Hatchery Scientific Review Group
Review and Recommendations

Wenatchee River Spring Chinook Population
And Related Hatchery Programs

January 31, 2009
1 Wenatchee River Spring Chinook

The Wenatchee Spring Chinook natural population is part of the Upper Columbia ESU that contains three extant populations- Wenatchee, Entiat and Methow rivers, and one extinct population, the Okanogan River spring Chinook (ICTRT 2004). Upper Columbia River spring Chinook are classified as endangered under the Endangered Species Act (ESA). Major and minor spawning areas are shown on the figure above.

The Interior Columbia Technical Review Team (ICTRT) has classified the Wenatchee River spring Chinook as a “Very Large” population in size based on its historic habitat potential. A “Very Large” population is one that requires a minimum abundance of 2,000 wild spawners and an intrinsic productivity greater than 1.75 recruits per spawner (R/S) to be viable. According to the Upper Columbia Spring Chinook and Steelhead Recovery Plan (UCSSRP), spring Chinook have similar life-history characteristics to those runs originating in the Snake River system. In general, spring Chinook enter the tributaries of the upper Columbia River from April through July, with peak passage in May. Spawning occurs in the late summer to early fall. Juveniles spend one year in freshwater before migrating to the ocean (UCSRB 2007).

Historical Chinook run size to the Wenatchee River was about 41,000 fish; however, the proportion that was spring Chinook is not known (UCSRB 2007). Wenatchee River spring Chinook were likely distributed throughout the main river, portions of the Chiwawa, Little Wenatchee, White River, Nason Creek, Icicle Creek and Peshastin Creek. Based on intrinsic productivity analysis, spring Chinook may have also used portions of Mission and Chiwaukum creeks.

2 Current Conditions

Spring Chinook currently spawn in the upper mainstem Wenatchee River, upstream from the mouth of the Chiwawa River, in the Chiwawa River, Nason Creek, Little Wenatchee River and White River. During periods of higher adult abundance, spring Chinook may also spawn in Chiwaukum Creek. From 2001 through 2005, Leavenworth (Carson stock) adult spring Chinook were planted in Peshastin Creek. These planted fish were not part of the ESU. Fish spawning in Icicle Creek are from out-of-basin (non-listed spring Chinook) from the Leavenworth National Fish Hatchery.

From 1960 through 2003, the abundance of 3+ spring Chinook for this subbasin ranged from 51 to 6,718 fish. The 12-year running geometric mean of spawners in the Wenatchee River has ranged from 383 to 3,449, and were 417 spawners at the time of species listing. Returns-per-spawner over this same period ranged from 0.31 to 1.19, with a geometric mean of 0.74. Smolts produced per redd surveyed was estimated at 364, 250 for the Chiwawa area upstream of Tumwater Canyon and 197 in the Wenatchee subbasin.

2.1 Current Population Status and Goals

This section describes the current population, status, and goals for the natural population.

- **ESA Status:** Wenatchee River spring Chinook are part of the Upper Columbia River Salmon ESU, which was listed as Endangered under the ESA on June 28, 2005 (70 CFR 37160).

- **Population Description:** The Wenatchee population is classified by the ICTRT as “Very Large”. For the HSRG review, the population has been classified as Primary.
- Recovery Goal for Abundance: 2,000 wild spawners
- Productivity Improvement Expectation: The 8-year geometric mean for abundance and productivity (i.e. growth rate) of naturally-produced spring Chinook within the Wenatchee population will be improved to exceed the 10% extinction-risk (viability) curves developed by the ICTRT (e.g., ~ 2,000 spawners at a productivity of 1.75) (UCSRB 2007) 1.
- Habitat Productivity and Capacity:
  - Chiwawa Population Component: Productivity: 5; Capacity: 598
  - Nason Creek Population Component: Productivity: 2.8; Capacity: 371
  - White River Population Component: Productivity: 4.8; Capacity: 253
  - Leavenworth NFH Population Component: N/A

2.2 Current Hatchery Programs Affecting this Population

There are three in-basin hatchery programs that may affect the Wenatchee Spring Chinook population:

1. Chiwawa River Spring Chinook (Eastbank Hatchery): This program can release up to 672,000 smolts yearly from the Eastbank Hatchery as part of an integrated conservation program although this number has not been achieved (average 350,000 smolts). Adults are collected from the Chiwawa River and at Tumwater Dam2. Fish spawning and incubation activities take place at Eastbank Hatchery. Yearlings (12 fpp) are released in the spring into the Chiwawa River (acclimated at the Chiwawa Rearing Ponds). The HGMP notes that 27% of returning adults from the program stray to areas outside of the Chiwawa River. A DNA pedigree analysis is currently in progress to determine the success of the Chiwawa Hatchery population and naturally-produced spring Chinook. All smolts released are 100% adipose fin-clipped or are externally mark using other methods. The program has an R/S of 6.4.

2. Wenatchee River/White River Captive Brood (Eastbank Hatchery): This is a juvenile-based captive brood program that will produce approximately 150,000 yearling fish (second generation) for release to the White River. Currently, egg incubation and early rearing occurs at the Little White Salmon National Fish Hatchery. Adults of White River origin will be collected either at Tumwater Dam (using DNA pedigree analysis) or the White River. The current juvenile component of the program uses eggs collected from 50 redds in the White River. An adult-based supplementation program will be implemented in the future. Program has an R/S of 2.65.

3. Wenatchee Icicle Creek (Leavenworth Hatchery): This segregated harvest program releases 1.63 million smolts (15-18 fpp) each year from the Leavenworth National Fish Hatchery into Icicle Creek. Broodstock used in the program are volunteers returning to the hatchery. All egg incubation and juvenile rearing activities occur on station. Yearling smolts are force-released directly from the raceways starting in mid-April. The program also releases 500 adult spring Chinook into Peshastin and Ingalls creeks. All juveniles released from the facility are 100% adipose fin-clipped. R/S of 2.9 for this program.

Estimated number of hatchery strays affecting the Wenatchee spring Chinook population:

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1 As productivity increases, abundance targets decrease. Thus, there are multiple combinations of productivity and abundance values that would achieve program objectives.
2 A genetic marker is needed for Chiwawa River-origin fish before they can be collected at Tumwater Dam.
Hatchery strays from in-basin integrated programs: 1,110 fish

Hatchery strays from in-basin segregated and out-of-basin hatchery programs: 110 fish

3 HSRG Review

The HSRG has developed guidelines for minimal conditions that must be met for each type of program as a function of the biological significance of the natural populations they affect. For populations of the highest biological significance, referred to as Primary, the proportion of effective hatchery-origin spawners (pHOS) should be less than 5% of the naturally spawning population, unless the hatchery population is integrated with the natural population. For integrated populations, the proportion of natural-origin adults in the broodstock should exceed pHOS by at least a factor of two, corresponding to a proportionate natural influence (PNI) value of 0.67 or greater. For Contributing populations, the corresponding guidelines are: pHOS less than 10% or PNI greater than 0.5. It is important to note that these represent minimal conditions, not targets. For example, the potential for fitness loss when effective pHOS is 5% is significantly greater than it would be at 3%. For Stabilizing populations, we assume the current pHOS or PNI would be maintained.

The HSRG analyzed the current condition and a range of hatchery management options for this population, including the effect of removing all hatchery influence, and arrived at one or more proposed solutions intended to address the manager’s goals consistent with the HSRG guidelines for Primary, Contributing, and Stabilizing populations. The solution included in the cumulative analysis is the last option described in the Observations and Recommendation box below.

In order to highlight the importance of the environmental context, two habitat scenarios were considered: current conditions and a hypothetical 10% habitat quality improvement. See HSRG Observations and Recommendations in the box below for more information.

3.1 Effect on Population of Removing Hatchery

The No Hatchery scenario is intended to look at the potential of the natural population absent all hatchery effects with projected improved fish passage survival in the Snake and Columbia mainstem (FCRPS Biological Opinion May 5, 2008).

Our analysis estimated that Adjusted Productivity (with harvest and fitness factor effects from AHA) for Nason Creek would increase from 1.2 to 2.7. Average abundance of natural-origin spawners (NOS) would increase from approximately 107 fish to approximately 245 fish. Harvest contribution of the natural and hatchery populations would go from approximately 16 fish to approximately 37 fish. The analysis of the Chiwawa estimated that Adjusted Productivity would increase from 2.3 to 4.8. Average abundance of NOS would increase from approximately 277 fish to approximately 502 fish. Harvest contribution of the natural and hatchery populations would go from approximately 389 fish to approximately 76 fish. For the White River population component, estimated Adjusted Productivity would increase from 2.1 to 4.6. Average abundance of NOS would increase from approximately 130 fish to approximately 211 fish. Harvest contribution of the natural and hatchery populations would increase from approximately 46 fish to approximately 32 fish.
3.2 **HSRG Observations/Recommendations**

In the Observation and Recommendation box below we describe elements of the current situation (Observations) that were important to evaluate the natural population and where applicable, the hatchery program(s) affecting that population. We also describe a solution (Recommendations) that appeared to be consistent with manager’s goals; however, this is not the only solution. In some cases more than one solution is described.

Summary results of this analysis are presented in Table 1. The adjusted productivity values reported for each alternative incorporates all factors affecting productivity (i.e., habitat quality, hatchery fitness effects, and harvest rates).

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**Observations**

The Managers have stated their goals for this program as: “Supporting the recovery of ESA listed species by increasing the abundance of natural adult populations, while ensuring appropriate spatial distribution, genetic stock integrity, and adult spawner productivity” (Goal statement adopted by Habitat Conservation Plan Committee, Hatchery Sub-Committee). To achieve this end, the managers identified a current mitigation goal of 672,000 smolts for release within the basin (150,000 White; 250,000 Nason; 272,000 Chiwawa). Until recently, all smolts have been released into the Chiwawa and have been of Chiwawa origin. Managers have identified Wenatchee spring Chinook as an important population with five substructure components. For the purposes of this analysis, the HSRG assumed this population should be considered a Primary population. As currently managed, it is not consistent with that designation, having a PNI less than 0.5.

The **White River** population component is genetically distinct and occupies unique habitat within the basin. White River is a major tributary to Lake Wenatchee, is glacial fed, and the spring Chinook in this river may have unique physiological and life history characteristics. This small population component is currently part of a captive broodstock program derived from eyed eggs pumped from redds in the White River. This subbasin appears capable of supporting 200-250 spawning adult fish under current and expected improved habitat conditions and does not appear capable of supporting substantially larger spawner abundance. The captive broodstock program released less than 2,000 yearling smolts annually prior to the 2005 brood year, but released 60,000 and 142,000 yearling smolts from brood years 2005 and 2006, respectively. Fish are currently reared at the Little White Salmon National Fish Hatchery (NFH) in the Columbia Gorge region. We understand that managers plan to transition to a traditional program (based on the spawning of returning adults) with a target release of 150,000 yearling smolts per year.

The **Little Wenatchee** population component is very depressed and has limited habitat potential. This stream is a tributary to Lake Wenatchee and, therefore, this spring Chinook spawning aggregate may also have unique characteristics associated with migration through a lake. The genetic and demographic relationship to the White River population is unknown.

The planned release for the **Chiwawa population component** is 672,000 smolts per year; however, the average release has been approximately 350,000 smolts. The program smolt release objective is scheduled to be reduced to 298,000 smolts by 2013. The broodstock management protocol has been to collect no more than 33% of the natural-origin adults, leading to an average pN0B of 36% and an average pHOS exceeding 60%. The habitat capacity within the Chiwawa River does not appear to be able to support an integrated program of 672,000 smolts consistent
with the criteria for a Primary designation. All hatchery fish released from the Chiwawa River have both a clipped adipose fin and coded-wire tag.

Chiwawa-origin hatchery fish have been observed to stray to all of the Wenatchee population components upstream of Tumwater Canyon. We understand that operational changes have been adopted at the water intake structure that should reduce this straying.

The Nason Creek population component is depressed, but historically was an important component of the Wenatchee River population of spring Chinook. This stream habitat has potential to be improved. Currently there is no hatchery-directed program for the Nason Creek population component; however, plans are in development to initiate a program in the near future as part of Grant County PUD’s mitigation obligation.

The Leavenworth NFH program is a self-sustaining segregated hatchery population of Carson NFH origin. The current Leavenworth NFH population is considered locally adapted, highly successful in the Wenatchee system, and provides significant harvest benefits in Icicle Creek. While the stray rate from this hatchery program is low, the impact on the small receiving natural components of the Wenatchee population in the upper watershed is a concern. Leavenworth NFH fish can be differentiated from the integrated programs in the upper basin (e.g., Chiwawa hatchery fish) by an adipose fin-clip and the lack of coded-wire tag, although some index groups released from Leavenworth NFH also carry a coded-wire tag for fishery assessments.

Recommendations

The HSRG acknowledges that managing for the recommended PNI values may not be possible or appropriate in the near term when abundance levels are low and demographic risks to the population increase. To address this concern, managers should develop a variable sliding scale for managing abundance so that in low abundance years, more hatchery-origin fish of the appropriate population component are allowed to reach the spawning grounds to reduce demographic risk to the respective populations. A variable abundance sliding scale for managing natural spawners should be incorporated into each of the program-specific recommendations described below. The near-term focus for each integrated program described below should prioritize contributing to the conservation goals in the upper basin.

An example of such a sliding scale would look like this:

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

In years of low NOR abundance, the same 40% of the NOR return would be removed for use in the hatchery brood (pNOB). However, in these years, that 40% may make up only a small part of the needed brood (i.e. pNOB 10%). In these years, enough HORs should be used to achieve needed hatchery brood and additional HORs should be allowed to spawn naturally (pHOS) to achieve the minimum acceptable level of naturally spawning.
The goal of this sliding scale is to achieve an “average” PNI over time of the desired level (0.67 or 0.5) depending on the population designation even though it may not be achieved in any one year. A good way to determine the level of NORs that should be removed each year (see above) is to review the return of NORs over a long time frame and iterate what level (30, 40, 50%) are needed, on average, to achieve the desired PNI.

The HSRG identified two potential options to manage the Wenatchee populations. One option includes transitioning the Leavenworth NFH to a locally-derived stock; the second option keeps the Leavenworth program unchanged.

**Option 1:** This option achieves the standards of a Primary designation for the composite Wenatchee population; however, not all individual components achieve this designation. This option maintains a reserve for individual components while maintaining the current Leavenworth program. Population-specific recommendations under this option are as follows:

**White River:** Once the transition from a captive broodstock to an anadromous broodstock has been accomplished, a program up to 150,000 smolts could be released consistent with managing the White River as a component of the Wenatchee Primary population. This would require a 33% pNOB and controlling the proportion of hatchery fish spawning to achieve a pHOS less than 33%. This could be accomplished by removing approximately 85% of hatchery-origin fish at Tumwater Dam which will contribute to hatchery broodstock and other uses including harvest, food bank donations and stream nutrification. In the rebuilding phase, a high pHOS may be appropriate to help increase abundance of natural-origin spawners.

**Chiwawa:** A program of up to 150,000 smolts could be released consistent with managing the Chiwawa as a component of the Wenatchee Primary population. This would require a 45% pNOB and controlling the proportion of hatchery fish spawning to achieve a pHOS less than 15%. This could be accomplished by removing approximately 85% of hatchery-origin fish at Tumwater Dam which will contribute to hatchery broodstock and other uses including harvest, food bank donations and stream nutrification.

**Nason Creek:** A program up to 150,000 smolts could be released consistent with managing Nason Creek as a component of the Wenatchee Primary population. This would require a 33% pNOB and controlling the proportion of hatchery fish spawning to achieve a pHOS less than 33%. This could be accomplished by removing approximately 85% of hatchery-origin fish at Tumwater Dam which will contribute to hatchery broodstock and other uses including harvest, food bank donations and stream nutrification.

**Leavenworth National Fish Hatchery:** The current hatchery program could be operated consistent with a Primary designation for the Wenatchee population if all identifiable Leavenworth Hatchery fish are removed at Tumwater Dam.

**Additional Production Opportunities:** In addition to the specific program recommendations described above, the HSRG suggests that additional production up to 800,000 smolts could be developed in the lower watershed to provide additional fishery opportunities. Surplus hatchery fish from the integrated programs described above could be used for this program. This opportunity is contingent upon removing strays at Tumwater Dam.

**Option 2:** This option achieves the standards of a Primary designation for each individual component of the Wenatchee population while providing broodstock to transition Leavenworth to a native based stock. This option maintains a reserve for individual components while providing broodstock for stepping stone harvest programs in the lower basin.
Population-specific recommendations under this option are as follows:

**White River:** Once the transition from a captive broodstock to an anadromous broodstock has been accomplished, a program up to 150,000 smolts could be released consistent with managing the White River as a component of the Wenatchee Primary population. This would require a 10% pNOB and controlling the proportion of hatchery fish spawning to achieve a pHOS less than 5%. This could be accomplished by removing approximately 98% of hatchery-origin fish at Tumwater Dam. In the near term, a high pHOS for up to three generations may be appropriate to help increase abundance of natural-origin spawners.

**Chiwawa:** A program of up to 430,000 smolts could be released consistent with managing the Chiwawa as a component of the Wenatchee Primary population. This would require a 10% pNOB and controlling the proportion of hatchery fish spawning to achieve a pHOS less than 5%. This could be accomplished by removing approximately 98% of hatchery-origin fish at Tumwater Dam.

**Nason Creek:** A program up to 160,000 smolts could be released consistent with managing Nason Creek as a component of the Wenatchee Primary population. This would require a 10% pNOB and controlling the proportion of hatchery fish spawning to achieve a pHOS less than 5%. This could be accomplished by removing approximately 98% of hatchery-origin fish at Tumwater Dam.

**Leavenworth National Fish Hatchery:** The current hatchery program could be operated consistent with a Primary designation for the Wenatchee population if all identifiable Leavenworth Hatchery fish are removed at Tumwater Dam. The HSRG understands that co-managers are considering transitioning the current broodstock to a Wenatchee-based stock. If managers decide to replace the current Leavenworth stock, they should consider maintaining this stock at another suitable location or by maintaining a smaller program at Leavenworth Hatchery.

The HSRG recommends that managers implement a BKD control strategy for their spring and summer/fall Chinook hatchery programs where BKD has proved a recurring problem. Ideally, the strategy should include culling (destroying) eggs/progeny from hatchery- and natural-origin brood that are found to be infected with the BKD agent. However, because brood fish with high levels of the BKD agent are more likely to transmit the agent to their progeny than brood with lesser levels of the agent, the culling of eggs/progeny from infected brood fish, should, at the very least, be applied to those with high levels of the BKD agent (e.g., ELISA OD value of 0.4 and above when broodstock are not in short supply and ELISA OD value of 0.6 and above when broodstock are in short supply). In addition, in programs using ESA-listed natural-origin brood fish, the culling of their eggs/progeny may, at the managers’ discretion, be dispensed with. However, the ESA-listed broodstock should be injected, pre-spawning, with an appropriate antibiotic (preferably, azithromycin at 40 mg/kg fish), and the resulting eggs should be surface-disinfected with an iodophor. All pre-spawning brood injections may be limited to females, ESA-listed or otherwise.

Finally, eggs and hatchlings derived from broodstock found to be heavily infected with the BKD agent should be incubated/reared in isolation from those obtained from broodstock with no or lesser levels of the BKD agent. In addition, the hatchlings should be reared at the lowest possible densities (below current standards), and, at the first signs of infection with the BKD agent, they should be treated with orally administered erythromycin (100 mg/kg fish) for 28 days. The treatment should be repeated if there is evidence that the BKD agent has persisted in the hatchlings.
Table 1. Results of HSRG analysis of current condition and HSRG Solution for Wenatchee Spring Chinook. The light green row indicates the natural population and yellow indicates the segregated hatchery population, if applicable. A 10% habitat improvement is applied to the HSRG Solution to evaluate the additional effect of improved habitat towards conservation objectives.

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