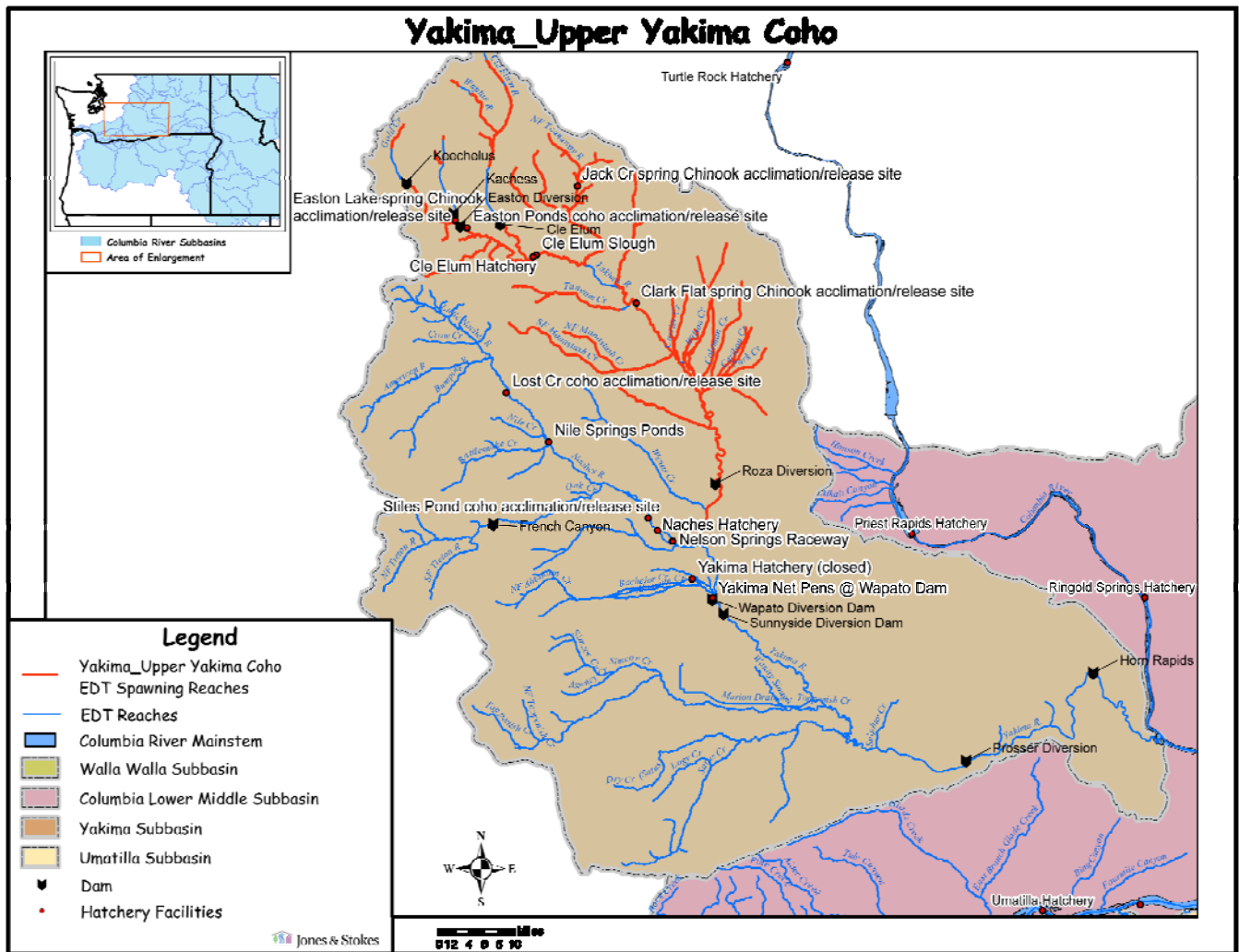


# Hatchery Scientific Review Group Review and Recommendations

## Yakima River Coho Population and Related Hatchery Programs

January 31, 2009



# 1 Yakima Subbasin Coho

Although endemic coho were extirpated in the early 1980s, natural reproduction of hatchery-reared coho, outplanted as smolts, is now occurring in both the Yakima and Naches rivers. Natural reproduction is evident from the increasing occurrence of zero-aged coho parr in samples taken at numerous points in the basin (YN, unpublished data, 2000) and from the counts of unmarked adults seen at the Prosser Dam counting station (all hatchery coho released in the Yakima subbasin since 2000 have been ad-clipped or coded-wire tagged). Adult counts at Roza Dam on the upper Yakima River from 1941 - 1968 indicate that the endemic stock was early-run. The vast majority of the hatchery coho smolts out planted since 1985 have also been early-run.

Based on fragmentary WDFW records of spawner surveys, the endemic stock spawned in the upper Yakima above the Cle Elum confluence and in the Naches, primarily in the lower alluvial reaches, below the Tieton confluence. Bryant and Parkhurst (1950) reported that in the early years of the 20<sup>th</sup> century, coho also spawned in smaller tributaries of the upper Yakima, such as Taneum and Umtanum creeks. Affidavits from early settlers of the Wenatchee subbasin state that “silvers” were found in virtually every perennial creek and river in the basin prior to extensive development. It is now assumed that coho used virtually every low-gradient, perennial stream in the basin before extensive habitat alterations in the late 19<sup>th</sup> century (Yakima Subbasin Plan 1990).

A considerable portion of the current, naturalized run spawns in reaches downstream of historic production areas. This is due in part because, until 1999, the vast majority of hatchery smolts were acclimated and/or released well downstream of historic spawning areas. Releases occurred in the lower Yakima mainstem, between Sunnyside Dam (RM 103) and Granger Drain (RM 83). Since 1999, all hatchery coho have been released exclusively within the historic coho production areas: from acclimation ponds in the Naches River at RM 9 and 39, and from ponds on the upper Yakima at RM 160 and RM 180. In 1999, a radiotagging study indicated that 66% of all spawning occurred in or below the Granger Drain to Sunnyside Dam reach. By 2002 and 2003, radio-tagging data showed that the proportion of spawning in the lower Yakima mainstem had dropped to 36 and 41%, respectively, and a majority of spawning was occurring within the historic production areas of the middle Yakima, upper Yakima and Naches Rivers. The Yakima Coho Master Plan (Hubble and Woodward 2003) states that the likely reasons that ~40% of returning coho still spawn in the lower river are a lack of stamina (particularly for females) and false attraction to upper Yakima waters released through irrigation returns on the lower river.

Kreeger and McNeil (1993) and the Yakima Subbasin Plan (1990) estimate the historic coho run at 44,000 and 100,000, respectively. Since regular outplanting began in 1985, coho returns have increased steadily, climbing from 0 in 1984 to a peak of 5,700 in 2000. Few of the outplanted coho were marked until the 1998 brood year. For the years 2001 through 2008, the count of unmarked, naturally reared coho at Prosser Dam on the lower Yakima (RM 47) ranged from 309 to 1,820, with a mean NOR return of 1,326. Total returns (hatchery + natural) during this period ranged from 475 to 4,978 (mean 3,020), and naturally reared fish have comprised an average of 46% of the run (C. Frederickson, Yakama Nation, personal communication, 2008).

The terminal fishery on coho is negligible, estimated at 1% by Yakama Nation biologists.

## 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: Naturalized Yakima coho are not part of any ESU.
- Population Designation: Using a rating system similar to that used by the recovery planners for the Lower Columbia and Willamette arrives at a designation of Stabilizing.
- Current Viability Rating: Unknown
- Recovery Goal for Abundance: Not applicable because not listed
- Productivity Improvement Expectation: Unknown
- Habitat Productivity and Capacity (from EDT): Productivity: 1.8; Capacity: 3,185

### 2.2 Current Hatchery Programs Affecting this Population

The current Yakima coho program is very likely to be changed in the near future (C. Frederickson, Yakama Nation, personal communication, 2008); therefore, both the current and the likely future programs are described below.

Under the current program, up to 700,000 Yakima stock smolts are acclimated and released from ponds on the Naches River at RM 9 and RM 39, and from ponds on the upper Yakima River at RM 160 and 180. The Naches and upper Yakima are not managed as separate populations. Adults used in the broodstock are collected in a manner that does not distinguish these population components.

The duration of the acclimation period is roughly February through May. Acclimation and release protocols are driven partly by an experimental assessment of the feasibility of reintroducing coho to the basin. The major objectives of the original study were to determine which watershed, upper Yakima or Naches, affords greater survival rates; whether survival differs as function of early (~May 7) or late (~May 28) releases; and whether survival rates differ between the progeny of Yakima-stock or broodstock from out-of-basin coho (either from the Little White Salmon Hatchery or Cascade Fish Hatchery). The Yakima stock are adult coho that are captured inside the Yakima River, specifically at the Prosser Dam right bank fish ladder. Under the current program, volitional releases occur beginning in April. The percent natural origin fish in the current Yakima stock was not known precisely until 2006. From 1999-2004 YN attempted to bring 100% NOR into the hatchery using non-CWT adults as brood. Unfortunately, the Prosser Right Bank Denil only passes an average of 40% of annual coho escapement, only a small proportion of which is NOR. Additionally, relying on CWTs is not the best way to obtain NOR/HOR differences due to both tag loss in either the juvenile or adult stages and the inaccuracy of CWT detectors in a metal and rebar reinforced concrete room. Using the 40% breakdown at the right bank denil, the remainder of adult escapement over Prosser Dam for NOR's and HOR's were extrapolated. Therefore, to increase accuracy on both juvenile out migration and adult escapement all coho have been adipose clipped since 2004. Each year the pNOB and pHOB is adjusted in season in accordance with escapement. The actual releases, prior to 2008, of Yakima stock coho have been considerably less than 500,000. In 2008, release of in-basin fish rose from an average of 10% from 2003-2007 to 27% in 2008. The in-basin releases

are projected to increase to 47% in 2009 with a maximum release of approximately half of the goal.

Most of the fish released under the original program were hatchery fish from the Little White Salmon (Willard) or Cascade hatcheries. Under the current program the primary source of coho comes from the Eagle Creek National Fish Hatchery. Approximately 500,000 of these hatchery smolts are released annually from the acclimation ponds in the upper Yakima and Naches. From 1999-2004 all coho released were CWT'd. Since 2004, all fish released have been 100% ad-clipped and 10,000 in-basin and 10,000 out-of-basin coho are PIT-tagged. PIT-tagging occurred in four ponds, each contained one group of 2,500 in-basin PIT-tags and 2,500 out-of-basin PIT-tags (for a total of 5,000 in each). Starting in 2005 extremely heavy predation in one acclimation pond reduced the acclimation comparisons down to only 4 ponds that contained the PIT-tags.

Under the future proposed program, 225,000 Yakima stock smolts would be released from both the upper Yakima and Naches river acclimation ponds (450,000 total). Whenever possible, 100% of the broodstock for these smolts would be natural origin fish (pNOB = 100%). This element of the program would be managed as an integrated harvest/conservation program. The overall goal of the in-basin broodstock program is to have 100% pNOB, however, under current collection conditions the goal is to first establish a Yakima line of hatchery fish. The pNOB approached 70% in 2004; however, releases of in-basin fish remained too low for significant returns. The YN has taken a stepped approach to keep out-of-basin returns separate from in-basin broodstock development. The next step will be to keep the hatchery YN returns out of the broodstock and move towards a full pNOB line of coho. Since 2005, broodstock has been approaching an even split, and in-basin releases have remained very low. Beginning in brood year 2006, the YN began using more YN fish, therefore increasing the total number of in-basin coho releases by 17% in 2008, and nearly 40% projected in 2009, with the full intention of moving to a 100%pNOB as soon as possible.

The future program would also include a segregated harvest element, with 500,000 smolts from Eagle being acclimated and released at the Prosser Hatchery (RM 47, just below Prosser Dam).

Like the current program, all fish from both groups would be ad-clipped or coded-wire tagged, and two groups of 2,500 coho, one group representing in-basin and one group representing out-of-basin stocks would be PIT-tagged and released into the active acclimation ponds. Assuming a 50% female sex ratio for returning Yakima and Naches river coho, and a mean fecundity of 2,900 eggs/female, 15% pre-spawning mortality and 85% egg to smolt survival, the project must collect approximately 430 Yakima NOR adults in order to produce 450,000 smolts. If fewer than these numbers of fish are available in-basin, they would be augmented with coho from lower Columbia River hatcheries. The plan assumes broodstock for the upper Yakima releases would be collected at Roza Dam and broodstock for the Naches releases would be collected either at Cowiche Dam on the lower Naches River or at Prosser Dam.

The results of the coho reintroduction study are summarized as follows (abstract from article submitted to American Fisheries Society North American Journal of Fisheries Management titled "*Evaluating the feasibility of reintroducing a coho salmon population in the Yakima River, Washington*"):

“Historical returns of coho salmon (*Oncorhynchus kisutch*) to the Yakima River Basin have been estimated to range from 45,000 to 100,000 fish annually. Due to many causes, coho salmon became extinct in the Yakima River by the early 1980s. In 1996 a project was initiated “to

determine the feasibility of reestablishing a naturally spawning coho population ... within the Yakima River Basin ...”. The Yakima coho project explored whether successful adaptation and recolonization occurred when multi-generation hatchery fish were reintroduced to native habitats. The project also evaluated smolt survival for coho releases with different broodstock origins, and temporal and spatial distributions. The 2001-2003 releases from Yakima-return broodstock parents had significantly higher smolt-to-smolt survival indices than releases from out-of-basin broodstock parents. We found no significant difference between the smolt-to-smolt survival indices of smolts released in early versus late May. During 2000-2003, releases from the Naches subbasin (lower in the watershed) had higher smolt-to-smolt survival indices than releases from the Upper Yakima River. We also compared relative smolt-to-adult survival between Yakima River coho and spring Chinook (*O. tshawytscha*) since both are stream-type (yearling migrant) salmon. For seven juvenile migration years from 1997-2003, the mean smolt-to-adult survival index for returns from hatchery-derived coho production was estimated to be 3.7%, approximately 70% of the estimated mean survival index for wild/natural spring Chinook (5.3%) in the Yakima Basin over the same period. Finally, we documented that substantial natural production of coho is occurring, and smolt-to-adult survival for naturally produced coho appears to be at least 3.5 times the survival for returns from known hatchery releases. While the project demonstrated some success in reestablishing a natural spawning population of coho from an out-of-basin hatchery population, further development of locally adapted natural broodstock and establishing naturally producing populations in tributaries are likely necessary to sustain long-term, natural production.”

Estimated number of hatchery strays affecting this program:

- Hatchery strays from in-basin integrated hatchery program – from AHA summary: 1,838 fish
- Hatchery strays from in-basin segregated and out-of-basin hatchery programs: 5,391 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 Adjusted Productivity (with harvest and fitness factor effects from AHA) would increase from 0.6 to 1.3. Average abundance of natural-origin spawners (NOS) would decrease from 1,043 to 518. Harvest contribution of the natural and hatchery populations would go from 7,940 to 232.

### 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).

#### **Observations**

For management purposes, the entire Yakima subbasin is treated as a single stock. There is a reintroduction program in the upper river and a segregated harvest program in the lower river. The reintroduction program uses a mix of natural and hatchery returns collected at Prosser. The lower river segregated program currently uses out-of-basin broodstock.

All fish are currently adipose fin-clipped, but this is a practice that will cease for in-basin coho in an attempt to improve survival by reducing sport harvest in selective fisheries. In-basin coho will be coded wire tagged and out-of-basin coho will continue to be adipose clipped under the Mitchell Act.

#### **Recommendations**

The reintroduction programs should continue to move aggressively toward developing local broodstocks within the basin. Broodstock for fish released in the upper Yakima should be

collected at Roza. Broodstock for fish released in the Naches should be collected from the Naches. We recommend that these fish should be coded-wire tagged but not adipose fin-clipped.

The segregated harvest program in the lower river should also be based on a local broodstock from hatchery returns. These fish should have external marks and a portion coded-wire tagged to maximize harvest so that broodstock separation can be achieved and straying into the natural population can be evaluated.

In-basin facilities for incubation and rearing should be developed. In the interim, local broodstock may need to be incubated and reared out-of-basin.

Table 1. Results of HSRG analysis of current condition and HSRG Solution for Yakima River Coho. 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	452.1	25%	0%	76%	0.21	1043	0.6	4,324	286
	Seg Harv	427.9	0%						3,616	0
No Hatchery	None None	-	0%	0%	0%	1.00	518	1.3	232	-
HSRG Solution	Int Both	452.1	30%	0%	68%	0.53	709	0.9	4,276	636
	Seg Harv	427.9	98%						3,616	1,893
HSRG Solution w/ Improve Habitat	Int Both	452.1	30%	0%	63%	0.54	872	1.0	4,349	636
	Seg Harv	427.9	98%						3,616	1,893