# Status of the Species
# Upper Columbia Spring-run Chinook Salmon
# February 2023

The Upper Columbia River (UCR) spring-run Chinook salmon evolutionarily significant unit (ESU) was listed as an endangered species on March 24, 1999 (64 FR 14308). On August 16, 2022, in the agency's 5-year review for UCR spring-run Chinook salmon, NMFS concluded that the species should remain listed as endangered (NMFS 2022).

The ESU includes all naturally-spawned spring-run populations of Chinook salmon in all river reaches accessible to Chinook salmon in Columbia River tributaries upstream of Rock Island Dam and downstream of Chief Joseph Dam, excluding the Okanogan River subbasin (64 FR 14208). The Okanogan population is considered extinct; however, NOAA designated a "non-essential experimental population" of spring-run Chinook salmon in the Okanogan River sub-basin under section 10(j) of the ESA in 2014 (79 FR 20802). The spring-run Chinook salmon that are designated as part of an experimental population are not included as part of the ESU. Seven artificial propagation programs are included in this ESU: The Twisp River Program, Chief Joseph spring Chinook Hatchery Program (Okanogan release), Methow Program, Winthrop National Fish Hatchery Program, Chiwawa River Program, White River Program, and the Nason Creek Program (85 FR 81822).

Factors contributing to the decline of UCR spring-run Chinook salmon included the intensive commercial fisheries in the lower Columbia River. These fisheries began in the latter half of the 1800s, continued into the 1900s, and nearly eliminated many salmon and steelhead stocks. With time, the construction of dams and diversions, some without passage, blocked or impeded salmon and steelhead migrations. Early hatcheries, operated to mitigate the impacts of dams on fish passage and spawning and rearing habitat, employed practices such as transferring fish among basins without regard to their origin. While these practices increased the abundance of stocks, they also decreased the diversity and productivity of populations they intended to supplement. Concurrent with these activities, human population growth within the basin was increasing and land uses were adversely affecting salmon spawning and rearing habitat. In addition, non-native species were introduced by both public and private interests that directly or indirectly affected salmon (UCSRB 2007).

Conservation partners have implemented many tributary habitat restoration projects across the ESU, improving habitat conditions for salmon spawning, rearing, and migration in many reaches. However, widespread areas of degraded habitat persist across the basin, with simplified stream channels, disconnected floodplains, impaired instream flow, loss of cold water refugia, and other limiting factors (NMFS 2022). An emerging risk is climate change and the consequent threat to the juvenile rearing stage vulnerable to low stream flow and high stream changes. Other threats described in the paragraph above as well as pinniped predation continue.

***Life history.*** Adult UCR spring-run Chinook salmon begin returning from the ocean in April and May, with the run into the Columbia River peaking in mid-May. They enter the upper Columbia River tributaries from April through July. After migration, they hold in freshwater tributaries until spawning occurs in the late summer, peaking in mid-to-late August. Juvenile spring

Chinook salmon spend a year in freshwater before migrating to saltwater in the spring of their second year of life. Most UCR spring-run Chinook salmon return as adults after 2 or 3 years in the ocean. Some precocious males, or jacks, return after one winter at sea. A few other males mature sexually in freshwater without migrating to the sea. The run, however, is dominated by 4 and 5-year-old fish that have spent 2 and 3 years at sea, respectively. Fecundity ranges from 4,200 to 5,900 eggs, depending on the age and size of the female (UCSRB 2007).

***Spatial structure and diversity.*** There is a single major population group (MPG), the North Cascades MPG, in this ESU. It is composed of three populations including the Wenatchee, Entiat, and Methow. The spatial structure risk is low for the Methow and Wenatchee River populations. It is moderate for the Entiat population due to the loss of production in the lower section which increases effective distance to other populations (Ford 2022). Large-scale supplementation efforts in the Methow and Wenatchee Rivers are ongoing, intended to counter short-term demographic risks given current survival levels. Supplementation in the Entiat ceased in 2007. All three populations are rated high risk for diversity, driven primarily by the high proportions of hatchery-origin spawners in natural spawning areas and lack of genetic diversity among natural-origin spawners (Ford 2022).

***Abundance and productivity.*** All three populations in the UCR spring-run Chinook salmon ESU remain at high overall risk for the integrated abundance and productivity metric (NMFS 2022). Productivity remains well below thresholds established in the recovery plan for each population (Ford 2022). Natural origin abundance has decreased over the levels reported in the 2016 5-year review for all populations in this ESU, in many cases sharply. The abundance data for the entire ESU show a downward trend over the last 5 years, with the 2015-2019 5-year abundance levels for all three populations declining by an average of 48 percent. Longer-term (15-year) trends are also negative for all populations, although the 95 percent confidence intervals include 0 (Ford 2022). Between 2010 and 2021, there have been substantial year-to-year variations in wild adult escapement at Rock Island Dam ranging from a low of 704 in 2019 to a high of 3,256 in 2015 (Ford 2022). Relatively low ocean survival in recent years was a major factor in recent abundance patterns.

Although the consistent and recent sharp decline of population abundances is concerning, each population remains well above the abundance levels of when they were listed. All three populations remain at high risk.

New information available since the last 5-year review indicates that many restoration and protection actions have been implemented in freshwater tributary habitat, but those actions do not change overall trends in habitat quality, quantity, and function at this time (NMFS 2022). We remain concerned with habitat conditions throughout the range of the UCR steelhead DPS and UCR spring-run Chinook salmon ESU, particularly with regard to water quality, water quantity, riparian condition, and floodplain function.

***Recovery***. The Interior Columbia Basin Technical Recovery Team (ICTRT; 2007) recommended that three populations meet viability criteria, two of which must meet high viability criteria for the ESU to be viable. The final Upper Columbia Salmon Recovery Board (UCSRB) 2007 recovery plan adopted by NMFS established a recovery goal of securing long-term persistence of

viable populations of naturally produced spring Chinook salmon distributed across their native range. The UCSRB identified five recovery criteria that address the viable salmonid population (VSP) metrics of abundance, productivity, spatial structure, and diversity. For recovery, the UCSRB recommended that all spring-run Chinook salmon populations within the ESU meet abundance/productivity criteria that represent a five percent extinction risk over a 100-year period. In addition, the UCSRB recommended that naturally produced spring Chinook utilize four of the five major spawning areas in the Wenatchee subbasin, one major spawning area within the Entiat subbasin, and within the Twisp, Chewuch, and Upper Methow major spawning areas in the Methow subbasin. NMFS adopted the UCSRB recommendations as the recovery scenario.

Many restoration and protection actions have been implemented in freshwater tributary habitat since 2015, but those actions do not change overall trends in habitat quality, quantity, and function. Habitat conditions throughout the range of the UCR spring-run Chinook salmon ESU continue to limit recovery of the species, particularly with regard to water quality, water quantity, riparian condition, and floodplain function. The greatest opportunities to advance recovery of the species over the next five years include; (1) prioritizing actions that improve habitat resilience to climate change; (2) reconnecting stream channels with floodplains; (3) implementing restoration actions at watershed scales; and (4) reducing pinniped predation on adults returning to the lower Columbia River (NMFS 2022).

Crozier et al. (2019) concluded that UCR spring-run Chinook salmon have a high risk of overall climate vulnerability based on their high risk for biological sensitivity, high risk for climate exposure, and moderate capacity to adapt. However, the impact of climate change specifically on marine survival is uncertain. The estuary stage sensitivity is low because of their rapid migration from fresh water to the early marine stage (Crozier et al. 2019). Risk during early life history is low because of the high elevation and relatively stable flows that influence the egg stage in spring time. The juvenile freshwater rearing stage is high risk because of the year-around reliance on freshwater habitat and sensitivity to changes in summer flows and stream temperatures. UCR Chinook salmon may have sufficient adaptive capacity to shorten the juvenile freshwater residence period, but the consequences of such a shift for population viability are unknown, and adult spring-run Chinook salmon are also unlikely to shift migration timing substantially.

***Summary***. Current estimates of natural-origin spawner abundance decreased substantially relative to the levels observed in the prior review for all three extant populations (Ford 2022). Productivities also continued to be very low, and both abundance and productivity remained well below the viable thresholds called for in the Upper Columbia Salmon Recovery Plan (UCSRB 2007) for all three populations. Short-term patterns in those indicators appear to be largely driven by year-to-year fluctuations in survival rates in areas outside of these watersheds - in particular, a recent run of poor ocean condition years. Large-scale supplementation efforts in the Methow and Wenatchee Rivers are ongoing, intended to counter demographic risks given current average survival levels and the associated year-to-year variability. Based on the combined risk ratings for the VSP parameters, all three of the extant populations of UCR spring-run Chinook salmon remain rated at high overall risk. Under the current recovery plan, implementation of habitat

protection and restoration actions directed at key limiting factors is necessary to achieve recovery.

## References

Crozier, L. G., M. M. McClure, T. Beechie, S. J. Bograd, D. A. Boughton, M. Carr, T. D. Cooney, J. B. Dunham, C. M. Greene, M. A. Haltuch, E. L. Hazen, D. M. Holzer, D. D. Huff, R. C. Johnson, C. E. Jordan, I. C. Kaplan, S. T. Lindley, N. J. Mantua, P. B. Moyle, J. M. Myers, M. W. Nelson, B. C. Spence, L. A. Weitkamp, T. H. Williams, and E. Willis-Norton. 2019. Climate vulnerability assessment for Pacific salmon and steelhead in the California Current Large Marine Ecosystem. PLoS ONE 14(7): e0217711. https://doi.org/10.1371/journal.pone.0217711.

Ford, M. J., editor. 2022. Biological viability assessment update for Pacific salmon and steelhead listed under the Endangered Species Act: Pacific Northwest. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-171.

ICTRT (Interior Columbia River Technical Recovery Team). 2007. Interior Columbia Basin TRT: Viability criteria for application to Interior Columbia Basin Salmonid ESUs. Available at http:// www.nwfsc.noaa.gov/trt/trt_viability.cfm.

NMFS. 2022. 2022 5-year Review: Summary and Evaluation of Upper Columbia River Spring-run Chinook Salmon and Upper Columbia River Steelhead. August 16, 2002. 95pp.

UCSRB (Upper Columbia Salmon Recovery Board). 2007. Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan.