



Photo credit: NMFS.

**Brief Species Description:**

Chinook salmon are easily the largest of any salmon, with adults often exceeding 40 pounds (18 kg), while individuals over 120 pounds (54 kg) have been reported. They are very similar to coho salmon in appearance while at sea (blue-green back with silver flanks), except for their large size, small black spots on both lobes of the tail, and black pigment along the base of the teeth. Chinook salmon adults migrate from a marine environment into the freshwater streams and rivers of their birth in order to mate (called [anadromy](#)). They spawn only once and then die (called semelparity). Chinook salmon feed on terrestrial and aquatic insects, amphipods, and other crustaceans while young, and primarily on other fishes when older. Populations of Chinook salmon exhibit considerable variability in size and age of maturation and in the timing of migrations, and at least some portion of this variation is genetically determined.

In the Central Valley of California (Figure 1), juvenile fall-run Chinook spend 3 to 6 months rearing in freshwater, while late-fall run Chinook spend about one year in freshwater before migrating to the sea in the spring. As the time for migration to the sea approaches, juveniles lose their parr marks, the pattern of vertical bars and spots on their sides, useful for camouflage. They then gain the dark back and light belly coloration used by fish living in open water. They then seek deeper water, avoid light, and their gills and kidneys begin to change so that they can process salt water.

Next the juveniles spend between one and four summers at sea, with fall-run Chinook from the San Joaquin River spending the least, and late-fall-run Chinook spending the most time at sea, on average (Myers et al., 1998). Fall-run Chinook return to freshwater in September or October, and late-fall-run Chinook in December or January. Adult female Chinook will prepare a redd (or nest) in a stream area with suitable gravel type composition, water depth and velocity. The adult female Chinook may deposit eggs in 4 to 5 "nesting pockets" within a single redd. Spawning sites have larger gravel and more water flow up through the gravel than the sites used by other Pacific salmon.

**KEY INFORMATION**

**Areas of Concern**

Sacramento and San Joaquin rivers, California.

**Year Identified as "Species of Concern"**  
1999

**Factors for Decline**

- Dams and other impediments
- Water development projects
- Introduced species
- Hatchery fish interactions
- Pollution
- Habitat loss

**Conservation Designations**

American Fisheries Society: Vulnerable  
IUCN: Not Evaluated  
Species of Special Concern: CA



## Species of Concern

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After laying eggs in a redd, adult Chinook will guard the redd from 4 to 25 days before dying. Chinook salmon eggs will hatch, depending upon water temperatures, 90 to 150 days after deposition. Eggs are deposited at a time to ensure that young salmon fry emerge during the following spring when the river or estuary productivity is sufficient for juvenile survival and growth. Presently, fall- and late-fall-run Chinook spawn in the Sacramento and San Joaquin rivers and their tributaries between Keswick dam and the Merced River (Figure 1).



Photo credit: U.S. Geological Survey

### Rationale for “Species of Concern” Listing:

#### ***Demographic and Genetic Diversity Concerns:***

Natural spawning abundance was quite high up to 1999, the most recent status review by NOAA (5-year geometric mean was 190,000 natural spawners for the Sacramento River Basin). The number of mainstem fall-run spawners continues to decline in the upper Sacramento River, as indicated by counts at Red Bluff Diversion Dam (5-year geometric mean abundance through 1996 was 78,996 fish, and mean abundance through 1998 was 26,092 fish). The dam counts represent the total number of fall-run chinook salmon returning to that portion of the river, including hatchery fish. Available evidence suggests that at least 20 to 40 percent of these natural spawners are of hatchery origin. The other Sacramento River Basin streams showing continued declines in abundance of fall-run chinook salmon are Deer and Mill Creeks (short-term trend in abundance through 1998 was –10 percent per year for Mill Creek, long-term trend in abundance through 1998 was –2.8 percent per year for Deer Creek). All other streams for which there are abundance data show increases in abundance over the 10 years up to 1998. As discussed in the Biological Review Team report (Myers et al.





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1998), many of the streams with high abundance of fall-run Chinook salmon in this [Evolutionarily Significant Unit](#) are influenced by hatchery programs (especially the Feather and American Rivers and Battle Creek), so the contribution of those populations to the overall persistence of the wild component of the ESU is not clear.

The late-fall component of the Sacramento River run continues to have low, but perhaps stable abundances. Recent estimates up to 1992, when Red Bluff Diversion Dam counts were still accurate, ranged from 6,700 to 9,700. Estimates from 1993 to 1997 were essentially incomplete due to the inability to monitor fish at the Red Bluff Diversion Dam. Beginning in 1998, carcass surveys again allowed a reasonable estimate to be made, and the 1998 abundance estimate (9,717 fish) seems comparable to the early 1990s. Nevertheless, there is considerable uncertainty in estimating the recent trend in abundance due to changes in estimation methods. Populations of fall-run Chinook salmon in the San Joaquin River Basin have exhibited synchronous population booms and busts and appeared to be on an upward trend in abundance as of 1998. The influence of hatchery fish on natural production in the San Joaquin River Basin is not clear. As in the rest of the Central Valley, insufficient sampling of natural spawners make quantitative estimation of hatchery influence difficult. The uncertainty about the effects of hatchery operations was a major factor in the inability of the BRT to determine conclusively the status of this ESU.

In the past few years we have seen large declines in the fall-run population. In 2007 and 2008 only 88,000 and 66,000 fish, respectively, were estimated to have returned to spawn throughout the basin. A multi-agency scientific review panel, lead by NMFS scientists, released a report on March 18, 2009 (Lindley et al., 2009) that outlines the potential causes for the recent severe decline in the abundance of Sacramento River fall Chinook salmon. The panel found that poor conditions in the coastal ocean in 2005 and 2006 resulted in unusually poor survival of fall-run chinook salmon returning to the river in 2007 and 2008. These fish entered the ocean during periods of weak upwelling, warm sea surface temperatures, and scarce food.

### ***Factors for Decline:***

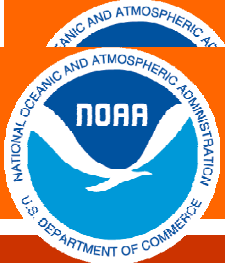
Loss of historic spawning grounds due to dams and other impediments to fish movement has affected this species like it has many other salmonids. Degradation of remaining spawning habitat from water diversions, introduced species, and altered sediment dynamics has occurred. Competition and predation from hatchery reared Chinook salmon leads to a number of problems including genetic introgression, competition, etc. Degraded water quality from a variety of pollution sources including agriculture and urbanization and other development has probably contributed to species decline. Loss of riparian and estuary habitats from the above-listed development sources is also a problem.

### **Status Reviews/Research Underway:**

The last status review was in 1999 and it is discussed above.

### **Data Deficiencies:**

Current sampling and marking regimes are insufficient to adequately estimate how many fish of hatchery origin are spawning naturally. Similarly, the location and magnitude of self-sustaining natural production is poorly known.



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#### Existing Protections and Conservation Actions:

ESA listing was found to be not warranted on September 16, 1999 but the ESU was classified as a Candidate species at that time due to specific risk factors. It was then transferred to the new Species of Concern list on April 15, 2004. The ESU includes all naturally spawned populations of fall-run Chinook salmon in the Sacramento and San Joaquin River Basins and their tributaries, east of Carquinez Strait, California. Under the auspices of the CALFED and Anadromous Fish Restoration Programs, many conservation actions have been taken to improve habitat conditions for anadromous fish in the Central Valley, including fall and late-fall-run Chinook (see further info links). Ocean

salmon fisheries that target this ESU have been curtailed to protect the ESA-listed winter-run Chinook and to meet conservation objectives for Klamath River Chinook.

#### For Further Information:

- [NMFS Northwest Regional Office Chinook Salmon ESU Information](#)
- [NOAA's National Marine Sanctuaries](#)
  - [Gulf of the Farallones Sanctuary Chinook Salmon Species Card](#)
- [U.S. Fish and Wildlife Service CyberSalmon Chinook Salmon Information](#)
- Pacific Salmonids: Major Threats and Impacts - Office of Protected Resources - NOAA Fisheries
- [CALFED bay Delta program](#)
- [USFWS Anadromous Fish Restoration Program](#)

#### Videos:

Jumping (0:20) <http://www.youtube.com/watch?v=dRnxKgZJws4>

Using fish ladder (0:20) <http://www.youtube.com/watch?v=bBoeQI0ZB04>

#### References:

Lindley, S.T. et al. 2009. What caused the Sacramento River fall Chinook stock collapse? Pre-publication report to the Pacific Fishery Management Council.

[http://swfsc.noaa.gov/uploadedFiles/Operating\\_units/FED/Salmon\\_decline\\_report\\_March\\_2009.pdf](http://swfsc.noaa.gov/uploadedFiles/Operating_units/FED/Salmon_decline_report_March_2009.pdf)

Myers, J.M., R.G. Kope, G.J. Bryant, D. Teel, L.J. Lierheimer, T.C. Wainwright, WS. Grant, F.W. Waknitz, K.' Neely, S.T. Lindley, and R.S. Waples. 1998. Status review of chinook salmon from Washington, Idaho, Oregon, and California. NOAA Tech, Memo. NMFS-NWFSC-35, 443 p.

West Coast Chinook Salmon Biological Review Team. 1999. Status review update for deferred ESUs of West Coast Chinook Salmon (*Oncorhynchus tshawytscha*) from Washington, Oregon, California, and Idaho.

<http://www.nwr.noaa.gov/Publications/Biological-Status-Reviews/upload/SR1999-chinook.pdf>

#### Point(s) of contact for questions or further information:

For further information on this Species of Concern, or on the Species of Concern Program in general, please contact NMFS, Office of Protected Resources, 1315 East West Highway, Silver Spring, MD 20910, (301) 713-1401, [soc.list@noaa.gov](mailto:soc.list@noaa.gov); <http://www.nmfs.noaa.gov/pr/species/concern/>, or Dr.Melissa Neuman, NOAA



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