Fish Salvage at the Tracy Fish Collection Facility during the 2015 Water Year

by

Geir A. Aasen

Contract Number

R1130005

January 28, 2016

California Department of Fish and Wildlife
Bay-Delta Region
Native Fishes and Fish Facilities Monitoring Unit
2109 Arch-Airport Road, Suite 100
Stockton, CA 95206

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 2015 water year (10/1/2014-9/30/2015) 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 2015 were noted. Salvage data from WYs 1981 to 2015 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. Intra-annual abundances were examined by plotting the monthly salvage totals for selected fish species and for all fish taxa combined for 2015.

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 February 24 through June 11 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 695,650 acre feet (AF) of water which was a record low and represented a 27% decrease from the previous record low in WY 2014 (947,777 AF) (Figure 1). The annual exports in WYs 2014-2015 were a marked decrease to WYs 2008-2013 which ranged from 1,844,493 to 2,539,025 AF. The record low export coincided with WY 2015 being a critical water year and the 4th straight year of drought conditions in California.

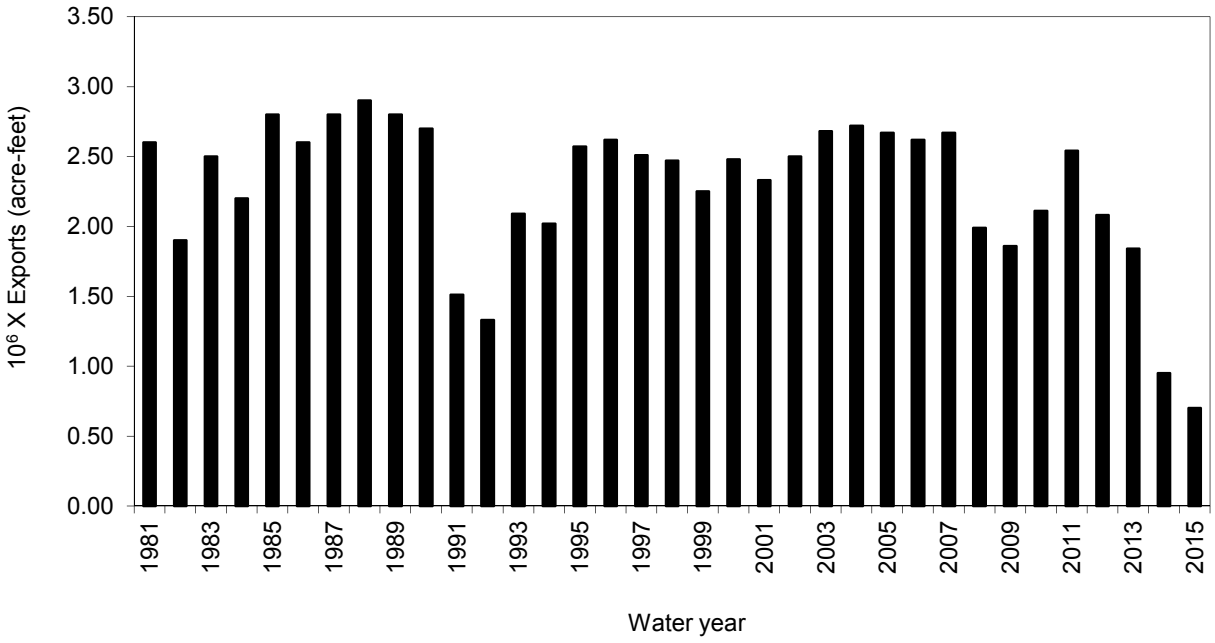

Figure 1 Annual exports (by water year; WY) in millions of acre-feet for the Central Valley Project, WYs 1981–2015

The majority of water exports occurred in December 2014, March 2015, and September 2015 (Figure 2). During this period, a total of 322,154 AF was exported, accounting for 46.3% of the total export. The 2014-2015 WY monthly exports differed from past years where December and March exports were generally lower than summer and fall months, but December 2014 exports coincided with rain events while exports were higher in the first 2 weeks of March 2015 because of available water in the Delta. Monthly exports ranged from 18,811 to 136,196 AF. Combined exports for April-June was 97,312 AF which was a decrease for the same period during WYs 2004-2013 (137,323-439,833 AF).

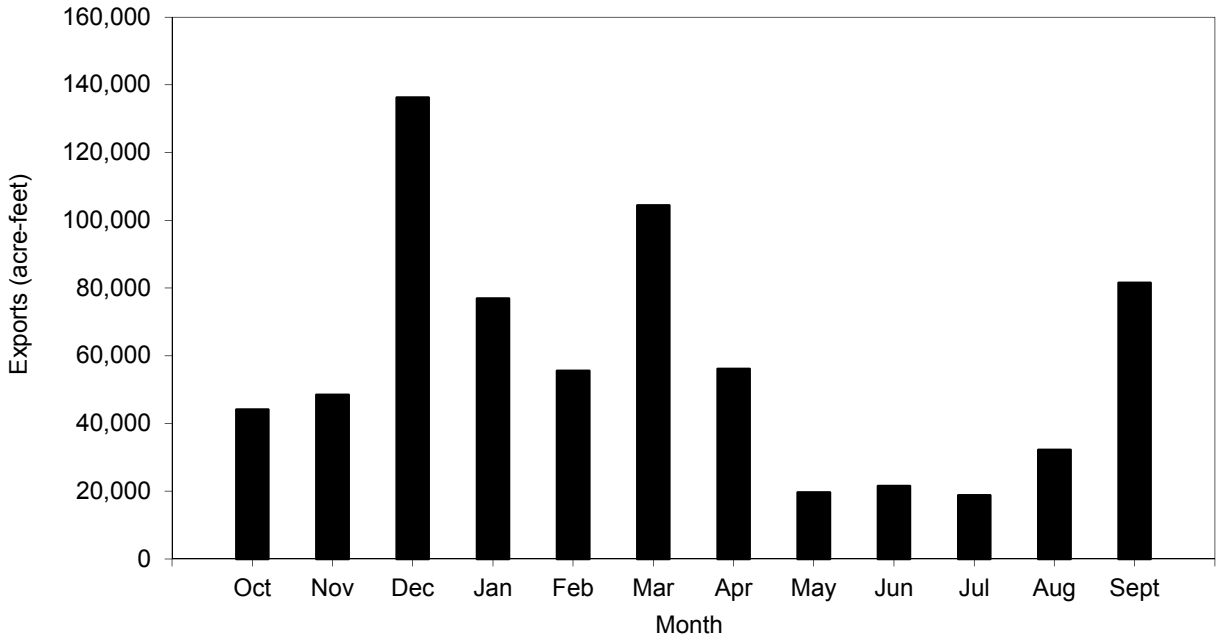

Figure 2 Monthly exports (in acre-feet) for the Central Valley Project, WY 2015

Total Salvage and Prevalent Species

Total fish salvage (all fish combined) at the TFCF was low at 295,854 (Figure 3). This was an increase from the record low in WY 2014 (160,681), but was well below the record high salvage of 37,659,835 in WY 2006. The low total fish salvage in WYs 2014-2015 was most likely affected by record low exports since salvage in recent years has been influenced by exports (i.e. lower salvage at low exports).

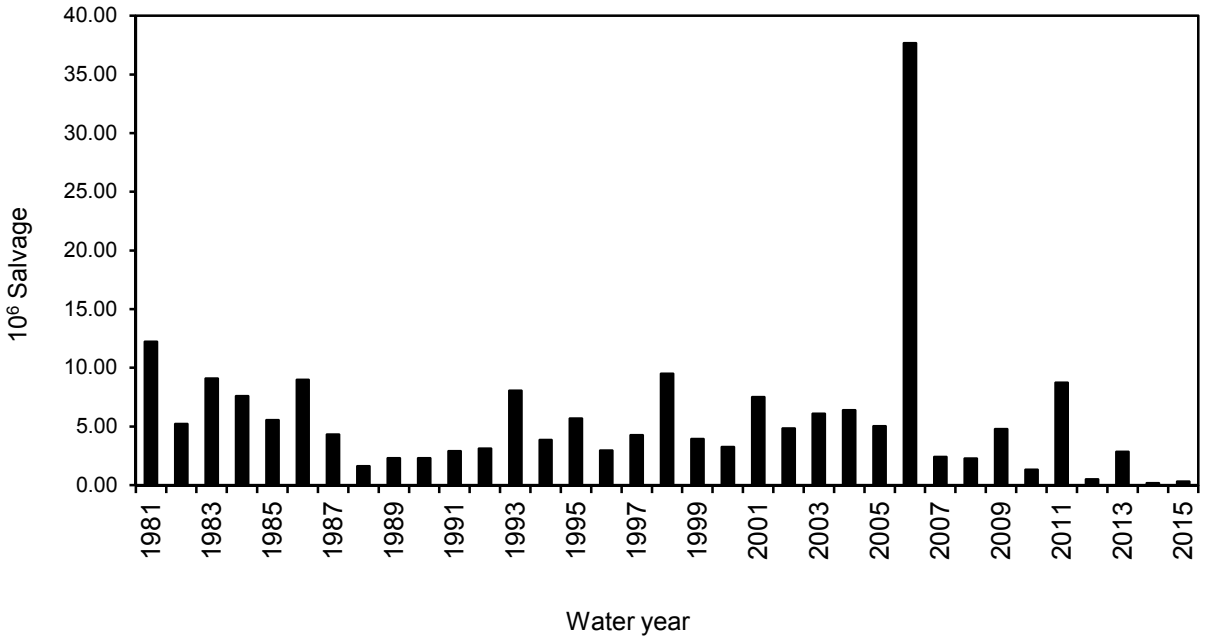

Figure 3 Annual salvage (by water year, WY; in millions) of all fish taxa combined at the TFCF, WYs 1981–2015

Threadfin Shad accounted for 38.8% of the total salvage (Figure 4 and Appendix A). Threadfin Shad usually makes 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 Bluegill (36.5%), Striped Bass (7.2%), Shimofuri Goby (3.9%), and Largemouth Bass (3.8%). The Striped Bass contribution to

total salvage increased compared to WY 2014 (3.7%) and WY 2013 (2.0%), but decreased substantially compared to WY 2012 (22.3%). Native species comprised 1.3% of total fish salvage. Chinook Salmon, Steelhead, Delta Smelt, and Longfin Smelt accounted for 0.1% of salvage.

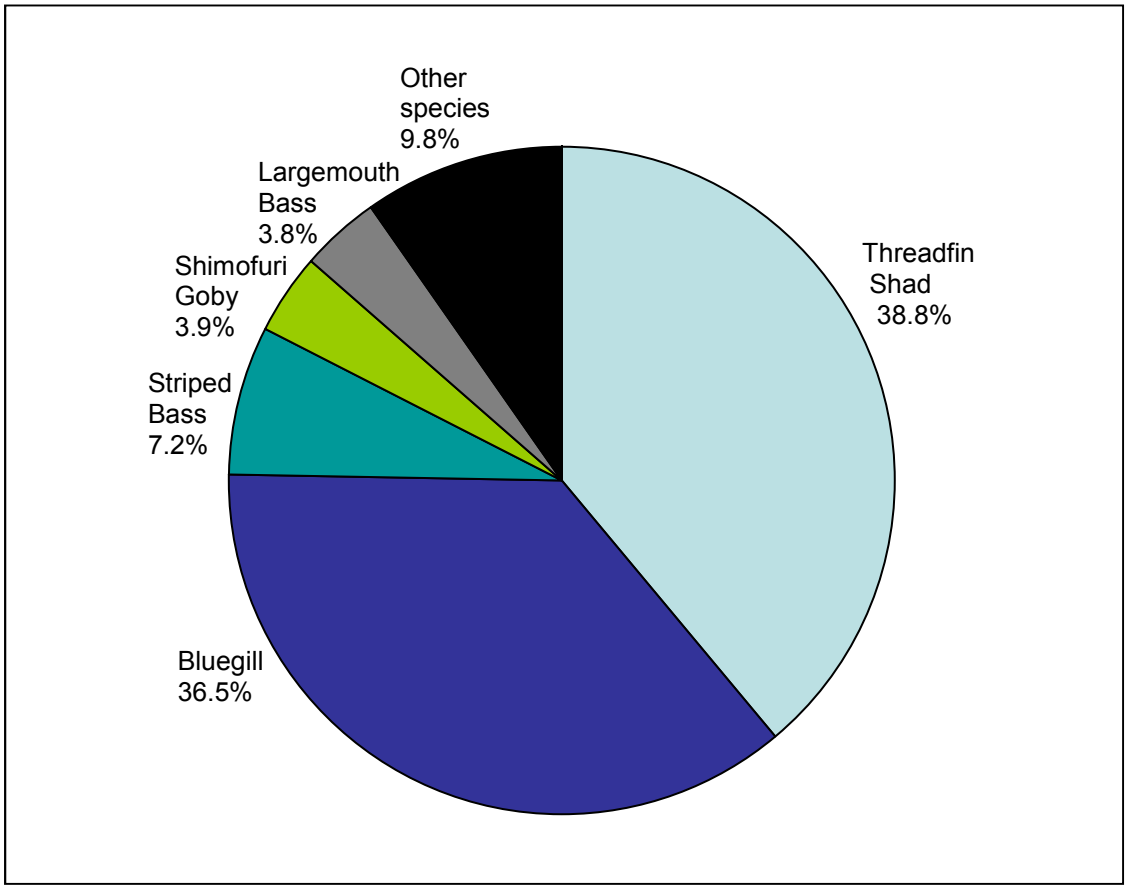

Figure 4 Percentages of annual salvage for the 5 most-prevalent species and other species combined at the TFCF, WY 2015

Chinook Salmon

The annual salvage of 187 juvenile 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 2015 was a marked decrease from the previous record lows in WY 2014 (1,177) and WY 2012 (1,965). Mean WYs 2001-2015 TFCF salvage was only 11.0% of the mean salvage in WYs 1981-2000.

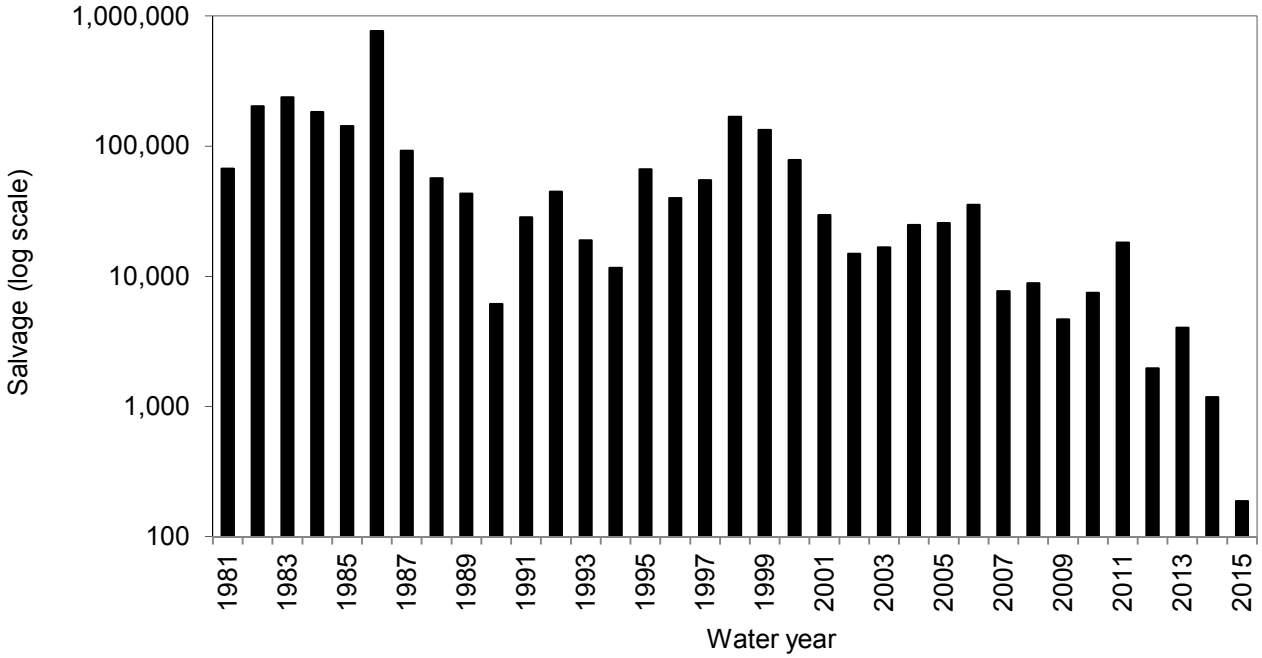

Figure 5 Annual salvage of Chinook Salmon (all races and origins combined) at the TFCF, WYs 1981–2015

Wild Chinook Salmon consisted primarily of spring run sized fish (47.2%) followed by winter run sized fish (39.6%; Table 1). Wild spring run fish were salvaged in March-May while wild winter run fish were salvaged in December and January (Figure 6). The majority of wild spring run fish (65.1%) were salvaged in April and the majority of wild winter run fish (66.7%) were salvaged in January. The estimated loss of Chinook Salmon was 148 (Table 1).

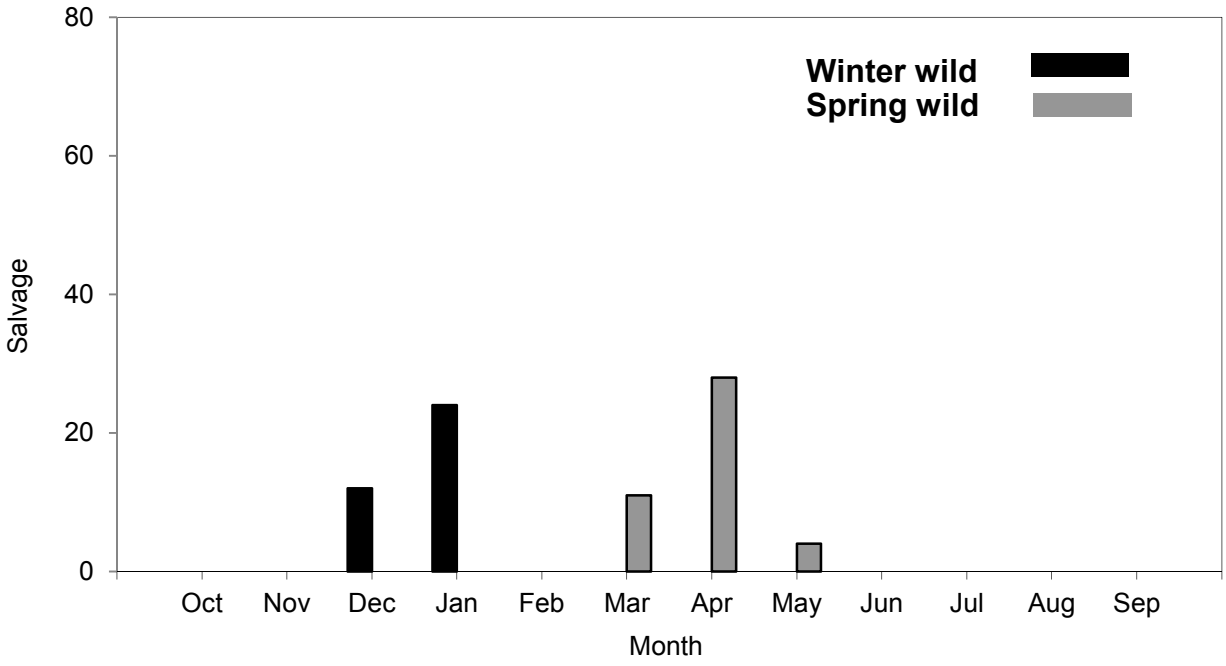

Figure 6 Monthly salvage of wild spring and winter run Chinook Salmon at the TFCF, WY 2015

Table 1 Chinook Salmon annual salvage, percentages of annual salvage, and losses at the TFCF, WY 2015, by race and origin (wild or hatchery)

Origin	Race	Salvage	Percentage	Loss
Wild	Fall	12	13.2	9
	Late-fall	0	0.0	0
	Spring	43	47.2	36
	Winter	36	39.6	31
Total Wild		**91**		**76**
Hatchery	Fall	0	0.0	0
	Late-fall	72	75.0	54
	Spring	8	8.3	7
	Winter	16	16.7	11
Total Hatchery		**96**		**72**
Grand Total		***187***		**148**

Steelhead

Salvage of wild and hatchery Steelhead (124) was a record low and continued the pattern of mostly low salvage observed since WY 2005 (Figure 7). Salvage decreased markedly from WY 2014 (330) and WY 2013 (646).

Juvenile Steelhead salvage estimates were primarily of hatchery origin. The salvage composition was 116 hatchery and 8 wild fish.

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

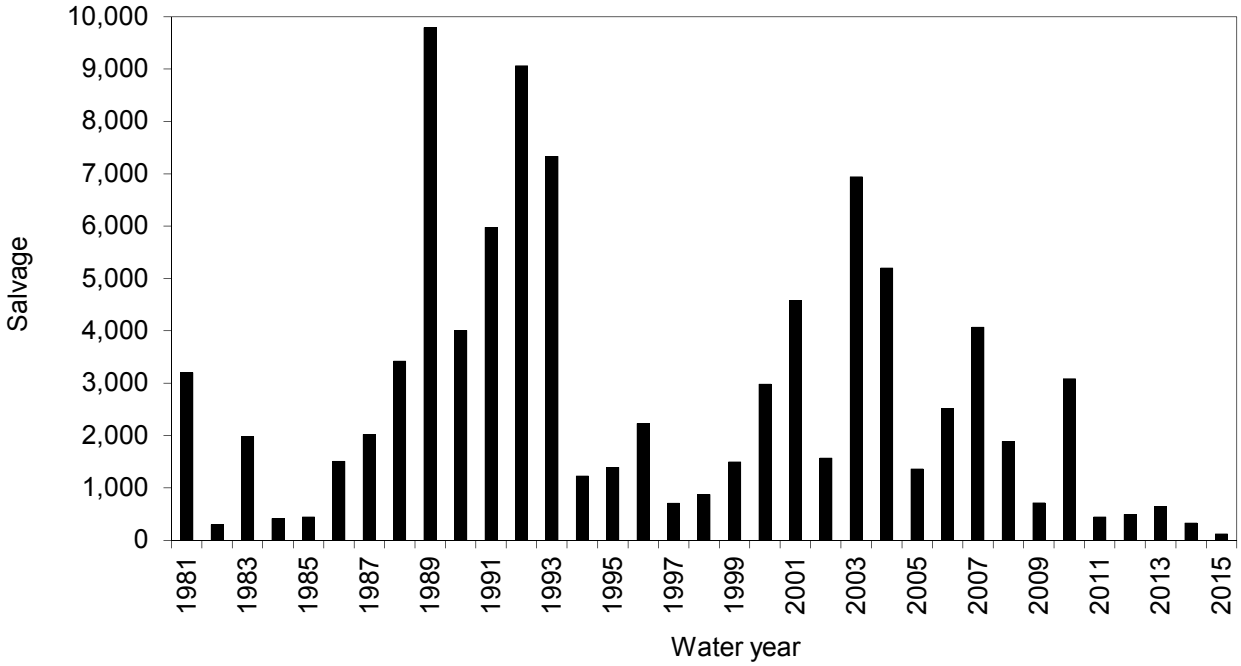

Figure 7 Annual salvage of Steelhead (all origins combined) at the TFCF, WYs 1981–2015

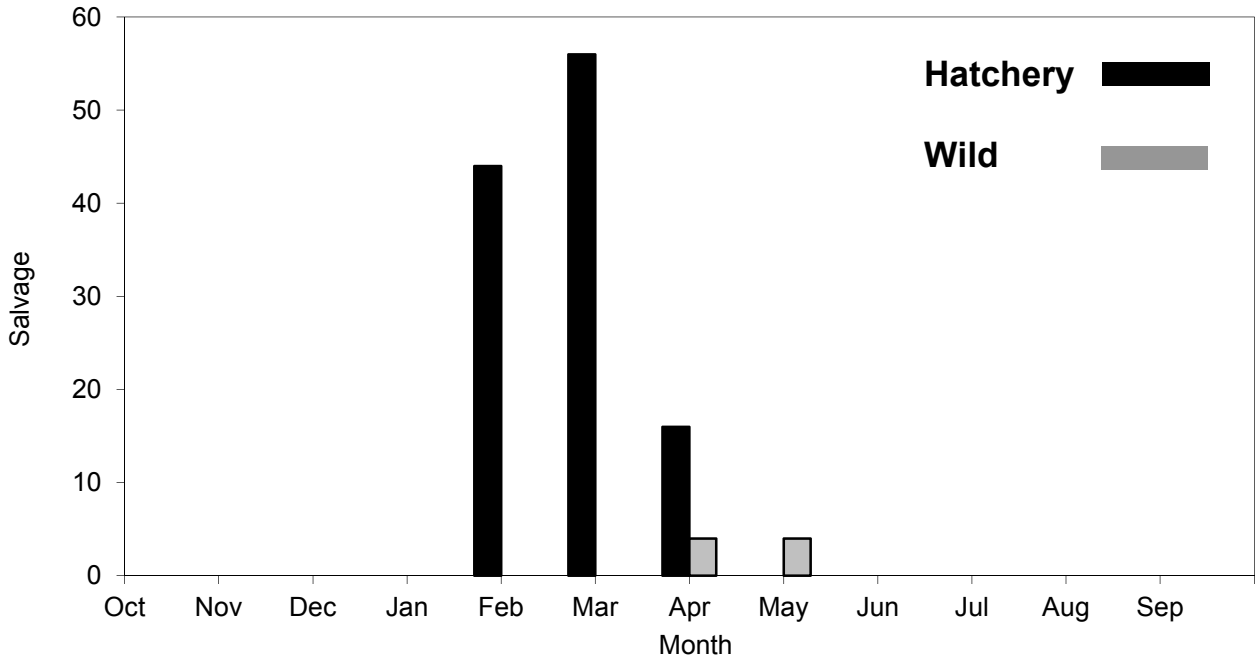

Figure 8 Monthly salvage of hatchery and wild Steelhead at the TFCF, WY 2015

Striped Bass

The annual salvage of 21,398 Striped Bass was a near record low and continued the low salvage trend 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 was salvaged in December and May-June (Figure 10). The December salvage (3,286), May salvage (9,265), and June salvage (5,443) accounted for 84.1% of the total salvage. The high salvage in December, which was unusual, coincided with high monthly water export. Striped Bass was salvaged every month and the lowest salvage occurred in October (2).

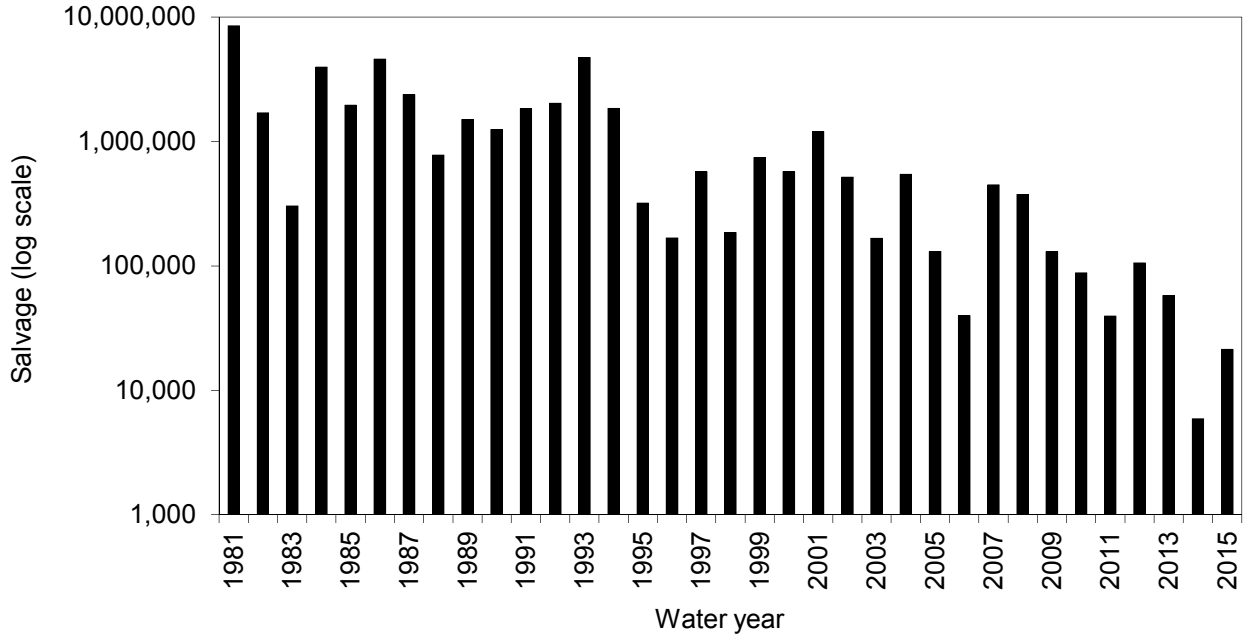

Figure 9 Annual salvage of Striped Bass at the TFCF, WYs 1981–2015

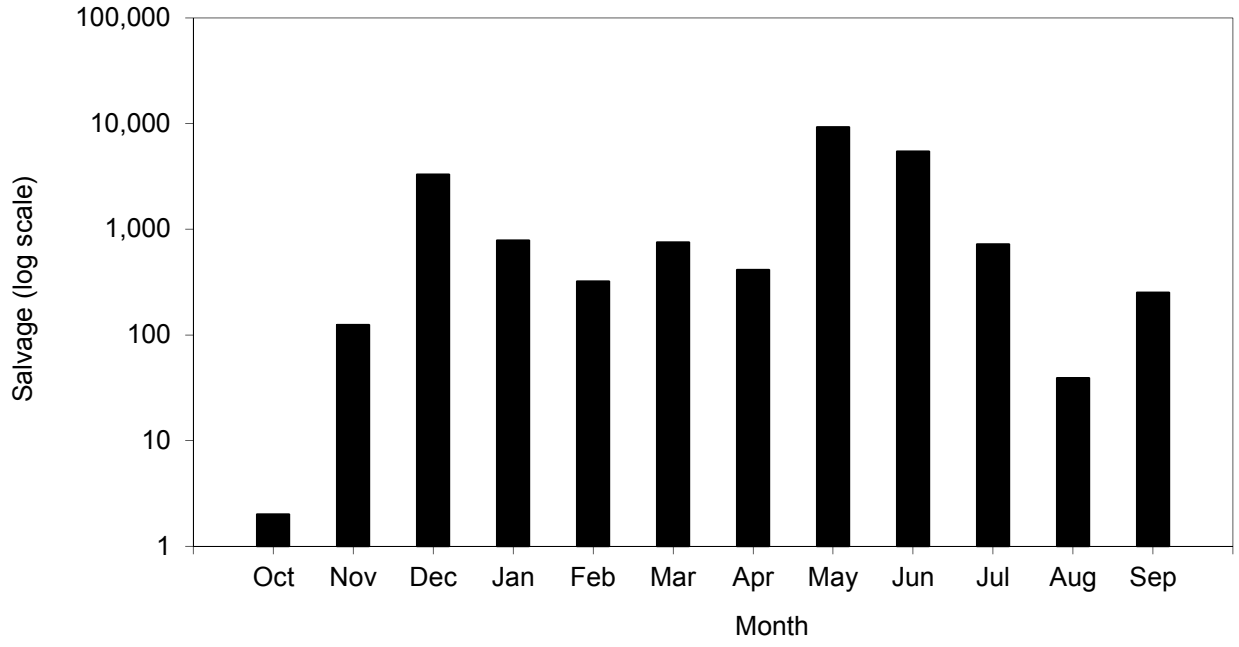

Figure 10 Monthly salvage of Striped Bass at the TFCF, WY 2015

Delta Smelt

Salvage of Delta Smelt (68) was a near record low and increased from the record low in WY 2014 (16), but was a marked decrease from WY 2013 (300) (Figure 11). WYs 2005-2015 was the lowest 10-year period of annual salvage on record (16-1,009).

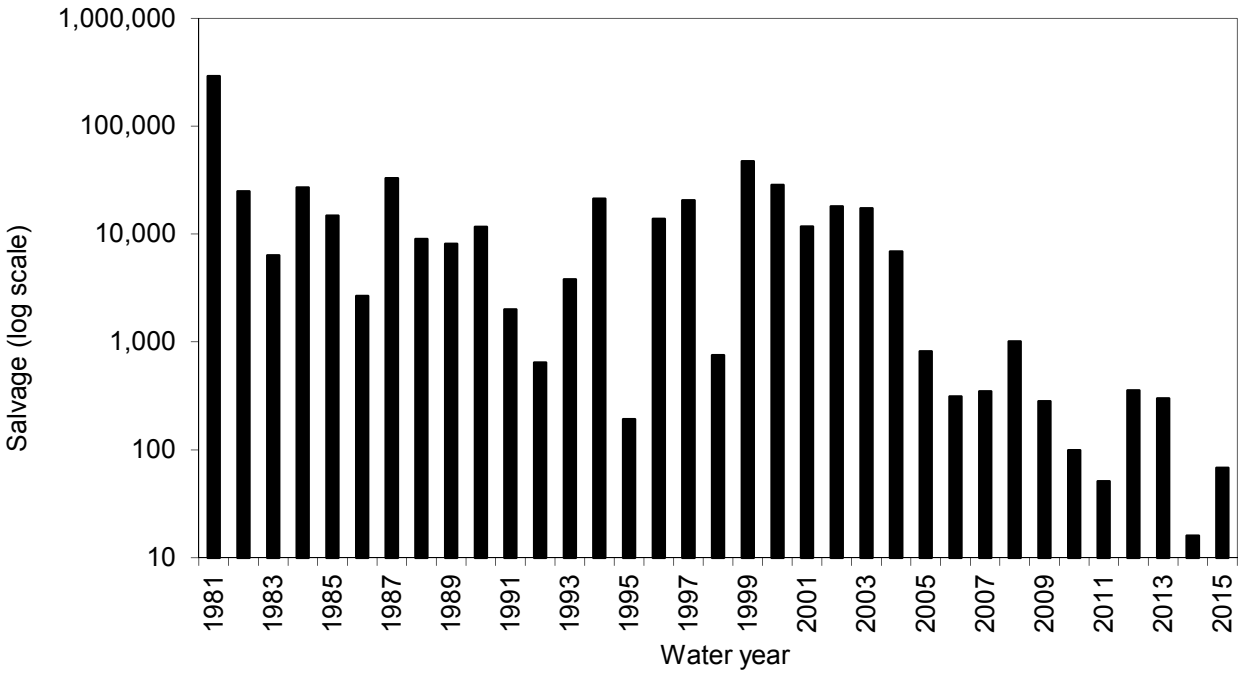

Figure 11 Annual salvage of Delta Smelt at the TFCF, WYs 1981–2015

Adult Delta Smelt was salvaged January-February, where January salvage (52) accounted for 76.5% of the total WY salvage. Juvenile Delta Smelt was salvaged in May (Figure 12).

No Delta Smelt less than 20 mm FL were detected at the TFCF in WY 2015 which was a decrease from WY 2014 (6) and WY 2013 (9).

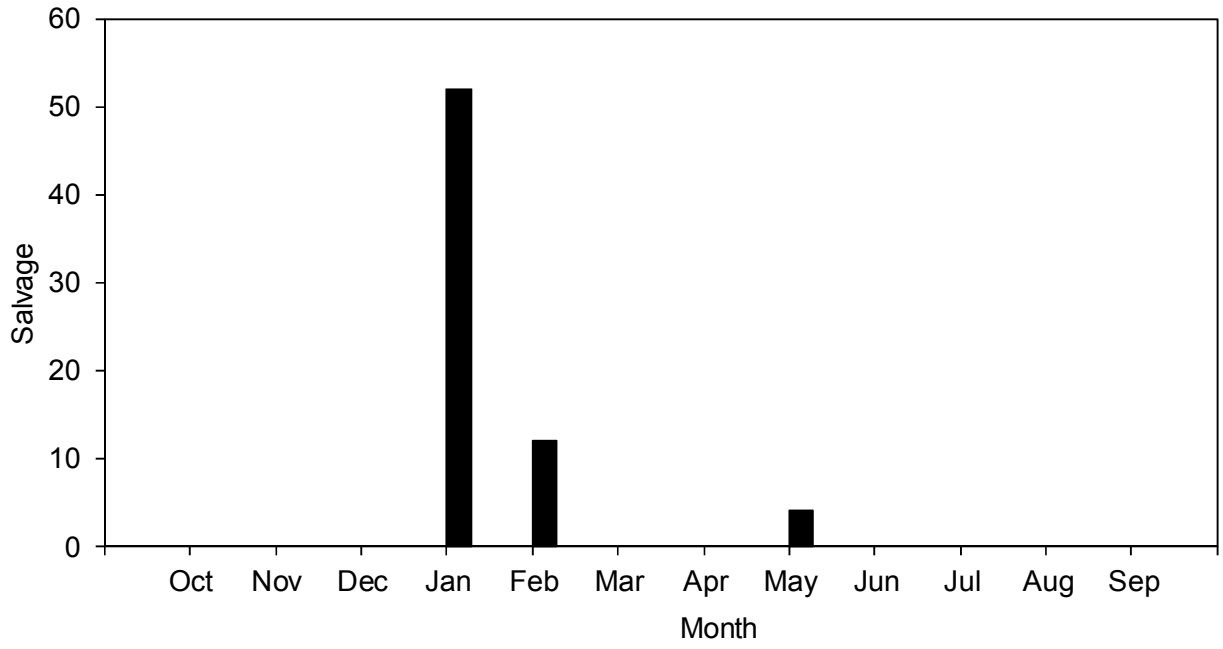

Figure 12 Monthly salvage of Delta Smelt at the TFCF, WY 2015

Longfin Smelt

Salvage of Longfin Smelt (28) increased from WY 2014 (8), but markedly decreased from WY 2013 (241). Low annual salvages have generally been observed since 1991, with the exception of 43,056 salvaged in WY 2002 (Figure 13).

Juvenile Longfin Smelt was salvaged March-May. April salvage (12) accounted for 42.9% of the total WY salvage (Figure 14).

Longfin Smelt less than 20 mm FL were first detected at the TFCF on February 27 and were observed on 5 days of monitoring (Table 2). April recorded the most daily detections (3 days).

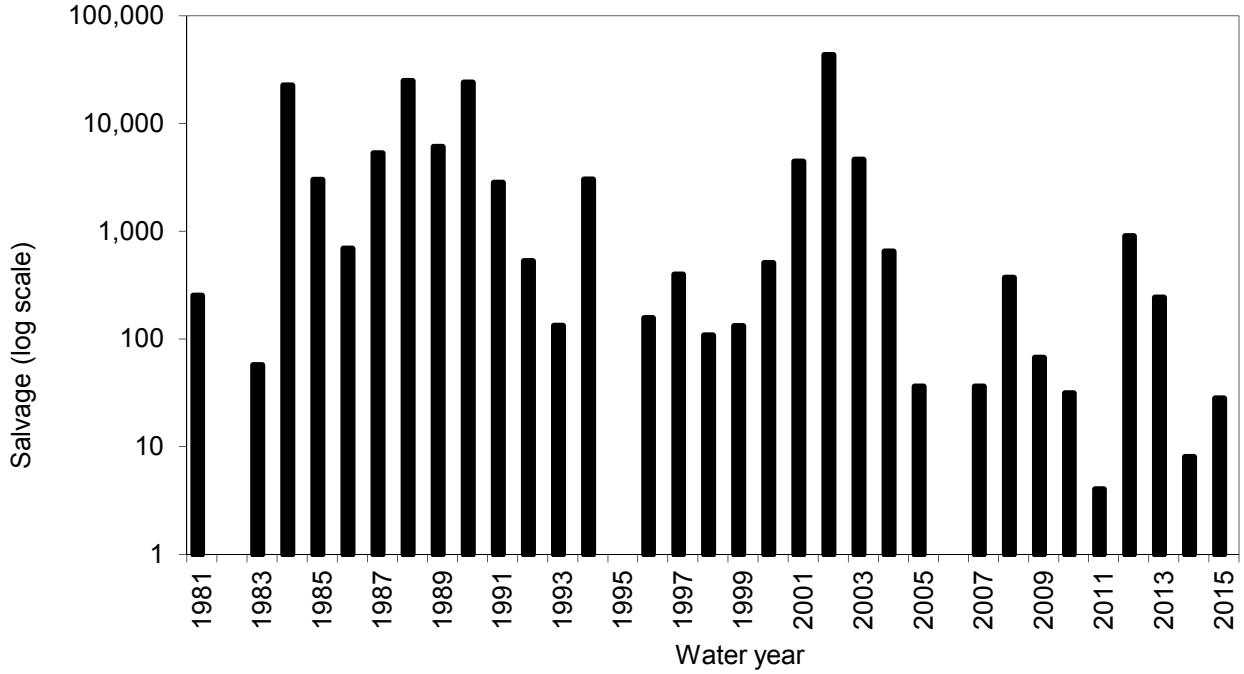

Figure 13 Annual salvage of Longfin Smelt at the TFCF, WYs 1981–2015

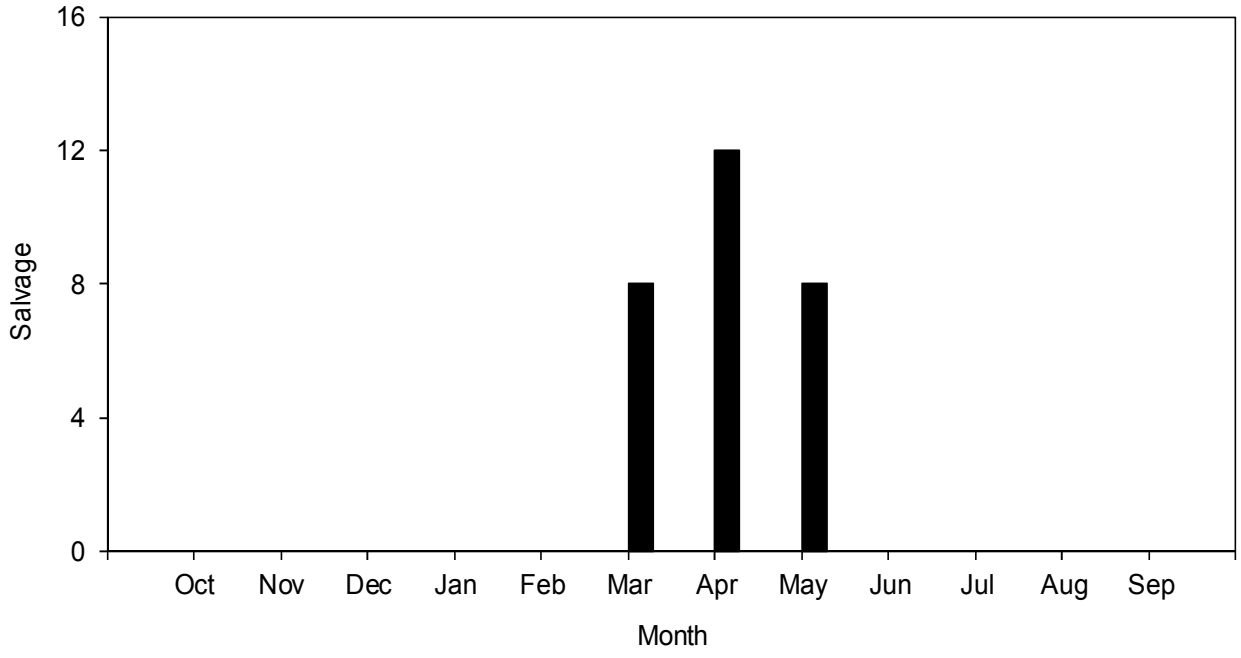

Figure 14 Monthly salvage of Longfin Smelt at the TFCF, WY 2015

Table 2 Longfin Smelt less than 20 mm fork length (FL) observed in larval samples collected from the TFCF in WY 2015. Daily numbers of Longfin Smelt < 20 mm FL are recorded

Date	Longfin Smelt larvae
2/27/2015	1
3/30/2015	1
4/8/2015	1
4/14/2015	1
4/23/2015	1

Splittail

The record tying low salvage of Splittail (12) was equal to the record low in WY 2014 (12), 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.

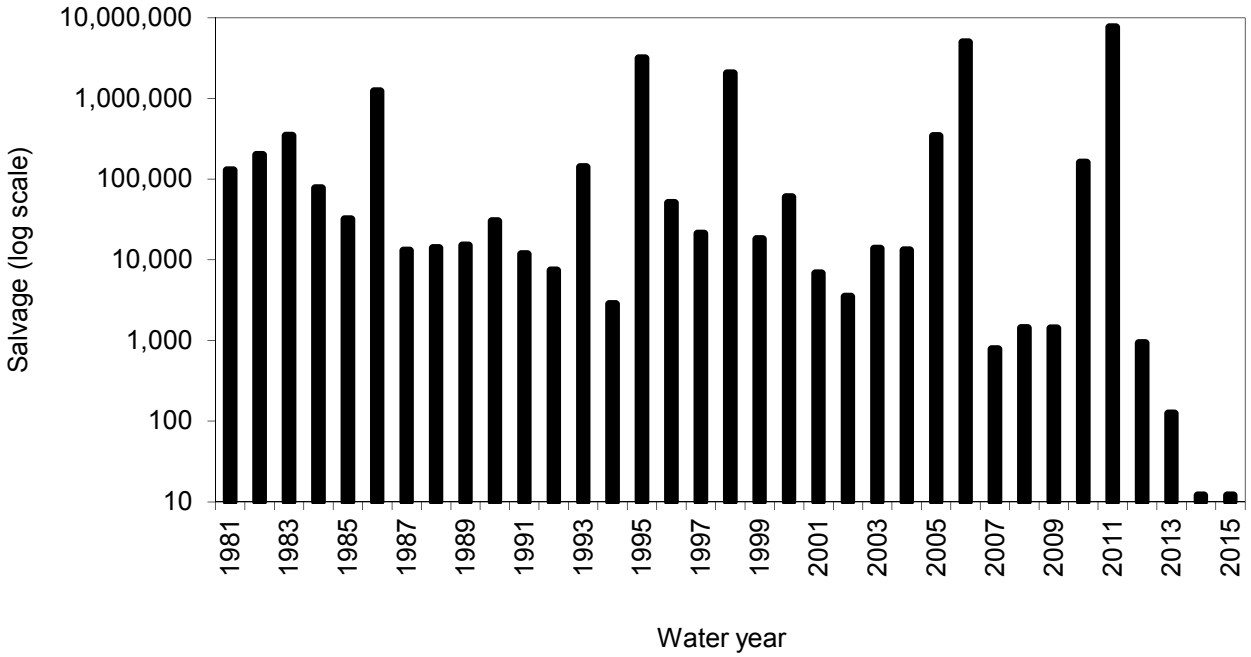

Figure 15 Annual salvage of Splittail at the TFCF, WYs 1981–2015

Threadfin Shad

The near record low salvage of juvenile and adult Threadfin Shad (114,804) was an increase from the record low in WY 2014 (47,603), but a substantial decrease from WY 2013 (2,463,695). 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).

Threadfin Shad salvage in WY 2015 followed the same trend as observed in past years (Figure 17). Adult Threadfin Shad was generally salvaged in fall, winter, and spring. Juvenile Threadfin Shad was salvaged June-September where August-September salvage (82,349) accounted for 71.7% of the total WY salvage.

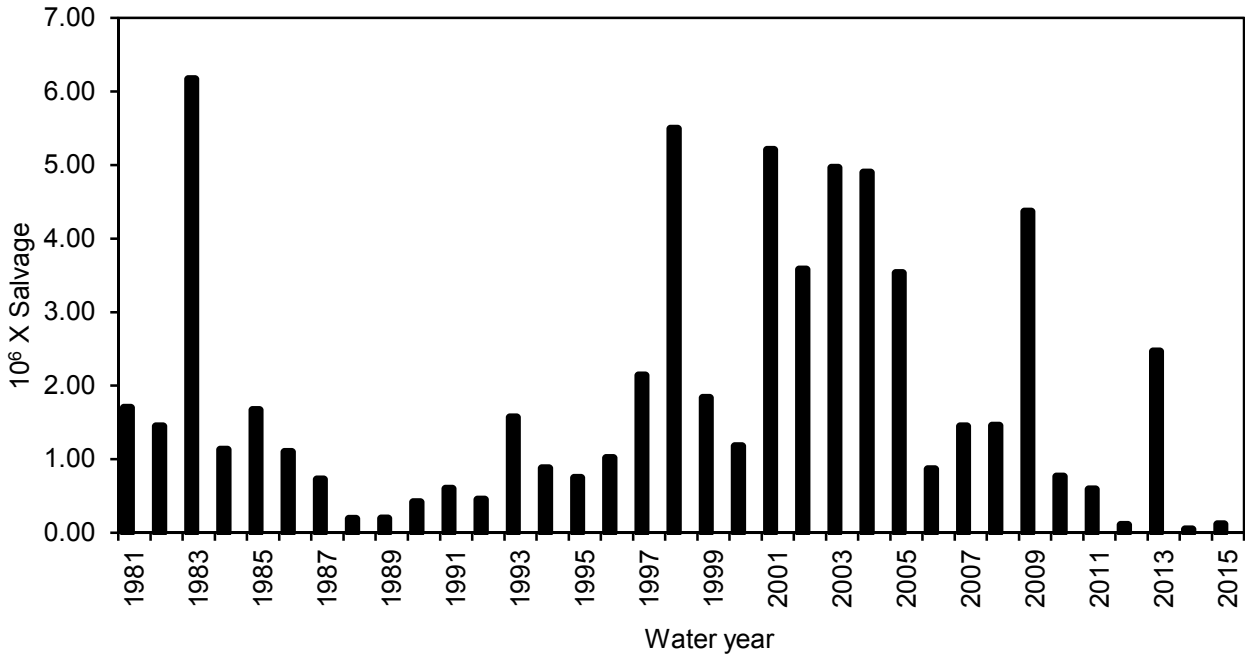

Figure 16 Annual salvage (in millions) of Threadfin Shad at the TFCF, WYs 1981–2015

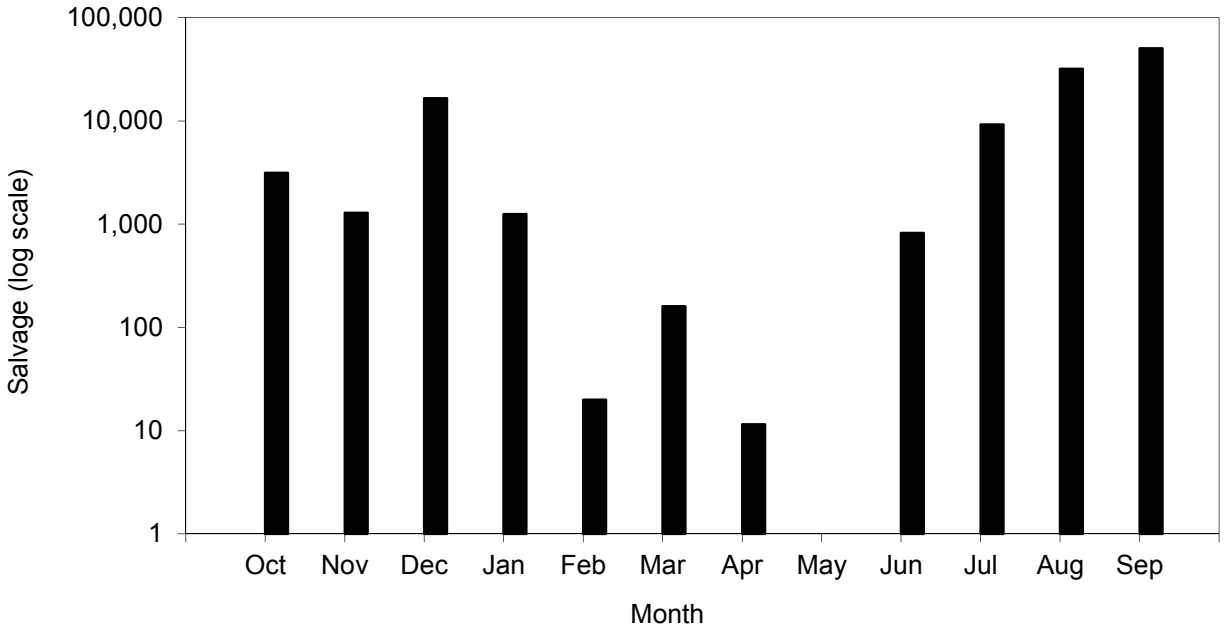

Figure 17 Monthly salvage of Threadfin Shad at the TFCF, WY 2015

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 2015 and WY 2014

Species	2015 Salvage	% Composition	2014 Salvage	% Composition
Threadfin Shad	114,804	38.8	47,603	29.6
Bluegill	107,883	36.5	63,667	39.6
Striped Bass	21,398	7.2	5,933	3.7
Shimofuri Goby	11,467	3.9	4,382	2.7
Largemouth Bass	11,278	3.8	11,961	7.4
White Catfish	7,979	2.7	10,261	6.4
Inland Silverside	4,187	1.4	6,163	3.8
American Shad	3,384	1.1	1,080	0.7
Prickly Sculpin	2,836	1.0	2,494	1.6
Rainwater Killifish	2,240	0.8	835	0.5
Yellowfin Goby	1,545	0.5	352	0.2
Channel Catfish	1,276	0.4	972	0.6
Golden Shiner	1,232	0.4	1,367	0.9
Redear Sunfish	949	0.3	268	0.2
Western Mosquitofish	837	0.3	389	0.2
Black Crappie	808	0.3	667	0.4
Black Bullhead	324	0.1	47	<0.1
Pacific Lamprey	265	<0.1	144	<0.1
Chinook Salmon	187	<0.1	1,177	0.7
Brown Bullhead	172	<0.1	30	<0.1
Threespine Stickleback	164	<0.1	154	0.1
Bigscale Logperch	148	<0.1	35	<0.1
Steelhead	124	<0.1	330	0.2
Striped Mullet	88	<0.1	0	0.0
Delta Smelt	68	<0.1	16	<0.1
Warmouth	48	<0.1	32	<0.1
Green Sunfish	32	<0.1	7	<0.1
Lamprey Unknown	31	<0.1	24	<0.1
Longfin Smelt	28	<0.1	8	<0.1
Red Shiner	24	<0.1	0	0.0
Pacific Staghorn Sculpin	12	<0.1	0	0.0
Splittail	12	<0.1	12	<0.1
Starry Flounder	12	<0.1	0	0.0
River Lamprey	4	<0.1	0	0.0
Tule Perch	4	<0.1	35	<0.1
White Crappie	4	<0.1	4	<0.1

Appendix A (Cont) Annual salvages and percentages of annual salvage (%) for fish collected from the TFCF in WY 2015 and WY 2014

Species	2015 Salvage	% Composition	2014 Salvage	% Composition
Pacific Herring	0	0.0	204	0.1
Wakasagi	0	0.0	12	<0.1
Pacific Brook Lamprey	0	0.0	8	<0.1
Sacramento Blackfish	0	0.0	4	<0.1
Blue Catfish	0	0.0	4	<0.1