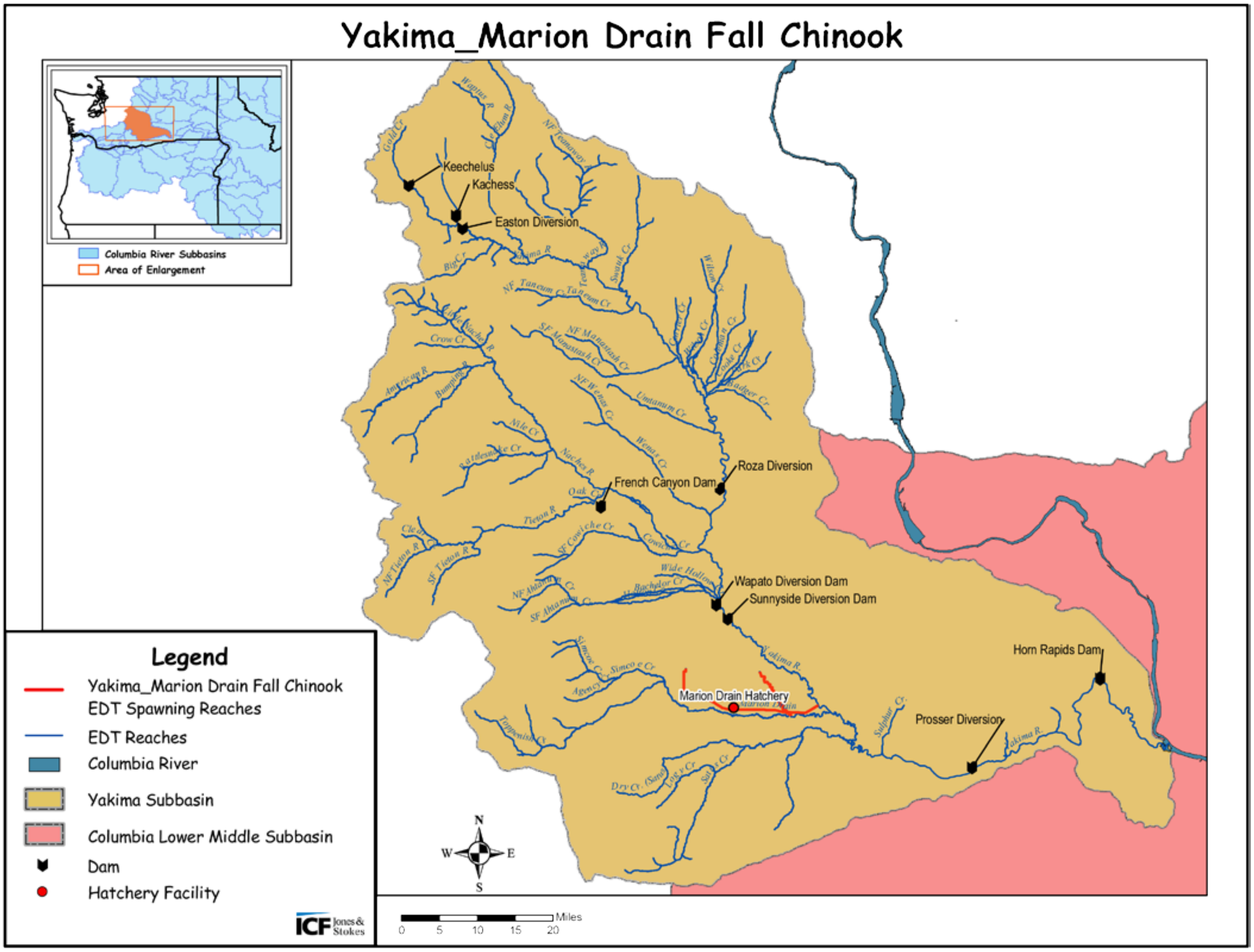
Hatchery Scientific Review Group
Review and Recommendations

Marion Drain Fall Chinook
Population and Related Hatchery Programs

January 31, 2009



1 Marion Drain Fall Chinook

Marion Drain is an 18-mile long irrigation ditch that was built in 1910 and drains the large irrigated area on the Yakama Indian Reservation served by the Wapato Irrigation Project. The ditch is deep enough that it intercepts ancient alluvial gravels and collects large quantities of groundwater that percolate toward it from the irrigated fields to the north. Much of Marion Drain functions like a spawning channel, with large quantities of groundwater upwelling through a cobble/gravel substrate. At some point in the past and by some means (a number of stories exist about intentional or unintentional outplanting in the past), a population of fall Chinook with an URB-like spawn timing (mid-October to mid-November) became established inside Marion Drain. Based on an electrophoretic analysis of allozyme samples collected from spawning fish in Marion Drain and the mainstem near Benton City in 1989 and 1990, Busack et al (1991) concluded that there were two genetically distinct stocks in the basin: the Marion Drain stock and the "mainstem stock." Subsequent analyses of allozymes from fish collected in the mainstem above Prosser Dam were indistinguishable from the Benton City samples. Therefore, all mainstem spawners appear to belong to the same genetic group, which is indistinguishable from Hanford Reach URBs. The Marion Drain stock, on the other hand, genetically resembles Snake River fall Chinook and Deschutes River (OR) fall Chinook more than URBs, and apparently occurs only in Marion Drain.

Marion Drain redd counts ranged from 12 to 117 (mean of 56) between 1983 and 2004 (HGMP). Because of a very unusual age and sex composition, these numbers translate to spawning escapements ranging from 120 to 1,170, with a mean of 560. In 1992, an adult trap was installed on lower Marion Drain and the entire run was counted, sexed and aged (Seiler 1992). A total of 412 fish entered the Drain, 14% of which were adult females, 42% of which were adult males and 44% of which were jacks. The age composition of the adults was also unusual. In Marion Drain, the proportion of adults that were ocean age 1, 2, 3 and 4 was 48%, 46%, 6% and 0%, respectively. By contrast, the age composition of adult fall Chinook sampled in the Yakima mainstem the same year was 12%, 12%, 66% and 11% for ocean ages 1 through 4. The Marion Drain population is clearly much younger than the mainstem population. One theory for this difference is that the large quantity of groundwater in the drain, plus the abundance of amphipods and other prey, physiologically trigger early maturation and jacking. Water temperatures in the drain clearly are warmer in the winter and cooler in the summer than the Yakima mainstem, and fall Chinook fry do emerge in mid-February in the drain and mid-April in the mainstem (Talbot 1992).

Prior to 1999, in-basin harvest of fall Chinook was virtually nonexistent. Since 1999, terminal harvests have ranged from 34 to 2,300 with a mean of 1,025 (HGMP). The Yakama Nation has estimated terminal harvest, almost entirely from sport fishing, averages around 12%.

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: Undetermined. Mainstem Yakima fall Chinook are part of the Upper Columbia Summer/Fall run Chinook ESU, for which listing is not warranted. The National Marine Fisheries Service ESU Status and Description web page (http://www.nwr.noaa.gov/ESA-Salmon-Listings/Salmon-Populations/Chinook/CKUCF.cfm) specifically excludes Marion Drain fall Chinook from the Upper Columbia Summer/Fall Chinook ESU. The Marion Drain population is, however, assigned to the mid-Columbia and Snake fall Chinook Genetic Diversity Unit (GDU 6)

- 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 Contributing.
- Current Viability Rating: Unknown; SaSSI rates as Healthy.
- Recovery Goal for Abundance: NA, because not listed.
- Productivity Improvement Expectation: Unknown, but likely very small.
- Habitat Productivity and Capacity (from EDT): Productivity: 2.08; Capacity: 448.

2.2 Current Hatchery Programs Affecting this Population

From 1983 to 1999, only Little White Salmon (LWS) Hatchery URBs were released in the Yakima River. From 1983 to 1993, two releases were generally made, one at various sites near Sunnyside Dam (RM 104), the approximate upstream end of the historic fall Chinook spawning area; and one below Prosser Dam (RM 47). Survival of the upriver releases to the smolt trap at Prosser Dam was very poor. Consequently, after 1993, all LWS releases were made from a number of large acclimation ponds at the newly constructed Prosser Hatchery, located just downstream of Prosser Dam. That practice continues to the present time.

Artificial propagation programs using naturally-spawned Yakima fish as broodstock began in 1997, both at Marion Drain and at the Prosser Hatchery. The Marion Drain program is an integrated program that uses a fish wheel to collect broodstock approximately 6.7 miles inside Marion Drain. Any un-clipped fish collected are assumed to be of Marion Drain stock (neither the Marion Drain nor the Prosser programs adipose-clip their fish). There is, however, some evidence that this assumption may be incorrect. Todd Kassler, a WDFW geneticist, wrote a memo to Yakima/Klickitat Fisheries Project staff in August of 2007 describing the results of a genetic analysis of Marion Drain broodstock collected in 2005. In it he says, “The individual assignments of the 2005 Marion Drain samples were to the lower Yakima River instead of Marion Drain.” Mr. Kassler speculated that this might mean mainstem fish in some numbers in fact do stray 6.7 miles inside Marion Drain to the fish wheel, and/or that the Marion Drain and mainstem populations had already introgressed to the point where they are indistinguishable. The issue has not yet been resolved. Thus, the percent natural-origin broodstock for this program is unclear at two levels: the proportion of brood fish that were not spawned in Marion Drain Hatchery, and the proportion of brood fish that are genetically descended from the unique Marion Drain population first described in the late 1980s.

The number of broodstock collected between 1998 and 2002 ranged from 8 (2 females and 6 males) to 32 (7 females and 25 males). Over this period, from 4,000 to 52,000 (mean 23,870) sub-yearling smolts at approximately 65 fish per pound were released. Releases begin early to mid-April and are volitional for two weeks, after which fish are forced from the raceway and into Marion Drain. Marion Drain fish are not adipose-clipped, but are coded-wire tagged, and 1,000 to 4,000 are PIT-tagged to facilitate survival estimates.

Estimated number of hatchery strays affecting this population:

- Hatchery strays from in-basin integrated hatchery program: 42 fish.
- Hatchery strays from in-basin segregated and out-of-basin hatchery programs: 445 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 0.6 to 1.1. Average abundance of natural-origin spawners (NOS) would decrease from 112 to 23. Harvest contribution of the natural and hatchery populations would go from 189 to 21.

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 is a gene banking conservation program intended to protect what is presumed to be a small and unique population. The fish currently are coded-wire tagged, but not adipose-clipped, and 1,000 to 4,000 are PIT-tagged.

Recommendations

Develop a conservation and recovery plan for this population. In the near term, collect as many natural-origin fish for broodstock as possible. Additional methods to collect broodstock should be developed. Monitor natural escapement and make every effort to restrict it to fish from the Marion Drain population.

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 Marion Drain 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 Cons	20.5	50%	0%	78%	0.24	112	0.6	189	30
No Hatchery	None None	-	0%	0%	0%	1.00	23	1.1	21	-
HSRG Solution	Int Cons	20.5	10%	0%	84%	0.49	153	0.7	237	6
HSRG Solution w/ Improved Habitat	Int Cons	20.5	10%	0%	82%	0.49	172	0.8	254	6