# 2007 Fish Salvage at the Tracy Fish Collection Facility

by

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## Introduction

The Tracy Fish Collection Facility (TFCF) diverts (salvages) some fish from water exported from the Sacramento-San Joaquin Delta. The fish are loaded into tanker trucks, trucked to release sites away from the immediate influence of the export pumps, and released back into the Delta. This report summarizes salvage information from the TFCF in 2007. The following species are given individual consideration: Chinook salmon (*Oncorhynchus tshawytscha*), steelhead (*O. mykiss*), striped bass[1] (*Morone saxatilis*), delta smelt[1] (*Hypomesus transpacificus*), longfin smelt[1] (*Spirinchus thaleichthys*), threadfin shad[1] (*Dorosoma petenense*), and Sacramento splittail (*Pogonichthys macrolepidotus*).

## Methods

The daily volume of water exported was reported from gauge readings from the C.W. "Bill" Jones Pumping Plant at Byron. Monthly water exports were plotted and examined for time trends. Annual exports for the Central Valley Project (CVP) from 1982 through 2007 were noted.

Fish abundance was reported as 'estimated salvage'. Only fish longer than 20 mm FL (TL in the case of sturgeon, *Acipenser spp.*) were numerated (counts), because salvage efficiency degrades rapidly for fish smaller than this size. Salvage estimates were primarily obtained by expanding the routine sample counts by the duration that water was pumped using the following equation:

$$SALVAGE_{SAMPLE} = COUNT_{SAMPLE} \mathbf{x} (MINUTES\ PUMPING \mathbf{/} MINUTES_{SAMPLE}). \quad (1)$$

Fish collected during predator removals were not expanded:

$$SALVAGE_{PREDATOR\ REMOVAL/SECONDARY\ FLUSH} = COUNT_{PREDATOR\ REMOVAL/SECONDARY\ FLUSH.} \quad (2)$$

Monthly or annual salvage estimates were calculated by the summation of Equations (1) and (2) by month or year. Intra-annual abundances were examined by plotting the monthly salvage totals for selected species and for all taxa combined for 2007.

The annual and daily salvage estimates for Chinook salmon and steelhead were subcategorized as wild or hatchery. Salmonid origin was determined by the presence (wild) or absence (hatchery) of an adipose fin. The race of Chinook salmon was classified by the Delta salmon length-race key using body length and date of capture information.

Fish loss was only reported for Chinook salmon because information necessary to calculate loss are lacking for other species. Loss is the estimated number of fish encountered by the facility minus the number of fish that survive salvage operations. Loss was subcategorized by origin and race.

**Water Exports**

The CVP exported 2,590,344 acre-feet (AF) of water in 2007 (Figure 1). The annual export in 2007 was comparable to recent exports ranging from 2,598,459 to 2,783,950 AF (2003-2006).

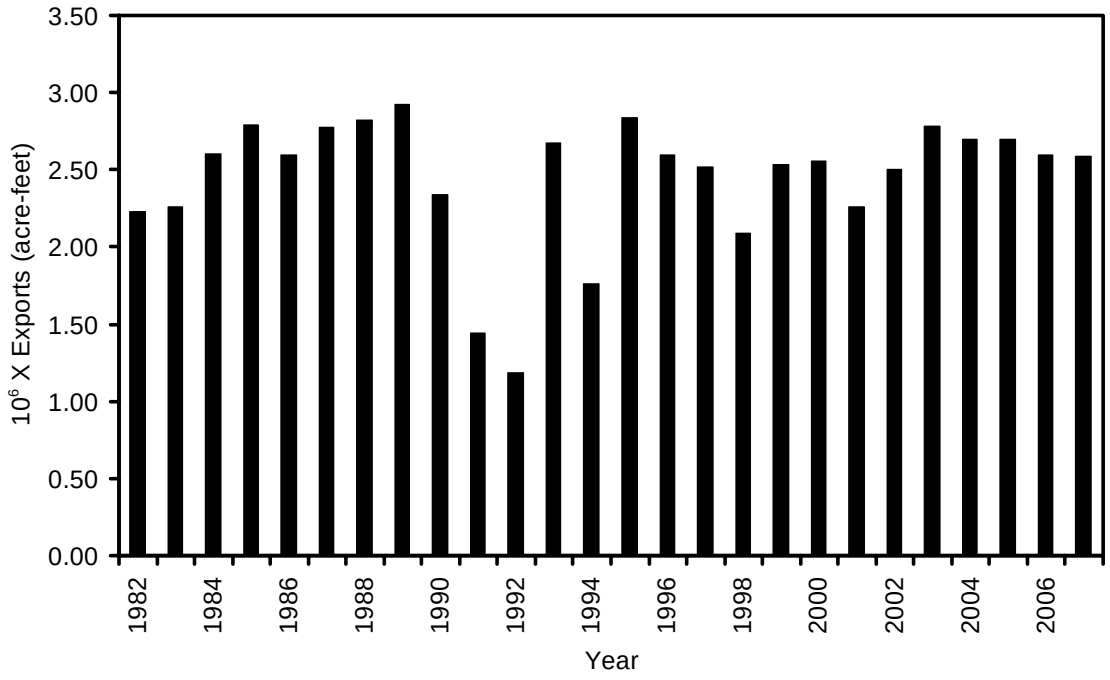


Figure 1 Annual exports (in millions of acre-feet) for the Central Valley Project, 1982 – 2007

The majority of water export in 2007 occurred from July through December (Figure 2). CVP exports ranged from 51,730 to 278,713 AF. From July through December, 1,478,376 AF was exported, accounting for 57% of the 2007 annual export.

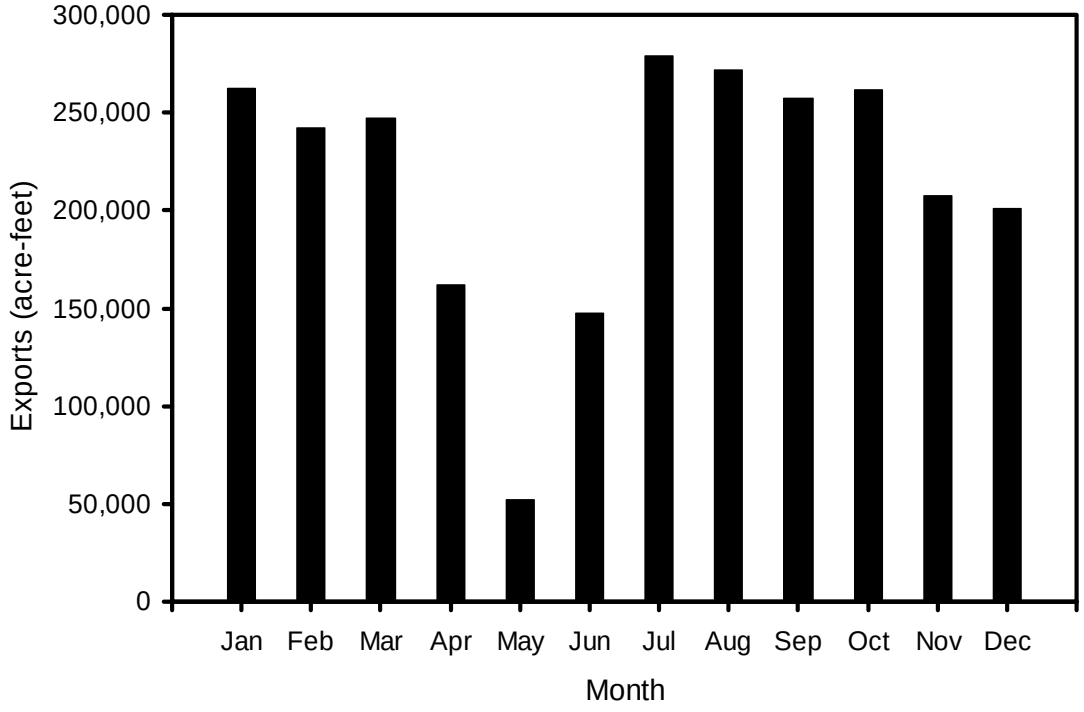


Figure 2 Monthly exports (in acre-feet) for the Central Valley Project, 2007

**Total Salvage and Prevalent Species**

Annual combined salvage (annual salvage) in 2007 of 3,164,530 was lower than the average annual salvage. Generally, annual salvage has been below 10 million (Figure 3). In contrast, the 2006 annual salvage of 37,266,449 was an order of magnitude greater than the annual salvage in 2007 and 2005 (2,430,642).

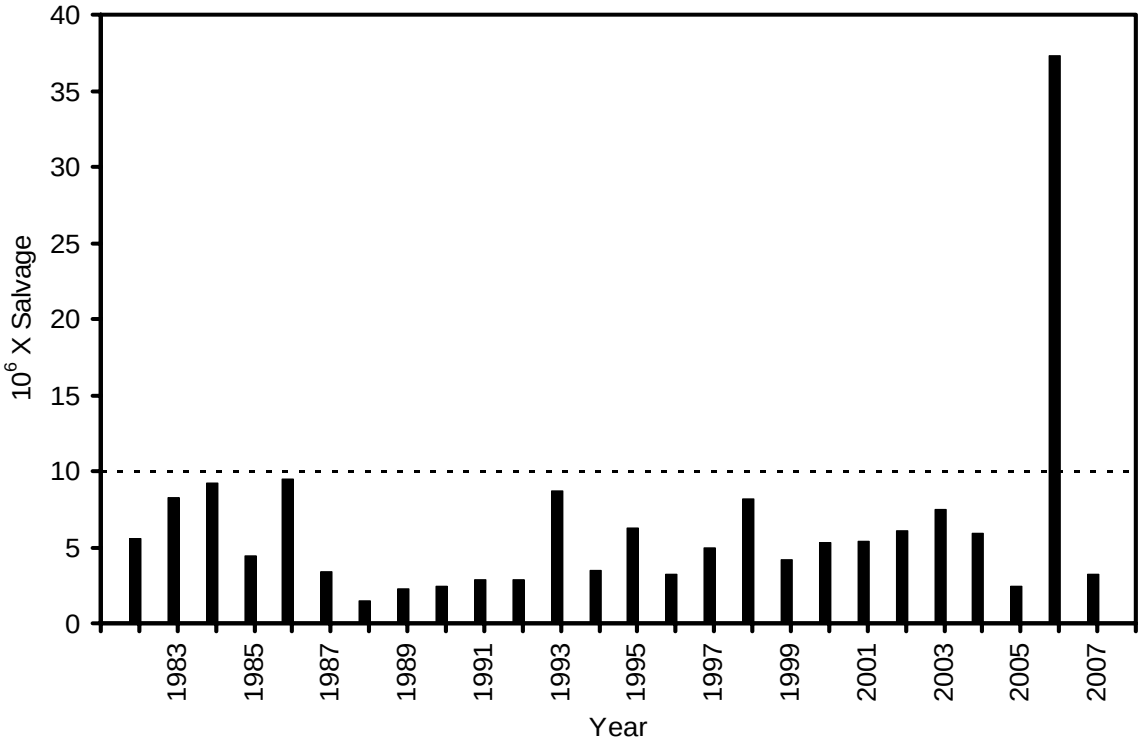


Figure 3 Annual salvage (in millions) of all taxa combined at the TFCF, 1982 – 2007

Threadfin shad accounted for 70.9% of the annual salvage (Figure 4 and Appendix A). The only other species to be salvaged in substantial numbers were striped bass (14.2%). Generally, threadfin shad have made up the bulk of salvage, especially in later years except for 2006 when common carp accounted for 81.8% and threadfin shad accounted for just 1.9%. Salvage of common carp decreased substantially in 2007 accounting for less than 0.1%. Sacramento splittail salvage also decreased substantially from 2006 to 2007, accounting for 13.4% and less than 0.1%, respectively. Relatively few (< 0.4%) Chinook salmon, steelhead, delta smelt, longfin smelt, and Sacramento splittail were salvaged.

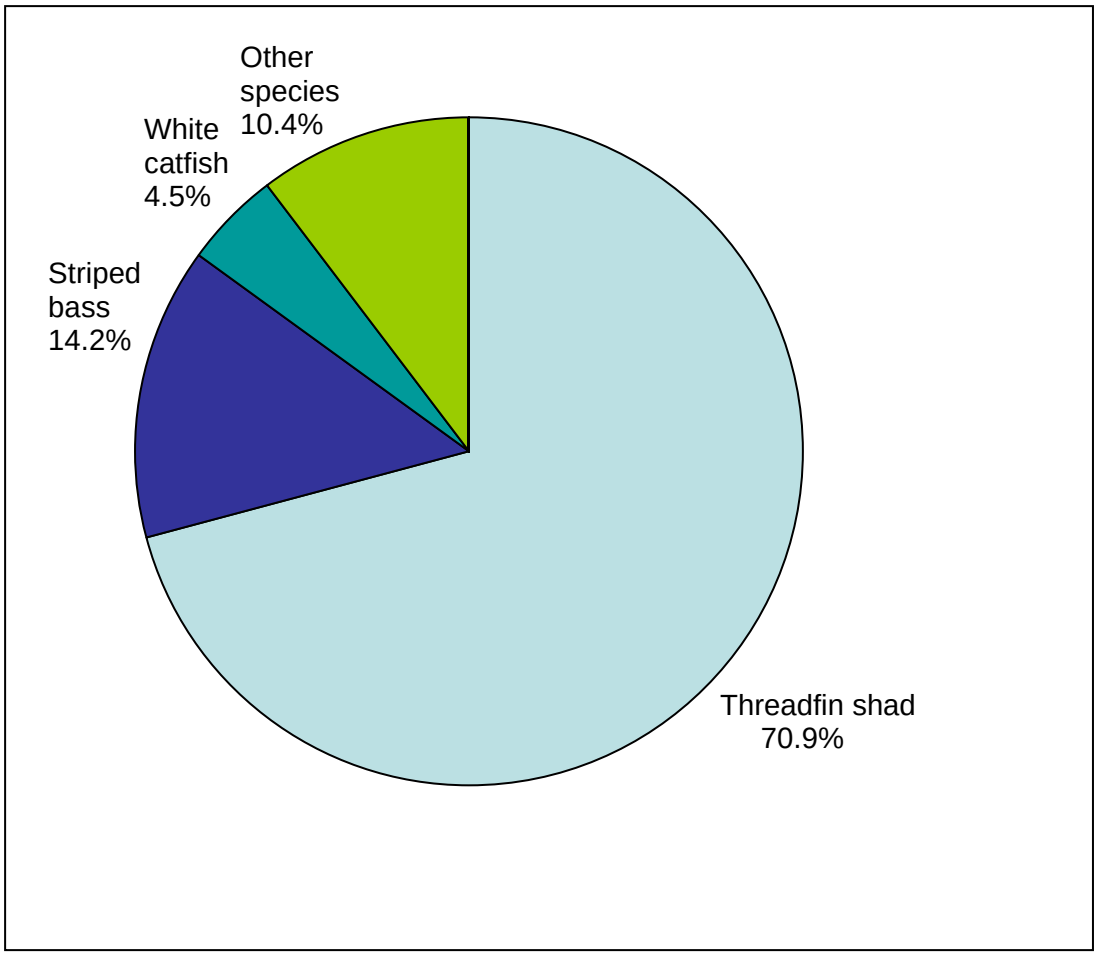


Figure 4 Percentages of annual salvage for the 3 most prevalent species and other species combined at the TFCF, 2007

**Chinook Salmon**

Annual salvage (all races and origins combined) of Chinook salmon continued to be low (Figure 5). The annual salvage of 7,622 salmon in 2007 was a marked decrease from the annual salvage of 35,319 observed in 2006 and ended an increasing trend that started in 2002. Annual salvage from 2002 to 2007 was about 5-fold lower than salvage in the 1980's and the late 1990's.

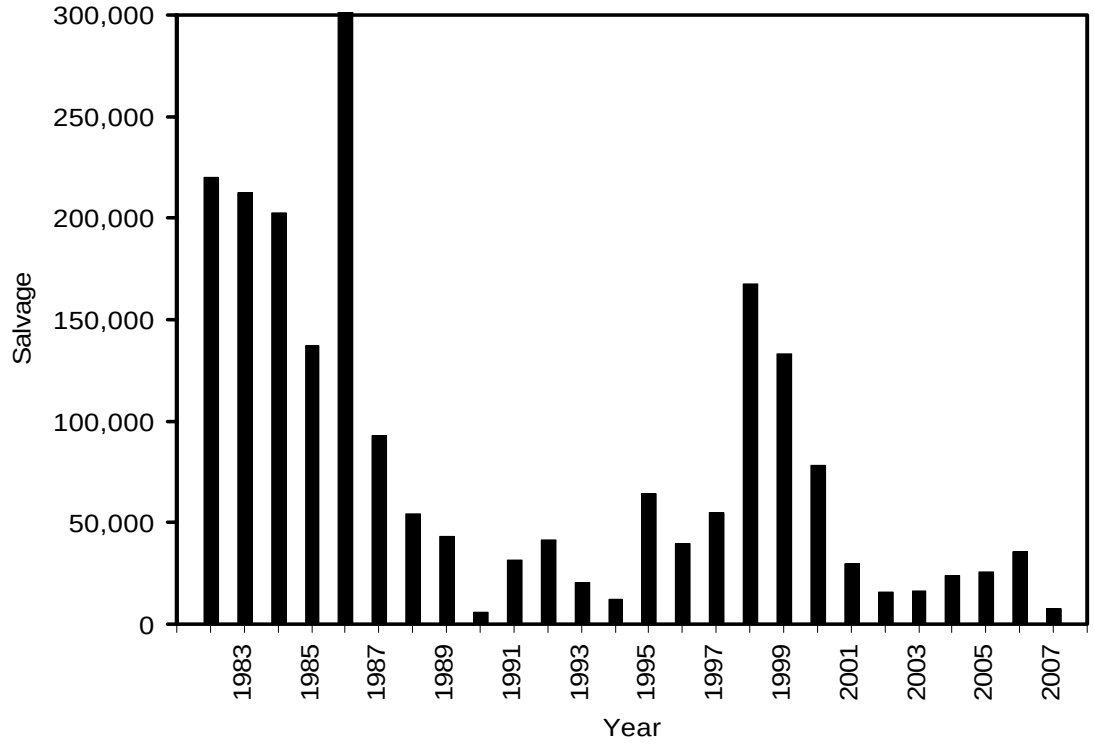


Figure 5 Annual salvage of Chinook salmon (all races and origins combined) at the TFCF, 1982 – 2007. The 1986 salvage of 752,039 was truncated for scale considerations

Salvaged Chinook salmon consisted primarily of wild spring run fish (39%) followed by wild winter run fish (35%; Table 1). Wild fall run fish comprised only 25% of the annual salvage of wild salmon; a substantial decrease from annual salvage in 2006 where they comprised 82% of the salvaged wild salmon. Fall run salmon were salvaged from February through June and spring run salmon were salvaged from March through May (Figure 6). The majority of fall run salmon (46%) and spring run salmon (94%) were salvaged in April. The estimated loss of 5,111 salmon in 2007 was small compared to the estimated loss of 23,508 salmon in 2006 (Table 1).

Table 1 Chinook salmon annual salvage, percentage of annual salvage, race and origin (wild or hatchery), and loss at the TFCF, 2007

| Origin | Race | Salvage | Percentage | Loss |
|---|---|---|---|---|
| Wild | Fall | 1,629 | 25 | 1,187 |
| | Late-fall | 12 | <1 | 9 |
| | Spring | 2,532 | 39 | 1,649 |
| | Winter | 2,305 | 35 | 1,516 |
| **Total Wild** | | **6,478** | | **4,361** |
| Hatchery | | | | |
| | Fall | 24 | 2 | 17 |
| | Late-fall | 36 | 3 | 25 |
| | Spring | 24 | 2 | 15 |
| | Winter | 1,060 | 93 | 693 |
| **Total Hatchery** | | **1,144** | | **750** |
| ***Grand Total*** | | ***7,622*** | | ***5,111*** |

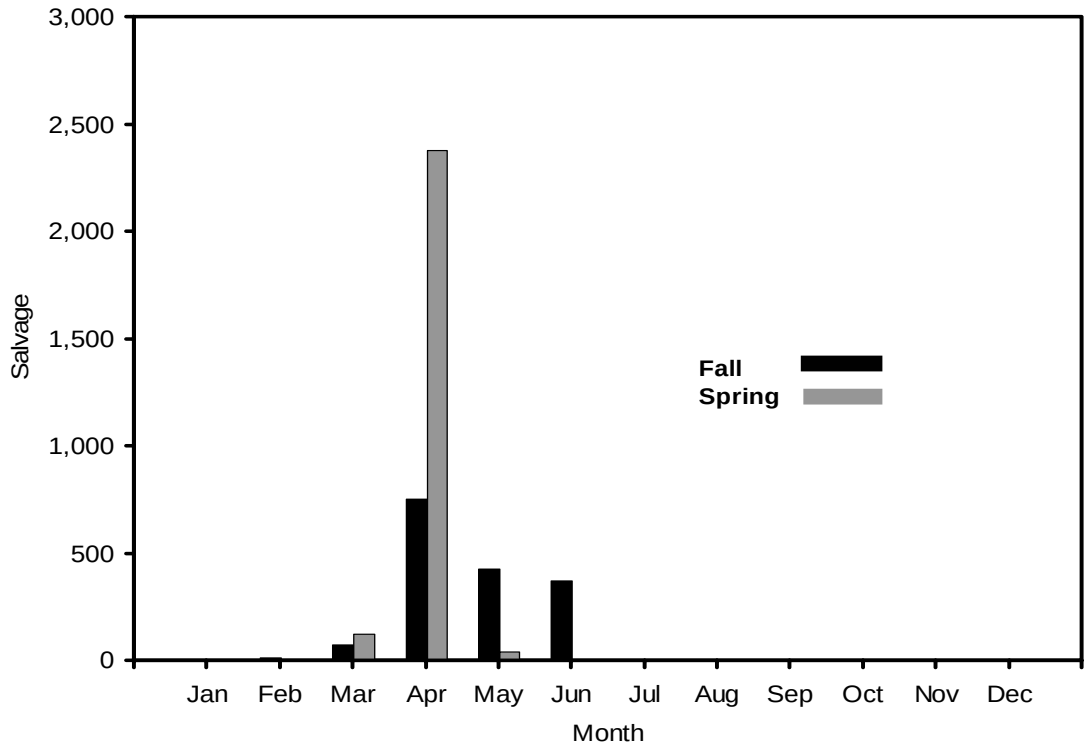


Figure 6 Monthly salvage of wild fall run and wild spring run Chinook salmon at the TFCF, 2007

**Steelhead**

The annual salvage of steelhead (all origins combined) increased in 2007 (Figure 7). Annual salvage in 2007 was greater than in 2006; 4,068 as opposed to 2,516.

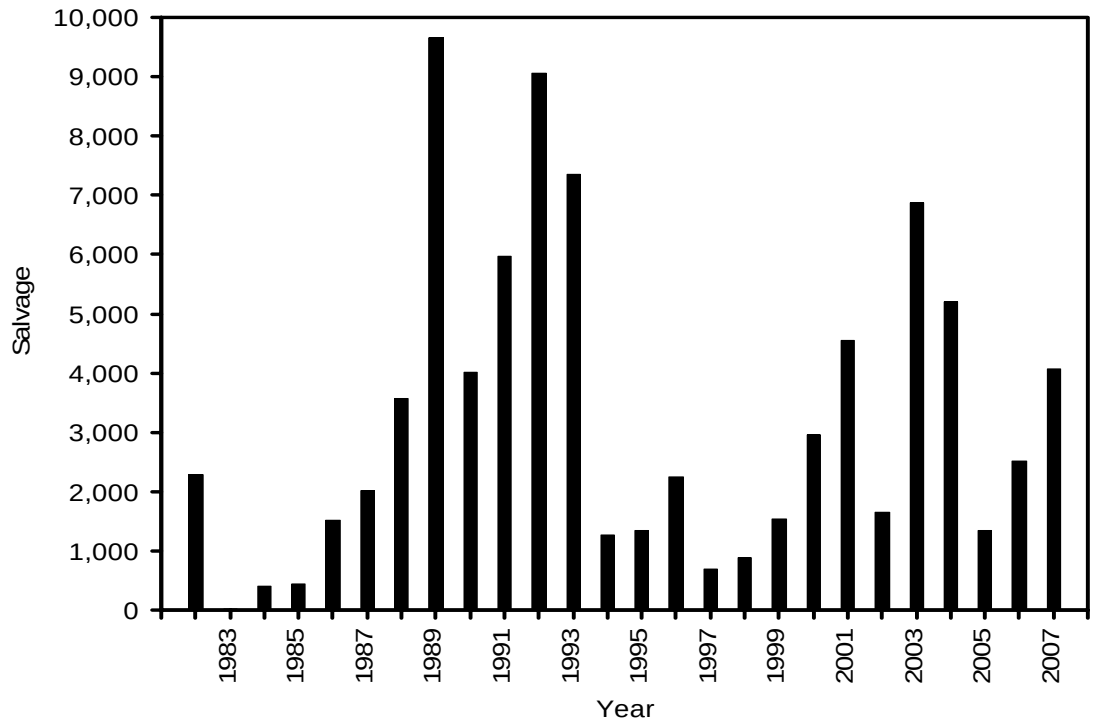


Figure 7 Annual salvage of steelhead (all origins combined) at the TFCF, 1982 – 2007

The majority of steelhead salvaged were of hatchery origin. The salvage composition was 2,241 hatchery and 1,827 wild fish.

All salvage of hatchery and wild steelhead occurred in the first half of the year. Hatchery steelhead were salvaged from January through May and wild steelhead were salvaged from January through June (Figure 8). Both hatchery and wild steelhead were salvaged most frequently in the months of February, March, and April.

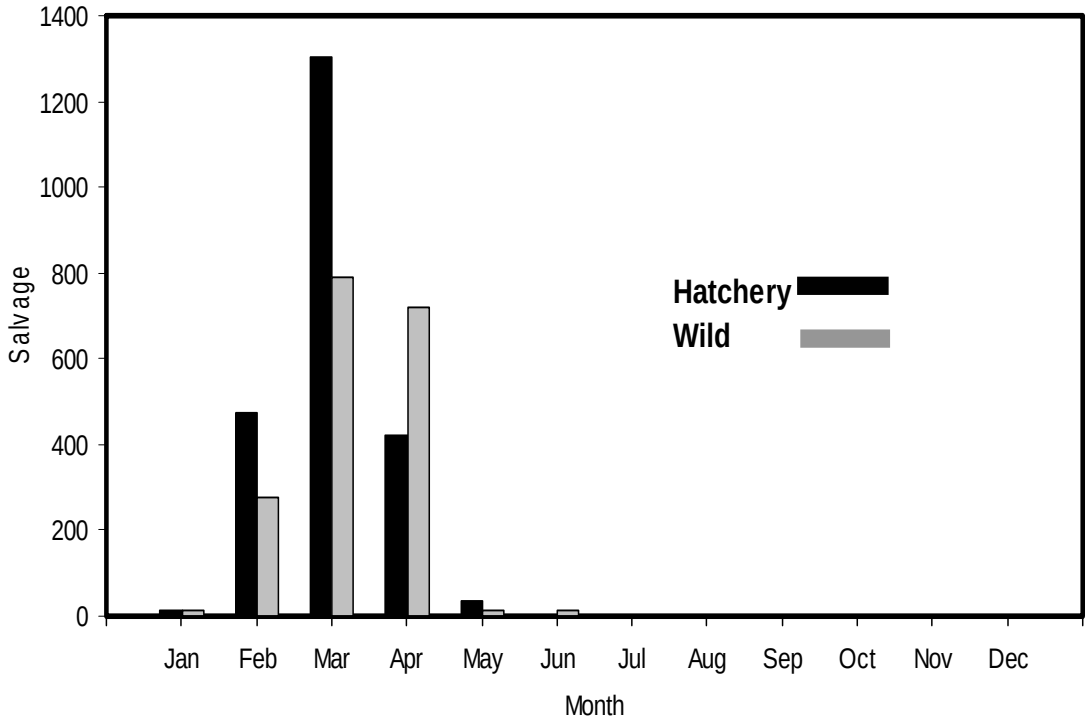


Figure 8 Monthly salvage of hatchery and wild steelhead at the TFCF, 2007

**Striped Bass**

Low annual salvage of striped bass in 2007 continued the low trend since 2002 (Figure 9). The salvage of 447,971 in 2007 was an increase from the record low annual salvage of 37,359 in 2006.

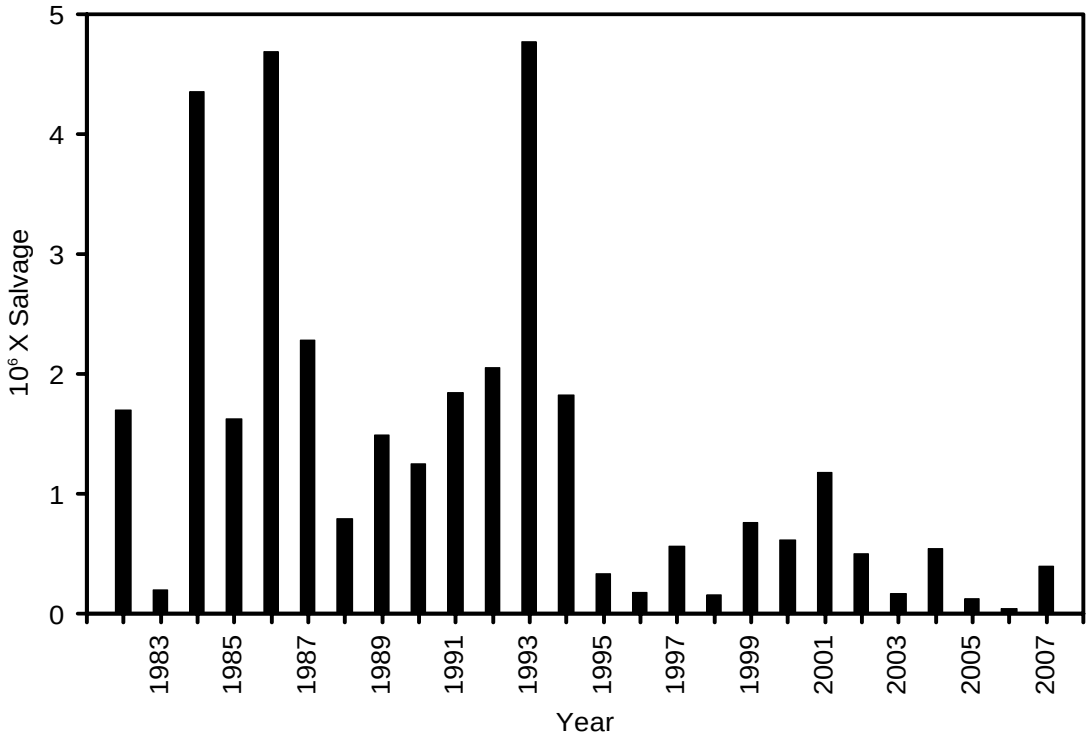


Figure 9 Annual salvage (in millions) of striped bass at the TFCF, 1982 – 2007

Most striped bass were salvaged in June and July (Figure 10). The June salvage of 231,912 and the July salvage of 180,183 accounted for 92% of the annual salvage. Striped bass were salvaged every month and the lowest monthly salvage was in October (428).

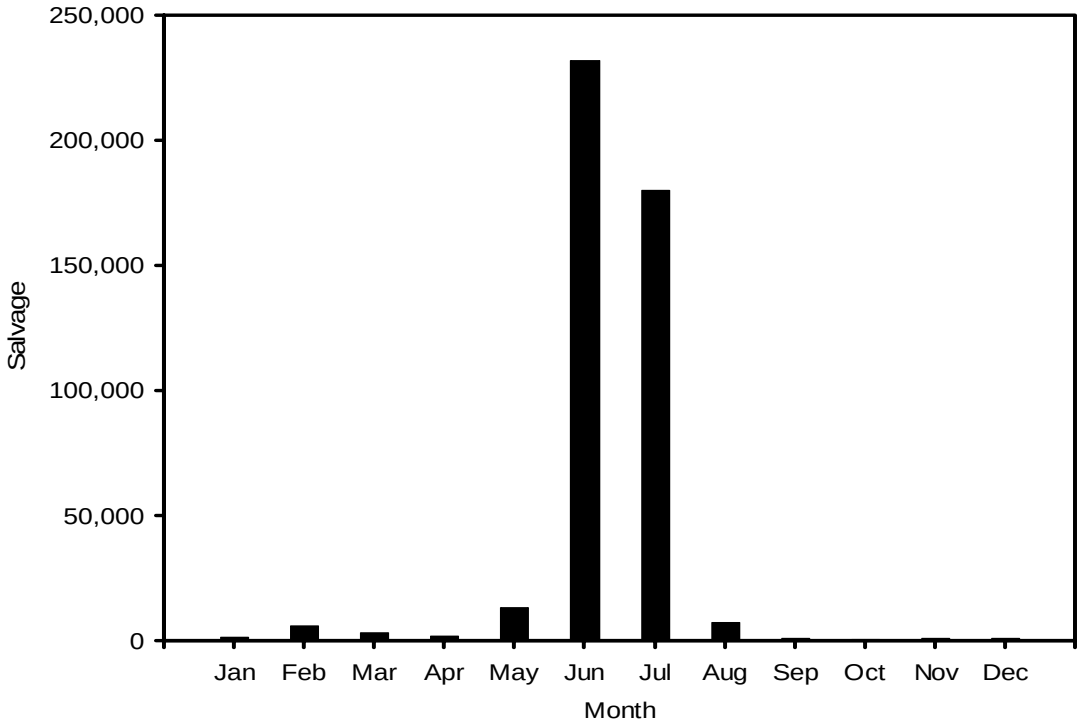


Figure 10 Monthly salvage of striped bass at the TFCF, 2007

**Delta Smelt**

Comparatively few delta smelt were salvaged, continuing the decline in salvage since 2003 (Figure 11). The 2007 annual salvage of delta smelt was 348, similar to the previous year's annual salvage of 312.

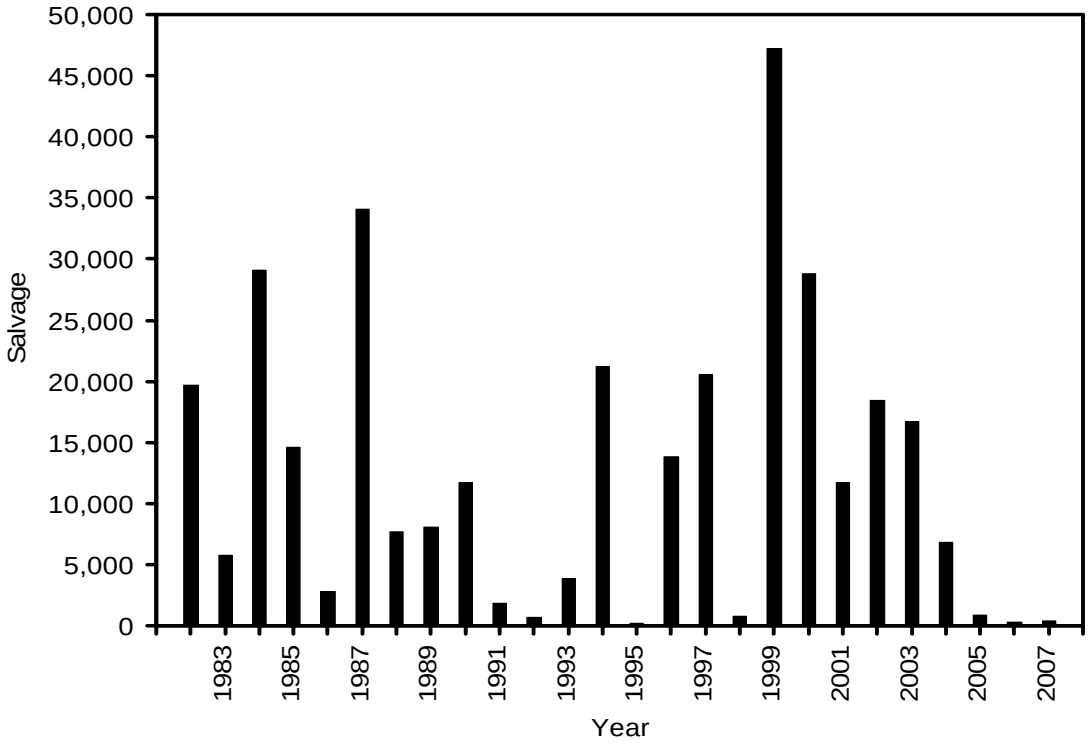


Figure 11 Annual salvage of delta smelt at the TFCF, 1982 – 2007

Delta smelt were salvaged most frequently during the spring and summer of 2007 (Figure 12). Most of the delta smelt were salvaged in May.

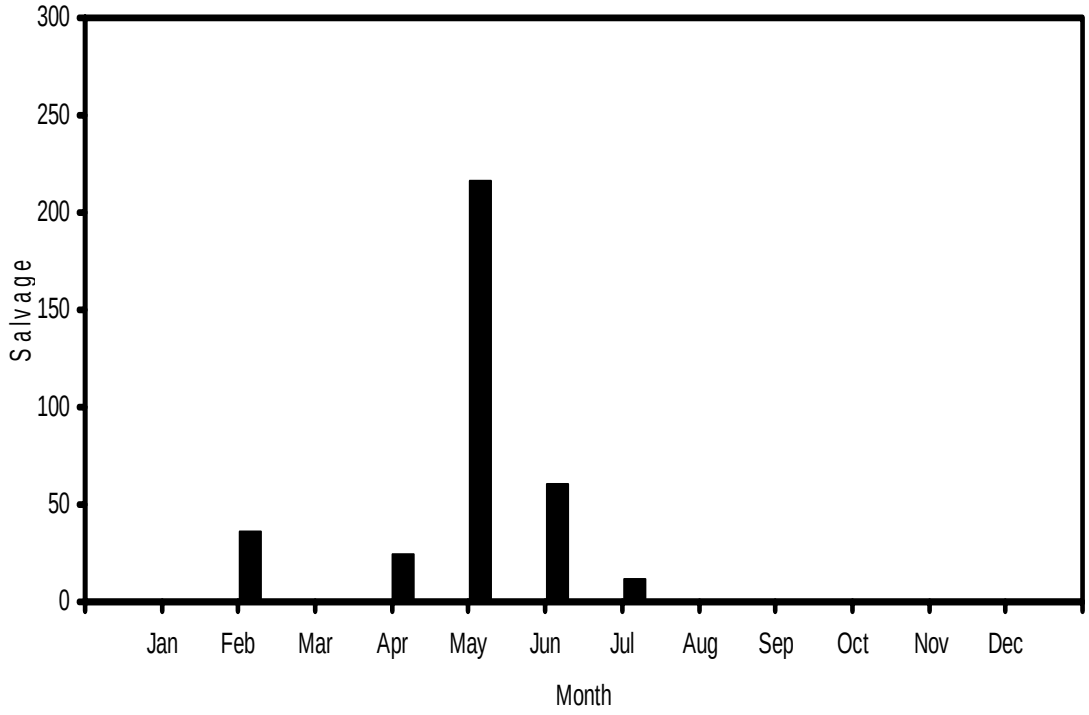


Figure 12 Monthly salvage of delta smelt at the TFCF, 2007

**Longfin Smelt**

Longfin smelt salvage continued the decline that started in 2003 (Figure 13). The annual salvage in 2007 was 48. Low or zero annual salvages of longfin smelt are not uncommon. No longfin smelt were salvaged in 1982, 1995, and 2006. Large (greater than 10,000) annual salvages of longfin smelt were observed in 1984, 1988, 1990, and 2002.

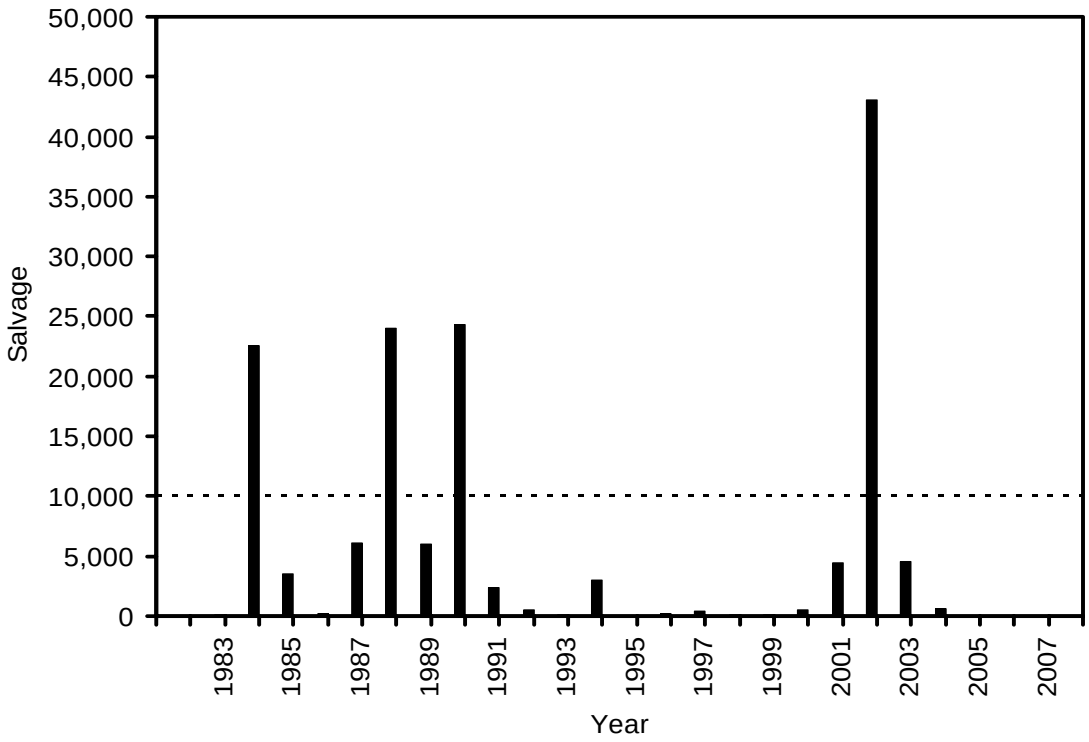


Figure 13 Annual salvage of longfin smelt at the TFCF, 1982 – 2007

Longfin smelt were salvaged in the winter and spring (Figure 14). Twelve longfin smelt were salvaged per month in January, February, May, and December.

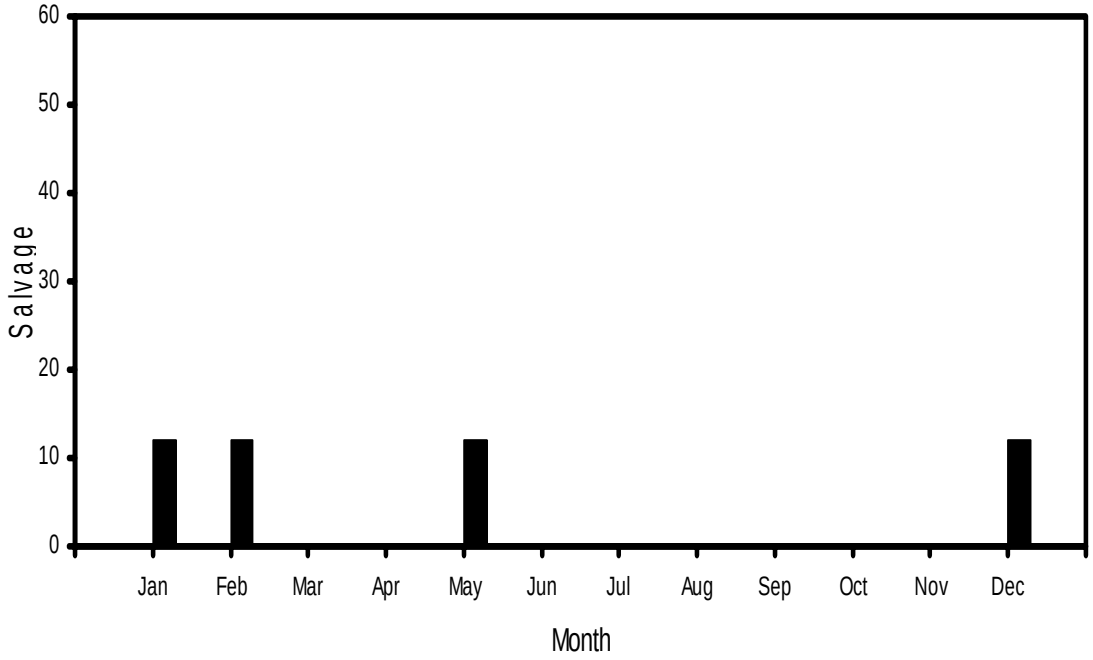


Figure 14 Monthly salvage of longfin smelt at the TFCF, 2007

**Sacramento Splittail**

The annual salvage of Sacramento splittail was substantially lower in 2007 than in 2006 (Figure 15). The salvage of 780 in 2007 was the lowest in recent record since 1982 and a marked decrease from the record-high 5.0 million in 2006.

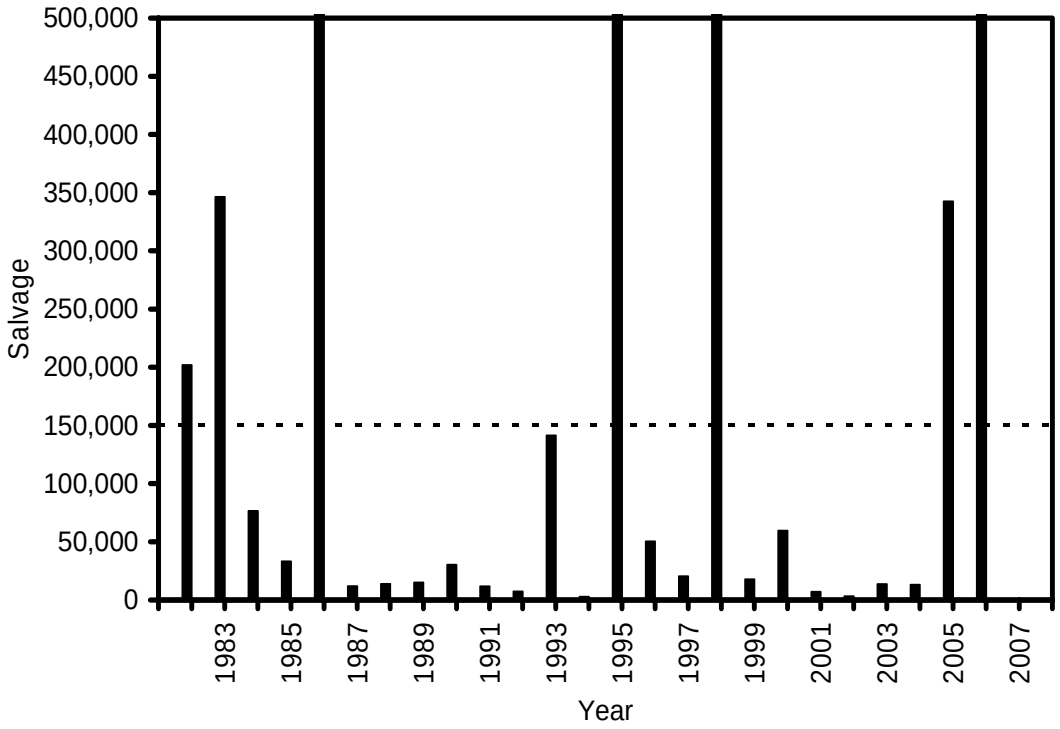


Figure 15 Annual salvage of Sacramento splittail at the TFCF, 1982 – 2007. The following annual salvages for the following years have been truncated for scale considerations: 1986 (1,231,283), 1995 (3,143,156), 1998 (2,051,660), and 2006 (5,002,611)

**Threadfin Shad**

Annual salvage of threadfin shad was markedly higher in 2007 than in 2005 and 2006 (Figure 16). The salvage of 2,242,577 in 2007 was greater than salvage of 717,112 in 2006 and 1,111,569 in 2005.

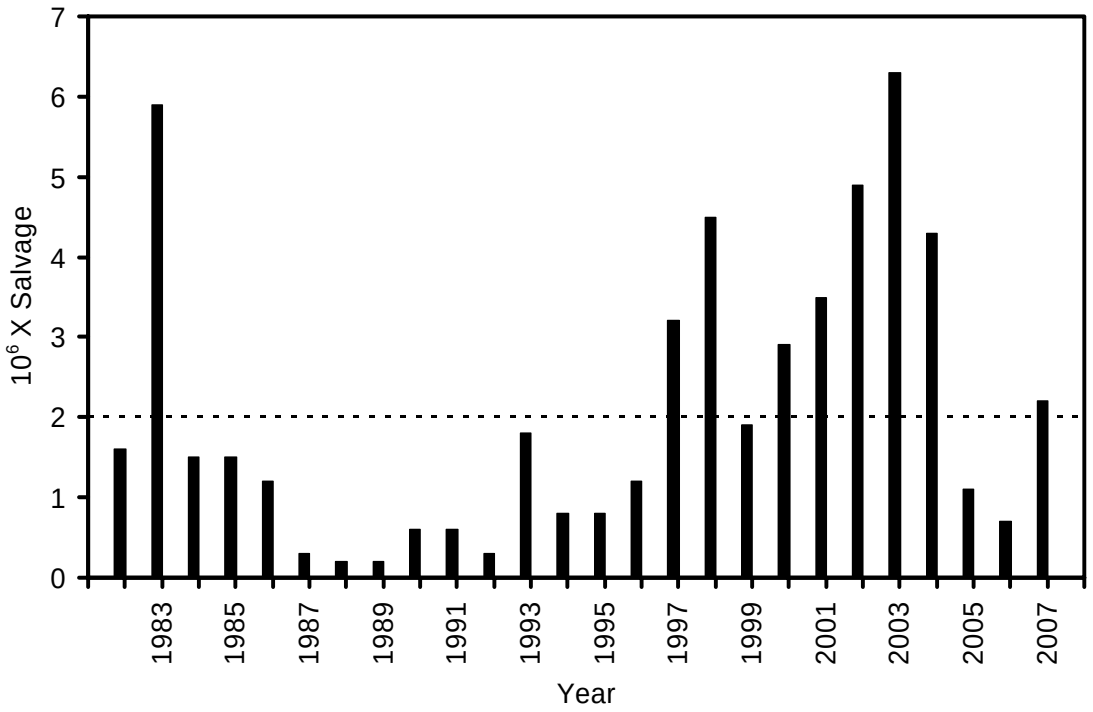


Figure 16 Annual salvage (in millions) of threadfin shad at the TFCF, 1982 – 2007

Annual salvage of threadfin shad over 2 million is historically the exception and not the rule. At the TFCF, 9 years out of 26 had annual salvages over 2 million. The majority of annual salvages over 2 million occurred in years since 2000.

**Conclusion**

The annual water export was comparable to years since 2003. Salvage in 2007 was dominated by threadfin shad and striped bass. Chinook salmon, steelhead, delta smelt, and longfin smelt were predominantly salvaged in winter and spring. Striped bass were salvaged throughout the year but mostly in summer.

Except for threadfin shad, Sacramento splittail and steelhead, salvage of all species declined in recent years.

FOOTNOTES

1. Pelagic Organism Decline (POD) species

Appendix A Annual salvage (salvage) and percentage of annual salvage (%) for fish collected from the TFCF in 2006 and 2007

| | 2007 | | 2006 | |
|---|---|---|---|---|
| Species | Salvage | % | Salvage | % |
| Threadfin shad | 2,242,577 | 70.9 | 717,112 | 1.9 |
| Striped bass | 447,971 | 14.2 | 256,080 | 0.7 |
| White catfish | 143,918 | 4.5 | 37,359 | 0.1 |
| Bluegill | 84,035 | 2.6 | 143,453 | 0.4 |
| American shad | 65,574 | 2.1 | 151,068 | 0.4 |
| Largemouth bass | 45,159 | 1.4 | 169,927 | 0.5 |
| Channel catfish | 28,587 | 0.9 | 48,803 | 0.1 |
| Inland silverside | 24,157 | 0.8 | 18,809 | 0.1 |
| Yellowfin goby | 22,276 | 0.7 | 6,468 | < 0.1 |
| Prickly sculpin | 21,318 | 0.7 | 6,198 | < 0.1 |
| Sacramento sucker | 8345 | 0.3 | 26,086 | 0.1 |
| Chinook salmon | 7622 | 0.2 | 35,319 | 0.1 |
| Black crappie | 5707 | 0.2 | 127,452 | 0.3 |
| Steelhead | 4068 | 0.1 | 2,516 | < 0.1 |
| Golden shiner | 3564 | 0.1 | 4,589 | < 0.1 |
| Redear sunfish | 1492 | < 0.1 | 1,627 | < 0.1 |
| Rainwater killifish | 1,300 | < 0.1 | 58 | < 0.1 |
| Fathead minnow | 1164 | < 0.1 | 288 | < 0.1 |
| Sacramento splittail | 780 | < 0.1 | 5,002,611 | 13.4 |
| Common carp | 746 | < 0.1 | 30,495,884 | 81.8 |
| Bigscale logperch | 702 | < 0.1 | 480 | < 0.1 |
| Shimofuri goby | 626 | < 0.1 | 438 | < 0.1 |
| Western mosquitofish | 554 | < 0.1 | 361 | < 0.1 |
| Warmouth | 420 | < 0.1 | 2,268 | < 0.1 |
| Brown bullhead | 358 | < 0.1 | 240 | < 0.1 |
| Delta smelt | 348 | < 0.1 | 312 | < 0.1 |
| Starry flounder | 220 | < 0.1 | 0 | 0.0 |
| Black bullhead | 205 | < 0.1 | 440 | < 0.1 |
| Unknown lamprey | 168 | < 0.1 | 2,028 | < 0.1 |
| Wakasagi | 144 | < 0.1 | 36 | < 0.1 |
| Red shiner | 72 | < 0.1 | 204 | < 0.1 |
| White sturgeon | 72 | < 0.1 | 1 | < 0.1 |
| Sacramento blackfish | 60 | < 0.1 | 6,972 | < 0.1 |
| Tule perch | 48 | < 0.1 | 144 | < 0.1 |
| Longfin smelt | 48 | < 0.1 | 0 | 0.0 |
| Sacramento pikeminnow | 36 | < 0.1 | 205 | < 0.1 |
| Threespine stickleback | 28 | < 0.1 | 60 | < 0.1 |
| Goldfish | 24 | < 0.1 | 48 | < 0.1 |
| Green sturgeon | 12 | < 0.1 | 324 | < 0.1 |
| Pacific staghorn sculpin | 12 | < 0.1 | 0 | 0.0 |
| Blue catfish | 1 | < 0.1 | 24 | < 0.1 |
| Riffle sculpin | 0 | 0.0 | 72 | < 0.1 |
| Green sunfish | 0 | 0.0 | 72 | < 0.1 |
| Chinese mitten crab | 0 | 0.0 | 12 | < 0.1 |