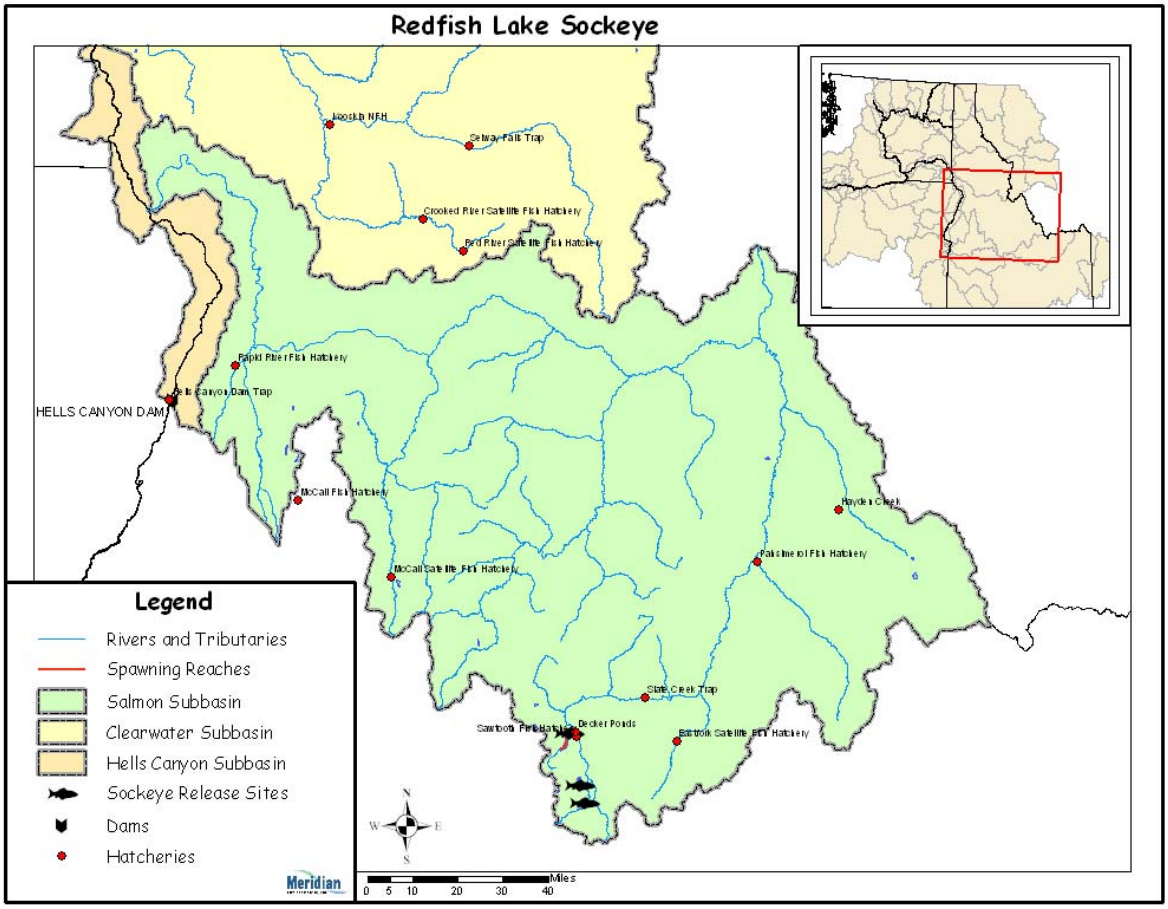
Hatchery Scientific Review Group
Review and Recommendations

Salmon Redfish Sockeye
Population and Related Hatchery Programs

January 31, 2009



1 Salmon Redfish Sockeye

This population is considered part of the Snake River Sockeye ESU that is classified as Endangered under the Endangered Species Act. Snake River sockeye salmon were listed as an Evolutionarily Significant Unit (ESU) due to their uniqueness as the southern most spawning population that also travels the farthest inland (> 1,400 km) and to the highest elevation (> 1,980 m) of any sockeye salmon population in the world. At the time of listing, Redfish Lake, located in the upper Salmon River subbasin, contained the only remaining population of sockeye salmon in the Snake River Basin. Historically, it was estimated that as many as 40,000 sockeye returned to the Stanley River subbasin each year (NPCC 2004).

The Interior Columbia Technical Recovery Team (ICTRT) designated at least three historical populations within the Stanley Lakes Basin: Redfish Lake (including Little Redfish), Alturas Lake, and Stanley Lake. The Redfish Lake sockeye population includes both anadromous and residualized sockeye that spawn synchronously with the anadromous fish. In addition, two more lakes - Pettit Lake and Yellowbelly Lake - may have supported independent populations; however, currently available information did not allow the ICTRT to determine their status with certainty. The ICTRT therefore regarded them as potential populations.

In addition, three other lakes or groups of lakes in the Snake River drainage supported sockeye populations: Warm Lake (in the South Fork Salmon drainage); Payette, Upper Payette and Little Payette Lakes (Payette River drainage); and Wallowa Lake (Grande Ronde drainage). The distance between these lakes or groups of lakes is consistent with observed distances between extant ESUs of lake-spawning sockeye, suggesting that each of these groups would likely have been separate major population groups and may have been separate ESUs.

2 Current Conditions

The Redfish Lake population includes all the fish in this ESU. Less than 200 adults have returned to the subbasin since 1987 (NPCC 2004) and the number of wild sockeye smolts emigrating from Redfish Lake is less than 5,000 in most years. However, an effort is underway with support to increase the number of smolts released annually by this program. Over the last three years, smolt releases have average approximately 100,000 fish. The expansion of smolt releases is supported with language in the 2008 Federal Columbia River Power System Biological Opinion and the 2008 Fish Accords signed by Bonneville Power Administration and the State of Idaho. Low out-of-basin survival is the primary limiting factor for this population.

Juvenile sockeye rear one or two years in the lake and then emigrate to the ocean in April and May. Adults arrive back in the Stanley subbasin between mid-July and early September.

A captive broodstock hatchery program was initiated in 1991 to safeguard the remnant population (conserve the genome) and begin a population rebuilding process. All 16 anadromous adults that returned to Redfish Lake in the 1990s (1992 through 1998) were trapped and incorporated in the broodstock program. Other “founders” included residual sockeye salmon trapped in Redfish Lake and several hundred outmigrants trapped while emigrating from Redfish Lake.

The captive broodstock program maintains a safety net at the IDFG Eagle Hatchery in Eagle, Idaho and at NOAA hatcheries in Puget Sound (Manchester and Burley Creek). The program replaces the broodstock annually in addition to producing eggs and fish for reintroduction to natal waters (Redfish, Alturas, and Pettit lakes).

The Shoshone-Bannock Tribes operate a habitat monitoring and improvement project in project nursery lakes. This includes a whole-lake fertilization program.

2.1 Current Population Status and Goals

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

- ESA Status: Snake River Sockeye are listed as Endangered under ESA.
- Population Description: Small remnant population near extinction. The majority of production is from the captive broodstock program.
- Recovery Goal for Abundance: The interim recovery standards established by NOAA are 1,000 naturally-produced adults returning to Redfish Lake and 500 naturally-produced adults returning to two additional lakes (presumably Alturas and Pettit lakes).
- Productivity Improvement Expectation: Not available
- Habitat Productivity and Capacity: Productivity: 0.14; Capacity: 10,000

2.2 Current Hatchery Programs Affecting this Population

A captive broodstock program was developed in 1991 to protect the remnant population. A full-term captive broodstock is maintained at the IDFG Eagle Fish Hatchery and at NOAA's Burley Creek Fish Hatchery and Manchester Marine Lab in Puget Sound. Every effort is made to maintain the genetic diversity of this population and to avoid inbreeding. Annually, captive adults are spawned based on a genetic spawning matrix established to prioritize spawn crosses that avoid inbreeding. Anadromous adults captured at adult weirs in the Stanley subbasin may be incorporated in spawning designs. Maturation of adult broodstock has occurred primarily at age three. Egg survival to the eyed-stage of development has ranged from 0% to 99% (by individual female) with overall eye-up averaging greater than 60% (for hatchery-origin females). Survival of broodstock in the hatchery has been excellent (approximately 80% from hatch to spawning).

Annually, the program produces eggs and fish for reintroduction to natal waters. The program has followed a spread-the-risk reintroduction strategy while researches work to determine the most successful options. Additional efforts are underway to locate and acquire additional production rearing space for this program.

Current production goals for the program include: 50,000 eyed-eggs planted in egg boxes in Pettit Lake; 120,000 pre-smolts planted in Redfish, Alturas, and Pettit lakes (combined release); and 80,000 smolts planted in the outlet of Redfish Lake and in the upper Salmon River immediately upstream of the Sawtooth Fish Hatchery (equal split). Additionally, the program produces up to 500 full-term hatchery adults that are planted primarily in Redfish Lake for natural spawning.

Estimated number of hatchery strays affecting this population:

- Hatchery strays from integrated in-basin programs: 100%
- Hatchery strays from in-basin segregated and out-of-basin hatchery programs: 0 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 that Adjusted Productivity (with harvest and fitness factor effects from AHA) would be increase from 0.07 to 0.14. Average abundance of natural-origin spawners (NOS) would decrease from approximately 15 fish to approximately 0 fish. The harvest contribution of the natural and hatchery populations would go from approximately 13 fish to approximately 0 fish.

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

Managers have identified a strategy for Redfish Lake sockeye salmon that emphasizes maintaining existing natural spawning populations, and using hatchery-origin sockeye salmon in an attempt to augment natural production.

A full-term captive broodstock is maintained at the IDFG Eagle Fish Hatchery and at NOAA's Burley Creek Fish Hatchery and the Manchester Research Station in Puget Sound. Spawning occurs annually at these locations and is guided by an inbreeding avoidance matrix developed at the IDFG genetics lab. Every effort is made to spawn all maturing adults and to equalize their representation in subsequent generations (within the captive safety net).

Annually, the program replaces the captive broodstock at IDFG and NOAA facilities by selecting eggs from all spawn crosses and by equalizing individual representation. The program also produces eggs and fish for reintroduction to natal waters. Following a spread-the-risk reintroduction strategy, the current production goals for the program include: 50,000 eyed-eggs planted in egg boxes in Pettit Lake; 120,000 pre-smolts planted in Redfish, Alturas, and Pettit lakes (combined release); and 80,000 smolts planted in the outlet of Redfish Lake and in the upper Salmon River immediately upstream of the Sawtooth Fish Hatchery (equal split). Additionally, the program produces up to 500 full-term hatchery adults that are planted primarily in Redfish Lake for natural spawning. Currently a large proportion of the smolt releases have a ventral fin clip applied. Reduced survival from ventral fin clipping is well-identified in the literature.

Efforts are underway to locate and acquire additional production rearing space for planned increases in the size of this program. Recent modifications were also made to the IDFG and NOAA broodstock stations. Over the last three years, program smolt releases have increased from an average of 10,000 to 20,000 annually to over 100,000. In 2008, over 600 anadromous adults returned to the Sawtooth Valley, ID.

Recommendations

The HSRG concurs with the decision initiated by managers to increase smolt releases from the program. This action to increase smolt production (500,000 to 1 million fish) is identified in the 2008 FCRPS Biological Opinion. Increased smolt releases should produce increased anadromous adult returns that will be incorporated into hatchery broodstock or released to the habitat to increase natural production.

Additionally, the HSRG recommends that managers pursue other actions that have the potential to increase the availability of anadromous adults. One option is to capture adult Snake River sockeye salmon at Lower Granite Dam for transport back to Idaho. This action is also identified in the 2008 FCRPS Biological Opinion.

In addition to the above, the HSRG recommends that managers implement a downstream anadromous release and adult capture program at an appropriate lower Columbia River hatchery integrated with the expanded upriver program. This option would generate a more consistent return of anadromous sockeye salmon that could be spawned to augment the production of eggs and juveniles for incorporation into the suite of release strategies.

The overarching goal for implementing any or all of the above strategies is to return greater numbers of anadromous adults that could be used selectively in spawning designs

or released to the habitat to address concerns over loss of fitness in this closed population. The HSRG also recommends that managers tag/mark all fish released by this program to facilitate subsequent collection and identification. The HSRG recommends finding alternative means of identifying fish and discontinuing the practice of ventral fin clipping.

Table 1. Results of HSRG analysis of current condition and HSRG Solution for Salmon -Redfish Sockeye. 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	Seg-Cons	151.7	0%	0%	92%	0.0	15	0.07	13	0
No Hatchery	None None	-	0%	0%	0%	1.0	0	0.14	0	-
HSRG Solution	Seg-Cons	749.9	75%	0%	92%	0.0	28	0.07	90	316
HSRG Solution w/ Improved Habitat	Seg-Cons	749.9	75%	0%	91%	0.0	31	0.08	90	316