

**Suisun Marsh Salinity Control Gates
Salmon Passage Evaluation Report
2003**

Department of Water Resources
And
Department of Fish and Game

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Adult Salmon Migration Monitoring, Suisun Marsh Salinity Control Gates, September – November 2003

Introduction

The 2003 adult salmon passage study is the third year of a planned three-year program to monitor the passage rate and passage time of migrating Chinook salmon (*Oncorhynchus tshawytscha*) past the Suisun Marsh Salinity Control Gates (SMSCG) in Montezuma Slough. Telemetry studies were begun in 1993 (Tillman *et al* 1996; Edwards *et al* 1996) to monitor and assess the effects of the SMSCG on migrating adult Chinook salmon, particularly federally listed winter-run which may be present in Montezuma Slough during the peak operating times of the gates, October – May. These studies showed that the gates did have a negative effect on salmon passage and recommended making modifications to the structure. In 1998, modifications were made to the flashboards to include 2 horizontal openings to increase passage rate and decrease passage time through the gates for migrating adult salmon. Results from the 1998 and 1999 studies indicated that the modified flashboards did not improve salmon passage at the SMSCG (Vincik *et al* 2003).

Studies began in 2001 focused on the use of the existing boat lock as a fish passageway that was already a part of the SMSCG structure and could be held open during gate operations to allow salmon passage during periods when the flashboards were installed and the gates tidally operated (2001 Suisun Marsh Salinity Control Gates Salmon Passage Evaluation Report. <http://iep.water.ca.gov/suisun/dataReport/index.html>). Fish passage through the gates was monitored during three operational configurations (phases) of the SMSCG including: flashboards installed, gates tidally operated, boat lock closed (Full Operation Phase), flashboards out, gates held open, boat lock closed (Full Open Phase), and flashboards installed, gates tidally operated, boat lock open (Modified Phase) (Figure 1).

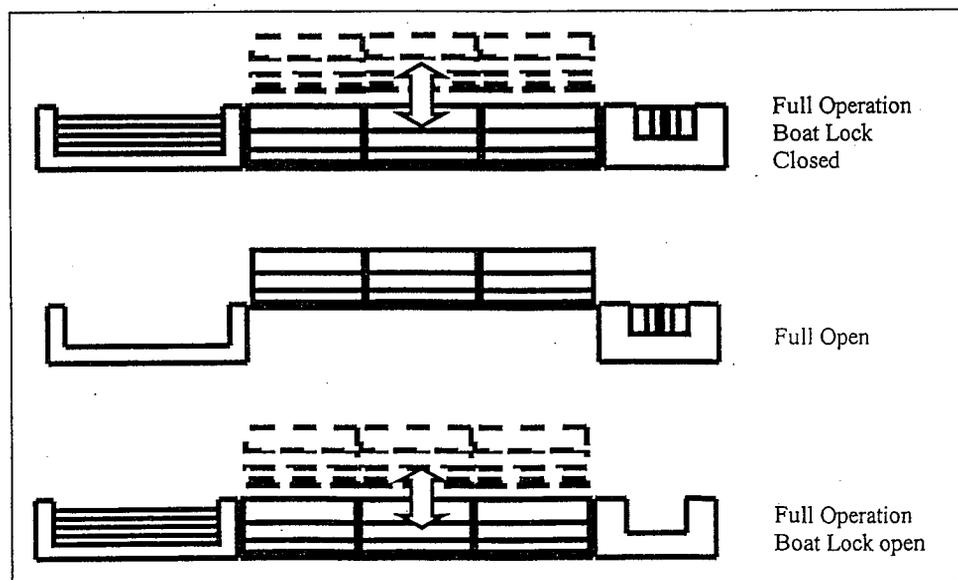


Figure 1. Three Operational configurations of the SMSCG.

These configurations were used in the 2001 – 2003 studies with the order of the operations changed per study year to determine if timing of the adult salmon migration had any affect on passage.

During the 2003 study a total of 163 adult salmon were captured using a large mesh gill net, measured to the nearest mm fork length, visually sexed and internally implanted with an ultrasonic transmitter. A Floy tag was attached externally just behind and below the dorsal fin the help identify any tagged fish that might be recaptured by the tagging crew. The address of the Stockton Fish and Game office was printed on each Floy tag to aid in the recovery of information from recreational anglers if the fish were caught. Salmon were tagged and monitored during September 30 – November 10:

Phase	Gate Configuration	Date	# of Tagged Salmon
I	Full Operation, Boat Lock Closed	9/30 – 10/13	54
II	Full Operation, Boat Lock Open	10/14 – 10/27	44
III	Full Open	10/28 – 11/10	65

Adult fall-run Chinook salmon were used as a surrogate for the federally listed winter-run with tagging being completed by October 31 which did not overlap with the time designated for the presence of winter-run in Montezuma Slough.

For the 2001 and 2002 studies, Sonotronics telemetry equipment was used to track and monitor tagged salmon. In 2003, due to equipment problems, Sonotronics equipment was replaced with Vemco brand products which required less maintenance and were easier to deploy in and around the SMSCG. Each ultrasonic tag was coded with a unique signal to identify individual tagged fish. The signals were recorded at stationary monitoring sites located upstream and downstream of, and on the SMSCG (Figure 2).

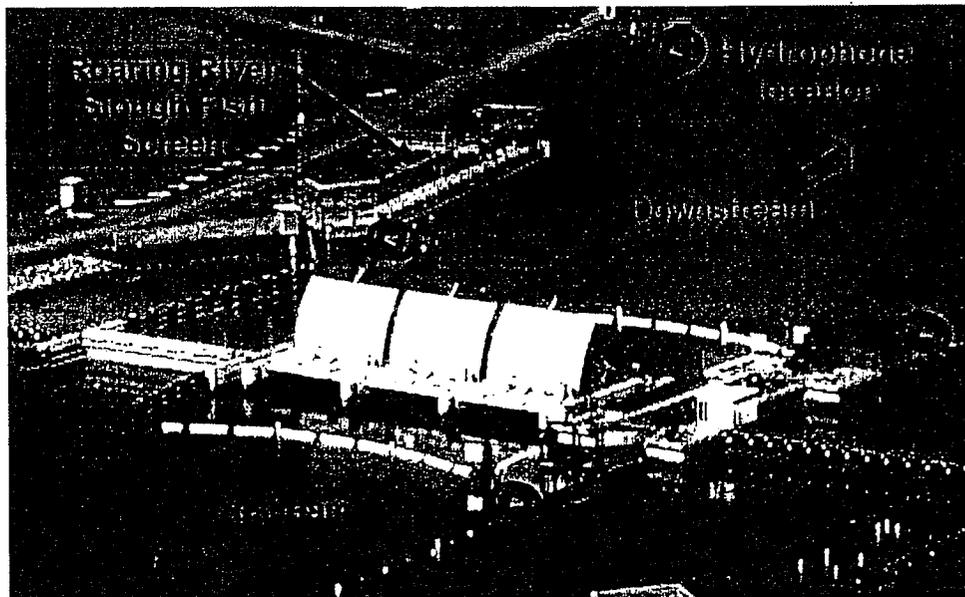


Figure 2. Location of hydrophones at the SMSCG Sept – Nov 2003

2003 Results

One hundred and three tagged salmon passed through the SMSCG during the 2003 tagging study representing 63% of the 163 total tagged adult fish. Fifty-two tagged salmon did not pass the gates (32%) having exited Montezuma Slough by going back downstream after tagging and 8 salmon were removed from the sample population due to non-detection or having died after tagging (5%). The highest percentage of tagged salmon passed the gates during the full open configuration (Phase III) and the lowest percentage of passage was during the full operation with boat lock closed configuration (Phase I) (Figure 3.)

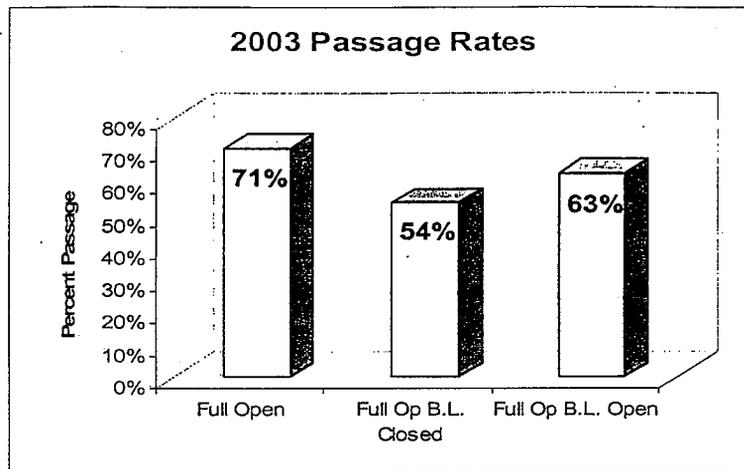


Figure 3. Passage rates by phase at the SMSCG, Sept – Nov 2003

The average passage time for tagged fish ranged from 1.2 to 229 hours with the full operational, boat lock closed configuration (Phase I) having the longest mean passage time, although there was no significant difference between each operational phase (Figure 4).

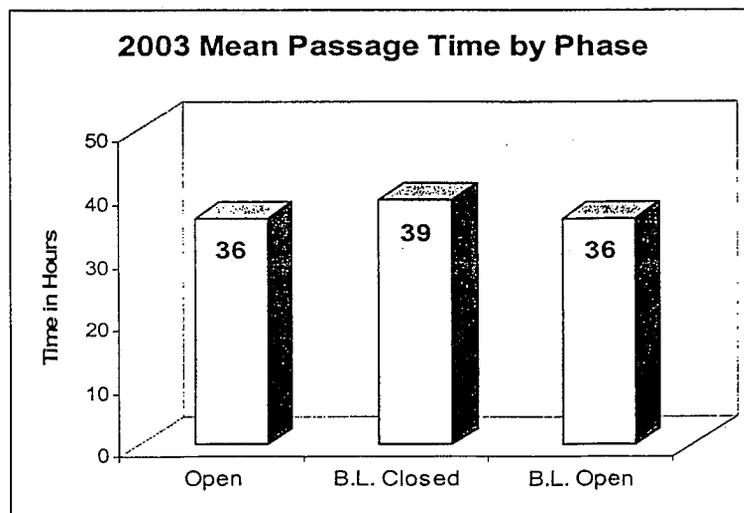


Figure 4. Mean passage time by phase at the SMSCG, Sept – Nov 2003

Tagged fish ranged in size from 600 to 1120 mm fork length and were evenly distributed between males and females.

Passage by Phase

Phase I (Full operation, boat lock closed) - 54% passed the gates with a mean passage time of 39 hours (1.5 to 211.0). During this phase, there were no tagged fish that moved back downstream after passing the gates. There were 2 tagged fish (4%) that had no records or were mortalities.

Phase II (Full operation, boat lock open) - 63% passed the gates with a mean passage time of 36 hours (1.9 to 229.0). During this phase, two tagged fish (5%) moved back downstream after tagging and three fish (7%) had no records or were mortalities.

Phase III (Full open) - 71% passed the gates with a mean passage time of 36 hours (1.2 to 209.0). During this phase, six tagged fish (9%) moved back downstream after tagging and three fish (4%) had no records or were mortalities.

The full open configuration had the best passage rate and was not significantly different from the boat lock open phase. There was a significant difference between the open phase and the boat lock closed phase. There was no significant difference in the passage times between each phase (Table 1).

Table 1.
Chi-square and probability for passage rates

2003

Phase I vs. Phase II: $\chi^2 = 1.51, P = 0.219$

Phase I vs. Phase III: $\chi^2 = 4.28, P = 0.039^*$

Phase II vs. Phase III: $\chi^2 = 0.42, P = 0.517$

Kruskal-Wallis Analysis of Variance for passage times

Phase I vs. Phase II vs. Phase III: $P = 0.726$

* = Significant difference

Salmon Usage of the Boat Lock

During the phase II configuration (full operation, boat lock open), of the 29 tagged fish to pass through the gates eight (29%) used the boat lock for passage. One half (4) of the

2003 denotes the third year of a planned three-year study of the effectiveness of the boat lock for adult salmon passage at the SMSCG. Two out of the three years of the study show improvement in passage rates and passage time for tagged adult salmon, but the results from the 2002 study cannot be ignored. Further analysis and comparison of all three years and a possible fourth year of the study in 2004 may help to validate the effectiveness of using the boat lock as a permanent means to facilitate fish passage in Montezuma Slough.

References

- Edwards, G.W., K.A.F. Urquhart, and T.L. Tillman. 1996. *Adult salmon migration monitoring, Suisun Marsh Salinity Control Gates, September-November 1994*. Technical Report 50, Interagency Ecological Program for the San Francisco Bay/Delta Estuary. 27pp.
- Tillman, T.L., G.W. Edwards, and K.A.F. Urquhart. 1996. *Adult salmon migration during the various operational phases of the Suisun Marsh Salinity Control Gates in Montezuma Slough, August-October 1993*. Agreement to the Department of Water Resources, Ecological Services Office by Department of Fish and Game; Bay-Delta and Special Water Projects Division. 25pp.
- Vincik, R.F. 2002. *Adult salmon migration monitoring at the Suisun Marsh Salinity Control Gates, Sept. - Nov. 2001*. Interagency Ecological Program for the San Francisco Estuary Newsletter 15:45-48.
- Vincik, R.F., G.W. Edwards, G.A. Aasen, and R.W. Fujimura. 2003. *Suisun Marsh Salinity Control Gates adult salmon passage monitoring, 1998-1999*. Technical Report (unpublished), Interagency Ecological Program for the San Francisco Bay/Delta Estuary. 27pp.