## Juvenile Chinook Salmon Relative Abundance and Real Time Protection

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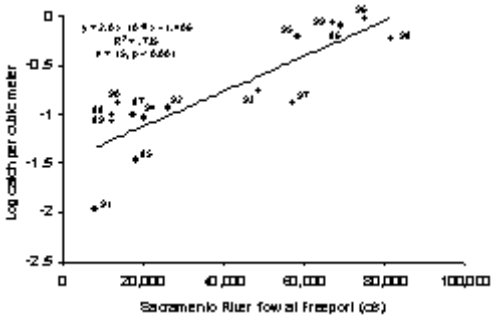
The U.S. Fish and Wildlife Service (USFWS) monitors the abundance and distribution of juvenile chinook salmon (Oncorhynchus tshawytscha) in the lower Sacramento and San Joaquin rivers, Delta, and San Francisco and San Pablo bays using the beach seine. In addition, trawling is conducted at Sacramento and Mossdale to document the movement of juveniles into the Delta (from the Sacramento and San Joaquin basins respectively) and at Chipps Island to document the relative density of juveniles leaving the Delta.

Following is a discussion of relative abundance during the 1999 field season as well as a brief discussion of winter-run and spring-run yearling protection efforts between October and March of the 1999 field season.

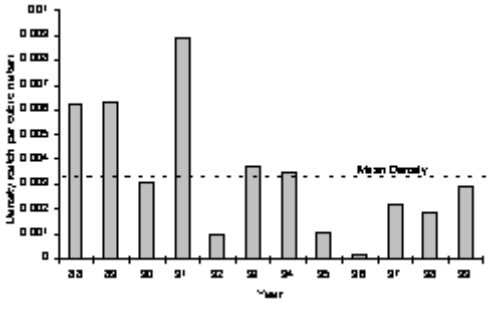
### Relative Abundance

Between January and March 1999 densities of chinook fry (<70 mm) in the North Delta beach seine were relatively high. Catches during these months were mostly composed of fall-run and spring-run fry, as beach seining is most efficient at capturing smaller juveniles rearing near the shore. The high catches in the Delta during this time in 1999 are likely a result of the high outflow conditions which possibly moved more fry into the Delta from upstream. There is a significant relationship between flow at Freeport during February and mean density of fry in the north Delta beach seine between January and March (Figure 1). The 1999 field season index improved this historic correlation.



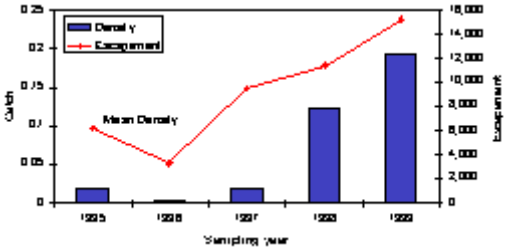

1. Log of catch per cubic meter of juvenile chinook salmon fry in the north Delta beach seine (between Sherman Island and Discovery Park on or adjacent to the Sacramento River) between January and March versus mean February flow on the Sacramento River at Freeport for the years 1985 to 1999

Relative densities of juvenile salmon in the Sacramento midwater trawl between April and June 1999 were slightly below the 1988-1998 average (Figure 2). Catches between April and June mostly consist of fall-run smolts and can be influenced by hatchery salmon released from Coleman National Fish Hatchery. The near-average densities of juveniles observed in the Sacramento trawl and the high densities of fry observed in the north Delta beach seine suggest high fall-run juvenile production during 1999. This is in contrast to 1996 and 1997 where smolt abundance was lower at Sacramento and fry abundance in the north Delta beach seine was similar or lower than in 1999.



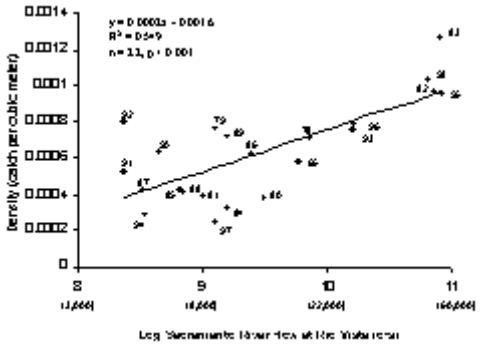
**1. Mean catch of juvenile chinook salmon per cubic meter between April 1 and June 30, from 1988 to 1999 in the Sacramento midwater trawl. There was no sampling in April 1992. In 1990, trawling occurred at Courtland, about 20 mi downstream of the Sacramento site. Dotted line is 1988 to 1998 mean density.**

Between February and June 1999 density of fall run in the beach seine on the lower San Joaquin River was much higher than in previous years and appears to be related to prior year adult escapement (Figure 3).



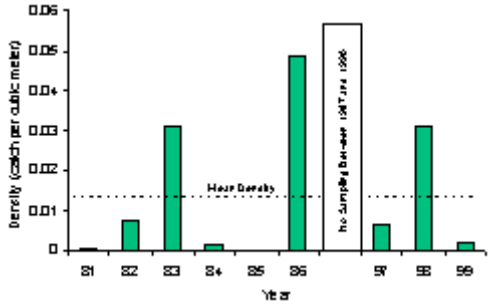

**1. Mean catch of juvenile chinook salmon per cubic meter between February 1 and June 30 in the beach seine on the lower San Joaquin River between 1995 and 1999 and San Joaquin Basin adult escapement one year before juvenile migration**

Salmon captured at Chipps Island (catch per cubic meter) between April and June mostly consisted of fall-run and spring-run smolts. Catch in this trawl is often influenced by releases of hatchery salmon. The density during 1999 fits within the established significant relationship between mean flow at Rio Vista and mean catch per cubic meter at Chipps Island (Figure 4).



**1. Mean catch of unmarked chinook salmon smolts per cubic meter in the midwater trawl at Chipps Island between April and June 1978 to 1999 versus log of mean daily Sacramento River flow (cfs) at Rio Vista between April and June**

Density of juvenile salmon between January and March during 1999 in San Francisco Bay was below the average density obtained in previous years (Figure 5).

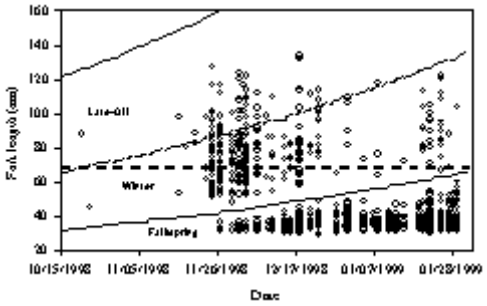



**1. Mean catch of chinook salmon fry per cubic meter between January 1 and March 31, 1981-1986 and 1997 and 1999 in the bay beach seine. No sampling was conducted between 1987 and 1996.**

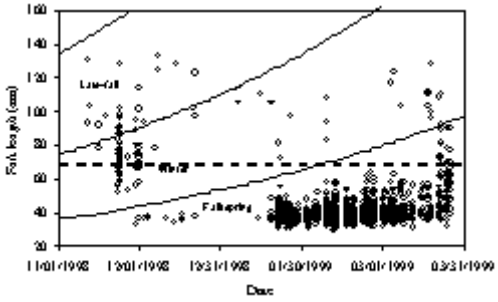
## Winter-run and Spring-run Yearling Chinook Protection

Sampling at Sacramento in the fall and winter months using the Kodiak trawl and beach seine was used to enhance capture of larger, less abundant winter-run and spring-run yearling salmon. The information gained was used to develop operational recommendations to protect these listed races from diversion into the Delta via the Delta Cross Channel where reduced survival has been shown to occur.

Identifying winter-run and spring-run yearlings in the Delta is challenging. The daily size criterion (Fisher 1992) is based on Sacramento River fall-run growth rates in the upper river and does not describe the alternate life history strategy of some tributary spring run that emigrate as yearlings. Thus, in addition to protection for winter run (described by the size criteria), chinook salmon between 70 and 200 mm were closely monitored between October and January and considered for protection as potential spring run yearlings. All chinook collected in the fall and early winter of 1998-1999 in the Sacramento area beach seine and the Kodiak trawl are shown in Figures 6 and 7, respectively. The size criteria model seems to define fall-run and spring-run fry well. Winter and late-fall populations are described but less clearly distinguished.Note that spring-run yearlings are not described by the size criteria, but would occur somewhere in the winter run and or late-fall run area of the graphs above the dashed line.




**1. Fork lengths of chinook salmon observed in the Sacramento area beach seine (RM 43 to 80) during the 1999 field season between October 15, 1998, and January 31, 1999. Race discrimination criteria as designated by Fisher in 1992 are also included. The dashed line marks the minimum cutoff (70 mm) used to identify potential spring run yearlings.**



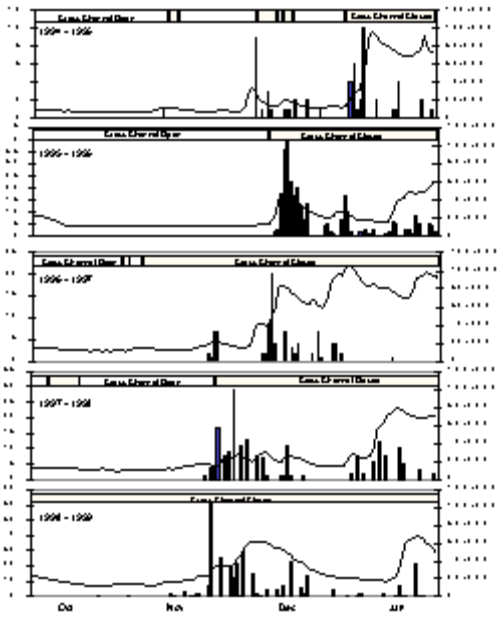

**1. Fork lengths of chinook salmon observed in the Sacramento Kodiak trawl during the 1999 field season between November 1, 1998, and March 31, 1999. Race discrimination criteria as designated by Fisher in 1992 are also included. The dashed line marks the minimum cutoff (70 mm) used to identify potential spring run yearlings.**

The USFWS monitoring program attempted to determine when these large yearlings were entering the Delta. When chinook yearling abundance was relatively high, export curtailments or Cross Channel Gate closures were considered to provide protection for the greatest number of fish. However, catches of these low abundant races are usually sparse and variable, making decisions for protection difficult.

Daily catch rates of 70 to 200 mm chinook salmon between October 1 and January 31 in the Kodiak trawl and beach seine at Sacramento obtained since fall 1994 are shown in Figure 8. Yearling spring run chinook are expected to emigrate within this size range. Peak seaward migration of these fish varied between years; however, most catches appear to correlate with flow spikes between early November and late January. The status of the Delta Cross Channel Gates is also described in Figure 8. The gates appear to have been closed (protective status) when most of the winter run and spring run yearlings were captured at Sacramento, with the exception of a large part of December 1994.

**References**

Fisher FW. 1992. Chinook salmon, Oncorhynchus tshawytscha, growth and occurrence in the Sacramento-San Joaquin river system. Draft Inland Fisheries Division Office Report. Sacramento (CA): California Department of Fish and Game.



**1. Daily catch of juvenile chinook (70 to 200 mm) per day in the Sacramento Kodiak trawl and beach seine and flow at Freeport (cfs) between October 1 and January 31, 1995 to 1999. Effort within and between years is not consistent. Status of gates (open, closed) is provided on each graph. Daily catch scale varies between years.**