Species of Concern
NOAA National Marine Fisheries Service

Chinook salmon
Oncorhynchus tshawytscha
Central Valley Fall, Late-fall run ESU

Photo credit: NMFS.

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
IUCN: Not Evaluated
Species of Special Concern: CA

Brief Species Description:
Chinook salmon are easily the largest of any salmon, with adults often exceeding 40 pounds (18 kg); individuals over 120 pounds (54 kg) have been reported. Chinook salmon 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. Chinook salmon populations 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 (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 useful for camouflage. They then gain the dark back and light belly coloration used by fish living in open water. Chinook salmon seek deeper water, avoid light, and their gills and kidneys begin to change so that they can process salt water.

They then 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-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. 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).

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.

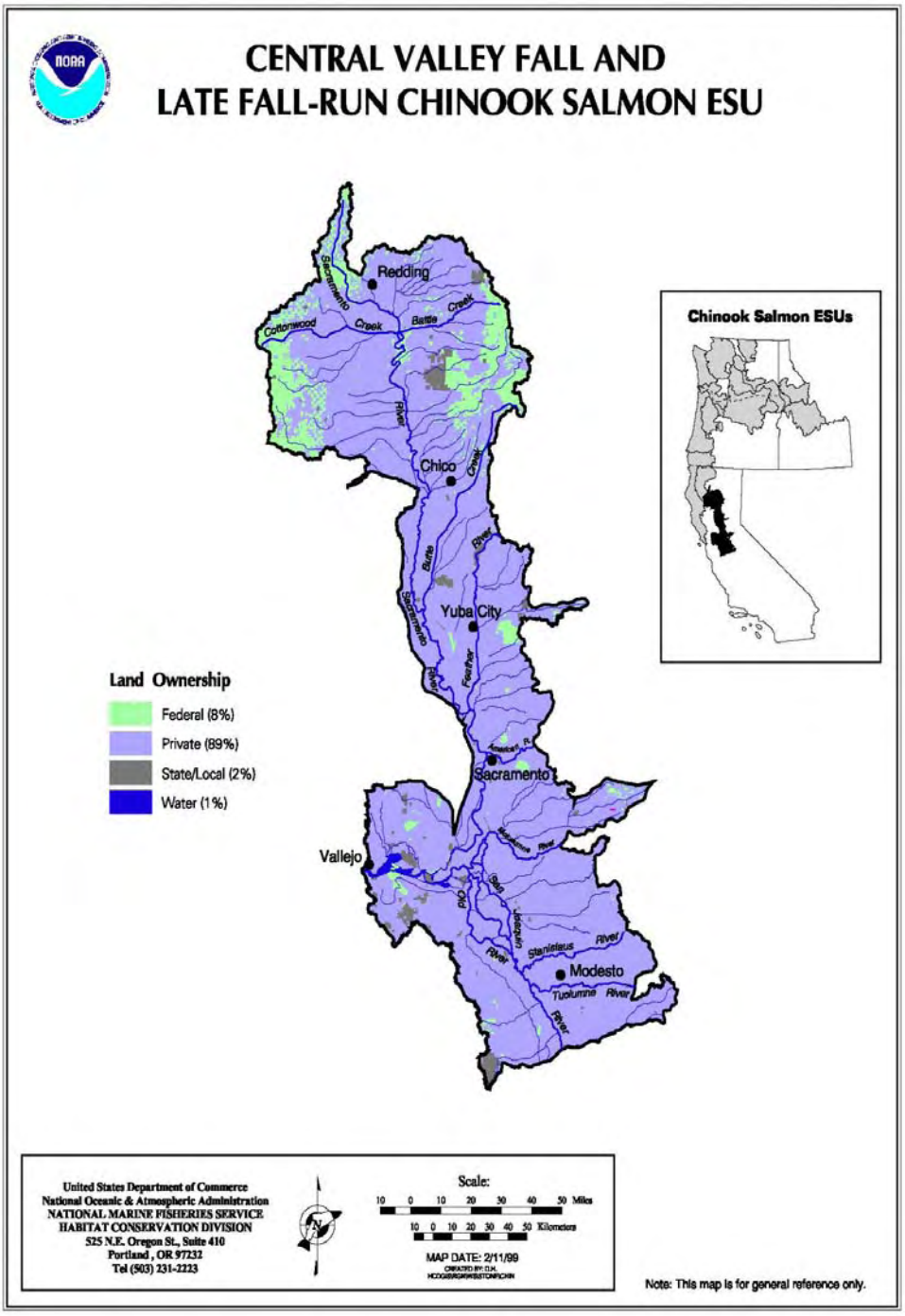

Figure 1: Distribution of the Central Valley fall and late fall-run Chinook salmon. NMFS.

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, the nature of CWT applications and 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.

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-mentioned 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.

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

References:

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; http://www.nmfs.noaa.gov/pr/species/concern/, or Dr.Melissa Neuman, NOAA Fisheries, Southwest Region, Protected Resources Division,501 W. Ocean Blvd. Suite 4200, Long Beach, California, 90802-4213, (562) 980-4115, Melissa.Neuman@noaa.gov, or Steve Lindley, NMFS, Southwest Fisheries Science Center, Fisheries Ecology Division, 110 Shaffer Road, Santa Cruz, CA 95060, (831) 420-3921, Steve.Lindley@noaa.gov.