SNAKE RIVER FALL-RUN CHINOOK SALMON
STATUS OF THE SPECIES
JULY 2024

Background

The Snake River (SR) fall Chinook salmon evolutionarily significant unit (ESU) was listed as threatened on April 22, 1992 (57 FR 14653). On August 18, 2022, in the agency's 5-year review for SR fall Chinook salmon, NMFS concluded that the species should remain listed as threatened (NMFS 2022).

The ESU includes fall Chinook salmon that spawn in the mainstem of the Snake River and lower reaches of its major tributaries. The ESU also includes four artificial propagation programs: the Lyons Ferry Hatchery, Fall Chinook Acclimation Ponds, Nez Perce Tribal Hatchery, and Idaho Power programs (85 FR 81822). Historically, this ESU included one large additional population spawning in the mainstem of the Snake River upstream of the Hells Canyon Dam complex (Ford 2022). Snake River fall Chinook salmon have substantially declined in abundance from historic levels, primarily due to the loss of primary spawning and rearing areas upstream of the Hells Canyon Dam complex (57 FR 14653). Additional concerns for the species have been the high percentage of hatchery fish returning to natural spawning grounds and the relatively high aggregate harvest impacts by ocean and in-river fisheries (Good et al. 2005). Despite improvements in status, threats associated with hydropower, habitat degradation and access in the tributaries, hatcheries, harvest, and predation continue to challenge ESU recovery (NMFS 2022).

Life History

After spending one to five years in the ocean, SR fall Chinook salmon enter the Columbia River in July and August, and migrate past the lower Snake River mainstem dams from August through November. Fish spawning takes place from October through early December in the mainstem of the Snake River, primarily between Asotin Creek and Hells Canyon Dam, and in the lower reaches of the Tucannon, Grande Ronde, Clearwater, Salmon, and Imnaha Rivers (Connor and Burge 2003; Ford 2011). Juveniles emerge from the gravels in March and April of the following year.

Most SR fall Chinook salmon migrate to the Pacific Ocean during their first year of life, normally within 3 months of emergence from the spawning substrate as age-0 smolts, to spend their first winter in the ocean. Chinook salmon juveniles tend to display a "rear as they go" strategy, in which they continually move downstream through shallow shoreline habitats during their first summer and fall, continually growing until they reach the ocean by winter (Connor and Burge 2003; Coutant and Whitney 2006). Tiffan and Connor (2012) showed that subyearling fish favor water less than 6-feet deep, and Tiffan et al. (2014) found that riverine reaches were likely better rearing habitat than reservoir reaches. Some SR fall Chinook are also known to overwinter in either the lower Snake River reservoirs or the Columbia River estuary before entering the ocean as yearling (age-1) smolts (NMFS 2017).

Spatial Structure and Diversity

The SR fall Chinook salmon ESU includes one, large, extant population of fish that primarily spawn in five major spawning areas (Upper Hells Canyon, Lower Hells Canyon, Grand Ronde, Clearwater, and Tucannon rivers). Fall Chinook salmon also occasionally spawn in the mainstem Snake River downstream from Lower Granite Dam (Dauble et al. 1999; Dauble et al. 1995; Dauble et al. 1994; Mueller 2009). The spatial structure risk for this population is therefore low and is not precluding recovery of the species (Ford 2022). After moving some hatchery production into the lower Salmon River, as part of an effort to create a natural production emphasis area in the upper Hells Canyon reach of the Snake River, substantial numbers of SR fall Chinook are now spawning naturally in this tributary as well.

There are several diversity concerns for SR fall Chinook salmon, leading to a moderate diversity risk rating for the extant Lower Snake population. One concern is the relatively high proportion of hatchery spawners (70%) in all major spawning areas within the population (Ford 2022; NMFS 2017). The fraction of natural-origin fish on the spawning grounds has remained relatively stable, with five-year means of 31 percent (2010-2014) and 33 percent (2015-2019) (Ford 2022). Since 2018, the fraction of natural-origin fish in the Upper Hells Canyon natural production emphasis area has ranged from about 35 to 55 percent (pers. comm. C. Bussak, National Marine Fisheries Service [NMFS] West Coast Region [WCR] Sustainable Fisheries Division, to R. Graves, NMFS WCR Columbia Hydropower Branch, on July 26, 2024). The diversity risk will need to be reduced to low in order for this population to be considered highly viable. Because there is only one extant population, it must achieve highly viable status in order for the ESU to recover.

Abundance and Productivity

Historical abundance of SR fall Chinook salmon is estimated to have been 416,000 to 650,000 adults (NMFS 2006), but numbers declined drastically over the 20th century, with only 78 natural-origin fish and 306 hatchery-origin fish (WDFW and ODFW 2023) passing Lower Granite Dam in 1990. After 1990, abundance increased dramatically, and exceeded 10,000 natural-origin returns each year from 2012-2015. However, the 5-year geometric means of natural-origin spawners declined by 36 percent 2010-2014 (11,254) and 2015-2019 (7,252). Although there have been recent declines in natural-origin returns, the 10-year geometric mean for 2010-2019 (9,034 natural-origin adults) exceeds the recovery plan abundance metric (i.e., > 4,200 natural-origin spawners) (Ford 2022; NMFS 2017; NMFS 2022). While the recovery plan abundance metric is currently exceeded, the associated 20-year geometric mean of population productivity is only 0.63 (which includes a 40 percent or greater harvest exploitation rate and is likely an underestimate of intrinsic productivity), which is far below the recovery plan metric of 1.7 (Ford 2022 and NMFS 2017). The abundance and diversity risk rating is rated as low (NMFS 2022). The most recent (2018-2022) five-year geomean is 8,617, and there were 7,492 naturally-produced adult returns in 2023 (Table 5 in WDFW and ODFW 2024), which is an increase in abundance compared to 2015-2019.

Recovery

NMFS completed a recovery plan for SR fall Chinook salmon in 2017 (NMFS 2017). The most likely pathway to recovery is achieving a substantial amount of natural production in one or two of the five major spawning areas. The natural production emphasis areas would be managed to have a low percentage of hatchery-origin spawners (NMFS 2022). The Upper Hells Canyon spawning area was selected as the natural production emphasis area and Idaho Power Company fall Chinook hatchery releases were moved from Hells Canyon Dam to the lower Salmon River starting in 2018. This effort has greatly increased the number of adult spawners in the lower Salmon River and increased the proportion of natural origin fish in the upper Hells Canyon reach of the Snake River, though to not the degree anticipated (Arnsberg et al. 2022). In order to maintain and improve the status of this ESU, NMFS (2022) recently recommended implementing a number of actions, including but not limited to: (1) Idaho Power Company's SR fall-run Chinook salmon spawning program; (2) Columbia River Power System biological opinion; (3) measures to reduce impacts of reservoir and river channel dredging and disposal; (4) tributary habitat improvement actions and TMDLs; (5) restore an early-spawning fall Chinook salmon component in the Clearwater River; (6) additional research, monitoring, and evaluation to answer questions related to relocation of hatchery fish releases to the Salmon River and estimation of the relative contribution of naturally spawning hatchery SR fall-run Chinook salmon to productivity and diversity.

The quality of data used to evaluate climate-related threats is limited, and our understanding of how salmonids, and the ecosystems upon which they depend, might respond is even more limited. Crozier et al. (2019) rated the vulnerability of SR fall Chinook salmon as high. We generally expect that abundance could decrease and extinction risk increase as a result of climate change. Fall-migrating adults could potentially respond temporally to changing environmental conditions by migrating later in the fall. Developing eggs and fry could be negatively affected by altered flows (e.g., low flows or winter flood events), but these effects are likely to be substantially dampened because they spawn and incubate in the lower segments of larger rivers where they are less vulnerable to these events. Juvenile emergence and rearing could potentially become "out- of-sync" with nursery conditions in these rivers. Juveniles using an ocean-type, subyearling life history strategy could potentially respond temporally by migrating earlier in the spring, avoiding exposure to higher summer temperatures. Though the quality of information is mixed, sensitivity in the marine stage is certainly high, and exposure to changing marine conditions, including high levels of ocean acidification, will occur.

Summary

The status of this ESU has improved since the time of listing. While the population is currently considered to be viable, it is not meeting its recovery goals. This is due to: (1) low population productivity; (2) uncertainty about whether the elevated natural-origin abundance can be sustained over the long term; and (3) high levels of hatchery-origin spawners in natural spawning areas (NMFS 2022). This ESU also continues to face threats from tributary and mainstem habitat loss, degradation, or modification; disease; predation; harvest; hatcheries; and climate change (NMFS 2022).

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