

Exhibit 31, entered by the U.S. Fish and Wildlife Service for the State Water Resources Control Board 1987 Water Quality/Water Rights Proceeding on the San Francisco Bay/Sacramento-San Joaquin Delta.

The Needs of Chinook Salmon, Oncorhynchus tshawytscha,
in the Sacramento-San Joaquin Estuary

The values for 1983 and 1984 probably are biased high relative to other years since they were planted about 26 miles downstream of Sacramento (at the "Courtland" site) and thus traveled a shorter distance than smolts released in earlier years at Sacramento. They are labeled differently in Figure 4-1. Survival indices in 1984 probably are more biased than in 1983, since flows were much lower in 1984.

Our second measure of smolt survival through the Delta, that based on tag recoveries from trawling at Chipps Island, also was correlated with flow (Figure 4-2). Maximum survival was reached at flows of about 30,000 cfs at Rio Vista. The slope of this relationship is less than that from our ocean recovery based estimate possibly due to the survival indices being lowered due to net avoidance. Releases in 1983 to 1987 were made at Courtland and thus are labeled differently.

Both relationships show that very high flows (~50,000 cfs at Rio Vista in 1983) do not substantially increase salmon smolt survival over that observed at from 20,000 to 30,000 cfs but that increases in flow up to those latter levels are highly beneficial.

Validity of Survival Indices

We attempted to evaluate any potential biases and imprecision characterizing our survival measures. We evaluated the unavoidable differences in fish release size, dates of release and temperature conditions at the release sites between the two release groups (Sacramento and Suisun Bay) in a given year and no biases were identified (Appendices 18 and 19). Data was