2010 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 southern portion of 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 into the western Delta. This report summarizes the 2010 operational and biological information gathered from the TFCF. 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*), splittail (*Pogonichthys macrolepidotus*), and threadfin shad[1] (*Dorosoma petenense*) .

Methods

The daily volume of water exported was reported from gauge readings at 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 2010 were noted. Salvage data from 1982 to 2010 were examined for analytical convenience and for their relevance to recent conditions.

Fish abundance was reported as "estimated salvage". Only fish longer than 20 mm FL were numerated (counts), because salvage efficiency degrades rapidly for fish smaller than that size. Salvage estimates were primarily obtained by expanding routine sample counts by the duration that water was pumped:

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

Fish collected during predator removals were not expanded:

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

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 2010.

The annual and monthly salvage estimates for Chinook salmon and steelhead were made for wild and for hatchery fish. 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.

Chinook salmon loss estimates are presented because its loss model has been widely accepted and has undergone extensive field validation. 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.

Larval and post-larval (<20 mm FL) fish sampling was done to monitor larval delta smelt and longfin smelt occurrence. The fish screen used in regular fish counts was lined with a 0.5 mm nitex net in order to retain smaller fish. Larval sampling was conducted at 0400, 1000, 1600, and 2200 hours. Larval fish were identified to species by TFCF personnel and reported by approximately 1000 the next working day.

Water Exports

The CVP exported 2,317,028 acre-feet (AF) of water (Figure 1). The annual exports

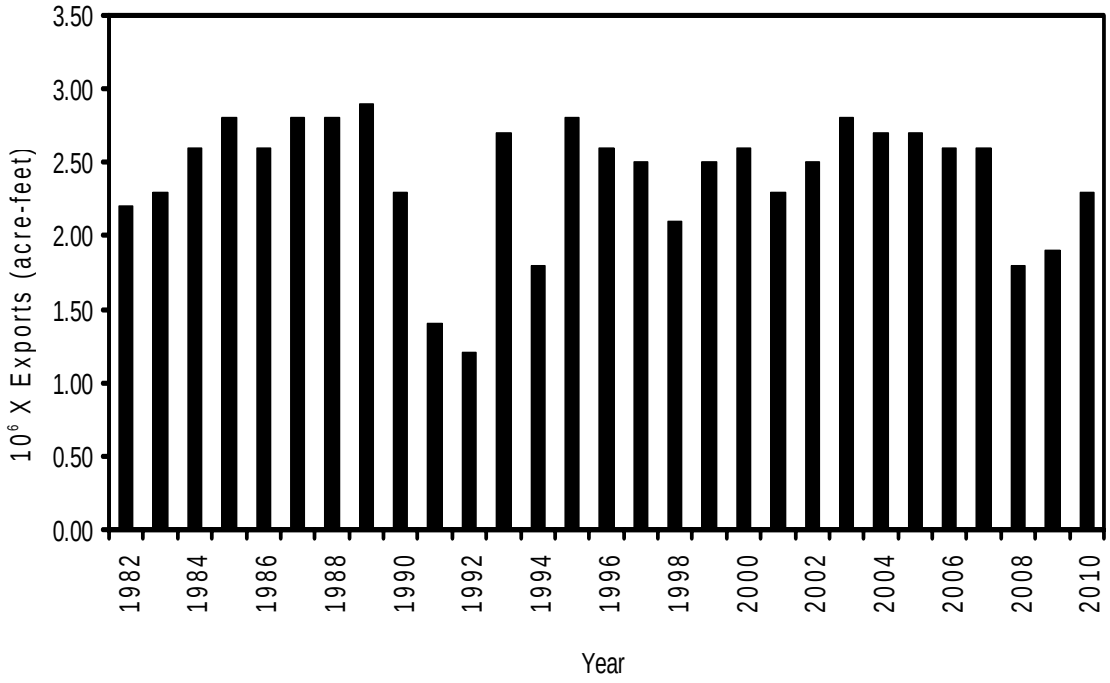

Figure 1 Annual exports (in millions of acre-feet) for the Central Valley Project, 1982 – 2010

in 2010 was an increase from 2009 (1,907,455) and 2008 (1,813,529), but reduced relative to 2004-2007 exports which ranged from 2,590,344 to 2,697,077 AF.

The majority of water exports occurred in July-December (Figure 2). Monthly exports ranged from 48,320 to 254,313 AF. In July-December, a total of 1,496,957 AF was exported, accounting for 64.6% of the annual export. Combined export for April-June was 308,900 AF which was a small reduction from the same period during 2004-2007 (358,873- 439,833 AF), but an increase from 2008 (174,096 AF) and 2009 (225,615 AF).

Total Salvage and Prevalent Species

Salvage at the TFCF was low at 1,387,644, although it was an increase from the record low salvage of 859,669 in 2009 (Figure 3). Salvage was substantially lower than in

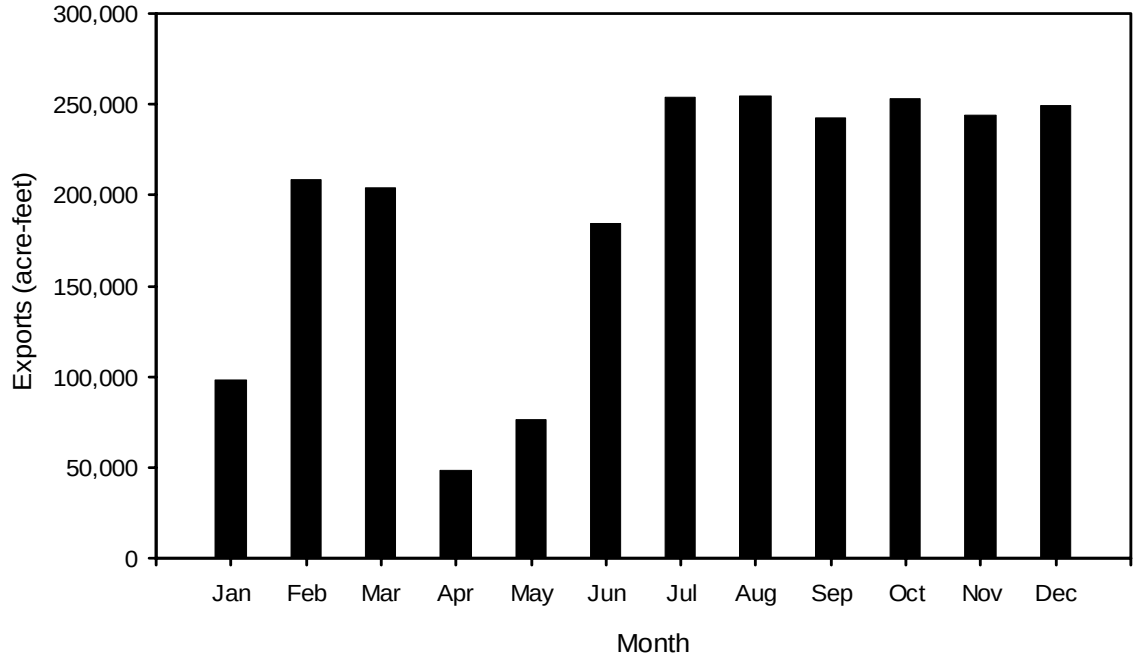

Figure 2 Monthly exports (in acre-feet) for the Central Valley Project, 2010

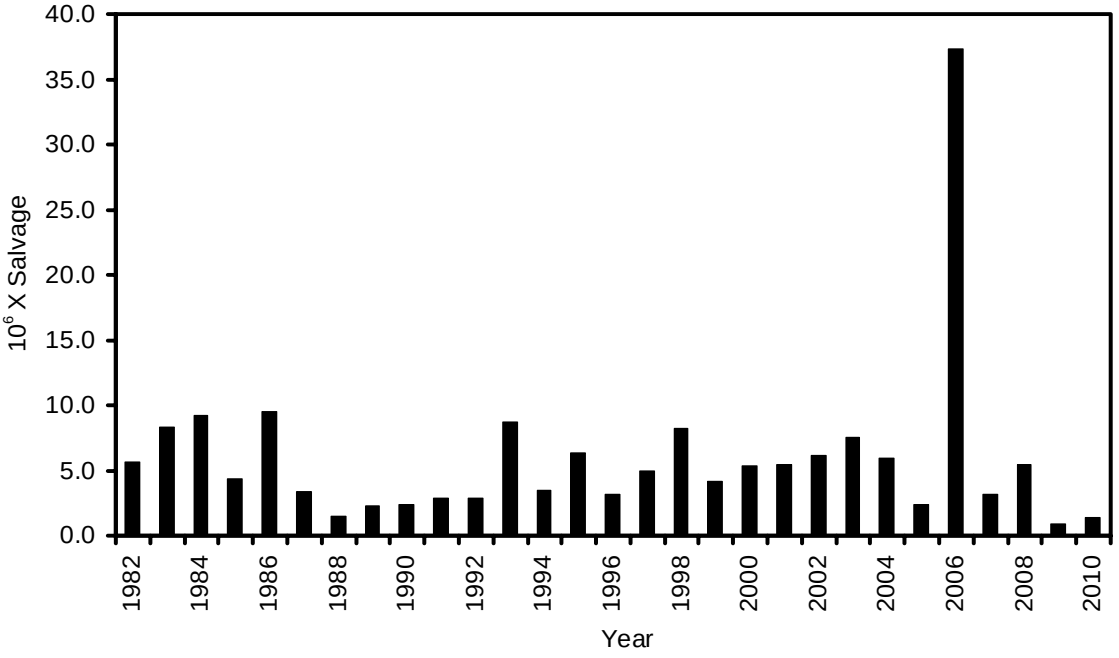

Figure 3 Annual salvage (in millions) of all taxa combined at the TFCF, 1982 – 2010

previous years, which ranged 1.5-37.3 million from 1982 through 2008. Threadfin shad accounted for 58.5% of the annual salvage (Figure 4 and Appendix A). Threadfin shad usually make up the bulk of salvage, although salvage in 2006 — when common carp accounted for 81.8% (30,495,884) of salvage — was an exception. The only other species to be salvaged in substantial numbers in 2010 were splittail (11.6%) and American shad (7.2%). Striped bass salvage decreased to 6.5% in 2010 compared to 2009 (15.0%).

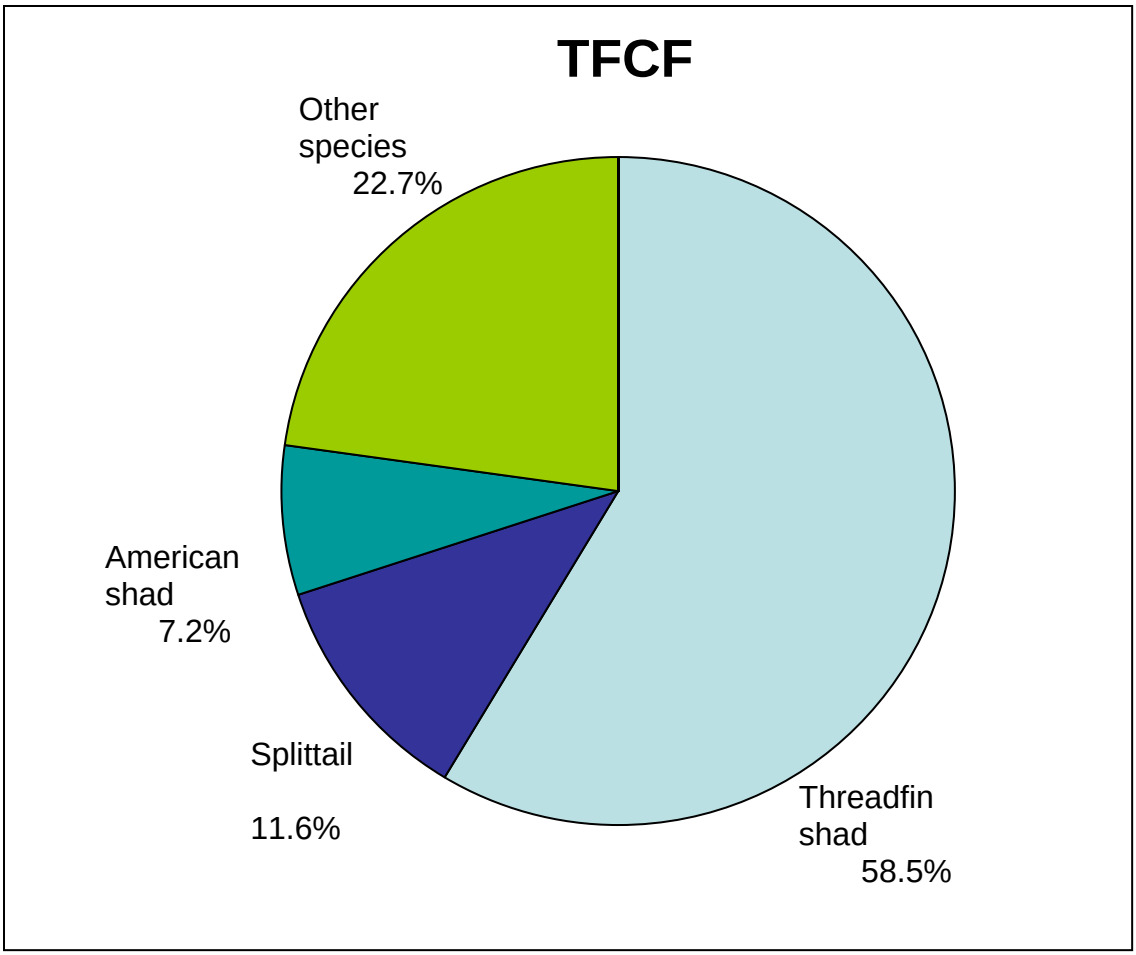

Figure 4 Percentages of annual salvage for the 3 most prevalent species and other species combined at the TFCF, 2010

Chinook salmon, steelhead, delta smelt, and longfin smelt accounted for 0.8% of salvage.

Chinook Salmon

Annual salvage (all races and origins combined) of 8,119 Chinook salmon continued the low salvage trend since 2001 (Figure 5). Annual salvage was higher than the annual salvage observed in 2009 (4,666), 2007 (7,622), and similar to 2008 (8,786), but was a substantial decrease from the annual salvage in 2006 (35,319). Mean 2001-2010 salvage was about 6-fold lower than salvage in the 1980's and the late 1990's.

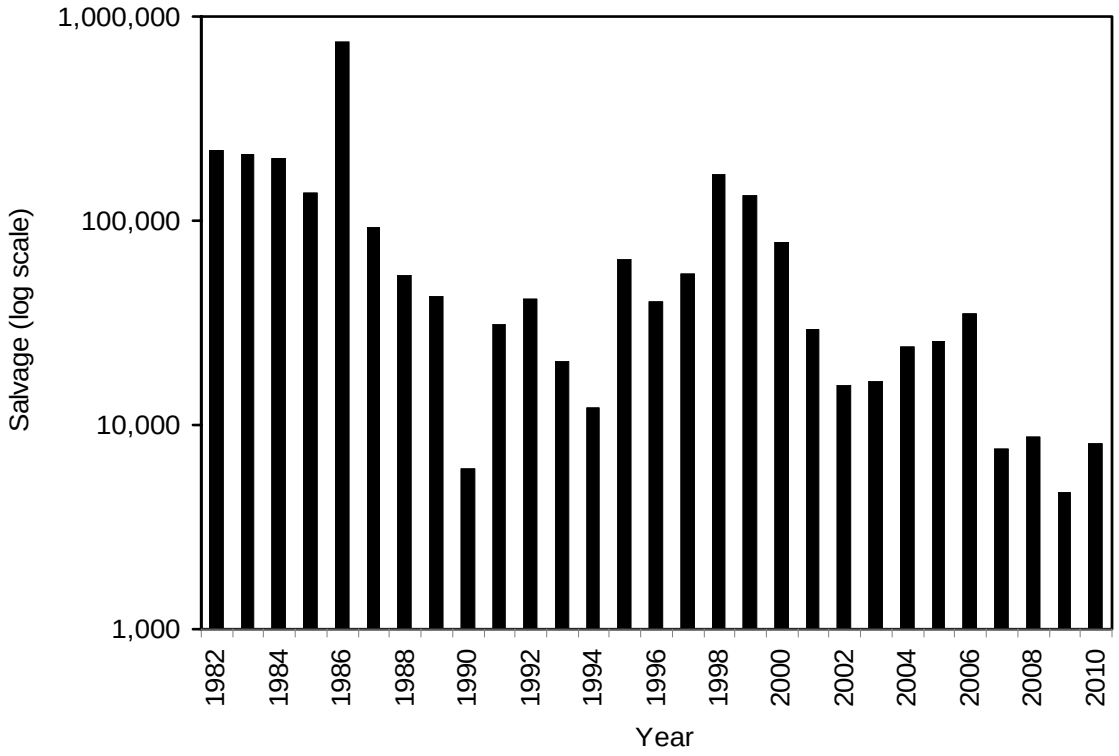

Figure 5 Annual salvage of Chinook salmon (all races and origins combined) at the TFCF, 1982 – 2010

Salvaged Chinook salmon consisted primarily of wild spring run salmon (48.4%; Table 1) followed by wild fall run salmon (35.1%). Fall run salmon were salvaged January-July and November-December while spring run salmon were salvaged March-June (Figure 6). The majority of spring run salmon (48%) and fall run salmon (71%) were salvaged in May. The estimated loss of salmon in 2010 was 6,369 (Table 1).

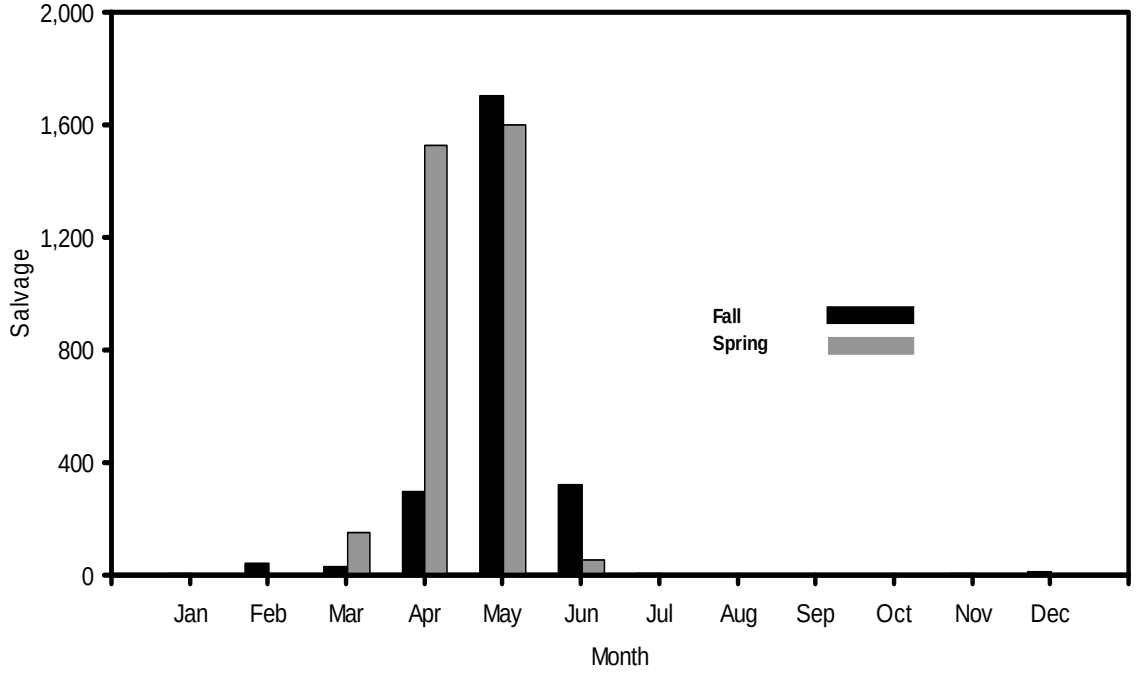

Figure 6 Monthly salvage of wild fall run and wild spring run Chinook salmon at the TFCF, 2010

Table 1 Chinook salmon annual salvage, percentage of annual salvage, race and origin (wild or hatchery), and loss at the TFCF, 2010

Origin	Race	Salvage	Percentage	Loss
Wild	Fall	2,417	35.1	1,855
	Late-fall	172	2.5	115
	Spring	3,335	48.4	2,848
	Winter	969	14.0	679
Total Wild		**6,893**		**5,497**
Hatchery				
	Fall	56	4.6	40
	Late-fall	239	19.7	167
	Spring	30	2.5	23
	Winter	889	73.2	634
Total Hatchery		**1,214**		**864**
Unknown Race		**12**		**8**
Grand Total		***8,119***		***6,369***

Steelhead

Annual salvage (all origins combined) of steelhead was 3,088 (Figure 7). Salvage increased from 2009 (712) and 2008 levels (1,887). Annual steelhead salvage in 2007 (4,068) was greater than in 2005 (1,347) and 2006 (2,516).

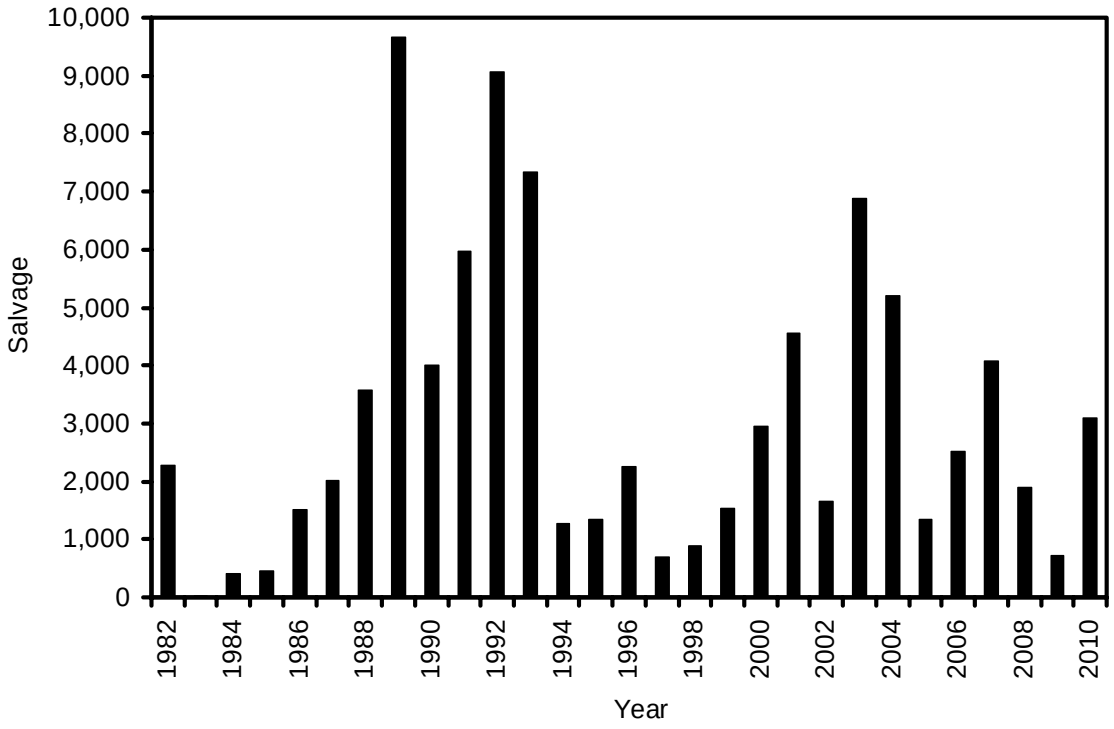

Figure 7 Annual salvage of steelhead (all origins combined) at the TFCF, 1982 – 2010

The majority of salvaged steelhead were of hatchery origin. The salvage composition was 2,460 hatchery and 628 wild fish.

All salvage of steelhead occurred in the first half of the year. Hatchery and wild steelhead were salvaged January-June (Figure 8). Both hatchery and wild steelhead were salvaged most frequently in February.

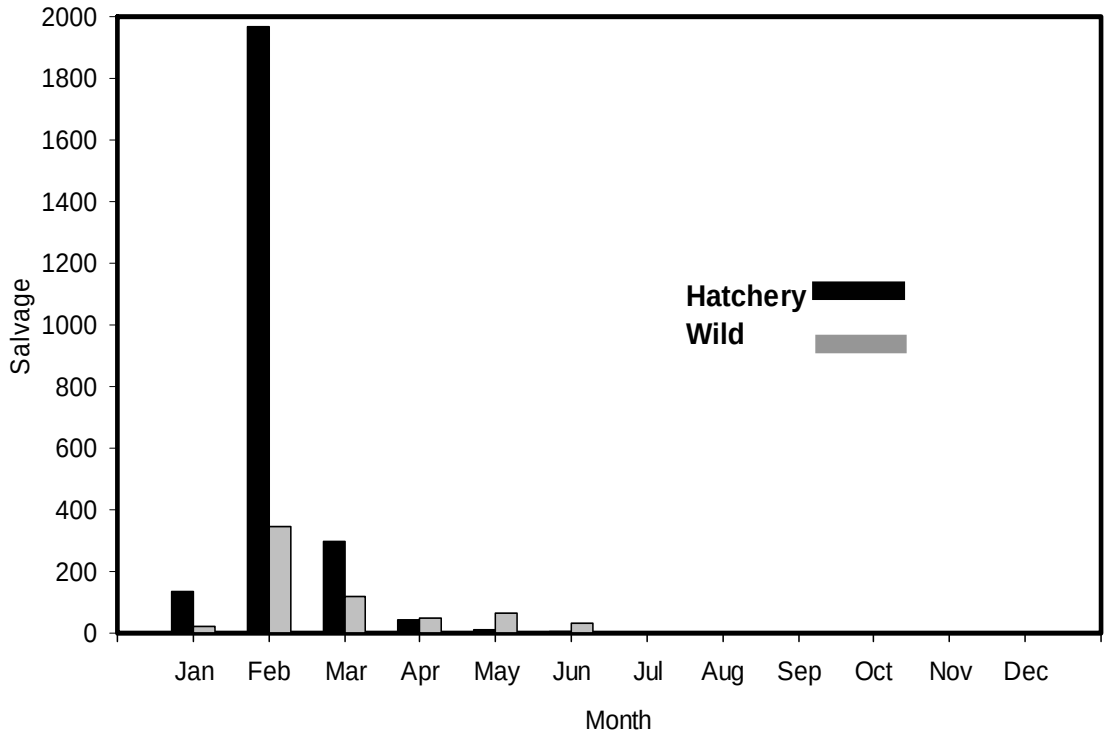

Figure 8 Monthly salvage of hatchery and wild steelhead at the TFCF, 2010

Striped Bass

The annual salvage of 90,328 striped bass continued the low trend observed since 1995 (Figure 9). Annual salvage in 2001 (1,182,799) was a large increase from the 1995-2000 salvage but decreased again from 2002-2008 salvage. Prior to 1995 and except for 1983 and 1988, annual striped bass salvage was generally above 1,000,000.

Striped bass exhibited a bimodal monthly salvage distribution and were most frequently salvaged in January-March and June-July (Figure 10). Low salvage in April and May coincided with low monthly water exports. The March salvage (20,639) and June salvage (20,669) accounted for 46% of the annual salvage. Striped bass were salvaged every month and the lowest salvage occurred in May (253).

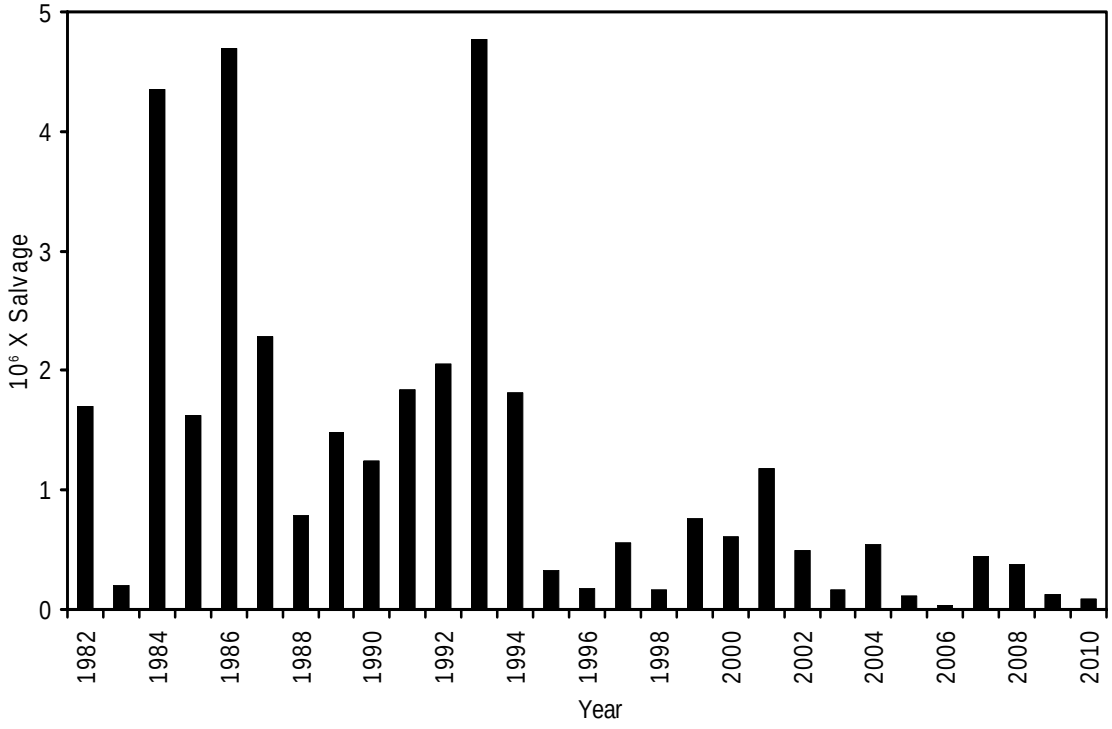

Figure 9 Annual salvage (in millions) of striped bass at the TFCF, 1982 – 2010

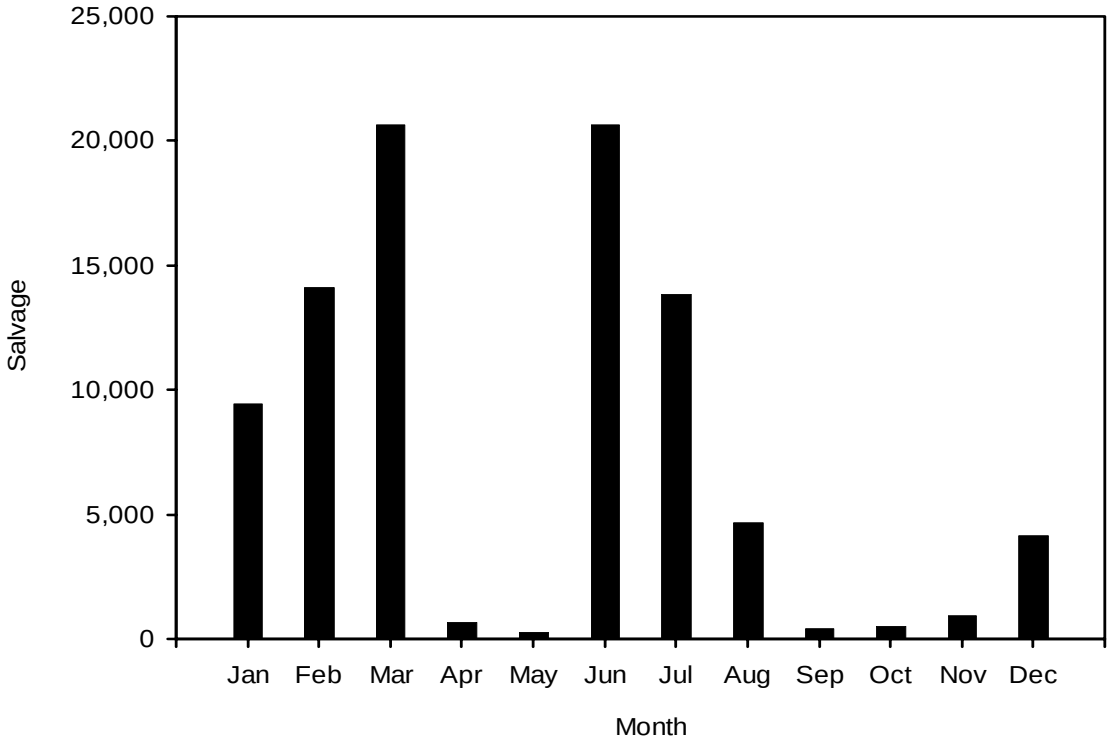

Figure 10 Monthly salvage of striped bass at the TFCF, 2010

Delta Smelt

The annual salvage of delta smelt (95) was the lowest on record and continued the low trend observed since 2005 (Figure 11). Salvage during 2005 to 2010 (95 - 1,009) was the lowest 6-year period of salvage on record.

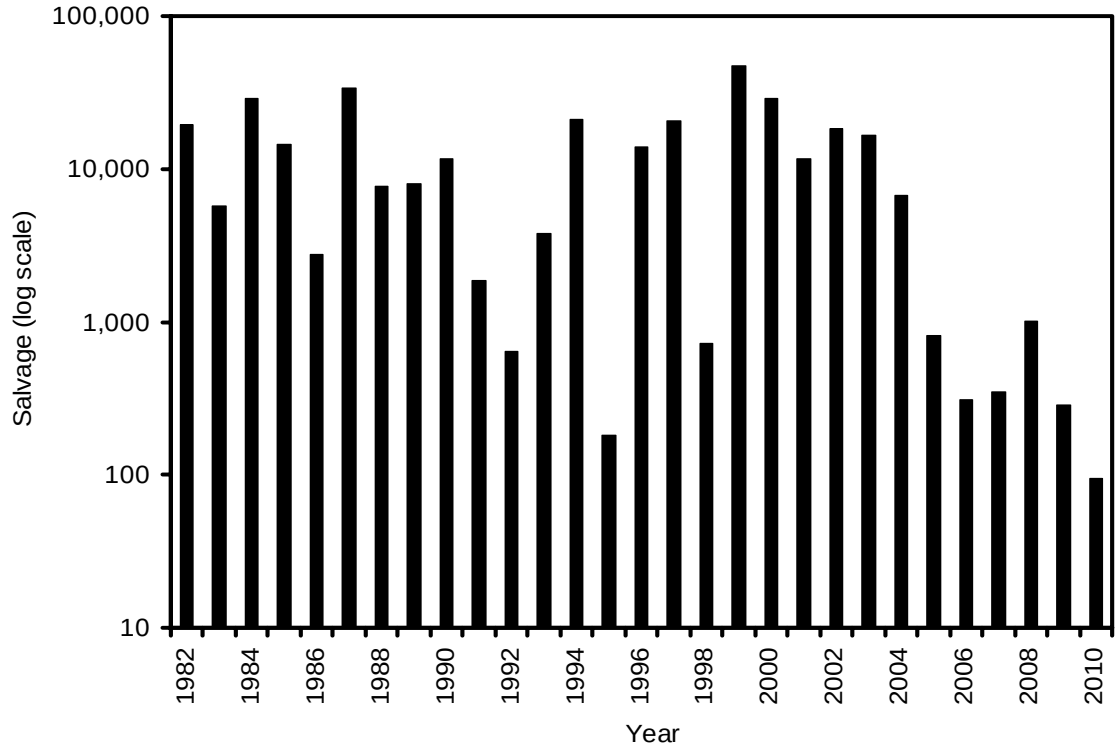

Figure 11 Annual salvage of delta smelt at the TFCF, 1982 – 2010

Delta smelt were salvaged most frequently during late winter (Figure 12). Most of the delta smelt were salvaged in February (44) and March (28) which accounted for 76% of the annual salvage.

Only 1 delta smelt less than 20 mm was detected on May 12. In contrast, delta smelt larvae or post-larvae were observed on 19 days in 2009.

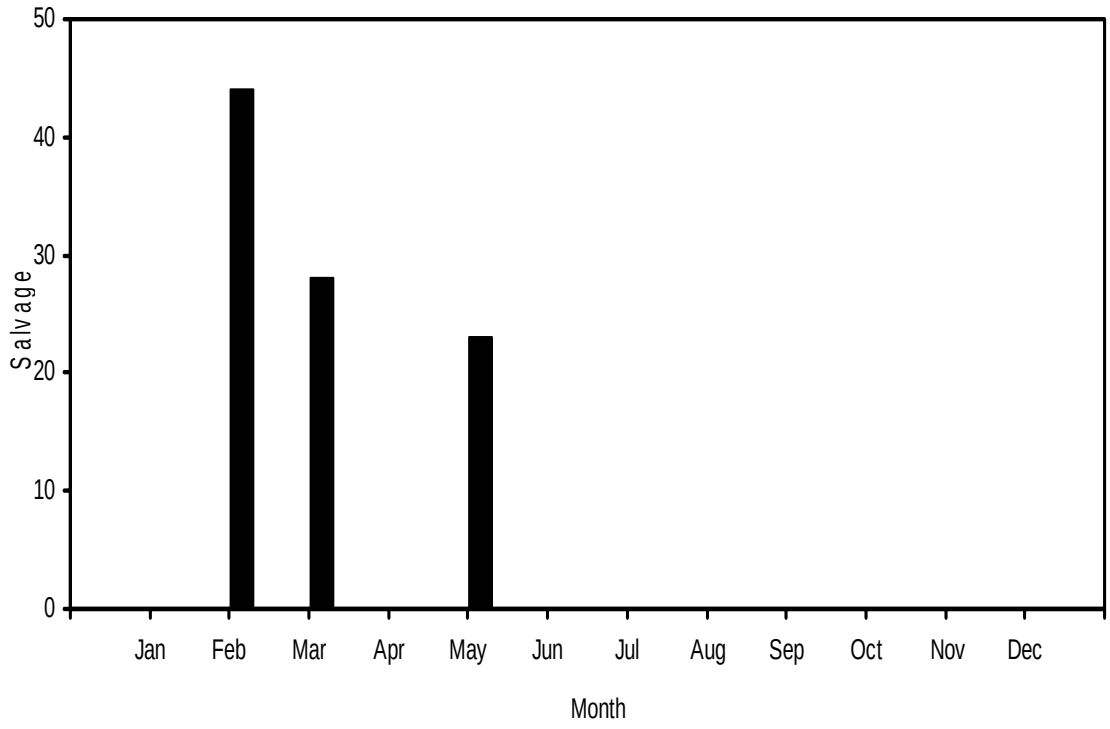

Figure 12 Monthly salvage of delta smelt at the TFCF, 2010

Longfin Smelt

Longfin smelt continued to be salvaged at low levels (31). Low annual salvages have been observed since 1991, with the exception of 43,080 salvaged in 2002 (Figure 13). The annual salvage in 2009 was 66.

Longfin smelt were salvaged in spring (Figure 14). Salvage of juvenile longfin smelt peaked in May (28; 90%).

Only 1 longfin smelt less than 20 mm was detected on April 18. In contrast, longfin smelt larvae or post-larvae were observed on 10 days in 2009.

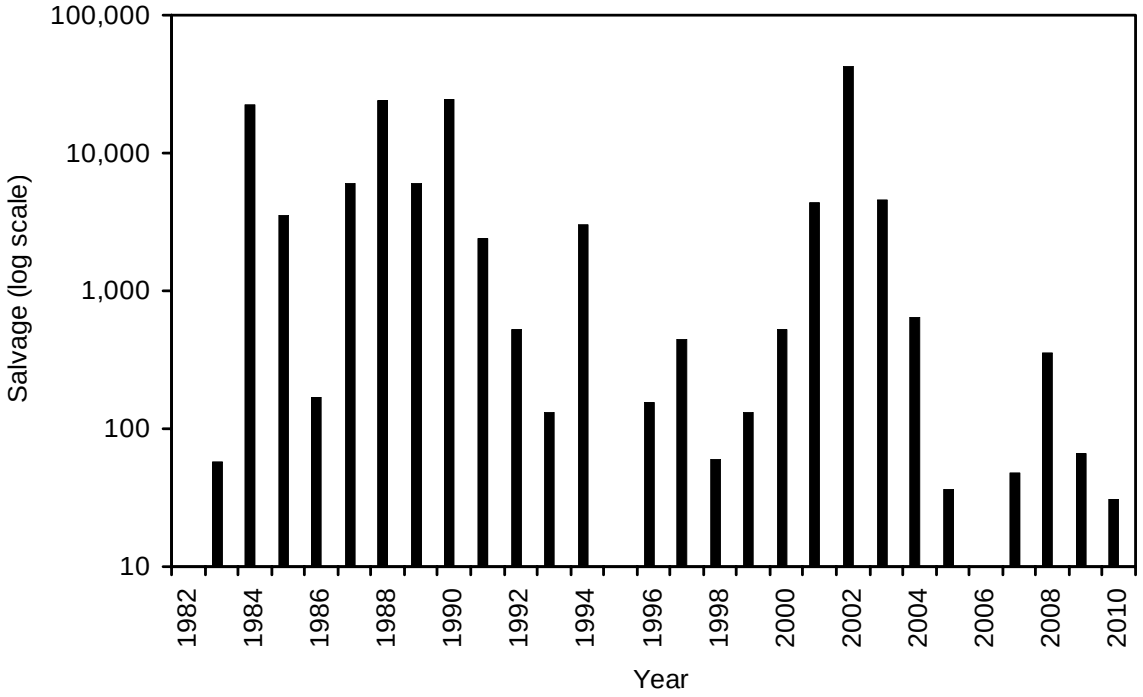

Figure 13 Annual salvage of longfin smelt at the TFCF, 1982 – 2010

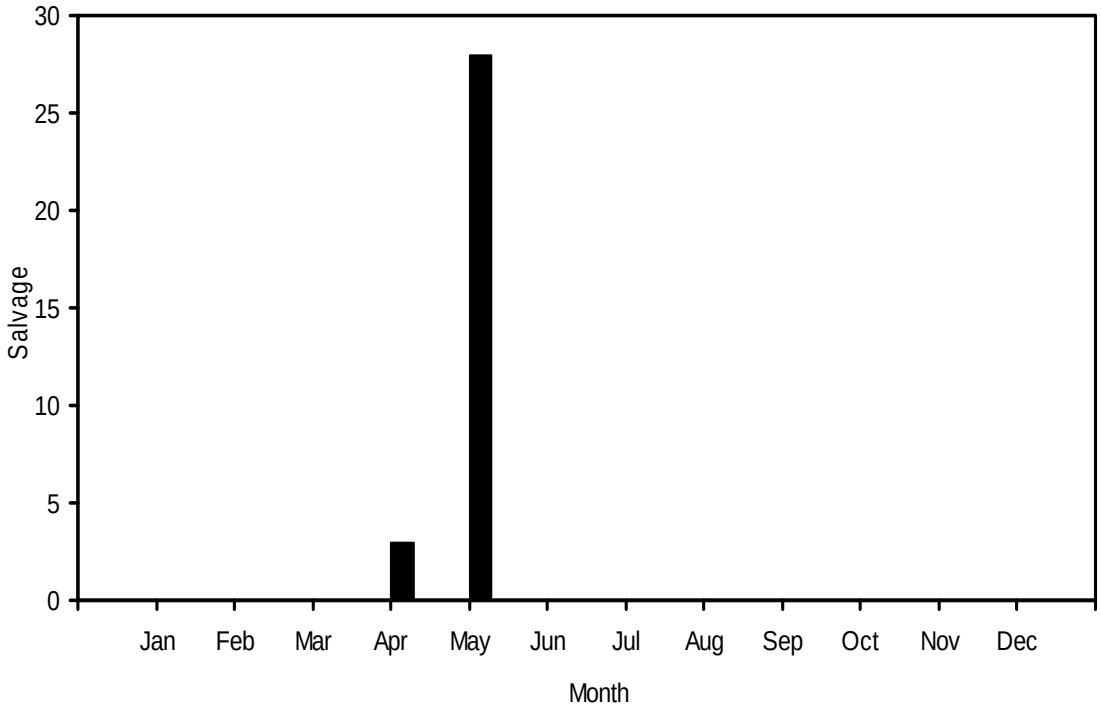

Figure 14 Monthly salvage of longfin smelt at the TFCF, 2010

Splittail

The annual salvage of splittail in 2010 (161,050) was markedly higher than in 2009 (1,405) and 2008 (1,439). Salvage in 2007 (780) was the lowest in recent record and a marked decrease from the record-high salvage in 2006 (5.0 million). Splittail salvage has followed a boom-or-bust pattern, often varying year to year by several orders of magnitude (Figure 15).

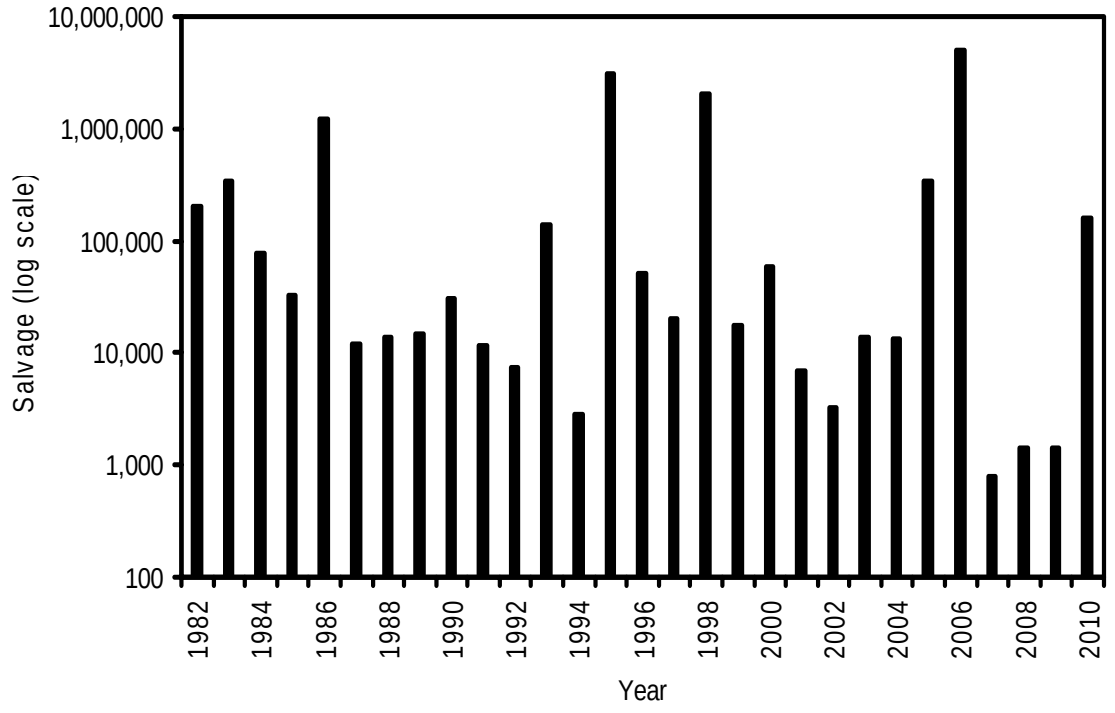

Figure 15 Annual salvage of splittail at the TFCF, 1982 – 2010

Threadfin Shad

Annual salvage of threadfin shad in 2010 (811,164) was an increase from 2009 (401,911), but markedly lower than in 2008 (4,617,313) and 2007 (2,242,577). Similar to splittail, annual salvage of threadfin shad has varied greatly through time (Figure 16). Prior to

2005, the 2000-2004 salvage (2.9 - 6.3 million) was the highest 5-year period of salvage on record.

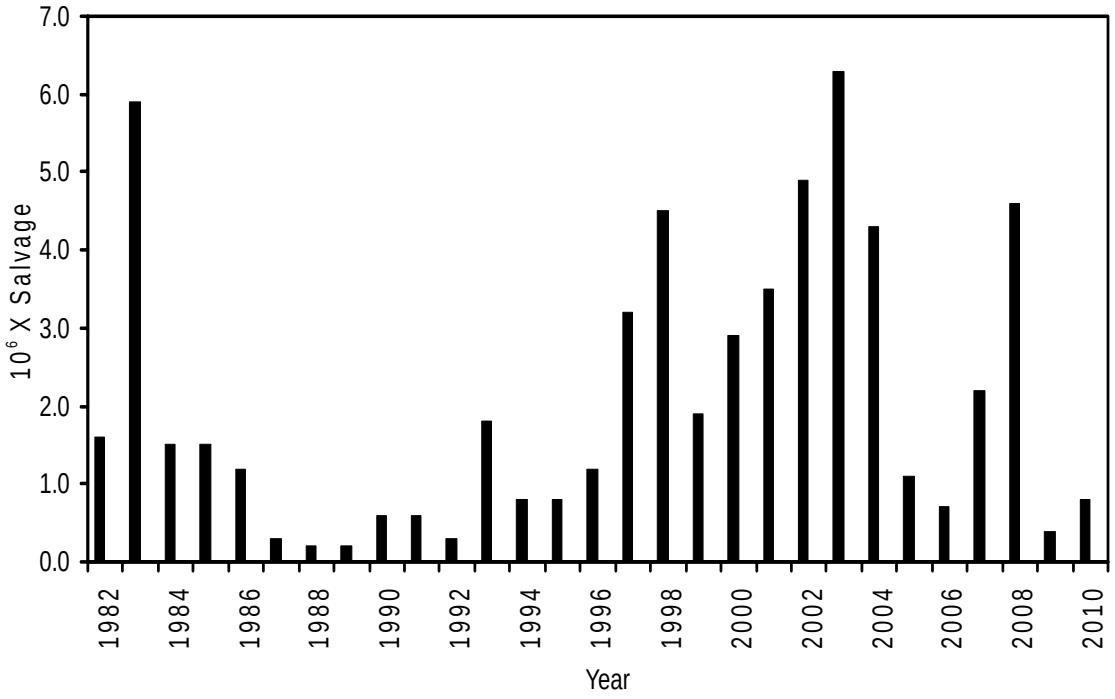

Figure 16 Annual salvage (in millions) of threadfin shad at the TFCF, 1982 – 2010

FOOTNOTES

1. Pelagic Organism Decline (POD) species

Appendix A Annual salvage (salvage) and percentage of annual salvage (%) for fish collected from the TFCF in 2009 and 2010

Species	2010 Salvage	%	2009 Salvage	%
Threadfin shad	811,164	58.5	401,911	46.7
Splittail	161,050	11.6	1,405	0.2
American shad	99,847	7.2	110,710	12.9
Striped bass	90,328	6.5	128,790	15
White catfish	62,071	4.5	49,473	5.8
Bluegill	58,410	4.2	27,692	3.2
Yellowfin goby	26,404	1.9	18,638	2.2
Channel catfish	24,190	1.7	31,250	3.6
Largemouth bass	14,956	1.1	45,387	5.3
Inland silverside	11,753	0.8	22,626	2.6
Chinook salmon	8,119	0.6	4,666	0.5
Shimofuri goby	5,726	0.4	3,766	0.4
Prickly sculpin	3,241	0.2	5,849	0.7
Steelhead	3,088	0.2	712	0.1
Golden shiner	1,556	0.1	801	0.1
Unknown lamprey	1,545	0.1	172	<0.1
Rainwater killifish	1,125	0.1	2,645	0.3
Redear sunfish	882	0.1	419	<0.1
Black crappie	801	0.1	601	0.1
Western mosquitofish	304	<0.1	92	<0.1
Warmouth	186	<0.1	192	<0.1
Threespine stickleback	171	<0.1	352	<0.1
Brown bullhead	150	<0.1	28	<0.1
Delta smelt	95	<0.1	286	<0.1
Common carp	95	<0.1	261	<0.1
Bigscale logperch	87	<0.1	166	<0.1
Tule perch	52	<0.1	28	<0.1
Black bullhead	41	<0.1	16	<0.1
Longfin smelt	31	<0.1	66	<0.1
Western brook lamprey	28	<0.1	0	0
Pacific staghorn sculpin	24	<0.1	100	<0.1
Sacramento sucker	20	<0.1	24	<0.1
White crappie	20	<0.1	0	0
Starry flounder	16	<0.1	4	<0.1
Red shiner	12	<0.1	63	<0.1
Fathead minnow	8	<0.1	340	<0.1
Wakasagi	8	<0.1	104	<0.1
Blue catfish	8	<0.1	0	0
Hitch	5	<0.1	0	0
Shokihaze Goby	4	<0.1	8	<0.1

Appendix A (Cont) Annual salvage (salvage) and percentage of annual salvage (%) for fish collected from the TFCF in 2009 and 2010

Species	2010 Salvage	%	2009 Salvage	%
Green sunfish	4	<0.1	4	<0.1
Sacramento pikeminnow	4	<0.1	3	<0.1
Goldfish	4	<0.1	0	0
Smallmouth bass	4	<0.1	0	0
Sacramento blackfish	4	<0.1	0	0
Chinese mitten crab	3	<0.1	12	<0.1