Summary

Striped bass, delta smelt, and San Joaquin tributary salmon populations in the Sacramento-San Joaquin River Delta have declined as a consequence of spring and summer exports from the south Delta by State Water Project and Central Valley Project pumping plants. Evidence presented over the past 30 plus years by the California Department of Fish and Game and other federal and state resource agencies indicates that water quality standards (D-1485 and D-1641) for the Bay-Delta have not provided adequate protection for Delta fish populations. The California Bay Delta Authority (formerly CALFED) and the Central Valley Project Improvement Act programs have also provided insufficient protection for these fish populations. Biological opinions for pumping plant operations for the delta smelt and salmon have also not provided adequate protection. Export losses of striped bass, delta smelt, and salmon have severely depressed young production and recruitment into their adult populations, which further results in lower adult population levels and lower subsequent young production (Figures S-1 to S-6). Annual exports have increased from 2 million acre-ft in the 1960's, to 4 million acre-ft in the 1970's, to 6 million acre-ft in the 1980's (Figure S-7). In 2001 and 2003 annual exports reached record annual levels of 6.3 million acre-ft. In 2003 June-July export reached a record 1.3 million acre-ft. Summer exports are now near the 11,000 cfs capacity of the two pumping plants (Figure S-8). Additional exports are being considered with the available 15,000 cfs export capacity.

High spring-summer exports lead to reverse flows in the lower San Joaquin River, the export of over 50 % of larval and juvenile striped bass from the Delta in some years, and severely depressed production of young striped bass in most years (Figures S-9 and S-10). These losses directly affect recruitment of 3 yr-old striped bass into the adult spawning population (Figure S-11). Reductions in the spawning population then additionally translate into even fewer young produced (Figure S-12). Thus the effect on the population from export losses is compounded as predicted by the Striped Bass Working Group enlisted by the State Water Resources Control Board in 1982 to study the striped bass decline.

Similarly, declines in the delta smelt populations are related to export rate (Figure S-13), and subsequent production of young is related to the spawning population size (Figure S-14), which leads to a compounding of the effect of export losses on young delta smelt.

Salmon recruitment is also related to export losses and spawning population size, and thus the salmon population is also doubly sensitive to export losses (Figures S-15 and S-16).

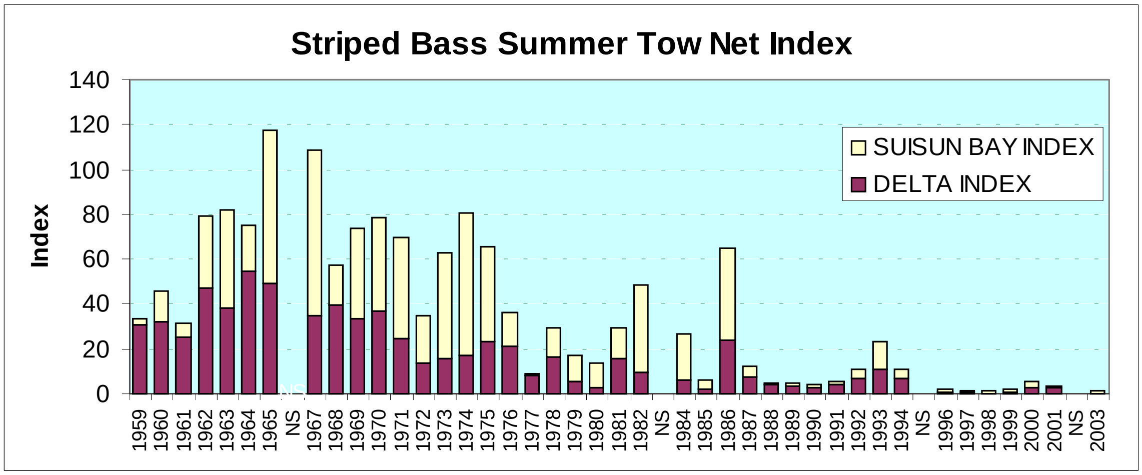

Figure S-1. The striped bass summer townet index from 1959 to 2003. The index has two components: a Delta and Suisun Bay index. NS = no survey.

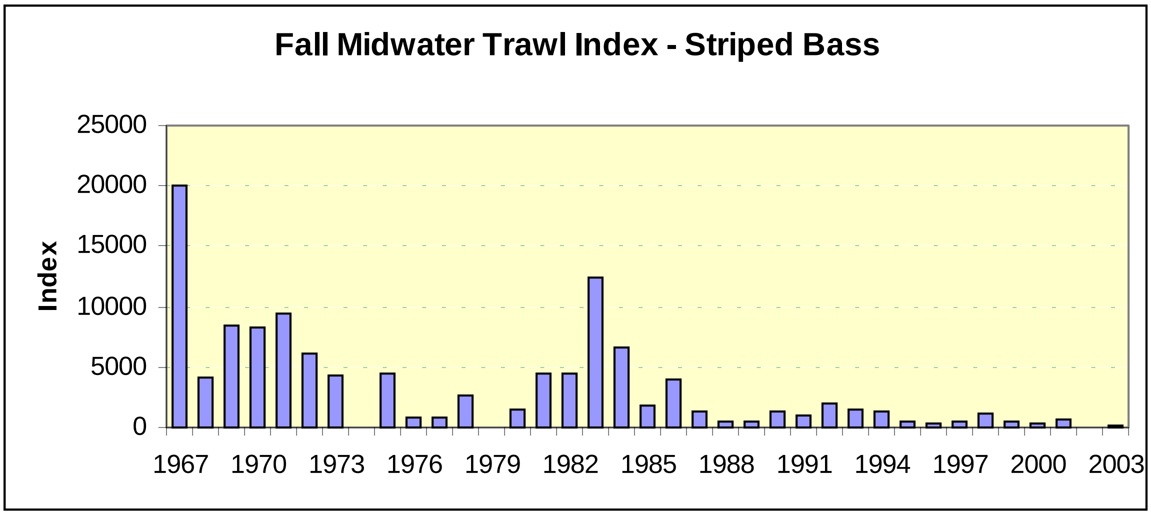

Figure S-2. The striped bass fall midwater trawl index from 1967 to 2003. No index was determined for 1974 and 1979.

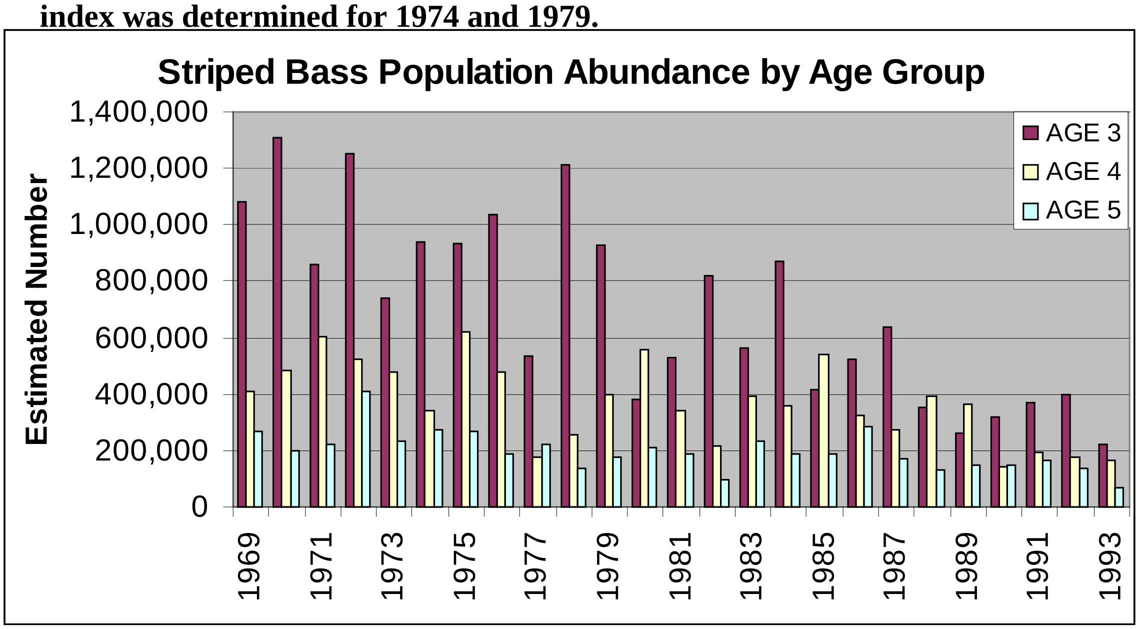

Figure S-3. The striped bass adult population estimates from 1969 to 1993.

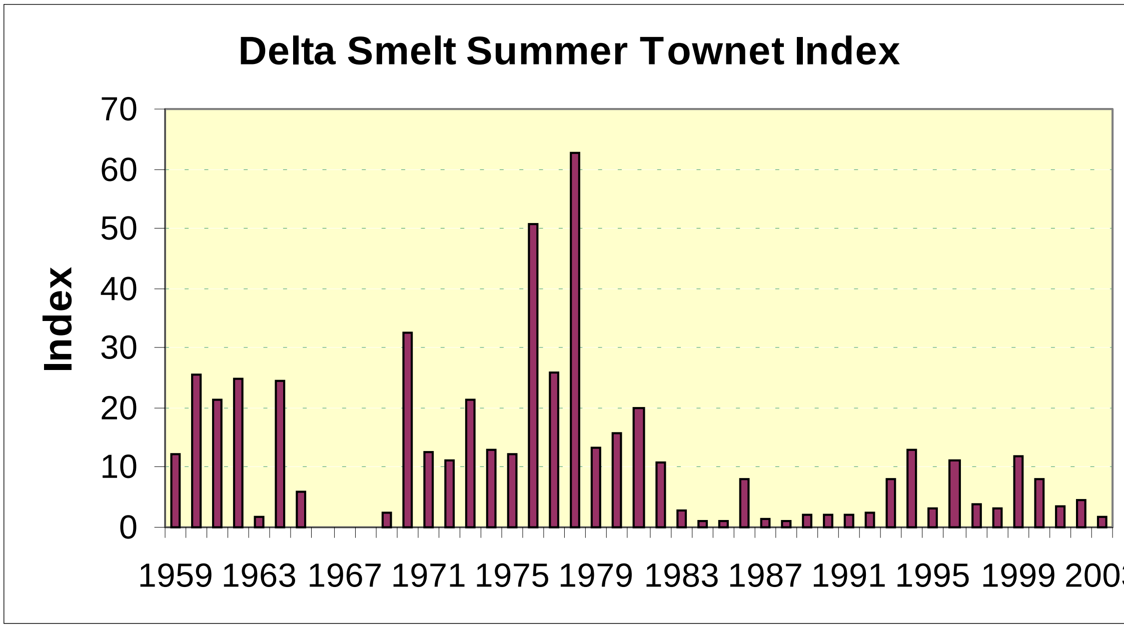

Figure S-4. Delta smelt Summer Townet Survey abundance index.

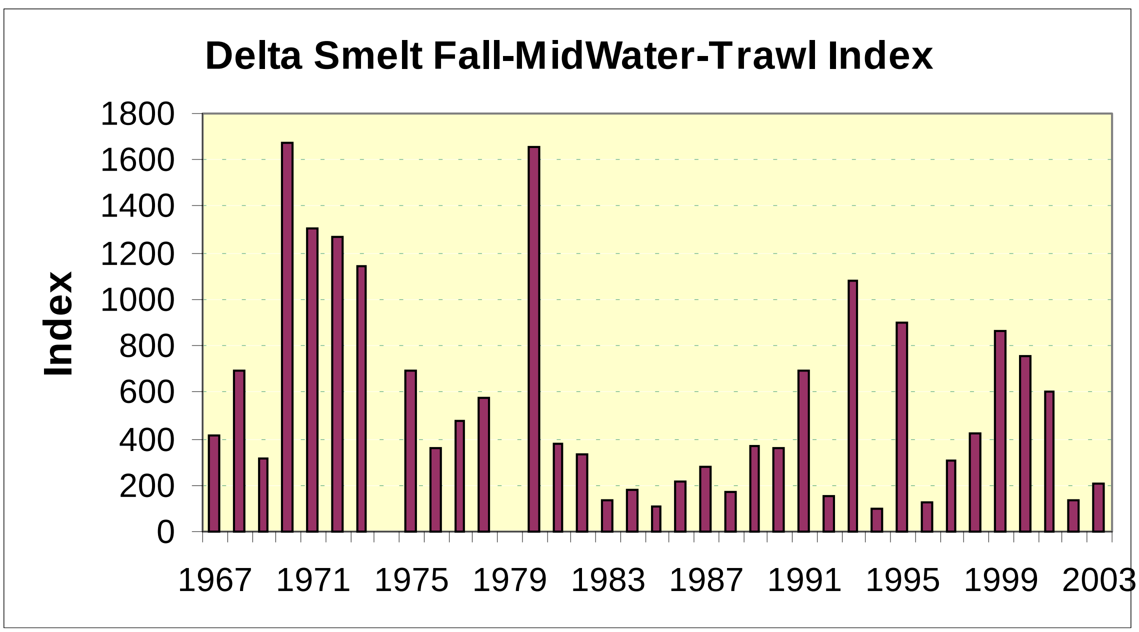

Figure S-5. Delta smelt Fall Midwater Trawl Survey abundance index.

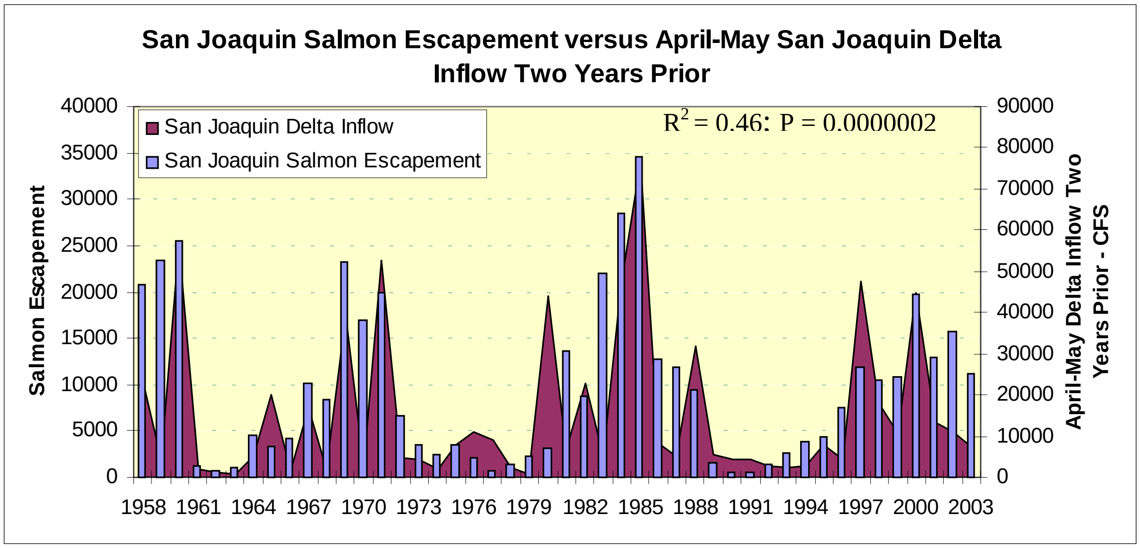

Figure S-6. San Joaquin tributary spawner escapement from 1958-2003 and April-May Delta inflow two-years prior (the flow when three year old salmon would have been migrating a young through the Delta to the ocean).

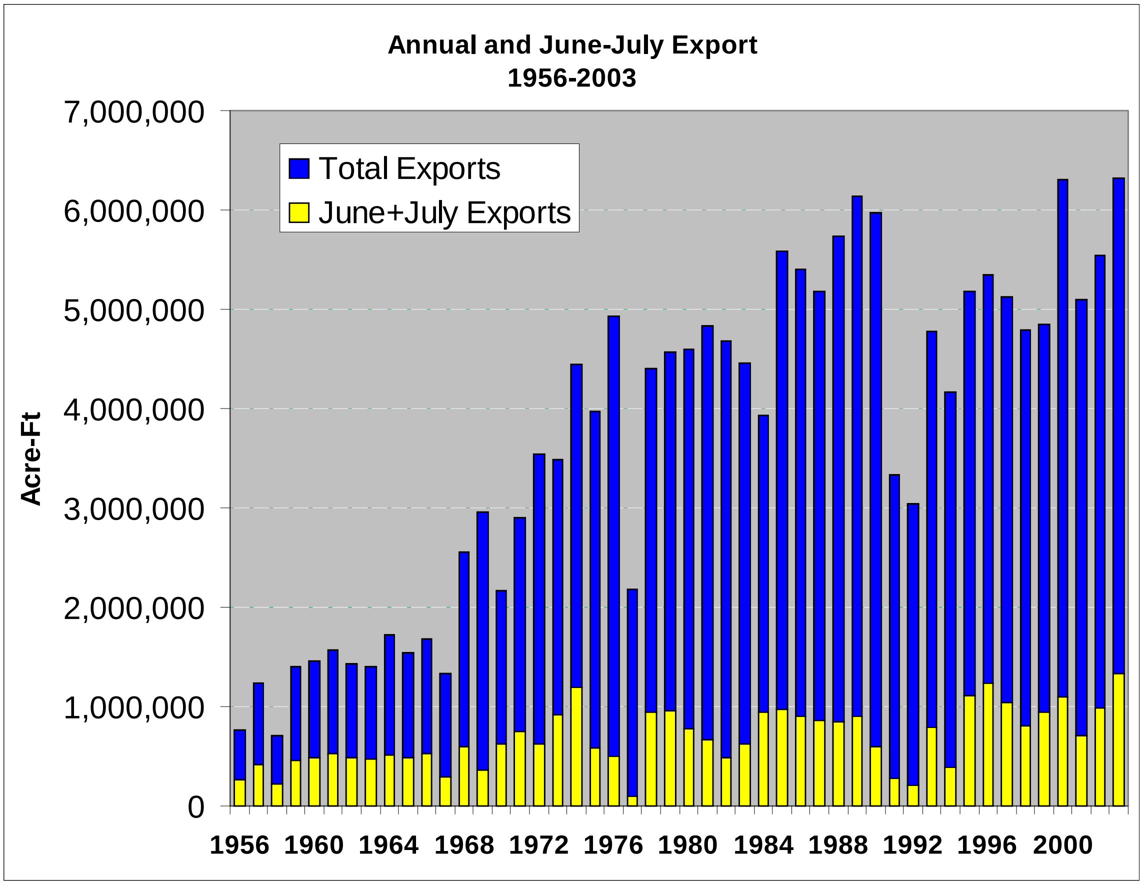

Figure S-7. Total and June-July exports 1956-2003.

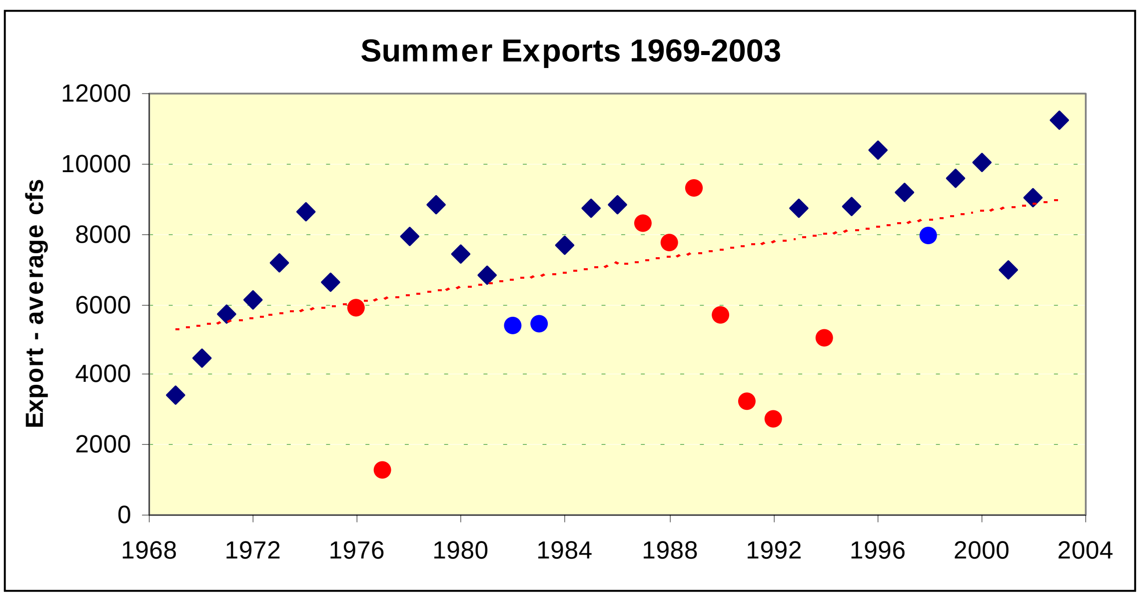

Figure S-8. Summer (June-September) average daily exports (cfs) from 1969 to 2003. Blue dots are high summer outflow years and red dots are drought years. Red dashed line is trend or regression line, which is significantly positive.

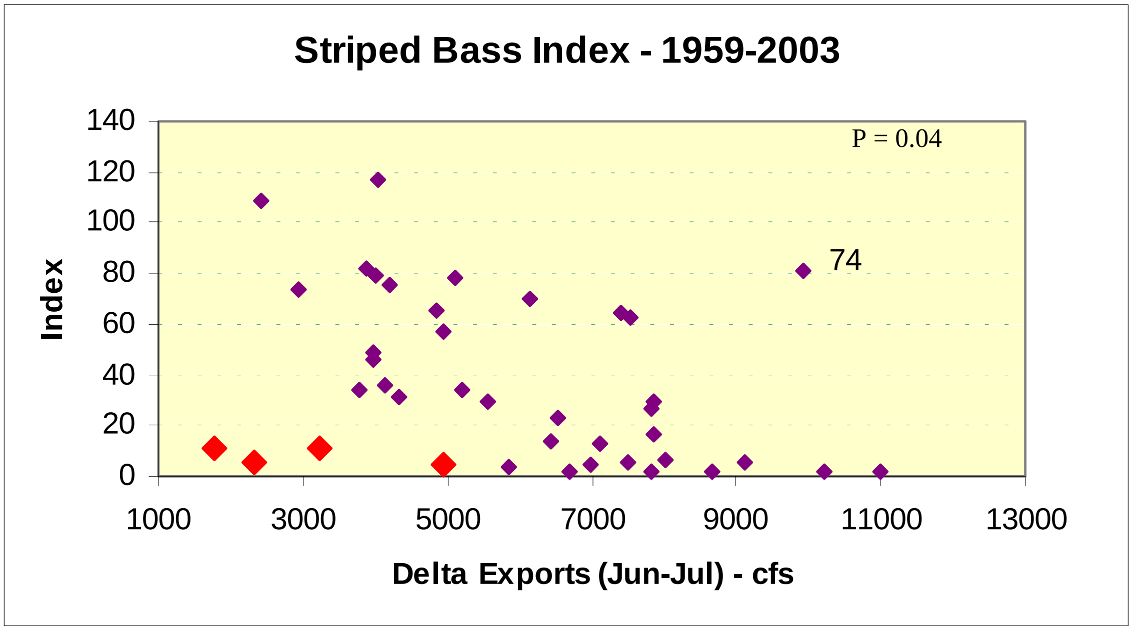

Figure S-9. Striped bass young summer index versus average June-July Delta export from 1959-2003. Large red diamonds are critical drought years. Year 1974 was considered an outlier because it occurred at the beginning of the decline and high export losses that year may very well have contributed to the decline. Without these drought years the negative relationship between the index and exports is highly significant.

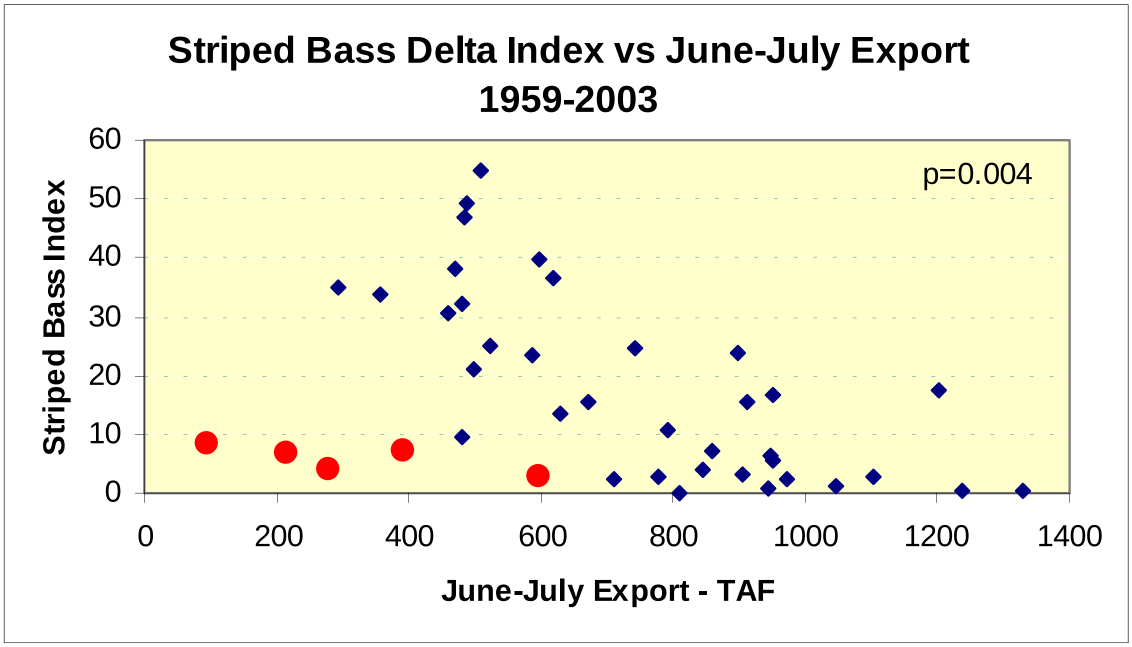

Figure S-10. The portion of the striped bass young summer index for the Delta versus average June-July Delta export from 1959-2003. Five red dots are drought years 77, 90-92, and 94 when exports were curtailed from lack of water.

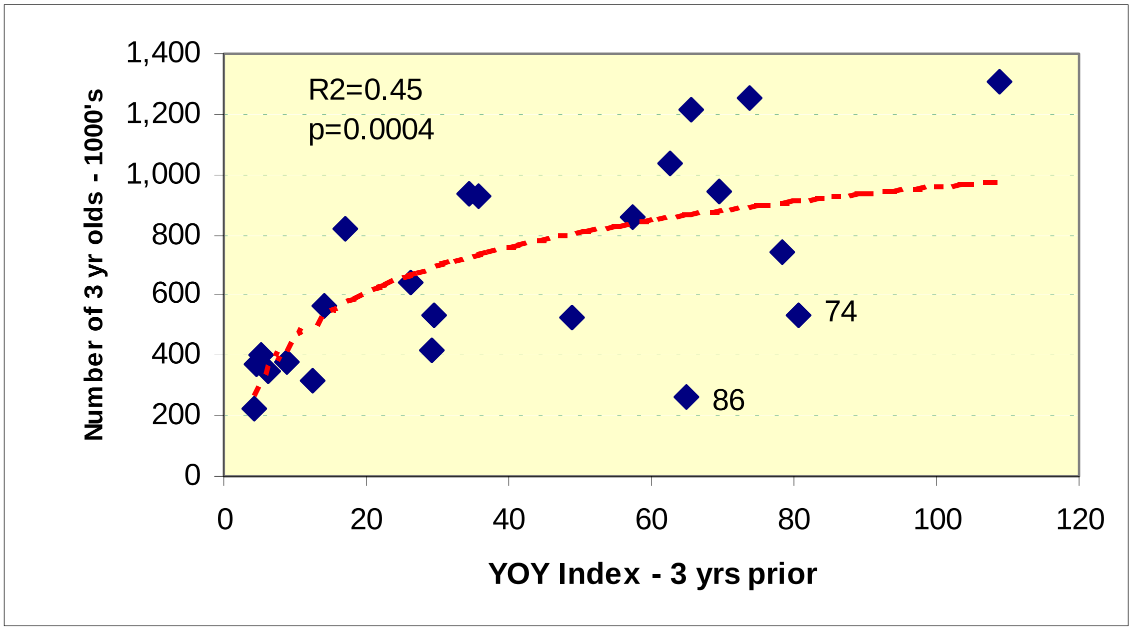

Figure S-11. The striped bass 3yr olds estimate versus summer index three years earlier -1972 to 1993. Years 1974 and 1986 were high young index years followed by two years of severe drought, which likely contributed to poor survival to age 3.

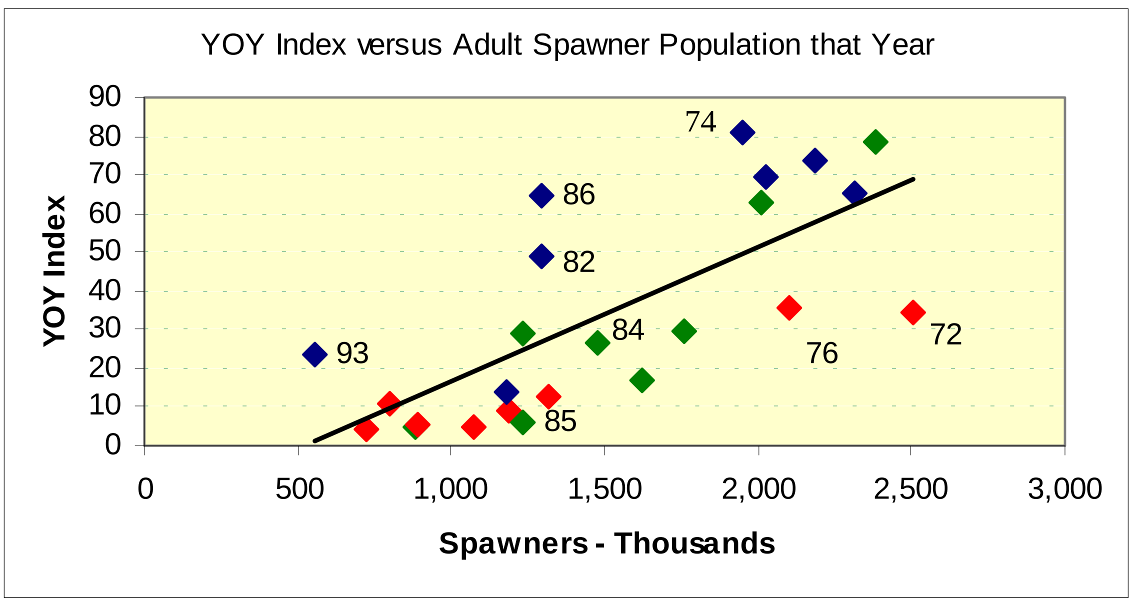

Figure S-12. Young index versus number of spawners. Red dots signify low June-July outflow years. Blue dots indicate high June-July outflow years. Green dots indicate moderate June-July outflow years.

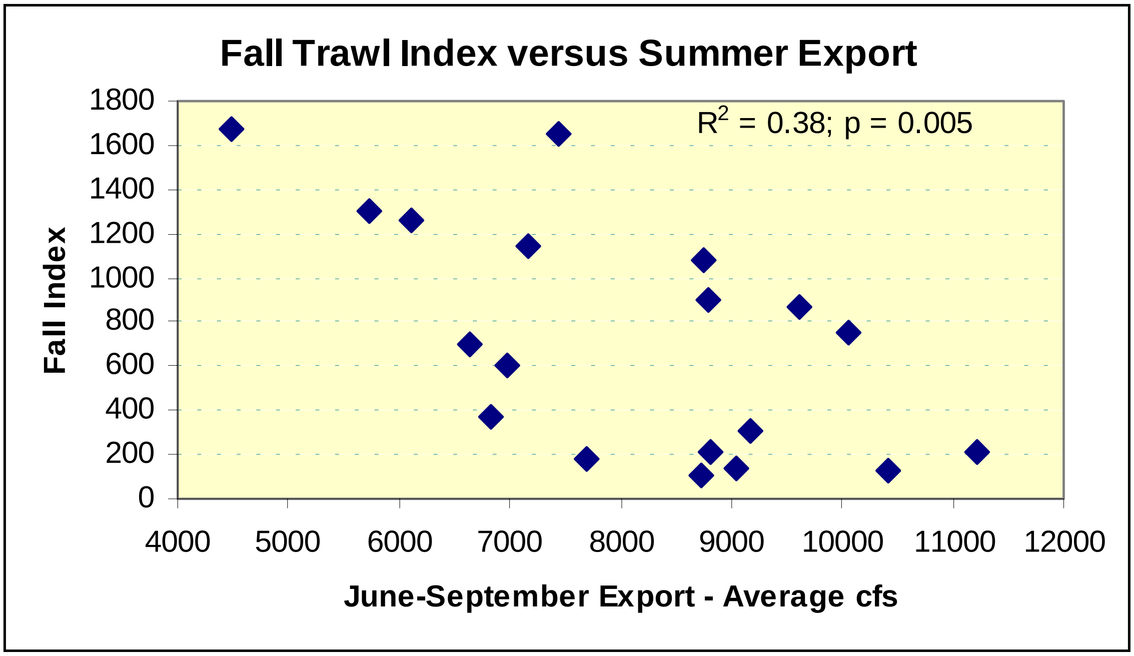

Figure S-13. Delta smelt Fall Index versus average June-September export rate. Drought years and years with wet summers are not included.

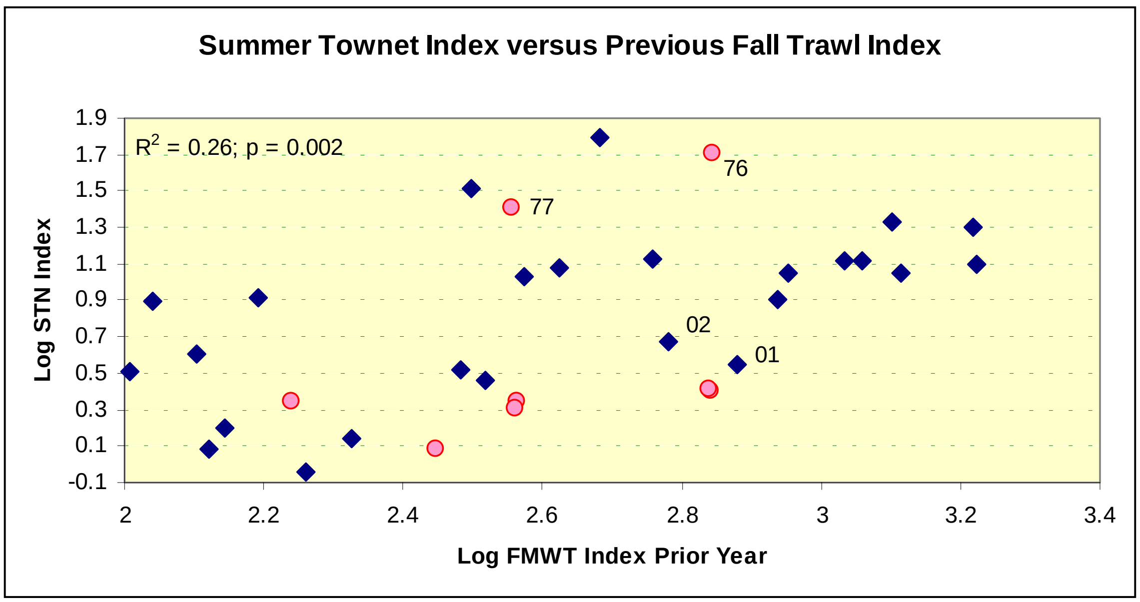

Figure S-14. Log of delta smelt summer townet index versus log of fall midwater trawl index the prior year – 1969-2003. Drought years shown with red dots. Drought years 1987-1992 tended to have lower production of young per size of population the previous fall.

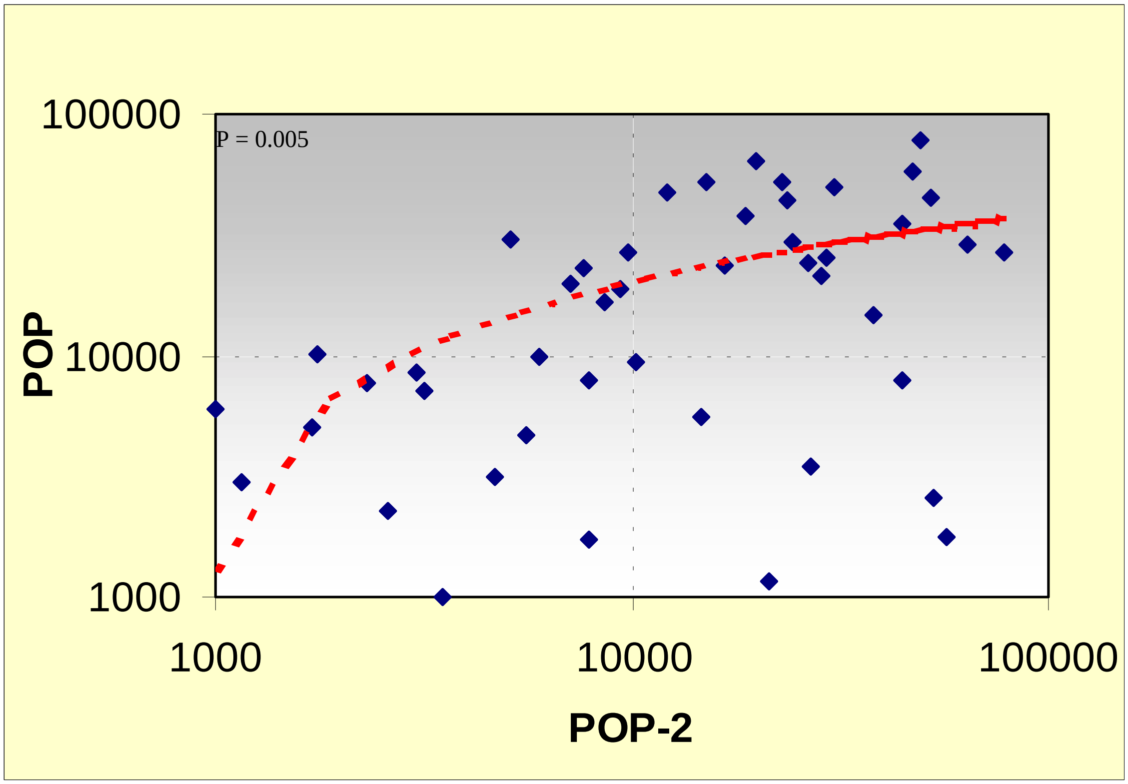

Figure S-15. Log of San Joaquin salmon escapement versus log of escapement two years earlier.

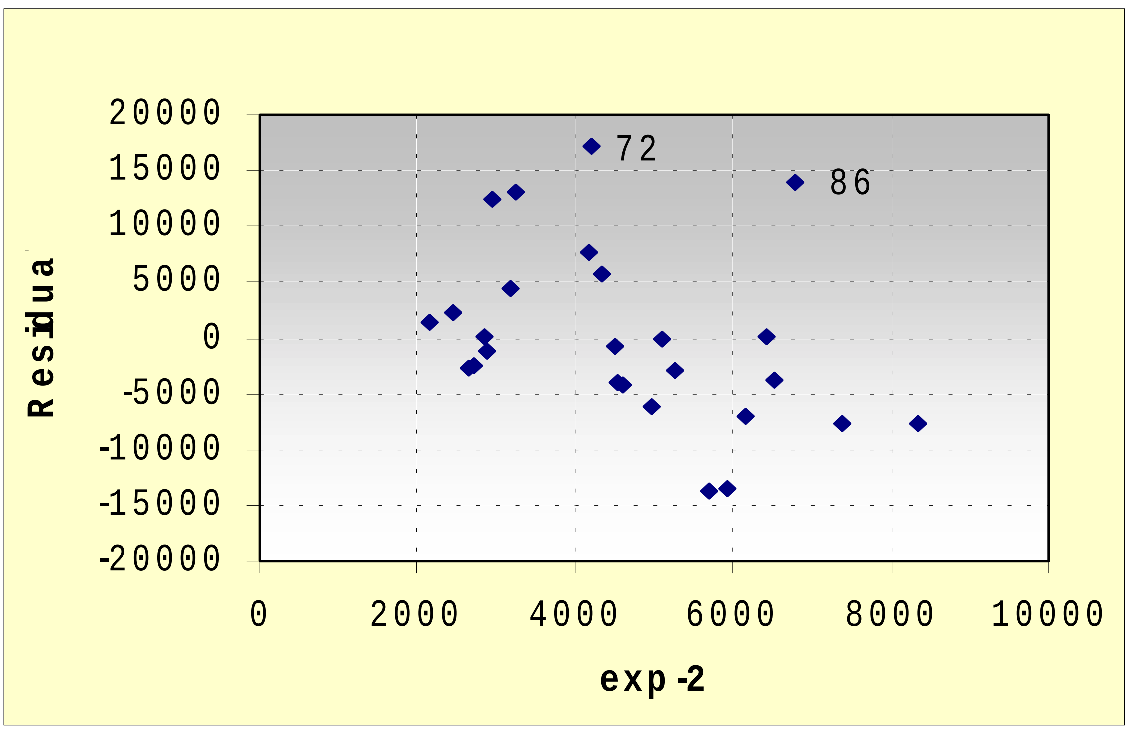

Figure S-16. Residuals of regression of escapement, flow, and escapement two years earlier versus export level in April-May two years earlier for only low flow years. The relationship is marginally significant with 1972 and 1986, and highly significant without these years. Both years followed several years of high escapement, which may have contributed to the higher than predicted escapement in 1972 and 1986. The unusually high flows in the fall of 1986 may have also contributed to the large spawning run in the San Joaquin River that year.