Hatchery Scientific Review Group
Review and Recommendations

Upper Yakima Spring Chinook
Population and Related Hatchery Programs

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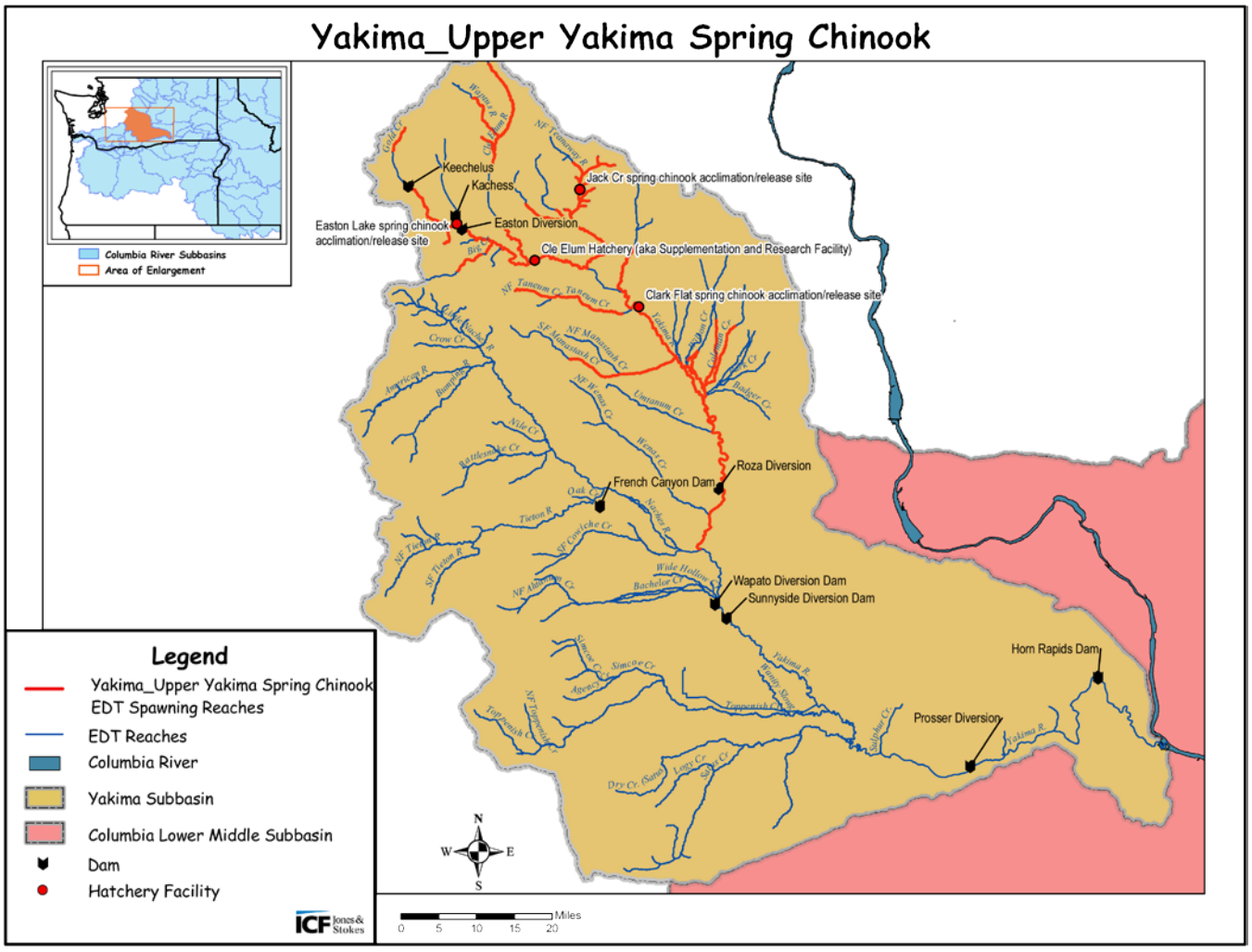

1 Upper Yakima Spring Chinook

The Yakima subbasin supports three genetically and demographically distinct stocks of spring Chinook: the American River stock (numerically smallest), the Naches River stock (numerically intermediate) and the upper Yakima stock (numerically largest). Estimates of the size of historical Yakima spring Chinook returns (all stocks) range from approximately 50,000 (Kreeger and McNeil 1993) to 200,000 (Yakima Subbasin Plan 1990). Currently, about 60% of Yakima spring Chinook are upper Yakima stock. If current and historical stock composition is similar, the historical upper Yakima population may have been as small as 30,000 or as large as 120,000. From 1982 to 2007, NOR escapement to the upper Yakima ranged from 355 to 10,972 fish, with a mean of 3,231. The escapement of natural-origin fish in the upper Yakima has increased substantially since 2000. Mean escapement from 1982 to 1999 was 1,569; mean escapement from 2000 to 2007 was 4,126. The first return of 4-year-old hatchery adults was in 2001 from the Cle Elum Supplementation and Research Facility (CESRF) (Bill Bosch, Yakama Nation, personal communication, 2007).

A non-Mitchell Act spring Chinook hatchery in the upper Yakima subbasin, the CESRF began operation in 1997. The hatchery is located near the town of Cle Elum at RM 184. From 2001 (year of the first return of adults) through 2007, total HOR spawning escapement ranged from 1,109 to 7,047, with a mean of 3,244 fish. Over this same period, the proportion of hatchery fish in the natural spawning escapement has ranged from 19.5% to 76.3%, with a mean of 52.3%.

From 1982 to 2007, in-basin harvest of NORs ranged from 25 to 2,806, with a mean of 648 fish. Since 2001, in-basin harvest of HORs ranged from 12 to 1,865, with a mean of 659. Sport harvest is selective, but tribal harvest is not.

Spawning reaches shown in the map represents the likely historic range of spring Chinook in the upper Yakima subbasin. Dams in the upper Yakima River and Cle Elum River do not have fish ladders. Spring Chinook spawning currently occurs in the mainstem Yakima from just below Roza Dam (RM 128) to Keechelus Dam (RM 214), but is concentrated between the Cle Elum River confluence (RM 186) and Easton Dam (RM 202). Substantial spawning also occurs in two larger tributaries, the Teanaway River (confluence at RM 176 of the Yakima River) and the Cle Elum River (confluence at RM 186 of the Yakima River) downstream of Cle Elum reservoir. Spring Chinook spawning generally occurs from early September through early October (Yakima Subbasin Plan).

2 Current Conditions

2.1 Current Population Status and Goals

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

- ESA Status: Native upper Yakima Spring Chinook are part of the Middle Columbia Spring-run Chinook ESU, which NOAA determined does not warrant listing under the ESA at this time.
- Population Designation: Using a rating system similar to that used by the recovery planners for the Lower Columbia and Willamette results in a designation of Primary.
- Current Viability Rating: Unknown.
- Recovery Goal for Abundance: NA, because not listed.

- Productivity Improvement Expectation: 1.06 to 1.16 (C. Frederickson, Yakama Nation, personal communication).
- Habitat Productivity and Capacity (from EDT): Productivity 3.28; Capacity 5,292.

2.2 Current Hatchery Programs Affecting this Population

Upper Yakima spring Chinook are endemic to the watershed, but between 1959 and 1987, numerous releases of non-native hatchery smolts (primarily Carson stock) occurred (Yakima Subbasin Summary). Busack et al. (1991) conducted an electrophoretic genetic stock analysis of Yakima spring Chinook. Regarding Carson/upper Yakima introgression, they state:

> "Hatchery influence is to be expected in the upper Yakima, and the observed electrophoretic clustering of the Carson and upper Yakima stocks may reflect this, although it is unknown how similar the stocks were before the hatchery operations began."

The CESRF has been producing spring Chinook for conservation and harvest since 1997 (first releases were in 1999). The program uses only unclipped natural-origin fish for broodstock, except for an experimental, segregated hatchery line which uses only clipped, hatchery-reared fish. Although full production is 810,000 (720,000 yearling smolts from NOR x NOR crosses and 90,000 smolts from HOR x HOR crosses), an average of only 694,000 smolts have been released through brood year 2005 (release year 2007). The average number of NOR broodstock collected through the 2007 brood was 510 fish. Broodstock is randomly collected over the entire return at the Roza Dam Adult Collection Facility and includes jacks. The only way for fish to move beyond Roza Dam is to pass through the ladder and adult facility. Except for HOR x HOR crosses, fish not needed for broodstock pass freely above Roza Dam. All HOR x HOR fish not needed for broodstock are removed to preclude natural spawning. A maximum of 50% of the natural return may be taken for broodstock. Except for exclusion of HOR x HOR progeny, the contribution of hatchery fish (NOR x NOR) to natural spawning escapement is not controlled.

Fish are transferred from the CESRF to three acclimation ponds in January or February. The ponds are located at two sites on the upper Yakima mainstem, at Clark Flat (RM 168) and Easton (RM 202), as well as on the North Fork Teanaway River (RM 5.6), an upper Yakima tributary. Beginning March 15, fish are volitionally released from all acclimation ponds. All fish are coded-wire tagged, (snout) and adipose fin-clipped, and HOR x HOR fish are differentially marked (coded-wire tag placed in posterior dorsal fin). Fish are also marked with fluorescent elastomer implants, and a subset is also PIT-tagged to facilitate estimation of outmigration and survival rates. Outlet channels from the acclimation ponds to the river are equipped with PIT-tag detectors. Through release year 2001, size at release ranged from 15 to 18 fish per pound, but release size (and growth profile) is now being experimentally manipulated and fish are somewhat smaller (22.7 fish per pound for the 2002 release (HGMP)). Previous experiments indicated that the SAR for fish subject to semi-natural rearing and exposure to predators did not significantly differ from fish that had been conventionally reared (Fast et al. *in press).* Experimental treatments now focus on reducing the incidence of precocialism through manipulation of the growth profile.

Estimated number of hatchery strays affecting this population:

- Hatchery strays from in-basin integrated hatchery program: 3,053 fish.
- Hatchery strays from in-basin segregated and out-of-basin hatchery programs: NA.

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 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 2.4 to 2.7. Average abundance of natural-origin spawners (NOS) would increase from 2,873 to 3,005. Harvest contribution of the natural and hatchery populations would go from 2,402 to 956.

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

This ESU is not listed under the ESA, but this population would meet the standards of a Primary population in the context of an ESU.

This population has experienced highly variable returns with poor survival in some years, resulting in low natural spawner abundance. In low-abundance years, the hatchery program provides a demographic buffer.

Research related to the effect of broodstock management and natural production is an important objective of this program. Facilities were designed and constructed to support long-term research projects. A spawning channel supports research on reproductive success of hatchery and natural adults.

Roza Dam provides an opportunity to manage broodstock composition in the hatchery and on the spawning grounds.

This is a well-run integrated program that provides harvest, addresses important research questions and conservation benefits. A segregated program would provide similar harvest opportunities but would not meet the research or conservation objectives.

Recommendations

This integrated hatchery program should be continued and also should continue to provide research on topics of importance to the Columbia River Basin.

The managers should pursue opportunities to increase harvest of hatchery fish. This would also contribute to conservation benefits by reducing pHOS, thus improving fitness. The challenge is to achieve this increased harvest of hatchery fish with minimal impact on natural populations in the basin. In the event that additional harvest is not possible under these circumstances, the managers could consider removing additional hatchery fish at Roza Dam to achieve a conservation benefit.

The HSRG recommends that managers continue the BKD culling program at the Cle Elum facility, and implement a BKD control strategy for other 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 Upper Yakima 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.

Alternative	Type and Purpose	Prog Size (/1000)	HOR Recapture	Additional Weir Efficiency	Effective pHOS	PNI	NOS Esc	Adj Prod	Harvest	Hatchery Surplus
Current	Int Both	810.7	5%	0%	47%	0.68	2,873	2.4	2,402	161
No Hatchery	None None	-	0%	0%	0%	1.00	3,005	2.7	956	-
HSRG Solution	Int Both	810.7	5%	0%	47%	0.68	2,871	2.4	2,414	161
HSRG Solution w/ Improved Habitat	Int Both	810.7	5%	0%	44%	0.69	3,304	2.7	2,552	161