

WRINT-DFG-EXHIBIT 4

STATUS OF WHITE CATFISH IN THE SACRAMENTO-SAN JOAQUIN DELTA

IMPORTANCE OF WHITE CATFISH.

White catfish (*Ictalurus catus*) are native to the lower reaches of east coast rivers from New Jersey to Florida. They were introduced into the Sacramento-San Joaquin Delta in 1874. Conditions for white catfish in the Delta were apparently favorable and their abundance rapidly increased. They were fished commercially in the Delta until commercial fishing for catfish was outlawed by the State Legislature in 1953. Between 1916 and 1952, the statewide commercial harvest, largely from the Delta, ranged from 178,600 to 1,012,000 lbs annually (Skinner 1962). Since 1953, catfish have been subject to sport fishing only and are one of the most commonly caught fish in the Delta. A study conducted from 1953-1954 indicated that anglers harvested about 28% of the white catfish population annually (Borgeson and McCammon, 1967). Based on mark-recapture estimates from 1978 to 1980, the abundance of white catfish larger than seven inches was estimated at 5.5 million fish. Anglers harvested 18% or approximately one million of those fish annually (Schaffter 1987).

STATUS OF THE WHITE CATFISH POPULATION.

Population estimates of adult white catfish have not been made since the 1978-1980 study which estimated there were about 5.5 million fish. However, data from four independent sources

indicate that abundance of white catfish has declined severely since the mid-1970's. These sources are the catch of young-of-the-year white catfish (size \leq 4.5 inches) in the summer townet survey for striped bass, the catch of white catfish (mixed year classes) in the fall midwater trawl survey, and the salvage of white catfish at the State Water Project (mixed year classes) and the Central Valley Project (mixed year classes) fish screens. Even though white catfish salvaged from the SWP and CVP facilities are mixed year classes, the predominant age of salvaged fish is young-of-the-year. During June, July, and August of 1989 and 1990, 63% of the white catfish salvaged from the SWP were young-of-the-year, and 52% of the white catfish salvaged from the CVP were young-of-the-year.

Abundance of white catfish in townet surveys fluctuated from about one to more than four fish per tow from 1968 to 1975 (Figure 1a). Since 1975, the catch has never exceeded one fish per tow and in several years the catfish catch has been less than 0.06 per tow.

In the midwater trawl survey, the white catfish abundance index exceeded 260 and ranged up to about 853 in all but one year from 1967 to 1974 (Figure 1b). Since 1975 the index has fluctuated downward, never exceeding 240 and it was 4.6, 6.0, and 12.0 in 1982, 1987, and 1989 respectively.

White catfish salvage at the SWP fish screens started at about 810,910 fish in 1968 when water exports were still relatively low (Figure 1c). White catfish salvage subsequently increased, generally exceeding one million fish through 1974, and

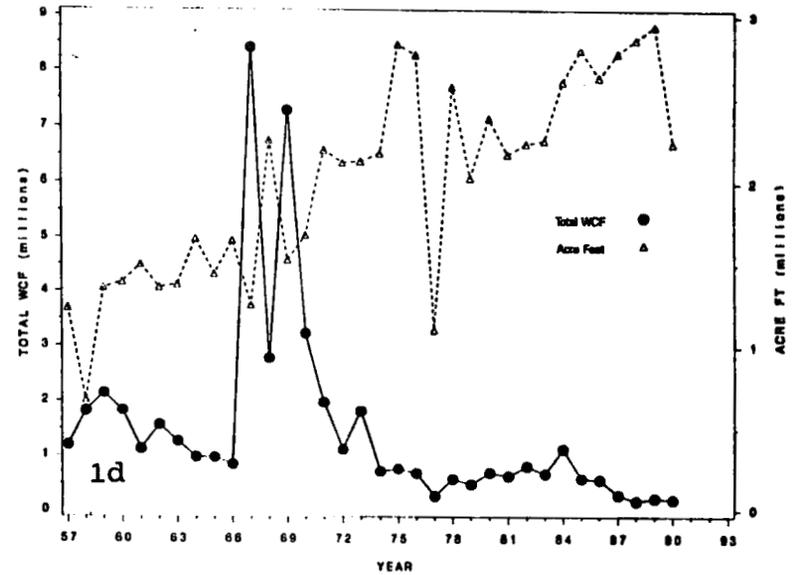
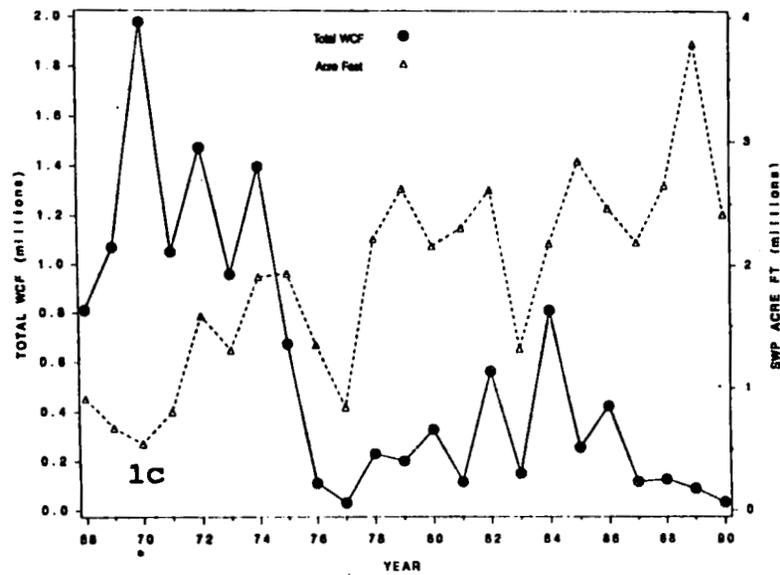
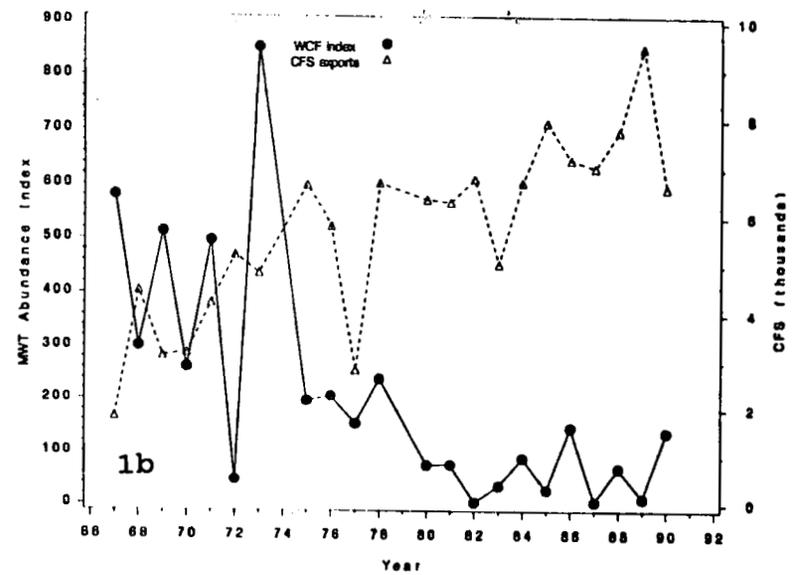
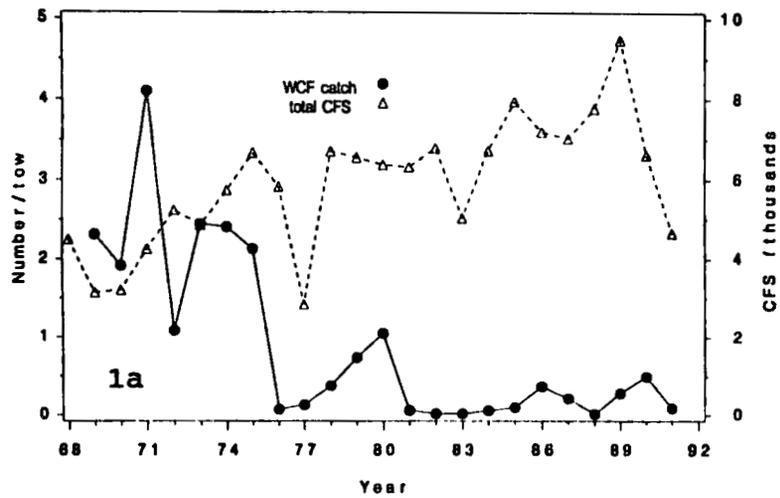


Figure 1. Abundance trends of white catfish (straight line) verses water exports (dotted line) as measured by totnet survey and total annual exports (a), midwater trawl and total annual exports (b), salvage at SWP fish screens and SWP exports (c), and salvage at CVP fish screens and CVP exports (d).

peaking at 1.98 million in 1970. Afterwards, despite a continued upward trend in water exports, which in essence represents increasing population sampling effort, catfish salvage decreased substantially. The low was 30,828 fish salvaged in 1977. Since 1977, salvage was as high as 813,353 fish only in 1984. The 1990 salvage of only 32,974 catfish is near the record low despite one of the highest water export levels of record.

Salvage and export data from the CVP fish facility reflect similar trends in white catfish abundance although salvage has tended to be at much higher levels than at the SWP (Figure 1d). White catfish salvage at the CVP ranged from 847,886 to 2,143,123 fish from 1957 to 1966 and peaked at over eight million fish in 1967. White catfish salvage has dropped dramatically at the CVP since 1969 despite increased water exports. In 1990, white catfish salvage at the CVP was only 203,095 fish.

Because total white catfish salvage at the SWP and CVP fish screens is affected by the amount of water exported, we also examined the trends in white catfish abundance based on salvage per acre foot of water exported. This analysis was limited to summer months (June-September) because peak salvage occurred during that period in both a representative wet year (1975) and dry year (1990). However within this summer period, the peak salvage still varied by month depending on measure (total salvage, salvage/acre foot), year, and salvage facility (SWP, CVP) (Figures 2 and 3). The trends in salvage of white catfish per acre foot during the summer indicate a decline in the abundance of white catfish since 1970 (Figure 4), a result similar to the

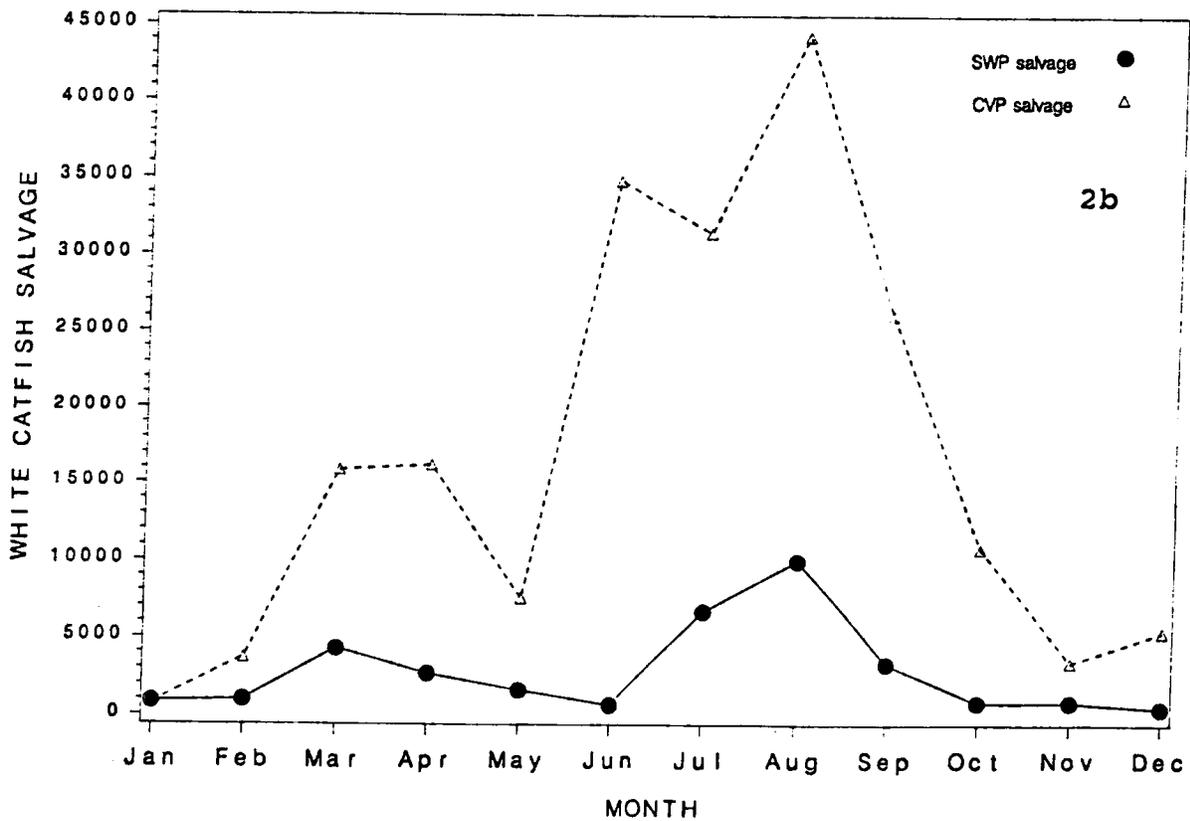
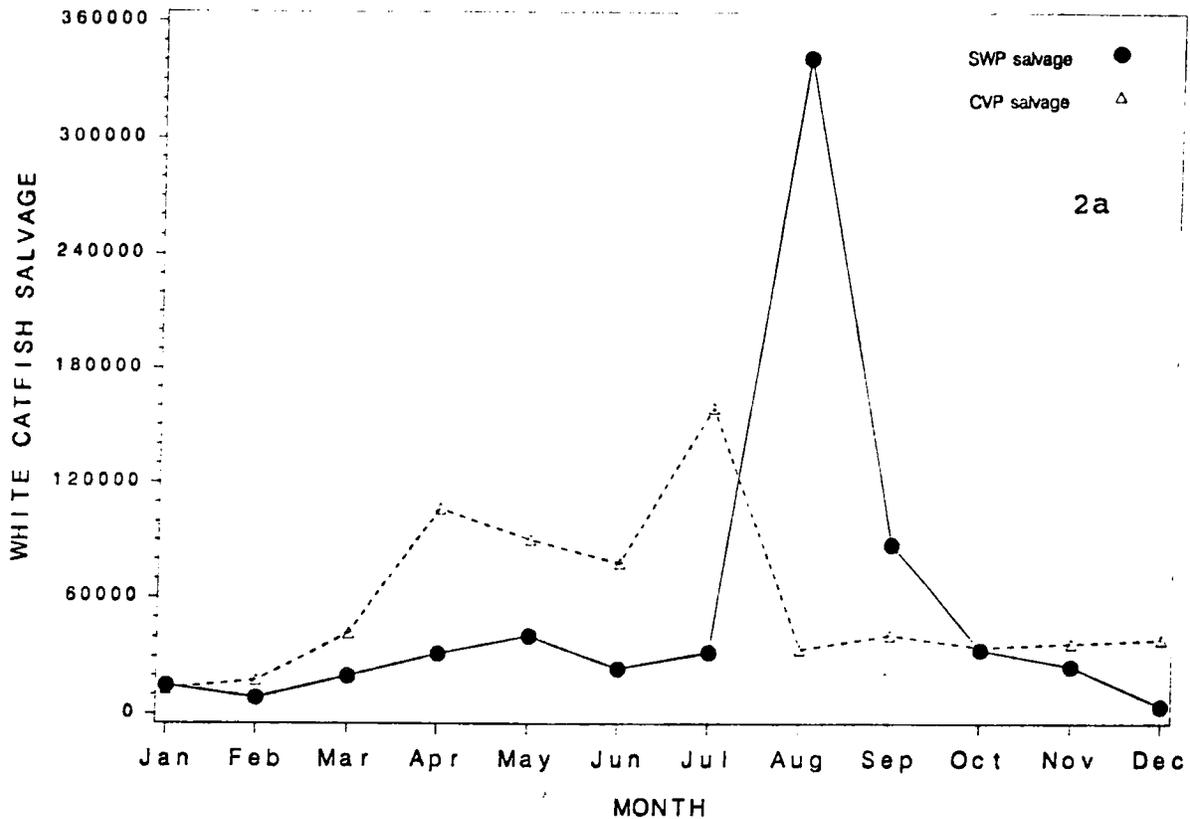


Figure 2. Seasonality of total white catfish salvage for a wet year, 1975 (2a) and for a dry year, 1990 (2b).

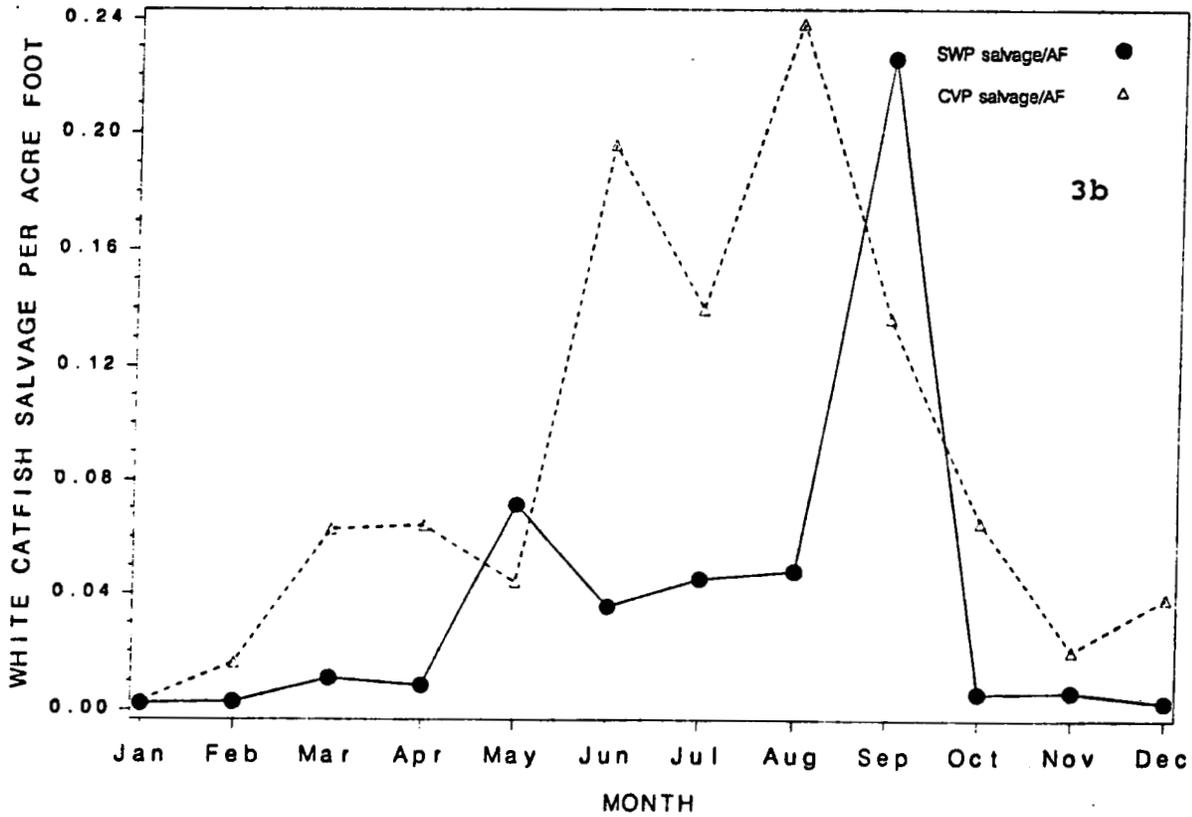
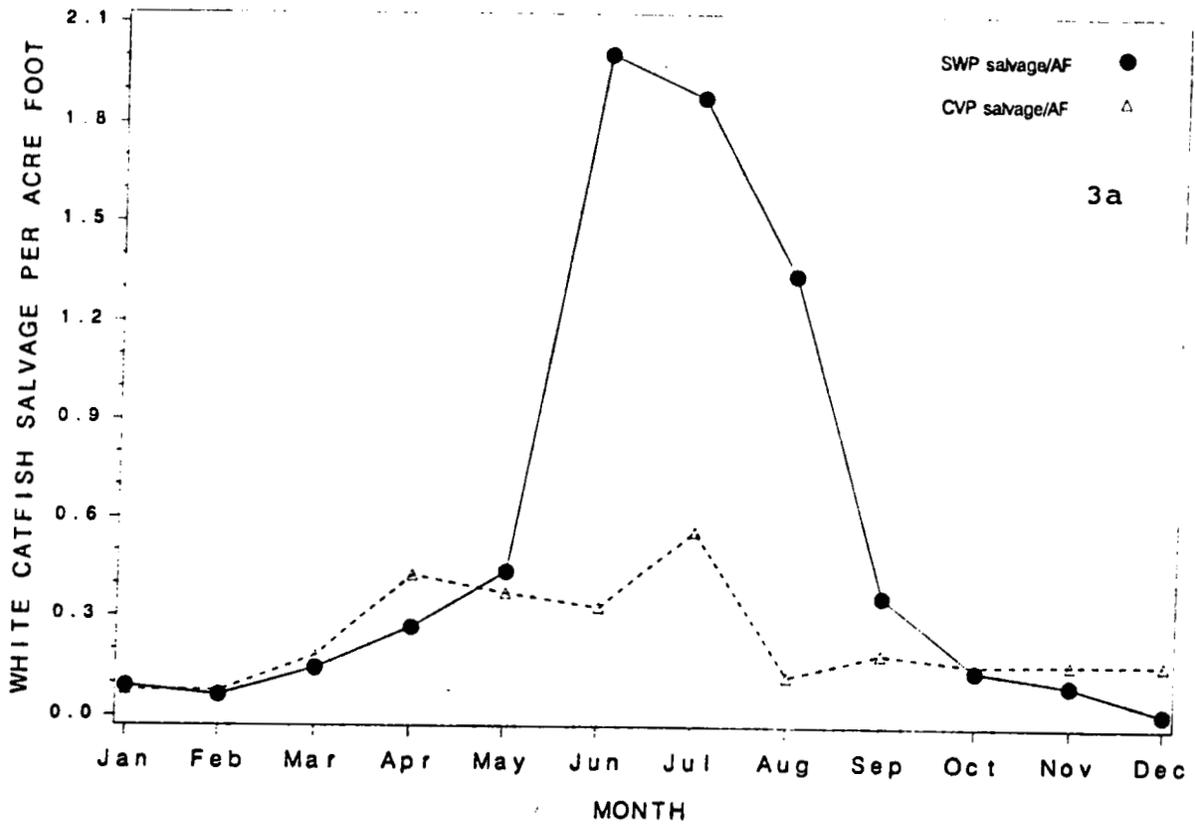


Figure 3. Seasonality of white catfish salvage per acre foot for a wet year, 1975 (3a) and for a dry year, 1990 (3b).

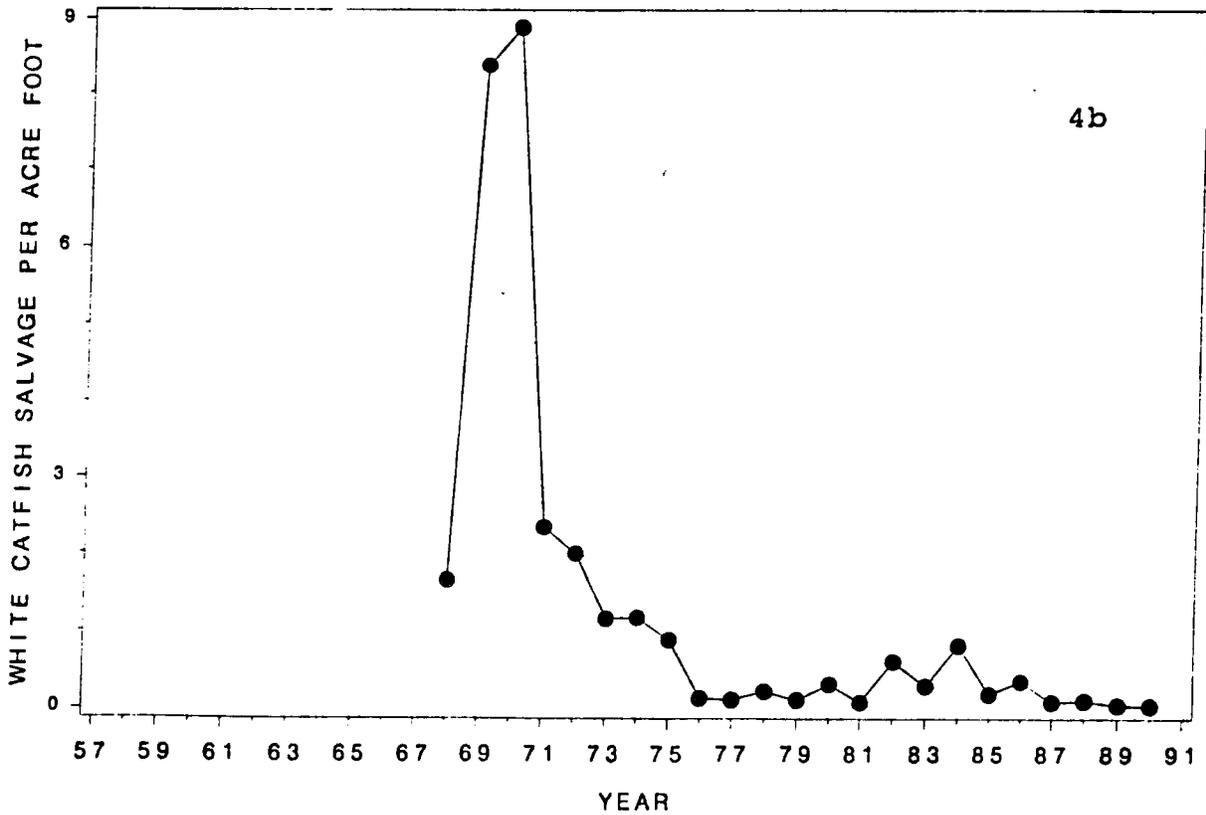
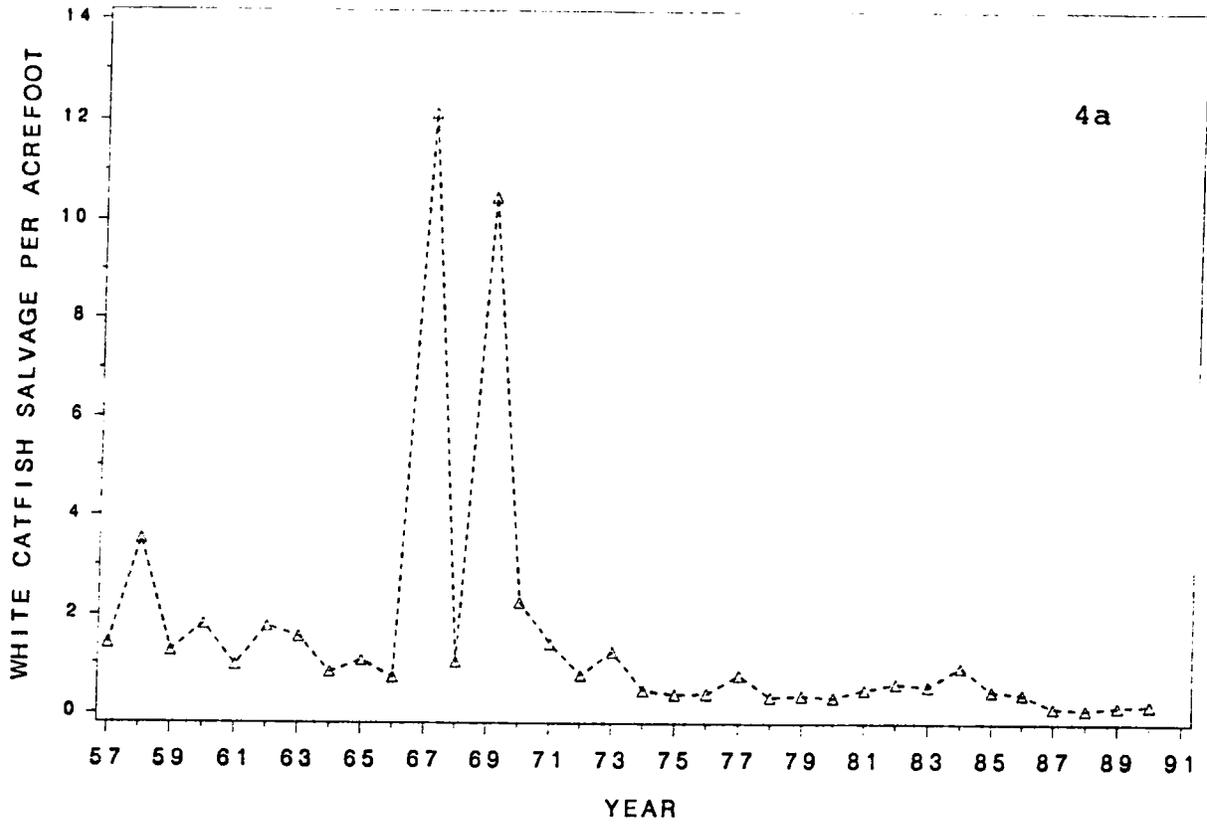


Figure 4. White catfish salvage per acre foot of water exported during summer (June through September) for the CVP fish screen facility (4a) and for the SWP fish screen facility (4b).

trends based on the townet and midwater trawl surveys and total salvage from the SWP and CVP.

Salvage (Figure 1) and salvage per acre foot (Figure 4) at the CVP suggest that the wet years 1967 and 1969 were "banner years" for white catfish and population trends based on monitoring, which began approximately at that time, may be unduly influenced by those years. However, when 1967 and 1969 are deleted from the salvage records, a major downtrend in white catfish abundance is still evident during the 1957-1990 period of record (Figure 5).

WHITE CATFISH POPULATION DECLINE AND WATER EXPORTS.

The distribution of young white catfish based on catches in the summer townet survey indicated that, historically, white catfish reproduction has been concentrated in the south and east Delta (Figure 6), and that this source of recruitment of new fish has greatly diminished since the early 1970's (Figure 7).

Because the water project intakes are located in the south Delta, draw water from these key reproductive areas, entrain large numbers of catfish relative to the 1980 estimate of catfish abundance in the estuary, and screening efficiencies on catfish are low relative to other species such as striped bass and threadfin shad (Table 1), it seems reasonable to hypothesize that, as for striped bass (WRINT DFG-Exhibits 2 and 3), losses to water exports have caused the decline in white catfish abundance. Such losses are potentially manifested in the population data in three ways: 1) through losses that occur in the individual years

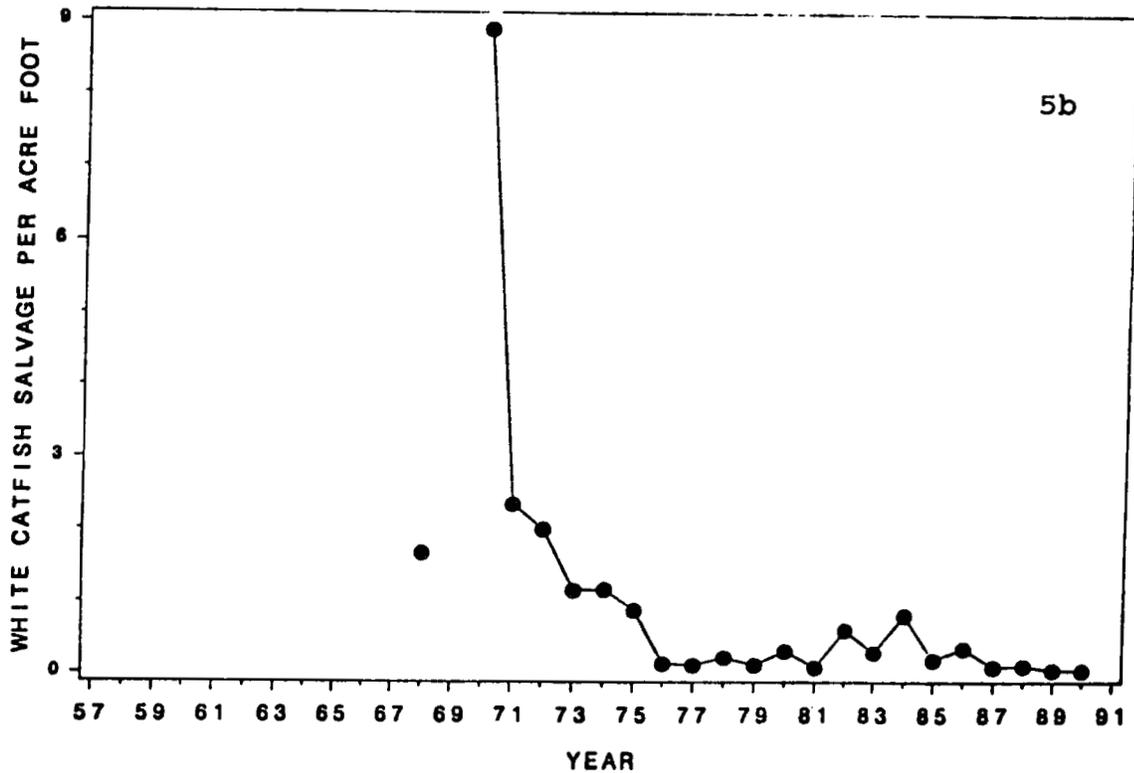
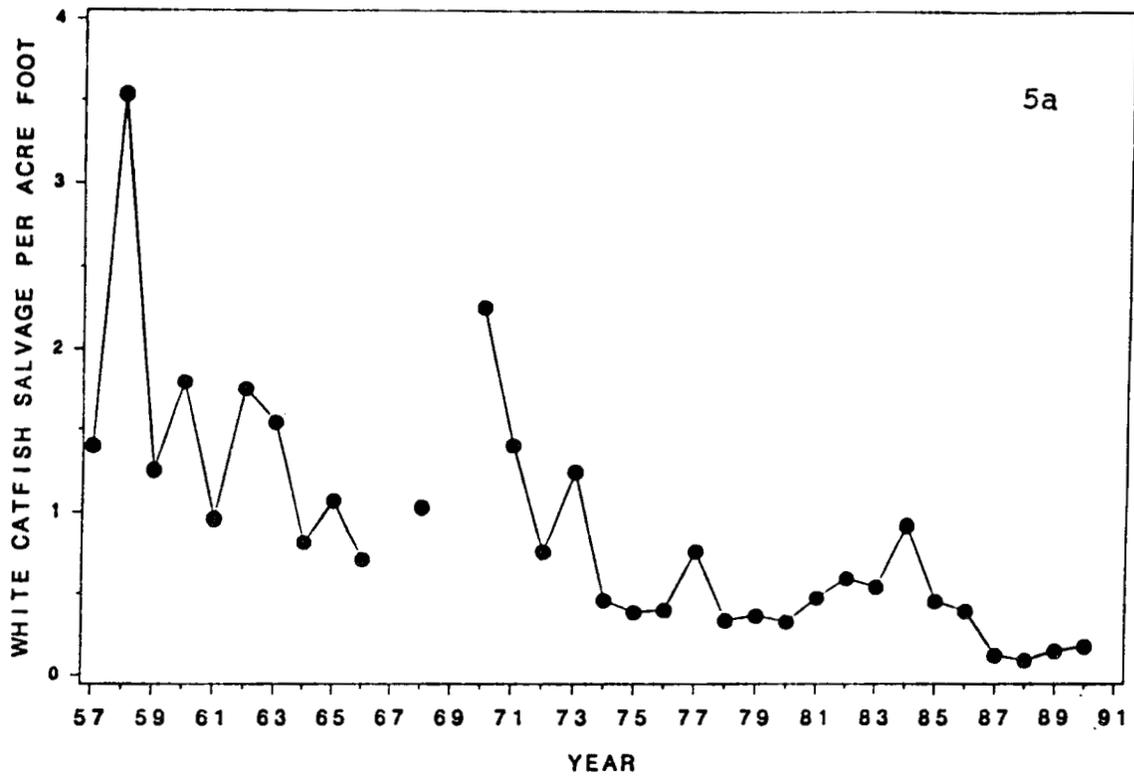


Figure 5. Salvage of white catfish per acre foot of water exported during summer (June through September) at the CVP fish screens (5a) and the SWP fish screens (5b) with 1967 and 1969 deleted.

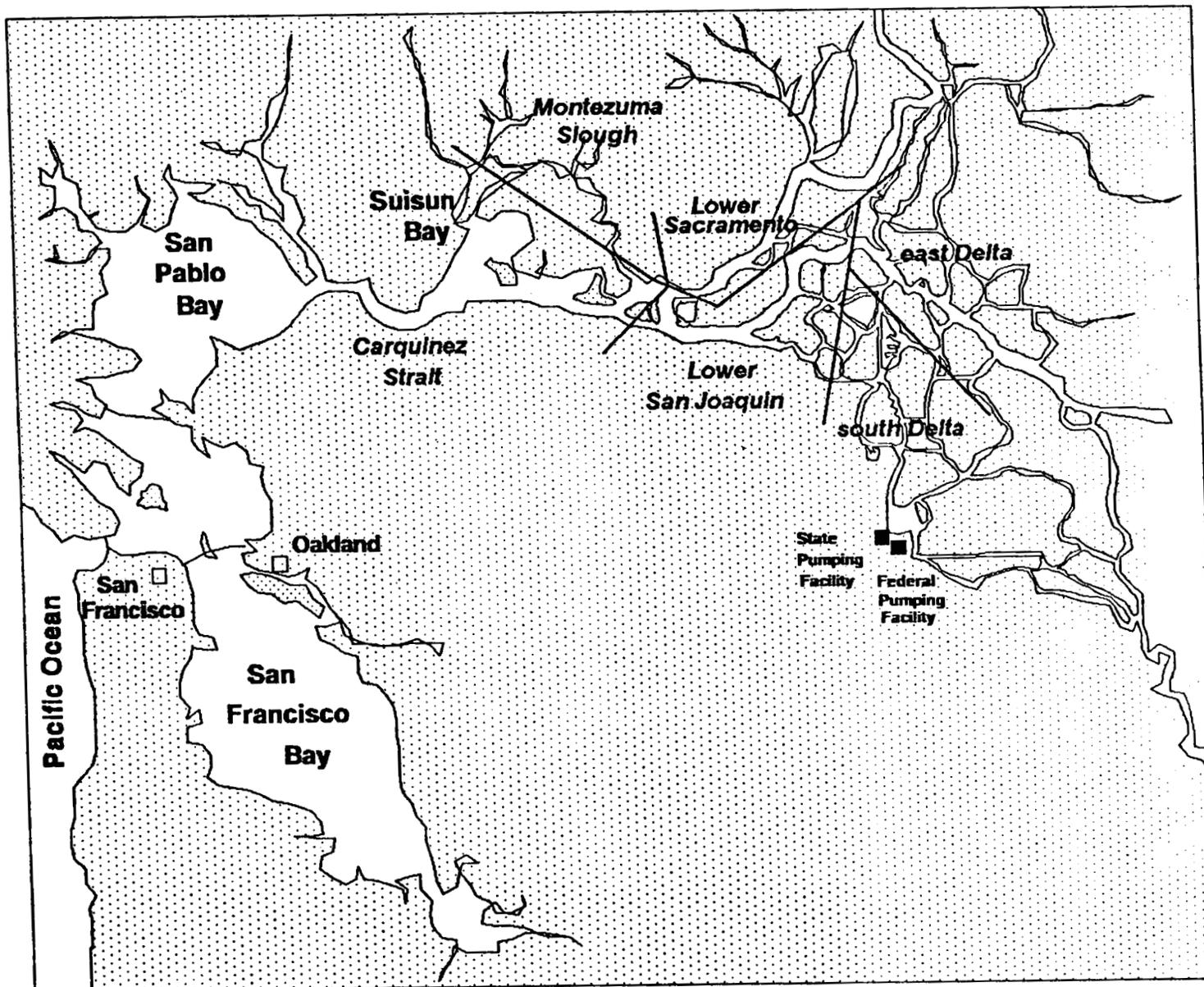


Figure 6. Division of the Delta into geographical areas for surveys.

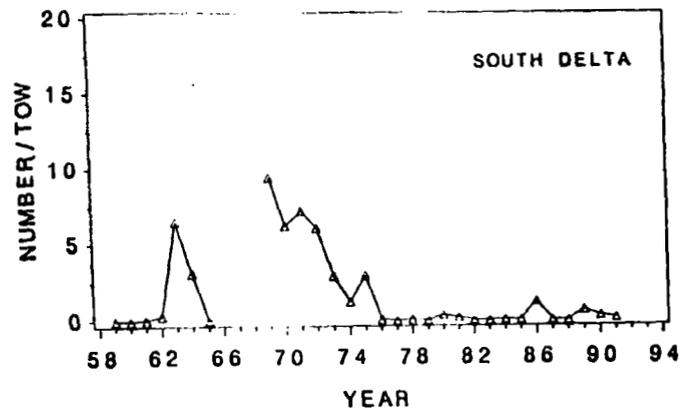
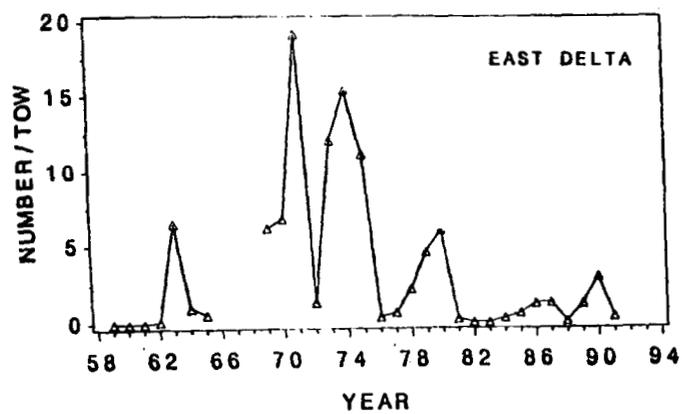
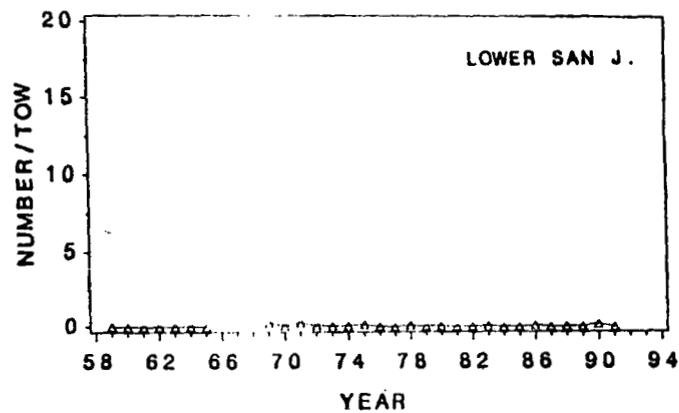
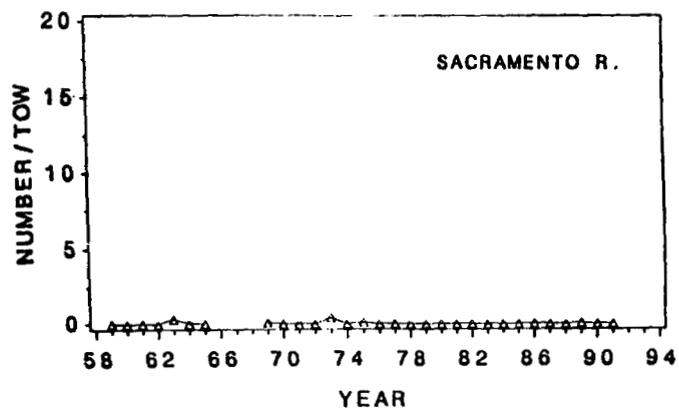
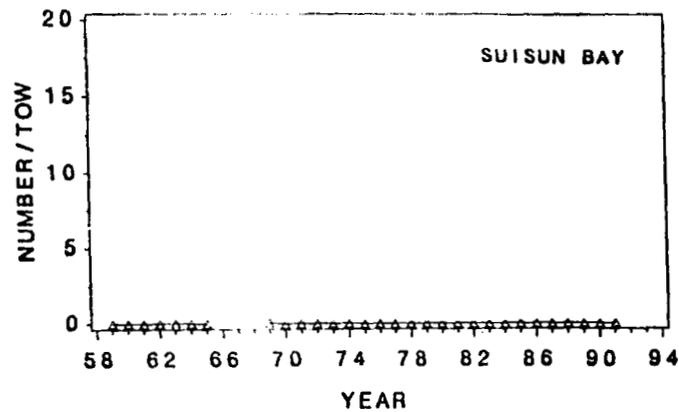
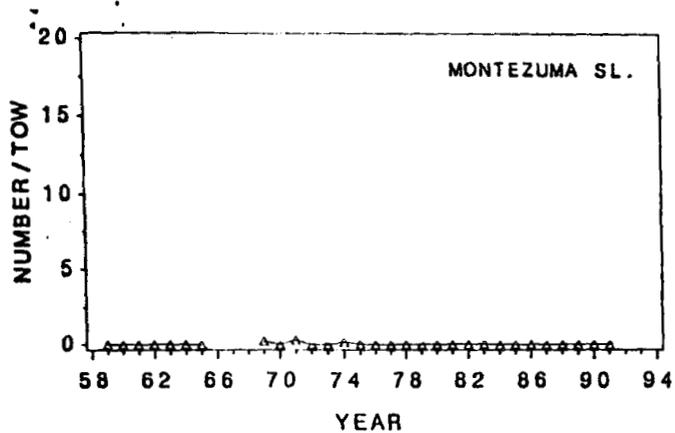


Figure 7. Trend in young white catfish abundance in six areas of the Sacramento-San Joaquin Delta as measured by CDFG's summer tow-net survey.

Table 1. Comparison of percent efficiency of fish salvage at the SWP fish facility for young-of-the-year (YOY) white catfish, striped bass, and threadfin shad. Efficiencies not determined are reported as n.d. (CDWR and CDFG, 1973).

Size (mm)	striped bass (%)	threadfin shad (%)	white catfish (%)
10	0	0	0
30	42	27	8
50	64	47	24
70	72	62	40
90	78	n.d.	57
100	81	n.d.	62

before the population is monitored in the summer and fall, 2) through cumulative losses over previous years which reduce the number of fish alive in any given year, and 3) through the effect of cumulative past losses reducing the abundance of spawners which in turn reduces the production of new fish. Comparisons in the population trends measured by the four data sources (Figures 1a-1d) clearly demonstrate that the decline in catfish is inversely associated with the increasing trend in water exports. Correlation coefficients between the catfish abundance indices and water exports using data from individual years are all moderately high and are negative (Table 2). Thus, these correlations support the hypothesis that losses to water exports have depleted the catfish population. Much of the imprecision in the correlations may reflect effects of cumulative losses and their impact on the spawning stock and reduced production of young fish.

Table 2. Correlation coefficients between white catfish abundance indices and water export rates.

Source	Correlation (r =)
Townet Survey	-0.46
Midwater Trawl Survey	-0.62
SWP	-0.54
CVP	-0.44

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