SNAKE RIVER SOCKEYE SALMON
STATUS OF THE SPECIES UPDATE
JULY 2024

Background

The Snake River (SR) sockeye salmon evolutionarily significant unit (ESU) includes all anadromous and residual sockeye salmon from the Snake River basin in Idaho, as well as artificially propagated sockeye salmon from the Redfish Lake captive propagation and SR sockeye salmon hatchery programs (85 FR 81822). The ESU was first listed as endangered under the ESA on November 20, 1991 (56 FR 58612). On August 18, 2022, in the agency's 5-year review for SR sockeye salmon, NMFS concluded that the species should remain listed as endangered (NMFS 2022).

Reasons for the decline of this species include high levels of historic harvest, dam construction including hydropower development on the Snake and Columbia Rivers, water diversions and water storage, predation on juvenile salmon in the mainstem river migration corridor, and active eradication of sockeye salmon from some lakes in the 1950s and 1960s (56 FR 58619; ICTRT 2003). Although some factors have improved since 2016 (e.g., hydropower operational changes, improved water quality regulatory controls at the state level, increased hatchery production and improved hatchery practices) climate change has emerged as a higher risk to the species' persistence (NMFS 2022). Continued threats include negative impacts of climate change on all life stages, poor ocean conditions potentially exacerbated by increasing hatchery fish production across the Pacific, and predation by pinnipeds in the Lower Columbia River (NMFS 2022).

Life History

Snake River sockeye salmon adults enter the Columbia River primarily during June and July, and arrive in the Sawtooth Valley peaking in August. The Sawtooth Valley supports the only remaining run of SR sockeye salmon. The adults spawn in lakeshore gravels, primarily in October (Bjornn et al. 1968). Eggs hatch in the spring between 80 and 140 days after spawning. Fry remain in the gravel for 3 to 5 weeks, emerging from April through May. Juveniles remain in the natal lake feeding on plankton for 1 to 3 years before they migrate to the ocean, leaving their natal lake in the spring from late April through May (Bjornn et al. 1968). Snake River sockeye salmon usually spend 2 to 3 years in the Pacific Ocean and return to Idaho in their 4th or 5th year of life.

Spatial Structure and Diversity

Within the SR ESU, the ICTRT identified historical sockeye salmon production in five Sawtooth Valley lakes, in addition to Warm Lake and the Payette Lakes in Idaho and Wallowa Lake in Oregon (ICTRT 2003). The sockeye salmon runs to Warm; Payette, and Wallowa Lakes are now extinct, and the ICTRT identified the Sawtooth Valley lakes as a single major population group (MPG) for this ESU. The MPG consists of the Redfish, Alturas, Stanley, Yellowbelly, and Pettit Lake populations (ICTRT 2007). The only extant population is Redfish Lake, which is highly dependent on a captive broodstock program and juvenile fish production facilitated by the

Sawtooth, Springfield, and Eagle Hatcheries. Although the captive brood program rescued the ESU from extinction, the diversity risk remains high and will continue to remain high without sustainable natural production (Ford 2022).

Hatchery fish from the Redfish Lake captive broodstock program have been outplanted in Alturas and Pettit Lakes since the mid-1990s in an attempt to reestablish those populations, thus improving spatial structure of the ESU (Ford 2011). There is some evidence of very low levels of early-timed returns in some recent years from outmigrating, naturally-produced Alturas Lake smolts, but the ESU remains at high risk for spatial structure. With such a small number of populations in this MPG, the reestablishment of any additional populations would substantially reduce the risk faced by the ESU (ICTRT 2007).

Abundance and Productivity

Prior to the turn of the 20th century (ca. 1880), around 150,000 sockeye salmon ascended the Snake River to the Wallowa, Payette, and Salmon River basins to spawn in natural lakes (Evermann 1896, as cited in Chapman et al. 1990). The Wallowa River sockeye salmon run was considered extinct by 1905, the Payette River run was blocked by Black Canyon Dam on the Payette River in 1924, and anadromous Warm Lake sockeye salmon in the South Fork Salmon River basin may have been trapped in Warm Lake by a land upheaval in the early 20th century (ICTRT 2003). In the Sawtooth Valley, the Idaho Department of Fish and Game eradicated sockeye salmon from Yellowbelly, Pettit, and Stanley Lakes in favor of other species in the 1950s and 1960s, and irrigation diversions led to the extirpation of sockeye salmon in Alturas Lake in the early 1900s (ICTRT 2003), leaving only the Redfish Lake sockeye salmon population. From 1991 to 1998, a total of just 16 wild adult anadromous sockeye salmon returned to Redfish Lake. These 16 wild fish were incorporated into a captive broodstock program that began in 1992 and has since expanded. The program targets an annual release of 1,000,000 sockeye smolts, at least 250 full-term hatchery adult releases to Redfish Lake, and 100 full-term hatchery adult releases in Pettit Lake (IDFG 2022).

The increased abundance of hatchery reared SR sockeye salmon reduces the risk of extinction over the short-term, but levels of naturally produced sockeye salmon returns are variable and remain extremely low (Ford 2022). The ICTRT's viability target is at least 1,000 naturally produced spawners per year in each of Redfish and Alturas Lakes and at least 500 in Pettit Lake (ICTRT 2007). The highest adult returns since the captive broodstock program began were in 2014, with a total of 1,579 counted in the Stanley Basin (Ford 2022). The general increases observed in the number of adult returns during 2008-2014 were likely due to a number of factors, including increases in hatchery production and favorable marine conditions. The 5-year geometric mean of natural-origin adult returns was 137 for 2010-2014. Since then, natural-origin adult returns have declined with a 2015-2019 5-year geometric mean of 16 (Ford 2022). Adult returns crashed in 2015 due to a combination of low flows and warm water temperatures in the migration corridor. There was also high in-basin mortality of smolts released in 2015-2017 due to water chemistry shock between hatchery waters and the water of Redfish Lake Creek (Ford 2022). Poor survival and growth in the ocean also play a role in low returns. The total number of returning adults documented in the Sawtooth Valley in 2020, 2021, 2022, and 2023 was 152, 55,

749, and 174, respectively (Johnson et al. 2021, Phillips 2022, IDFG 2022 unpublished data, IDFG 2023 unpublished data).

Recovery

NMFS completed a recovery plan for SR sockeye salmon in 2015 (NMFS 2015). The recovery scenario includes restoring two of the three historical lake populations to highly viable and one to viable. The three focal populations targeted for these recovery goals are Redfish Lake, Alturas Lake, and Pettit Lake. During the most recent status review, NMFS (2022) identified the greatest opportunities to advance recovery of this ESU. Those include: (1) measurably reduce water temperatures in mainstem habitat and establish cold-water refugia along the entire migratory corridor; (2) improve water quantity and quality in migratory reaches; (3) investigate causal factors for poor juvenile survival in the Upper Salmon River basin and initiate actions to improve survival; (4) fertilize and monitor natal lakes; (5) protect and, where possible, restore natural processes such as free fish passage in natal lakes and their inlet and outlet streams; (6) monitor in-river adult survival in concert with environmental conditions and initiate adult transport as necessary to maximize adult survival; and (7) prioritize maintenance and replacement of fish screens on irrigation diversions.

The projected influence of climate change on water temperatures and flow and the resulting impacts on sockeye survival continue to pose an increasing risk to the species' persistence (Crozier et al. 2019). Increased exposure of freshwater migration stages to higher temperatures and lower flows is expected to decrease productivity and abundance for SR sockeye, which already has low spatial and genetic diversity, and low potential to adapt to climate change. Climate change impacts are a significant and increasing threat to the persistence of this ESU.

Summary

The species remains at high risk across all four VSP parameters (spatial structure, diversity, abundance, and productivity) and is at a high risk of extinction within 100 years. Although the captive brood program has been highly successful in producing hatchery sockeye salmon, substantial increases in survival rates across all life history stages must occur in order to reestablish sustainable natural production (Ford 2022). In particular, juvenile and adult losses during travel through the Salmon, Snake, and Columbia River migration corridor continue to present a significant threat to species recovery (NMFS 2022). This ESU continues to face threats from habitat modification and degradation through the migratory corridor, predation, disease, and climate change (NMFS 2022).

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