2009 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 salvage information from the TFCF in 2009. 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 splittail (*Pogonichthys macrolepidotus*).

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 2009 were noted. Salvage data from 1982 to 2009 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 2009.

The annual and daily 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 conventional fish screen 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 1,907,455 acre-feet (AF) of water (Figure 1). The annual exports in

2009 and 2008 (1,813,529) were reduced relative to 2004-2007 exports which ranged from 2,590,344 to 2,697,077 AF.

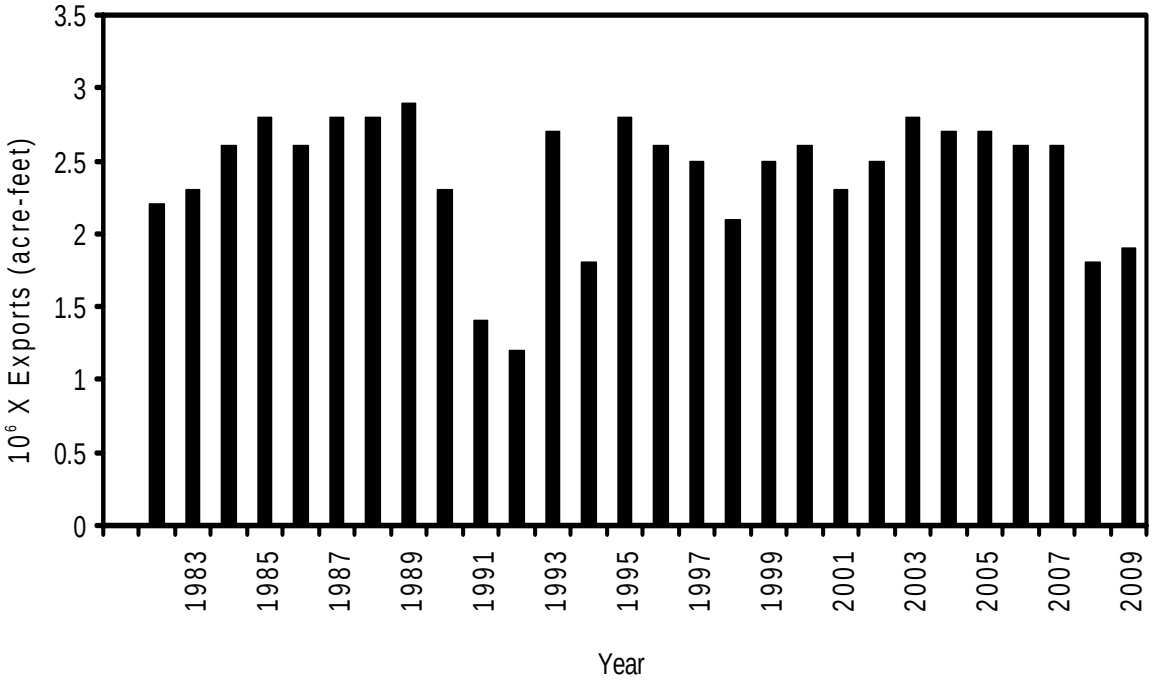

Figure 1 Annual exports (in millions of acre-feet) for the Central Valley Project, 1982 – 2009

The majority of water exports occurred in July-October (Figure 2). Monthly exports ranged from 63,943 to 252,968 AF. In July-October, a total of 970,348 AF was exported, accounting for 51 % of the annual export. Combined export for April-June was 225,615 AF which was a reduction from the same period during 2004-2007 (358,873- 439,833 AF), but similar to 2008 (174,096 AF).

Total Salvage and Prevalent Species

Salvage at the TFCF was a record-low 859,669 (Figure 3). Salvage was substantially lower than in 2008 (5,365,057) and in previous years, which ranged 1.5-37.3 million from 1982 through 2007.

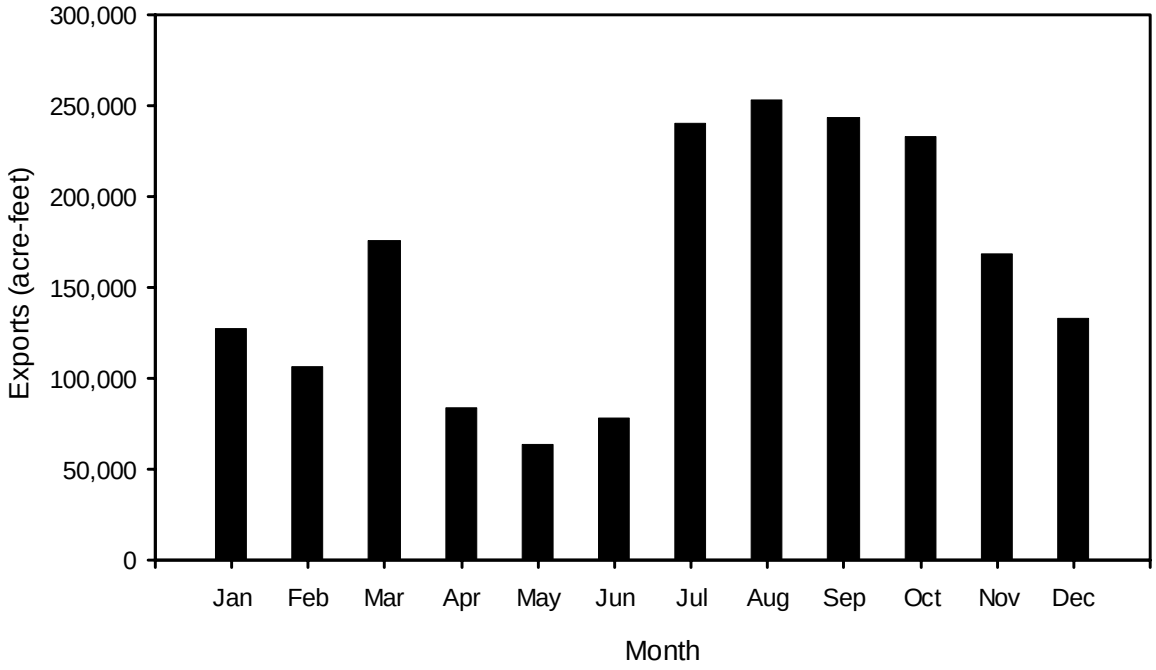

Figure 2 Monthly exports (in acre-feet) for the Central Valley Project, 2009

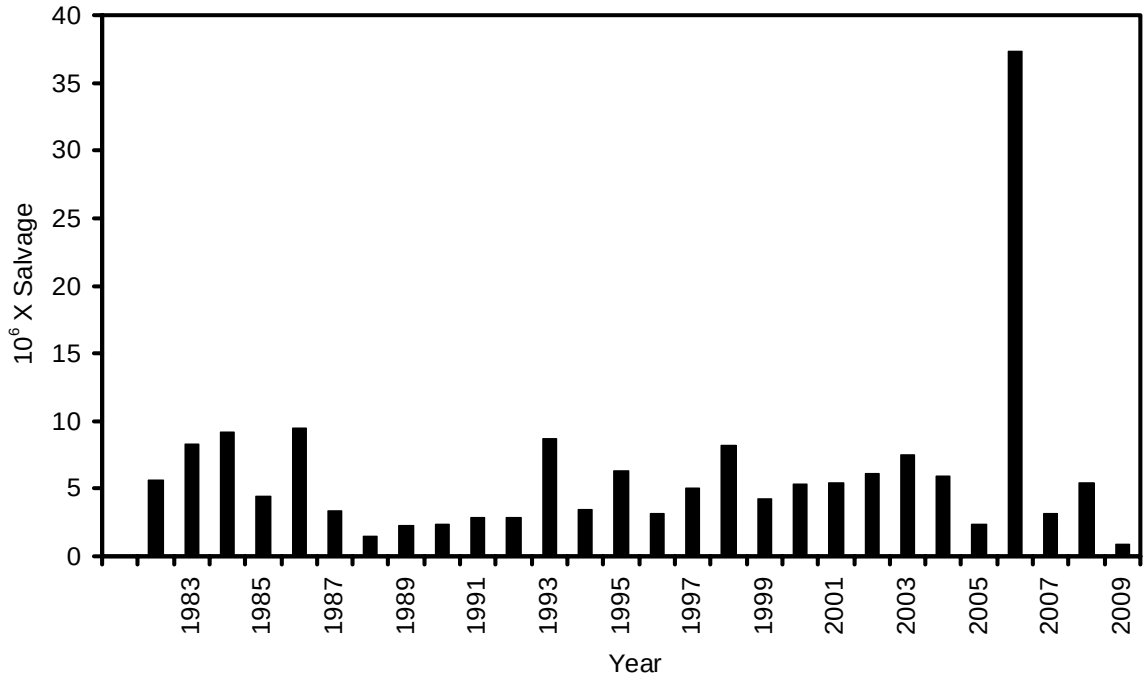

Figure 3 Annual salvage (in millions) of all taxa combined at the TFCF, 1982 – 2009

Threadfin shad accounted for 46.7% 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 2009 were striped bass (15.0%) and American shad (12.9%). Striped bass salvage increased in 2009 compared to 2008 (7.0%).

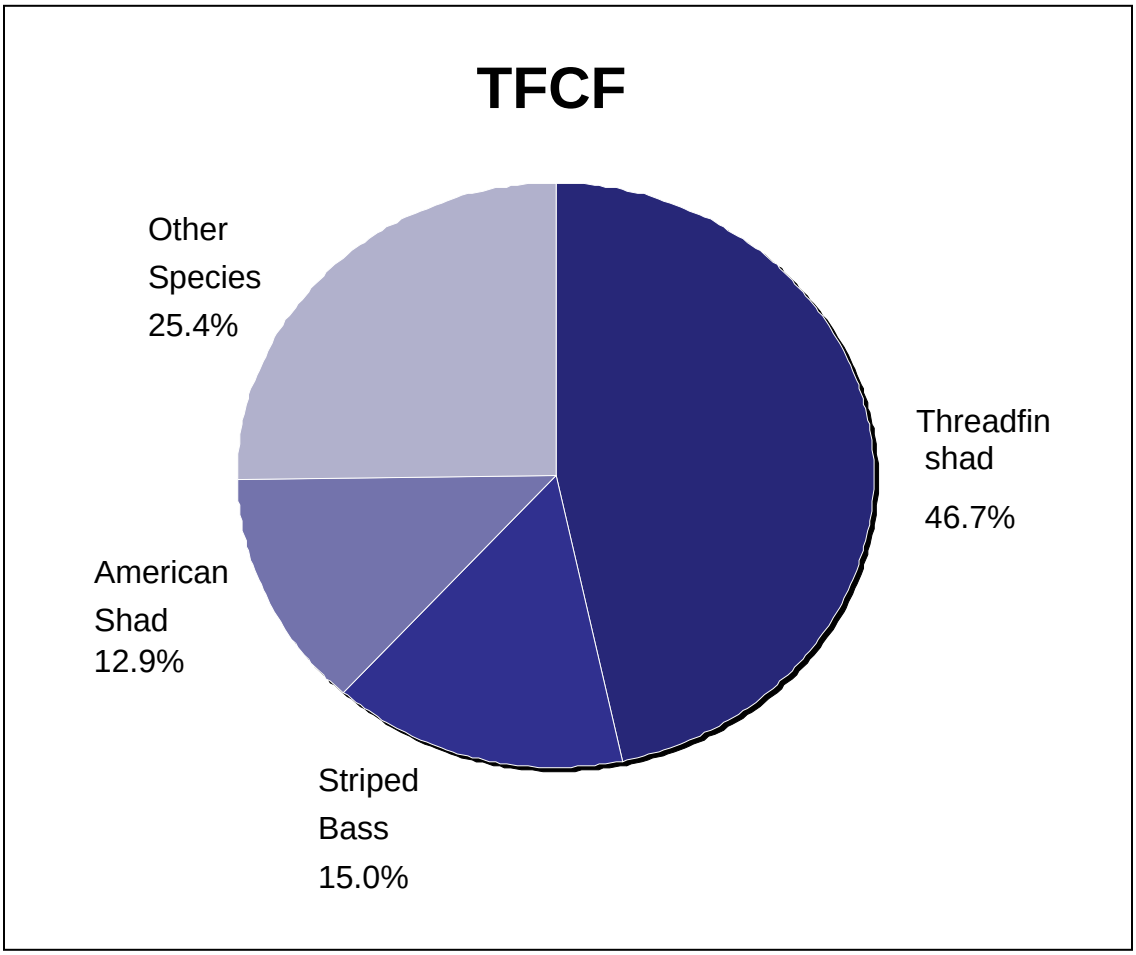

Figure 4 Percentages of annual salvage for the 3 most prevalent species and other species combined at the TFCF, 2009

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

Chinook Salmon

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

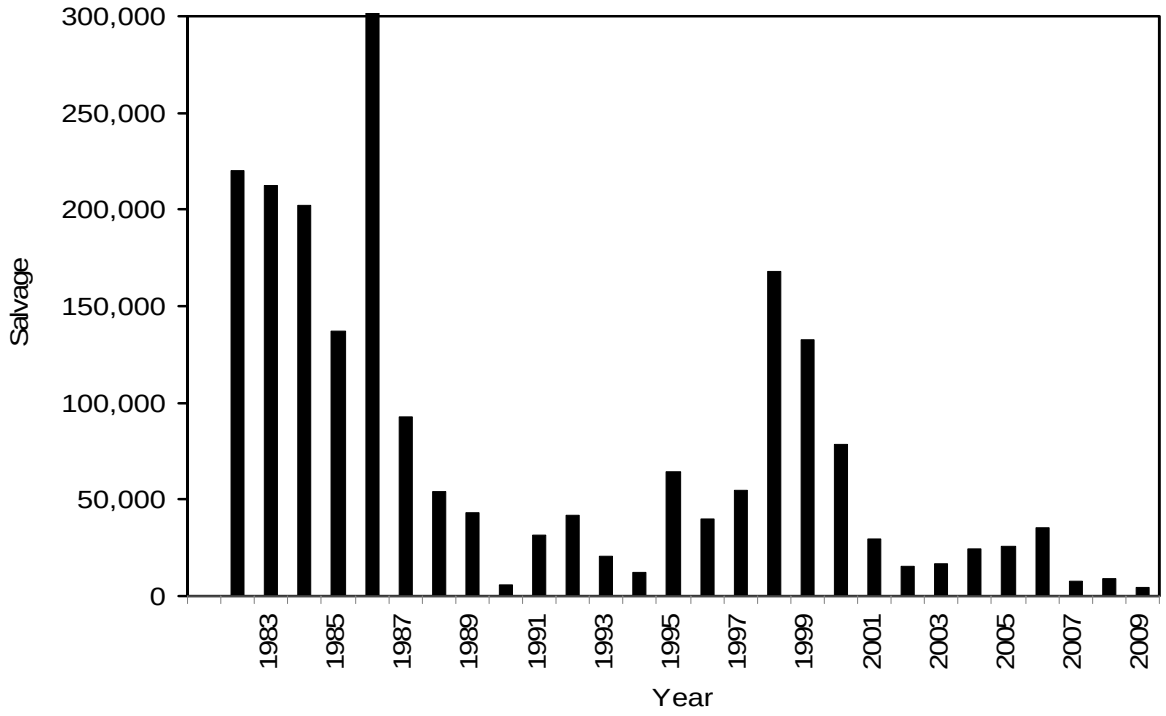

Figure 5 Annual salvage of Chinook salmon (all races and origins combined) at the TFCF, 1982 – 2009. The 1986 salvage of 752,039 was truncated for scale considerations

Salvaged Chinook salmon consisted primarily of wild spring run salmon (72%; Table 1) followed by wild fall run salmon (22%). Spring run and fall run salmon were salvaged March-June (Figure 6). The majority of spring run salmon were salvaged in April (66%) and the majority of fall run salmon were salvaged in May (75%). The estimated loss of salmon in 2009 was 3,682 (Table 1).

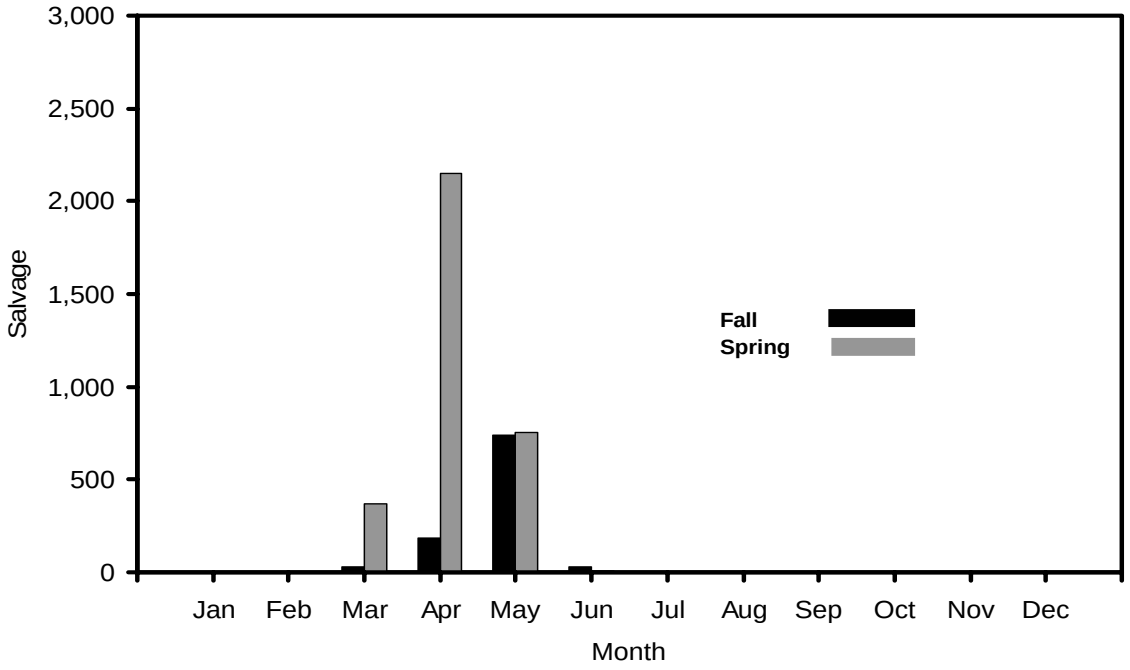

Figure 6 Monthly salvage of wild fall run and wild spring run Chinook salmon at the TFCF, 2009

Table 1 Chinook salmon annual salvage, percentage of annual salvage, race and origin (wild or hatchery), and loss at the TFCF, 2009

Origin	Race	Salvage	Percentage	Loss
Wild	Fall	986	22	778
	Late-fall	0	0	0
	Spring	3,270	72	2,585
	Winter	290	6	219
Total Wild		**4,546**		**3,582**
Hatchery				
	Fall	0	0	0
	Late-fall	4	3	4
	Spring	15	13	12
	Winter	101	84	84
Total Hatchery		**120**		**100**
Grand Total		***4,666***		***3,682***

Steelhead

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

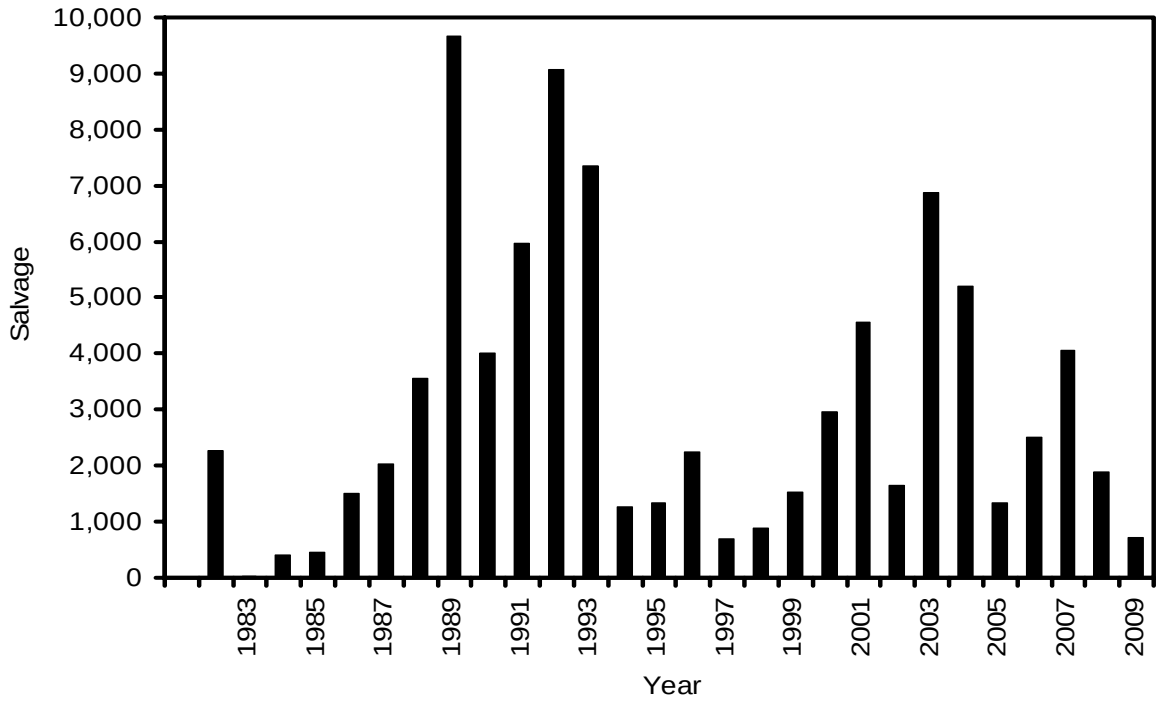

Figure 7 Annual salvage of steelhead (all origins combined) at the TFCF, 1982 – 2009

The majority of salvaged steelhead were of hatchery origin. The salvage composition was 511 hatchery and 201 wild fish.

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

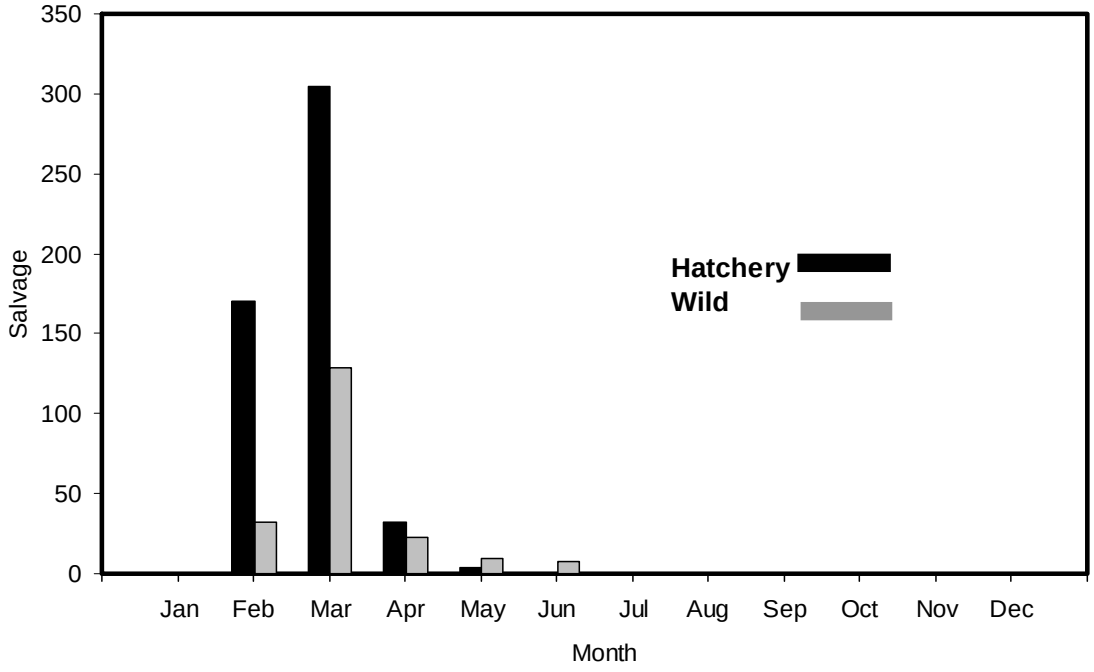

Figure 8 Monthly salvage of hatchery and wild steelhead at the TFCF, 2009

Striped Bass

The annual salvage of 128,790 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.

Most striped bass were salvaged June-July (Figure 10). The June salvage (62,084) and July salvage (48,825) accounted for 86% of the annual salvage. Striped bass were salvaged every month and the lowest salvage occurred in January (294).

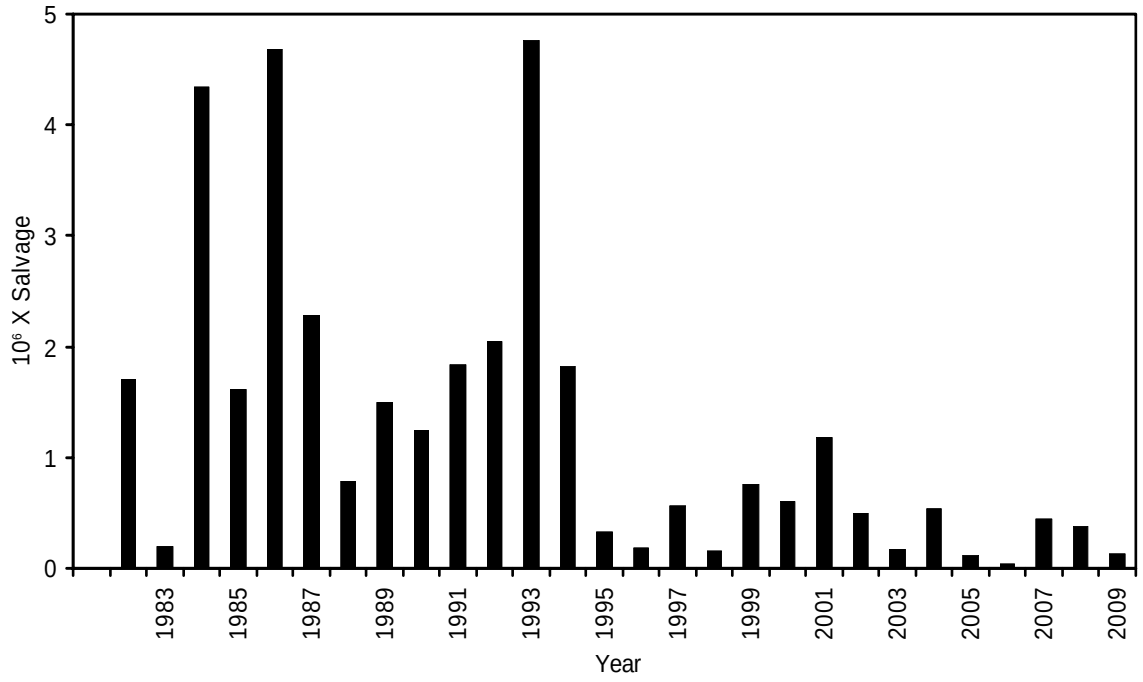

Figure 9 Annual salvage (in millions) of striped bass at the TFCF, 1982 – 2009

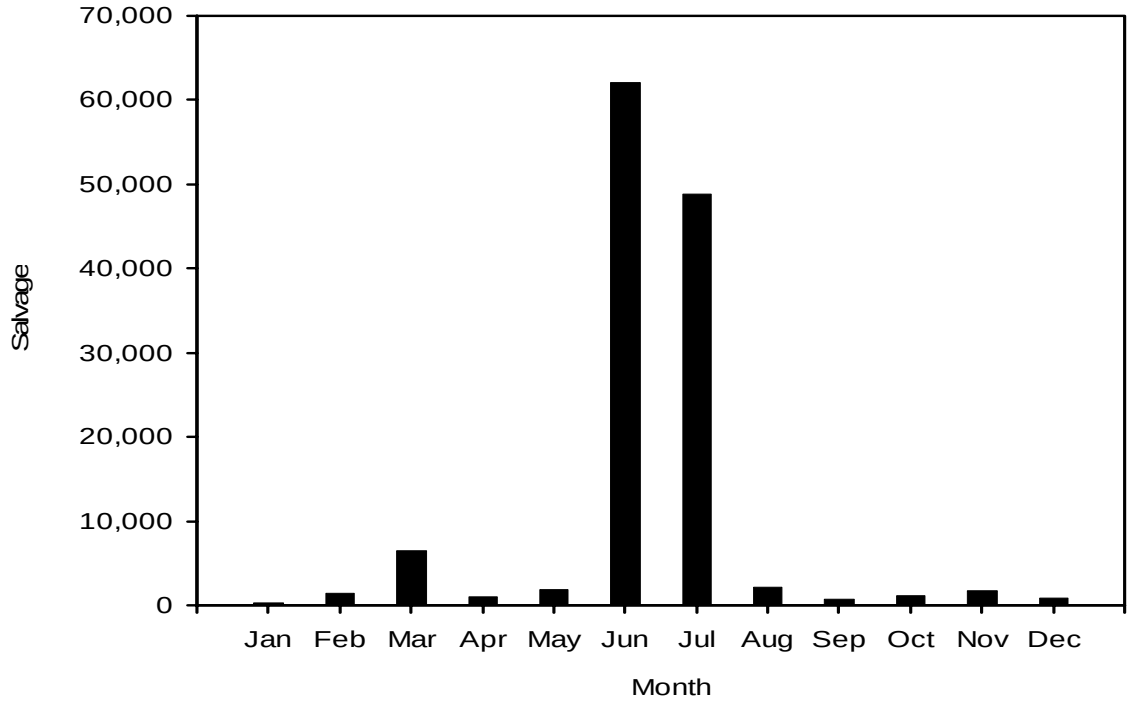

Figure 10 Monthly salvage of striped bass at the TFCF, 2009

Delta Smelt

The annual salvage of delta smelt (286) continued the low trend observed since 2005 (Figure 11). Salvage during 2005 to 2009 (286 - 1,009) was the lowest 5-year period of salvage on record.

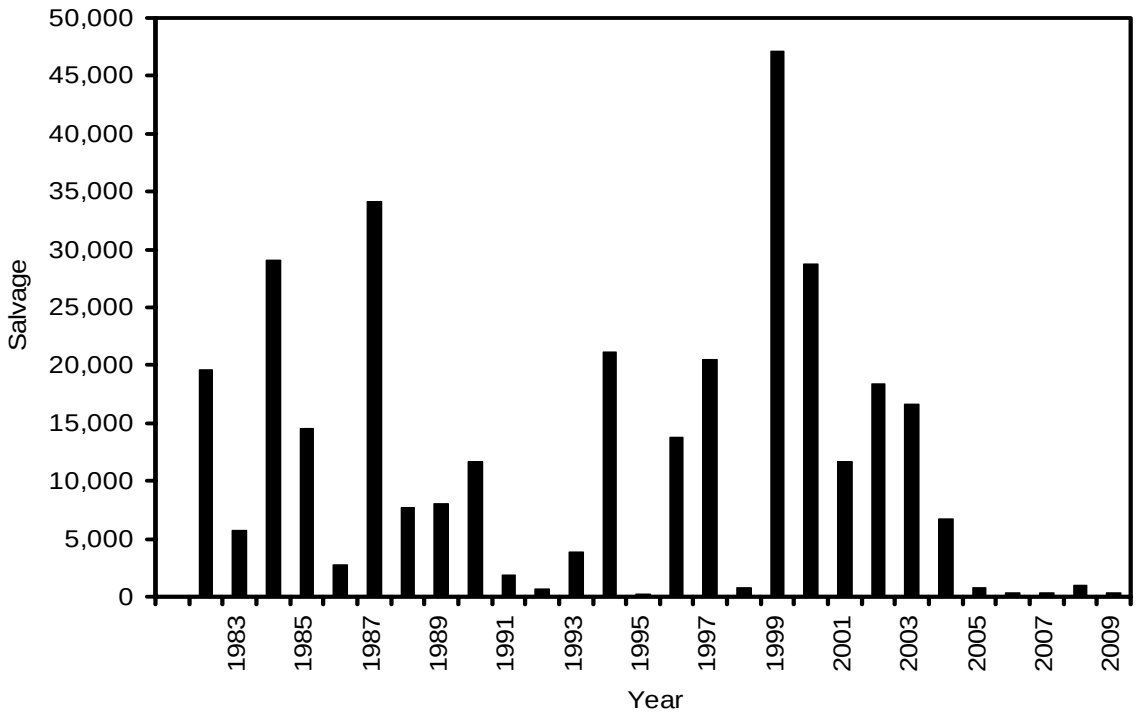

Figure 11 Annual salvage of delta smelt at the TFCF, 1982 – 2009

Delta smelt were salvaged most frequently during the late spring (Figure 12). Most of the delta smelt were salvaged in May (212) and June (58) which accounted for 94% of the annual salvage.

Delta smelt less than 20 mm were first detected on April 10 (Table 2). Delta smelt larvae or post-larvae were observed on 19 days. Only 3 days of sampling detected delta smelt

in 2 or more counts per 24 hour period. The longest period of consecutive daily detections was May 5-8. Larval delta smelt were most-frequently detected in May (14 days).

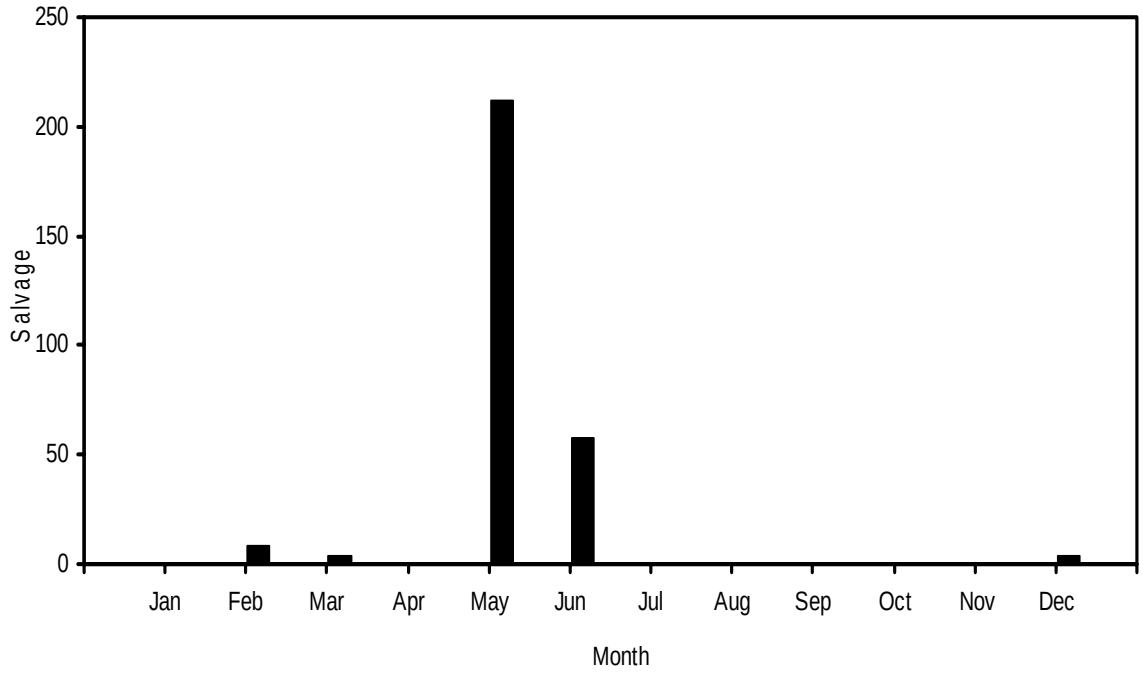

Figure 12 Monthly salvage of delta smelt at the TFCF, 2009

Longfin Smelt

Longfin smelt continued to be salvaged at low levels (66). Low annual salvages have been observed since 1991, with the exception of 43,080 salvaged in 2002 (Figure 13). The annual salvage in 2008 was 357.

Longfin smelt were salvaged in winter and spring (Figure 14). Salvage of juvenile longfin smelt peaked in March (28; 42%).

Young longfin smelt were collected on 10 occasions, mostly in March (Table 2). Longfin smelt larvae or post-larvae were first collected on February 25. Only 1 day of sampling

Table 2 Daily larval fish sampling detections for delta smelt and longfin smelt collected from the TFCF in 2009. A "Y' indicates that larval fish < 20 mm FL were found while an "N" indicates no detection. If larvae were detected in more than one count per day, number of counts per day with detections were recorded in parenthesis

DATE	Delta smelt larvae Y or N	Longfin smelt larvae Y or N
2/25/2009	N	Y
2/26/2009	N	Y
3/3/2009	N	Y
3/8/2009	N	Y (2)
3/10/2009	N	Y
3/16/2009	N	Y
3/24/2009	N	Y
4/10/2009	Y	N
4/20/2009	Y	Y
4/22/2009	Y	N
4/25/2009	Y	N
4/29/2009	N	Y
5/3/2009	N	Y
5/5/2009	Y	N
5/6/2009	Y (2)	N
5/7/2009	Y	N
5/8/2009	Y	N
5/11/2009	Y	N
5/13/2009	Y	N
5/14/2009	Y	N
5/17/2009	Y	N
5/18/2009	Y	N
5/19/2009	Y	N
5/21/2009	Y	N
5/22/2009	Y	N
5/26/2009	Y (2)	N
5/30/2009	Y (2)	N
6/1/2009	Y	N

detected longfin smelt in 2 or more counts per 24 hour period. The longest period of consecutive daily detections was February 25-26.

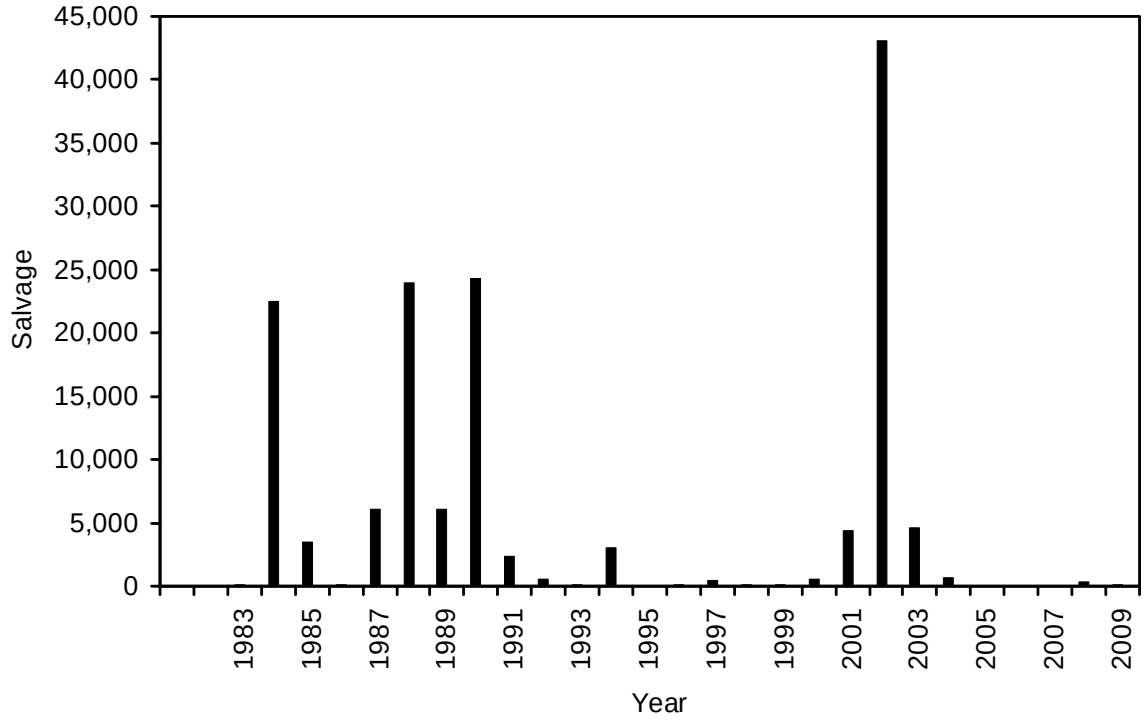

Figure 13 Annual salvage of longfin smelt at the TFCF, 1982 – 2009

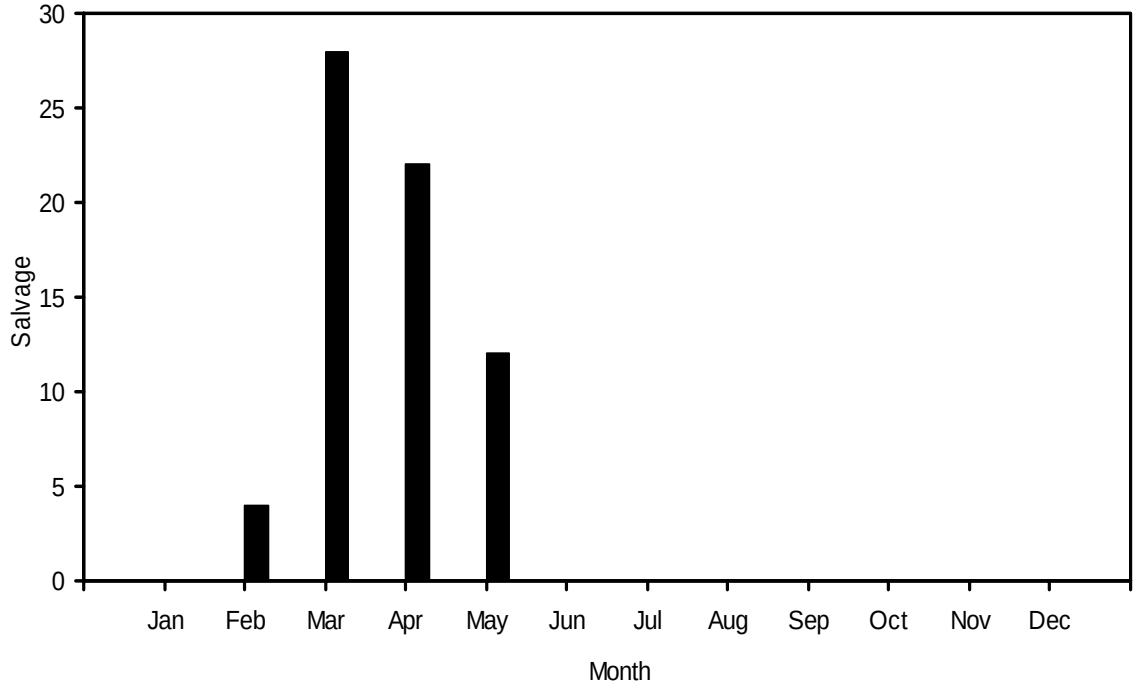

Figure 14 Monthly salvage of longfin smelt at the TFCF, 2009

Splittail

The annual salvage of splittail was 1,405 and slightly lower than in 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).

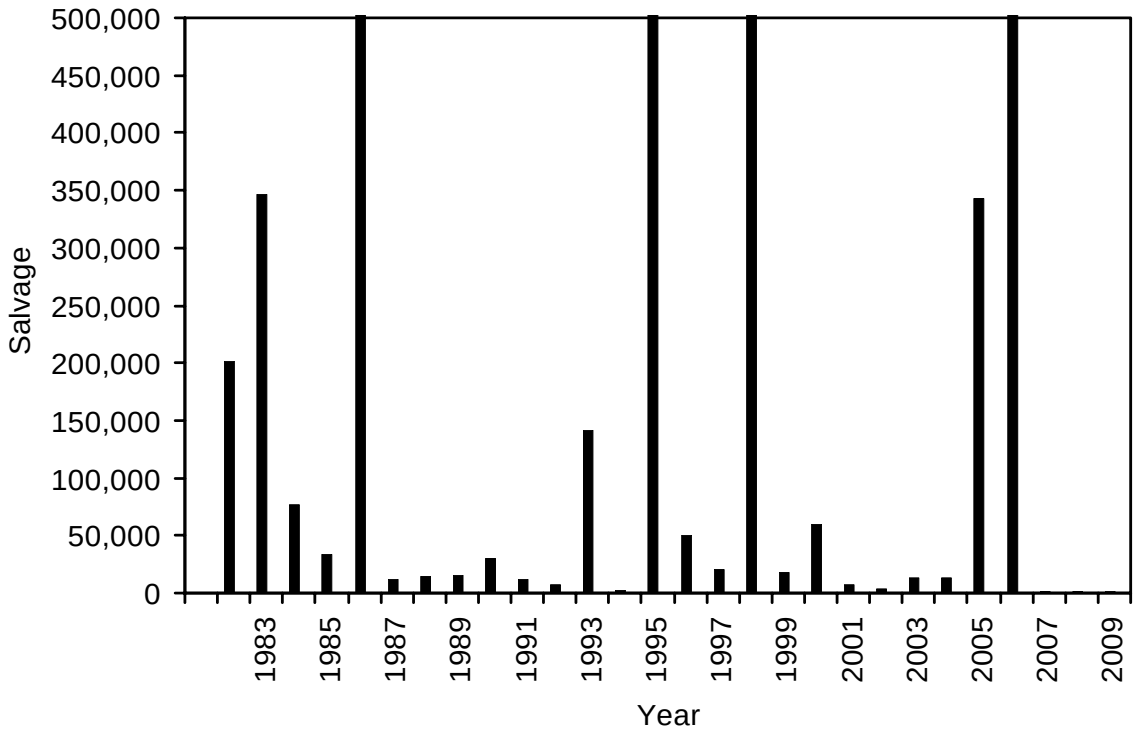

Figure 15 Annual salvage of splittail at the TFCF, 1982 – 2009. The following annual salvages for the following years have been truncated for scale considerations: 1986 (1,231,283), 1995 (3,143,156), 1998 (2,051,660), and 2006 (5,002,611)

Threadfin Shad

Annual salvage of threadfin shad was markedly lower in 2009 (401,911) 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.

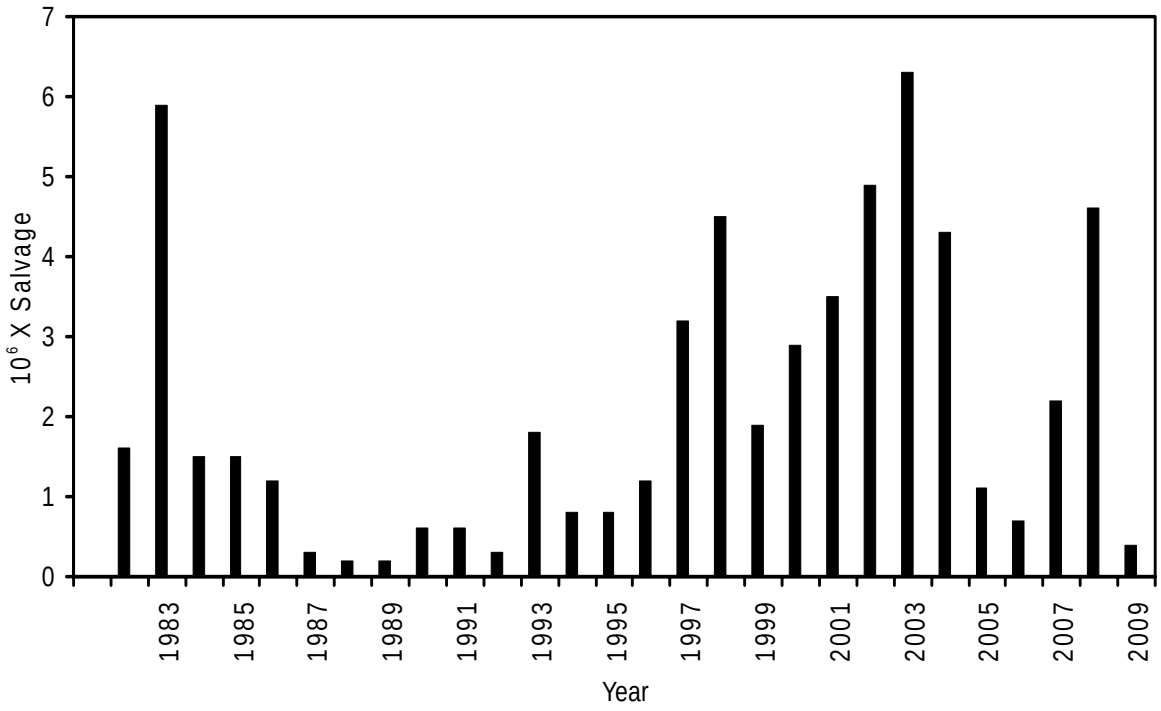

Figure 16 Annual salvage (in millions) of threadfin shad at the TFCF, 1982 – 2009

FOOTNOTES

1. Pelagic Organism Decline (POD) species

Appendix A Annual salvage (salvage) and percentage of annual salvage (%) for fish collected from the TFCF in 2008 and 2009

Species	2009 Salvage	%	2008 Salvage	%
Threadfin shad	401,911	46.7	4,617,313	86.1
Striped bass	128,790	15.0	378,916	7.0
American shad	110,710	12.9	45,795	0.9
White catfish	49,473	5.8	44,621	0.8
Largemouth bass	45,387	5.3	22,710	0.4
Channel catfish	31,250	3.6	21,574	0.4
Bluegill	27,692	3.2	67,387	1.3
Inland silverside	22,626	2.6	86,295	1.6
Yellowfin goby	18,638	2.2	25,375	0.5
Prickly sculpin	5,849	0.7	8,991	0.2
Chinook salmon	4,666	0.5	8,786	0.2
Shimofuri goby	3,766	0.4	4,056	0.1
Rainwater killifish	2,645	0.3	1,084	< 0.1
Splittail	1,405	0.2	1,439	< 0.1
Golden shiner	801	0.1	14,754	0.3
Steelhead	712	0.1	1,887	< 0.1
Black crappie	601	0.1	7,570	0.1
Redear sunfish	419	<0.1	1,326	< 0.1
Threespine stickleback	352	<0.1	51	< 0.1
Fathead minnow	340	<0.1	485	< 0.1
Delta smelt	286	<0.1	1,009	< 0.1
Common carp	261	<0.1	88	< 0.1
Warmouth	192	<0.1	317	< 0.1
Unknown lamprey	172	<0.1	1,495	< 0.1
Bigscale logperch	166	<0.1	418	< 0.1
Wakasagi	104	<0.1	44	< 0.1
Pacific staghorn sculpin	100	<0.1	328	< 0.1
Western mosquitofish	92	<0.1	112	< 0.1
Longfin smelt	66	<0.1	357	< 0.1
Red shiner	63	<0.1	4	< 0.1
Brown bullhead	28	<0.1	84	< 0.1
Tule perch	28	<0.1	24	< 0.1
Sacramento sucker	24	<0.1	148	< 0.1
Black bullhead	16	<0.1	36	< 0.1
Chinese mitten crab	12	<0.1	0	0.0
Shokihaze Goby	8	<0.1	20	< 0.1
Starry flounder	4	<0.1	36	< 0.1
Green sunfish	4	<0.1	16	< 0.1
Sacramento pikeminnow	3	<0.1	12	< 0.1
Spotted bass	0	0.0	34	< 0.1
Goldfish	0	0.0	18	< 0.1
Blue catfish	0	0.0	16	< 0.1
Green sturgeon	0	0.0	8	< 0.1
Hitch	0	0.0	4	< 0.1
Smallmouth bass	0	0.0	4	< 0.1

Appendix A (Cont) Annual salvage (salvage) and percentage of annual salvage (%) for fish collected from the TFCF in 2008 and 2009

	2009		2008	
Species	Salvage	%	Salvage	%
Riffle sculpin	0	0.0	4	< 0.1
White crappie	0	0.0	4	< 0.1
Pumpkinseed	0	0.0	4	< 0.1