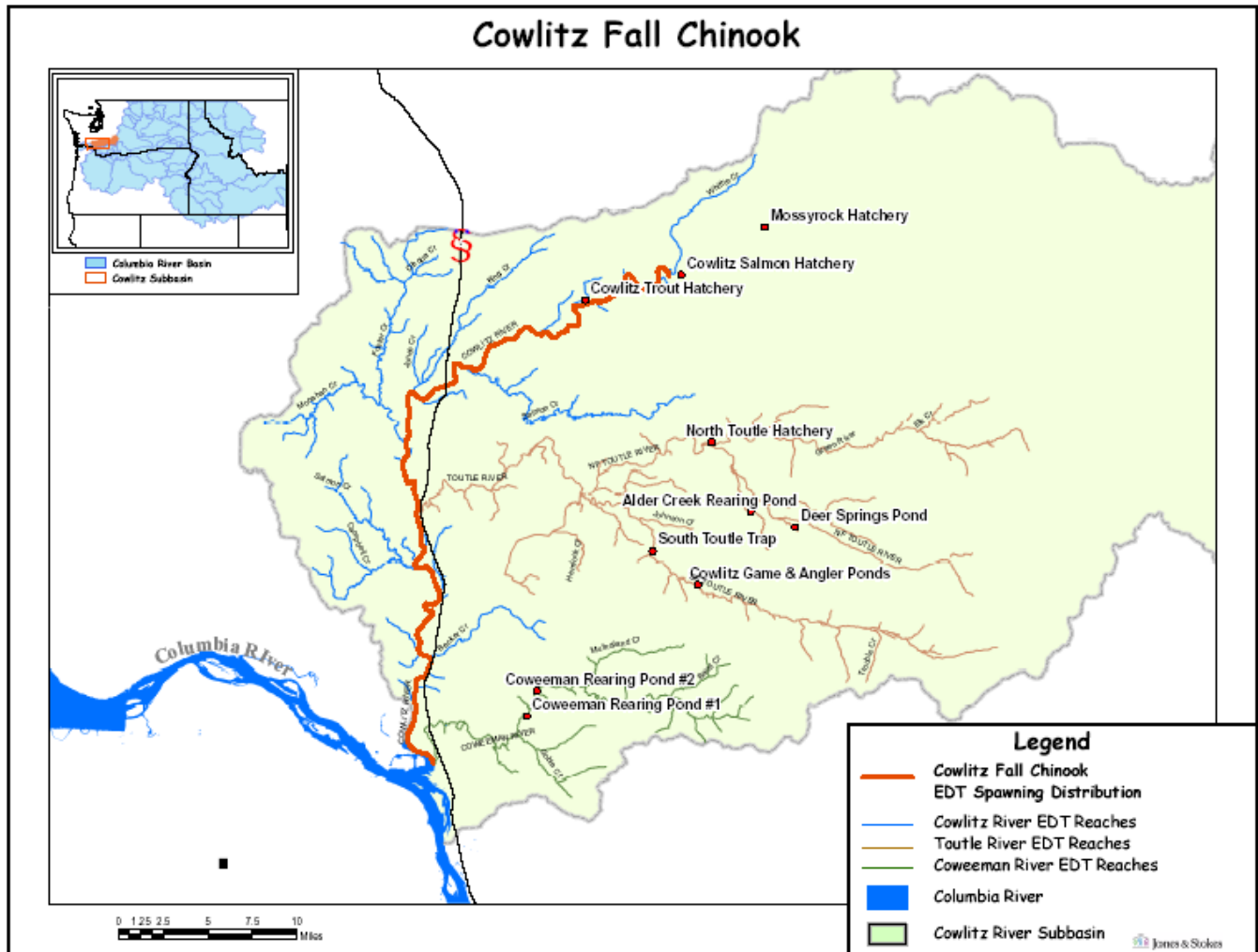


Hatchery Scientific Review Group Review and Recommendations

Cowlitz Fall Chinook Population and Related Hatchery Programs

January 31, 2009



1 Cowlitz Fall Chinook

Stock status was rated Depressed in 2002, because of chronically low escapements. Natural spawning abundance is more a reflection of the size of returns to the Cowlitz Salmon Hatchery and stray rates than of natural production. The natural spawning escapement goal is 3,000 adults. Until 2001, the goal had not been met since 1989.

With the construction of Mayfield Dam (1962), spawning is now limited to mainstem waters below the dam. Spawning generally occurs from late September to mid-November.

No genetic analysis has been done on naturally-spawning Cowlitz fall Chinook. Allozyme analysis of Cowlitz Hatchery fall Chinook sampled in 1981, 1982 and 1988 showed that they were similar to, but distinct from, Kalama hatchery fall Chinook and distinct from all other Washington Chinook examined (WDF and WDW 1993, SaSSI 2002).

In 1951, the fall Chinook escapement to the Cowlitz River and tributaries was estimated at 31,000, with the following distributions: 10,900 to the mainstem Cowlitz and its minor tributaries, 8,100 to the Cispus, 500 to the Tilton, 6,500 to the Toutle, and 5,000 to the Coweeman (WDF 1951). Forty-six percent of the fall Chinook run in the Cowlitz River was estimated to have come from above Mayfield Dam in 1950 to 1961, and 28% of the spawning grounds were inundated by Mayfield and Mossyrock reservoirs (Easterbrooks 1980). Age ranges from 2-year-old jacks to 6-year-old adults, with dominant adult age of 3, 4, and 5 (averages are 16.49%, 58.05%, and 19.31%, respectively). Natural spawning abundance is more a reflection of the size of returns to the Cowlitz Salmon Hatchery and stray rates than of natural production. The natural spawning escapement goal is 3,000 adults. Until 2001, the goal had not been met since 1989 (SaSSI 2002). In 2002, escapement was 1,427, while 10,329 were reported for 2003 and 4,466 for 2004. Most of the spawning takes place between the Kelso Bridge and the Cowlitz Salmon Hatchery (WDF et. al. 1993). Fall Chinook will not be used in the upper Cowlitz while the spring Chinook evaluation is ongoing, but adults are taken to the Tilton River. Fall Chinook production occurs in the Tilton River and Mayfield Lake tributaries because adults are transported by Tacoma Power. Smolts are collected at Mayfield Dam (HGMP 2004).

2 Current Conditions

2.1 Current Population Status and Goals

- **ESA Status:** This population is listed as threatened and is part of the Lower Columbia Chinook ESU.
- **Population Description:** This stock is one of 23 fall Chinook stocks in the ESU and is designated as a Contributing stock (LCSR&SP 2004). Historically, this is likely the most significant lower Columbia fall Chinook population. There have been few out of basin transfers into the hatchery stock. The natural population has consistent contributions from stray Lewis River natural spawners.
- **Current Viability Rating:** Low+, with a goal to achieve a Medium rating.
- **Recovery Goal for Abundance:** 2,300 naturally spawning fish.
- **Productivity Improvement Expectation:** 20%, based on the recovery plan (LCSR&SP 2004).
- **Habitat Productivity and Capacity (from EDT):** Productivity 5.9; Capacity 8,873.

2.2 Current Hatchery Programs Affecting this Population

The program currently releases approximately 5,000,000 fingerlings from the Cowlitz Salmon Hatchery. Approximately 2,200 broodstock are needed to support the program. Adults are also planted in the Tilton River and Mayfield Lake. The level of adult releases in the upper watershed has varied from just over 100 fish in 1997 to over 5,000 fish in 2002.

Historically, hatchery broodstock have been mostly native Cowlitz fall Chinook. However, four non-native plants of juvenile Chinook occurred between 1951 and 1981, including Toutle, Kalama, Big Creek, and Bonneville stocks. Broodstock is collected from volitional returns to the Cowlitz Salmon Hatchery. This is an integrated harvest program, and some natural-origin fish may be inadvertently collected for broodstock, but the level is unknown since the marking/tagging level of the hatchery release does not allow the identification of natural-origin fish. Incubation and rearing occurs on-station at the Cowlitz Salmon Hatchery.

The Cowlitz River Hydroelectric Project Settlement Agreement prioritizes restoring ecosystem integrity with the restoration and recovery of wild, indigenous salmonid stocks, including ESA listed and unlisted stocks. Success of restoration efforts may lead to significant investment in volitional fish passage in the future. Overall survival averaged 0.10% for brood years 1988 – 1999. The total fishery contribution averaged slightly more than 1,500 fish per year between 1992 and 2001.

Hatchery practices include the following:

- Hatchery strays from in-basin integrated hatchery program – from AHA summary: 1,069
- Mating protocols use pooled gametes from 2 males and 2 females.
- Jacks are incorporated into the broodstock at a rate of approximately 2%.
- The rearing flow index is approximately 1.6, higher than recommended.
- Approximately 200,000 juveniles are adipose-clipped and coded-wire tagged.

The program is described as an integrated harvest program, but does not systematically include natural-origin fish as broodstock. The current estimate of the proportion of hatchery-origin spawners (pHOS) in the total spawning population is 35%, with a proportionate natural influence (PNI) of zero. The estimated adjusted productivity (with harvest and fitness factor effects) is estimated to be 1.42. The projected average natural-origin escapement is 1,600 fish annually. The projected annual harvest contribution is 5,900 fish. Hatchery returns are projected to exceed broodstock needs by approximately 1,093 fish annually.

Estimated number of hatchery strays affecting this population:

- Hatchery strays from in-basin integrated hatchery program: 1,103 fish
- Hatchery strays from in-basin segregated and out-of-basin hatchery programs: 125 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 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 Recommendations 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 adjusted productivity (with harvest and fitness factor effects from AHA) would increase from 1.4 to 2.8. Average abundance of natural-origin spawners (NOS) would increase from 2,424 to 4,294. Harvest contribution of the natural and hatchery populations would go from 6,854 to 4,305.

3.2 HSRG Observations/Recommendations

In the Observations and Recommendations 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 incorporate all factors affecting productivity (i.e., habitat quality, hatchery fitness effects, and harvest rates).

Observations

Currently, this is a Contributing population intended to be managed as an integrated program (4.0 million release), according to the FERC settlement agreement.

This was historically an important fall Chinook population with significant remaining habitat productivity and capacity. The Cowlitz River fall Chinook population can make a contribution to the recovery of the listed ESU, even in the short term, sustaining a natural spawning population of approximately 2,300 fish and supporting an integrated hatchery program for harvest.

Challenges to achieving conservation standards are managing spawning composition and collecting natural-origin broodstock.

Recommendations

Managers should consider designating this as a Primary population given its available habitat and genetic legacy. Develop the capability to meet the challenges of managing spawning composition and collecting natural-origin broodstock. This includes a monitoring program to estimate composition on the spawning grounds (pHOS). A hatchery program using 25% natural-origin broodstock (pNOB) and releasing 4.8 million smolts would meet this requirement.

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 Cowlitz Fall 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.

Alternative	Type and Purpose	Prog Size (/1000)	HOR Recapture	Additional Weir Efficiency	Effective pHOS	PNI	NOS Esc	Adj Prod	Harvest	Hatchery Surplus
Current	Int Harv	4,807.4	75%	0%	29%	0.00	2,424	1.4	6,854	1,155
No Hatchery	None None	-	0%	0%	0%	1.00	4,294	2.8	4,305	-
HSRG Solution	Int Harv	4,370.4	75%	0%	13%	0.70	5,166	3.3	7,078	1,377
HSRG Solution w/ Improved Habitat	Int Harv	4,370.4	75%	0%	11%	0.73	6,190	3.7	7,566	1,377