1967 except in 1974 and 1979, with a total of 29 years surveyed. The FMWT abundance index is the sum of monthly indices for September-December.

The 1997 FMWT abundance index for young striped bass was 565, which was higher than indices from the last two years, but was the fifth lowest of record (Figure 2). The December index was 64, the second lowest of record. High mean April-July outflow during the spawning and early nursery period usually produces larger striped bass year classes than low outflow conditions, but moderate outflow in 1997 corresponded to a lower than average abundance. The index for 1997 was about one-third of the 1993 index, a year with similar outflow. The low 1997 FMWT abundance index reflects the low summer townet index; historically, the two sets of indices are strongly correlated ($r=0.85$, $p=0.0001$).

Young striped bass were found mainly in the lower San Joaquin and Sacramento rivers in September. Striped bass distribution expanded into Suisun Bay in October and into San Pablo Bay by December, but more fish were caught in the Sacramento River in November and December than in any other area.

More information about FMWT results can be viewed on the Internet at www.delta.dfg.ca.gov/data/mwt97/.

American Shad

Stephen F. Foss and Lee W. Miller, DFG

The 1997 fall midwater trawl (FMWT) abundance index for American shad was 2,594 which was about half the 1996 index and about one-third of the record high index of 6,859 measured in 1995. Abundance indices for American shad have been increasing in recent years (Figure 1), after adjusting for Delta outflow. The residuals from a regression of FMWT American shad indices on April-June outflows significantly increased over time (Figure 2, $r2=0.35$, $P=0.0007$).

American shad were located mainly in the lower San Joaquin and Sacramento rivers in September through November, but moved into Suisun and San Pablo bays in December.

A table of American shad FMWT indices can be viewed on the Internet at www.delta.dfg.ca.gov/data/mwt97/.

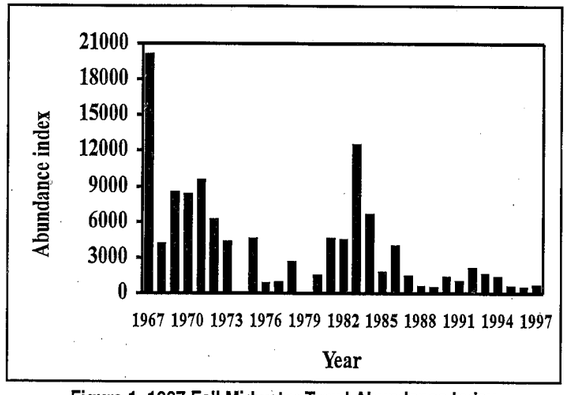

Figure 1. 1997 Fall Midwater Trawl Abundance Index for American Shad

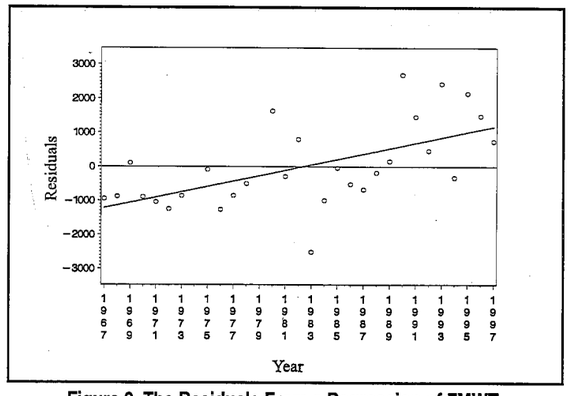

Figure 2. The Residuals From a Regression of FMWT American Shad Indices

White Sturgeon

David W. Kohlhorst, DFG

Measures of white sturgeon abundance in the Sacramento-San Joaquin Estuary are available intermittently from 1967 to 1997. Three measures are used to assess trends in population size: (1) mark-recapture abundance estimate based on tagging in the fall in San Pablo and Suisun bays and recapture of tagged fish in the same and subsequent tagging periods, (2) catch per net-hour in trammel nets used to catch sturgeon for tagging, and (3) total catch of white sturgeon during tagging.

Abundance of white sturgeon seems to vary in a cyclical manner, with high abundance in 1967 and 1968, the mid-1980s, and the late 1990s (Figure 1). All three measures of abundance are consistent in showing this pattern, but differ in depicting the magnitude of variations. Between 1994 and 1997, estimated abundance of white sturgeon greater than 40 inches total length increased from 26,000 to 140,000, catch per net-hour increased from 3.8 to 8.5, and catch during tagging increased from 593 to 1,326 fish. The abundance estimate is probably biased by the small number of recaptures (3), the lack of random mixing of the tagged fish into the untagged population, and different catchability between untagged and recently tagged fish. Nevertheless, both the abundance estimate and catch rate suggest a substantial increase in sturgeon abundance since 1994 in San Pablo Bay and, probably, in the entire estuary. The apparent increase in abundance may be due to a combination of recruitment of the strong 1982 and 1983 year classes since 1994 and return of fish to the estuary from the ocean after the end of the persistent drought of the late 1980s and early 1990s.

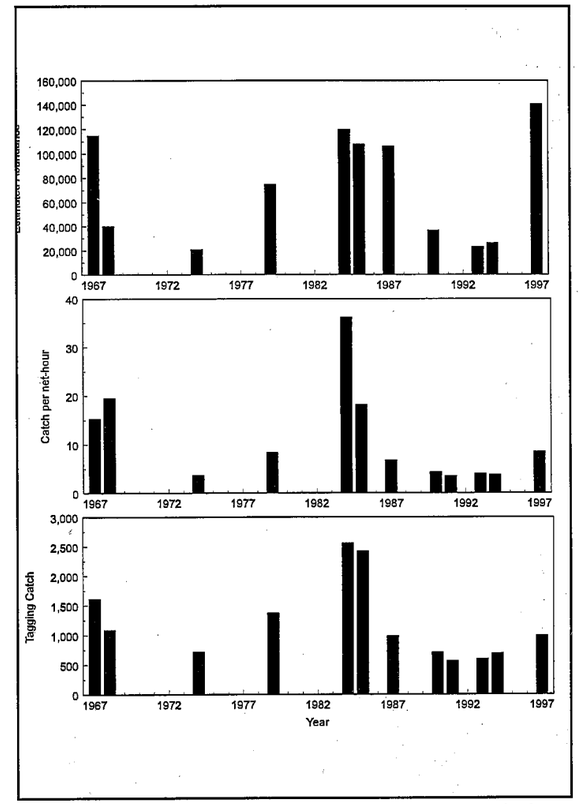

Figure 1. Three Measures of White Sturgeon Abundance in the Sacramento -San Joaquin Estuary: Mark-recapture Abundance Estiamte, Tagging Catch Per Net Hour, and Tagging Catch