Fish Salvage at the Tracy Fish Collection Facility during the 2013 Water Year

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 2013 water year (10/1/2012-9/30/2013) 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

Daily volumes of water exported were reported from gauge readings at the C.W. "Bill" Jones Pumping Plant at Byron. Monthly water exports were plotted and examined for time trends. Water year (WY) exports for the Central Valley Project (CVP) from 1981 through 2013 were noted. Salvage data from WYs 1981 to 2013 were examined for long and short-term trends.

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 multiplying routine sample counts by an expansion factor calculated as minutes of water pumped divided by minutes of the sample count:

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

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 WY year. Intra-annual abundances were examined by plotting the monthly salvage totals for selected fish species and for all fish taxa combined for 2013.

The annual and monthly salvage estimates for Chinook Salmon and Steelhead were calculated for wild and for hatchery fish. Salmonid origin was determined by the presence (assumed to be wild) or absence (assumed to be 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 review. 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 fish sampling was conducted during March 11 through June 20 to detect the presence of Delta Smelt and Longfin Smelt larvae and post-larval juveniles (<20 mm

FL). 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 the next working day.

Water Exports

The CVP exported 1,844,493 acre feet (AF) of water (Figure 1). The annual export in WY 2013 was comparable to WYs 2008-2010 and WY 2012 which ranged from 1,861,746 to 2,105,748 AF, but a decrease in exports from WY 2011 (2,539,025) and WYs 2002-2007.

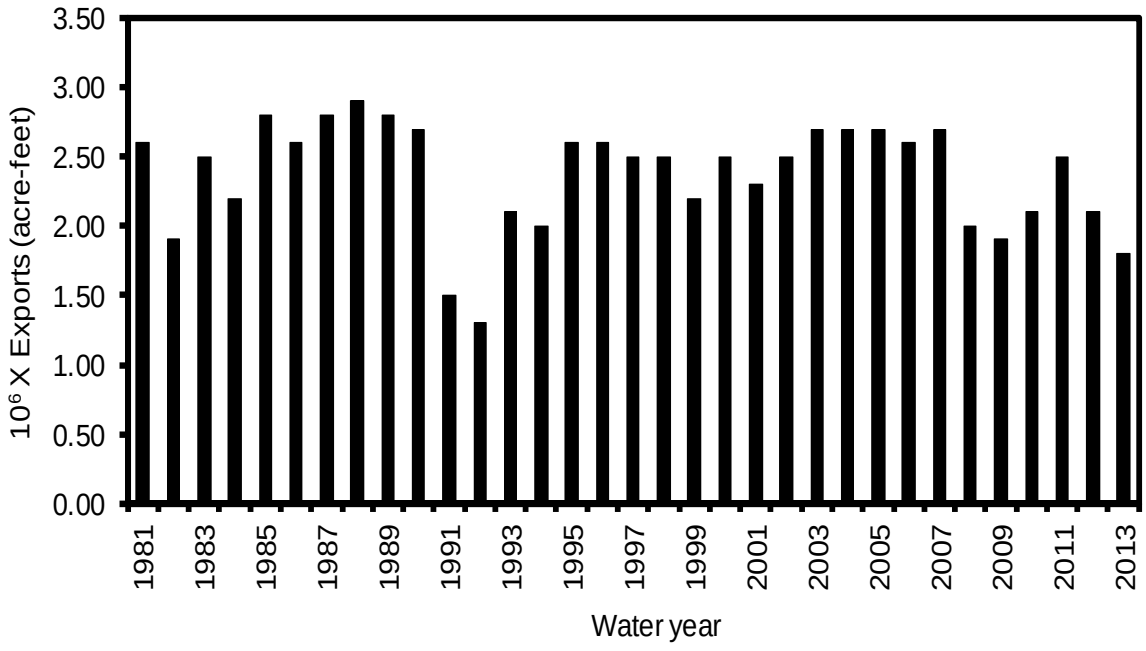

Figure 1 Annual exports (by water year; WY) in millions of acre-feet for the Central Valley Project, WYs 1981–2013

The majority of water exports occurred in October-November 2012 and July-August 2013 (Figure 2). During this period, a total of 933,835 AF was exported, accounting for 50.6% of the total export. Monthly exports ranged from 27,053 to 233,905 AF. Combined export for April-June was 137,323 AF which was a decrease from the same period during WYs 2004-2012 (174,096-439,633 AF).

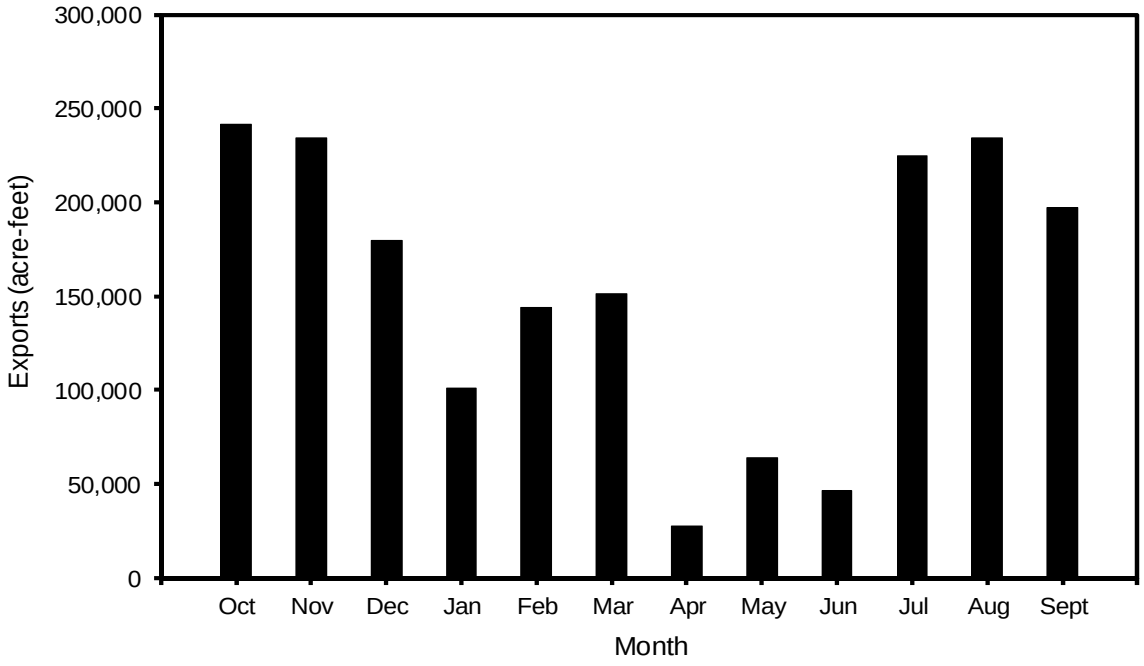

Figure 2 Monthly exports (in acre-feet) for the Central Valley Project, WY 2013

Total Salvage and Prevalent Species

Total fish salvage (all fish combined) at the TFCF was low at 2,828,514 (Figure 3). Total salvage increased from the record low salvage from WY 2012

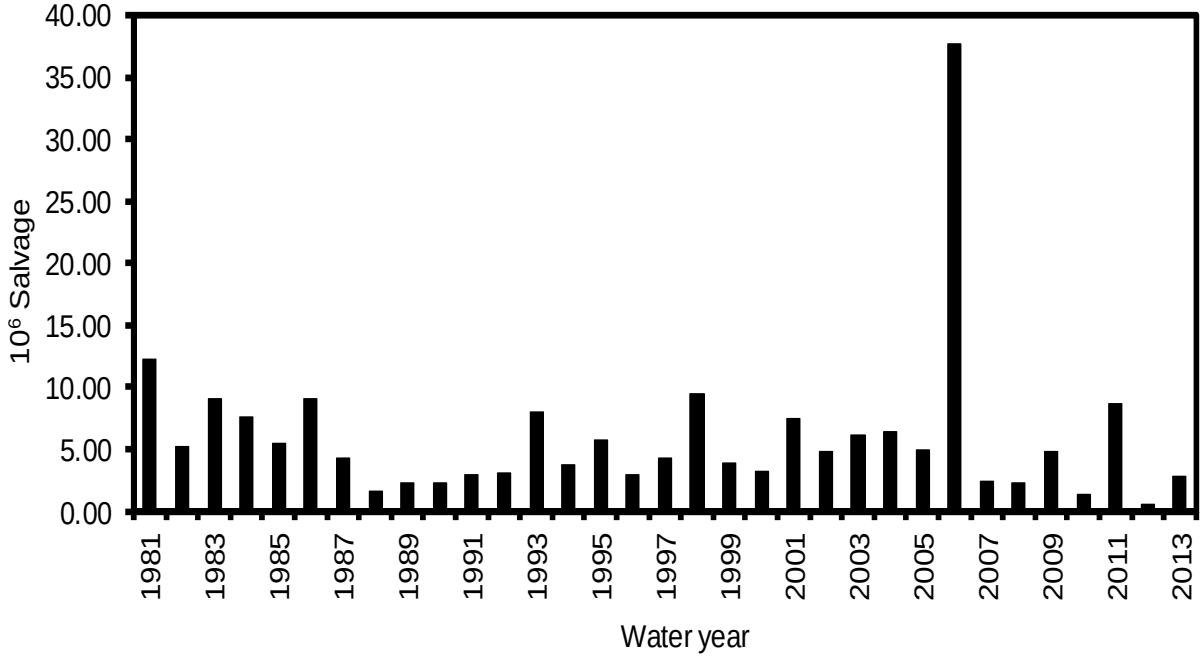

Figure 3 Annual salvages (by water year, WY; in millions) of all fish taxa combined at the TFCF, WYs 1981–2013

(475,082), but was well below the record high salvage of 37,659,835 in WY 2006.

Threadfin Shad accounted for 87.1% of the total salvage (Figure 4 and Appendix A). Threadfin Shad usually make up the bulk of salvage, but an exception was when Common Carp accounted for 81.8% (30,495,481) of salvage in WY 2006. The 2nd to 5th most salvaged species were Bluegill (4.1%), American Shad (2.5%), Striped Bass (2.0%), and Largemouth Bass (1.5%). The Striped Bass contribution to total salvage decreased substantially compared to WY 2012 (22.3%), but increased from WY 2011 (0.5%). Native species comprised 0.5% of total fish salvage. Chinook Salmon, Steelhead, Delta Smelt, and Longfin Smelt accounted for <0.2% of salvage.

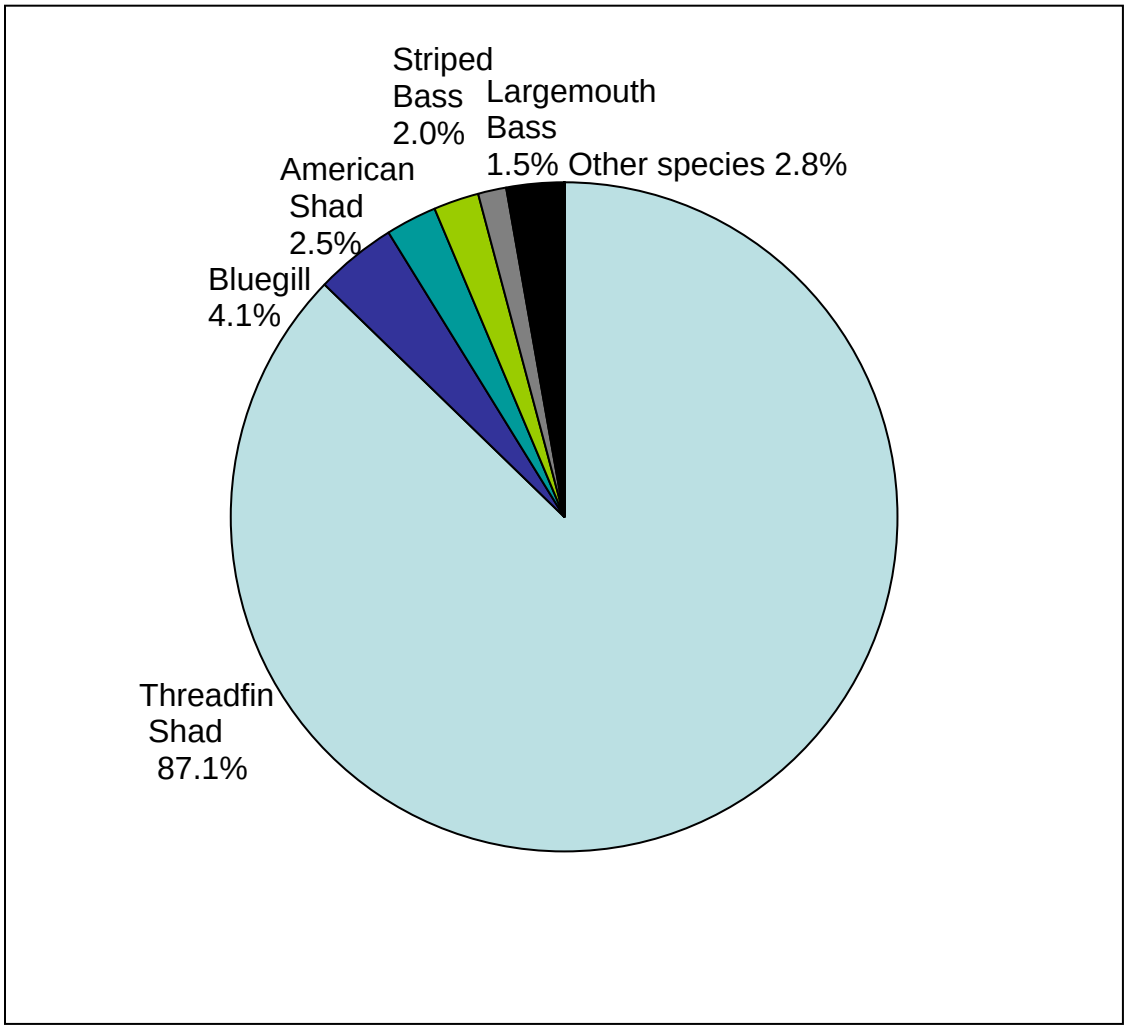

Figure 4 Percentages of annual salvage for the 5 most-prevalent species and other species combined at the TFCF, WY 2013

Chinook Salmon

The annual salvage of 4,032 Chinook Salmon (all races and origins combined) continued the low salvage trend since WY 2001 (Figure 5). Salvage of Chinook Salmon in WY 2013 was higher than the record low salvage in WY 2012 (1,965), but substantially lower than WY 2011 (18,135). Mean WY 2001-2013 salvage was about one-eighth lower than salvage in the 1980's and the 1990's.

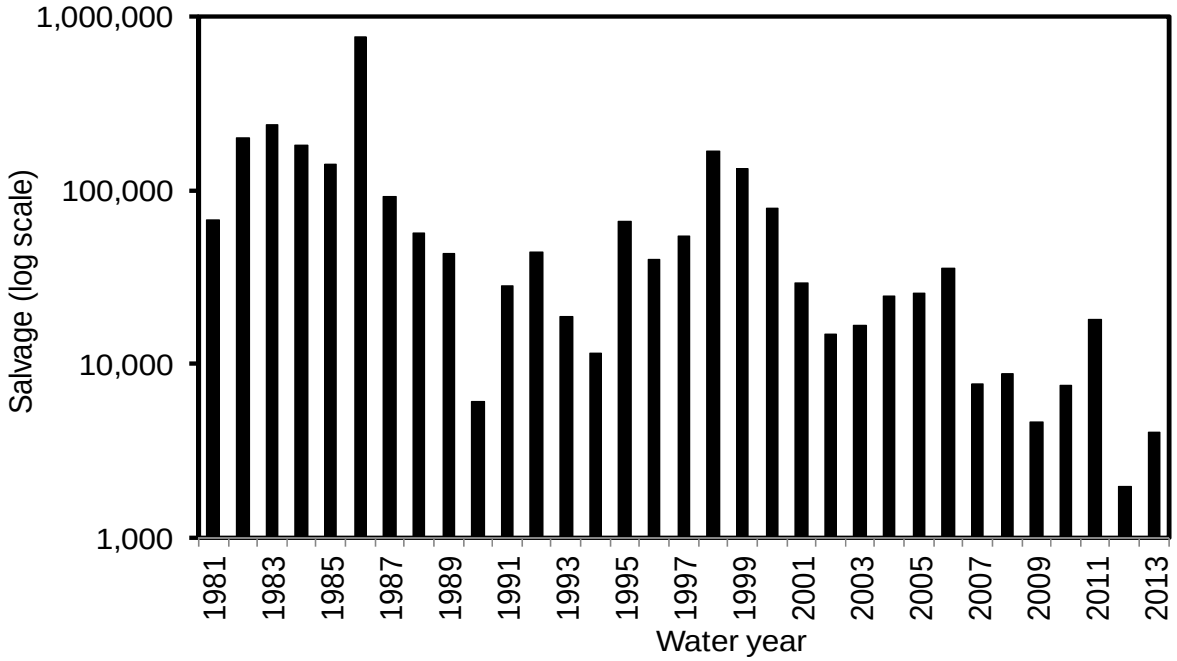

Figure 5 Annual salvages of Chinook Salmon (all races and origins combined) at the TFCF, WYs 1981–2013

Wild Chinook Salmon consisted primarily of fall run fish (84.6%; Table 1) followed by spring run fish (10.9%). Wild fall run fish were salvaged in December and in February-June (Figure 6). Wild spring run fish were salvaged March-May. The majority of wild fall run fish (60.3%) and wild spring run fish (46.5%) were both salvaged in May. The estimated loss of Chinook Salmon was 3,069 (Table 1).

Steelhead

Salvage (wild and hatchery) of Steelhead (646) continued the pattern of mostly low salvage observed since WY 2005 (Figure 7). Salvage increased from WY 2012 (493) and WY 2011 (445). Annual Steelhead salvage in WY 2010 (3,088) was greater than in WY 2009 (712) and WY 2008 (1,887).

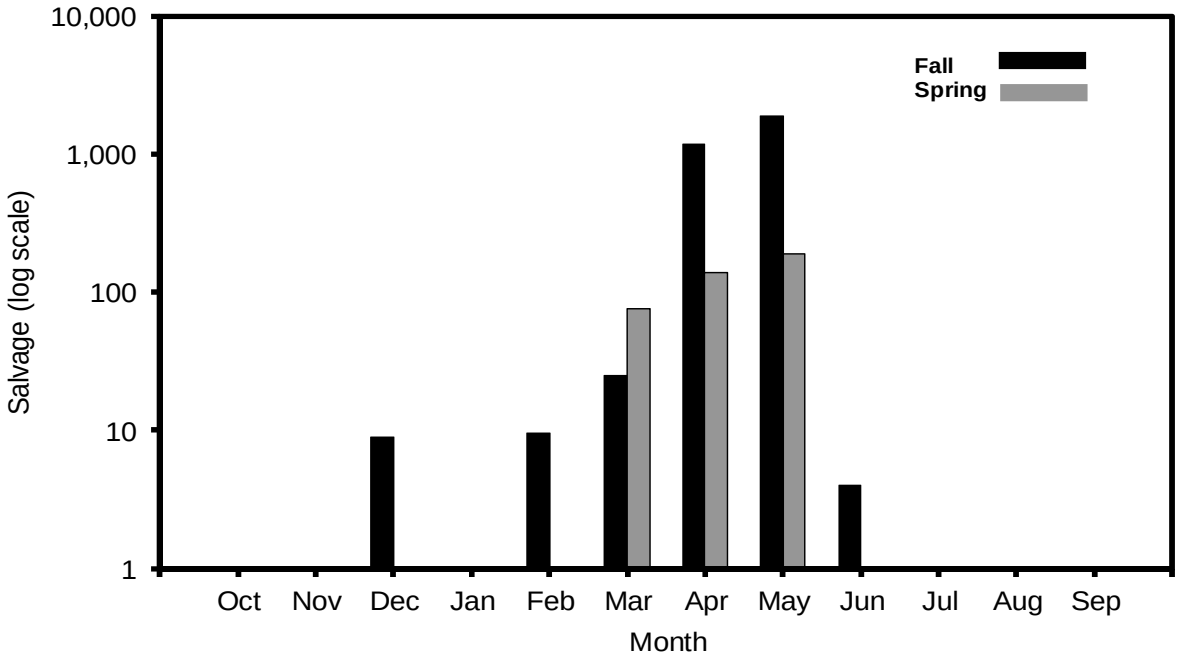

Figure 6 Monthly salvages of wild fall and spring Chinook Salmon at the TFCF, WY 2013

Table 1 Chinook Salmon annual salvages, percentages of annual salvage, and losses at the TFCF, WY 2013, by race and origin (wild or hatchery)

Origin	Race	Salvage	Percentage	Loss
Wild	Fall	3,134	84.6	2416
	Late-fall	28	0.8	18
	Spring	404	10.9	297
	Winter	129	3.5	98
	Unknown Race	8	0.2	5
Total Wild		**3,703**		**2,834**
Hatchery	Fall	93	28.3	62
	Late-fall	165	50.1	118
	Spring	4	1.2	2
	Winter	67	20.4	53
Total Hatchery		**329**		**235**
Grand Total		***4,032***		**3,069**

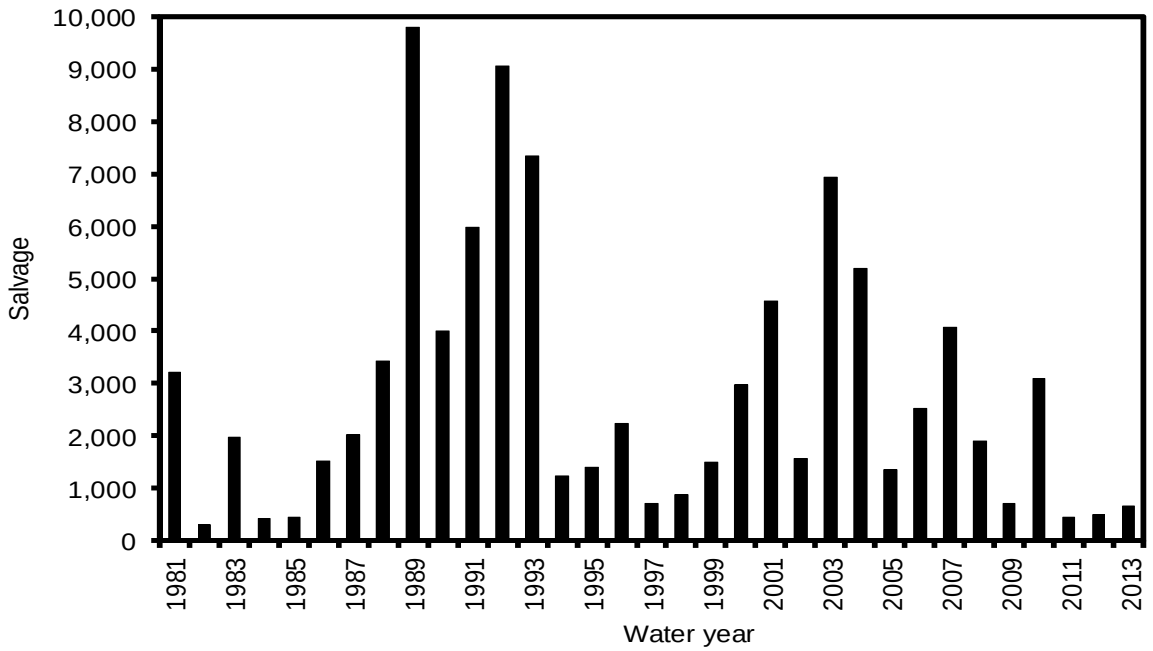

Figure 7 Annual salvages of Steelhead (all origins combined) at the TFCF, WYs 1981–2013

Steelhead salvage estimates were equally split between fish of wild and hatchery origin. The salvage composition was 320 hatchery and 326 wild fish.

Salvage of Steelhead occurred in the middle of the water year. Hatchery Steelhead were salvaged January-June while wild Steelhead were salvaged December-May (Figure 8). Hatchery Steelhead and wild Steelhead were salvaged most frequently in March.

Striped Bass

The annual salvage of 57,855 Striped Bass continued the low salvage trend

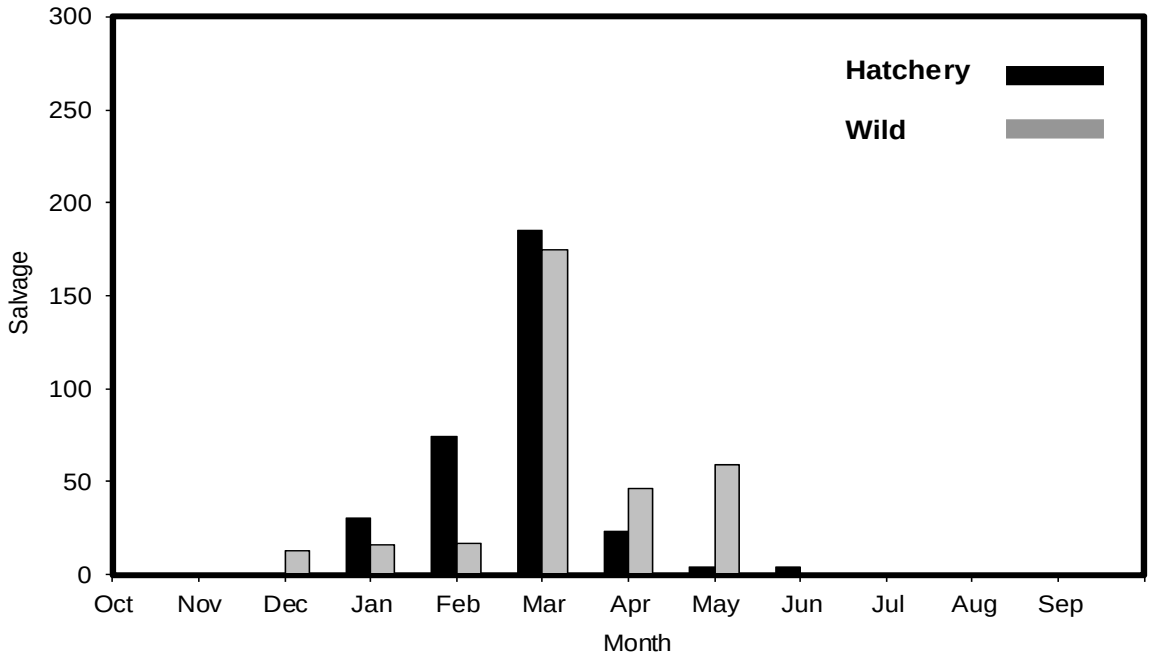

Figure 8 Monthly salvages of hatchery and wild Steelhead at the TFCF, WY 2013

observed since WY 1995 (Figure 9). Prior to WY 1995 and except for WY 1983 and WY 1988, annual Striped Bass salvages were above 1,000,000.

Most Striped Bass were salvaged in May-July (Figure 10). Low salvage in April coincided with low monthly water export. The May salvage (14,445), June salvage (16,812), and July salvage (19,878) accounted for 88.4% of the total salvage. Striped Bass were salvaged every month and the lowest salvage occurred in April (56).

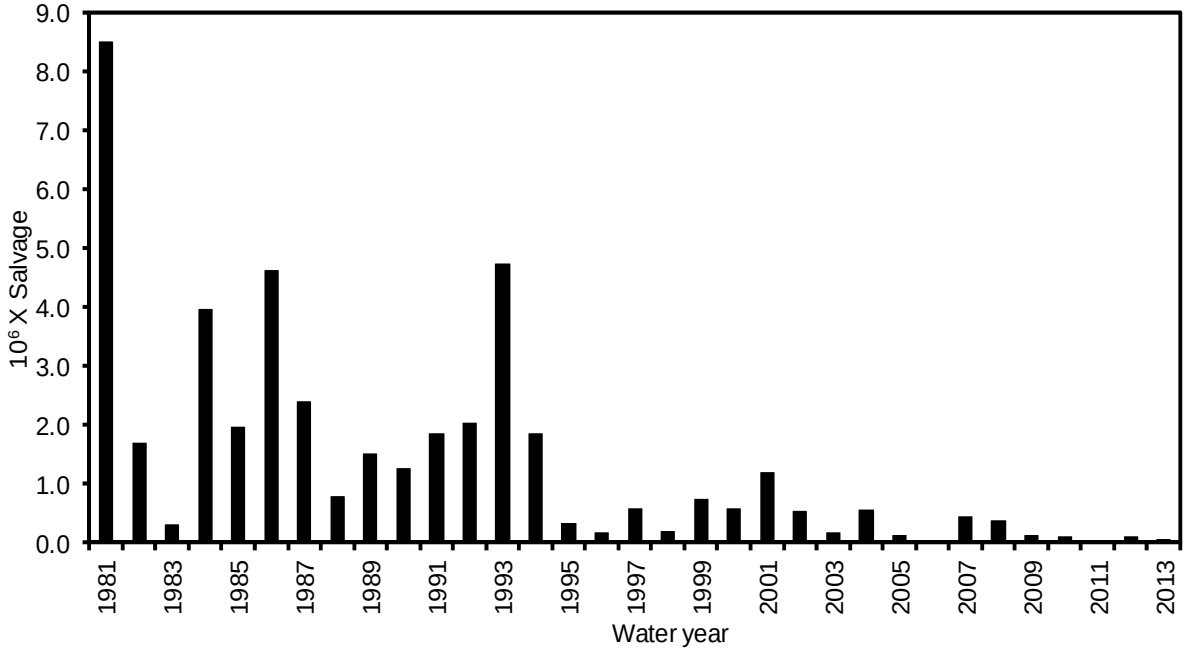

Figure 9 Annual salvages (in millions) of Striped Bass at the TFCF, WYs 1981–2013

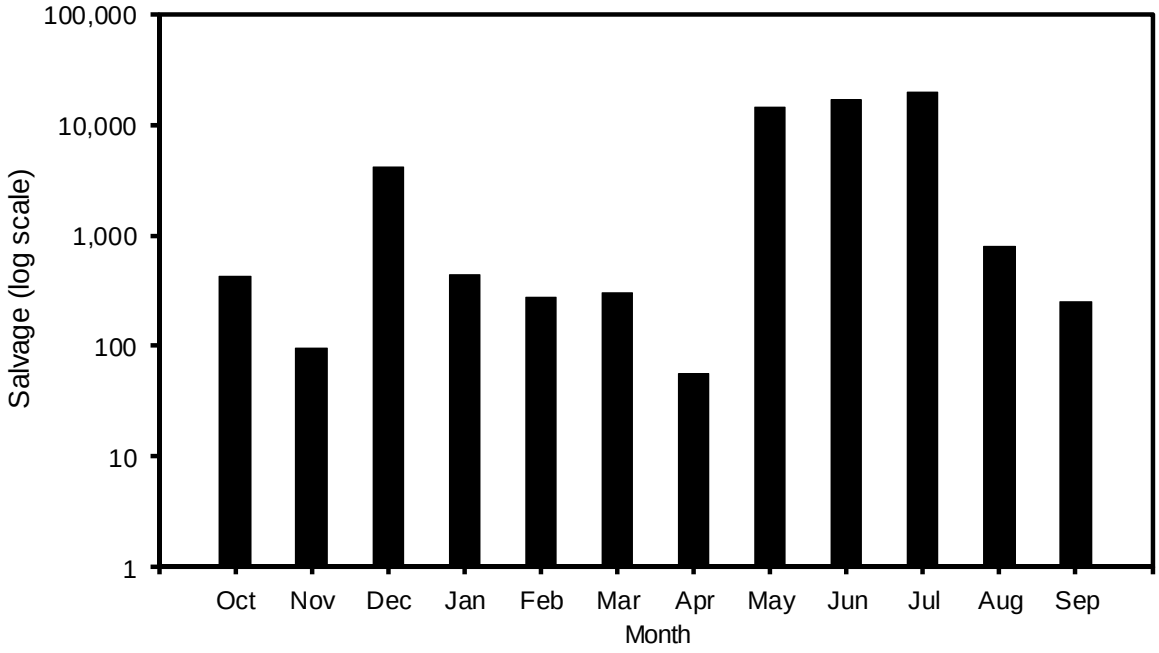

Figure 10 Monthly salvages of Striped Bass at the TFCF, WY 2013

Delta Smelt

Salvage of Delta Smelt (300) decreased from WY 2012 (355), but increased from the record low in WY 2011 (51) (Figure 11). WYs 2005-2013 was the lowest 9-year period of annual salvage on record (51-1,009).

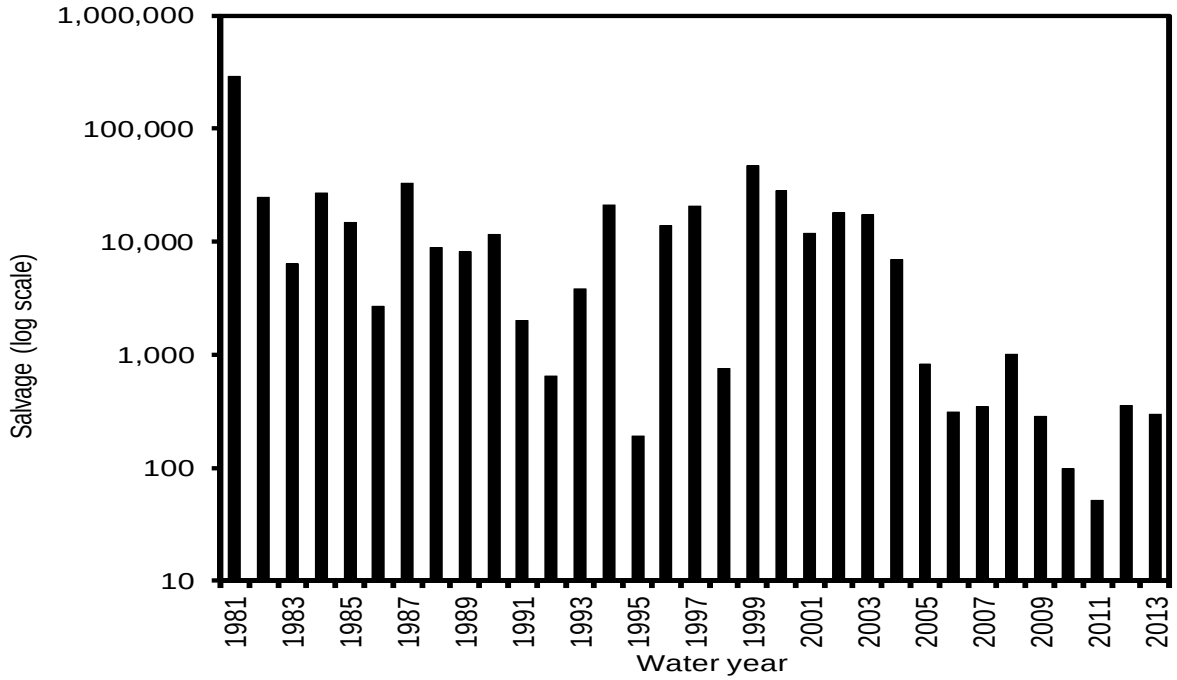

Figure 11 Annual salvages of Delta Smelt at the TFCF, WYs 1981–2013

Salvage of Delta Smelt occurred in the middle of the water year (Figure 12). Adult Delta Smelt were salvaged December- March. Juvenile Delta Smelt were salvaged April-June, where May salvage (72) accounted for 24.0% of the total salvage.

Delta Smelt less than 20 mm were first detected on March 18 and were

observed on 8 days of monitoring (Table 2). The longest period of consecutive daily detections was March 22-23. The period with most daily detections occurred in March (4 days).

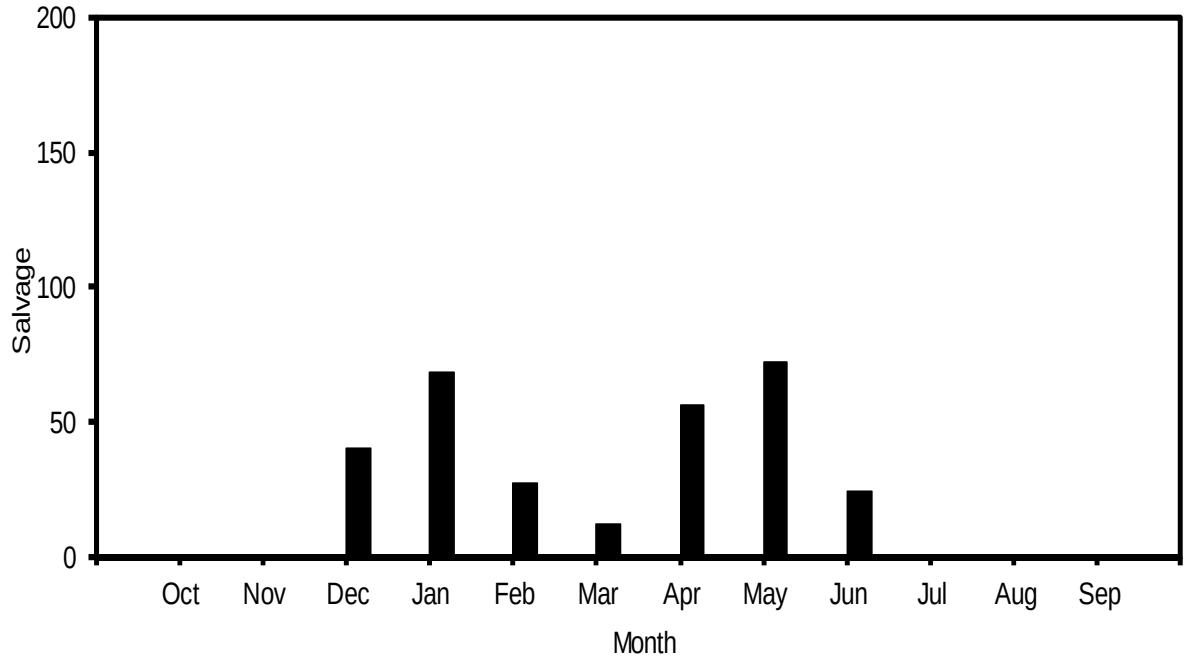

Figure 12 Monthly salvages of Delta Smelt at the TFCF, WY 2013

Longfin Smelt

Salvage of Longfin Smelt (241) decreased from WY 2012 (898), but was an increase from WY 2011 (4). Low annual salvages have generally been observed since 1991, with the exception of 43,056 salvaged in WY 2002 (Figure 13).

Longfin Smelt were salvaged March-May. March salvage (111) accounted for 46.1% of the total salvage (Figure 14).

Table 2 Smelt less than 20 mm fork length (FL) observed in larval samples collected from TFCF in WY 2013. Daily numbers of Delta Smelt and Longfin Smelt < 20 mm FL are recorded while an "N" indicates no detection. No sampling occurred during 4/2-14/2013 due to maintenance

Date	Delta Smelt Larvae	Longfin Smelt larvae
3/13	N	4
3/14	N	5
3/16	N	3
3/17	N	5
3/18	1	6
3/19	N	3
3/22	1	1
3/23	2	N
3/24	N	1
3/25	N	1
3/26	1	N
3/28	N	1
3/31	N	4
4/15	N	1
4/16	N	1
4/18	N	1
4/20	N	1
4/22	N	1
4/30	1	N
5/7	N	1
5/13	1	N
5/19	1	N
5/21	1	N

Longfin Smelt less than 20 mm were first detected on March 13 and were observed on 17 days of monitoring (Table 2). The longest period of consecutive daily detections was March 16-19. The period with most daily detections also occurred in March (11 days).

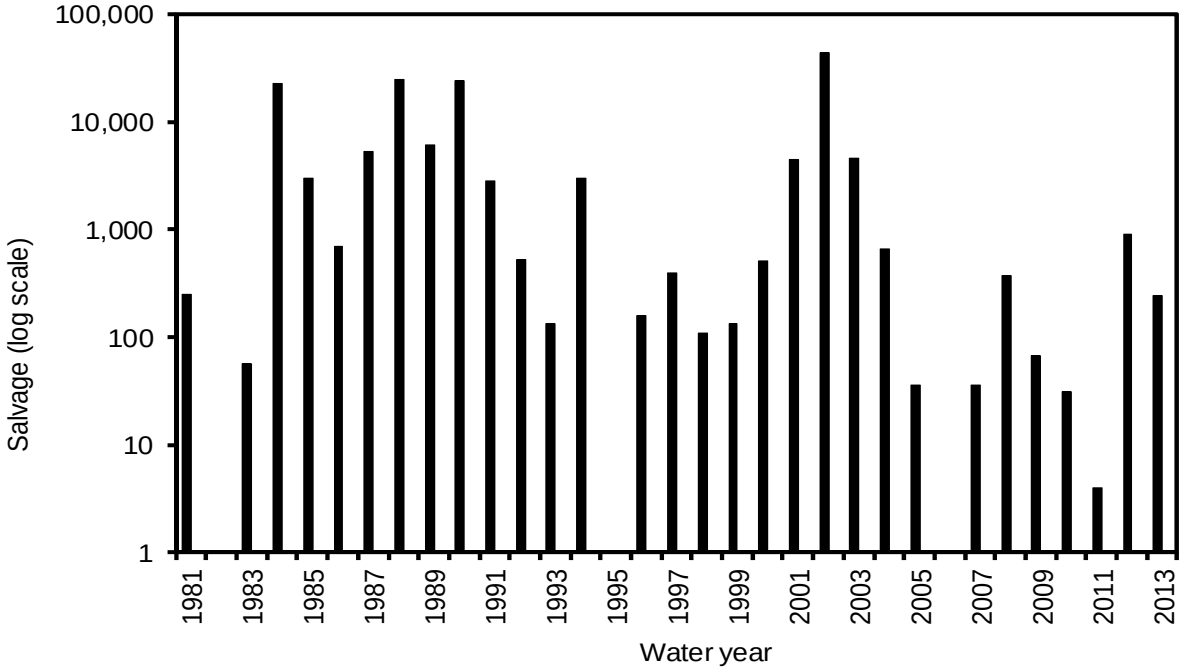

Figure 13 Annual salvages of Longfin Smelt at the TFCF, WYs 1981–2013

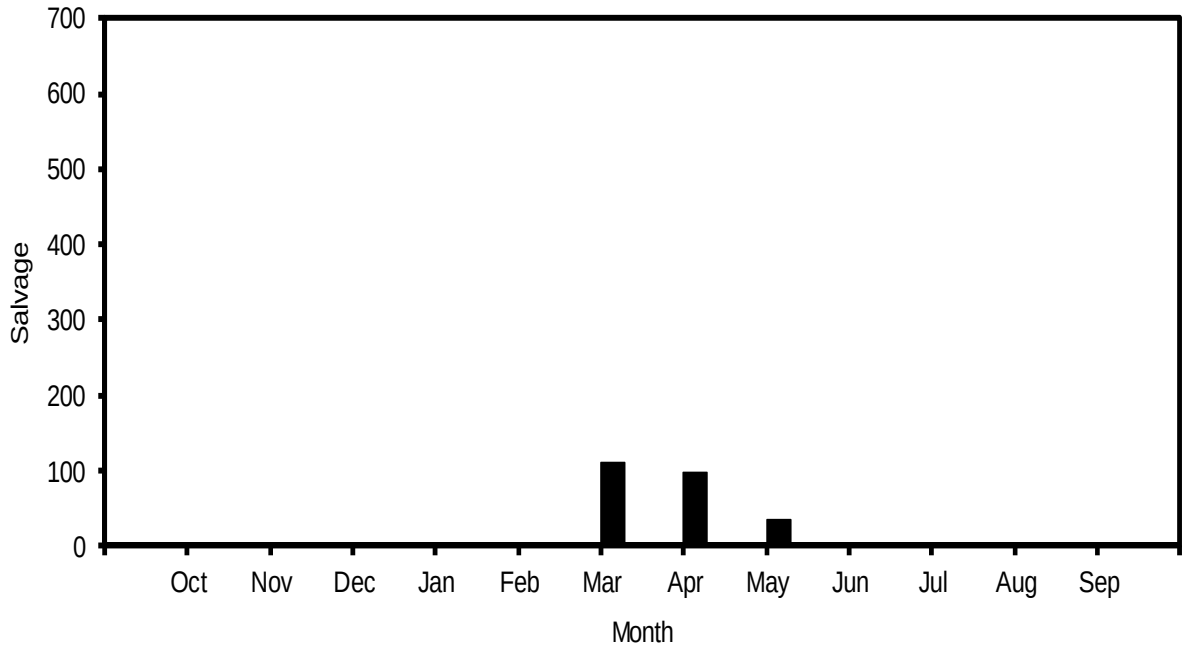

Figure 14 Monthly salvages of Longfin Smelt at the TFCF, WY 2013

Splittail

The record low salvage of Splittail (125) was a decrease from WY 2012 (929), and markedly lower than the record high in WY 2011 (7,660,024) and WY 2010 (160,929). Splittail salvage has followed a boom-or-bust pattern, often varying year to year by several orders of magnitude (Figure 15).

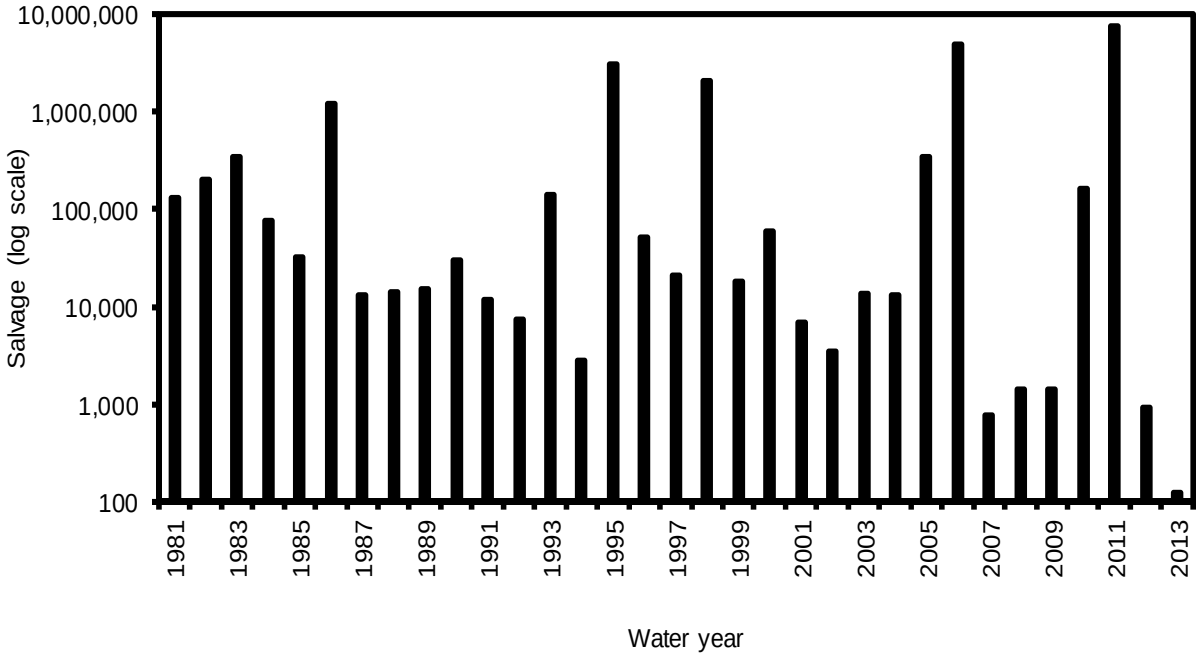

Figure 15 Annual salvages of Splittail at the TFCF, WYs 1981–2013

Threadfin Shad

Salvage of 2,463,695 Threadfin Shad was a substantial increase from the record low salvage in WY 2012 (109,610) and the low salvage in WY 2011 (591,111). Similar to Splittail, annual salvages of Threadfin Shad have varied greatly through time (Figure

16). Prior to WY 2005, WYs 2001-2004 was the highest 4-year period of annual salvage on record (3.6-5.2 million).

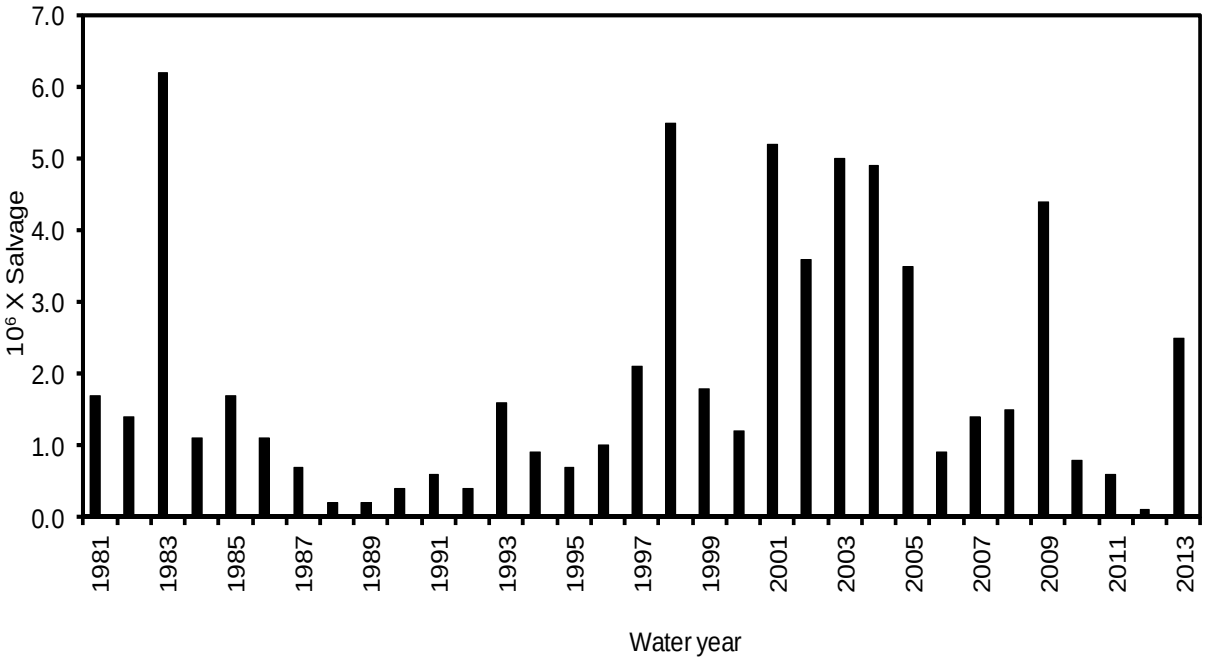

Figure 16 Annual salvages (in millions) of Threadfin Shad at the TFCF, WYs 1981–2013

FOOTNOTES

1. Pelagic Organism Decline (POD) species

Appendix A Annual salvages and percentages of annual salvage (%) for fish collected from the TFCF in WY 2013 and WY 2012

Species	2013 Salvage	% Composition	2012 Salvage	% Composition
Threadfin Shad	2,463,695	87.1	109,610	23.1
Bluegill	115,796	4.1	52,986	11.2
American Shad	71,619	2.5	72.603	15.3
Striped Bass	57,855	2.0	105,760	22.3
Largemouth Bass	43,291	1.5	63,670	13.4
Inland Silverside	28,747	1.0	5,954	1.3
White Catfish	12,341	0.4	29,069	6.1
Rainwater Killifish	7,444	0.3	6,025	1.8
Prickly Sculpin	6,621	0.2	8,606	1.3
Chinook Salmon	4,032	0.1	1,965	0.4
Golden Shiner	3,920	0.1	1,281	0.3
Channel Catfish	3,150	0.1	10,121	2.1
Black Crappie	3,093	0.1	629	0.1
Yellowfin Goby	1,343	<0.1	1,755	0.4
Lamprey Unknown	1,288	<0.1	31	<0.1
Redear Sunfish	1,078	<0.1	840	0.2
Steelhead	646	<0.1	493	0.1
Shimofuri Goby	601	<0.1	162	<0.1
Delta Smelt	300	<0.1	355	0.1
Longfin Smelt	241	<0.1	898	0.2
Tule Perch	232	<0.1	118	<0.1
Western Mosquitofish	222	<0.1	212	<0.1
Black Bullhead	166	<0.1	35	<0.1
Warmouth	159	<0.1	318	0.1
Bigscale Logperch	141	<0.1	244	0.1
Splittail	125	<0.1	929	0.2
Threespine Stickleback	97	<0.1	47	<0.1
Brown Bullhead	47	<0.1	54	<0.1
Green Sunfish	46	<0.1	13	<0.1
Wakasagi	42	<0.1	24	<0.1
Common Carp	26	<0.1	148	<0.1
Pacific Lamprey	24	<0.1	0	0.0
White Crappie	23	<0.1	0	0.0
Sacramento Blackfish	16	<0.1	0	0.0
Pacific Brook Lamprey	16	<0.1	0	0.0
Shokihaze Goby	11	<0.1	0	0.0
Pacific Staghorn Sculpin	8	<0.1	17	<0.1
White Sturgeon	4	<0.1	64	<0.1
Starry Flounder	4	<0.1	8	<0.1
Fathead Minnow	4	<0.1	28	<0.1

Appendix A (Cont) Annual salvages and percentages of annual salvage (%) for fish collected from the TFCF in WY 2013 and WY 2012

Species	2013 Salvage	% Composition	2012 Salvage	% Composition
Red Shiner	0	0.0	5	<0.1
Sacramento Pikeminnow	0	0.0	4	<0.1
Hitch	0	0.0	1	<0.1