Fish Salvage at the Tracy Fish Collection Facility during the 2014 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 2014 water year (10/1/2013-9/30/2014) 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 2014 were noted. Salvage data from WYs 1981 to 2014 were examined for long and short-term trends.

Fish abundance was reported as "estimated salvage". Only fish ≥ 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 salvage minutes divided by minutes of the sample count:

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

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 2014.

The annual and monthly salvage estimates for Chinook Salmon and Steelhead were calculated for wild and hatchery fish. Salmonid origin was determined by the presence (assumed to be wild) or absence (assumed to be hatchery) of an adipose fin. Race of Chinook Salmon was determined solely by the Delta criteria based on length at date of salvage (California Dept. of Fish and Wildlife 2014).

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 13 through June 7 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 947,777 acre feet (AF) of water which was a record low (Figure 1). The annual export in WY 2014 was a marked decrease to WYs 2008-2013 which ranged from 1,844,493 to 2,539,025 AF.

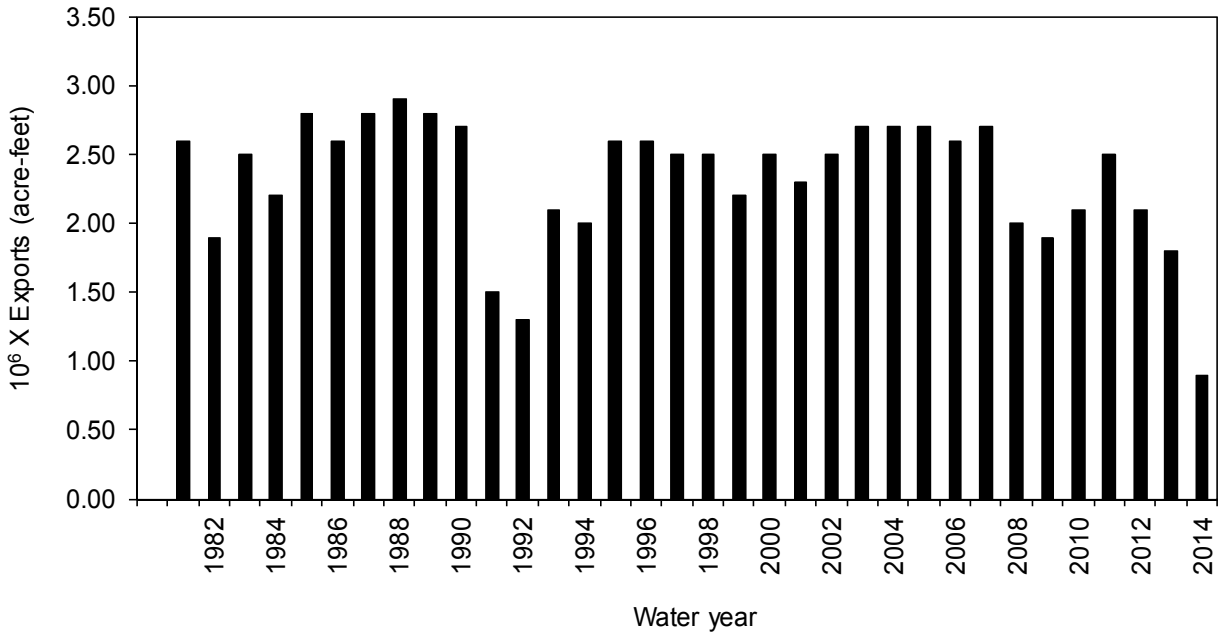

Figure 1 Annual exports (by water year; WY) in millions of acre-feet for the Central Valley Project, WYs 1981–2014

The majority of water exports occurred in October-November 2013 and March-April 2014 (Figure 2). During this period, a total of 559,010 AF was exported, accounting for 59.0% of the total export. Monthly exports ranged from 14,824 to 180,363 AF. Combined export for April-June was 257,586 AF which was comparable to the same period during WYs 2004-2013 (137,323-439,633 AF).

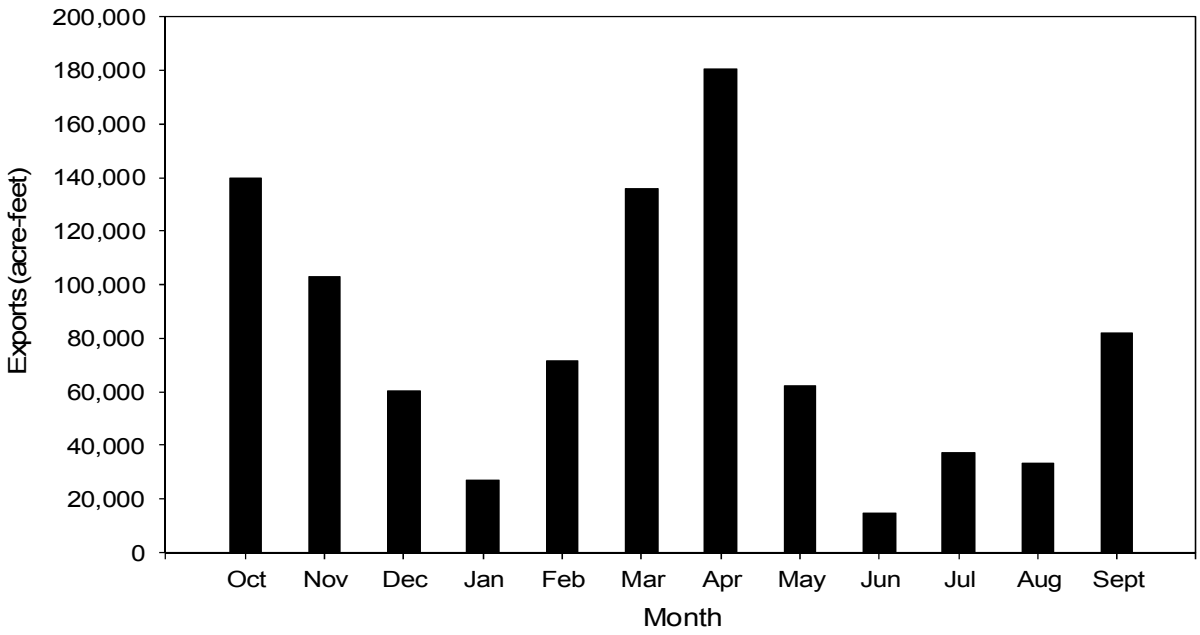

Figure 2 Monthly exports (in acre-feet) for the Central Valley Project, WY 2014

Total Salvage and Prevalent Species

Total fish salvage (all fish combined) at the TFCF was a record low at 160,681 (Figure 3). This was a marked decrease from WY 2013 (2,828,514), and was well below the record high salvage of 37,659,835 in WY 2006.

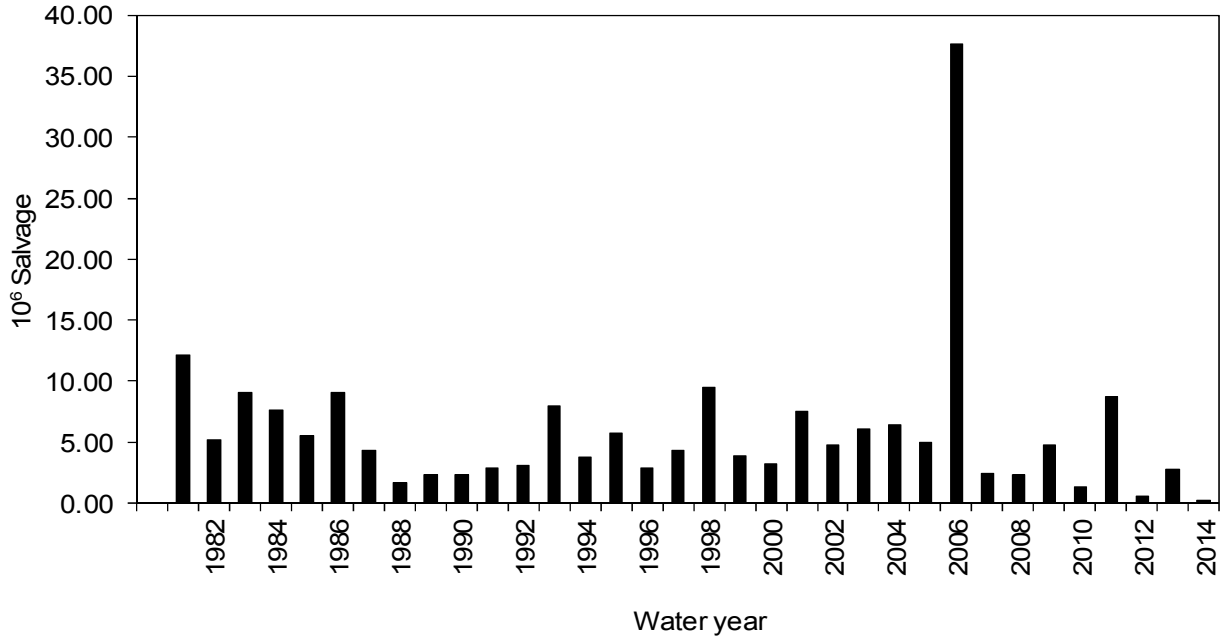

Figure 3 Annual salvage (by water year, WY; in millions) of all fish taxa combined at the TFCF, WYs 1981–2014

Bluegill accounted 39.6% of the total salvage (Figure 4 and Appendix A). Threadfin Shad usually make up the bulk of salvage in most years, 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 Threadfin Shad (29.6%), Largemouth Bass (7.4%), White Catfish (6.4%), and Inland Silverside (3.8%). The Striped Bass (3.7%) contribution to total salvage increased compared to WY 2013 (2.0%) but decreased substantially compared to WY 2012 (22.3%). Native species comprised 2.9% of total fish salvage. Chinook Salmon, Steelhead, Delta Smelt, and Longfin Smelt accounted for <0.1% of salvage.

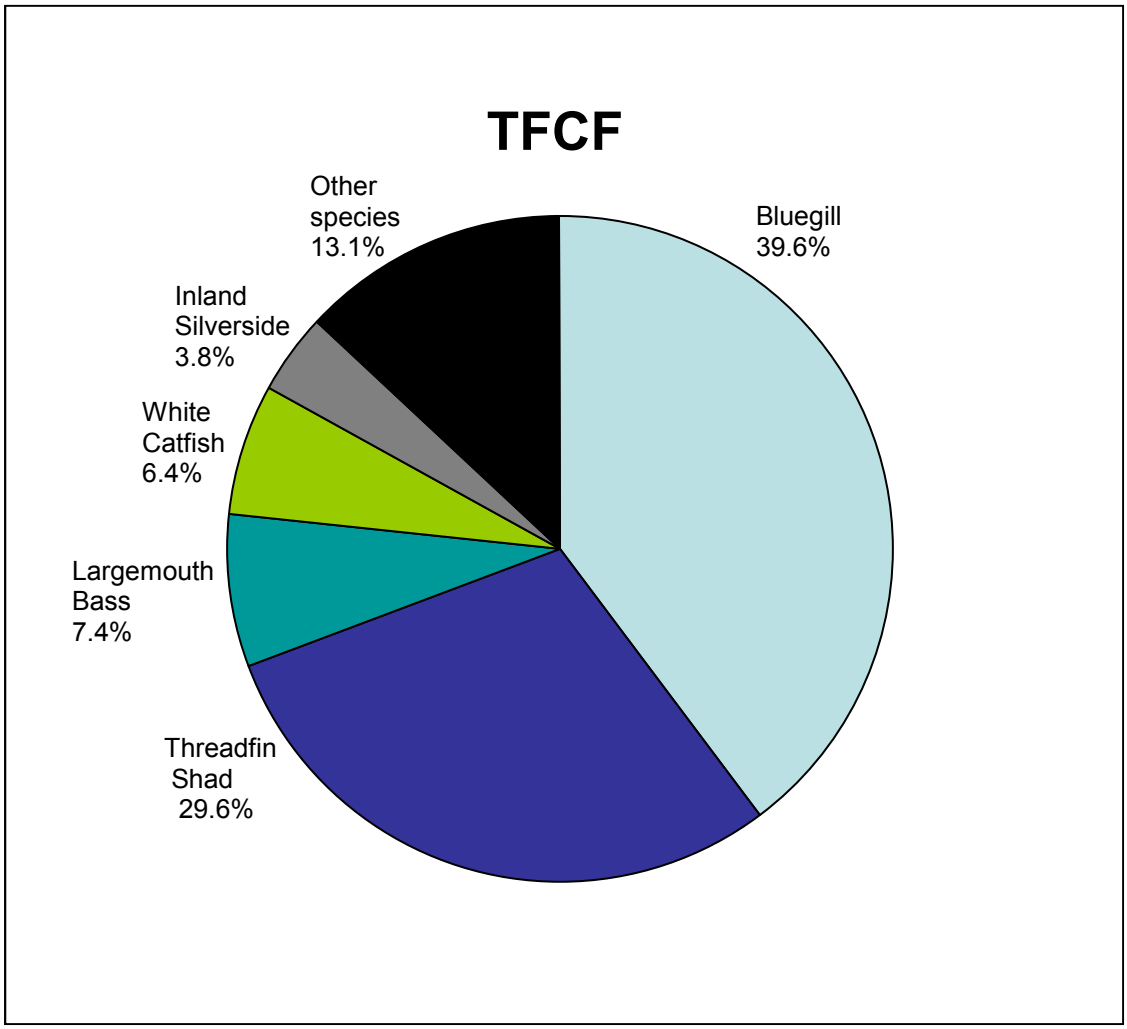

Figure 4 Percentages of annual salvage for the 5 most-prevalent species and other species combined at the TFCF, WY 2014

Chinook Salmon

The annual salvage of 1,177 Chinook Salmon (all races and origins combined) was a record low and continued the low salvage trend since WY 2001 (Figure 5). Salvage of Chinook Salmon in WY 2014 was a decrease from WY 2013 (4,032) and the previous record low in WY 2012 (1,965). Mean WY 2001-2014 TFCF salvage was about 12% of the mean salvages in the 1980s and the 1990s.

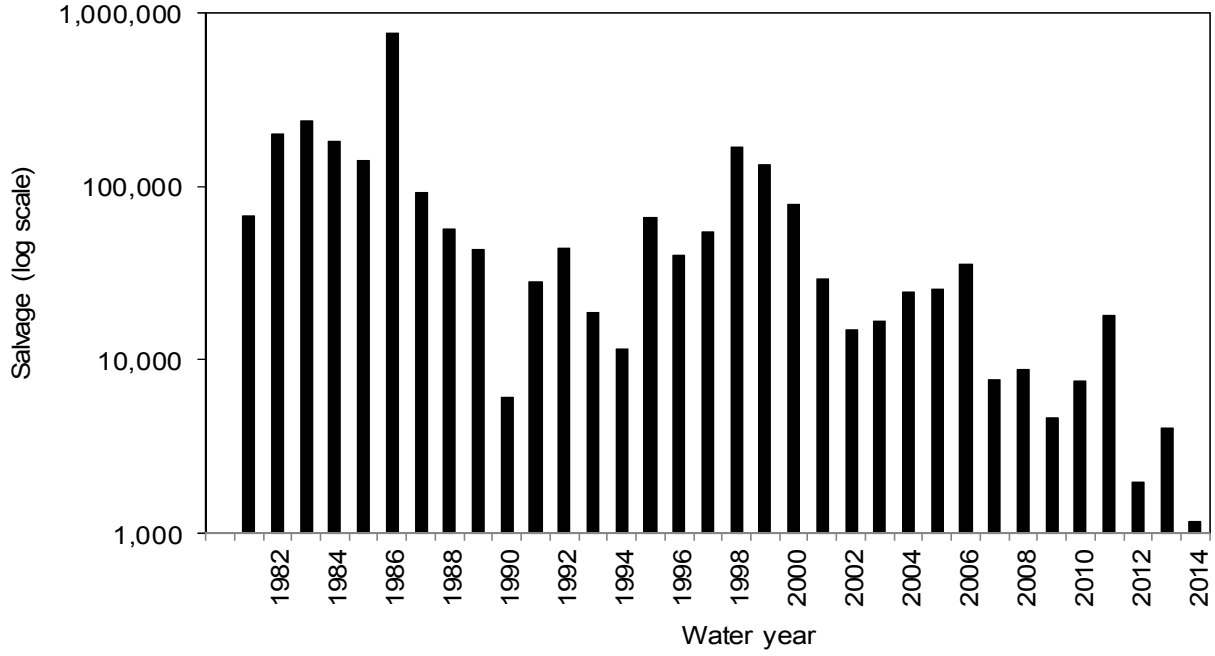

Figure 5 Annual salvage of Chinook Salmon (all races and origins combined) at the TFCF, WYs 1981–2014

Wild Chinook Salmon consisted primarily of fall run fish (46.5%; Table 1) followed by spring run fish (41.0%). Wild fall run fish and wild spring run fish were both salvaged in March-May (Figure 6). The majority of wild fall run fish (76.3%) and wild spring run fish (84.2%) were both salvaged in April. The estimated loss of Chinook Salmon was 827 (Table 1).

Steelhead

Salvage (wild and hatchery) of Steelhead (330) continued the pattern of mostly low salvage observed since WY 2005 (Figure 7). Salvage decreased from WY 2013 (646) and WY 2012 (493).

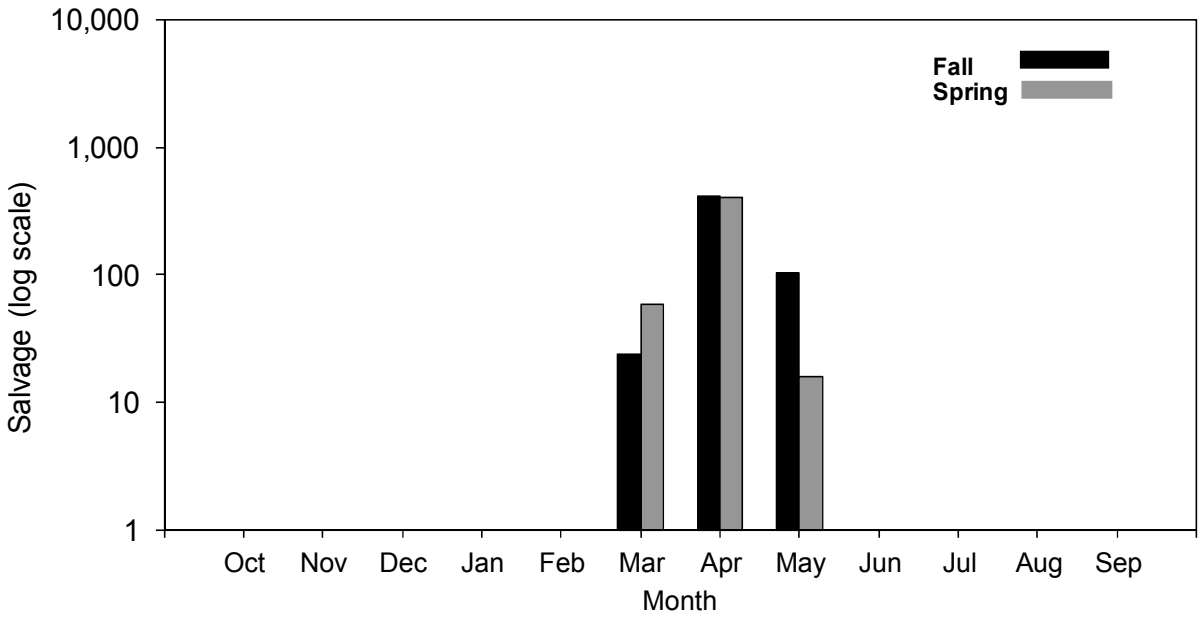

Figure 6 Monthly salvage of wild fall and spring Chinook Salmon at the TFCF, WY 2014

Table 1 Chinook Salmon annual salvage, percentages of annual salvage, and losses at the TFCF, WY 2014, by race and origin (wild or hatchery)

Origin	Race	Salvage	Percentage	Loss
Wild	Fall	540	46.5	385
	Late-fall	0	0.0	0
	Spring	476	41.0	313
	Winter	141	12.2	118
	Unknown Race	4	0.3	*
Total Wild		**1,161**		**816**
Hatchery	Fall	0	0.0	0
	Late-fall	0	0.0	0
	Spring	12	75.0	8
	Winter	4	25.0	3
Total Hatchery		**16**		**11**
Grand Total		***1,177***		**827**

* No length was taken for Chinook Salmon and consequently race and loss could not be determined

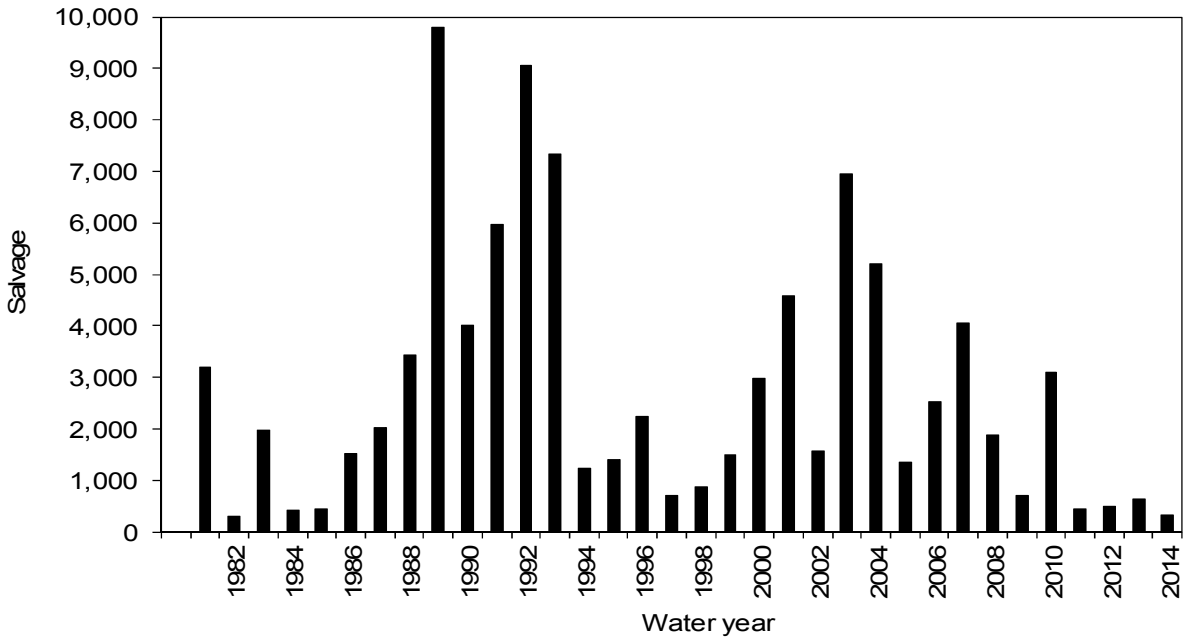

Figure 7 Annual salvage of Steelhead (all origins combined) at the TFCF, WYs 1981–2014

Steelhead salvage estimates were close to equally split between fish of wild and hatchery origin. The salvage composition was 183 hatchery and 147 wild fish.

Salvage of Steelhead occurred in the middle of the water year. Hatchery Steelhead was salvaged February-April while wild Steelhead was salvaged February-May (Figure 8). Hatchery Steelhead was salvaged most frequently in March while wild Steelhead was salvaged most frequently in April.

Striped Bass

The annual salvage of 5,933 Striped Bass was a record low and continued the low salvage trend observed since WY 1995 (Figure 9). Prior to WY 1995 and except

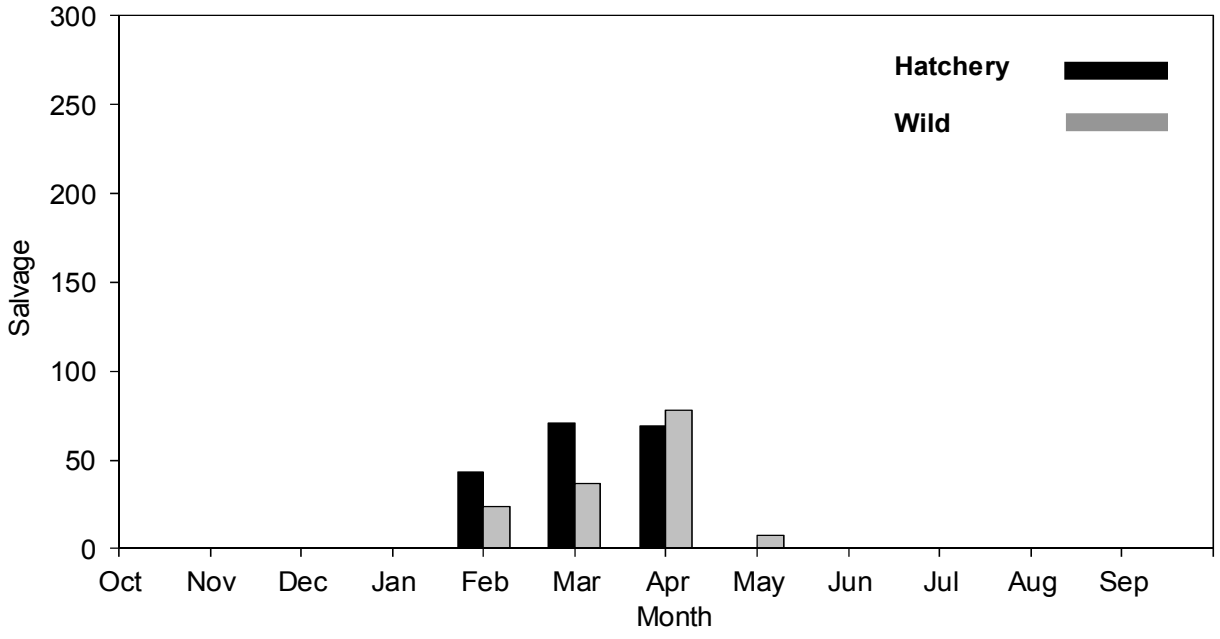

Figure 8 Monthly salvage of hatchery and wild Steelhead at the TFCF, WY 2014

for WY 1983 and WY 1988, annual Striped Bass salvages were above 1,000,000.

Most Striped Bass was salvaged in May-July (Figure 10). The May salvage (3,082), June salvage (1,543), and July salvage (550) accounted for 87.2% of the total salvage. Striped Bass was salvaged every month and the lowest salvage occurred in December (9).

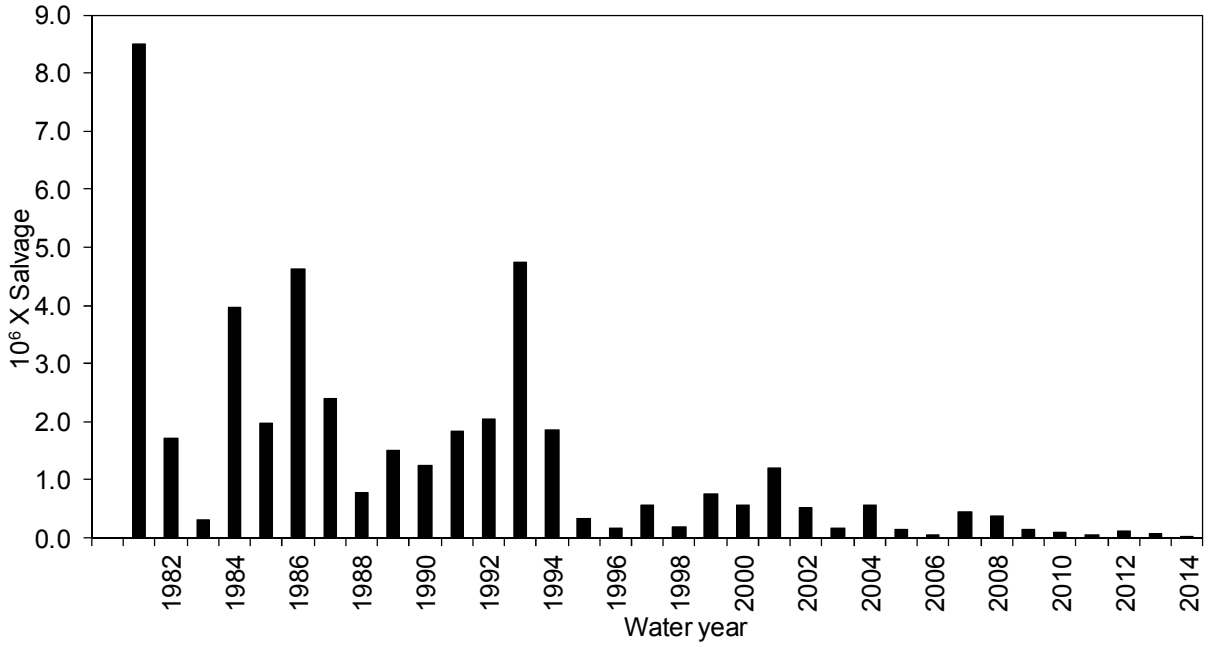

Figure 9 Annual salvage (in millions) of Striped Bass at the TFCF, WYs 1981–2014

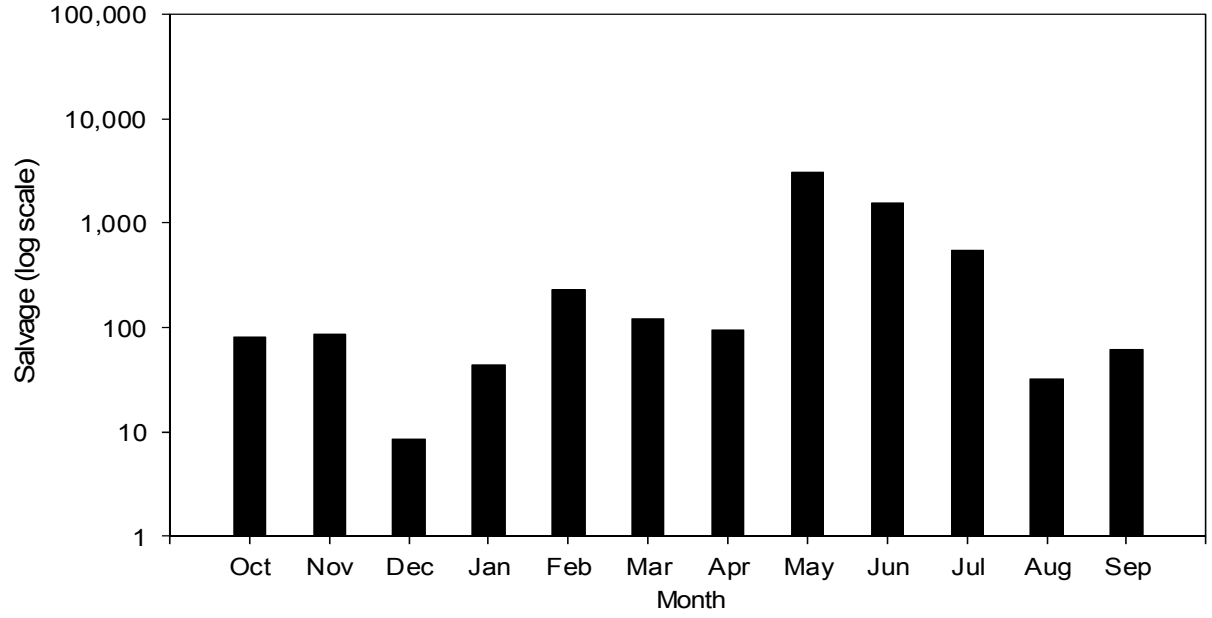

Figure 10 Monthly salvage of Striped Bass at the TFCF, WY 2014

Delta Smelt

Salvage of Delta Smelt (16) was a record low and decreased substantially from WY 2013 (300) and WY 2012 (355) (Figure 11). WYs 2005-2014 was the lowest 10-year period of annual salvage on record (16-1,009).

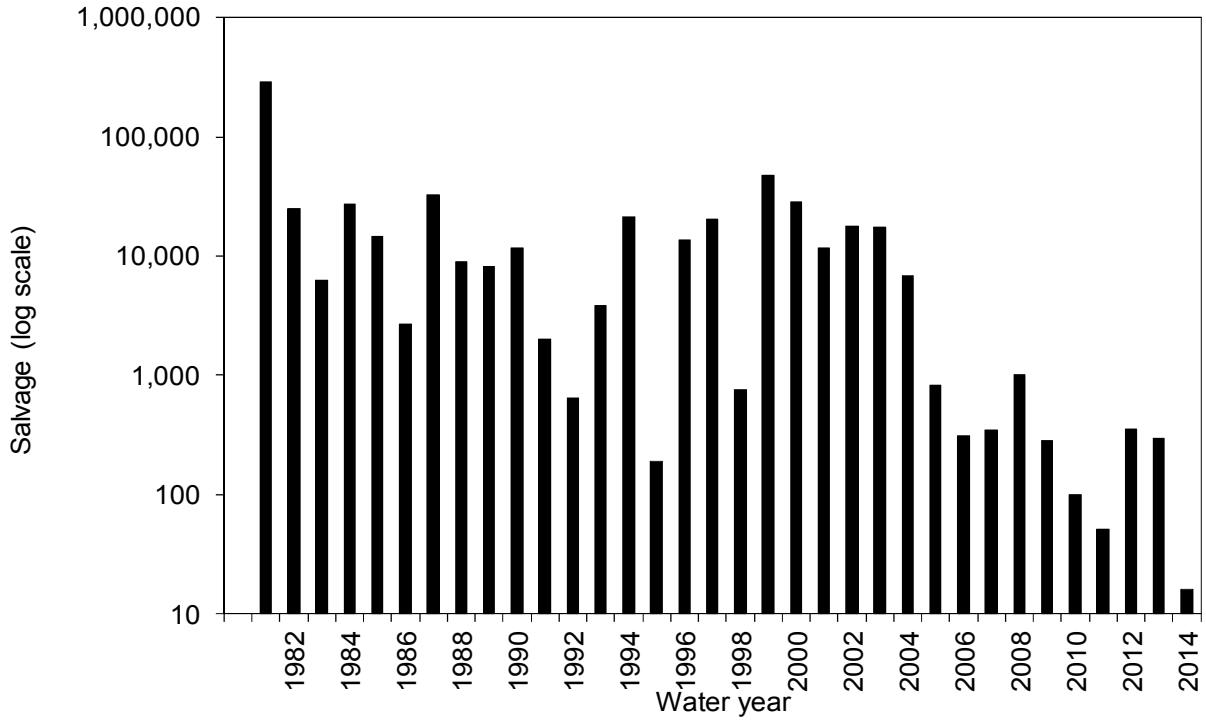

Figure 11 Annual salvage of Delta Smelt at the TFCF, WYs 1981–2014

No adult Delta Smelt was salvaged at the TFCF. Juvenile Delta Smelt was salvaged April-May, where May salvage (12) accounted for 75.0% of the total salvage (Figure 12).

Delta Smelt less than 20 mm FL were first detected at the TFCF on April 19 and were observed on 5 days of monitoring (Table 2). The longest periods of consecutive daily

detections were April 24-25 and May 2-3. April recorded the most daily detections (3 days).

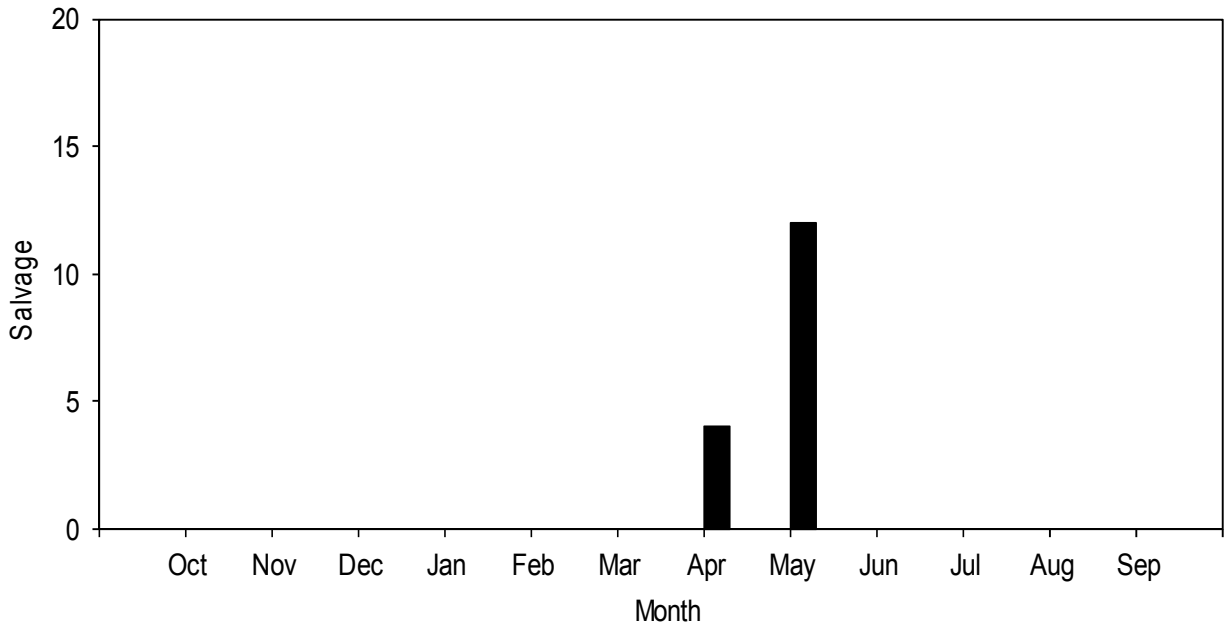

Figure 12 Monthly salvage of Delta Smelt at the TFCF, WY 2014

Table 2 Smelt less than 20 mm fork length (FL) observed in larval samples collected from the TFCF in WY 2014. Daily numbers of Delta Smelt and Longfin Smelt < 20 mm FL are recorded while an "N" indicates no detection

DATE	Delta Smelt larvae	Longfin Smelt larvae
4/13/2014	N	1
4/19/2014	1	N
4/21/2014	N	1
4/24/2014	1	N
4/25/2014	1	N
5/2/2014	1	N
5/3/2014	2	N

Longfin Smelt

Salvage of Longfin Smelt (8) decreased from WY 2013 (241) and 2012 (898). Low annual salvages have generally been observed since 1991, with the exception of 43,056 salvaged in WY 2002 (Figure 13).

Longfin Smelt was only salvaged in April at the TFCF which accounted for 100.0% of the total annual salvage (Figure 14).

Longfin Smelt less than 20 mm FL were first detected at the TFCF on April 13 and were observed on 2 days of monitoring (Table 2). April was also the only month with <20 mm FL detections.

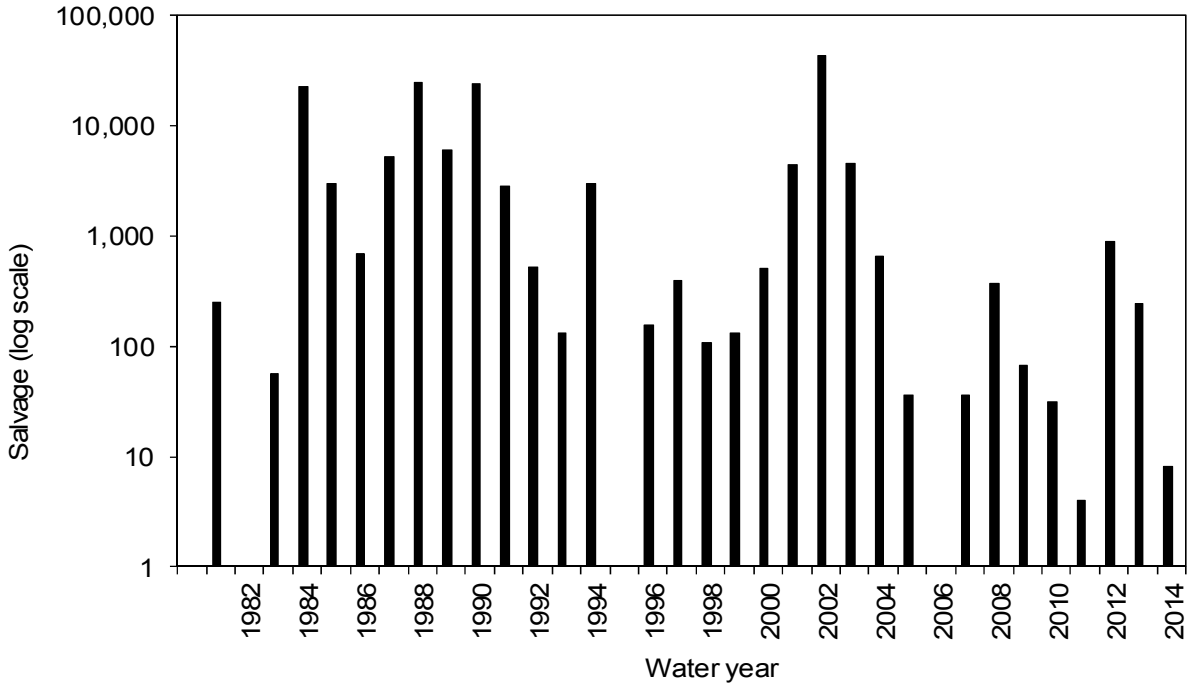

Figure 13 Annual salvage of Longfin Smelt at the TFCF, WYs 1981–2014

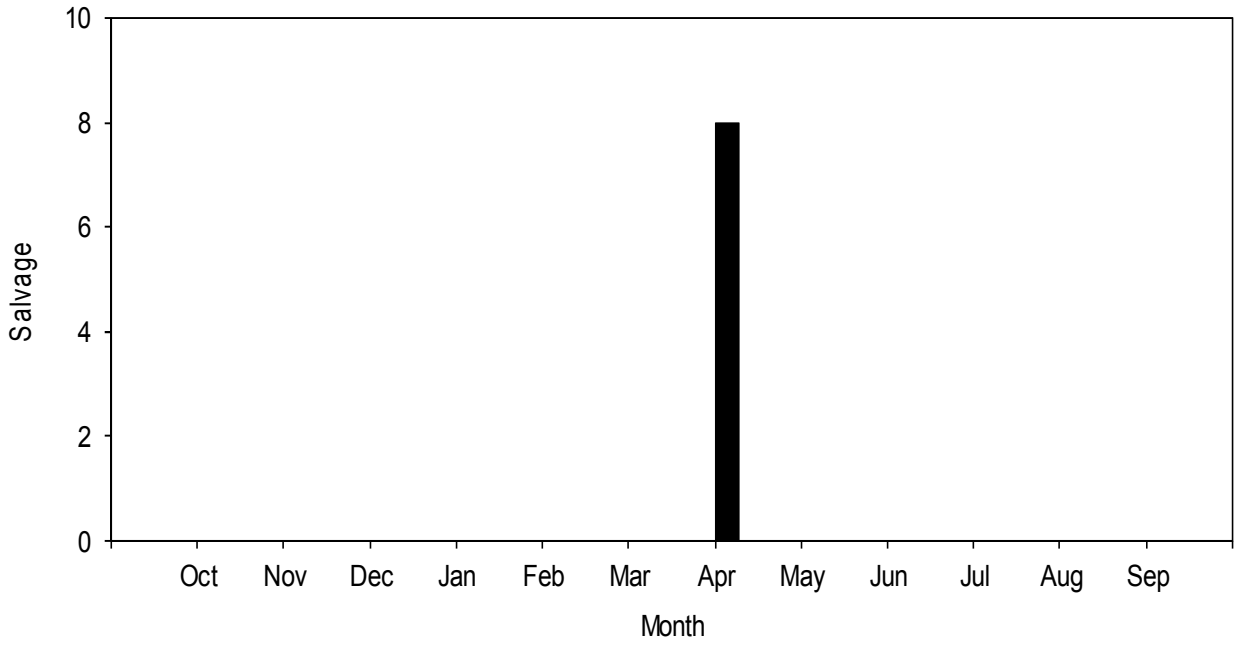

Figure 14 Monthly salvage of Longfin Smelt at the TFCF, WY 2014

Splittail

The record low salvage of Splittail (12) was a decrease from WY 2013 (125), and markedly lower than the record high in WY 2011 (7,660,024). Splittail salvage has followed a boom-or-bust pattern, often varying year to year by several orders of magnitude (Figure 15). High Splittail salvage is generally associated with wet years.

Threadfin Shad

The record low salvage of Threadfin Shad (47,603) was a substantial decrease from WY 2013 (2,463,695) and the previous record low salvage in WY 2012 (109,610). 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).

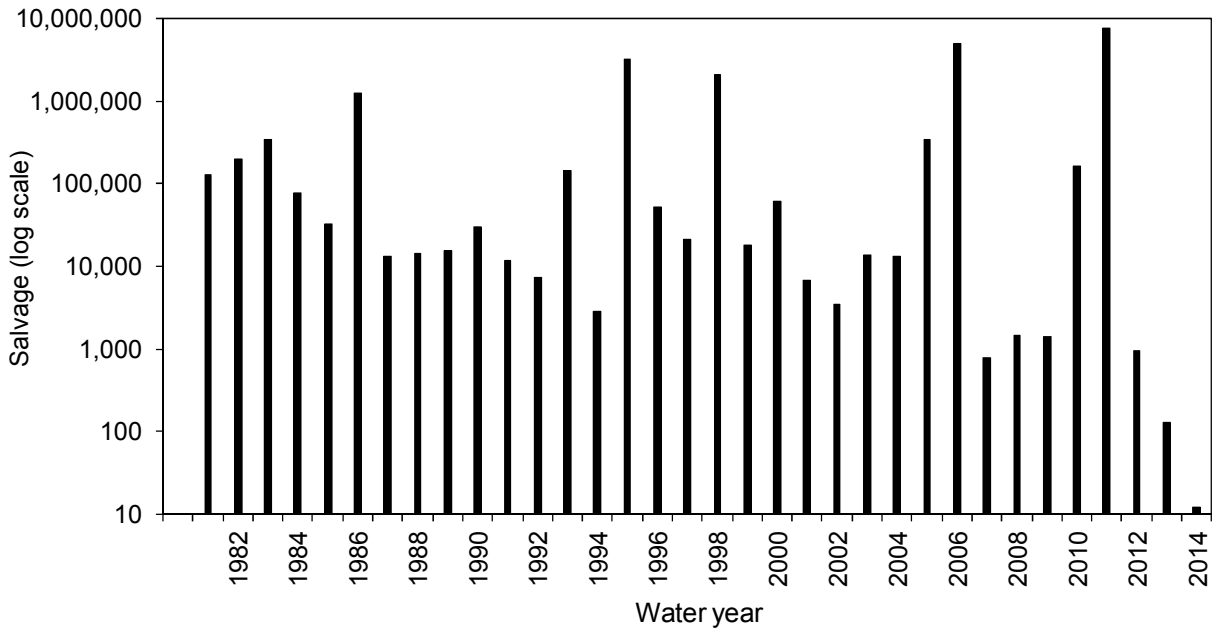

Figure 15 Annual salvage of Splittail at the TFCF, WYs 1981–2014

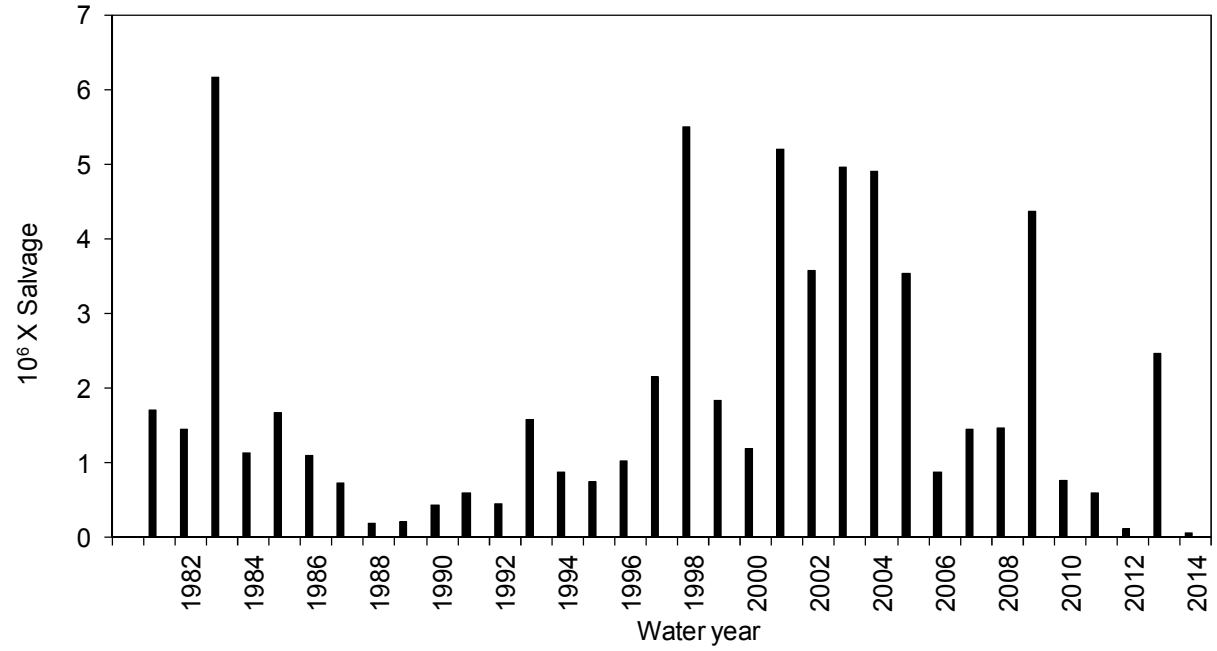

Figure 16 Annual salvage (in millions) of Threadfin Shad at the TFCF, WYs 1981–2014

References

California Dept. of Fish and Wildlife. 2014. Delta Model length at date table.

Available at: ftp://ftp.dfg.ca.gov/salvage/

FOOTNOTES

1. Pelagic Organism Decline (POD) species

Appendix A Annual salvages and percentages of annual salvage (%) for fish collected from the TFCF in WY 2014 and WY 2013

Species	2014 Salvage	% Composition	2013 Salvage	% Composition
Bluegill	63,667	39.6	115,796	4.1
Threadfin Shad	47,603	29.6	2,463,695	87.1
Largemouth Bass	11,961	7.4	43,291	1.5
White Catfish	10,261	6.4	12,341	0.4
Inland Silverside	6,163	3.8	28,747	1.0
Striped Bass	5,933	3.7	57,855	2.0
Shimofuri Goby	4,382	2.7	601	<0.1
Prickly Sculpin	2,494	1.6	6,621	0.2
Golden Shiner	1,367	0.9	3,920	0.1
Chinook Salmon	1,177	0.7	4,032	0.1
American Shad	1,080	0.7	71,619	2.5
Channel Catfish	972	0.6	3,150	0.1
Rainwater Killifish	835	0.5	7,444	0.3
Black Crappie	667	0.4	3,093	0.1
Western Mosquitofish	389	0.2	222	<0.1
Yellowfin Goby	352	0.2	1,343	<0.1
Steelhead	330	0.2	646	<0.1
Redear Sunfish	268	0.2	1,078	<0.1
Pacific Herring	204	0.1	0	0.0
Threespine Stickleback	154	0.1	97	<0.1
Pacific Lamprey	144	<0.1	24	<0.1
Black Bullhead	47	<0.1	166	<0.1
Bigscale Logperch	35	<0.1	141	<0.1
Tule Perch	35	<0.1	232	<0.1
Warmouth	32	<0.1	159	<0.1
Brown Bullhead	30	<0.1	47	<0.1
Lamprey Unknown	24	<0.1	1,288	<0.1
Delta Smelt	16	<0.1	300	<0.1
Splittail	12	<0.1	125	<0.1
Wakasagi	12	<0.1	42	<0.1
Longfin Smelt	8	<0.1	241	<0.1
Pacific Brook Lamprey	8	<0.1	16	<0.1
Green Sunfish	7	<0.1	46	<0.1
Sacramento Blackfish	4	<0.1	16	<0.1
White Crappie	4	<0.1	23	<0.1
Blue Catfish	4	<0.1	0	0.0
Common Carp	0	0.0	26	<0.1
Shokihaze Goby	0	0.0	11	<0.1
Pacific Staghorn Sculpin	0	0.0	8	<0.1

Appendix A (Cont) Annual salvages and percentages of annual salvage (%) for fish collected from the TFCF in WY 2014 and WY 2013

Species	2014 Salvage	% Composition	2013 Salvage	% Composition
White Sturgeon	0	0.0	4	<0.01
Starry Flounder	0	0.0	4	<0.01
Fathead Minnow	0	0.0	4	<0.01