

**Relationship of Delta Cross Channel Gate Operations  
To Loss of Juvenile Winter-run Chinook Salmon at the CVP/SWP Delta Facilities**

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Winter-run Chinook salmon are distinguishable from the three other Chinook runs in the Sacramento River system by the timing of their upstream migration and spawning. Due to precipitous decline in the population from the late 1960's through the late 1980's, NOAA Fisheries listed the run as "threatened" in August 1989, and subsequently reclassified the run as "endangered" in 1992. The state of California listed the run as endangered in 1989.

Many factors contributed to the decline in the winter-run Chinook population. Among these factors, operation of the federal Central Valley Project and State Water Project has had continuing impacts on winter-run Chinook. Of particular concern have been the direct entrainment losses of juvenile winter-run Chinook at the project export facilities in the Delta.

There is considerable annual variability in the magnitude of direct winter-run entrainment losses in the Delta. Analysis has shown that this variability is not directly related to the estimated number of juvenile winter-run entering the Delta each year (estimated based on the number of spawners or the number of juveniles emigrating from the upper Sacramento River), nor does it appear to be directly related to the timing or magnitude of project exports. In this analysis, the relationship was evaluated between annual winter-run loss and Delta Cross Channel gate operations during the time period of juvenile emigration to the Delta.

One way juvenile salmon emigrating from the Sacramento River enter the interior Delta, and may be vulnerable to entrainment at the project facilities, is by diversion through the Delta Cross Channel (DCC) and Georgiana Slough. Operation of the DCC gates may significantly affect the survival of juvenile salmon emigrating from the Sacramento River associated with the diversion of a significant proportion of Sacramento water into the interior Delta. The Delta Cross Channel (DCC), completed in 1951, is a controlled diversion channel between the Sacramento River and the interior Delta. Up to 6,000 cfs of water can be diverted through the Channel into Snodgrass Slough (DWR 1991). From Snodgrass Slough, Sacramento River water flows through natural channels of the lower Mokelumne River to the vicinity of the CVP and SWP export facilities (Figure 1).

During the period juvenile winter-run Chinook salmon are emigrating through the lower Sacramento River, approximately 40-50 % of Sacramento River flow is diverted into the interior Delta through DCC when both gates are open; with the gates closed, approximately 15-20 % of Sacramento River flow enters the interior Delta through Georgiana Slough.