rivers with the Snake River Spring/Summer Chinook ESU. This ESU was listed as *threatened* under the ESA on April 22, 1992 (57 Federal Register [FR] 14653). The ICTRT has designated spring/summer Chinook in the Little Salmon River and other tributaries downstream in the lower Salmon River as one of four demographically independent populations within the South Fork Salmon River MPG. The geographic range of the Little Salmon River population includes all tributaries to the Salmon River between the Little Salmon and Snake rivers. The ICTRT (2005) classified the Little Salmon River population of spring/summer Chinook as *intermediate* based on historical habitat potential. The HSRG (2009) classified this population as *stabilizing* with respect to ESA recovery of the ESU. [NOTE: Although NOAA Fisheries includes Little Salmon and Lower Salmon River spring/summer Chinook with the South Fork Salmon River MPG for the purpose of ESA Recovery Planning, distinct genetic and life history characteristics of Little Salmon River spring/summer Chinook raise questions regarding its biological placement in the S.F. Salmon River MPG (Idaho Snake River draft Recovery Plan).
Biological Significance	*Low.* Natural populations of Chinook salmon in the Little Salmon River have been influenced genetically by Rapid River hatchery spring Chinook. Small natural populations of spring Chinook occur also in Whitebird and Slate creeks, the only areas in the lower Salmon River supporting spring or summer Chinook populations downstream from the confluence of the Little Salmon River. These latter populations have also been influenced genetically by the Rapid River hatchery stock. A distinct natural population of summer Chinook (n = 200-400 adults/years) inhabits Rapid River upstream of the Rapid River FH. The weir at Rapid River FH protects the natural population of summer Chinook from hatchery-origin spring Chinook.
Population Viability	*Very Low*. The population viability of natural-origin spring Chinook in the Little Salmon River is driven largely by small adjunct tributaries, including Whitebird and Slate Creeks in the lower Salmon River. Tributaries in the Little Salmon and lower Salmon rivers are characterized by very low productivities and capacities. The ICTRT concluded that neither abundance/productivity nor spatial structure/diversity are adequate. The HSRG (2009) estimated the habitat productivity and capacity for the Little Salmon River population of spring/summer Chinook as R/S_{max} = 1.3 and C = 1,250 natural-origin adults, respectively.
Habitat	*Low.* Inadequate riparian vegetation for shade and bank stabilization, including high water temperatures, are common factors limiting the quality of salmonid rearing habitat in the Little Salmon River, lower Salmon River mainstem, and some associated tributaries. This area of the Salmon River basin has been significantly affected by human development (e.g., logging, ranching, agriculture), including concentrated sport angling on the lower Little Salmon River. The most intense logging in the Salmon River basin has occurred in the Little Salmon and lower Salmon river watersheds. Tributary drainages are mostly high-gradient streams in deep canyons having very unstable soils. Increased sedimentation and stream channelization have occurred in areas where logging and road building were conducted on unstable lands. Approximately 84% of the Little Salmon and lower Salmon rivers are classified as "moderately to very highly impacted." Access to potential habitat in most tributaries including Hazzard, Hard, Fall, Elk, Slate and Boulder Creek is limited by natural barriers and steep gradients. The upper portion of the Little Salmon River is inaccessible to salmon and steelhead because of a barrier cascades at stream mile 21 immediately upstream from the confluence of Hazard Creek. In contrast to the Little

	Salmon and lower Salmon rivers, most of the Rapid River drainage - the largest tributary to the little Salmon River - is comparatively pristine. This latter river is protected as a *Wild and Scenic River*. Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers.
Harvest	*Low* for unmarked hatchery and natural-origin fish.

Table 23. Rapid River hatchery spring Chinook (Rapid River FH)

Management Premises and Goals	
ESA Status	*Not listed.* NOAA Fisheries does not include the Rapid River hatchery stock of spring Chinook with the *Snake River Spring/Summer Chinook Salmon ESU.*
Biological Significance	*Medium to High.* The Rapid River hatchery stock of spring Chinook was derived ancestrally from natural-origin, upstream-migrating adults intercepted at Hells Canyon Dam during construction. Natural populations of spring Chinook upstream of Hells Canyon Dam are now extirpated, and the Rapid River hatchery stock represents the genetic legacy of those extirpated populations.
Population Viability	*Medium.* Smolt-to-adult survivals back to the hatchery have averaged 0.2% (range = 0.001-0.51%) for release years 1990-99, with the number of returning adults ranging from 72 to 14,000 fish, and the number of smolts released ranging from 86,000 to 2.9 million smolts (mean = 1.9 million smolts). The HSRG (2009) estimated a mean overall R/S = 6.0 for the Rapid River hatchery stock of spring Chinook in the Little Salmon and Rapid rivers.
Habitat	*Low.* See Habitat description for Little Salmon and Lower Salmon River Spring/Summer Chinook Salmon. Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers.
Harvest	*High for marked hatchery fish*. The most consistent sport and tribal harvests in the Salmon River subbasin over the past two decades have occurred on Rapid River FH spring Chinook in the Little Salmon River. Sport and tribal harvests combined ranged from approximately 3,000 to 9,500 fish/year for 2000-2003 (Salmon River Sub-Basin Plan) and from 50 to 6,000 fish/year for 1993-1999 (IDFG Report 07-03).
Hatchery Program	
Facilities	Rapid River FH (IDFG), Oxbow FH (IDFG). Adult broodstock are trapped at Rapid River FH and Hells Canyon. Fish are reared at Rapid River FH from a common broodstock and released into Rapid River and the Snake River immediately downstream from Hells Canyon Dam.
Type	Segregated. Only hatchery-origin fish are used for broodstock.
Authorization and Funding	Idaho Power Company.

Primary Purpose	Harvest.
Secondary Purposes	Conservation. The Rapid River FH stock represents the genetic legacy of natural populations of spring Chinook that were native historically to the Snake River drainage upstream of Hells Canyon Dam. Those natural populations are now extirpated, thus placing an unspecified conservation value on the Rapid River FH stock of spring Chinook. The Rapid River FH stock of spring Chinook has been the stock of choice for reintroducing spring/summer Chinook into the Clearwater drainage for natural spawning and harvest programs. The Shoshone-Bannock Tribes strongly supports the reintroduction of Chinook salmon above the Hells Canyon Complex and place a high conservation value on this stock.
Broodstock Origin(s)	Natural populations of upper Snake River spring Chinook trapped at Hells Canyon Dam

Table 24. South Fork Salmon River summer Chinook (Natural + Hatchery)

Management Premises and Goals	
ESA Status	*Threatened.* NOAA fisheries includes natural and hatchery-origin summer Chinook in the South Fork (S.F.) Salmon River with the Snake River Spring/Summer Chinook ESU. This ESU was listed as *threatened* under the ESA on April 22, 1992 (57 Federal Register [FR] 14653). The geographic range of the South Fork Mainstem population includes all tributaries to the Salmon River between the South Fork Salmon and Little Salmon rivers. The HSRG (2009) classified the South Fork Salmon River population as *primary* with respect to its contribution to ESA recovery of the Snake River Spring/Summer Chinook ESU.
Biological Significance	*High.* The S.F. Salmon River, including the Secesh River and East Fork of the South Fork, historically produced 60 to 70% of the total number of adult summer Chinook returning to Idaho each year.
Population Viability	*Natural component: Low.* The number of natural origin summer Chinook adults intercepted at the S.F. Salmon River weir has ranged from 91 to 1,780 fish/yr, and averaged 611 fish/yr, for the period 1990-2001. Redd counts have ranged from ≈100 to ≈1000 redd/yr for the period 1992-2003, which includes counts from the S.F. mainstem, Secesh River, and Johnson Creek. However, redd counts are assumed to be inflated by the natural spawning of hatchery-origin fish. The most recent 10-year geometric mean number of natural spawners for the South Fork Mainstem population is 556 adults/year (NOAA Draft Recovery Plan). The most recent 20-year mean number of adult recruits per spawner are R/S = 0.90. Two major spawning areas exist within the S.F. mainstem population: Poverty Flats and Stolle Meadows, approximately 18 and 4 miles downstream and upstream, respectively of the adult weir that is used to trap broodstock for the hatchery program. The ICTRT has determined that natural population growth rates (λ) for the S.F. Mainstem population is less than needed for replacement (e.g., λ = 0.757 and 0.815 for Poverty Flats and Stolle Meadows, respectively) and, hence, does not currently meet minimum viability criteria for ESA recovery. The ICTRT identified low abundance and productivity as the primary factors limiting the viability of Chinook salmon in the S.F.

	Salmon River, due largely to insufficient out-of-basin smolt-to-adult survivals (SARs). Parr densities, which measure percent juvenile carrying capacity, have averaged below 60% for the South Fork watershed. The HSRG (2009) estimated the habitat productivity and capacity for the South Fork Mainstem population as R/S_{max} = 3.0 and C = 2,150 natural-origin adults, respectively. *Hatchery component: Medium to High.* Smolt to adult survivals (escapement plus harvest) averaged ≈1% (range 0.08 to 1.7%) for broodyears 1996-1999. Over this same time period, the number of smolts released (South Fork mainstem program) each year ranged from 419,000 to 1.2 million smolts, averaging 964,000 smolts/year. The HSRG (2009) estimated smolt-to-adult survivals and the mean number of adult recruits per adult spawner in the hatchery as SAR ≈ 0.8% and R/S ≈ 6.0, respectively.
Habitat	*Low to High.* The South Fork Salmon River watershed has not been significantly impacted by altered hydrology. However, the aquatic habitat is recovering from catastrophic sediment impacts that occurred in the mid-1960s when unusually high precipitation, combined with logging and road construction, resulted in massive silt loads into the river. Twenty-one percent (21%) of the total stream length in the South Fork Salmon River watershed is impaired currently by sedimentation. Although the watershed is federally classified as "roadless" for management purposes, service roads generally occur immediately adjacent to waterways and are a source of silt. In addition, wild fires have burned large amounts of the watershed during the last decade. Timber harvests in the South Fork Salmon River watershed had greater impacts historically than currently: approximately 37% of the watershed has not been impacted by logging, while the remaining 63% of the watershed is evenly divided among low, moderate, and high logging impacts. Within the S.F. Salmon River, the East Fork is the most limited habitat due to reduced riparian habitat quality, decreased stream bank stability from roads, and residual impacts from mining, including the leaching of heavy metals from mine sites. Localized livestock grazing occurs in the most important Chinook salmon spawning areas of Johnson Creek. Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers.
Harvest	*Low for unmarked and natural-origin fish. Medium to High for marked hatchery-origin fish.* Salmon fishing was a major economic resource in the South Fork Salmon River prior to 1965, and anglers historically harvested 1,700 to 4,000 wild salmon annually. Sport fishing harvest for wild salmon in the South Fork ended in 1965. Recreational salmon fishing, supported by returns of hatchery-origin fish, was re-initiated on the South Fork Salmon River in 1997. The number of anglers on the South Fork ranged from 1,812 to 14,996 anglers/year (average = 7,029 anglers/year) from 1997 to 2007. Over this same time period, the number of summer Chinook harvested ranged from 364 to 6,843 fish/year (average = 2,722 fish/year). Additional fish were caught and released. The Tribal Chinook fishery in the S.F. Salmon River prior to 1976 was not limited by any harvest guidelines, dates, or specific seasons. Between 1976 and 1981, the tribal fishery was limited by the number of fish each family could catch for subsistence. In 1978, the Shoshone-Bannock Tribes established sanctuary areas in the S.F. and Johnson Creek. From 1981 to 1986, the Shoshone-Bannock Tribes curtailed fishing in the S.F. Salmon River to rebuild natural populations. Fishing was reinitiated in 1987 for both natural and hatchery Chinook salmon. The number of summer Chinook harvested annually by the Shoshone-Bannock Tribes 1987-2008, averaged 265 (range = 0 to 1,359) and 62 (range = 0 to 313) hatchery and natural-origin fish, respectively. These harvests averaged 513 and 109 hatchery and natural-origin fish, respectively, for the 10-year period 1999-2008. The Shoshone Bannock Tribes consider the South Fork Salmon River as their most consistent tribal fishery since 1992.

Hatchery Program	
Facilities	*South Fork Salmon River adult weir and trap; McCall FH* (operated by Idaho Fish and Game). Adult summer Chinook are trapped and spawned at the South Fork weir and trap. Fertilized eggs are transferred to McCall FH for incubation, hatch, and rearing of smolts. Yearling smolts (1.0 M) are transported by truck from McCall FH to the S.F. Salmon River and released at the Knox Bridge near the S.F. Salmon River weir.
Type	*Segregated.* The S.F. Salmon River hatchery stock of summer Chinook was initially developed as an integrated broodstock with natural-origin Chinook included with the broodstock. Currently, only hatchery-origin fish are used for the "production" broodstock. One component of the hatchery program supports ongoing supplementation research as part of the Idaho Supplementation Studies where hatchery and natural-origin fish are cross-bred and their differentially marked progeny are allowed to pass upstream to spawn naturally with natural-origin fish. In addition, the Shoshone-Bannock Tribes use streamside incubators to hatch 300,000 eyed eggs in Dollar Creek, a tributary of the South Fork Salmon River.
Authorization and Funding	LSRCP.
Primary Purpose	*Harvest*. The program is intended to mitigate for reduced harvests on natural-origin Chinook salmon resulting from the effects of the four dams on the lower Snake River.
Secondary Purposes	*Conservation.* The program is intended to help conserve the naturally spawning population of summer Chinook in the South Fork Salmon River and provide data for the Idaho Supplementation Studies. The Shoshone-Bannock Tribes Dollar Creek Supplementation Program is intended to supplement natural-origin Chinook salmon in the South Fork Salmon River and contribute to natural reproduction by hatching eggs in streamside incubators and allowing natural selection to determine survival of successful progeny.
Broodstock Origin(s)	The program was founded with adult summer Chinook salmon collected between 1974 and 1979 at the trap on the South Fork Salmon River. Those trapped adults were supplemented with fish trapped at the Lower Snake River Dams (Ice Harbor, Little Goose, and Lower Granite dams). Adults trapped at the dams were collected from the summer run period to collect fish that most likely originated in the South Fork Salmon River. Early collections established an egg bank program prior to the completion of the hatchery. Between 1976 and 1980, smolts produced from these early collections were planted in the South Fork Salmon River upstream of the present location of the weir. Since 1981, all adults used for broodstock purposes have been collected at the South Fork Salmon River weir. [IDFG 2002 South Fork Salmon River Summer Chinook HGMP, p 27]

Table 25. Secesh River summer Chinook (Natural)

Management Premises and Goals	
ESA Status	*Threatened.* NOAA fisheries includes summer Chinook in the Secesh River, a tributary to the South Fork Salmon River, with the Snake River Spring/Summer Chinook ESU. This

	ESU was listed as *threatened* under the ESA on April 22, 1992 (57 Federal Register [FR] 14653). The ICTRT identified summer Chinook within the Secesh River as a demographically independent population within the S.F. Salmon River MPG. The HSRG (2009) classified the Secesh River population as *primary* with respect to ESA recovery of the Snake River Spring/Summer Chinook Salmon ESU.
Biological Significance	*High.* Geographic distance, genetic data, and timing of juvenile outmigration contributed to designating the summer Chinook in the Secesh River as a demographically independent population within the South Fork Salmon River subbasin. No releases of hatchery-origin Chinook salmon occur in the Secesh River.
Population Viability	*Low.* The most recent estimate for the 10-year geometric mean number of naturally spawning summer Chinook in the Secesh River is 304 adults (NOAA Draft Recovery Plan). The most recent estimated for the 20-year mean number of adult recruits per spawner in the Secesh River is R/S = 1.04 adults. The ICTRT has determined that natural population growth rates (λ) for summer Chinook in the Secesh River are less than needed for replacement, and hence, those growth rates do not currently meet minimum viability criteria for ESA recovery. The ICTRT identified low abundance and productivity as the primary factors limiting the viability of all summer Chinook populations in the S.F. Salmon River subbasin, due largely to insufficient out-of-basin smolt-to-adult survivals (SARs). The HSRG (2009) estimated the habitat productivity and capacity for the Secesh River population as R/S_{max} = 1.62 and C = 1,350 natural-origin adults, respectively. AHA modeling data submitted by IDFG estimate current mean adult escapement and *adjusted productivity* for this population as 372 adults and R/S=1.38, respectively.
Habitat	*Low to High.* Riparian habitat in the subbasin is degraded and sediment levels are relatively high due to legacy mining (see also Table 24). Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers.
Harvest	*Low.* The harvest rate on unmarked, natural origin summer Chinook from the Secesh River is assumed to be low, occurring primarily as incidental harvest in fisheries targeting hatchery-origin summer Chinook. The Shoshone-Bannock Tribes conduct a ceremonial and subsistence fishery under the guidance of the Tribal Resource Management Plan.

Table 26. East Fork, South Fork Salmon River summer Chinook (Natural + Hatchery)

Management Premises and Goals	
ESA Status	*Threatened.* NOAA fisheries includes natural and hatchery-origin summer Chinook in the East Fork of the South Fork (S.F.) Salmon River with the Snake River Spring/Summer Chinook ESU. This ESU was listed as *threatened* under the ESA on April 22, 1992 (57 Federal Register [FR] 14653). The ICTRT identified summer Chinook within the East Fork of the S.F. Salmon River, including Johnson Creek, as a demographically independent population within the South Fork Salmon River MPG. The HSRG (2009) classified the East Fork South Fork Salmon River population as *primary* with respect to its contribution to ESA recovery of the *Snake River Spring Summer Chinook Salmon ESU*.

Biological Significance	*High.* Summer Chinook in Johnson Creek have a distinct juvenile migration timing in the mainstem which is the main basis for designating the East Fork S.F. Salmon River as an demographically independent population within the S.F. Salmon River MPG.
Population Viability	*Low.* The most recent 10-year geometric mean number of natural spawners in the East Fork S.F. Salmon River is 321 adults (NOAA Draft Recovery Plan). The most recent 20-year mean number of adult recruits per spawner is R/S = 1.03. The ICTRT has determined that natural population growth rates (λ) for the East Fork S.F. Salmon River population is less than needed for replacement, and hence, the population does not currently meet minimum viability criteria for ESA recovery. The HSRG (2009) estimated the habitat productivity and capacity for the East Fork S.F. population as R/S_{max} = 1.45 and C= 1,700 natural-origin adults, respectively.
Habitat	*Low to High.* The South Fork Salmon River watershed is recovering from catastrophic sediment impacts that occurred in the mid-1960s when unusually high precipitation, combined with logging and road construction, resulted in massive silt loads into the river. Within the S.F. Salmon River, the East Fork is the most limited habitat due to reduced riparian habitat quality, decreased stream bank stability from roads, and residual impacts from mining, including the leaching of heavy metals from mine sites. Localized livestock grazing occurs in the most important Chinook salmon spawning areas of Johnson Creek (see also Table 24). Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers.
Harvest	*Low.* The harvest rate on unmarked and natural origin summer Chinook from the East Fork S.F. Salmon River is assumed to be low, occurring primarily as incidental harvest in fisheries targeting hatchery-origin summer Chinook and in tribal ceremonial and subsistence fisheries. The Shoshone-Bannock Tribes conduct a ceremonial and subsistence fishery under the guidance of the Tribal Resource Management Plan.
Hatchery Program	
Facilities	*Johnson Creek adult weir and trap* (operated by Nez Perce Tribe). Adult summer Chinook are trapped at the Johnson Creek weir and transported to the South Fork weir holding ponds where the adult fish are held and spawned. Fertilized eggs are transferred to McCall FH for incubation, hatch, and rearing of smolts. Yearling smolts (100,000) are transported by truck from McCall FH and released in Johnson Creek near Wapiti Ranch.
Type	*Integrated.* The program has an adult broodstock goal of 100% natural-origin adults.
Authorization and Funding	LSRCP.
Primary Purpose	*Conservation/restoration/research*. The program is intended to help recover the naturally spawning population of summer Chinook in Johnson Creek, and to provide data for the Idaho Supplementation Studies.
Secondary Purposes	*Harvest* (long-term goal).
Broodstock Origin(s)	Natural-origin adult summer Chinook are trapped annually for broodstock at the Johnson Creek weir.

Table 27. Middle Fork Salmon River Spring/Summer Chinook Salmon MPG (Natural)

Management Premises and Goals	
ESA Status	*Threatened.* NOAA Fisheries includes Chinook salmon in the Middle Fork Salmon River with the Snake River Spring/Summer Chinook ESU. This ESU was listed as threatened under the ESA on April 22, 1992 (57 Federal Register [FR] 14653). The ICTRT identified nine demographically independent populations within the Middle Fork Salmon River MPG: *Chamberlain Creek, Big Creek, Camas Creek, Loon Creek, Sulphur Creek, Bear Valley Creek, Marsh Creek, Lower Middle Fork Mainstem* (downstream of Indian Creek), and *Upper Middle Fork Mainstem* (upstream and including Indian Creek). Chamberlain Creek is not within the Middle Fork watershed but was included as a demographically independent population within the *Middle Fork Salmon River MPG* based on geographic proximity and life history similarities. The HSRG (2009) classified all populations within the *Middle Fork Salmon River MPG*, except for the *Lower Middle Fork Mainstem*, as *primary* with respect to their biological significance and potential contributions to ESA recovery of the *Snake River Spring Summer Chinook Salmon ESU.* In contrast, the Lower Middle Fork Mainstem was classified as *contributing.*
Biological Significance	*High.* Chinook salmon in the Middle Fork Salmon River represent native populations with little or no hatchery influence based on stocking records. Big and Loon creeks support summer-run populations; the other seven populations within the MPG are considered spring-run. These populations exhibit a strong age-5 component among returning adults. The Chamberlain Creek population has some distinct genetic characteristics and is located in a significant geographic position between the Middle and South Forks. The Middle Fork Salmon River is located primarily in designated wilderness areas and is managed by IDFG, the Nez Perce Tribe, and the Shoshone-Bannock Tribes as a natural production area with no hatchery intervention.
Population Viability	*Low.* Population growth rates (λ) for all Middle Fork MPG populations during the 1990s were all less than 1.0 and substantially less than needed for replacement (for example, λ = 0.812, 0.675, and 0.681 for Bear Valley/Elk, Marsh, and Sulphur creeks, respectively). The total number of spring/summer Chinook salmon redds counted in area surveys decreased substantially from 1957 to 1995. Coinciding with decreasing trend in redd abundance was an increasing trend in synchrony of spawn timing among populations, consistent with the hypothesis of reduced life history diversity between populations. Abundance of redds increased in recent years from a low of 21 redds in 1995 to over 1,500 redds in 2001 and 2002. All populations sampled from 1985 to 2002 have remained below the estimated 50% juvenile carrying capacity (except Marsh Creek in 1994), with substantial declines in abundance by all populations in 1995, 1996, and 1997. The *Middle Fork Salmon River MPG* currently does not meet MPG-level viability criteria because none of the component populations is rated as viable. Low smolt-to-adult returns (SARs) have been identified as a major out-of-basin factor limiting the viability of Chinook salmon in the Salmon River Basin. The HSRG (2009) estimated habitat productivities for Middle Fork Salmon River populations ranging from R/S_{max} = 1.25 (Camas Creek) to 2.50 (Bear Valley Creek) and capacities ranging from C= 360 (Sulphur Creek) to 1,700 (Big Creek) natural-origin adults.
Habitat	*Medium to High.* Most (>95%) of the Middle Fork Salmon River watershed is within the Frank Church–River of No Return Wilderness Area. The watershed was managed as a primitive area from 1930 to 1980 prior to becoming wilderness in 1980. Road and trail densities are low, and most tributaries are in relatively pristine condition. Portions of

	several tributaries (Bear Valley, Marsh, Camas, Marble, Big, and Loon creeks) are outside the wilderness area and are recovering from the historical effects of mining, grazing, logging, and road building. Dredge mining occurred historically in Bear Valley Creek, and this area has continued to contribute about 35% of the fine sediment to the creek since active mining ceased. Elevated water temperatures have been identified as the primary factor limiting aquatic habitat in non-wilderness portions of the watershed. The Middle Fork Salmon River is classified as part of the National Wild and Scenic River System. Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers.
Harvest	*Low.* The Middle Fork Salmon River is reported to have historically supported 27% of Idaho's sport harvest of Chinook salmon (Mallet 1974). The Tribal Chinook fishery prior to 1978 was limited by individual tribal fishers and subsistence needs. In 1978, the Shoshone-Bannock Tribes established sanctuary areas for the following streams in the Middle Fork Salmon River: Marsh Creek, Big Creek, Camas Creek, Loon Creek, Bear Valley Creek, and the mainstem Middle Fork Salmon River. Over the next several years, fisheries were re-established in Bear Valley Creek (1981) and Marsh Creek (1983). Shoshone-Bannock Tribal and incidental out-of-basin harvest rates on natural-origin spring/summer Chinook salmon are estimated to be less than 10% annually. Shoshone-Bannock Tribal harvests currently occur in Bear Valley, Marsh, Loon, and Camas creeks, although all areas in the Middle Fork Salmon River are open for subsistence fisheries under the guidance of the Tribal Resource Management Plan.

Table 28. Upper Salmon River Spring/Summer Chinook Salmon MPG (Natural + Hatchery)

Management Premises and Goals	
ESA Status	*Threatened.* NOAA Fisheries includes natural and hatchery-origin spring/summer Chinook in the upper Salmon River (upstream of the Middle Fork) with the Snake River Spring/Summer Chinook ESU. This ESU was listed as threatened under the ESA on April 22, 1992 (57 Federal Register [FR] 14653). The ICTRT identified nine demographically independent populations of Chinook salmon within the *Upper Salmon River MPG*: *North Fork Salmon River, Lemhi River, Pahsimeroi River, East Fork Salmon River, Yankee Fork Salmon River, Valley Creek, Upper Salmon River Lower Mainstem* downstream from Redfish Lake Creek, *Upper Salmon River Upper Mainstem* upstream of, and including, Redfish Lake Creek, and *Panther Creek* (extirpated).
Biological Significance	*High.* Populations in this area include both spring and summer-run Chinook. Chinook salmon in the Pahsimeroi River are considered summer-run and are distinct genetically from other Chinook populations in the Upper Salmon River (see Table 29 for Pahsimeroi River summer Chinook). Chinook salmon in the North Fork Salmon River, Lemhi River, Yankee Fork Salmon River, Valley Creek, and upper mainstem Salmon River upstream of Redfish Lake Creek are considered spring-run. Chinook salmon in the upper mainstem Salmon River downstream from Redfish Lake Creek and in the East Fork Salmon River are considered a mixture of spring and summer-run fish. These life history patterns reflect the geographic and environmental diversity encompassed by the upper mainstem tributaries. All hatchery populations of Chinook salmon in the region (Pahsimeroi, Sawtooth, East

	Fork Salmon River, West-Fork Yankee Fork Salmon River) were developed primarily from indigenous natural populations within the respective watersheds (see hatchery section below). Chinook salmon in the Pahsimeroi and Lemhi rivers produce both subyearling and yearling smolts/outmigrants, which differs from the typical yearling smolt life history of other spring/summer Chinook populations in the Salmon River.
Population Viability	*Low for natural populations*. Population growth rates (λ) for these populations during the 1990s all were substantially less than needed for replacement. None of the nine demographically independent populations in the MPG meet population level viability criteria. Consequently, the *Upper Salmon River MPG* currently does not meet NOAA Fisheries MPG viability criteria. Low smolt-to-adult return rates (SAR's) have been identified as a major out-of-basin factor limiting viability of Chinook salmon populations in the Salmon River Basin. Historic records indicate that late-arriving summer-run fish spawned in the lower reaches of the Lemhi River, but this summer-run life history strategy appears to have been lost. Redd counts throughout the upper Salmon River have generally shown an increasing trend from very low numbers in 1995 to hundreds of redds in 2001-2003. Densities of juvenile parr averaged less than 30% of the estimated total carrying capacity (Figure 2-26 of the Northwest Power and Conservation Council's Salmon River Subbasin Plan). The HSRG (2009) estimated habitat productivities for upper Salmon River populations (excluding Panther Creek) ranging from R/S_{max} = 1.31 (Lemhi River) to 1.80 (upper Salmon River mainstem) and capacities ranging from C= 800 (Valley Creek) to 3,900 (Lemhi River) natural-origin adults. *Low for Sawtooth FH spring Chinook*. Overall mean smolt-to-adult survivals and adult recruits per spawner have averaged SAR = 0.1% and R/S = 2.0 adults, respectively (HSRG 2009). The smolt to adult survival back to the hatchery for broodyears 1991-2001 averaged 0.37% (range 0.003% to 1.03%). Over this same time period, the number of smolts released has ranged from approximately 5,000 to 1.1 million smolts, and averaged ≈300,000 smolts/year.
Habitat	*Low to High.* Unlike other subbasins in the Columbia River basin, the Salmon River subbasin has large areas where the composition, structure, and function of the aquatic, wetland and riparian ecosystems have been relatively undisturbed by anthropogenic effects. However, habitat conditions vary widely throughout the upper Salmon River watershed. Twelve percent of the total stream length in the Upper Salmon watershed is identified as being impaired by sedimentation. Altered riparian habitats, increased water temperatures, and reduced streambank stability characterize the North Fork region of the mainstem Salmon River. Primary habitat limiting factors in the Lemhi River subbasin are low stream flows and disconnected tributaries, a situation that reduces access to spawning and rearing habitat due to tributary dewatering from irrigation withdrawals (2,950 points of water diversion occur in the Lemhi watershed). The Lemhi, Pahsimeroi, and East Fork Salmon rivers have been significantly impacted by livestock grazing resulting in excessive sedimentation, high stream temperatures, and reduced riparian vegetation. Water diversion (primarily during low flow), has altered riparian areas, increased water temperatures, and created some fish-passage issues in some tributaries to the East Fork Salmon River. Historic dredge mining and chemical leaching from tailings have negatively impacted habitat quality in the Yankee Fork Salmon River. Portions of the Valley Creek population occur in areas recommended by the Forest Service for wilderness designation. The majority of streams occupied by the upper Salmon River mainstem population (upstream from Redfish Lake Creek) occur in inventoried roadless areas, with some areas recommended by the Forest Service for wilderness designation. Riparian areas for the upper mainstem population have been degraded in localized areas due to loss of riparian vegetation and stream/floodplain alterations from roads, recreation, water withdrawals, and grazing.

	Beginning in the 1940s, mining operations in Panther Creek seriously impaired water quality in this tributary to the Salmon River. By the 1970s, the endemic fish populations in Panther Creek had been extirpated due to acid and heavy metal leaching from cobalt mining operations. Panther Creek has since been stocked several times with hatchery fish from a variety of stocks. Habitat fragmentation associated with land uses, development, and land-use conversion have moderately impacted 32% of the Upper Salmon watershed, while 68% has been classified as having low impacts due to habitat fragmentation. Historically, timber harvest had greater impacts to habitat quality and quantity in the Upper Salmon watershed than currently: 54% of the watershed has not been impacted, while 7%, 4%, and 34% of the watershed has been highly, moderately, and lightly impacted, respectively. by timber-harvest activities. Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers.
Harvest	*Low.* Recreational fishing on Chinook salmon has not been permitted in the Sawtooth Valley of the upper Salmon River since 1977. Recreational fishing did not occur during the 1993-1999 adult return seasons. Shoshone-Bannock Tribal fishing has occurred in the Upper Salmon River MPG. IDFG's long-term goal for the Salmon River basin is to provide a harvest of 10,000 spring/summer Chinook in each of the sport and tribal fisheries, respectively. (Pete Hassemer, IDFG, pers. comm.).
Hatchery Program	
Facilities	Pahsimeroi FH, Sawtooth FH, East Fork Salmon River satellite facility. Two *segregated* programs occur in this region: Pahsimeroi FH summer Chinook and Sawtooth FH spring Chinook. IDFG's Eagle Research Hatchery and NOAA Fisheries' Manchester Research Station are used for captive rearing programs for the East Fork Salmon River and West Fork Yankee Fork populations., The two captive rearing programs involve pumping redds, rearing the resulting fish captively to adulthood , and then releasing those adults to spawn naturally. Those two programs on the East Fork Salmon River and the West Fork Yankee Fork Salmon River, respectively, were initiated in 1997 and are scheduled to release their last brood of captively-reared adults in 2009. The Shoshone-Bannock Tribes currently operate the Yankee Fork Chinook Salmon Supplementation (YFCSS) Project with the goal of reestablishing spring Chinook in the mainstem Yankee Fork derived from Sawtooth Hatchery-origin fish.
Type	*Segregated* for Pahsimeroi summer Chinook and Sawtooth spring Chinook. *Integrated* for East Fork Salmon River, West Fork Yankee Fork Salmon River, and the YFCSS programs
Authorization and Funding	LSRCP funds Sawtooth FH and the YFCSS Program. BPA funds the East Fork Salmon River and West Fork Yankee Fork Captive Rearing Programs. Idaho Power Company funds the Pahsimeroi FH.
Primary Purpose	*Harvest* for Pahsimeroi FH summer Chinook and Sawtooth FH spring Chinook. *Research* for East Fork Salmon River and West Fork Yankee Fork Salmon River Captive Rearing programs. *Conservation and harvest* for YFCSS program.
Secondary Purposes	*Conservation* for all hatchery programs.
Broodstock Origin(s)	*Sawtooth FH spring Chinook*: Initiated with natural-origin spring Chinook adults returning to the Upper Salmon River. Release objective = 1.4 million yearling smolts.

	East Fork Salmon River spring/summer Chinook: Initiated with eyed eggs pumped from natural-origin redds in the East Fork Salmon River and natural-origin parr collected in tributary habitats. Release objective = 40 captive-reared natural-origin adults. This is an experimental conservation program begun in 1997. *West Fork Yankee Fork Salmon River spring Chinook:* Initiated with eyed eggs pumped from natural-origin redds in the West Fork Yankee Fork Salmon River. This is an experimental conservation program begun in 1997 *Yankee Fork Chinook Salmon Supplementation Program* – Initiated with spring Chinook smolts and outplanted adults from Sawtooth FH (see Sawtooth broodstock origin(s). *Pahsimeroi FH summer Chinook.* See Table 29.

Table 29. Pahsimeroi River summer Chinook (Natural + Hatchery)

Management Premises and Goals	
ESA Status	*Threatened.* NOAA Fisheries includes both natural and hatchery-origin summer Chinook in the Pahsimeroi River with the Snake River Spring/Summer Chinook ESU. This ESU was listed as threatened under the ESA on April 22, 1992 (57 Federal Register [FR] 14653). The ICTRT identified natural-origin summer Chinook in the Pahsimeroi River as one of nine demographically independent populations of Chinook salmon within the *Upper Salmon River MPG* (see Table 28).
Biological Significance	*High.* Chinook salmon in the Pahsimeroi River are considered summer-run and are distinct genetically from other Chinook populations in the Upper Salmon River. Chinook salmon in the Pahsimeroi and Lemhi rivers produce both subyearling and yearling smolts, which differs from the typical yearling smolt life history of other spring/summer Chinook populations in the Salmon River.
Population Viability	*Low for the natural population*. Population growth rate (λ) during the 1990s was less than needed for replacement. The population currently does not meet NOAA Fisheries viability criteria. Low smolt-to-adult return rates (SAR's) have been identified as a major out-of-basin factor limiting viability of Chinook salmon populations in the Salmon River Basin. The HSRG (2009) estimated the habitat productivity and capacity for the Pahsimeroi River population as R/S_{max} = 1.70 and C= 3,200 natural-origin adults, respectively. *Medium for Pahsimeroi Hatchery Summer Chinook.* Overall mean smolt-to-adult survivals (SAR) and adult recruits per spawner (R/S) have averaged SAR = 0.3% and R/S = 6.0 adults, respectively (HSRG 2009). The smolt to adult survival back to the hatchery for release years 1990-99 averaged 0.2% (range 0.001% to 0.98%). Over this same time period, the number of adult returns back to the hatchery has ranged from 44 to 846 fish with the number of smolts released ranging from 66,000 to 1.0 million smolts. No fish were released in 1996 (Table 8.6 of IDFG Report 07-03)
Habitat	*Low.* The Pahsimeroi Rivers has been significantly impacted by livestock grazing resulting in excessive sedimentation, high stream temperatures, and reduced riparian vegetation.

	Water diversions have disconnected many tributaries from the mainstem Pahsimeroi River resulting in altered hydrologic regimes (i.e., peak and base flows and flow timing) and barriers to fish migration. The bacteria *Myxobolus cerebralis*, the causative agent of whirling disease, is present in the Pahsimeroi River watershed. Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers.
Harvest	*Low.* Recreational fishing on Chinook salmon has not been permitted in the upper Salmon River since 1977. Recreational fishing did not occur during the 1993-1999 adult return seasons. Shoshone-Bannock Tribal ceremonial and subsistence Chinook salmon fisheries have been conducted annually in the Pahsimeroi River. The HSRG (2009) estimated that the total harvest on Pahsimeroi River summer Chinook in all fisheries averaged approximately 991 hatchery-origin and 26 natural-origin fish, annually.
Hatchery Program	
Facilities	*Pahsimeroi FH*. The Pahsimeroi FH is comprised of upper and lower hatchery components. The lower component is located on the Pahsimeroi River approximately 1.6 kilometers above its confluence with the Salmon River. The upper component is located approximately 11.3 kilometers upstream from the lower facility on the Pahsimeroi River.
Type	*Segregated*. The broodstock has been derived exclusively from summer Chinook returns back to Pahsimeroi FH since 1989. Indigenous Pahsimeroi River summer Chinook salmon were solely used for propagation from 1969 until 1981.
Authorization and Funding	Idaho Power Company. Mitigation for construction and operation of the Hells Canyon Hydroelectric Dam Complex.
Primary Purpose	*Harvest.*
Secondary Purposes	*Conservation*. The hatchery stock was developed from summer Chinook native to the Pahsimeroi River and is included with the *Snake River Spring/Summer Chinook ESU*. *Research.* Chinook salmon in the Pahsimeroi River represent a "treatment" population as part of the Idaho Supplementation Studies.
Broodstock Origin(s)	Natural-origin summer Chinook trapped in the Pahsimeroi River beginning in 1969 and continuing through 1981. From brood year 1981 through 1984, Rapid River spring Chinook and IDFG's Hayden Creek Hatchery (Lemhi River) spring Chinook were used in an effort to achieve smolt production goals and expedite the return of harvestable numbers of Chinook salmon to the Salmon and Pahsimeroi rivers. In 1985 and 1987, the returning adults and few progeny were all released into the Yankee Fork and Panther Creek. Propagation of summer Chinook also continued during this period. In the 1980s, IDFG transferred eyed eggs from the South Fork Salmon River program to the Pahsimeroi FH to meet broodstock needs. The Chinook salmon program at Pahsimeroi FH converted back solely to a summer Chinook salmon program, with the last adult spring Chinook salmon returning in 1989. There is possible genetic influence from Rapid River FH hatchery-origin spring Chinook and Lemhi River spring Chinook. The current release objective is 1.0 million yearling smolts.

Table 30. Snake River (Redfish Lake) Sockeye Salmon ESU (Natural + Hatchery)

Management Premises and Goals	
ESA Status	*Endangered.* The Snake River Sockeye Salmon ESU was listed as an endangered species on November 20, 1991. NOAA Fisheries does not include native populations of kokanee (non-anadromous *O. nerka*) in the Snake River basin with the *Snake River Sockeye Salmon ESU*, but hatchery-origin sockeye salmon that are descendants from natural-origin ancestors from Redfish Lake are included with the ESU.
Biological Significance	*Very High.* The current population native to Redfish Lake is the last remaining population of sockeye salmon in the Snake River, and one of the few remaining populations in the Columbia River basin. Redfish Lake sockeye travel a greater distance from the sea (approximately 900 miles) and to a higher elevation (6,500 feet), and is the most southern population than any other sockeye salmon population globally. Other lakes in the Snake River watershed historically supporting sockeye salmon, but now considered extinct, include Lake Wallowa (Grande Ronde River drainage, Oregon), Payette Lake (Payette River drainage, Idaho) and Warm Lake (South Fork Salmon River drainage, Idaho). The mean size of adult sockeye salmon native to Redfish Lake was considered historically to be somewhat larger than the mean size of adults from other Columbia River stocks (ICTRT 2008).
Population Viability	*Very low.* Sockeye salmon in Alturas Lake were extirpated in the early 1900s as a result of irrigation diversions, although residual sockeye may still exist in the lake. From 1955-1965, the IDFG eradicated non-game fish populations from Pettit, Stanley, and Yellowbelly lakes, with the goal of developing fisheries for rainbow trout in those lakes. IDFG built rough fish barriers on each of the lake outlets that also prevented re-entry of anadromous sockeye salmon. Adult returns to Redfish Lake during the period 1954 through 1966, prior to construction of four hydropower dams on the lower mainstem Snake River (completed in 1975), ranged from 11 to 4,361 fish/year. In 1985, 1986 and 1987, only 11, 29, and 16 sockeye, respectively, returned to Redfish Lake. A total of only 18 natural-origin sockeye salmon have returned to the Stanley Basin since 1987. The Redfish Lake population is currently maintained via captive breeding and hatchery propagation. Current smolt-to-adult survival of sockeye salmon originating from the Stanley Basin lakes is rarely greater than 0.3%. Although the captive breeding program has increased the number of anadromous adults in some years, it has yet to produce consistent adult returns (presumably due to out-of basin effects). The HSRG (2009) estimated the habitat productivity and capacity for the Redfish Lake population as R/S_{max} = 0.14 and C= 10,000 natural-origin adults, respectively.
Habitat	*Medium.* The Payette Lakes (Big, Little, and Upper) at the headwaters of the Payette River system (now inaccessible to salmon and steelhead) were the largest producers of sockeye salmon in the Snake River basin (Evermann 1896). Sockeye were also extirpated from Lake Wallowa and Warm Lake by barrier dams. The remaining habitat in Redfish, Alturas, and Pettit Lakes in the upper Salmon River represents about 25 percent of the historically available sockeye rearing habitat in the Snake River basin. As rearing habitat in the Stanley Basin Lakes is limited but in relatively pristine condition, virtually all survival improvements for the ESU are likely to be achieved through survival improvements outside of the Stanley Basin. The majority of the Redfish Lake watershed is in wilderness and is considered pristine. Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers.
Harvest	*Low (incidental).* In 1898, the lower Columbia River commercial sockeye fishery (all

	stocks) peaked when 4.5 million pounds were harvested. From 1960 to 1973, commercial and tribal sockeye salmon fisheries in the Columbia River averaged 35,956 fish. Commercial fisheries were closed from 1974 to 1983. During the commercial closure, tribal harvest averaged approximately 1000 fish annually. Snake River sockeye salmon may have been susceptible to higher harvest rates than other stocks because of their low abundance relative to other sockeye populations and harvest practices that selected for larger fish. Tribal fisheries in the mainstem Columbia River between Bonneville and McNary dams (Fishery Zone 6) occur annually and probably harvest some Snake River sockeye salmon.
Hatchery Program	
Facilities	Eagle FH (IDFG), NOAA Fisheries Burley Creek FH and Manchester Research Station, Oxbow FH , Sawtooth FH, Redfish Lake Creek trap,.
Type	*Integrated + captive broodstock.*
Authorization and Funding	Bonneville Power Administration and NOAA Fisheries.
Primary Purpose	Conservation.
Secondary Purposes	Research.
Broodstock Origin(s)	Natural-origin adults trapped at the outlet of Redfish Lake. Release objectives: 50,000 eyed eggs into Pettit Lake, 120,000 pre-smolts into Redfish, Alturas, and Pettit lakes (combined release), 40,000 smolts each into Redfish Lake Creek (outlet of Redfish Lake) and the upper Salmon River at Sawtooth FH, and 500 captively-reared adults into Redfish Lake for natural spawning.

Table 31. Little Salmon River (A-run) summer steelhead (Natural)

Management Premises and Goals	
ESA Status	*Threatened*. The *Snake River Steelhead DPS* was listed as threatened under the ESA on August 18, 1997 (62 FR 43937). NOAA Fisheries classifies all natural populations of steelhead in the Salmon River basin as part of the *Snake River Summer Steelhead DPS* and *Salmon River MPG*. The ICTRT has designated steelhead in the Little Salmon River and other tributaries downstream in the lower Salmon River (e.g., Whitebird, Skookumchuck, and Slate creeks) as a demographically independent population within the *Salmon River Steelhead MPG*. The geographic range of this population includes all tributaries to the Salmon River between the Little Salmon and Snake rivers. The ICTRT (2005) classified the Little Salmon River population of A-run steelhead as *intermediate* based on historical habitat potential. The HSRG (2009) classified this population as *stabilizing* with respect to ESA recovery of the DPS.

Biological Significance	*Low to Medium.* The historic population is classified as consisting only of A-run steelhead. Populations in the Little Salmon River have been significantly affected by large numbers of hatchery-origin steelhead outplanted from multiple hatchery stocks. A natural population of steelhead, largely unaffected by hatchery-origin steelhead, inhabits the Rapid River upstream of the of the Rapid River FH weir. The absence of hatchery influence in the Rapid River population increases its biological significance.
Population Viability	*Low.* The Little Salmon River steelhead population does not currently meet the viability criteria of NOAA Fisheries for ESA recovery. This population also does not meet the criteria for a "maintained" population. The high proportion of hatchery origin fish potentially spawning naturally in the region increases spatial structure and diversity risks for long-term viability, although considerable uncertainty exists regarding the reproductive success of hatchery-origin spawners. The number of adult natural-origin (unclipped) adult steelhead counted at the Rapid River FH weir (1965-2002) has ranged from a low of 11 adults in 1999 to high of 221 adults in 1972. The HSRG (2009) estimated the habitat productivity and capacity for steelhead in the Little Salmon River (primarily in Rapid River) as R/S_{max} = 3.60 and C = 474 natural-origin adults, respectively.
Habitat	*Low to Medium.* Fish habitat conditions for the Little Salmon River population range from near-pristine in roadless areas of the Rapid River drainage to the significantly-altered Little Salmon River. (See also Habitat section for Little Salmon and lower Salmon River spring/summer Chinook, Table 22). Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers. Except for Rapid River, tributaries are small and steep, or blocked by natural barriers. Available habitat is mostly of poor quality.
Harvest	*Low to moderate.* Overall harvest impacts on natural populations of steelhead are unknown but are presumed to be low to moderate in the Little Salmon River due to intensive fisheries targeting non-listed hatchery-origin fish. The Little Salmon River receives approximately 900,000 hatchery-origin steelhead smolts annually.

Table 32. Middle and South Fork Salmon River (B-run) summer steelhead (Natural)

Management Premises and Goals	
ESA Status	*Threatened.* The *Snake River Steelhead DPS* was listed as threatened under the ESA on August 18, 1997 (62 FR 43937). NOAA Fisheries classifies all natural populations of steelhead in the Salmon River basin as part of the *Snake River Steelhead DPS* and *Salmon River Steelhead MPG*. The ICTRT designated two demographically-independent populations of steelhead in the S.F. Salmon River: (a) the Secesh River and (b) the mainstem South Fork Salmon River, including the East Fork of the South Fork and Johnson Creek. Similarly, the ICTRT designated two demographically independent populations of steelhead in the M.F. Salmon River: the *Upper Middle Fork* population upstream from the confluence of Loon Creek and the *Lower Middle Fork* including Loon Creek. All populations of steelhead in the Middle and South Forks are considered *B-run*. The ICTRT (2005) classified the Secesh and S.F. Salmon River populations of steelhead as *intermediate* and *basic*, respectively, based on historical habitat potential. The HSRG (2009) classified those two populations as *primary* and *contributing*, respectively, with

	respect to ESA recovery of the DPS. The ICTRT (2005) classified both the upper and lower M.F. Salmon River populations as *intermediate* based on historical habitat potential. The HSRG (2009) classified both populations as *primary* with respect to ESA recovery of the DPS.
Biological Significance	*High.* The only native populations of B-run steelhead in the Salmon River Basin occur in the Middle and South Forks of the Salmon River. Both watersheds are managed as wild steelhead sanctuaries. The Secesh River population within the South Fork watershed is diverged genetically from steelhead in other areas of the South Fork Salmon River. The two Middle Fork populations and the Secesh River population have no record of receiving hatchery-origin steelhead. Hatchery steelhead were released into the South Fork Salmon River and East Fork of the South Fork Salmon River from 1973 through 1981, although not in all years. Those releases consisted of steelhead fry except in 1980 and 1981 when small numbers of presmolts and smolts were released. The population is currently classified as consisting only of B-run steelhead. These Salmon River populations and B-run steelhead in the Clearwater River are considered the only B-run steelhead in the Columbia and Snake River basins.
Population Viability	*Low*. The four independent populations of steelhead in the South and Middle Forks of the Salmon River do not currently meet the viability criteria of NOAA Fisheries for ESA recovery. Those four populations also do not meet the criteria for a "maintained" population. Current abundance (number of adults spawning in natural production areas) is unknown for steelhead in the Middle Fork. Out of basin impacts associated with low smolt-to-adult survivals are the principal factors limiting viability of steelhead in the Middle and South Forks of the Salmon River. The HSRG (2009) estimated the habitat productivity and capacity for B-run steelhead in (a) S.F. Salmon River as R/S_{max} = 3.0 and C = 1,115 natural-origin adults, respectively; (b) Secesh River as R/S_{max} = 3.0 and C = 342 adults, respectively; (c) upper M.F. Salmon River as R/S_{max} = 2.5 and C = 1,667 adults, respectively; and (d) lower M.F. Salmon River as R/S_{max} = 2.5 and C = 1,587 adults, respectively.
Habitat	*Medium to High.* Most (>95%) of the Middle Fork Salmon River watershed is within the Frank Church–River of No Return Wilderness Area. Prior to becoming wilderness in 1980, the watershed was managed as a primitive area from 1930 to 1980. Road and trail densities are low, and most tributaries are in relatively pristine condition. The habitat in the Middle Fork has been unchanged since the 1950s. Excellent steelhead habitat is particularly abundant in both the Lower and Upper Middle Fork regions (see also habitat section for Middle Fork Spring/Summer Chinook). In contrast, the aquatic habitat in the South Fork Salmon River is recovering from catastrophic sediment impacts that occurred in the mid-1960s when unusually high precipitation, combined with logging and road construction, resulted in massive silt loads into the river. Twenty-one percent (21%) of the total stream length in the South Fork Salmon River watershed is impaired currently by sedimentation (see also the habitat section for South Fork Summer Chinook). Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers.
Harvest	*Low.* Overall harvest impacts on natural populations of steelhead are unknown but are assumed to be low. There are no freshwater recreational fisheries directly targeting natural-origin steelhead or hatchery-origin steelhead in the South and Middle Forks of the Salmon River. Indirect mortalities are assumed to occur in some fisheries targeting hatchery-origin fish downstream from the South and Middle Forks. Some size-selective harvest of steelhead may occur in mainstem Columbia River gillnet fisheries related to mesh size because B-run steelhead have a larger mean size than A-run steelhead. Further assessment

	is necessary to determine the extent of harvest-related mortality in mainstem Columbia and Snake river fisheries.

Table 33. Chamberlain Creek (A-run) summer steelhead (Natural)

Management Premises and Goals	
ESA Status	*Threatened.* The *Snake River Steelhead DPS* was listed as threatened under the ESA on August 18, 1997 (62 FR 43937). NOAA Fisheries classifies all natural populations of steelhead in the Salmon River basin as part of the Snake River DPS and Salmon River MPG. The ICTRT has designated steelhead in Chamberlain Creek as a demographically independent population within the *Salmon River Steelhead MPG*. The geographic range of this population includes all tributaries to the mainstem Salmon River between Chamberlain Creek and the Little Salmon River, excluding the South Fork Salmon River. The ICTRT (2005) classified the Chamberlain Creek population of A-run steelhead as *basic* based on historical habitat potential. The HSRG (2009) classified this population as *primary* with respect to ESA recovery of the DPS.
Biological Significance	*High.* The Chamberlain Creek population is distinctive from other steelhead populations in the Salmon River basin on the basis of life history, basin topography, and no history of hatchery steelhead releases.
Population Viability	*Low.* The Chamberlain Creek population does not currently meet NOAA Fisheries viability criteria for ESA recovery. It also does not meet the criteria for a "maintained" population. The HSRG (2009) estimated the habitat productivity and capacity for the Chamberlain Creek population as R/S_{max} = 3.0 and C = 399 natural-origin adults, respectively.
Habitat	*High.* The Chamberlain Creek drainage is one of the largest watersheds between the South Fork and Middle Forks of the Salmon River. It is the most important steelhead spawning stream in the canyon area of the Salmon River, followed by Bargamin, Horse, Crooked, Sabe, and Sheep creeks. The Chamberlain Creek population is located primarily within designated wilderness areas. With the exception of small-scale and local anthropogenic impacts, watersheds within the population boundary are generally not degraded from historical conditions. Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers.
Harvest	*Low.* Overall harvest impacts on steelhead populations are unknown but are presumed to be low in Chamberlain Creek. There are no freshwater recreational fisheries directly targeting naturally produced steelhead or hatchery-origin steelhead in Chamberlain Creek, although indirect mortalities are expected to occur in some downstream fisheries selective for hatchery fish.

Table 34. Panther Creek and North Fork Salmon River (A-run) summer steelhead (Natural)

Management Premises and Goals	
ESA Status	*Threatened.* The *Snake River Summer Steelhead DPS* was listed as threatened under the ESA on August 18, 1997 (62 FR 43937). NOAA Fisheries classifies all natural populations of steelhead in the Salmon River basin as part of the Snake River DPS and Salmon River MPG. The ICTRT has designated steelhead in Panther Creek and the N.F. Salmon River as demographically independent populations within the Salmon River steelhead MPG. These two populations include all tributaries to the Salmon River between the North Fork and Chamberlain Creek, exclusive of the South and Middle Fork watersheds. The ICTRT (2005) classified both populations of A-run steelhead as *basic* based on historical habitat potential. The HSRG (2009) classified both populations as *stabilizing* with respect to ESA recovery of the DPS.
Biological Significance	*Medium.* Panther Creek and the North Fork Salmon River represent two of eight demographically independent A-run populations of steelhead in the Salmon River MPG. Hatchery steelhead (A-run) were released into the North Fork Salmon River every year, 1977-1994. The Shoshone-Bannock Tribes conduct an eyed-egg outplanting program in Panther Creek using Pahsimeroi FH stock.
Population Viability	*Low.* The Panther Creek and North Fork steelhead populations do not currently meet NOAA Fisheries viability criteria for ESA recovery. The two populations also do not meet the criteria for a "maintained" population. The HSRG (2009) estimated the habitat productivity and capacity for the Panther Creek population as R/S_{max} = 2.0 and C = 428 natural-origin adults, respectively, and R/S_{max} =3.0 and C = 226 adults, respectively, for the N.F. Salmon River population.
Habitat	*Low.* Aquatic habitat in the Panther Creek drainage has been severely degraded through mining activity, substantially affecting the presence and distribution of steelhead within the watershed. Past land use in the North Fork Salmon River has had a moderate influence on impacting habitat quantity and quality, primarily in the form of decreased pool to riffle ratios. A major paved highway parallels the North Fork Salmon River for almost its entire course. Several small tributaries to the Salmon River between Panther Creek and the North Fork Salmon River currently support, or have the potential to support, natural populations of steelhead, but most of those streams have experienced anthropogenic impacts. The current range and habitat occupancy by steelhead in this region is significantly reduced from historic conditions. Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers.
Harvest	*Low.* Overall harvest impacts on natural populations of steelhead are unknown but are presumed to be low in Panther Creek and the North Fork Salmon River.

Table 35. Lemhi River (A-run) summer steelhead (Natural)

Management Premises and Goals	
ESA Status	*Threatened.* The *Snake River Summer Steelhead DPS* was listed as threatened under the ESA on August 18, 1997 (62 FR 43937). NOAA Fisheries classifies all natural populations of steelhead in the Salmon River basin as part of the Snake River DPS and Salmon River MPG. The ICTRT (2005) has designated steelhead in the Lemhi River as a demographically independent population within the Salmon River steelhead MPG. The geographic range of this population also includes all tributaries to the Salmon River between the Lemhi and North Fork Salmon rivers. The ICTRT (2005) classified the Lemhi River population of A-run steelhead as *intermediate* based on historical habitat potential. The HSRG (2009) classified this population as *primary* with respect to ESA recovery of the DPS.
Biological Significance	*Low.* Steelhead were virtually eliminated from the Lemhi River by a water diversion dam used for hydroelectric power generation at the mouth of the Lemhi River although it is possible that some steelhead gained access to the river during high flows[89]. Only A-run steelhead are presumed to have occupied this population historically. Hatchery-origin steelhead, representing out-of-basin source populations, have been released into the geographic area of the Lemhi River population nearly every year since 1967. In addition, during BY 2001-2005, 120,000 hatchery steelhead smolts (40,000 non adipose fin clipped) were released annually in the Lemhi River as part of the *US v Oregon* Management Agreement. At the present time, 120,000 yearling smolts from the Pahsimeroi FH (Table 33) are released into the mainstem Salmon River (at Red Rock) approximately 10 miles downstream from the confluence of the Lemhi River.
Population Viability	*Low.* The Lemhi River steelhead population does not currently meet the viability criteria of NOAA Fisheries for ESA recovery. The population also does not meet the criteria for a "maintained" population. Steelhead parr densities in the Lemhi River have been highly variable over time. The HSRG (2009) estimated the habitat productivity and capacity for the Lemhi River population as R/S_{max} = 1.8 and C = 1,139 natural-origin adults, respectively.
Habitat	*Low.* The Lemhi River flows primarily through a dry intermontane sagebrush valley, a type of habitat shared only with the Pahsimeroi River within the Salmon River basin. The Lemhi River subbasin has been substantially degraded from its historic condition. The primary factors affecting fish production in this subbasin are low stream flows and disconnected tributaries, a situation that reduces spawning and rearing habitat quantity for anadromous species and isolates resident populations of rainbow trout which may have been associated historically with the steelhead population. Although a relatively small number of spawning areas were identified within the Lemhi population, a large amount of intrinsic habitat is potentially available for spawning and rearing. Only 7% of all tributaries remain connected to the mainstem Lemhi River; Big Springs Creek and Hayden Creek are the only tributaries currently connected to the Lemhi River year-round. There are 2,950 points of water diversion in the Lemhi River watershed, the majority of which are screened to the screening criteria of NOAA Fisheries. However, the placement of diversion screens often occurs a considerable distance from the point of diversion because of the geography of the Lemhi River channel, creating excessively long ditches, ditch instability, fish stranding and high conveyance losses. Irrigation diversions and water use

[89] *(Bjornn, T. 1978. Cited in Section 7.5 of the ICTRT Draft Snake River Recovery Plan (Available at http://www.idahosalmonrecovery.net/recoverplans/srsteelhead.html)*

	have substantially reduced available spawning and rearing habitats in the Lemhi River upstream of Hayden Creek. Riparian function and channel morphology on the mainstem Lemhi River have been compromised further by road construction and floodplain development. Current abundance of adult steelhead in natural spawning areas is unknown. Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers.
Harvest	*Low to Moderate.* Overall harvest impacts on natural populations of steelhead population are unknown but are presumed to be low to moderate resulting from fisheries targeting hatchery-origin steelhead in this region.

Table 36. Pahsimeroi River (A-run) summer steelhead (Natural)

Management Premises and Goals	
ESA Status	*Threatened.* The *Snake River Summer Steelhead DPS* was listed as threatened under the ESA on August 18, 1997 (62 FR 43937). NOAA Fisheries classifies all natural populations of steelhead in the Salmon River basin as part of the Snake River DPS and Salmon River MPG. The ICTRT has designated steelhead in the Pahsimeroi River as a demographically independent population within the Salmon River steelhead MPG. The geographic range of this population also includes all tributaries to the Salmon River between the Pahsimeroi and Lemhi rivers. The ICTRT (2005) classified the Pahsimeroi River population of A-run steelhead as *intermediate* based on historical habitat potential. The HSRG (2009) classified this population as *contributing* with respect to ESA recovery of the DPS.
Biological Significance	*Medium.* The use of out-of-basin (and out of MPG) steelhead for the Pahsimeroi FH program, and uncertainties regarding the genetic impacts of those introduced hatchery fish on naturally spawning populations within the Pahsimeroi River population, compromises the biological significance of this population. On the other hand, the hatchery weir on the Pahsimeroi River minimizes the genetic impact of hatchery-origin fish on natural populations upstream of the weir. At the present time, 860,000 yearling smolts from the Pahsimeroi FH stock (Table 37) are released into the Pahsimeroi River below the hatchery weir. In addition, 80,000 yearling smolts from the Pahsimeroi FH stock and 140,000 yearling smolts from either the Pahsimeroi or Sawtooth FH stocks are released into the mainstem Salmon River (at Shoup Bridge and Colston Corner, respectively), approximately 20 and 30 miles downstream, respectively, from the Pahsimeroi River.
Population Viability	*Low.* The Pahsimeroi River steelhead population does not currently meet the viability criteria of NOAA Fisheries for ESA recovery. The population also does not meet the criteria for a "maintained" population. The number of natural-origin adult steelhead counted each year at the Pahsimeroi FH weir varied from 17 to over 450 adults from 1986 to 2003. Geometric mean abundance for the most recent ten years is 73 adults per year. The HSRG (2009) estimated the habitat productivity and capacity for the Pahsimeroi River population as R/S_{max} = 1.65 and C = 1,029 natural-origin adults, respectively.
Habitat	*Low.* Like the Lemhi River, the Pahsimeroi River watershed lies within a dry intermontane sagebrush valley ecoregion. The Pahsimeroi River subbasin has been degraded from its historic condition. The primary impacts to aquatic habitat quality in the Pahsimeroi River

	subbasin are altered riparian areas, increased fine sediment and altered hydrology, primarily through dewatering. Over a century of livestock grazing and instream flow alterations have substantially altered the species diversity, structure, composition, and connectivity of riparian zones in the Pahsimeroi River watershed. These changes have resulted in excessive sedimentation, high stream temperatures, reduced shading and bank instability, each of which may act cumulatively or independently to adversely affect steelhead populations. All mainstem tributaries in the Pahsimeroi River valley are often disconnected from the mainstem river because of water diversions and the geology of the valley. Connectivity is intermittent; and numerous tributaries are connected only in instances of extreme high water which is likely contributing to the absence of a functional and connected riparian corridor. Although a relatively small number of spawning areas were identified within the population, there is a large amount of intrinsic potential habitat available for spawning and rearing. Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers.
Harvest	*Low to Moderate.* Overall harvest impacts on steelhead populations are unknown but are assumed to be low to moderate because of fisheries targeting hatchery-origin fish within the geographic area occupied by the Pahsimeroi population.

Table 37. Pahsimeroi hatchery A-run summer steelhead (Pahsimeroi FH, Hagerman NFH, and Magic Valley FH)

Management Premises and Goals	
ESA Status	Not listed. NOAA Fisheries excludes the Pahsimeroi FH population of steelhead from the *Snake River Steelhead DPS*.
Biological Significance	*Low.* This is an introduced hatchery stock derived from natural-origin adults trapped in the Hells Canyon area of the Snake River, 1966-1970.
Population Viability	*Medium.* Pahsimeroi FH spawns approximately 650 adults per year, however both Sawtooth A's and Pahsimeroi A's have been released at or near Pahsimeroi FH and were not differentiated upon return (combined to form the Pahsimeroi A stock) so no calculation of a mean R/S is possible. The HSRG (2009) estimated R/S = 12.6 for hatchery-origin Pahsimeroi A-run steelhead released in the Salmon River.
Habitat	*Low.* See habitat description for the Pahsimeroi River (A-run) summer steelhead natural population.
Harvest	*High.* Pahsimeroi FH A-run steelhead contribute to sport and tribal fisheries in the Salmon River and, presumably, various fisheries in the lower Columbia and Snake Rivers. For brood years 1992 to 1999, the sport fishery annually harvested an average of 2,554 (range 580-4,897) Pahsimeroi A steelhead released into the Salmon River from Magic Valley FH and 906 (range 0-2,318) steelhead released from Hagerman NFH.
Hatchery Program	

Facilities	Pahsimeroi FH, Sawtooth FH, Magic Valley FH, Niagara Springs FH, Hagerman NFH.
Type	Segregated. The broodstock is composed of hatchery-origin steelhead returning to the Pahsimeroi FH weir.
Authorization and Funding	LSRCP and Idaho Power Company Mitigation.
Primary Purpose	Harvest.
Secondary Purposes	None.
Broodstock Origin(s)	A successful steelhead mitigation hatchery program has operated on the Pahsimeroi River since 1967. The hatchery stock was founded from natural-origin steelhead trapped at Hells Canyon Dam on the Snake River between 1966 and 1970. Oxbow stock was founded more than 10 years after establishment of the Pahsimeroi FH stock from smolts of the Pahsimeroi stock that were released back into the Snake River at Hells Canyon. However, native Pahsimeroi River steelhead and other upper Salmon River fish were likely included in the brood stock during the early years of the hatchery program. Some Dworshak NFH stock fish (North Fork Clearwater River B-run) were released at the Pahsimeroi FH in the 1980s and may have been incorporated into the brood stock when fish returned as adults.

Table 38. East Fork Salmon River (A-run) summer steelhead (Natural + Hatchery)

Management Premises and Goals	
ESA Status	*Threatened.* The *Snake River Summer Steelhead DPS* was listed as threatened under the ESA on August 18, 1997 (62 FR 43937). NOAA Fisheries classifies all natural populations of steelhead in the Salmon River basin as part of the Snake River DPS and Salmon River MPG. The ICTRT has designated steelhead in the East Fork Salmon River and tributaries to the Salmon River between the East Fork and Pahsimeroi rivers as a demographically independent population within the Salmon River steelhead MPG. The ICTRT (2005) classified the East Fork Salmon River population of A-run steelhead as *intermediate* based on historical habitat potential. The HSRG (2009) classified this population as *primary* with respect to ESA recovery of the DPS.
Biological Significance	*Medium to High.* Hatchery steelhead have been released in the East Fork Salmon River every year since 1976. Historic steelhead releases within the range of the East Fork Salmon River population have included Dworshak NFH B-run fish and Pahsimeroi FH A-run fish. Both hatchery populations represent "out-of-basin" stocks. The East Fork Salmon River historically supported one of the most upstream native population of steelhead within the Salmon River Basin. A small conservation hatchery program (release goal of 50,000 smolts) operates to help maintain the native population. In addition, 325,000 yearling *B-run* smolts from the Dworshak NFH stock (Table 8) are currently outplanted annually into the East Fork Salmon River immediately upstream from the mainstem Salmon River to support recreational and tribal fisheries under the LSRCP. Genetic data for natural-origin steelhead

	in the East Fork Salmon River are consistent with the hypothesis that genetic introgression from the Dworshak NFH B-run population has occurred but with little or no genetic introgression from the Pahsimeroi A-run steelhead population (Nielsen et al. 2004).[90]
Population Viability	*Low.* The East Fork Salmon River steelhead population does not currently meet the viability criteria of NOAA Fisheries for ESA recovery. The population also does not meet the criteria for a "maintained" population. Recent (1984-2001) returns of natural-origin steelhead to the East Fork Salmon River weir have ranged from 0 to 40 natural fish/year. An average of 28 natural-origin steelhead per year were trapped at the weir, 1987-2007. The HSRG (2009) estimated the habitat productivity and capacity for the East Fork Salmon River population as R/S_{max} = 1.50 and C = 1,048 natural-origin adults, respectively. The HSRG (2009) estimated R/S = 7.1 for hatchery-origin East Fork "natural" steelhead released in the E.F. Salmon River.
Habitat	*Medium.* The East Fork Salmon River watershed has been degraded from its historic condition. Localized areas have accelerated sediment impacts, increased water temperatures, and stream channel alteration from roads, developed and dispersed recreation, livestock grazing, mining, and stream flow alteration from irrigation diversions. Despite those impacts, a large percentage of the watershed remains roadless. The primary habitat impacts in the mainstem Salmon River between the East Fork Salmon and Pahsimeroi rivers, excluding the area known as the "12-mile reach", are increased fine sediments and reduced discharge from tributaries, primarily during low stream flows. The primary limiting factors in the 12-mile reach (near Challis, ID) are lack of fish access to floodplain and side-channel habitat from barriers and diking, altered riparian habitat resulting in reduced shade and streambank stability, and increased sediment loads. Nevertheless, a large amount of potential habitat is available for spawning and rearing. Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers.
Harvest	*Low to Moderate.* Overall harvest impacts on natural populations of steelhead populations are unknown but are presumed to be low to moderate (relative to abundance) for the East Fork Salmon River population depending on mortality associated with fisheries targeting hatchery-origin fish.
Hatchery Program	
Facilities	East Fork Salmon River Satellite Facility, Sawtooth FH, and Magic Valley FH.
Type	*Integrated.* Natural and hatchery-origin steelhead are captured for broodstock at the East Fork weir, approximately 18 miles upstream from the confluence with the Salmon River.
Authorization and Funding	LSRCP.
Primary Purpose	*Conservation*. The hatchery program aims to conserve and perpetuate the A-run summer steelhead population native to the East Fork Salmon River via hatchery propagation and natural spawning supplementation by returning hatchery-origin adults. At the present time, 50,000 yearling smolts from the East Fork "Naturals" program are released annually into

[90] *Nielsen, J.L., R. Valenzuela, T. Wiacek, A. Byrne, S. Graziano. 2004. Genetic population structure of Snake River Basin Steelhead in Idaho. Unpublished report submitted to Idaho Department of Fish and Game. Available as Reference SR-013 at: http://www.fws.gov/pacific/fisheries/hatcheryreview/.*

	the into the East Fork Salmon River at a permanent weir, approximately 18 miles upstream of the mainstem Salmon River. In addition, approximately 325,000 Dworshak NFH B-run steelhead are outplanted annually into the East Fork Salmon River immediately upstream from its confluence with the Salmon River. Also, 60,000 and 120,000 yearling smolts from either the Pahsimeroi or Sawtooth FH stocks (*A-run*) are released into the mainstem Salmon River (at Tunnel Rock and McNabb Point, respectively), approximately 10 and 20 miles downstream, respectively, from the East Fork Salmon River.
Secondary Purposes	*Research.* Purpose: evaluate the efficacy of supplementation; i.e., the reproductive success and productivity of naturally-spawning hatchery-origin fish.
Broodstock Origin(s)	The current hatchery program started in 2001 with collections of natural-origin adult steelhead at the East Fork weir. For BY 2009-2018, the program will consist of 200,000 smolts produced annually beginning with parents returning to freshwater in 2008 (2008-2017 *US v. Oregon* Management Agreement)

Table 39. Upper Mainstem Salmon River (A-run) summer steelhead (Natural)

Management Premises and Goals	
ESA Status	*Threatened.* The *Snake River Summer Steelhead DPS* was listed as threatened under the ESA on August 18, 1997 (62 FR 43937). NOAA Fisheries classifies all natural populations of steelhead in the Salmon River basin as part of the Snake River DPS and Salmon River MPG. The ICTRT has designated steelhead in the upper Salmon River basin upstream from the East Fork Salmon River as a demographically independent population within the Salmon River Steelhead MPG. The geographic range of this population includes all tributaries to the Salmon River upstream from the East Fork Salmon River. Major tributaries are the Yankee Fork Salmon River and Valley Creek. The ICTRT (2005) classified the Upper Mainstem Salmon River population of A-run steelhead as *intermediate* based on historical habitat potential. The HSRG (2009) classified this population as *stabilizing* with respect to ESA recovery of the DPS.
Biological Significance	*Low.* Large numbers of out-of-basin (out-of-MPG) hatchery-origin steelhead have been released within the boundaries of the Upper Mainstem Salmon River population for both harvest and natural-spawning supplementation. Approximately 750,000 steelhead smolts are released annually into the Salmon River at the Sawtooth FH near Stanley, Idaho. In addition, approximately 200,000 Dworshak NFH B-run steelhead are released annually into Squaw Creek.
Population Viability	*Low.* The Salmon River Upper Mainstem steelhead population does not currently meet the viability criteria of NOAA Fisheries for ESA recovery. The population also does not meet the criteria for a "maintained" population. Recent (1985-2001) annual returns of natural-origin steelhead intercepted at the Sawtooth FH weir ranged from four to 129 fish. An average of 34 natural-origin steelhead were intercepted annually at the Sawtooth FH weir, 1986-2007. Hatchery-origin fish compose a high proportion of naturally spawning steelhead in this region downstream from the hatchery weir. The HSRG (2009) estimated the habitat productivity and capacity for the Upper Salmon River population as R/S_{max} = 1.50 and C = 1,283 natural-origin adults, respectively.

Habitat	*Low to Medium.* The watersheds occupied by this population have experienced varying degrees of degradation from their historical condition. The major influences on habitat condition have been livestock grazing, irrigation withdrawal, and road/highway impacts. The primary effects of these anthropogenic effects are reduced instream flows and altered channel morphology. A large number of irrigation diversions exist within the population boundary, and fish are entering irrigation systems when irrigation is turned on before fish screens are in place. The extent of fish loss due to irrigation diversions is unknown. Mining activities in Yankee Fork Salmon River have resulted in significant habitat alterations and effects, and the legacy effects of mining continue to impair habitat quality, including the presence of unconsolidated dredge tailings in the lower Yankee Fork Salmon River. Instream flow has been reduced and channel morphology altered in Valley Creek as a result of livestock grazing and water withdrawals. Grazing impacts include sediment generation and mobilization, increased water temperatures, stream bank degradation, channel alteration and riparian vegetation destruction. The natural hydrologic regime in the Upper Mainstem Salmon (from the East Fork confluence to the headwaters) is significantly altered by water withdrawals, base flow is reduced and flow timing has been altered resulting in increased rates of sedimentation. Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers.
Harvest	*Low to Moderate.* Overall harvest impacts on natural populations of steelhead are unknown but are believed to be low to moderate (relative to abundance) for the Upper Salmon River population depending on mortality associated with fisheries targeting hatchery-origin fish.

Table 40. Sawtooth hatchery A-run summer steelhead (Sawtooth FH, Hagerman NFH, and Magic Valley FH)

Management Premises and Goals	
ESA Status	Not listed. NOAA Fisheries excludes the Sawtooth FH population of steelhead from the *Snake River Steelhead DPS*.
Biological Significance	*Low*. This is an introduced hatchery stock derived from the Pahsimeroi and Oxbow FH stocks.
Population Viability	*Low*. Sawtooth FH traps and spawns approximately 525 adults per year for the Sawtooth A-run program, however both Sawtooth A-run and Pahsimeroi A-run steelhead have been released at Sawtooth FH and were not differentiated upon return (combined to form the Sawtooth A stock) so no calculation of a mean R/S is possible. The HSRG (2009) estimated R/S = 12.6 for hatchery-origin Sawtooth *A-run* steelhead released in the Salmon River.
Habitat	*Low.* See habitat section for *Upper Mainstem Salmon River (A-run) Steelhead (Natural)*
Harvest	*High.* Sawtooth A-run steelhead reared at Hagerman NFH and Magic Valley FH contribute primarily to sport and tribal fisheries in the upper Salmon River, although those fish are also harvested in various fisheries in the lower Columbia and Snake Rivers. For brood

	years 1992 to 1999, the sport fishery in the Salmon River harvested an average of 657 (range = 0-3,063) Sawtooth A-run steelhead annually that were released from Magic Valley FH and 2,756 (range = 433-7,405) Sawtooth A steelhead that were released from Hagerman NFH. Total estimated harvest of Sawtooth A-run steelhead (all programs combined) for BY2002 was 826 fish in the Columbia and Snake River mainstems and 4,130 fish in Idaho waters upstream from Lower Granite Dam. Similarly, for BY 2003, an estimated 115 steelhead were harvested in the mainstem Columbia and Snake rivers and 2,216 steelhead were harvested in Idaho waters.
Hatchery Program	
Facilities	Sawtooth FH, Hagerman NFH, and Magic Valley FH.
Type	*Segregated.* Only hatchery-origin steelhead are used for broodstock.
Authorization and Funding	LSRCP.
Primary Purpose	*Harvest*. Approximately 9,300 adults, 5.4 million yearling smolts, 1.2 million subyearling parr, and 10.1 million fry were released into tributaries and the mainstem Salmon River from 1973 through 2006.
Secondary Purposes	None.
Broodstock Origin(s)	Pahsimeroi and Oxbow FH stocks with some natural-origin adults trapped at the Sawtooth FH until the early 1990's.

Table 41. Oxbow hatchery (Hells Canyon) A-run summer steelhead (Oxbow FH, Niagara Springs FH)

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

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

Table 42. Dworshak hatchery (Clearwater River) B-run summer steelhead (Hagerman NFH and Magic Springs FH)

Management Premises and Goals	
ESA Status	*Not listed*. Dworshak B-run steelhead transported from the Clearwater River and outplanted into the Salmon River are not included with the *Snake River Steelhead DPS* for the purpose of listing under the ESA.
Biological Significance	*Low*. Dworshak B-run steelhead are not native to Salmon River.

Population Viability	*Low.* Smolt-to-adult survivals (SARs) of Dworshak B-run steelhead outplanted into the Salmon River are approximately 15-20% of the SARs for Sawtooth A-run steelhead propagated within the Salmon River basin. The HSRG (2009) estimated R/S = 7.1 and 2.5 for Dworshak B-run steelhead released into the Little Salmon River and Squaw Creek, respectively.
Habitat	*Low.* Dworshak B-run steelhead are not intended to spawn naturally within the Salmon River. Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers.
Harvest	*Unknown.* The harvest of B-run steelhead released into the Salmon River is largely unquantified.
Hatchery Program	
Facilities	Hagerman NFH, Magic Valley FH, Squaw Creek acclimation ponds.
Type	*Segregated.* Hatchery-origin fish are collected for broodstock at Dworshak NFH. Attempts have been made to establish a local B-run broodstock from returning Dworshak B-run steelhead trapped in Squaw Creek, but adult returns have been insufficient for achieving that goal.
Authorization and Funding	LSRCP.
Primary Purpose	*Harvest.* Dworshak B-run steelhead are reared at Hagerman NFH and Magic Valley FH. From Hagerman NFH, 100,000 Dworshak B-run steelhead yearling smolts are released into the East Fork Salmon River, and 100,000 yearling smolts are released into the Little Salmon River. From Magic Valley FH, 215,000 yearling smolts are released into the Little Salmon River, 225,000 yearling smolts are released into the lower East Fork Salmon River, 60,000 yearling smolts are acclimated and released from Squaw Creek Pond, and 191,000 smolts are released into Squaw Creek.
Secondary Purposes	*Broodstock development.* The program at Magic Valley FH program includes the release of 60,000 Squaw Creek B-run steelhead smolts derived from Dworshak B-run adult broodstock collected as returning adults in Squaw Creek.
Broodstock Origin(s)	B-run summer steelhead native to the North Fork of the Clearwater River.

Table 43. Salmon River Resident Rainbow/Redband Trout (Natural)

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

Biological Significance	*Medium.* Some natural genetic exchange between steelhead and resident rainbow trout is presumed to occur in some regions of the Salmon River basin. Biologists for IDFG believe that resident rainbow trout, and not steelhead, were the dominant life history form native historically to the upper Salmon River basin upstream of the East Fork Salmon River.
Population Viability	*Low to Medium.* The viability of resident rainbow trout is largely unknown but is presumed to be similar to the viabilities of steelhead and bull trout in the respective regions where those latter species occur.
Habitat	*Low to High.* Resident rainbow trout are widely distributed in the Salmon River subbasin, but populations in many watersheds are fragmented by dewatering and impassable culverts. Local habitat issues are presumed to be similar to those for bull trout (Table 45)
Harvest	*Low to Moderate.* Some harvest of resident rainbow trout is presumed to occur in recreational fisheries targeting resident trout populations.

Table 44. Salmon River Westslope Cutthroat Trout (Natural)

Management Premises and Goals	
ESA Status	*Not listed.* The U.S. Fish & Wildlife Service, after conducting a one year range wide status review, ruled in August, 2003 that westslope cutthroat trout range-wide did not warrant listing as a threatened or endangered species.
Biological Significance	*High.* The Salmon River basin represents the largest contiguous watershed throughout the native range of westslope cutthroat trout where natural populations are largely unaffected genetically by natural hybridization with introduced rainbow trout[91]. Westslope cutthroat trout in the Salmon River basin exhibit fluvial and resident life histories, and adfluvial behavior in some populations is suspected.
Population Viability	*Medium.* Resident fish populations in the Salmon River basin have not received the same level of monitoring and evaluation afforded to anadromous populations. The viability of westslope cutthroat trout in the Salmon River basin is presumed to be similar to the viabilities of resident rainbow trout and bull trout in the respective sub-regions where those latter species occur. Cutthroat trout populations have been protected via catch-and-release regulations in large portions of the Salmon River basin since the 1970s, and no harvest of cutthroat trout has been permitted in mainstem rivers since 1996.
Habitat	*Low to High.* Westslope cutthroat trout are distributed widely throughout the Salmon River basin. The Middle Fork Salmon River occurs largely in designated wilderness and represents pristine habitat. Other portions of the Salmon River basin are highly fragmented due to water withdrawals, reduced instream flows, and the presence of culverts. High numbers of brook trout in the Secesh River pose a displacement threat to westslope cutthroat trout. Local habitat conditions for westslope cutthroat trout are assumed to be similar to those for bull trout (Table 45).

[91] *Shepard, B.B., B.E. May, and W. Urie. 2005. Status and conservation of westslope cutthroat trout within the western United States. North American Journal of Fisheries Management 25: 1426-1440.*

Harvest	*Low to Moderate.* Some harvest of westslope cutthroat trout is presumed to occur in recreational fisheries targeting resident trout populations.

Table 45. Salmon River Bull Trout (Natural)

Management Premises and Goals	
ESA Status	*Threatened.* The U.S. Fish & Wildlife Service listed bull trout as a threatened species range wide on November 1, 1999 (64 FR 58910).
Biological Significance	*Medium.* The biological significance of bull trout populations in the Salmon River basin, relative to populations elsewhere, is unknown. Bull trout in the Salmon River do not have any known unique biological attributes that distinguish them from bull trout elsewhere. The Salmon River Recovery Unit is one of the largest recovery units geographically for bull trout among 22 recovery units in the Columbia River basin.
Population Viability	*Medium.* Bull trout are well distributed throughout most of the Salmon River basin in 125 identified local populations located within 10 core areas. Bull trout are particularly common and locally abundant throughout the wilderness tributaries of the Salmon River. Abundance information for bull trout in the wilderness areas of the Middle Fork is incomplete; however, Bear Valley Creek contains one of the strongest bull trout populations in the Pacific Northwest. Bull trout are widely distributed in the South Fork Salmon River watershed with highest numbers in the East Fork of the South Fork and Secesh rivers. High densities of bull trout occur in tributaries to the East Fork Salmon River. Bull trout in most tributaries of the Pahsimeroi River but tend to be isolated due to water withdrawals. Bull trout are present in the Lemhi River, largely as isolated resident populations. Both resident and migratory or fluvial bull trout are present in the Sawtooth Valley. Since 1973, the number of bull trout migrating upstream in the Rapid River ranged from 112 adults in 1998 to 359 adults in 2001. Naturalized populations of brook trout in Valley Creek (upper Salmon River), Secesh River (S.F. Salmon River), and lower Salmon River tributaries (French, Elkhorn, and Slate creeks) pose a displacement and hybridization threat to native populations of bull trout. However, the extent of crossbreeding between bull and brook trout in the Salmon River basin is unknown, thereby precluding a scientifically-based evaluation of the risks that hybridization poses to bull trout throughout the Salmon River basin.
Habitat	*Low to High.* Bull trout appear to have more specific habitat requirements than other salmonids. Seasonal barriers associated with water withdrawals isolate many small populations of bull trout, and some bull trout populations in the subbasin are locally depressed. Connectivity between populations is limited by flow and water quality issues in some mainstem areas and by diversions in some tributaries. Most tributaries in the Pahsimeroi River watershed are not connected because of fish-passage barriers which reduces available spawning and rearing habitat, and isolates bull trout populations in tributaries. The mainstem Pahsimeroi River serves as a migratory corridor for fish to access the mainstem Salmon River. The mainstem Lemhi River contains fluvial bull trout, although connectivity between the tributaries and the Lemhi River is reduced because of migration barriers associated with water diversions. The Little Salmon River provides foraging and adult rearing habitat and connectivity between local populations. Leaching of toxic chemicals from mining wastes in Yankee Fork Salmon River limit habitat suitability

	for bull trout. Habitat fragmentation and reduced stream flows due to water diversions, changes to upland riparian vegetation, and modifications to floodplain function have altered natural hydrographs in the Upper Salmon River, Lemhi River, Pahsimeroi River, Panther Creek, and Little-Lower Salmon River core areas.
Harvest	*Low.* Incidental harvest of bull trout is assumed to occur in recreational and tribal fisheries targeting resident trout, steelhead, and Chinook salmon. Sport fisheries have been closed to harvest of bull trout since about 1990. Tribal fisheries remain open for bull trout.

Other Species of Concern

Table 46. Non-salmonid native fish species present in the Salmon River watershed

Common name	Scientific Name
Mountain whitefish	(*Prosopium williamsoni*)
Pygmy whitefish	(*Prosopium coulterii*)
Pacific lamprey	(*Lampetra tridentata*)
Sculpin	(*Cottus sp.)*
Dace	(*Rhinichthys sp.)*
Northern pikeminnow	(*Ptychocheilus oregonensis*)
White sturgeon	(*Acipenser transmontanus*)
Sucker	(*Catostomus sp.)*
Sand roller	(*Percopsis transmontana*)
Redside shiner	(*Richardsonius balteatus*)
Chiselmouth	(*Acrocheilus alutaceus*)
Other Cyprinids (chubs)	

Other species

Other species of interest include Pacific lamprey. These species have been affected by many of the same habitat and migratory factors associated with reductions in numbers of anadromous salmonids and will likely benefit by recovery actions taken to address those impacts.

Bliss Rapids Snail - Several Hatchery springs and water courses provide refuge for the Bliss Rapids Snail (*Taylorconcha serpenticola*) which is listed as threatened under ESA. Hagerman NFH is currently undergoing Section 7 consultation with Ecological Services, Snake River Office, Boise, Idaho and will be developing a management plan that provides protection for the Bliss Rapids Snail while allowing the hatchery to continue its legally mandated mitigation activities under LSRCP.

Salmon and Steelhead Hatcheries in the Watershed[92]

Hagerman National Fish Hatchery (U.S. Fish & Wildlife Service – LSRCP Facility)

The Hagerman NFH is located near Hagerman, Idaho about 30 miles (48 km) west of Twin Falls, Idaho at the Thousand Springs area of the Snake River. Hagerman NFH was authorized by 46 Stat, 371 on May 21, 1930, and was established in 1932. Construction of the physical facilities commenced in 1932, and fish production began in 1933.

[92] *See Figure 3.*

The initial purpose of the hatchery was to rear rainbow trout for stocking in Idaho, eastern Oregon, and northern Nevada. In the late 1970's, the hatchery became part of the LSRCP, which was authorized by the Water Resources Development Act of 1976, Public Law 94-587. The LSRCP is intended to mitigate for fish and wildlife losses caused by the construction of four dams on the lower Snake River. The hatchery's primary responsibility was changed from resident rainbow trout to steelhead as part of the LSRCP. The Hatchery operates under cooperative program management between the Service and the IDFG. The Hatchery currently rears steelhead smolts from eyed eggs obtained from adults returning to other hatcheries and then transports and releases those smolts into the Salmon River basin.

The current personnel plan for the hatchery lists eight full-time employees. The annual operation and maintenance (O&M) budget (FY2008) for the hatchery was $853,170 from the LSRCP and $37,500 from the Army Corps of Engineers. Approximately $70,000 was spent on marking and tagging Hagerman NFH program fish in 2008. Additional monitoring and evaluation (M&E) costs include $1.3 million distributed among the operating agencies for all LSRCP programs. Additionally, $62,952 (FY2008) were provided by the LSRCP for fish health monitoring. Capital improvements to Hagerman NFH totaled $941,012 for FY2004- 2008. One million of this total was provided by the Service construction fund for the construction of a new hatchery building.

Hagerman State Fish Hatchery (IDFG)

Hagerman State FH is located about 4 miles (6.5 km) south of Hagerman on highway 30. The purpose of the hatchery is to support resident recreational fisheries in Idaho. A large hatchery building housing 28 rectangular vats is used to incubate eggs and rear juvenile fish. The hatchery also includes 18 nursery raceways and 24 large raceways. The hatchery has four hauling vehicles of various sizes to stock the fish in lakes and rivers across the state. Water for the hatchery is supplied from Tucker Springs and Riley Creek. Hagerman State FH uses about 120 cubic feet per second of water to rear about four to five million fish. Of this total the Hagerman State FH diverts up to 69 cubic feet per second of water from Riley Creek below the outfall of the Hagerman NFH. A water chiller can decrease the temperature of 10,000 gallons of water in two storage tanks from 59 degrees F. to 42 degrees F. in about two hours. All rainbow trout released from Hagerman State FH are sterile (induced triploidy) to preclude potential interbreeding with natural populations. The hatchery also rears coho salmon, obtained annually from Eagle Creek NFH in the lower Columbia River regions, for stocking in Cascade Reservoir. Small numbers of steelhead are also reared. Four permanent hatchery personnel and one transport operator work at the hatchery. Funding for the hatchery is provided from the sale of recreational fishing licenses.

Magic Valley Fish Hatchery (IDFG - LSRCP Facility)

Magic Valley FH is located in the Thousand Springs area of the Snake River, seven miles (11 km) northwest of Filer, Idaho. The hatchery is operated by IDFG though a cooperative agreement with the Service. Magic Valley FH was authorized under LSRCP through the Water Resources Development Act of 1976, Public Law 94-587, to mitigate for fish losses caused by the construction and operation of the four hydropower dams on the lower Snake River. The hatchery consists of an incubation area and early rearing room containing 20 rearing containers, 32 large outside raceways, and two large settling ponds for effluent. When available, the hatchery can use a maximum 125 cubic feet per second of 59°F water from Crystal Springs, which is part of the Thousand Springs located on the north shore of the Snake River. The output of this spring is greatly diminished and continues to decline due to water level decline in the Eastern Snake Plain Aquifer. The current purpose of the hatchery is to rear approximately two million steelhead yearling smolts to a mean length of 8.3 inches for a total of

450,000 pounds of fish annually. The majority of those fish are used to help sustain runs of steelhead in the Salmon River and its tributaries.

The current personnel plan for the hatchery lists four full-time employees and up to two, 8-month temporary employees. The annual operation and maintenance (O&M) budget (FY2009) for the hatchery is $429,739 from the LSRCP and BPA. Total IDFG costs for monitoring and evaluation (M&E) of Idaho LSRCP activities in FY2009 are approximately $1,447,258 and include ~$700,00 for tagging and marking. Capital improvements to Magic Valley FH totaled $162,591 during the period 2004- 2008.

Niagara Springs Fish Hatchery (Idaho Power Company, IDFG)

The Niagara Springs FH is located on the Snake River ten miles (16 km) south of Wendell, Idaho. Niagara Springs Hatchery is one of four hatcheries which Idaho Power Company (IPC) owns and IDFG staffs and operates to mitigate for the construction and operation of three hydropower dams in the Hells Canyon region on the Snake River. The hatchery consists of an indoor nursery area, outdoor rearing raceways, and two flow-through settling ponds. Spring water supplies 21 upwelling incubators and 21- 60 $ft.^3$ rectangular vats for the hatching and early rearing of fry. The outdoor rearing space consists of 19 – 300 ft. x 10 ft. raceways which are supplied by constant temperature, gravity flow, spring water. Two flow-through settling ponds (150 ft x 60 ft) are provided to remove settable solids from the hatchery effluent water. The current purpose of Niagara Springs Hatchery is to rear 400,000 pounds of yearling steelhead smolts annually to sustain steelhead trout runs in the Snake River below Hells Canyon Dam and the Salmon River and its tributaries.

Sawtooth Fish Hatchery (IDFG - LSRCP Facility)

Sawtooth FH is an anadromous fish hatchery located five miles (8 km) south of Stanley, Idaho on the Salmon River adjacent to State Highway 75. The hatchery was constructed in 1985 as part of the LSRCP. Sawtooth FH consists of an incubation and early rearing room, six small outside raceways, 14 large outside raceways, and an adult spawning facility. The Salmon River and two production wells supply fish culture water to the hatchery. River water is distributed to indoor vats, outside raceways and the adult spawning facility. Well water is used for egg incubation and early-rearing of hatched fry. Sawtooth FH traps, spawns and rears spring Chinook salmon to smolt stage for release. A-run steelhead trout are also trapped and spawned, but the eggs are incubated only to the eyed-embryo stage and then transferred to Hagerman NFH and Magic Valley FH for hatching and grow-out to the yearling smolt stage. The facility also traps and rears sockeye salmon as part of the recovery plan for this species in Redfish Lake. Catchable rainbow trout and native westslope cutthroat trout are also held at the hatchery for stocking into lakes and streams.

The current personnel plan for the hatchery lists five full-time employees. The annual operation and maintenance (O&M) budget (FY2009) for the hatchery is $725,724 from the LSRCP and BPA. Total IDFG costs for monitoring and evaluation (M&E) of Idaho LSRCP activities in FY2009 are approximately $1,447,258 and include ~$700,00 for tagging and marking. Capital improvements to Sawtooth FH totaled $645,192 during the period 2004- 2008.

Rapid River Fish Hatchery (Idaho Power Company, IDFG)

Rapid River FH is located on the Rapid River, a tributary of the Little Salmon River, seven miles (11 km) southwest of Riggins, Idaho. The hatchery was constructed in 1964 by Idaho Power Company as partial mitigation for construction and operation of Brownlee, Oxbow, and Hells Canyon dams on the

Snake River. IDFG operates the hatchery with funding provided by Idaho Power. The Rapid River watershed upstream of the hatchery is protected as part of the Wild and Scenic Rivers Act. Culture facilities at the hatchery include 50 double vertical stack egg incubators, 12 outdoor concrete raceways, and six earthen rearing ponds with concrete side walls. Holding facilities for adult salmon broodstock consist of one concrete holding pond and one earthen holding pond. These holding ponds provide space for up to 4,000 adult salmon prior to spawning. The facilities also include an adult fish trap located on Rapid River approximately 1.5 miles downstream from the hatchery. The trap facility allows unimpeded migration of anadromous and resident fish around the velocity barrier. when trapping operations are not in progress. Idaho Power Company has also constructed a facility at Hells Canyon for trapping adult steelhead and Chinook salmon from the Snake River. Salmon from the Hells Canyon Trap are transported to Rapid River FH for spawning and rearing. The primary purpose of the Rapid River FH is to propagate a unique stock of spring Chinook salmon derived ancestrally from fish native to the Snake River upstream from the Hells Canyon Dam complex.

The Hells Canyon Hydroelectric Dam complex blocked access to habitat upstream from the dams and the entire remaining population of Spring Chinook salmon from the middle Snake River were trapped and transported to Rapid River as the broodstock source for this program. The goal of this program is to produce 3 million smolts annually for release. Recent Chinook returns from Rapid River FH have produced fish for sport and tribal harvest.

McCall Fish Hatchery (IDFG - LSRCP Facility)

McCall FH, located on the North Fork Payette River adjacent to Payette Lake in McCall, Idaho, was completed in 1981. The McCall FH is located on a site formerly occupied by an IDFG trout hatchery, that was selected for a site for salmon production because it was accessible year around, had a known water supply, and suitable infrastructure was available to support construction and operation of the facility. Adult collection and spawning is conducted at the South Fork Salmon Satellite, located near Warm Lake on the South Fork Salmon River approximately 50 miles (80 km) southeast of the hatchery.

McCall Fish Hatchery is part of the LSRCP, a goal of which is to return 8,000 summer Chinook salmon above Lower Granite Dam to mitigate for survival reductions resulting from construction and operation of the four lower Snake River dams.

The current personnel plan for the hatchery lists ??? full-time employees. The annual operation and maintenance (O&M) budget (FY2009) for the hatchery is $476,570 from the LSRCP and BPA. Total IDFG costs for monitoring and evaluation (M&E) of Idaho LSRCP activities in FY2009 are approximately $1,447,258 and include ~$700,00 for tagging and marking. Capital improvements to McCall FH totaled 1,057,879 during the period 2004- 2008.

Pahsimeroi Fish Hatchery (Idaho Power Company, Idaho Department Fish and Game)

Pahsimeroi FH, is owned and operated by Idaho Power Company (IPC) and located in the Pahsimeroi River watershed. The IDFG operates the facility under contract and produces summer Chinook salmon and steelhead. The facility was constructed in the mid-1960s as part of the Idaho Power's mitigation for anadromous fish production lost to construction and operation of Brownlee, Oxbow, and Hells Canyon dams on the Snake River. Originally it was a trapping and spawning facility for summer steelhead and an acclimation facility for steelhead smolts reared at IPC's Niagara Springs FH. Following implementation of the Hells Canyon Settlement Agreement in 1980, the role of Pahsimeroi FH was expanded to include the production of one million summer Chinook salmon smolts annually.

The Pahsimeroi FH is comprised of upper and lower hatchery components. The lower component is located on the Pahsimeroi River approximately one mile (1.6 km) above its confluence with the main Salmon River near Ellis, Idaho. The upper component is located approximately seven miles (11.3 km) further upstream from the lower facility on the Pahsimeroi River. This facility was completely renovated by Idaho Power in 2006-07 to reduce the impacts of whirling disease on hatchery reared fish. The IDFG operates the facility under contract and produces summer Chinook salmon and steelhead.

Oxbow Fish Hatchery (Idaho Power Company, Idaho Department Fish and Game)

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

Hagerman NFH B-run Steelhead

Operator: U.S. Fish & Wildlife Service

Summary of Current Program

Goals

- ***Harvest goal:*** The program does not have a quantified harvest goal at the present time. The LSRCP adult return goal for A-run and B-run steelhead reared at Hagerman NFH and released in the Salmon River is to return 13,600 adult steelhead to the Snake River Basin upstream of Lower Granite Dam. This LSRCP mitigation goal was calculated based on a "catch downstream of Lower Granite" to "escapement upstream of Lower Granite" ratio of 2:1 (commercial catch of 0.67:1 and sport catch 1.33:1).

- ***Broodstock escapement goal***: Not applicable. Broodstock are not collected at Hagerman NFH or in the Salmon River basin for the Hagerman B-run steelhead program. Rather, Hagerman NFH annually receives 215,000 eyed eggs that are the progeny of steelhead trapped and spawned at Dworshak NFH. Fertilized eggs are incubated to the eyed stage at Clearwater Hatchery and then transferred to Hagerman NFH.

- ***Conservation goal***: The program does not have a specified conservation goal. The sole purpose of the program is to support fisheries in the Salmon River.

- ***Escapement goal for natural-origin adults***: Specific escapement goals for natural-origin steelhead - where Dworshak NFH B-run steelhead are released in the Salmon River - have not been established. Native populations of B-run steelhead do not occur in regions of the Salmon River where Dworshak NFH steelhead are currently released. Native populations of *B-run* steelhead do occur in the Middle and South Forks of the Salmon River, but those rivers are managed as wild steelhead sanctuaries with no releases of hatchery-origin steelhead.

- **Research, education, and outreach goals:** Provide a proactive outreach program to increase visibility of Hagerman NFH. Encourage a partnership of Idaho U.S. Fish & Wildlife Service facilities to fund an outreach coordinator, and coordinate with other federal, state, and local information/public affairs offices to incorporate information about Hagerman NFH and the mission of the Service.

Objectives

- Obtain 215,000 Dworshak NFH B-run steelhead eyed eggs from the Clearwater Fish Hatchery. Steelhead eggs are fertilized at Dworshak NFH and then transferred to Clearwater Fish Hatchery for initial incubation prior to transfer as eyed eggs to Hagerman NFH. Approximately 40 adult female steelhead need to be trapped and retained annually for broodstock at Dworshak NFH to specifically meet the 215,000 eyed egg objective. A total of approximately 150 adults need to be retained for broodstock to achieve 1:1 pairwise spawning of males and females because females outnumber males by an approximately 3:1 ratio and to account for pre-spawning mortality.

- Incubate eyed eggs and rear resulting fish to yield 200,000 yearling *B-run* steelhead smolts annually for transport and release into the Salmon River Basin. Release 100,000 yearling B-run steelhead smolts into the East Fork Salmon River and 100,000 yearling steelhead smolts into the Little Salmon River. In coordination with the Service and other cooperating agencies, the Idaho Department of Fish and Game (IDFG) is responsible for developing and managing smolt release strategies, monitoring and evaluation activities, and assessing adult returns and fishery contributions in the Snake and Salmon rivers.

Program Description

The Hagerman NFH B-run steelhead program is intended to support fisheries in the Salmon River basin to mitigate for fish losses associated with four dams on the lower Snake River. The Hatchery receives Dworshak steelhead eyed eggs from Clearwater Fish Hatchery via broodstock collected and spawned at Dworshak NFH. Eggs are incubated to the eyed stage at Clearwater Fish Hatchery, are transferred to Hagerman NFH for hatching and rearing, and then transported and released as yearling smolts into the Salmon River basin. These fish were previously stocked back into the Clearwater River Basin. However, the discovery of New Zealand mud snails (*Potamopyrgus antipodarum)* in the water supply at Hagerman NFH prevents transfers from Hagerman NFH to the Clearwater River basin because *P. antipdarum* are absent from that watershed. As a result, beginning in 2004, Dworshak steelhead reared at Hagerman NFH are now released into the Salmon River to support harvest. In addition, 830,000 Dworshak steelhead eyed eggs are transferred annually from Clearwater Fish Hatchery to the Magic Valley Hatchery (Idaho Department of Fish and Game) for release of an additional 630,000 yearling smolts into the Salmon River. Both programs (Hagerman NFH and Magic Valley FH) continue to rely on the annual transfers of eyed eggs from the Clearwater River basin.

Assessment of Current Program

Operational Considerations

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

Broodstock Choice and Collection

- Eyed eggs for Hagerman NFH B-run steelhead are derived from broodstock collected at Dworshak NFH. The fertilized eggs are incubated initially at Clearwater FH and then transferred as eyed eggs to Hagerman NFH.

- Dworshak NFH B-run steelhead are included in the Snake River Steelhead ESU which is currently listed as *threatened* under the ESA.

Hatchery and Natural Spawning, Adult Returns

- B-run steelhead are native to the Middle and South Forks of the Salmon River, which are managed as wild steelhead sanctuaries with no releases of hatchery-origin steelhead; B-run

steelhead are not native to the upper Salmon River, East Fork Salmon River, or Little Salmon River where hatchery steelhead are released.

- Releases of Dworshak NFH B-run steelhead from Hagerman NFH into the E.F. Salmon and Little Salmon rivers (100k each annually) began in the spring of 2004 with expected adult returns beginning in 2005 (2-year old fish) and 2006 (3-year old fish).

- Dworshak B-run steelhead returning to the E.F. Salmon River support a valuable fishery to the Shoshone-Bannock Tribes. These fish are readily accessible to tribal fishers who use traditional tribal fishing methods.

- In 2007, PIT tags were applied to 300 fish of each group released into the Little Salmon and East Fork Salmon rivers. The 2007 release year was the first in which these fish were tagged with CWT's (East Fork Salmon River only; no CWT's in Little Salmon River releases). Idaho Department of Fish and Game is responsible for processing CWT data to determine contributions to fisheries.

- Current IDFG reports for harvest data are 5+ years out of date. Sampling rates in many sections are currently inadequate to accurately estimate harvest of B-run steelhead in Idaho to determine the benefit of the program. Harvest outside of Idaho is not included in the reports.

- Dworshak NFH B-run steelhead released into the Salmon River have been evaluated from smolts reared at Magic Valley FH. Estimated adult return rates for release years 1994-1998 suggest that Dworshak B-run steelhead outplanted into the upper Salmon River return at approximately 10-15% of the rate of A-run steelhead released into the Salmon River.[93]

- Unpublished data indicate that Dworshak B-run steelhead returned to the Salmon River at approximately 30% of the rate of A-run steelhead for brood years 2002 and 2003 (Sam Sharr, Idaho Department of Fish and Game, personal communication).

Incubation and Rearing

- Hagerman NFH receives 215,000 eyed eggs from Clearwater Fish Hatchery. Eyed steelhead eggs are shipped after attainment of 370 to 450 temperature units (TUs) of incubation. Shipments occur in May and June.

- Upon arrival at Hagerman NFH, the eyed eggs are disinfected in a standard 100 ppm iodine solution for 10 minutes. The eggs are enumerated (Von-Bayer or displacement method) and loaded into upwelling jars at approximately 20,000 eggs per jar. The jars are supplied with 59°F spring water at a flow rate of 6 to 8 gpm. Eggs are kept separate by spawn date to ensure synchronous hatching of eggs within individual jars. Hatching usually occurs within three to five days after receipt at Hagerman NFH.

[93] *Hanson, J., and M. White. 2003 and 2004. Evaluation of Idaho steelhead harvest for Lower Snake River Compensation Plan Hatchery Programs. IDFG Report Numbers 03-58 and 04-49. Idaho Department of Fish and Game, Boise, Idaho. Hanson, J. 2005. Evaluation of Idaho steelhead harvest for Lower Snake River Compensation Plan Hatchery Programs. IDFG Report Numbers 05-43. Idaho Department of Fish and Game, Boise, Idaho.*

- Hagerman NFH incubates, hatches, and rears three stocks of steelhead: Dworshak NFH B-run steelhead, Sawtooth A-run steelhead, and Pahsimeroi A-run steelhead. Typically, the Sawtooth stock is reared in Hatchery Building 1, and the Pahsimeroi and Dworshak stocks are reared in Hatchery Building 2.

- Hatched fry are initially transferred from incubators into indoor nursery tanks. Feeding is initiated in the indoor tanks when 80% of the fry have absorbed their yolk sacs and have achieved swim-up.

- Feeding typically begins 15 to 17 days post-hatch. Semi-moist salmon diets are hand fed at a minimum frequency of once per hour (six to eight times/day) during rearing in the nursery tanks in the hatchery buildings. Water flows in the nursery tanks are initially set at 10 gpm Flows are progressively increased to 60 gpm as the fish grow. Density and flow indexes in the nursery tanks are maintained below maximum values of D.I. = 0.80 and F.I. = 1.00, respectively.

- Dworshak NFH B-run steelhead are held in Hatchery Building 2 until transferred to outside raceways.

- Fish are hand fed in the nursery tanks and are continued on hand feeding until fish start on 1/8 pellet at which time demand feeders are used until release.

- Fish are transferred to outside raceways as subyearlings in August at approximately 100 fish per pound. Marking and tagging occurs during the transfer. Fish from ten nursery tanks are distributed to nine outside raceways in the lower of three raceway "decks" with the goal that final rearing densities prior to transport and release will be within culture guidelines. Fish are transferred to outside raceways before marking if rearing densities in the nursery tanks exceed the facility's maximum density index guidelines before marking can be performed.

- A study of broodyear 2007 steelhead reared at Hagerman NFH indicated an incremental increase in mortality when comparing unmarked to marked and/or tagged fish. Mortality for steelhead after marking and tagging, until release, was as follows: 1.89% unmarked, 3.18% adipose-fin clipped, 4.62% PIT tagged, and 6.79% adipose-fin clipped/coded-wire tagged.

- During the entire outside rearing cycle, all raceways are cleaned (swept) twice weekly. Fish are sampled monthly to estimate mean size and growth rate. Length frequency checks are done periodically and just prior to release.

- *Nucleospora salmonis*, a microsporidean parasite that is endemic to the Hagerman Valley, is annually detected in the station's fish. The Idaho Fish Health Center continues to investigate the fish health risks associated with this parasite which impairs the immune system of fish and results in a leukemia-like condition. The parasite can be transmitted directly to uninfected fish via ingestion of infected tissues and by cohabitation with infected fish.[94] In addition, a yearlong investigation correlated the parasite's presence and timing of appearance in the on-station fish and the Pebble snails, a native snail population. It was not found in the invasive New Zealand mud snail, a non-native aquatic nuisance species.

[94] *Georgiadis, MP, I. Gardner, and RP Hederick. 1998. Field evaluation of sensitivity and specificity of a polymerase chain reaction for detection of Nucleospora salmonis in rainbow trout. J. Aquatic Animal Health 10:372-380.*

- Dworshak NFH B-run steelhead suffer from "soreback" syndrome in the fall a cause of mortality. Beginning in October, *Nucleospora salmonis* is detected in the fish and, in concert with nipping behavior, dorsal fin erosion and opportunistic bacteria like *Aeromonas hydrophila*, may contribute to the "soreback" syndrome. Clinical signs indicate that the Dworshak NFH B-run steelhead stock is more susceptible to this syndrome than "A-run" steelhead reared at Hagerman NFH.

- Dworshak NFH B-run steelhead exhibit increasing cumulative mortality (1.5-4.0% monthly mortality) beginning in late January and extending through April (prior to export and release) relative to the Pahsimeroi and Sawtooth A-run stocks which show little to no increase in mortality during this time period. The Idaho Fish Health Center is investigating the role of *N. salmonis* and other possible pathogens as potential causes for this mortality which had been named the "B syndrome" after the B run Clearwater stock.

- Density indexes in the outside raceways are maintained below a maximum value of D.I. = 0.20. Flow indexes in the outside raceways are adjusted according to mean fish size at F.I. = 0.8, 1.00 and 1.2 for mean size less than 80 fish per pound (fpp), between 80 and 15 fpp, and greater than 15 fpp, respectively.

- NOAA Fisheries guidelines under the ESA require the release of summer steelhead at lengths ranging from 180 to 250 mm. The constant 59 degree Fahrenheit rearing water temperature promotes rapid fish growth. During winter, feeding is restricted to every other day and to every third day to reduce growth rates so that fish do not exceed the desired target sizes for steelhead in the spring at the time of release.

- A pathologist from the Idaho Fish Health Center examines fish of each stock and broodyear every two months to ascertain presence of pathogens and signs of disease. Hatchery staff send fish samples to the lab on an as needed basis.

- Chemical treatments for disease were used in the past but with limited success. Florfenicol was used unsuccessfully in an attempt to treat *Aeromonas salmonicida* (furunculosis) in early 2000's. Consequently, chemical treatments are currently used only as necessary and rarely since the mid-1990's.

- Exclusion of birds from raceways after addition of bird netting substantially reduced the incidence of furunculosis and IHNV.

Release and Outmigration

- The desired release size of steelhead smolts is 180 to 250 mm in length (220 mm is the mean target length) per guidelines established by NOAA Fisheries. The target release size is intended to correspond to optimum smolt size that minimizes residualism and potential impacts of hatchery-origin steelhead on natural populations, particularly those that are listed under the ESA. The target release size corresponds to 4.5 fish per pound.

- Fish are released at two sites: The release of Dworshak NFH B-run steelhead is restricted to the Salmon River due to the presence of the New Zealand mudsnail. This exotic (non-native) and highly invasive snail was discovered circa 2002 in the spring water supply for the hatchery.

- Smolts are transported from Hagerman NFH to the Salmon River basin in tractor-trailer semi-trucks carrying 5,000 gallon capacity fish transport tanks. Transportation and release Dworshak NFH B-run steelhead begin in early April and continue throughout the second week of May. The Hatchery follows IHOT fish transportation guidelines which adjusts truck loading based on tank water volume, fish size, water temperature, and time in transport.

- During the initial years of the A-run steelhead program (next section), fish were transported earlier in the season and acclimated at the Sawtooth Fish Hatchery prior to release. At that time of the year, water temperatures at Sawtooth Hatchery were much lower than desired and the acclimated fish appeared to have problems with stress and disease (e.g. enteric redmouth disease, ERM). Fish transportation for both A and B-run steelhead is now later in the season and a direct release without acclimation to reduce the temperature difference between Hagerman NFH and the Salmon River. Some concerns still exist regarding stress level at time of release. For example, a possible change in gas pressures in the transport tank as the fish are hauled over Galena Pass. This pass is at ~8700 feet elevation the change in gas pressure may be exacerbated during a low pressure storm event.

- Prior to 2004, Dworshak NFH B-run steelhead reared at Hagerman NFH were released into the Clearwater River, the source watershed for that stock. Hagerman NFH released 200,000 B-run steelhead smolts annually into the S. F. Clearwater River for supplementation (0% AD-clipped) from 2001 through 2003, and thus returning adults were unavailable to mark selective fisheries.

- Beginning in 2004 (BY 2003) Dworshak NFH B-run steelhead reared at Hagerman NFH were released into the East Fork Salmon River (100,000 smolts) and Little Salmon River (100,000 smolts) for harvest purposes (100% AD-clipped). Fish released at both locations in 2004-2006 were not coded wire tagged. The East Fork release in 2007 had 30k CWT's and the Little Salmon release had no CWT's. Dworshak NFH B-run steelhead are now released into the Salmon River because of (a) the discovery of New Zealand mud snails in the spring water supply for Hagerman NFH and (b) the absence of New Zealand mud snails in the Clearwater River basin but their presence in the Salmon River basin.

- Although the parasite, *Myxobolus cerebralis*, which causes whirling disease, is present in the Salmon River drainage, steelhead reared at Magic Valley FH and Hagerman NFH are released into the Salmon River at a size larger than when they would be susceptible to the parasite.

Facilities and Operations

- The hatchery has 78 outside raceways in use currently: 66 raceways rear steelhead for the LSRCP and 12 raceways rear rainbow trout for other programs.

- The water supply for the hatchery is a complex system of 17 springs diverted via 8 major diversions, through approximately two miles of pipelines. The water temperature is a constant 59 degrees F. and a combined average flow rate of approximately 29,000 gallons per minute (~65 cfs).

- .The hatchery intake structures for three of the springs (Bickel, Riley, and the Main spring) have wire mesh screening, while the intake for the fourth spring (Brailsford) uses a perforated plate to separate debris from the water prior to entering the hatchery. The screens are checked and cleaned daily and in the evening during scheduled overtime "night rounds". Screening to protect anadromous or ESA listed fish is not necessary because those fish do not inhabit the springs.

- The spring water sources for the hatchery span several hundred yards of basalt rock escarpment of the Snake River channel. To collect this water, the water delivery system for the hatchery has evolved into a complex system of ponds, concrete catch basins, weirs, collection boxes, various valve and stop-log control structures, and associated pipelines. All water used for rearing fish is delivered via gravity flow. This system requires 25 individual points of measurement to accurately quantify water use. Water use is measured weekly and reported annually, as required, to the Idaho Department of Water Resources (IDWR).

- The Hatchery staff must work closely with downstream water users in the Riley Creek watershed to ensure their water needs are met. To supply water to downstream users, the Hagerman NFH operates and maintains two pump stations to meet water delivery requirements. In the case of the Brailsford Ditch Association, a senior water appropriator on Spring 16 (Len Lewis Spring), water diversion from this spring must be consistent with a Snake River Basin Adjudication Court approved water management agreement negotiated by the Department of Justice in 1997. Implementation of this agreement requires the Hagerman NFH to maintain, and when required, operate the 250-hp Riley Creek Pumpback System. In the case for water diverted to the Bickel Ditch (a subordinate water right), which serves the needs of the IDFG for its operation of the Hagerman Wildlife Management Area and the Oster Lakes fishing area, water may be diverted either from Main Spring, via pipeline at the Main Spring diversion dam or via two 20-hp pumps located in the tail box. Operations more specific to implementing these diversions are described in the hatchery's intranet SOP website.

- Effluent water carrying cleaning wastes from nursery tanks and outside raceways is diverted to an off-line settling basin system where solids are removed prior to discharge into Riley Creek. Effluent water from the hatchery is monitored according to requirements of the NPDES permit.

- The requirements associated with the NPDES and TMDL permitting for Hagerman NFH are more rigorous than hatcheries located in the Clearwater and Salmon River basins because the mid-Snake River reach has been identified as "water quality limited" under the Clean Water Act.

- Because of its seasonal pattern of production the hatchery exceeds is average daily waste load allocation for phosphorous during peak steelhead production (January to April). The Idaho Department of Environmental Quality and the US. Environmental Protection agency approved a seasonal waste load allocation for phosphorous which allows the hatchery to remain in compliance when effluent phosphorus results are averaged for the entire year. The regulating agencies also allow a seasonal pattern for solids, however, the hatchery has no difficulty in complying with the effluent requirements for solids.

- Output from the spring water supply has decreased in recent years and continues to decrease. The loss of flow may necessitate reducing the number of fish reared at Hagerman NFH if the trend continues. As an example, water flows from two of the hatchery's diversions, Riley Creek Spring and Bickel Spring Creek, decreased 9.6% and 21.5%, respectively, from 1974 to 1994. At the present time, spring flows for the hatchery's water supply during winter (Dec – Mar, 2006) are approximately 14% (12.7 cfs) below the water right for the hatchery and were observed to be declining at a rate of approximately one cubic foot per second (1 cfs) per year between 1999 and 2006.

- Some modifications to the water delivery system or use may be required in the future to deal with the decreasing water supply at Hagerman NFH. For example, the current method of

cleaning raceways requires a substantial amount of water, and more efficient methods that require less water may be necessary.

- An electric weir exists on Riley Creek, the outlet stream from the hatchery, but the weir has not been operated for several years because of its location in an area that is accessible by the public. The weir was intended to prevent fish from swimming upstream into the hatchery.

- The springs and water courses at Hagerman NFH provide refuge for the Bliss Rapids Snail (*Taylorconcha serpenticola*) which is listed as *threatened* under ESA. The hatchery is currently undergoing ESA Section 7 consultations and will be developing a management plan for protecting the Bliss Rapids Snail while allowing the hatchery to continue its federally mandated mitigation activities under the LSRCP.

Research, Education, and Outreach

- As a cooperator under the LSRCP, IDFG provides monitoring, evaluation, and coordination services concerning steelhead programs at Hagerman NFH. The IDFG staff monitors biological characteristics of the hatchery stock, fish marking, tag recovery, contributions to fisheries, and other aspects of the hatchery program. The Service maintains the database that stores this information and serves as a link to databases maintained by other entities. The Idaho Fishery Resource Office (USFWS; Ahsahka, ID) also cooperates with the Hagerman NFH, Idaho Fish Health Center (USFWS; Ahsahka, ID) , Abernathy Fish Technology Center (USFWS; Longview, WA), and LSRCP co-managers to evaluate fish culture practices, assess impacts to native species, and coordinate hatchery programs both locally and regionally.

- The annual IDFG Steelhead Mark Plan establishes the umbers of fish to be marked, mark type, and release location of marked groups. This plan incorporates the results from other agreements and processes such as U.S. vs. Oregon. Generally, all 200,000 Dworshak NFH B-run steelhead reared at Hagerman NFH are marked with clipped adipose fins. In addition, starting in 2008, a representative number of fish destined for each release site will receive PIT tags: 3,810 and 1,890 fish will be PIT tagged for release in the Little Salmon and East Fork Salmon rivers, respectively, for assessing downstream survival and adult returns to Lower Granite Dam. Marking and coded-wire tagging occurs in mid August 2007 when fish are transferred from the indoor nursery tanks to outdoor raceways. Marking is coordinated with Niagara Springs FH, Magic Valley FH, and the IDFG marking crew. The IDFG marking crew conducts PIT tagging in late winter.

- The IDFG steelhead marking plan in 2008 for the Salmon River incorporates representative PIT tags for all release sites to assess both juvenile outmigration to Lower Granite Dam and adult returns to the Columbia and Snake Rivers. Unfortunately, funds were not sufficient to fully represent every release group (12,000 PIT tags per release) for assessing both outmigration and adult returns to Lower Granite Dam. Instead, IDFG grouped similar PIT tagged groups to have adequate levels of PIT tags (12,000 tags) to assess adult returns back to Lower Granite Dam. This latter approach is considered a major improvement over past tagging strategies.

- The release of 100,000 B-run steelhead smolts from Hagerman NFH into the Little Salmon River at Stinky Springs include will include 3,810 PIT-tagged fish. This release will be combined statistically with the release of 215,000 B-run steelhead smolts from Magic Valley Fish Hatchery into the Little Salmon River at Stinky Springs, of which 8,190 fish will be PIT-tagged. Adding the two groups together yields a combined total of 12,000 PIT-tagged B-run

steelhead smolts released into the Little Salmon River at Stinky Springs to assess adult return rates and survival.

- The release of 100,000 B-run steelhead smolts from Hagerman NFH into the East Fork Salmon River will include 1,890 PIT-tagged fish and will be combined statistically with five separate releases of B-run steelhead smolts from Magic Valley Fish Hatchery into the East Fork Salmon River and Squaw Creek, each of which will include PIT-tagged fish (10,110 PIT-tagged fish in total), to yield a combined total of 12,000 PIT-tagged B-run steelhead released into the upper Salmon River for assessing adult returns back to Lower Granite Dam.

- In the past, the number of Dworshak NFH B-run steelhead released in the Salmon River with PIT tags was only sufficient to assess time of travel and survival of smolts to Lower Granite Dam. Those numbers were insufficient to assess adult return rates back to Lower Granite Dam.

- Hagerman NFH maintains an active internet website that is an important source of information to the public and cooperators. Monthly activity reports, annual station reports, and associated research reports are posted on the hatchery's website. These reports also provide a mechanism for hatchery staff to be well-informed about policies, procedures, and issues at Hagerman NFH.

- On station outreach activities include self guided tours for individuals and guided tours for groups when requested. An information station directs visitors via signs to the various areas of the hatchery. An interactive touch-screen computer kiosk and brochure rack allow visitors to get more detailed information about the hatchery and its programs. The Hagerman Fifth Grade Class visits Hagerman NFH annually for a two to three day outdoor education experience.

- The hatchery actively solicits volunteers to serve as hatchery hosts to answer questions and disseminate general information. Volunteers are encouraged to stay at the hatchery in their personal recreational vehicles on a full utility hook-up site.

- Hagerman NFH and IDFG collaboratively host a Free Fishing Day event at the Hagerman State Fish Hatchery. The state fish hatchery is a more suitable site than Hagerman NFH for this event. Local sporting goods vendors, Boy Scouts, and interested citizens provide additional support for the event.

- The University of Idaho, Hagerman Fish Culture Experiment Station is located on two 2-acre parcels within the boundaries of the Service owned property at the hatchery.

Benefit and Risk Assessment[95]

BENEFITS CONFERRED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

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

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

Harvest Benefits

- None identified. Fish are not released in the Snake River in the immediate vicinity of Hagerman NFH.

Conservation Benefits

- None identified.

Research, Education, Outreach and Cultural Benefits

- Hagerman NFH has an active Hatchery Evaluation Team, and research appears to be an important component of culture activities (e.g., results comparing the on-station growth and survival of A-run and B-run steelhead as a function of rearing location within the three-tiered raceway configurations at Hagerman NFH).

- Hagerman NFH provides educational and outreach benefits to the surrounding community. Staff participate in local community events.

- The development of the University of Idaho's Hagerman Fish Culture Experiment Station provides additional outreach opportunities.

BENEFITS CONFERRED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

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

Harvest Benefits

- The harvest benefit of rearing Dworshak NFH B-run steelhead at Hagerman NFH and releasing those fish in the Salmon River has not been accurately quantified. Those releases began in 2004, and fish released from 2004 to 2007 were not given coded-wire tags. Of the 100,000 fish released in 2008 into the Little Salmon River and the East Fork Salmon River respectively, 30,000 fish of each release group carried coded-wire tags, thus allowing contributions to harvest to be first evaluated during the summer of 2009.

- Data on harvest of steelhead from Hagerman NFH in downstream Columbia River fisheries is limited. For all Snake River steelhead stocks combined, in the most recent 10 years of record (1996-2005), the mainstem harvest rate on A-run steelhead has ranged from 2.5% to 10.4%, averaging 5.3%. The B-run steelhead harvest in the mainstem has ranged from 3.4% to 34.6%, averaging 13.2%. B-run steelhead are harvested at a higher rate because run timing overlaps coho and fall Chinook and the zone 6 harvest gear is gill nets that select for larger fish[96].

- Dworshak NFH B-run steelhead released from Magic Valley FH into the Salmon River (approximately 630,000 yearling smolts annually) have contained CWT groups to estimate harvest contributions in the Salmon River. Estimated smolt-to-adult survivals have ranged from 0 to 0.26% smolt to adult survival to the Salmon River. Based on a maximum return rate of

[96] *Pete Hassemer, IDFG, Pers. Comm.*

0.26%, the maximum number of steelhead returning from the release of 100,000 smolts would be 260 fish.

- Dworshak NFH B-run steelhead are harvested by the Nez Perce Tribe and Shoshone Bannock Tribes for subsistence and ceremonial purposes.

Conservation Benefits

- Decaying steelhead carcasses provide nutrient benefits and forage opportunities for other species in streams in which hatchery-origin steelhead return.

- The springs and water courses at Hagerman NFH provide refuge for the Bliss Rapids Snail (*Taylorconcha serpenticola*) which is listed currently as *threatened* under ESA.

Research, Education, Outreach and Cultural Benefits

- Tribal harvest provides a cultural benefit to the Columbia River tribes.

- Hatchery staff provide educational and outreach opportunities offsite to other communities.

- The Nez Perce Tribe, IDFG and Shoshone-Bannock Tribes participate in research associated with this program.

RISKS POSED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

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

Genetic Risks

- None identified.

Demographic Risks

- Fish rearing densities in the indoor nursery tanks exceed guidelines, thus increasing fish health risks.

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

- Crowding and loading of fish onto trucks for transportation may injure the fish, thereby reducing post-release survival.

- Long-distance transportation of fish over mountain highways to release sites in April poses a demographic risk to the stock during transport (e.g., risk of a vehicle accident). Long distance transportation also poses an unknown physiological risk resulting from stress during transport and following release.

- Decreasing spring flows and water supply, including degrading pipelines, increases fish health risks.

- Reduced feed rations during winter, designed to slow growth rates to compensate for warm water temperatures and meet the release size criteria (180mm to 250mm) of NOAA Fisheries for steelhead, may impose a physiological stress on growing fish and thereby increase fish health risks (e.g. "soreback").

- The release locations above four Columbia River and four Snake River dams significantly reduces the survival of outmigrating juveniles and returning adults, posing a demographic risk to the return of sufficient numbers of adults for harvest and broodstock on a consistent basis.

Ecological Risks

- The presence of *Nucleospora salmonis* in the water supply poses a fish health risk to steelhead reared on station. This parasite can be directly transmitted from infected fish to uninfected fish via ingestion and cohabitation. The original source or origin of the parasite in the water supply is unknown although it has been found in Pebble snails, a native species (not listed under the ESA) occurring in the spring water source for the hatchery.

Physical Risks

- The specific location of the electric weir in Riley Creek (downstream of the facility) would pose a human health and safety risk to tourists and recreationists in the area if the weir was energized. Because of this risk, electricity to the weir has remained off continuously, and the weir has been non-functional for over 10 years.

Research, Education, Outreach and Cultural Risks

- None identified.

RISKS POSED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

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

Genetic Risks

- Outplanting of Dworshak NFH B-run steelhead into the Salmon River basin poses an unknown genetic risk to ESA-listed natural populations. According to the Interior Columbia Technical Recovery Team (TRT), the Salmon River steelhead major population grouping (MPG) currently does not meet MPG level viability criteria, thus increasing the genetic risks of outplanting fish from the Clearwater River into the Salmon River. The TRT also rated natural populations of steelhead in the East Fork and Little Fork Salmon rivers at high risk because of the large number of hatchery-origin fish released into those rivers. However, the historical status or abundance of native steelhead populations in those two rivers before anthropogenic influences is unknown.

- Potential straying of Dworshak NFH B-run steelhead outplanted in the Salmon River basin has not been adequately assessed. These risks are particularly a concern for native populations of B-

run steelhead in the South and Middle Forks of the Salmon River where steelhead are managed as natural population reserves with no direct releases of hatchery origin steelhead.

Demographic Risks

- None identified.

Ecological Risks

- Releases of large numbers of non-native hatchery steelhead in the Salmon River pose a predation risk to listed salmonid juveniles in the watershed.
- The presence of New Zealand mud snails in the water supply at Hagerman NFH poses an ecological risk to locations in the Salmon River where fish are released.
- Amplification of the parasite *Nucleospora salmonis* at Hagerman NFH poses disease risks to aquatic species in Riley Creek downstream from the hatchery and other stocks (e.g., A-run steelhead, rainbow trout) reared on station.
- Fish infected with *Nucleospora salmonis* pose a disease risk to other fish and aquatic species in the Salmon River basin.
- Operation and manipulation of the Hatchery's water diversions may affect the Bliss Rapids snail population on station.
- The collection and barging of steelhead smolts at mainstem Snake River and Columbia River dams poses a stress (crowding and handling) and overall fish health risk to other populations of salmon and steelhead that are co-collected for barging.

Research, Education, Outreach and Cultural Risks

- The current practice of continuously importing steelhead eggs from the Clearwater Basin, rearing them at facilities where they are susceptible to disease (Hagerman NFH and Magic Valley FH), and outplanting them into the Salmon River is inconsistent with current outreach priorities of emphasizing the conservation of native salmon and steelhead populations in their indigenous habitats.

Recommendations for Current Program[97]

The Review Team considered all the benefits and risks outlined in the preceding section. The Team concluded that some of the risks outlined in the preceding section were either minor or their probability of occurrence was small and, thus, did not warrant a proposed change or recommendation for the current program. The recommendations outlined below, in addition to potentially increasing

[97] *The Review Team believes that the Hagerman Hatchery Evaluation Team—as a whole, in task teams and/or with outside assistance and expertise—will be the logical body to implement most of the following recommendations.*

benefits towards achieving program goals, address the identified risks or potential problems considered by the Review Team to warrant a potential modification to the current program. Preceding each numbered recommendation is a brief summary of the issue.

Program goals and objectives

Issue HA1: Present program goals for B-run steelhead reared at Hagerman NFH are not fully expressed in terms of numeric outcomes that quantify intended benefits or goals. *Actual harvest contributions vary widely in response to variations in post-release survivals, marine conditions, and harvest regimes. Like most other programs, this hatchery program lacks specific numeric goals for contribution to harvest or other benefits. The LSRCP adult return goal for A-run and B-run steelhead reared at Hagerman NFH and released in the Salmon River is to return a total of 13,600 adult steelhead (A-run and B-run fish combined) upstream of Lower Granite Dam in the Snake River Basin. Specific harvest goals for Dworshak B-run in the Salmon River have not been specified, thus preventing evaluation of harvest benefits relative to goals and risks.*

Recommendation HA1: Establish a harvest goal for Dworshak B-run steelhead released from Hagerman NFH into the Salmon River basin so that program benefits can be evaluated relative to those goals and the risks that the program poses.(see HA17-HA25 under Research, Monitoring, and Evaluation).

Issue HA2: Current conditions affecting the survival of salmon and steelhead in the Snake and Columbia rivers (operation of the hydropower system, habitat, harvest, and ESA listings) downstream from release sites in the Salmon River differ from the assumptions that were used to establish LSRCP mitigation goals. *These different conditions inhibit consistent achievement of Hagerman NFH's contribution (13,600 adult steelhead) towards meeting the LSRCP mitigation goal of 55,100 adult steelhead returning annually upstream of Lower Granite Dam, as developed initially by the Army Corps of Engineers in the mid-1970's.*

Recommendation HA2: *Continue to work through various regional processes such as (a)* implementation of *the mainstem* Federal Columbia River Power System *Biological Opinion to improve migration survival, (b)* US vs. OR *discussions to address harvest issues, (c) NOAA Fisheries to complete ESA consultations on hatchery mitigation programs, and (d) local watershed groups to continue improving* habitat, to allow the Service and cooperators meet Army *Corps of Engineers and LSRCP mitigation goals on* a consistent basis. Reexamine current approaches for contributing 13,600 adult steelhead to the LSRCP mitigation goal of 55,100 adult steelhead *(upstream of Lower Granite Dam) to determine whether the current hatchery program should be modified to account for* existing conditions and capabilities at Hagerman NFH.

Broodstock Choice and Collection

Issue HA3: The continual release of Dworshak NFH B-run steelhead into the Salmon River (a) is inconsistent with the principles of local adaptation and managing hatchery stocks for maximum viability, (b) poses biological risks to ESA listed natural salmon and steelhead populations in the Salmon River, and (c) poses straying risks within the Salmon River basin. *IDFG analyzed nine years of "complete" B-stock return data to the Salmon River*

starting with fish released in 1989. IDFG found that released fish representing the progeny of outplanted Dworshak B-run steelhead returning as adult fish to the East Fork Salmon River had significantly higher smolt-to-adult return rates compared to outplanted fish that were the progeny of adult fish trapped and spawned at Dworshak NFH.[98]

Recommendation HA3: If the transfer of Dworshak NFH B-run steelhead eggs to Hagerman NFH continues, then LSRCP cooperators should develop acclimation facilities with adult recapture capabilities at release sites to reduce risks to natural populations (e.g. sites that increase homing and reduce straying). Implementation of this recommendation may necessitate new release sites. Alternatively, fish could be released from existing facilities (e.g., Pahsimeroi Fish Hatchery) that may also allow development of local broodstocks and eventual termination of eyed egg transfers from the Clearwater River basin. Adult recapture capabilities would also assist with assessing adult return rates and potential benefits of the program (see Recommendations HA22a, HA22b, and HA22c under *Research, Monitoring, and Accountability*).

Refer to the Dworshak NFH B-run steelhead section for other broodstock choice and collection recommendations associated with this program.

Hatchery and Natural Spawning, Adult Returns

Refer to HA3 and the Dworshak NF Hatchery and Natural Spawning, Adult Returns section under Recommendations for the Dworshak NFH B-run steelhead program.

Incubation and Rearing

Issue HA4: Dworshak NFH B-run steelhead are more difficult to rear and suffer higher mortality rates at Hagerman NFH than A-run steelhead reared at Hagerman NFH. *Dworshak NFH B-run steelhead have higher incidences of fish health problems, bacterial infections, and pre-release mortality rates than A-run steelhead during the final four months of rearing prior to transport to the Salmon River. Increasing mortality rates prior to transportation and release into the Salmon River raises concerns regarding the post-release survival of smolts*

Recommendation HA4: Continue to assess and ascertain the causes of pre-release mortality of Dworshak NFH B-run steelhead during the final four months of rearing at Hagerman NFH. Discontinue the program if survival cannot be improved.

Issue HA5: Nucleospora salmonis, a parasite known to impair the immune function of fish, is annually detected in the steelhead stocks at Hagerman NFH. Dworshak NFH B-run steelhead appear to be more susceptible to this endemic parasite than the locally adapted Salmon River stocks based on higher mortality rates under similar culture conditions. *Stocks that are more susceptible to the parasite may have poorer survival rates after release, serve as reservoirs of infestation and spread the parasite to other fish and aquatic hosts.* N. salmonis *is not regulated by federal or state fish health policies; however, outplanting highly*

[98] *Hanson, J. 2005. Evaluation of Idaho steelhead harvest for Lower Snake River Compensation Plan Hatchery Programs. IDFG Report Number 05-43 (see Table 20). Idaho Department of Fish and Game, Boise, Idaho. Available as reference document SR-061 at: www.fws.gov/fisheries/Pacific/.*

infected fish enhances the spread of infestations elsewhere. The source of the Nucleospora parasite at Hagerman NFH is unknown.

Recommendation HA5a: Implement a study to determine the epizootiology of *Nucleospora salmonis*, including the source of infection, alternate hosts and salmonid stock resistance. One hypothesized source may be the snails in the water supply.

Recommendation HA5b: Assess survival rates and levels of *N. salmonis* in Dworshak B-run and Sawtooth A-run steelhead in a post-transport survival study (see recommendation HA9).

Recommendation HA5c: Develop localized stock to enhance development of resistance to endemic parasite(s) and water conditions (see Issue HA3) or discontinue program.

Issue HA6: Feed strategies designed to slow growth during winter months to compensate for warm water temperatures and meet the release size criteria (180-250 mm fork length) of NOAA Fisheries may increase physiological stress and pose a fish health risk (e.g. "soreback").

Recommendation HA6: Develop alternative rearing strategies for meeting targeted release sizes without limiting feed (e.g., chilling eggs during incubation). Implementation of this recommendation may require working with IDFG to change protocols at Clearwater Fish Hatchery where the eggs are incubated to the eyed stage prior to transfer to Hagerman NFH.

Issue HA7: Rearing densities in the indoor nursery tanks (0.8 max DI) exceed culture guidelines for steelhead, thus increasing fish health risks. *Steelhead are reared in the indoor nursery tanks until they reach a size at which they can be marked and tagged while being transferred to the outdoor raceways. This protocol results in density indexes attaining D.I. = 0.8 in the indoor nursery tanks prior to transfer to the outdoor raceways.*

Recommendation HA7: Reduce rearing densities in the indoor nursery tanks to a maximum of D.I. = 0.5 by reducing the total number of Dworshak B-run fish reared, increasing the number of nursery tanks, and/or marking and tagging the fish after they are transferred to the outside raceways.

Issue HA8: Flow indexes [Total weight of fish/(mean length of fish)(water flow in gpm)] may exceed recommended guidelines because of the serial reuse of water between three banks of raceways (upper bank to middle bank to lower bank). *The Production Capacity Report for Hagerman NFH indicated that growth rates decreased at a density index greater than 0.5 and a flow index greater than 1.5*[99]*. Those results suggests that D.I. = 0.5 and F.I. = 1.5 are the upper carrying capacity limits for the hatchery, above which fish are stressed physiologically. The recommended carrying capacity flow index for steelhead reared at Hagerman NFH may be exceeded if the amount of water available for rearing continues to decline.*

Recommendation HA8: Flow index for individual raceways should not exceed 30% of the total system flow index when three banks are in use or 50% if only two banks are used. For example, if the total flow index for all three banks is calculated to be 1.25, then the flow index

[99] *http://www.fws.gov/hagerman/documents/HET/ ProductionCapacityAssessmentFinalReport.pdf*

calculated separately for each deck of raceways should not exceed F.I. = 0.38 if all three decks are being used.

Release and Outmigration

Issue HA9: The loading (via pumps) and long-distance hauling of steelhead smolts in tanker trucks from Hagerman NFH to the Salmon River (Little Salmon and East Fork Salmon River) results in crowding and potential stress prior to release. *Fish are further stressed when water temperatures at the Salmon River release sites are several degrees cooler than the water temperature in the transport truck. In addition, these fish can be infected with the parasite Nucleospora salmonis which impairs the immune system. All of these factors may result in poor acclimation and reduced survivals immediately after transport and release into the Salmon River.*

Recommendation HA9: *Continue to use PIT tags to assess post-release survivals to Lower Granite Dam. If survivals to Lower Granite Dam decrease in future years, additional research could include assessing survival 48 hours after release with live boxes or cages holding a random sample of fish at each release site. The prevalence of Nucleospora salmonis among transported fish could also be assessed to determine whether the parasite is contributing to mortality during transport or after release. [Note: New data supplied recently to the Review Team indicate that post-release mortality immediately after release into the Salmon River may not be a significant issue at the present time. For the migration years 2000-2008, average estimated survival rates for A-run steelhead trucked from Hagerman NFH, Niagara FH, and Magic Valley FH were 72%, 77%, and 75% respectively compared to 72% for steelhead trucked and outplanted into the South Fork Salmon River from Clearwater Fish Hatchery.]*

Facilities/Operations

Issue HA10: Lack of shade covers over the raceway increases crowding of fish, particularly during the summer months, potentially increasing stress and disease risks to steelhead juveniles.

Recommendation HA10: Construct covers over the raceways. Initial experimentation with floating covers would help quantify potential fish health benefits

Issue HA11: Water flows from springs supplying Hagerman NFH continue to decline, presumably due to increased water withdrawals from the aquifer and exacerbated by drought conditions. *Of the total water rights owned by the Service, 84.59 cfs can be diverted for fish production at the Hatchery. However, actual flow available for fish production decreased to 65 cfs in March of 2008. Flows continue to decline at a rate of 0.1 cfs per year. Although these decreasing water flows are largely due to factors external to the hatchery, Hagerman NFH can implement several compensatory actions.*

Recommendation HA11a: Repair the degraded pipelines and plumb Spring 17 to the Main Spring pool to provide the hatchery greater flexibility for water management. This would allow more efficient use of this water in Steelhead raceways but also could be used in the Trout raceways during the steelhead off-season. It would extend the beneficial use of this water right to all year.

Recommendation HA11b: Continue to actively monitor spring flows and prioritize the strains and stocks reared at Hagerman NFH, then reduce the total number of fish reared on station as water flows continue to decline.

Recommendation HA11c: Develop contingency plans for modifying the existing water delivery infrastructure and identifying technological enhancements (e.g., oxygenation, conditioned reuse, etc.) to compensate for continuing declines in water availability

Recommendation HA11d: The Service should continue to seek opportunities to negotiate a mitigation settlement for loss of water at Hagerman NFH.

Also see Recommendation HA40a under Recommendations for the Hagerman NFH Resident Rainbow Trout program, which states "the Service should establish a flow target which triggers a reduction in the number, time, and/or size at release of rainbow trout produced if the Hagerman NFH's if water supply continues to decline"

Issue HA12: A significant amount of water is used to clean the raceways. *Currently, raceways are flushed via a standpipe to the Off-line settling pond. This method of cleaning requires a high volume of water, thus only four raceways can be cleaned at the same time. Cleaning more than four raceways in the upper two decks at one time would rob water from the downstream raceways*

Recommendation HA12: Investigate alternative cleaning methods and determine whether modifications can be made to the settling pond that would allow more efficient use of water.

Issue HA13: The electric controller on the valve to the steelhead raceways in the Mixing Chamber is not functioning properly.

Recommendation HA13: Replace the valve immediately.

Issue HA14: The weir in Riley Creek has not been operated for several years because its location in poses a safety risk to anglers and others recreating in Riley Creek. *The weir was intended to prevent fish in Riley Creek from swimming upstream into the facility; however, Hagerman NFH has not indicated that fish are entering the facility.*

Recommendation HA14: Decommission the weir. If it is found a weir is needed, relocate the weir closer to the facility and/or improve protection around the weir to reduce safety risks.

Issue HA15: The presence of invasive New Zealand mud snails in the water supply poses a physical risk to the facility and an ecological risk to off-station locations where fish are released (e.g., Salmon River). *The presence of New Zealand mud snails has prevented the release of Dworshak NFH B-run steelhead back into the Clearwater River Basin (mud snails have not been detected in the Clearwater River). The continued release of steelhead from Hagerman NFH into the Salmon River increases ecological risks due to the potential amplification of the existing snail populations in that watershed.*

Recommendation HA15: Continue to implement that Hazard Analysis and Critical Control Point (HACCP) plan. Investigate methods (e.g. water purification system) that could help prevent snails from accessing the hatchery facility, and, thusly, reduce the potential for transferring the snails off-station.

Issue HA16: The fish display pond for visitors does not comply with the American Disabilities Act (ADA). For example, the display pond is not accessible to *wheelchairs, although Hagerman NFH receives many visitors.*

Recommendation HA16: The Team supports the current improvement of access and safety in the visitor's area so that it is ADA compliant.

Research, Monitoring, and Accountability

Issue HA17: The propagation of multiple stocks, including rainbow trout, at Hagerman NFH, coupled with its location in proximity to commercial trout farms, the Hagerman State Fish Hatchery (IDFG), and the University of Idaho's Hagerman Fish Culture Experiment Station, substantially increases fish health risks relative to other National Fish Hatcheries that are more insulated from other fish culture facilities.

Recommendation HA17a: Increase interactive communication of fish health issues among the Service, IDFG, the Idaho Aquaculture Industry, and the University of Idaho. Ensure that written records of all fish health exams (monthly/diagnostic, certifications and inspections) performed by the Service's Idaho Fish Health Center (IDFHC; Ahsahka, ID) are kept on station at Hagerman NFH to allow for ready communication with other fish health specialists and to maintain historical records. The completion of the new U.S. Fish & Wildlife Service Fish Health Database, now in development at the ID-FHC, should be expedited to help promote more effective communication of fish health information.

Recommendation HA17b: To reduce disease transmission risks between facilities, the Memorandum of Understanding (MOU) between the University of Idaho's Hagerman Fish Culture Experiment Station (sited adjacent to Hagerman NFH) and the U.S. Fish & Wildlife Service should be reviewed by both parties to facilitate the 1999 agreements and to clarify the responsibilities of each party. These recommendations include the following: (a) Install signage for directing vehicular traffic to the University of Idaho's research station along the agreed-upon route; (b) Ensure that written operational protocols exist for, and at, each station for minimizing risks of disease transmission between facilities (e.g., due to vehicular traffic, aerosols from irrigation and sprinkler systems, predators, outdoor fish tanks/raceways, import of exotic species, review of effluent treatment systems, etc.); (c) Complete all fish health preview and inspection exams prior to the transfer of aquatic animals into and out of each station, as required by federal and state policies; (d) Designate a fish health representative for each station to oversee fish health inspections/diagnostic exams and treatment, and expedite communication between the two stations regarding fish health issues that may impact the other station. As necessary**,** fish health monitoring should be increased to allow identification and/or reduction of endemic pathogens that affect the fish facilities in the Hagerman Valley.

Issue HA18: Accountability and coordination of monitoring activities are critically important for assessing the benefits and risks of the program. *The Service is responsible for on-station*

rearing and evaluation of fish performance at Hagerman NFH, while the Idaho Department of Fish and Game is responsible for evaluating post-release survival of juveniles (e.g., smolt-to-adult return rates), adult contributions to fisheries, and achievement of mitigation goals. However, the information available currently for evaluating the fishery benefits of the B-run steelhead program at Hagerman NFH is sparse, and post-release monitoring and evaluation of program benefits and risks do not appear to be jointly managed or high priorities.

Recommendation HA18: Continue to improve coordination of monitoring activities among the Service, Idaho Department of Fish and Game, and appropriate tribes. A significant amount of coordination currently occurs, but this coordination in largely in the form of annual planning. Both on-station and off-station fish performance should be cooperatively investigated via a well-developed monitoring and evaluation program. This cooperation could include fish health monitoring at Hagerman NFH (Recommendation HA17) by IDFG because of the geographic distance of the Services' Idaho Fish Health Center in Ahsahka, Idaho, and the comparatively close proximity of IDFG's fish health lab in Eagle, Idaho. Evaluation projects need to be discussed, proposed, funded and implemented cooperatively. Cooperative research and monitoring projects with University of Idaho's Hagerman Fish Culture Experiment Station Lab could also be developed.

Issue HA19: Currently, monitoring and evaluation of the physiological effects of transport and post-release survival of Dworshak NFH B-run steelhead in the Salmon River do not occur (see Issue HA9). *Long-distance transportation (4-6 hours), transport over a high elevation pass (>8,000 feet,) and water temperature differences between the tanker truck and Salmon River release sites creates uncertainties regarding the physiological ability of transported fish to survive the first 24-48 hours after release. A PIT tag program is being established in 2008 to assess outmigrant survival of Hagerman NFH A and B-run steelhead to lower Granite Dam, but those studies are not designed to evaluate physiological stress and immediate post-release survival at the release sites.*

Recommendation HA19: The Service should continue to assess, in collaboration with the tribes and IDFG, post-release survival of transported fish in the Salmon River via PIT tags. If significant differences in post-release survival occur among release sites, then studies should include measures of physiological stress during transport and at the time of release, ability of the released fish to acclimate physiologically to the receiving water, potentially as a function of temperature differences between the truck tank water and stream water, and predation risks – including angling – in the vicinity of the release sites (see also Recommendation HA9).

Issue HA20: Abundance and productivity data for natural populations of steelhead in the Salmon River are inadequate. *Without a better understanding of the abundance and productivity of natural populations, assessments of the genetic and ecological risks posed by the continued outplanting of Dworshak B-run on natural steelhead populations in the Salmon River Basin cannot be adequately assessed.*

Recommendation HA20: The Service should work with IDFG and appropriate tribes to develop protocols (sampling, marking, etc.) for estimating and monitoring the abundance and productivity of natural populations of steelhead in the Salmon River basin. This monitoring could include genetic studies to couple genetic monitoring with population monitoring for assessing genetic and ecological risks of continued outplanting of out-of-basin fish.

Issue HA21: Coded-wire tagged fish need to accurately represent all progeny groups released from Hagerman NFH. Currently, a total of 60,000 Dworshak NFH B-run steelhead in four of nine raceways are coded-wire tagged. *Fish in different raceways can differ in mean age and size, and the pond environments can differ slightly in flow index, flow pattern, and other environmental factors. Therefore, tagging fish in just a few raceways needs to accurately represent the entire population for that brood year. In most NFH production programs, salmon are spawned throughout the adult return to ensure that most segments of the run are represented in the resulting progeny. This procedure usually results in many different spawn "takes". The fry are ponded by take/hatch date into a series of raceways that, when fully populated, differ in age and size of fish (initially) between raceways. Production monitoring using coded-wire tags requires that the tags represent the entire population.*

Recommendation HA21: Idaho Department of Fish and Game should continue to consult with the staff at Hagerman NFH, the Idaho Fishery Resource Office (Ahsahka, ID), and the tagging crew at the Columbia River Fisheries Program Office (Vancouver, WA) to ensure that the tagging strategy at Hagerman NFH accurately represents the entire population of progeny from all spawn groups for each brood year. For example, all spawn groups should be proportionately represented among tag groups and raceways for the purpose of estimating smolt-to-adult return rates and related parameters for each brood year. The tagging and evaluation program, as a best management practice, needs to continue to accurately represent the population being studied.

Issue HA22a: Accurate estimates of the number of hatchery-origin steelhead, both A-run and B-Run, returning to the Salmon River do not exist for fish reared at Hagerman NFH. *The current sampling rate of coded-wire tags from harvested fish is unknown. From the sampling data that do exist, sampling rates in state and tribal fisheries appear to be inadequate and/or inconsistent. In addition, sample monitoring in natural spawning areas is limited. The LSRCP office has advocated adoption of a tag recovery goal of 20% from all harvested fish bearing coded-wire tags within the Snake River.*

Issue HA22b: Available data for Dworshak NFH B-run steelhead released into the Salmon River, but reared at Magic Valley State Hatchery, suggest that smolt-to-adult return rates are only 10-15% of those for "A-run" steelhead released into the Salmon River. Similar data are not available for B-run steelhead reared at Hagerman NFH. The absence of these latter data prevents assessment of the benefits of the B-run program at Hagerman NFH.

Recommendation HA22a: The Service should work with states and tribes to develop an adequate sampling and recovery program for coded-wire tags to assess return rates and contributions to harvest of Dworshak B run steelhead in the Salmon River. These assessments should include data on size and age (from scales or otoliths) of each adult fish with a coded wire tag to allow estimation of the mean size and age of hatchery-origin B-run versus A-run steelhead returning to the Salmon River. The Team understands that IDFG is investigating the potential use of DNA markers as a cost-effective alternative to coded wire tags for addressing these questions.

Recommendation HA22b: The Service should continue to work with IDFG to implement PIT tag protocols initiated with brood year 2007 that will allow annual estimates of total adult returns to the Columbia and Snake rivers for fish reared at different hatcheries (e.g., Hagerman NFH vs. Magic Valley FH) and released at different locations (e.g., upper Salmon River vs.

Little Salmon River). The Service has drafted Best Management Practices for the marking and tagging of juvenile salmon and steelhead prior to release. The initial benchmark is a minimum of 15,000 PIT tags for Dworshak NFH B-run steelhead reared at Hagerman NFH. Smolt-to-adult returns rates for fish released into the Little Salmon River vs. the upper Salmon River should also be assessed. The PIT tag program should also be used to (a) monitor downstream migration and survival of smolts and (b) assist with in-season harvest management of returning adults.

Recommendation HA22c: The Service should work with states and tribes to develop a PIT tagging program consistent with program goals and objectives and linked to regional goals and objectives. Comanagers in the Snake River are currently working to improve marking technologies (e.g., use of PIT tags and DNA markers), and the Service should continue to support those efforts.

Issue HA23: The evaluation and dissemination of tag recovery data are inadequate, thus inhibiting the ability of managers to make decisions based on current information. *Data reporting does not meet the specified standards of the Pacific Salmon Commission. Those standards require preliminary reporting of data for the current calendar year no later than January 31 of the following year.*[100]

Recommendation HA23: The Service should work with LSRCP cooperators to develop a data management plan that incorporates tagging goals and objectives, data management, and annual reporting requirements of coded-wire tag data at both the program and regional levels. This could be incorporated into the cooperative agreement between the LSRCP office and cooperators (IDFG and tribes).

Education and Outreach

Issue HA24: The Visitors Center at Hagerman NFH and available handouts are outdated. *The existing displays were installed in the 1980s when the facility was reconstructed.*

Recommendation HA24: Update the displays in the Visitors Center and handouts available to the public.

[100] *Pacific Salmon Commission's Data Standard Work Group Report "Specifications and Definitions for the Exchange of Coded-Wire Tag Data for the North American Pacific Coast".*

Alternatives to Current Program[101]

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

Alternative 1: Current Program with Recommendations

This alternative continues to rely on the continual importation of Dworshak NFH B-run steelhead eggs from the Clearwater basin obtained from adult steelhead returning to the Dworshak NFH. This alternative does recommend that juvenile acclimation facilities with adult recapture capabilities be developed at release sites in the Salmon River to (a) reduce biological risks to natural populations in the Salmon River, (b) allow accurate assessments of smolt-to-adult return rates, and (c) provide a potential mechanism for developing a "localized" hatchery stock of "B-run" steelhead in the Salmon River (see Alternative 2).

Pros

- Maintains fishing opportunity of B-run steelhead in the Salmon River and in downriver fisheries.
- Supports angler desires to catch large steelhead.

Cons

- Continues the transfer of out-of-basin stock into the Salmon River.
- Continues the risk of transporting New Zealand mud snails from Hagerman NFH into the Salmon River.
- Potential risk of spreading the parasite *N. salmonis*.
- Maintains a hatchery program with no documented benefits.
- Maintains high flow indices for steelhead reared at Hagerman NFH while the amount of water available for rearing continues to decline.
- Continues the rearing of a stock of fish that shows a significantly higher incidence of mortality at Hagerman NFH than A-run steelhead, suggesting that Dworshak NFH B-run steelhead may be more susceptible to pathogens at the hatchery or less adapted physiologically to the spring water available for rearing.

[101] *Alternatives presented here are intended to be consistent with those in the companion Idaho-LSRCP report.*

Alternative 2: Develop a locally adapted broodstock for maintaining a segregated harvest program for B-run steelhead in the Salmon River.

After development of acclimation ponds with adult recapture facilities as a first priority (Recommendation HA3), use recaptured adults as broodstock for developing a locally adapted, segregated hatchery program to replace the existing outplanting program that relies on steelhead broodstock returning to Dworshak NFH.

Pros

- Eventually eliminates the need to rely on adult returns to Dworshak NFH as broodstock assuming smolt-to-adult return rates in the Salmon River are sufficient to meet broodstock needs.
- Is expected to increase smolt-to-adult survival over successive generations due to local adaptation.
- Potentially increases harvest opportunity of B-run steelhead in the Salmon River and downstream fisheries due to predicted increases in smolt-to-adult return rates resulting from local broodstock rather than the continued importation of eyed eggs.
- May allow reduction in the overall size of the program (i.e., number of smolts released) to achieve the same harvest benefit.
- Reduces straying risks via the used of locally-adapted broodstock versus the continued use of imported stock.
- Enhances development of resistance to endemic parasites and reduces their spread.

Cons

- Requires the trapping and holding of adult broodstock in the Salmon River basin.
- Currently available data indicate that smolt-to-adult return rates for Dworshak NFH B-run steelhead released into the Salmon River may be insufficient to develop a local broodstock.
- Acclimation facilities with adult recapture capabilities need to be established unless existing facilities (e.g., Pahsimeroi Hatchery) can be used to establish a local broodstock program.
- Continues the release of an introduced stock of steelhead that may compete or interbreed with natural populations of listed steelhead, including competition with A-run hatchery-origin steelhead.

Alternative 3: Develop an integrated B-run steelhead conservation and harvest program from B-run steelhead native to the Salmon River (South and Middle Forks)

Terminate the release of Dworshak NFH B-run steelhead broodstock into the Salmon River and develop an integrated hatchery program derived from “B-run” steelhead native to South (or Middle)

Fork of the Salmon River. Release of hatchery-origin steelhead should occur where those fish can be recaptured as returning adults.

Pros

- Reduces demographic risk of extinction of native B-run steelhead in the Salmon River.
- Utilizes a stock native to the Salmon River as opposed to the continued use of an out-of-basin stock from the Clearwater River.
- Reduces straying risks by using native steelhead as opposed to the continued use of an out-of-basin stock from the Clearwater River.
- Enhances development of resistance to endemic parasites and reduces their spread.

Cons

- Natural origin B-run steelhead adults return to areas that may difficult to access for collecting broodstock, either due to remoteness (Middle Fork Salmon and South Fork Salmon) or high water flows at the time of broodstock collection.
- Development of a native B-run broodstock may require the trapping of outmigrating smolts and captively rearing them to sexual maturity to provide the first generation of broodstock.
- Low smolt-to-adult return rates into the Salmon River may limit the ability to maintain a native broodstock program via adult returns.
- Acclimation with adult recapture facilities may have to be established.
- Native B-run steelhead would have to be distinguished from A-run steelhead at the time of broodstock collection.

Alternative 4: Discontinue the transfer of Dworshak steelhead eyed eggs from Clearwater Fish Hatchery to Hagerman NFH, and replace with on-station rearing at Clearwater Fish Hatchery followed by direct release into the Salmon River

Pros

- Eliminates the need to rear Dworshak NFH B-run steelhead at Hagerman NFH, including the added cost and risk of transporting eyed-eggs from the Clearwater FH to Hagerman NFH.
- Reduces the risk of releasing New Zealand mud snails into the Salmon River from Hagerman NFH.
- Eliminates potential infection by *Nucleospora* that is prevalent at Hagerman NFH.
- Allows rearing densities for A-run steelhead to be reduced at Hagerman NFH.

- Creates options for on-station rearing at Dworshak NFH if problems with water quality there can be remedied.

Cons

- Reduces available rearing space at Clearwater Fish Hatchery for fish released into the Clearwater River basin (steelhead or spring Chinook), thus reducing the size of those latter programs.
- Increases transportation distance for smolts released into the East Fork Salmon River.
- Continues out-of-basin transfers from the Clearwater River basin to the Salmon River basin.
- Continues release of out-of-basin steelhead into area where natural populations of salmon and steelhead are protected under the ESA.

Alternative 5: Terminate the existing A and B-run steelhead programs at Hagerman NFH, and use Hagerman NFH exclusively for the conservation of freshwater aquatic species in the middle and upper Snake River watershed

Pros

- Hagerman NFH could propagate imperiled aquatic species with the greatest conservation priorities.
- Could assist with restoration and recovery of extirpated stocks.
- A research component could be part of the hatchery's new mission, particularly in collaboration with the University of Idaho.
- Gives the hatchery flexibility to respond to changing priorities and mandates.

Cons

- The risk of transporting New Zealand mud snails would still exist.
- Reduces fishing opportunity for A-run and B-run steelhead in the Salmon River.
- Reduces the number of A-run and B-run steelhead available for harvest in downriver fisheries.
- Reduces the ability of a National Fish Hatchery to meet mitigation responsibilities for anadromous salmonid fishes directly affected by federal water projects in the Snake River basin.
- This new role for the Hagerman NFH would need to be further defined, developed, and coordinated with cooperators.

- This alternative would probably require annual or semi-annual planning documents to define the immediate use of the facility and the planned use over each two- to five-year future period.

Alternative 6: Terminate the B-run steelhead program and maintain the A-run steelhead program at Hagerman NFH

Under this alternative, the B-run steelhead program (200,000 smolts) would be terminated. The A-run program could be maintained at its current size (1.25 million smolts), or it could be increased by up to 200,000 smolts (1.45 million smolts total) depending on water availability.

Pros

- Eliminates the transfer of an out-of-basin stock into the Salmon River via Hagerman NFH.
- Eliminates the need to rear B-run steelhead at Hagerman NFH and transport eyed-eggs.
- Reduces the risk of transporting New Zealand mud snails from Hagerman NFH.
- Eliminates a program with no documented benefits.
- Improves fish health on station and reduces disease transmission.

Cons

- Reduces fishing opportunity for B-run steelhead in the Salmon River.
- Reduces the number of B-run steelhead available for harvest in downriver fisheries.

Alternative 7: Terminate the A and B-run steelhead programs and decommission the facility

Pros

- Eliminates transfer of out-of-basin stock into the Salmon River.
- Eliminates the need to rear A and B-run steelhead at Hagerman NFH and transport eyed-eggs.
- Eliminates the risk of transporting New Zealand mud snails from Hagerman NFH.
- Eliminates the B-run steelhead program that has no documented benefits.
- Improves water quality and quantity for down stream users.

Cons

- Reduces fishing opportunity for A and B-run steelhead in the Salmon River.
- Reduces the number of A and B-run steelhead available for harvest in downriver fisheries.

- Eliminates outreach opportunities for the Service in the region.
- Reduces the ability of a National Fish Hatchery to meet mitigation responsibilities for anadromous salmonid fishes directly affected by federal water projects in the Snake River basin.

Recommended Alternatives

Alternatives 1, 2, and 4 were not given high consideration because Dworshak NFH B-run steelhead are not native to the upper Salmon River and may present a biological/genetic risk to the conservation and recovery of ESA listed natural populations in the upper Salmon River. In short, the Review Team concluded that the risks of the program, both to the B-run fish reared at Hagerman NFH and to natural populations in the Salmon River basin, outweighed the potential – but undocumented – benefits of the program.

Data examined by the Review Team indicated that Dworshak NFH B-run steelhead are more difficult to culture than A-run steelhead at Hagerman NFH, and that releases of Dworshak NFH B-run steelhead in the upper Salmon River survive and contribute to fisheries at a much lower rate than A-run steelhead released in the upper Salmon River. The current purpose of Hagerman NFH under the LSRCP is to mitigate for reduced abundance of natural-origin steelhead in the Snake River basin due to the construction and operation of four hydropower dams in the lower Snake River. Hagerman NFH also propagates A-run steelhead, derived from adult returns and broodstock at Sawtooth Fish Hatchery, for release into the upper Salmon River to meet this mitigation purpose. This mitigation purpose has not changed as the primary mission of Hagerman NFH. Moreover, the Review Team concluded that the decision to release Dworshak NFH B-run steelhead in the Salmon River, from fish reared at Hagerman NFH, was not based on the need to meet a specific mitigation responsibility in the Salmon River but, was rather, a decision to find an outlet for fish that could no longer be released back into the Clearwater River because of the discovered presence of New Zealand mud snails at Hagerman NFH.

Consequently, the Review Team recommends immediate implementation of Alternative 6: Terminate the Dworshak NFH B-run steelhead program and maintain the A-run steelhead program at Hagerman NFH.

This recommendation would eliminate the out-of-basin transfer of Dworshak NFH B-run steelhead into the upper Salmon River via Hagerman NFH, reduce culture difficulties associated with rearing B-run steelhead at Hagerman NFH, and increase harvest opportunities in the upper Salmon river due to increased survival and harvest rates on A-run steelhead. The recommendation presented here for Dworshak NFH B-run steelhead reared at Hagerman NFH is consistent with the Team's recommendations for A-run steelhead program described in the next section of this report.

The Review Team also recognized that elimination of the Dworshak B-run program at Hagerman NFH may reduce the opportunity for anglers to catch large steelhead in the upper Salmon River, but data to support that contention were unavailable to the Team. The Review Team further concluded that the continued transfer of Dworshak NFH B-run steelhead to Hagerman NFH and the Salmon River, despite documented culture problems at Hagerman NFH and the absence of documented benefits, are also inconsistent with the general principles of "hatchery reform".

Hagerman NFH A-run Steelhead

Operator: U.S. Fish & Wildlife Service

Summary of Current Program

Goals

- ***Harvest goal:*** The program does not have a quantified harvest goal at the present time. The LSRCP adult return goal for both A-run and B-run steelhead reared at Hagerman NFH and released in the Salmon River is to return 13,600 adult steelhead to the Snake River Basin upstream of Lower Granite Dam. This LSRCP mitigation goal was calculated based on a catch, downstream of Lower Granite, to escapement, upstream of Lower Granite, ratio of 2:1 (commercial catch of 0.67:1 and sport catch 1.33:1).

- ***Broodstock escapement goal:*** Not applicable. Broodstock are not collected at Hagerman NFH. The hatchery receives, from Sawtooth Fish Hatchery, 1.15 million Sawtooth and 215,000 Pahsimeroi A-run steelhead eyed eggs that are the progeny of adult steelhead trapped at Sawtooth and Pahsimeroi fish hatcheries, respectively. Fertilized eggs are incubated to the eyed stage at Sawtooth Hatchery and then transferred to Hagerman NFH for hatching and rearing.

- ***Conservation goal***: The program does not have a specified conservation goal. The sole purpose of the program is to support fisheries in the Salmon River. NOAA Fisheries does not include Sawtooth, Pahsimeroi, or Oxbow A-run steelhead within the Snake River Steelhead DPS. However, a potential conservation hatchery program for the Yankee Fork of the Salmon River is currently under development in collaboration with the Shoshone-Bannock Tribe.

- ***Escapement goal for natural-origin adults***: Specific escapement goals for natural-origin steelhead – where Sawtooth and Pahsimeroi A-run steelhead are released in the Salmon River - have not been established. All unmarked, natural-origin fish are passed upstream of hatchery weirs in the upper Salmon and lower Pahsimeroi rivers, respectively

- **Research, education, and outreach goals:** Provide a proactive outreach program, to increase visibility and public understanding of programs at Hagerman NFH. Encourage a partnership of southern Idaho Service facilities to fund an outreach coordinator, and coordinate with other federal, state, and local information/public affairs offices to incorporate information about Hagerman NFH.

Objectives

- Obtain 1.15 million eyed eggs from Sawtooth Hatchery and 215,000 eyed eggs from Pahsimeroi Hatchery.

- Incubate and hatch eyed eggs, and rear resulting fish to yield 1.05 million Sawtooth and 200,000 Pahsimeroi A-run steelhead smolts (total = 1.25 M A-run smolts), respectively, for transfer and release into the Salmon River Basin.

- Transport and release (a) 810,000 Sawtooth steelhead smolts into the Salmon River at Sawtooth Hatchery, (b) 240,000 Sawtooth steelhead smolts into the Yankee Fork of the Salmon River, and (c) 200,000 Pahsimeroi steelhead smolts into the Little Salmon River (160,000 smolts at Stinky Springs, 40,000 smolts at Hazard Creek). Idaho Department of Fish and Game (IDFG) is responsible for developing and managing smolt release strategies, monitoring and evaluation activities, brood stock collection and spawning, and assessing adult returns and fishery contributions in the Snake and Salmon river.

Program Description

The Salmon River A-run steelhead program at Hagerman NFH is intended to support fisheries in the Salmon River basin; it is not intended to address conservation objectives. The hatchery receives eyed eggs from Sawtooth Fish Hatchery that are obtained from adult steelhead returning to the Sawtooth and Pahsimeroi fish hatcheries, respectively. The steelhead stock propagated at Pahsimeroi Fish Hatchery was founded from adult steelhead trapped in Hells Canyon between 1966 and 1970 and included native steelhead or rainbow trout that swam into the Pahsimeroi Hatchery trap during the first 20 years of the program. The steelhead stocks propagated at Sawtooth and Oxbow hatcheries, respectively, were founded from hatchery-origin steelhead returning to the Pahsimeroi Fish Hatchery in the 1980s. Therefore, the three stocks (Pahsimeroi, Sawtooth, Oxbow) have common origins dating back to the late 1960's but are now propagated largely as three separate stocks. However, in the past, when the number of adult steelhead returning to Sawtooth or Pahsimeroi fish hatcheries were insufficient to meet eyed egg objectives at Hagerman NFH, additional eyed eggs representing A-run steelhead were obtained from Oxbow fish hatchery in the Hells Canyon area of the Snake River. After approximately ten months of rearing at Hagerman NFH rears approximately 1.25 million A-run steelhead smolts annually and transports them to various sites in the Salmon River Basin for release and outmigration to the Pacific Ocean. Under the LSRCP, IDFG is responsible for brood stock collection and spawning, developing and managing smolt release strategies, and all off-station monitoring and evaluation activities,.

Assessment of Current Program

Operational Considerations

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

Broodstock Choice and Collection

- Eyed eggs for Hagerman NFH A-run steelhead are derived from broodstock collected at Sawtooth FH and the Pahsimeroi FH. Eyed eggs have also been obtained from Oxbow FH to "backfill" shortages from the other two hatcheries.

- NOAA Fisheries excludes the three hatchery stocks (Sawtooth, Pahsimeroi, Oxbow) from the Snake River Steelhead DPS which is currently listed as *threatened* under the ESA. NOAA is

currently considering whether the Sawtooth FH A-run steelhead stock (Snake River derived) can be used to develop a localized population in Yankee Fork as part of an experimental program.

Hatchery and Natural Spawning, Adult Returns

- Approximately 285 females are required at Sawtooth Fish Hatchery to produce 1.15 million eyed eggs for Hagerman NFH. The male to female ratio among returning adults varies, but typically more males than females are trapped for broodstock (60-65% males). Males and females are selected randomly and spawned pairwise (1:1 female:male) with the fertilized eggs from two females combined prior to water hardening and initial incubation[102].

- 525 females are need for the full A-run program from Sawtooth FH: 1.15 M eggs go to Hagerman NFH, 480,000 eggs go to Magic Valley FH, and 500,000 eggs go the Shoshone-Bannock Tribes.

- Approximately 44 females are required at Pahsimeroi Fish Hatchery to produce 215,000 eyed eggs for Hagerman NFH.

- A-run steelhead reared at Hagerman NFH and released into the Salmon River had a mean 0.72% smolt-to-adult return rate (SAR) over the past nine years (BY 1992-2000) based on limited sampling and recovery of coded-wire tags upstream of Lower Granite Dam. This return rate translates into 8,640 adult steelhead based on a 1.2 million smolt. release.

- Based on estimates for all A-run and B-run adult steelhead returning to the Snake River basin during the 2000-2001 fishing seasons (fall and spring combined), IDFG estimates that sport anglers harvested approximately 18,188 steelhead from the Salmon River, 12,232 steelhead from the Clearwater River, and 3,182 fish from the mainstem Snake River.

- Angling effort fluctuates annually depending on several socio-economic factors in addition to the actual number and timing of returning adult steelhead. For the 2001-2002 steelhead season, approximately 22,000, 15,000, and 148,000 angler/days occurred on the mainstem Snake River, Little Salmon River, and mainstem Salmon River, respectively. For the 2002-2003 season, those numbers were approximately 18,000, 18,000, and 145,000 angler-hours, respectively.

Incubation and Rearing

- Hagerman NFH receives 1.3-1.4 million eyed eggs from Sawtooth FH, Pahsimeroi FH, and – in some years Oxbow FH. Eyed steelhead eggs are shipped between 370 and 450 TUs. Shipments occur in May and June. These eggs are obtained from brood stock returning to the Sawtooth FH and Pahsimeroi FH. Eggs are collected, fertilized, and water hardened at Pahsimeroi Hatchery. Water hardened eggs are shipped to Sawtooth FH on the same day as fertilization for incubation to the eyed stage prior to shipment to Hagerman NFH.

- In the past, Hagerman NFH did not receive eggs from all egg takes at Sawtooth Fish Hatchery. For example, in BY2007, Hagerman NFH did not receive any eggs from egg takes 5, 6, 8 and 10 of a total of 12 egg takes for rearing smolts for release at the hatchery weir in the upper Salmon

[102] *Additionally, from Sawtooth Fish Hatchery, Magic Valley FH receives 352,500 eyed eggs, and the Shoshone-Bannock Tribe receives 375,000 eyed eggs, in combination with Pahsimeroi steelhead, for a total of 1,827,500 eyed eggs from adults trapped and spawned at Sawtooth FH.*

River. Because Hagerman NFH did not receive eyed eggs from one-third of all egg takes in 2007, BY2007 fish released at Sawtooth Fish Hatchery did not represent a random sample of progeny from all adults trapped at the hatchery for broodstock.

- Upon arrival at Hagerman NFH, eyed eggs are disinfected in a standard 100 ppm iodine solution for 10 minutes. The eggs are enumerated using either the Von-Bayer or displacement method. Eggs are placed into upwelling jars at approximately 20,000 eggs per jar. The jars are supplied with 59°F spring water at a flow rate of 6 to 8 gpm. Eggs from multiple females are loaded into hatching jars according to spawn date to ensure synchronous hatching within individual jars. Hatching usually occurs within three to five days after receipt at Hagerman NFH.

- Hagerman NFH incubates, hatches, and rears three stocks of steelhead: Dworshak NFH B-run steelhead, Sawtooth A-run steelhead, and Pahsimeroi A-run steelhead. Typically, the Sawtooth stock is reared in Hatchery Building 1, and the Pahsimeroi and Dworshak stocks are reared in Hatchery Building 2.

- Hatched fry are initially transferred from incubators into indoor nursery tanks. Feeding is initiated in the indoor tanks when 80% of the fry have absorbed their yolk sacs and have achieved swim-up.

- Feeding typically begins 15 to 17 days post-hatch. Semi-moist salmon diets are hand fed at a minimum frequency of once per hour (six to eight times/day) during rearing in the nursery tanks in the hatchery buildings. Water flows in the nursery tanks are initially set at 10 gpm but are later increased and maintained at 60 gpm when the fish start feeding. Density and flow indexes in the nursery tanks are maintained below maximum values of D.I. = 0.80 and F.I. = 1.00, respectively.

- Fish are transferred to outside raceway as subyearlings in August at approximately 100 fish per pound. Marking (clipping adipose fins) occurs during the transfer. Fish in 50 indoor nursery tanks are distributed to 57 outside raceways in three serial raceway decks. The number of fish transferred to each raceway is determined by the maximum desired rearing densities, established by fish health protocols, immediately prior to transport and release into the Salmon River. Fish are transferred to outside raceways before marking if rearing densities in the nursery tanks exceed maximum density guidelines before marking can be performed.

- A study of broodyear 2007 steelhead reared at Hagerman NFH indicated an incremental increase in mortality when comparing unmarked to marked and/or tagged fish. Mortality for steelhead after marking and tagging, until release, was as follows: 1.89% unmarked, 3.18% adipose-fin clipped, 4.62% PIT tagged, and 6.79% adipose-fin clipped/coded-wire tagged.

- Fish are fed in the outside raceways with demand feeders. During the entire outside rearing cycle, all raceways are cleaned (swept) twice weekly. Fish are sampled monthly to estimate mean size and growth rate. Length frequency distributions of the fish are determined periodically.

- Smolts intended for release and natural spawning (as returning adults) in the Yankee Fork (of the Salmon River) are not marked with an adipose-fin clip and are reared separately from the other release groups that are marked.

- Sawtooth and Pahsimeroi A-run steelhead have fewer fish health problems than Dworshak NFH B-run steelhead reared at Hagerman NFH. For example, the confounding presence of *Nucleospora salmonis*, *Aeromonas hydrophila*, and dorsal fin erosion likely contributes to "soreback" syndrome that appears in the fall and causes significantly greater mortality to Dworshak NFH B-run steelhead than to Sawtooth or Pahsimeroi A-run steelhead.

- Dworshak NFH B-run steelhead exhibit increasing cumulative mortality (1.5-4.0% monthly mortality) beginning in January and extending through April relative to the Pahsimeroi and Sawtooth A-run steelhead which show little to no increase in mortality during this same time period. The Idaho Fish Health Center (Ahsahka, Idaho) is investigating the role of *N. salmonis* and other pathogens as potential causes for this mortality which has been name "B syndrome" after the Dworshak B-run stock.

- Density indexes in the outside raceways are maintained below a maximum value of D.I. = 0.20. Flow indexes in the outside raceways are adjusted according to mean fish size at F.I. = 0.8, 1.00 and 1.2 for mean sizes less than 80 fish per pound (fpp), between 80 and 15 fpp, and greater than 15 fpp, respectively.

- NOAA Fisheries guidelines under the ESA require the release of summer steelhead at lengths ranging from 180 to 250 mm. The constant 59° F. water temperature promotes rapid fish growth. To meet the size criterion of NOAA Fisheries, intermittent feeding is initiated during the fourth month of culture in the outside raceways. Mean weights (fish per pound) and lengths are estimated monthly for fish in representative ponds. During winter, feed is restricted to every other day or every third day to control growth rate and meet target size at release.

- A pathologist from the Idaho Fish Health Center (Ahsahka, ID) examines fish of each stock and broodyear every two months to ascertain presence of pathogens and/or signs of disease. Hatchery staff send fish samples to the lab as needed.

- Chemotherapeutants for treating disease were used in the past but with limited success. Furunculosis is prevalent in the water supply. Florfenicol was used unsuccessfully to treat Furunculosis in the early 2000's The use of vaccine to prevent this disease was successful. The Hatchery staff has reduced the amount of handling in an attempt to avoid the reoccurrence of a Furunculosis epizootic. Consequently, chemical treatments have been used only rarely since the mid-1990'.

- The Idaho Fish Health Center is currently investigating the fish health risks associated with pebble snails (native snail, not listed under the ESA) in the spring water supply. The appearance of the microsporidean parasite *N. salmonis* in the pebble snail correlates to the detection of the parasite in the hatchery fish. Studies are necessary to determine whether the snail is a host in the life cycle of this parasite which appears to be indigenous to the area. The parasite has not been detected in the invasive New Zealand mud snail.

Release and Outmigration

- The desired release size of steelhead smolts is 180 to 250 mm in length (220 mm is the mean target length) per guidelines established by NOAA Fisheries. The target release size is intended to correspond to optimum smolt size that minimizes residualism, precocial sexual maturity, and potential impacts on natural populations, particularly those that are listed under the ESA. The target release size corresponds to 4.5 fish per pound.

- Sawtooth A run steelhead reared at Hagerman NFH are released at two sites: (1) Salmon River immediately below the weir at Sawtooth Hatchery (810,000 smolts) and (2) Yankee Fork of the Salmon River (240,000 smolts).

- Pahsimeroi A-run steelhead are released at two sites in the Little Salmon River: (1) at Stinky Springs (160,000 smolts) and (2) at Hazard Creek (40,000 smolts).

- Release sites in the Salmon River follow guidelines provided by the Idaho Fishery Resource Office (Ahsahka, ID) with respect to the presence of New Zealand mud snails in the water supply at Hagerman NFH. New Zealand mud snails are present in the Salmon River drainage but not the Clearwater River drainage.

- The total estimated release into the Salmon River of A-run steelhead reared at Hagerman NFH (BY2007) is 1,250,000 smolts.

- BY2007 Sawtooth A-run steelhead smolt release goals for 2008 are: 810,000 adipose fin-clipped steelhead released in the Upper Salmon River at the Sawtooth Hatchery weir (80,000 coded-wire tagged and 10,000 PIT tagged); 140,000 unclipped steelhead into Yankee Fork for the Shoshone-Bannock supplementation program (1,500 PIT tagged); 100,000 adipose fin-clipped steelhead into the Yankee Fork (1,000 PIT tagged).

- BY2007 Pahsimeroi A-run steelhead smolt release goals for 2008 are: 200,000 unclipped steelhead into the Little Salmon River at Stinky Springs and Hazard Creek (5,800 PIT tagged).

- Smolts are transported from Hagerman NFH to the Salmon River basin in tractor-trailer semi-trucks with 5,000 gallon tank capacities. Approximately 18,000 smolts at 4.5 fpp can be loaded into a tanker trailer. Several truck loads are thus required for each site to meet smolt release objectives. Transportation and release begin in late March and early April, and continue throughout the second week of May. The Hatchery follows IHOT fish transportation guidelines that adjust truck loading based on tank water volume, fish size, water temperature, and time in transport.

- During the initial years of the A-run steelhead program (next section), fish were transported earlier in the season and acclimated at the Sawtooth Fish Hatchery prior to release. At that time of the year, water temperatures at Sawtooth Hatchery were much lower than desired for steelhead, and the acclimated fish appeared to have problems with stress and disease (e.g. enteric redmouth disease, ERM). Fish transportation for both A and B-run steelhead is now later in the season and a direct release without acclimation to reduce the temperature difference between Hagerman NFH and the Salmon River. Some concerns still exist regarding stress level at time of release. One issue of concern is a possible change in gas pressures in the transport tank as the fish are hauled over Galena Pass. This pass is at ~8700 feet elevation the change in gas pressure may be exacerbated during a low pressure storm event.

- Although the parasite, *Myxobolus cerebralis*, which causes whirling disease, is present in the Salmon River drainage, steelhead reared at Magic Valley FH and Hagerman NFH are released into the Salmon River at a size larger than when they would be susceptible to the parasite.

Facilities and Operations

Refer to the Facilities and Operations section under Operational Considerations for the Hagerman NFH B-run Steelhead program.

Research, Education, and Outreach

- Numbers of fish marked, mark type, and release locations are established by the annual IDFG Steelhead Mark Plan which incorporates other agreements and processes such as U.S. vs. Oregon. Marking and tagging occurs currently in August 2007. Marking is coordinated with Niagara Springs Fish Hatchery, Magic Valley Fish Hatchery, and the IDFG Marking Crew.

- The application of PIT tags to Sawtooth and Pahsimeroi A-run steelhead released in the Salmon River was intended initially to assess survival and the duration of travel to Lower Granite Dam. IDFG is currently working on a new PIT tagging plan that will also allow assessment of adult return rates back to the Snake River and Lower Granite Dam.

- 80,000 BY2006 Sawtooth A-run steelhead with clipped adipose fins and coded-wire tags were released at the Sawtooth Hatchery weir in 2007. Coded-wire tags will be used to measure adult contribution to fisheries, as well as evaluate total adult returns by release group. IDFG is responsible for evaluating coded-wire and PIT tag data to estimate smolt-to-adult return rates and fishery contributions. PIT tags are used to evaluate juvenile out-migration success to Lower Granite Dam and beyond. No direct comparisons between groups will be made, so these tags are used largely to evaluate the success of outmigration class success and detect potential gross problems with releases. There is currently no plan to use CWT data to assess adult return rates or fishery contributions of steelhead reared at Hagerman National Fish Hatchery and released in 2006.

- The Shoshone-Bannock Tribes are conducting an experimental study to evaluate instream "egg boxes" as a method to generate outmigrating smolts in the Yankee Fork. Each steelhead spawned at Sawtooth Fish Hatchery to supply eyed eggs to the Tribe will be genotyped at a suite of DNA loci so that juvenile and adult progeny can be later identified via parentage analysis without the use of physical tags. Those returning "F1" adult fish are intended to spawn naturally and increase the number of natural-origin fish produced in Yankee Fork. The resulting natural origin "F2" progeny will be identified via DNA genotyping and a grand-parentage genetic analyses.

- See the B-run Steelhead at Hagerman NFH program description for additional research, education and outreach considerations.

Benefit and Risk Assessment[103]

BENEFITS CONFERRED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

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

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

Harvest Benefits

- None identified. Fish are not released in the Snake River in the immediate vicinity of Hagerman NFH.

Conservation Benefits

- None identified.

Research, Education, Outreach and Cultural Benefits

- See the same section of benefits under the Hagerman NFH B-run steelhead program.

BENEFITS CONFERRED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

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

Harvest Benefits

- The program supports sport and tribal harvest in the Salmon River and downstream fisheries in the Snake and Columbia rivers (Idaho, Washington and Oregon).

- A-run steelhead reared at Hagerman NFH and released into the Salmon River exhibited a mean smolt-to-adult return rate of 0.72% (BY 1992-2000) based on limited data used to estimate returns upstream of Lower Granite Dam,. This mean return rate translates into a predicted return of 8,640 adult steelhead based on an annual release of 1.2 million smolts.

- Data on harvest of steelhead from Hagerman NFH in downstream Columbia River fisheries is limited. For all Snake River steelhead stocks combined, in the most recent 10 years of record (1996-2005), the mainstem harvest rate on A-run steelhead has ranged from 2.5% to 10.4%, averaging 5.3%. The B-run steelhead harvest in the mainstem has ranged from 3.4% to 34.6%, averaging 13.2%. B-run steelhead are harvested at a higher rate because run timing overlaps coho and fall Chinook and the zone 6 harvest gear is gill nets that select for larger fish[104].

- Hatchery-origin A-run steelhead released into the Salmon River contribute significantly to recreational fisheries. IDFG estimated that approximately 18,000 and 15,000 steelhead (A-run and B-run fish combined for all hatchery-produced steelhead) were harvested by anglers in Idaho during the fall of 2000 and spring of 2001, respectively. The estimated number of total adult returns from smolts reared at all three rearing facilities in the Hagerman Valley (Hagerman NFH, Magic Valley Fish Hatchery, Niagara Springs Fish Hatchery) was 22,649 steelhead. Anglers harvested approximately 18,000, 12,000, and 3,000 steelhead from the Salmon, Clearwater, and mainstem Snake rivers, respectively, during the 2000-2001 steelhead fishing season. Harvest data for fish reared at each of the three facilities are not available.

- Angling effort for steelhead in Idaho fluctuates annually depending on the number and return timing of adult fish available for harvest and several socio-economic factors. For the 2001-2002 steelhead season, anglers contributed approximately 22,000, 15,000, and 148,000 angler/hours

[104] *Pete Hassemer, IDFG, Pers. Comm.*

on the Snake, Little Salmon, and mainstem Salmon rivers, respectively, during the 2001-2002 steelhead fishing season. Those numbers were approximately 18,000, 18,000, and 145,000 angler-hours, respectively, during the 2002-2003 steelhead fishing season.

Conservation Benefits

- The A-run steelhead program at Hagerman NFH may be contributing to the maintenance of naturally spawning populations of steelhead in the Salmon River (e.g., in Yankee Fork), although this is not an explicit goal of the program.
- Decaying steelhead carcasses provide nutrient benefits to streams in which hatchery-origin steelhead return.
- The springs and water courses at Hagerman NFH provide refuge for the Bliss Rapids Snail (*Taylorconcha serpenticola*) which is listed as threatened under ESA.

Research, Education, Outreach and Cultural Benefits

- Tribal harvest provides a cultural benefit to the Shoshone-Bannock, Nez Perce, and other Columbia River basin tribes.
- Hatchery staff provide educational and outreach opportunities offsite to other communities.
- The Nez Perce Tribe, IDFG and Shoshone-Bannock Tribes participate in research associated with this program.

Risks Posed to the Propagated Stock and Local Community

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

Genetic Risks

- Mutual backfilling of egg shortages among Sawtooth, Pahsimeroi, and Oxbow Fish Hatcheries - has occurred in the recent past. This backfilling inhibits development of locally-adapted broodstocks at each of the three facilities where returning adults are trapped for broodstock. Backfilling, in the long run, is expected to reduce smolt-to-adult return rates, increase stray rates, and reduce desired benefits (e.g., harvest) for steelhead reared at Hagerman NFH (and elsewhere) and released into the Salmon River.

Demographic Risks

- Multiple transport of fish and eggs among three adult steelhead trapping locations (Sawtooth, Pahsimeroi, and Oxbow Fish Hatcheries) and three steelhead rearing locations (Hagerman NFH, Magic Valley Fish Hatchery, and Niagara Springs Fish Hatchery) increases demographic risks due to repeated handling and transportation. The duplicate rearing of the same stocks (e.g., Sawtooth A-run steelhead) at multiple facilities (e.g., Hagerman NFH, Magic Valley Fish Hatchery) contributes to this risk.

- See also demographic risks for B-run steelhead at Hagerman NFH.

Ecological Risks

- Same as those for B-run steelhead at Hagerman NFH.

Physical Risks

- Same as those for B-run steelhead at Hagerman NFH.

Research, Education, Outreach and Cultural Risks

- None identified.

RISKS POSED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

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

Genetic Risks

- The straying of non-ESA-listed A-run hatchery steelhead has not been adequately assessed, and the genetic risk to listed natural populations is uncertain.

- Non-ESA-listed A-run hatchery steelhead outplanted in the Salmon River Basin at locations without adult recapture facilities pose genetic risks to natural steelhead populations that may exist in the vicinity of those locations. According to the Interior Columbia Technical Recovery Team (TRT), the Salmon River steelhead major population grouping (MPG) currently does not meet MPG level viability criteria, thus increasing the potential risk.

Demographic Risks

- None identified.

Ecological Risks

- Releases of large numbers of non-native hatchery steelhead pose a predation risk to listed salmonid juveniles in the watershed (e.g., spring Chinook in Valley Creek.

- Out-of-basin straying of these fish as returning adults poses ecological risks to other stocks.

- The presence of New Zealand mud snails in the water supply at Hagerman NFH poses an ecological risk to release locations in the Salmon River.

- Fish infected with *Nucleospora salmonis* are a disease risk to other fish and aquatic species and may spread the parasite in the Salmon River.

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

Research, Education, Outreach and Cultural Risks

- None identified.

Recommendations for Current Program

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

Program Goals and Objectives

Issue HA25: Present program goals for A-run steelhead at Hagerman NFH are not fully expressed in terms of numeric outcomes that quantify intended benefits or goals. *Harvest contributions vary widely in response to post-release survivals, marine conditions, and harvest regime. Like most other programs, this hatchery program lacks specific numeric goals for contribution to harvest or other benefits. Overall, the Hagerman NFH LSRCP adult return goal of 13,600 steelhead upstream of Lower Granite Dam is for A and B-runs combined. Harvest goals for A-run steelhead reared at Hagerman NFH and released into the Salmon River should be specified as "benchmarks" to allow monitoring and evaluation of the harvest benefits resulting from the A-run program.*

Recommendation HA25: Restate program goals to include harvest goals for A-run steelhead adults from Hagerman NFH for the Salmon River basin.

Issue HA26: Current conditions affecting the survival of salmon and steelhead in the Snake and Columbia rivers (operation of the hydropower system, habitat, harvest, and ESA listings) downstream from release sites in the Salmon River differ from the assumptions that were used to establish LSRCP mitigation goals. *These different conditions inhibit consistent achievement of Hagerman NFH's contribution (13,600 adult steelhead) towards meeting the LSRCP mitigation goal of 55,100 adult steelhead returning annually upstream of Lower Granite Dam, as developed initially by the Army Corps of Engineers in the mid-1970's.*

Recommendation HA26: Continue to work through various regional processes such as (a) implementation of the mainstem *Federal Columbia River Power System Biological Opinion* to improve migration survival, (b) *US vs. OR* discussions to address harvest issues, (c) NOAA

Fisheries to complete ESA consultations on hatchery mitigation programs, and (d) local watershed groups to continue improving habitat, to allow the Service and cooperators meet Army Corps of Engineers and LSRCP mitigation goals on a consistent basis. Reexamine current approaches for contributing 13,600 adult steelhead to the LSRCP mitigation goal of 55,100 adult steelhead (upstream of Lower Granite Dam) to determine whether the current hatchery program should be modified to account for existing conditions and capabilities at Hagerman NFH.

Broodstock Choice and Collection

Issue HA27a: Hagerman NFH rears A-run steelhead from broodstock collected at Sawtooth and Pahsimeroi Fish Hatcheries. *Hagerman NFH is scheduled to receive 1.15 million eyed eggs from Sawtooth Hatchery and 215,000 eyed eggs from Pahsimeroi Hatchery annually. Similarly, Magic Valley Hatchery is scheduled to receive 480,000 and 475,000 eyed eggs from Sawtooth and Pahsimeroi Fish Hatcheries, respectively. Rearing multiple stocks at both facilities creates a "criss-cross" network of egg and fish transfers among broodstock collection facilities, rearing facilities, and release locations that complicates the culture and logistics of rearing and transferring steelhead smolts to multiple locations in the Salmon River. For example, rearing multiple stocks in smaller lots increases inefficiencies in rearing space utilization and marking/tagging programs.*

Issue HA27b: *Only Sawtooth A-run steelhead reared at Hagerman NFH are released at Sawtooth NFH; fish reared at Magic Valley are outplanted to support mainstem fisheries. In the past, all of the eyed eggs from one third of the egg takes at Sawtooth FH were transferred to Magic Valley FH for rearing. This protocol effectively eliminated the genetic contribution of adult steelhead in those egg takes from the population at Sawtooth FH. (see also Issue 29).*

Recommendation HA27: Discontinue rearing Pahsimeroi A-run steelhead at Hagerman NFH and rear all Sawtooth A-run steelhead released in the Salmon River at Hagerman NFH. This could be accomplished by the following: (a) transfer the responsibility of rearing 200,000 Pahsimeroi A-run steelhead from Hagerman NFH to Magic Valley Fish Hatchery, (b) discontinue rearing Dworshak NFH B-run steelhead (200,000 smolts) at Hagerman NFH (see recommendation DW4 and recommended Alternative 6 for the Dworshak B-run program at Hagerman NFH), (c) discontinue rearing Sawtooth A-run steelhead at Magic Valley Fish Hatchery, and (d) rear up to an additional 400,000 Sawtooth A-run steelhead smolts at Hagerman NFH (see also Recommendation HA29).

Issue HA28: Egg take shortages at Sawtooth and Pahsimeroi Hatcheries, two sources of eyed eggs for Hagerman NFH, have been backfilled in the past with eyed eggs from Oxbow Hatchery in the Hells Canyon area of the Snake River when adult returns to Sawtooth and Pahsimeroi hatcheries are insufficient to meet eyed egg objectives at Hagerman NFH and Magic Valley FH. *In addition, Sawtooth and Pahsimeroi eggs have also been used in the past to backfill shortages at the other facility. Backfilling of egg shortages among hatcheries is inconsistent with the principles of local adaptation and is expected - in the long run - to prevent individual stocks from attaining their respective viability potentials, thus reducing smolt-to-adult return rates. "Backfilling" can occur at several stages in the culture cycle because fish from each facility are not differentially marked or tagged prior to release; for example, "backfilling" can occur when (a) eyed eggs are shipped to Hagerman NFH, (b) fish from one hatchery (Sawtooth, Pahsimeroi, or Oxbow) are released at the adult collection site*

for another hatchery, or (c) fish are released in areas (e.g., mainstem Salmon River) that results in adults straying into a another facility. In recent years, Oxbow, Sawtooth, and Pahsimeroi stocks have been managed as three separate stocks with occasional backfilling. However, the 2008 Salmon River Annual Operations Plan suggests that backfilling among stocks is a management option.

Recommendation HA28: Continue to manage Sawtooth, Pahsimeroi, and Oxbow Hatchery stocks separately with no backfilling among stocks to meet facility capacities at Hagerman NFH. Sawtooth A-run steelhead, Pahsimeroi A-run steelhead, and Oxbow A-run steelhead should be managed as three distinct broodstocks to maximize local adaptations and individual stock viabilities. Backfilling of egg shortages *for broodstock* should only occur as an emergency conservation measure when adult returns to a particular hatchery are sufficiently low over multiple years to increase genetic and demographic risks to the hatchery stock itself. If backfilling is used to meet fishery or other mitigation responsibilities in the upper Salmon River, then fish resulting from backfilled eggs should be reared separately and given differential marks or tags to exclude the non-origin fish from the local broodstock when those fish return as adults to the backfilled facility.

Hatchery and Natural Spawning, Adult Returns

Issue HA29: Eyed eggs transferred to Hagerman NFH from Sawtooth Fish Hatchery may not accurately represent all the adults returning to Sawtooth Hatchery. *For example, for brood year 2007, eyed eggs transferred to Hagerman NFH were from only 8 of 12 spawn takes at Sawtooth Fish Hatchery. However, Sawtooth A-run steelhead reared at Hagerman NFH are the source of future broodstock at Sawtooth Fish Hatchery and should accurately represent all egg takes from adults trapped and spawned at the hatchery.*

Recommendation HA29: Transfer eyed eggs from all spawn takes at Sawtooth Fish Hatchery to Hagerman NFH for rearing and subsequent release as smolts at Sawtooth FH. If Recommendation HA27 is implemented, then all Sawtooth A-run steelhead would be reared at Hagerman NFH, facilitating implementation of Recommendation HA29 described here.

Incubation and Rearing

Refer to HA5, HA6, and HA7 under Recommendations for the Hagerman NFH B-run steelhead program.

Release and Outmigration

Issue HA30: The current outplanting of A-run steelhead under the LSRCP in the mainstem Salmon River may not be consistent with ESA recovery planning. *The interior Columbia River Technical Recovery Team (ICTRT) has identified the mainstem Salmon River and tributaries upstream of the East Fork Salmon River as a "demographically independent population" distinct from the East Fork and the mainstem Salmon River downstream of the East Fork. The 2008 Annual Operations Plan for the Salmon River lists three sites in the mainstem Salmon River downstream from the East Fork ("Colston Corner", "Tunnel Rock", and "McNabb Point") where either Pahsimeroi or Sawtooth A-run steelhead can be released. At the present time, fish released at those three locations are currently reared at Magic Valley FH. However,*

if all Sawtooth A-run steelhead are reared at Hagerman NFH (Recommendation HA27), then the Team presumes that some of those fish could potentially be released at one or more of the three mainstem sties downstream from the East Fork. To be consistent with the concepts of local adaptation and the population designations ICTRT, the Team has concluded that the release of Sawtooth A-run steelhead from Hagerman NFH should continue to be restricted to the upper Salmon River basin upstream of the confluence of the East Fork, even if Recommendation HA27 is implemented. The unintended residualism of smolts and potential natural spawning of Sawtooth A run steelhead that stray into tributaries downstream of the East Fork with listed salmon and steelhead poses ecological and genetic risks to ESA listed populations.

Recommendation HA30: Restrict the release Sawtooth A-run steelhead in the mainstem Salmon River upstream of the East Fork where opportunities exist to recapture unharvested adults . For example, restrict the release of Sawtooth A-run steelhead to (a) immediately below the weir at Sawtooth Hatchery to support downstream fisheries and provide sufficient numbers of returning adults back to Sawtooth Fish Hatchery for broodstock, and (b) offsite areas upstream of the East Fork Salmon River consistent with ESA recovery strategies that minimize risks to listed populations (e.g., Yankee Fork).

Issue HA31: Sawtooth A-run hatchery steelhead, which are currently reared at both Hagerman NFH and Magic Valley FH, are released at several locations (e.g., Yankee Fork, mainstem Salmon River downstream from East Fork Salmon River) that preclude collection of returning adults for broodstock at Sawtooth Fish Hatchery. Those off-site releases reduce the ability to meet broodstock collection goals at Sawtooth Fish Hatchery in low adult return years if the total number of fish released from Sawtooth Fish Hatchery is reduced to meet off-site release objectives.

Recommendation HA31: Establish Sawtooth Hatchery as the *first priority* for releases of Sawtooth A-run steelhead. This is particularly important in brood years resulting from low numbers of returning adults. In addition, when the number of adult steelhead trapped at Sawtooth Fish Hatchery is insufficient to meet all release objectives for Sawtooth A-run steelhead in the upper Salmon River (i.e., upstream from the East Fork Salmon River), a portion of their progeny released at Sawtooth Fish Hatchery can be unmarked (unclipped adipose fish) but 100% tagged with coded-wire tags to increase survival through the fisheries and allow their identification at the hatchery (see also Recommendation HA28 regarding "backfilling" of egg shortages). Reduce the total number of release sites for Sawtooth A run steelhead in the Salmon River (see Recommendation HA30) and/or reduce the number of fish released at off-station locations when the total number of smolts available for release is below program objectives.

Issue HA32: According to the comanagers' 2008 Annual Operations Plan for the Salmon River, 170,000 and 50,000 Sawtooth A-run steelhead smolts are intended to be released in the Yankee Fork and Valley Creek, respectively, with intact adipose fins and no coded (or blank) wire tags (3,200 of those 220,000 smolts will carry PIT tags). [Note: 140,000 of those fish are reared at Hagerman NFH and 80,000 are reared at Magic Valley FH.] Similarly, 200,000(and 60,000 Pahsimeroi A-run steelhead reared at Hagerman NFH and Magic Valley Fish Hatchery, respectively, with intact adipose fins and no wire tags are intended to be released into the Little Salmon River and Slate Creek, respectively (7,100 of those 260,000 smolts will carry PIT tags). The release of large numbers (≈470,000) of unmarked

and untagged smolts in the upper Salmon River precludes accurate assessments of program benefits and risks related to comanager goals for harvest and conservation.

Recommendation HA32: Mark or tag all A-run steelhead reared at Hagerman NFH and released into the Salmon River. This recommendation applies also to all hatchery-origin fish released into the Salmon River.

Issue HA33: Pahsimeroi stock steelhead reared at Hagerman NFH are released into the Little Salmon River. However, if Recommendation HA29 is implemented, Pahsimeroi steelhead will not be reared at Hagerman NFH and only Sawtooth steelhead would be reared.

Recommendation HA33: Discontinue the release of A-run steelhead from Hagerman NFH into the Little Salmon River as part of the reprogramming outlined in Recommendation HA29.

Issue HA9 under Recommendations for the Hagerman NFH B-run steelhead program also applies to A-run steelhead.

Facilities/Operations

Refer to the Facilities/Operations section under Recommendations for the Hagerman NFH B-run steelhead program.

Research, Monitoring, and Accountability

Issue HA34: Coded-wire tagged fish need to accurately represent all progeny groups released from Hagerman NFH. Currently, a total of 80,000 Sawtooth A-run steelhead in only four of 48 raceways at Hagerman NFH are given coded-wire tags (of the 810,000 smolts released at Sawtooth FH). *Fish in different raceways can differ in mean age and size, and the pond environments can differ slightly in flow index, flow pattern, and other environmental factors. Therefore, tagging fish in just a few raceways needs to represent the entire population for that brood year. In most NFH production programs, salmon are spawned throughout the adult return to ensure that most segments of the run are represented in the resulting progeny. This procedure usually results in many different spawn "takes". The fry are ponded by take/hatch date into a series of raceways that, when fully populated, differ in age and size of fish (initially) between raceways. Production monitoring using coded-wire tags requires that the tags represent the entire population.*

Recommendation HA34: The Service and staff at Hagerman NFH should continue to consult with Idaho Department of Fish and Game and the Idaho Fishery Resource Office (Ahsahka, ID) to ensure that the tagging strategy at Hagerman NFH accurately represents the entire population of progeny from all spawn groups for a particular brood year. For example, all spawn groups should be proportionately represented among tag groups and raceways with fish destined for different release sites given different tag codes. The tagging and evaluation program, as a best management practice, needs to continue to accurately represent the population being studied.

Issue HA35: Long distance transportation (4-6 hours), transport over a high elevation pass (>8,000 feet), and water temperature differences between the tanker truck and Salmon River release sites, creates uncertainties regarding the physiological ability of transported fish to survive the first 24-48 hours after release (see also Issue HA9). *Comanagers are initiating a PIT tag program in 2008 to assess outmigrant survival of A and B-run steelhead to lower Granite Dam, but those studies are not designed to evaluate physiological stress and immediate post-release survival at the release sites.*

Recommendation HA35: The Service should continue to assess, in collaboration with the tribes and IDFG, post-release survival of transported fish in the Salmon River via PIT tags. New data supplied recently to the Review Team indicate that post-release mortality immediately after release into the Salmon River may not be a significant issue at the present time. For the migration years 2000-2008, average estimated survival rates for A-run steelhead trucked from Hagerman NFH, Niagara FH, and Magic Valley FH were 72%, 77%, and 75% respectively compared to 72% for steelhead trucked and outplanted into the South Fork Salmon River from Clearwater Fish Hatchery. If post-release survivals to Lower Granite Dam decrease in future years, then new studies should include measures of physiological stress during transport and at the time of release, ability of the released fish to acclimate physiologically to the receiving water as a function of temperature differences between the truck tank water and stream water, and predation risks – including angling – in the vicinity of the release sites (see also Recommendation HA9).

Issue HA36: *The outplanting of steelhead into the Yankee Fork, and other locations where non-harvested fish cannot be recaptured (e.g., Valley Creek), poses genetic risks to natural populations that may exist in the immediate vicinity of the release sites (Note: Habitat characteristics in those outplanted streams may have historically precluded self-sustaining natural populations of steelhead but may have supported resident trout populations). Specific conservation and harvest goals for those outplants have not been explicitly stated. The extent that outplanting increases straying to populations outside the target return areas is unknown.*

Recommendation HA36: Evaluate the benefits versus risks of outplanting Sawtooth A-run steelhead into the Yankee Fork, Valley Creek, and Slate Creek (see Recommendation HA33). Discontinue the release of steelhead into those streams if those outplants yield no measurable benefit, or the benefits of those outplants do not outweigh the risks. Construction of a permanent weir in the Yankee Fork could facilitate evaluation of the benefits and risks of outplanting steelhead. In addition, a weir could provide additional research opportunities and allow potential development of a local broodstock for steelhead.

Refer to the Recommendations for the Hagerman NFH B-run steelhead program (HA17 and HA23) for additional Research, Monitoring and Accountability recommendations

Education and Outreach

See Recommendation HA24 under Hagerman B-run steelhead program.

Alternatives to Current Program[105]

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

Alternative 1: Current Program with Recommendations

This alternative represents the current A-run steelhead program at Hagerman NFH with implementation of all recommendations. These recommendations include rearing only Sawtooth A-run steelhead at Hagerman NFH and rearing of Pahsimeroi A-run steelhead at Magic Valley Fish Hatchery. Under these recommendations, the release of Sawtooth A-run steelhead would be restricted to immediately below the weir at Sawtooth Fish Hatchery and areas consistent with the recovery of ESA listed salmonids Implementation of these recommendations would also eliminate "backfilling" of egg shortages among Sawtooth, Pahsimeroi, and Oxbow fish hatcheries for meeting egg and fish culture capacities at Hagerman NFH.

Pros

- Improves local adaptation (e.g. disease resistance, homing, etc.), and works towards a one-to-one correspondence among broodstock collection, rearing, and release locations in the upper Salmon River.
- Improves fish culture practices and efficiency by allowing staff to focus on one stock of A-run steelhead.
- Decreases disease risks by substantially reducing the number of source and recipient locations for eggs and fish.
- Maintains the existing level of fishing opportunity for A-run steelhead in the Salmon River and in downriver fisheries.
- Supports angler priorities for meeting fishery mitigation responsibilities.
- Improves accountability and traceability of fish performance by allowing variances in post-release survival to be traced back to fish culture practices.

[105] *Alternatives presented here are intended to be consistent with those in the companion Idaho-LSRCP report.*

- Reduces slightly (by 30,000 smolts) the total number of A-run steelhead reared at Magic Valley Fish Hatchery.

- Allows state, tribal, and federal comanagers to focus on the biological constraints and relationships among the upper Salmon River upstream of the confluence of the East Fork, Sawtooth Fish Hatchery, and Hagerman NFH.

- Is consistent with the steelhead recovery management units identified by the Interior Columbia Technical Recovery Team for recovering the Snake River *distinct population segment* (DPS) of steelhead.

Cons

- Increases the risk of a catastrophic loss of an entire broodyear of Sawtooth A-run steelhead if those fish are all reared at one facility.

- Increases slightly the total number of A-run steelhead reared at Hagerman NFH from 1.25M to 1.28M smolts while the amount of water available for rearing continues to decline. However, elimination of the Dworshak NFH B-run steelhead program at Hagerman NFH (recommended Alternative 6 for that program) would reduce overall rearing densities for A-run steelhead by 11.7% if the total number of A-run steelhead reared on station is maintained at 1.28M smolts.

- May reduce the total number of A-run steelhead released into the Salmon River in years when insufficient numbers of returning adults are available for broodstock at Sawtooth, Pahsimeroi, or Oxbow fish hatcheries to meet egg take requirements (assuming surplus adults are available at one facility and no backfilling is performed).

- Continues the risk of transporting New Zealand mud snails from Hagerman NFH to the Salmon River.

- Maintains high flow indices for steelhead reared at Hagerman NFH if the Dworshak B-run program is retained.

- Potential risk of spreading the parasite *N. salmonis*.

Alternative 2: Develop an integrated A-run steelhead conservation and harvest program from A-run steelhead native to the Salmon River.

This alternative would replace (or supplement) the current *segregated* A-run steelhead program at Hagerman NFH with an *integrated* program derived from natural-origin steelhead returning to the Salmon River. Once established, the program would be maintained by annually including natural-origin fish in the broodstock at some defined proportion (e.g. 25%) of the total number of adult fish spawned for broodstock each year.

Pros

- The new broodstock would potentially be better adapted at assisting with recovery of natural populations than a broodstock maintained strictly from hatchery-origin adults.

- The current A-run steelhead program could be retained for harvest – albeit, at a smaller size – while establishing and maintaining a small integrated hatchery program focused primarily on conservation objectives (e.g., restoration of natural populations via supplementation natural spawning by hatchery-origin adults).

- An integrated program could eventually evolve into a "stepping-stone" program whereby returning adults surplus to broodstock needs could be used for broodstock in the "segregated-harvest" program, thereby maintaining some genetic continuity between the latter program and natural populations in the Salmon River.

Cons

- Would require identification of one or more natural populations of sufficient viability to support an integrated hatchery program while, at the same time, meeting natural spawning escapement goals for that natural population.

- Would reduce the total number of fish available for harvest while the integrated program is being developed.

- May be difficult to collect sufficient numbers of natural-origin adults for broodstock because logistic constraints of trapping wild steelhead and the low productivity (number of adult recruits per adult spawner) of most steelhead populations in the upper Salmon River (upstream from the Middle Fork).

- The risk of transporting New Zealand mud snails and *N. salmonis* to offsite locations would still exist.

Alternative 3: Terminate the existing A and B-run steelhead programs at Hagerman NFH, and use Hagerman NFH exclusively for the conservation of freshwater aquatic species in the middle and upper Snake River watershed

Pros

- Hagerman NFH could propagate imperiled aquatic species with the greatest conservation priorities.

- Could assist with restoration and recovery of extirpated stocks.

- A research component could be part of the hatchery's new mission, particularly in collaboration with the University of Idaho.

- Gives the hatchery flexibility to respond to changing conservation priorities and mandates.

Cons

- The risk of transporting New Zealand mud snails and *N. salmonis* to offsite locations would still exist.

- Reduces the number of steelhead available for harvest in the Salmon River by 30-40%.
- Reduces the ability of a National Fish Hatchery to meet mitigation responsibilities for anadromous salmonid fishes directly affected by federal water projects in the Snake River basin.
- This new role for the Hagerman NFH would need to be further defined, developed, and coordinated with cooperators.
- This alternative would probably require annual or semi-annual planning documents to define the immediate use of the facility and the planned use over each two- to five-year future period.

Alternative 4: Terminate the A and B-run steelhead programs and decommission the facility

Pros

- Eliminates transfer of out-of-basin stock into the Salmon River.
- Eliminates the need to rear steelhead at Hagerman NFH and transport eyed-eggs.
- Eliminates the risk of transporting New Zealand mud snails from Hagerman NFH.
- Eliminates the B-run steelhead program at Hagerman NFH, the risks of which outweigh the documented benefits.

Cons

- Reduces fishing opportunities for steelhead in the Salmon River.
- Reduces the number of steelhead available for harvest in downriver fisheries.
- Eliminates outreach opportunities for the Service in the region.
- Reduces the ability of a National Fish Hatchery to meet mitigation responsibilities for anadromous salmonid fishes directly affected by federal water projects in the Snake River basin.

Recommended Alternatives

Alternative 2 was not given higher consideration because of (a) the very low numbers of natural-origin A-run steelhead currently observed at existing racks within the upper Salmon River (e.g., at Sawtooth FH, Pahsimeroi FH, and the East Fork weir), (b) the current absence of a recovery plan for steelhead in the Salmon River that could be used as a foundation for new hatchery programs, and (c) the potential need for new infrastructures and facilities to implement an integrated hatchery program with conservation objectives for steelhead. Alternative 2 could be one component of a steelhead recovery plan for steelhead in the Salmon River if artificial propagation is identified as a desired recovery tool in a Recovery Plan for the Snake River Steelhead DPS.

The Review Team also concluded that Alternatives 3 and 4 are inconsistent with current comanager goals for fish and wildlife resources in the Snake River. Steelhead in the Snake River are currently listed as a threatened species under the ESA, and their propagation at Hagerman NFH helps to maintain the species in a region impacted significantly by habitat modifications and hydropower development.

Consequently, the Review Team **recommends implementation of Alternative 1**: retention of the current A-run steelhead program with implementation of all program-specific recommendations. Implementation of Alternative 1 for A-run steelhead, coupled with implementation of Alternative 6 for the Dworshak B-run program, would result in the following actions: (1) the rearing of all Sawtooth A-run steelhead for the Salmon River at Hagerman NFH; (2) the rearing of all Pahsimeroi A-run steelhead at Magic Valley Fish Hatchery (LSRCP portion) and Niagara Springs Fish Hatchery (Idaho Power mitigation portion); and (c) termination of the rearing of Dworshak NFH B-run steelhead at Hagerman NFH.

Implementation of Alternative 1 would not change the number of A-run steelhead smolts released in the upper Salmon River upstream of the confluence of the East Fork (1.28M smolts), but those fish would be restricted to progeny of adults trapped exclusively at Sawtooth Fish Hatchery with no "backfilling" of egg shortages with eggs from either Pahsimeroi or Oxbow fish hatcheries. The total number of A-run steelhead released into the upper Salmon River (i.e., upstream of the East Fork) could be increased from 1.28M to 1.45M smolts if the Dworshak NFH B-run steelhead program at Hagerman NFH is terminated and rearing densities of A-run steelhead are not reduced. However, declining water flows from the natural spring water supply for Hagerman NFH may require reductions in rearing densities in the immediate future.

The Review Team also concluded that A-run steelhead are easier to culture than Dworshak NFH B-run steelhead at Hagerman NFH, and that releases of A-run steelhead in the Salmon River survive and contribute to fisheries at a much higher rate than Dworshak NFH B-run steelhead transferred from the Clearwater River and reared to the smolt stage at Hagerman NFH.

The current purpose (and mandate) of the Hagerman NFH is to assist with meeting mitigation responsibilities of the federal government for loss of natural populations and productivity of steelhead in the Snake River resulting from the construction and operation of four hydropower dams in the lower Snake River. The Review Team believes that implementation of Alternative 1 described here for A-run steelhead at Hagerman NFH – particularly if coupled with termination of the Dworshak B-run program at Hagerman NFH – would increase stock viabilities and intended fishery benefits in the Salmon River while, at the same time, reduce culture risks at Hagerman NFH and straying risks in the Salmon River. Implementation of these recommendations is also expected to increase local adaptations and viabilities of each hatchery stock (Sawtooth, Pahsimeroi, and Oxbow A-run steelhead) while increasing culture efficiencies and decreasing culture risks at Hagerman NFH.

Hagerman NFH Resident Rainbow Trout

Operator: U.S. Fish & Wildlife Service

Summary of Current Program

Goals

Provide mitigation for rainbow trout that were impacted by the construction of Dworshak Dam.

Objectives

- Hagerman NFH raises 90,000 resident rainbow trout to 5 inches for stocking in the spring and 40,000, 9-inch trout for stocking in the fall.
- Obtain 150,000 eyed triploid eggs from Hayspur State Fish Hatchery in late December.
- Maintain beneficial use of Hagerman NFH water rights during periods which do not conflict with steelhead rearing.

Program Description

The Hagerman NFH Dworshak Reservoir mitigation program is conducted as an in-kind exchange program with the Idaho Department of Fish and Game (IDFG). The Hagerman NFH releases rainbow trout in local area waters in Southern Idaho, where by the IDFG stocks rainbow trout produced at the Nampa State Fish Hatchery directly into Dworshak Reservoir. In May, the Hatchery releases 90,000, 5-inch fish for various IDFG put-grow and take fisheries. In the fall the reservoirs are stocked with catchable 9-inch fish.

Assessment of Current Program

Operational Considerations

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

Broodstock Choice and Collection

- Eyed triploid eggs for Hagerman NFH Incubation and Rearing are obtained from the Hayspur State Fish Hatchery.
- Broodstock are either Kamloop (KT) or Hayspur (T9) strains.

Incubation and Rearing

- The outside rearing segment of the rainbow trout program is conducted in twelve raceways dedicated to Service programs. Rainbow trout are incubated, reared and, fed similar to the steelhead. Please refer to the Hagerman NFH B-run steelhead section for this information.

- Upon arrival, the eggs are disinfected in a standard 100 ppm iodine solution for 10 minutes. The eggs are enumerated using either the Von-Bayer or displacement method.

- In the Hatchery, the eggs are evenly divided into upwelling hatchery jars at the head end in each of 9 tanks. Flow rate is set at approximately 6 to 8 gallons /minute per jar. A better than 90% hatching survival is expected.

- At the end of February, when the rainbow trout reach ~ 130 fish per pound or reach a Flow Index of ~ 0.8 and Density Index of 0.6, they are transferred outside to three of the 8' x 80' trout raceways. At this time they are on Spring #17 water entirely (~3 cfs). Since this supply is plumbed to only the trout raceways, no water is diverted from the steelhead production at this time.

- When the trout reach a Flow Index of 0.76 and a Density Index of 0.23, on or about April 15th, fish are spilt into 6 raceways at 6 cfs (an additional 3 cfs is diverted from Main Spring Pool since steelhead loading has been reduced due to ongoing smolt releases for the past two weeks).

- The 90,000 five inch fingerlings are released on or about May 12th. Typically, Flow Index will reach 0.62 and Density Index will be at 0.21.

- The remaining fingerlings are reared in 4 raceways until the fall release. Typically maximum flow will be set at 8 cfs (combination of Spring #17 and flow diverted from Main Spring Pool).

- A disease outbreak in the Hayspur rainbow trout (fall release, group) resulted in a 40% loss of fish, with daily mortalities ranging from 0.1% to 3.5% that began in April 2007 and continued to release in the fall. These fish had infections of *N. salmonis*, *Gyrodactylis*, and *Costia* although the clinical signs indicated that some other, undetermined disease agent was involved. These fish were outplanted to Cascade Lake after consultation with Idaho Fish and Game.

Release and Outmigration

- In mid-September the 40,000 nine inch catchable-size fish are released. Typically, the maximum Density Index is 0.31 and the Flow Index is at 0.47.

- All fish are trucked to various release sites.

Facilities and Operations

Refer to the Facilities and Operations section under Operational Considerations for the Hagerman NFH B-run Steelhead program.

Research, Education, and Outreach

- The Idaho Department of Fish and Game conducted a harvest evaluation of the Brood Year 2006 catchable rainbow trout released into Lake Walcott. A report is pending.

Benefit and Risk Assessment[106]

BENEFITS CONFERRED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

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

Harvest Benefits

- Local harvest benefits are not adequately documented. Anecdotal information indicates rainbow trout released into Little Camas Reservoir and Lake Walcott make significant contributions to their respective fisheries.

Conservation Benefits

- Hagerman NFH rainbow trout program has no conservation benefit for the non-anadromous waters in southern Idaho.

Research, Education, Outreach and Cultural Benefits

- Hagerman NFH provides educational and outreach benefits to the surrounding community. Staff participate in local community events.

- The development of the University of Idaho's Hagerman Fish Culture Experiment Station provides additional outreach opportunities.

BENEFITS CONFERRED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

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

Harvest Benefits

- Anglers benefit in areas throughout south-central Idaho where trout are outplanted.

Conservation Benefits

- None identified.

Research, Education, Outreach and Cultural Benefits

- Hatchery staff provide educational and outreach opportunities offsite to other communities.

RISKS POSED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

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

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

Genetic Risks

- None identified.

Demographic Risks

- There are numerous repair patches in the Spring #17 pipeline that fail periodically.
- The continuing decline in water supply poses a risk to the continued operation of the resident rainbow trout program at its current size.

Ecological Risks

- The parasite *Nucleospora salmonis* has been isolated in the rainbow trout stocks reared at Hagerman NFH which makes them susceptible to other disease agents.

Physical Risks

- None identified.

Research, Education, Outreach and Cultural Risks

- None identified.

RISKS POSED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

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

Genetic Risks

- All rainbow trout raised for this program are triploid to prevent inbreeding with native cutthroat trout. However, a small percentage may remain diploid, able to hybridize with native trout stocks. The effects of hybridization are limited spatially by releasing the rainbow trout in reservoirs.

Demographic Risks

- Rearing rainbow trout at Hagerman NFH may jeopardize other stocks reared (i.e. steelhead) on-station since rearing space is limited and water availability continues to decline.

Ecological Risks

- Disease outbreaks pose a fish health risk to other stocks on station, to the downriver state hatchery and to other trout stocks where the fish are outplanted.
- Rainbow trout pose a competition risk to other trout stocks and species where fish are outplanted.

Research, Education, Outreach and Cultural Risks

- None identified.

Recommendations for Current Program[107]

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

Issue HA37: Currently, no Memorandum of Agreement (MOA) exists between the Army Corps of Engineers (ACOE) and IDFG for the rearing of rainbow trout at Hagerman NFH.

Recommendation HA37: Establish an MOA with the Army Corps of Engineers and IDFG that defines the rearing arrangement and responsibilities for Hagerman NFH. [Note: The Service has begun negotiations on a new MOA with the Walla Walla district of the ACOE, and this new MOA will clarify the Dworshak Project mitigation responsibilities, including rainbow trout.]

Issue HA38: Water flows from springs supplying Hagerman NFH continue to decline, presumably due to increased water withdrawals from the aquifer and exacerbated by drought conditions (*Refer to HA11 in the Hagerman B-run steelhead section for a complete description of the issue*.). *The declining water supply at Hagerman NFH has the potential to produce a conflict between the steelhead and rainbow trout program. Hayspur State Fish Hatchery is unable to provide eyed triploid eggs later than January which requires trout incubation must begin before steelhead yearlings are transported off station to their release sites when water use at the hatchery is at its highest level.*

Recommendation HA38a: In conjunction with recommendations HA11a-d listed in the Hagerman NFH B-run steelhead section, the Service should establish a flow target which triggers a reduction in the number, time, and/or size at release of rainbow trout produced if the Hagerman NFH's if water supply continues to decline.;

Recommendation HA38b: To minimize conflict over water use between this program and steelhead production, purchase eyed triploid eggs from a commercial vendor later in late March or early April, after the hatchery has begun transporting steelhead yearlings off-station to their release sites.

[107] *The Review Team believes that the Hagerman Hatchery Evaluation Team—as a whole, in task teams and/or with outside assistance and expertise—will be the logical body to implement most of the following recommendations.*

Overall Recommendation:

The Team acknowledges that Hagerman NFH is a particularly good facility for rearing resident rainbow trout. However, the Army Corps of Engineers and the IDFG should re-assess the need for the resident rainbow trout program based on current management goals for Dworshak Reservoir mitigation. The Team supports continuing the program if the two parties determine that the program continues to be viable. However, the Team feels that rearing steelhead for release into the Salmon River takes precedence at Hagerman NFH. The Team recommends that the Service continue to assess the carrying capacity of Hagerman NFH, especially given the declining water supply, so that the rainbow trout program does not affect the steelhead programs on station.

V. Conclusions

In general, Dworshak, Kooskia, and Hagerman NFHs are providing intended fishery benefits that outweigh the biological risks associated with those programs. Indeed, programs at all three hatcheries are conferring valuable fishery benefits to both sport and tribal fishers in the Salmon and Clearwater rivers. Nevertheless, current management of those three hatcheries to meet comanager goals for harvest often conflict with the physical constraints of the facilities, conservation goals for natural populations, and/or the biological constraints of the fish themselves. For example, water quantity and temperature constraints at Kooskia NFH impose fish culture risks for spring Chinook at that facility. The Review Team concluded that rearing another species at Kooskia NFH, specifically coho salmon, would reduce fish culture risks, contribute to the Nez Perce Tribe's program for reintroducing coho salmon to the Clearwater River, and provide future harvest opportunities that currently do not exist. Such a change would not preclude the continued release of spring Chinook smolts at Kooskia NFH with rearing occurring at Dworshak NFH. The Team also concluded that the annual transfer and rearing of Dworshak B-run steelhead at Hagerman NFH, followed by the outplanting of those fish into the East Fork Salmon River, increases fish health risks at the latter hatchery and poses biological risks to natural populations in the upper Salmon River, particularly in the East Fork. Rearing multiple stocks of steelhead at multiple facilities in southern Idaho for direct release at multiple sites in the Salmon River increases fish culture risks at each facility and is inconsistent with development of local adaptations, minimizing straying, and maximizing the viability of each hatchery stock. The direct outplanting of Dworshak B-run steelhead into the South Fork Clearwater River and Clear Creek - without facilities or strategies for recapturing non-harvested adults – increases biological risks compared to on-station releases from hatcheries or satellite acclimation facilities that can trap returning adults. Disease risks at Dworshak NFH are particularly acute and would be reduced substantially if gravity-feed water from Dworshak Reservoir could be used for fish culture instead of pumped water from the North Fork Clearwater River at the hatchery site downstream from Dworshak Dam. The declining water supply at Hagerman NFH, due to decreasing output from the Eastern Snake Plain aquifer, is expected to reduce the carrying capacity of the hatchery and increasingly limit the ability of the facility to meet its mitigation goal for steelhead. All of the Team's recommendations are intended to reduce the aforementioned risks while maintain current fishery benefits.

Appendices

Appendix A: All-H Analyzer (AHA) output for salmon and steelhead stocks in the Clearwater and Salmon River Watersheds

(Available from the Columbia Basin Hatchery Review website, www.fws.gov/pacific/fisheries/hatcheryreview/reports.html/)

Appendix B: Lower Snake NFHs Briefing Document

Available from the Columbia Basin Hatchery Review website, www.fws.gov/pacific/fisheries/hatcheryreview/reports.html/

Appendix C: Comments on Draft Report and Review Team Responses

TO BE Available from the Columbia Basin Hatchery Review website, www.fws.gov/pacific/fisheries/hatcheryreview/reports.html/

Appendix D. Complete Text of Comment Letters Received from Stakeholders

TO BE Available from the Columbia Basin Hatchery Review website, www.fws.gov/pacific/fisheries/hatcheryreview/reports.html/

Appendix E: Lower Snake NFHs Operations and Maintenance Costs Summary

TO BE Available from the Columbia Basin Hatchery Review website, www.fws.gov/pacific/fisheries/hatcheryreview/reports.html/

Appendix F: Summary of the Idaho Supplementation Studies

Available from the Columbia Basin Hatchery Review website, www.fws.gov/pacific/fisheries/hatcheryreview/reports.html/

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June 2009