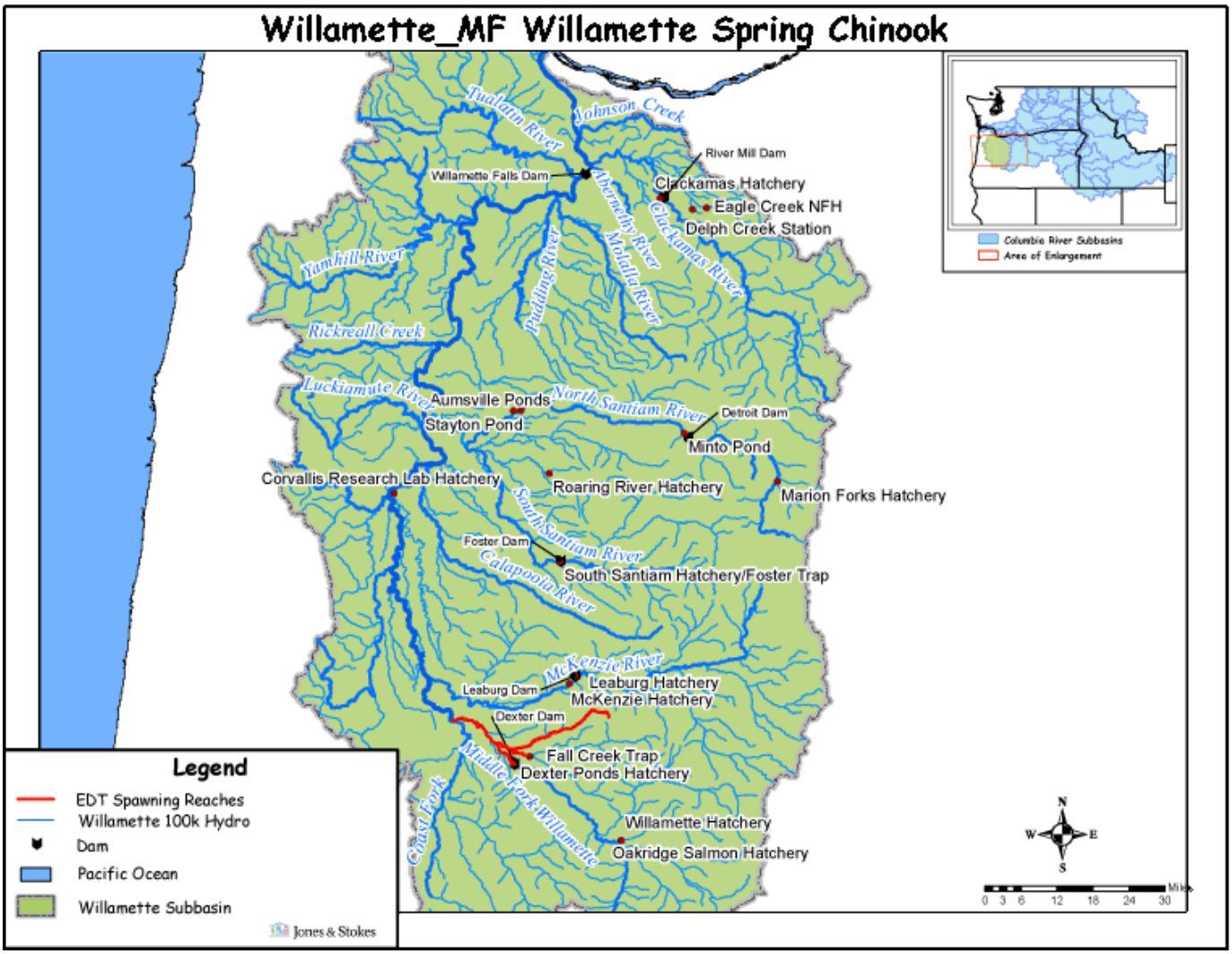
Hatchery Scientific Review Group
Review and Recommendations

Willamette – Middle Fork Willamette Spring Chinook Salmon Population and Related Hatchery Programs

January 31, 2009



1 Middle Fork Willamette Spring Chinook Salmon

Historically, there were seven demographically independent populations of spring Chinook salmon in the Upper Willamette River spring Chinook salmon ESU: Clackamas, Molalla/Pudding, Calapooia, North Santiam, South Santiam, McKenzie, and Middle Fork Willamette—all eastside tributaries (Meyers et al. 2003). Today, the Middle Fork Willamette is one of four core populations (Clackamas, North Santiam, McKenzie and Middle Fork Willamette) (McElhany et al. 2003; Subbasin Plan).

Historically, the Middle Fork Willamette River spring Chinook salmon run may have been the largest in the Upper Willamette Basin (Hutchison 1966; Thompson et al. 1966). Spring Chinook salmon in the Middle Fork Willamette subbasin spawned in Fall Creek, Salmon Creek, the North Fork of the Middle Fork Willamette River, Salt Creek, and the mainstem Middle Fork Willamette River (Parkhurst et al. 1950). Based on egg collections at the Willamette River Hatchery (Dexter Ponds, 1909 to the present), the estimated minimum run size is approximately 7,100 adult spring Chinook for the area that is now above Lookout Point Dam (U.S. Army Corps of Engineers, 2002). This estimate does not include fish that spawned downstream of the hatchery rack (such as in the mainstem Middle Fork Willamette River below Dexter and in the Fall Creek watershed). Mattson (1948) estimated a run size of 2,550 naturally produced spring Chinook to the Middle Fork Willamette River in 1947. The USFWS (1962) reported that approximately 450 spring Chinook salmon spawned above the site of Fall Creek Dam in the years immediately before construction (the project was completed in 1966).

Mattson (1948) estimated that 98% of the 1947 run in the Middle Fork Willamette system spawned upstream of the Lookout Point dam site and that the remaining 2% spawned upstream of the Fall Creek dam site. Construction of these dams restricted the population to only 20% of its historical spawning area below Dexter/Lookout Point and above Fall Creek Reservoir (ODFW 1990). In 1998, 10 redds were observed in the reach between the town of Jasper and Dexter Dam, which was not used for spawning before the dams were built (Lindsay et al. 1999). ODFW (1998) states that there may be a small but unquantified amount of natural production in Little Fall Creek.

Currently, the naturally spawning population of spring Chinook salmon in the Middle Fork Willamette subbasin is very small and probably is made up mostly of the progeny of hatchery fish that were released to spawn in the wild. The Fall Creek subbasin remains accessible to anadromous salmonids. Although Parkhurst et al. (1950) estimated that the Fall Creek subbasin could support several thousand salmon; by 1938 the run had already been severely depleted. In 1947, the run dwindled to an estimated 60 fish (Mattson 1948). Construction of the Fall Creek Dam (1965) included trap and haul fish passage facilities, but passage is only possible during high flow years (Connolly et al. 1992). ODFW (1995) concluded that the native spring-run population was extinct, although some natural production, presumably by hatchery-origin adults, still occurs. Of the 260 carcasses examined from the Middle Fork Willamette River (including Fall Creek), 11 (4%) were estimated to have been naturally produced (Schroder et al. 2003).

Changes in water temperature regimes from the dams have affected Upper Willamette spring Chinook spawn timing. Mattson (1962) noted that as a result of the thermal effects of Lookout Point and Dexter dams, spawning below Dexter was delayed until early October and lasted through November. Surveys above and below Fall Creek Dam in 1969 showed that spawning started in early- to mid-September and was completed by mid-October (ODFW 1990). Because naturally produced fish now make up a small portion of the Middle Fork Willamette subbasin population, little is known about the time of entry or spawning of the wild stock (Subbasin Plan).

For the period 2002 to 2007, the number of adult salmon released above Fall Creek Reservoir varied from 339 to 2,805 fish. Numbers of redds resulting from these outplants ranged from 28 to 217, with fish-to-redd ratios of 2.8 to 23.7 (personal communication, Greg Taylor, USACE, January 2008). The high ratio of fish to redds indicates a high level of pre-spawning mortality, probably as a result of handling in the trap and haul system. In the North Fork Middle Fork River, Greg Taylor reported that anywhere from 18 to 363 redds resulted from outplants of 481 to 3,765 adults spring Chinook (personal communication, USACE, January 2008). Fish-to-redd ratios varied from 2 to 94, indicating handling stress resulting from the trap and haul operation. Firman et al. (2002) estimated a natural-origin run of spring Chinook salmon to the Middle Fork Willamette subbasin of 987 fish in 2002, based on counts of naturally spawned carcasses and the number of unmarked fish taken for hatchery broodstock at Dexter Dam (Subbasin Plan).

It appears that the Middle Fork Willamette subbasin does not currently support a self-sustaining population of naturally produced spring Chinook salmon. A small amount of natural production probably does occur from spawning both above and below the dams, but is based on ODFW's releases of hatchery-origin adults into the upper Middle Fork above Hills Creek Reservoir since 1992 and into the North Fork of the Middle Fork above Lookout Point Reservoir since 1999. Natural spawning occurs in the mainstem Middle Fork Willamette below Dexter Dam, although ODFW investigations indicated that warm water temperatures cause eggs to succumb to fungus infections, and those eggs that do survive produce juveniles that emerge early (Ziller et al. 2002;Subbasin Plan).

In addition, there is a high estimated pre-spawning mortality. Although the pre-spawning mortality estimates are not considered very precise, it appears that during most years, over 80% of the females that return to the river die before spawning; second only to the Calapooia population for the highest spring Chinook pre-spawn mortality in the Willamette. Taken together, these data support the conclusion that there is little, if any, natural production of spring Chinook in the Middle Fork Willamette.

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: Middle Fork Willamette spring Chinook are part of the Upper Willamette River Chinook Salmon ESU, which was listed as threatened under the ESA in March 24, 1999 (64 CFR 14308).
- Population Description: The Middle Fork Willamette spring Chinook population has not been assigned a designation, although it is considered a core population by TRT. It was given a Contributing designation for the HSRG review.
- Recovery Goal for Abundance: Unknown.
- Productivity Improvement Expectation: Unknown.
- Habitat Productivity and Capacity (e.g., from EDT): Productivity 1.1; Capacity 1,800.

2.2 Current Hatchery Programs Affecting this Population

Currently, there is an integrated harvest spring Chinook hatchery program in the Middle Fork Willamette River at the Willamette Hatchery (on Salmon Creek at RM 1.2 and the Dexter Ponds

satellite facility (RM 16.8). Broodstock goals are 835 females and 835 males. These numbers are not always achieved; in 2002, 772 males were spawned with 795 females. Fifty-two unmarked fish (3%) were used in the broodstock (2004 HGMP). Managers expect more unmarked adults to be returning to the Middle Fork Willamette from progeny of adults released into the upper basin above the dams. The goal for this stock is to have natural-origin adults make up 30% of the broodstock, incorporating any and all natural-origin fish returning to the base of Dexter Dam.

The Middle Fork Willamette River spring Chinook hatchery program was developed to mitigate for habitat lost when Dexter, Lookout Point and Hills Creek dams were built on the Middle Fork Willamette River. Prior to dam construction, Mattson (1948) estimated the Middle Fork Willamette spring Chinook run to comprise 21% of the spawning population above Willamette Falls. With the dams blocking more than 80% of the subbasin previously used by spring Chinook (Connolly et al., 1992), the entire run returned to the hatchery. Broodstock collection and all rearing occur within the Middle Fork Willamette River subbasin. Approximately 300,000 yearlings are released onsite in November; another 1,354,148 1+yearlings are released onsite the following February/March; and another 100,000 1+yearlings are released in the Hills Creek Reservoir (personal communication, Manuel Farinas, ODFW, January 2008).

This program also supplies 855,000 yearling smolts (reared at Gnat Creek Hatchery) to the SAFE net pens in Youngs Bay.

Estimated number of hatchery strays affecting this population:

- Hatchery strays from in-basin integrated hatchery program: 2,648 fish.
- Hatchery strays from in-basin segregated and out-of-basin hatchery programs: 43 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 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 0.4 to 0.9. Average abundance of natural-origin spawners (NOS) would decrease from approximately 580 fish to approximately 0 fish. Harvest contribution of the natural and hatchery populations would go from approximately 3,600 fish to zero.

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

The hatchery population was founded by local stock and has had limited introductions from other stocks. The purpose of the program is to provide fish for harvest and to act as a gene bank for Willamette spring Chinook until access to quality habitat in the upper watershed is reestablished. Less than 1% of the historic habitat capacity is downstream of the passage barriers created by dam construction. Significant habitat capacity still exists above the projects (primarily in the North Fork), but there is no juvenile collection or passage.

The hatchery program attempts to incorporate natural-origin adults into the broodstock, but few natural-origin fish exist. If the hatchery programs were terminated, this population of fish would likely become extinct.

This program has experienced significant pre-spawning mortality. Mortality is likely caused by a combination of high temperatures and lack of appropriate adult handling and holding facilities at the Dexter and Willamette hatcheries. The multiple release strategy (spring releases and a fall release) contributes to maintaining life history diversity by encouraging the return of adults over a broader range of age classes.

Given the habitat assumptions provided, we were unable to develop any hatchery scenarios (including the no hatchery scenario) that demonstrated improvement over current natural population abundance.

Recommendations

Unless habitat conditions are better than we have assumed or passage conditions are improved, the program would be consistent only with designation as a Stabilizing population. The current program should be continued.

To address pre-spawning mortality problems, we encourage efforts to improve adult collection and handling at Dexter and adult holding facilities at Willamette. Adult holding density should be at levels that don't impair survival.

This program supports the Youngs Bay net pen program. In view of limited adult holding capacity, a different program should be considered to support this net pen program.

The HSRG recommends that managers continue to implement their apparently successful BKD strategies, which include culling.

Table 1. Results of HSRG analysis of current conditions and HSRG solution for Middle Fork Willamette 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	1,256.6	50%	0%	79%	0.01	581	0.4	3,565	893
No Hatchery	None None	-	0%	0%	0%	1.00	0	0.9	0	-
HSRG Solution	Int Both	1,256.6	50%	0%	79%	0.01	581	0.4	3,565	893
HSRG Solution w/ Improved Habitat	Int Both	1,256.6	50%	0%	77%	0.01	647	0.5	3,583	893