Sacramento fall-run Chinook salmon abundance

The number of Chinook salmon returning in the fall to the Sacramento River has become more variable in the last two decades.

Since the mid-1990s, the numbers of Chinook salmon returning to the Sacramento River to spawn have fluctuated considerably. This iconic fish (also known as king salmon) is among California's most valued natural resources, and an important part of the cultural identity of Native American tribes. It is highly prized by sport and commercial fishers. Sacramento fall-run Chinook is the largest contributor to the ocean salmon harvest off California and Oregon, supporting an industry valued at over $1 billion per year.

During different stages of their lives, Chinook salmon live in fresh water and ocean water. A warming climate, alongside other human-caused threats such as habitat loss and polluted runoff, threatens both these habitats.

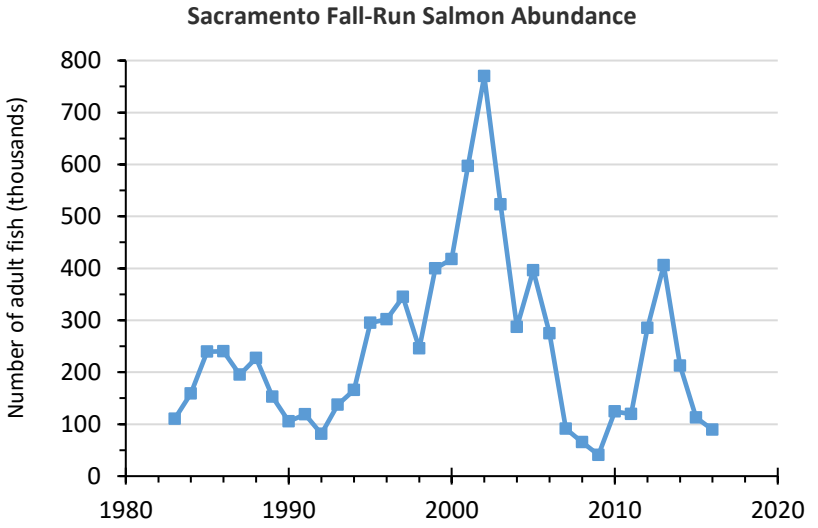
Central Valley Chinook salmon are born in inland fresh water, migrate as juveniles to the Pacific Ocean, and return as adults to fresh water to spawn.

Photo: Allen Harthorn

What does the indicator show?

The graph shows the number of fall-run Chinook salmon returning to the Sacramento River each year. Since 1995, the numbers have been highly variable, peaking in 2002. After record-low numbers in 2008 and 2009, which led to the closure of commercial and recreational fisheries, the population recovered in 2012 and 2013, then declined in the three years that followed.

Four distinct runs of Chinook salmon spawn in the Sacramento-San Joaquin River system, the fall-run being the most abundant. This subpopulation is designated as a Species of Concern under the federal Endangered Species Act.



Source: Pacific Fisheries Management Council 2017

Why is the indicator important?

Salmon can serve as an indicator of the health of both marine and inland freshwater ecosystems. Climate change can alter these habitats, putting salmon populations at risk. With warming air temperatures, river and stream temperatures increase. As more precipitation falls as rain instead of snow, less snowpack accumulates in the mountains, reducing snowmelt runoff that provides cold water year-round. Warmer stream and river temperatures can affect juvenile and adult migration, spawning, egg viability, and rearing conditions. In the ocean, warmer temperatures impact salmon survival by affecting the distribution and abundance of their prey, which consists largely of krill, forage fish and crab larvae. In addition, water temperature affects fish metabolism, development, behavior and distribution.

In addition to warming, other climate change influences may affect the health and survival of salmon. Rising sea levels can lead to inundation of low-lying lands and increases in salinity, transforming estuary habitats for migrating salmon. Another possible threat is the acidification of coastal waters, a consequence of increasing levels of carbon dioxide in air. Ocean acidification can impact the growth of some of the organisms that are important to the salmon diet.

Both climate change and other human-caused impacts will likely put salmon at risk of extirpation (eradication from an area) and/or extinction. If current trends in climate change and other pressures persist, scientists predict that nearly all of California's salmon could face extinction within 50 to 100 years.

Warming stream temperatures can delay the development of Chinook salmon. Salmon fry which emerged on the same day show different degrees of development. As eggs, they were exposed to different temperatures.

Photo: Abby Tillotson/US Forest Service

For more information about this and other climate change indicators, visit:
https://oehha.ca.gov/climate-change/report/2018-report-indicators-climate-change-california