Fish Salvage at the Tracy Fish Collection Facility during the 2017 Water Year

by

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Contract Number

R1130005

December 27, 2017

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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 2017 water year (10/1/2016-9/30/2017) 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 (JPP) in Byron. Monthly water exports were plotted and examined for time trends. Water year (WY) exports for the Central Valley Project (CVP) from 1981 through 2017 were noted. Salvage data from WYs 1981 to 2017 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 obtained by multiplying routine sample counts by an expansion factor calculated as salvage minutes divided by minutes of the sample count:

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

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 WY 2017.

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 initially determined by the Delta criteria based on length at date of salvage (California Dept. of Fish and Wildlife 2014). If Coded Wire Tag (CWT) information was available the race of hatchery Chinook Salmon was updated.

Chinook Salmon loss estimates are presented because they are used to measure the fishery impact of the water export operation. Loss is the estimated number of fish encountered by the facility minus the number of fish that survived salvage operations. Loss was subcategorized by origin and race.

Daily loss estimates are used as a regulatory trigger to protect listed salmonid species by reducing CVP and SWP water exports. The Federal Biological Opinion (BO) established the use of daily loss densities to trigger mandatory consultation with the National Marine Fisheries Service (NMFS) and water export reductions. In addition,

Federal and State export agencies must monitor and report annual loss of listed salmonids to avoid exceeding the BO's Incidental Take Limits.

Larval fish sampling was conducted during February 20 through June 25 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 2,679,464 acre feet (AF) of water which was a large increase from WY 2016 (1,360,026 AF), the record low in WY 2015 (695,650 AF), and WY 2014 (947,777 AF) (Figure 1). The annual export was slightly higher than exports from WYs 2008-2013 which ranged from 1,844,493 to 2,539,025 AF. Increases in exports in WY 2017 coincided with 2017 being a wet water year (Sacramento Water Supply and San Joaquin Water Supply) following five years of drought conditions in California.

The highest monthly water exports occurred in June-September (Figure 2). During these periods, a total of 1,005,461 AF was exported, accounting for 37.5% of the total export. Monthly exports ranged from 149,049 to 267,724 AF.

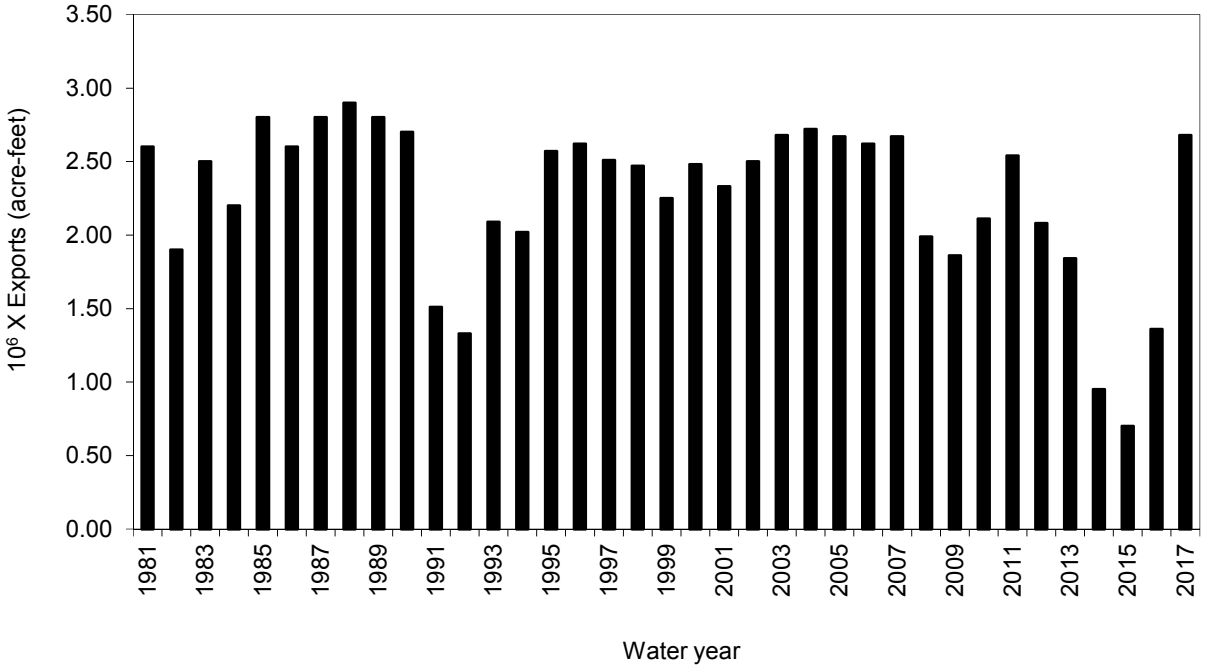

Figure 1 Annual exports (by water year; WY) in millions of acre-feet for the Central Valley Project, WYs 1981–2017

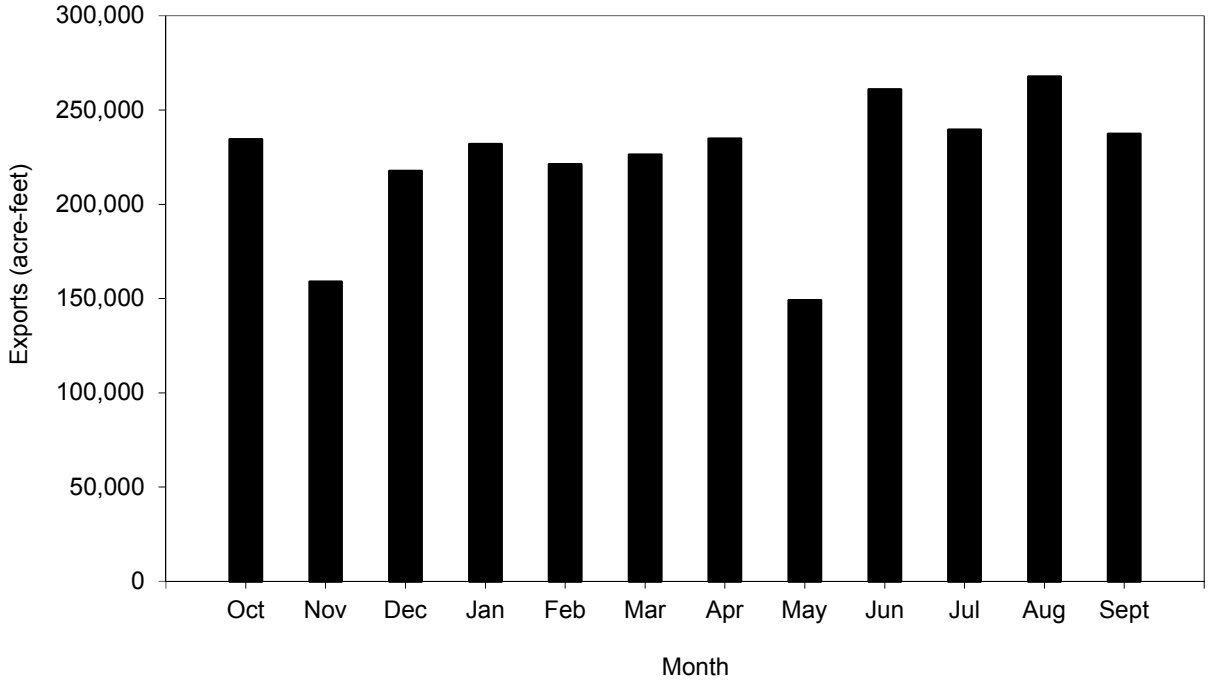

Figure 2 Monthly exports (in acre-feet) for the Central Valley Project, WY 2017

Total Salvage and Prevalent Species

Total fish salvage (all fish combined) at the TFCF was 2,061,133 (Figure 3). This total was an increase from WY 2016 (1,437,551), WY 2015 (295,854), and the record low salvage in WY 2014 (160,681). The WY 2017 total was well below the record high salvage of 37,659,835 in WY 2006. The increase in total fish salvage in WY 2017 was most likely affected by an increase in exports since salvage in recent years has been influenced by exports (i.e. increased salvage at high exports).

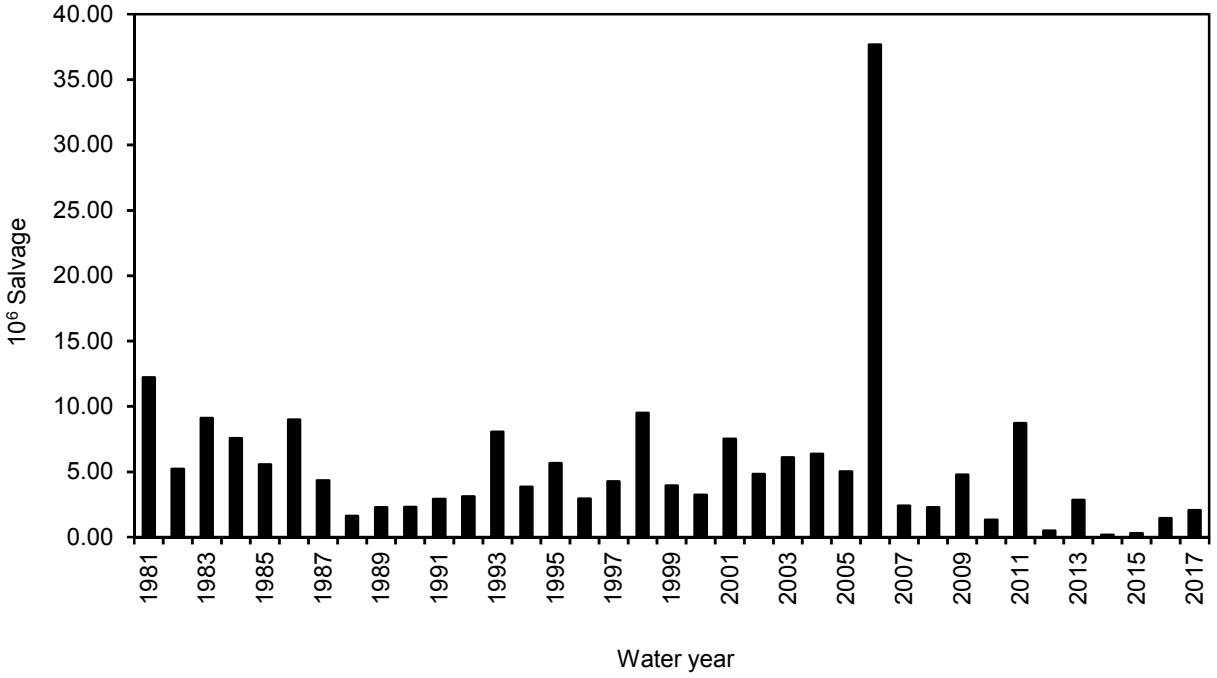

Figure 3 Annual salvage (by water year, WY; in millions) of all fish taxa combined at the TFCF, WYs 1981–2017

Threadfin Shad accounted for 35.5% 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 Splittail (20.2%), American Shad (19.7%),

Bluegill (6.0%), and White Catfish (5.2%). Native species comprised 22.1% of total fish salvage. This was a large increase from WY 2016 when native species comprised 0.7% of salvage and the increase in WY 2017 was largely due to an increase in Splittail salvage. Chinook Salmon, Steelhead, Delta Smelt, and Longfin Smelt accounted for 1.1% of salvage. This was an increase from WY 2016 when these four species comprised 0.1% of salvage

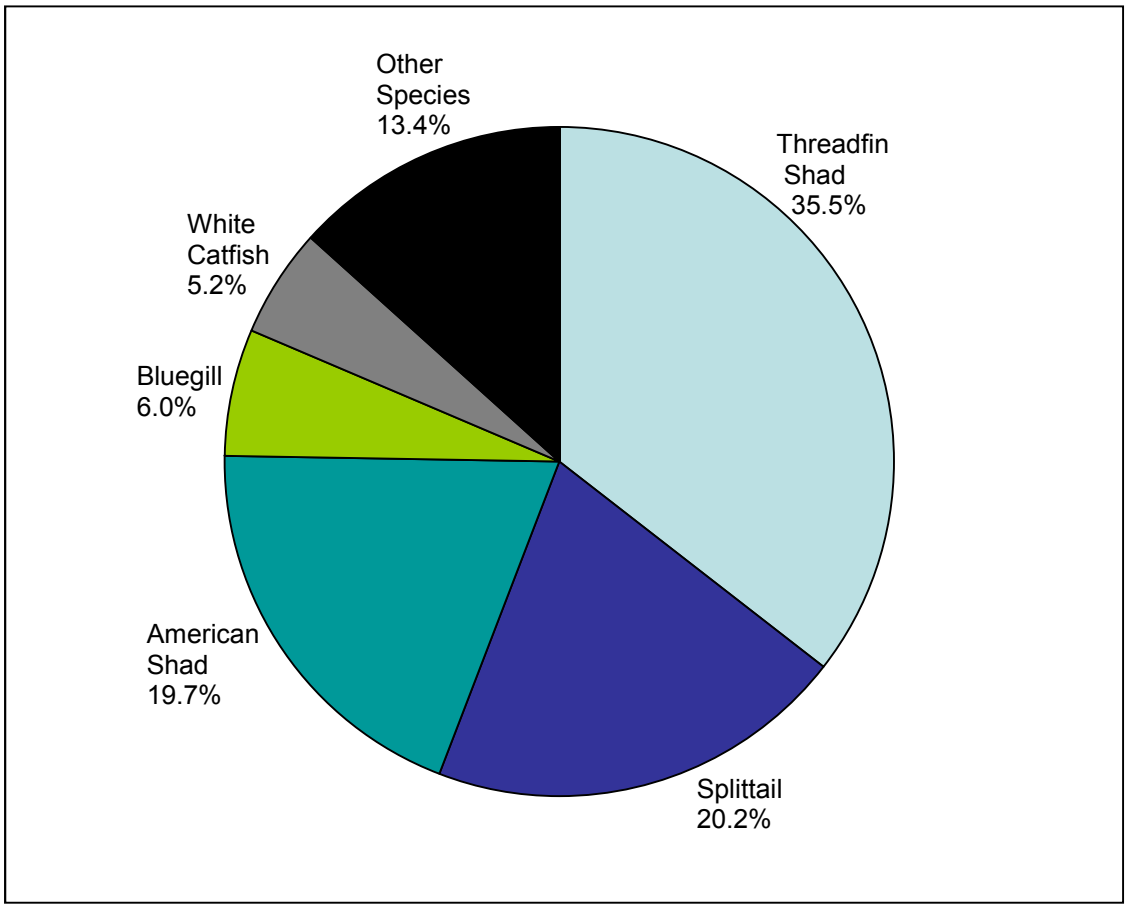

Figure 4 Percentages of annual salvage for the 5 most-prevalent species and other species combined at the TFCF, WY 2017

Chinook Salmon

The annual salvage of juvenile Chinook Salmon was 23,633 (all races and origins combined)(Figure 5). Salvage of Chinook Salmon in WY 2017 was a striking increase from WY 2016 (970) and the record low in WY 2015 (187). Mean salvage for WYs 2001-2017 was only 10.9% of the mean salvage for WYs 1981-2000.

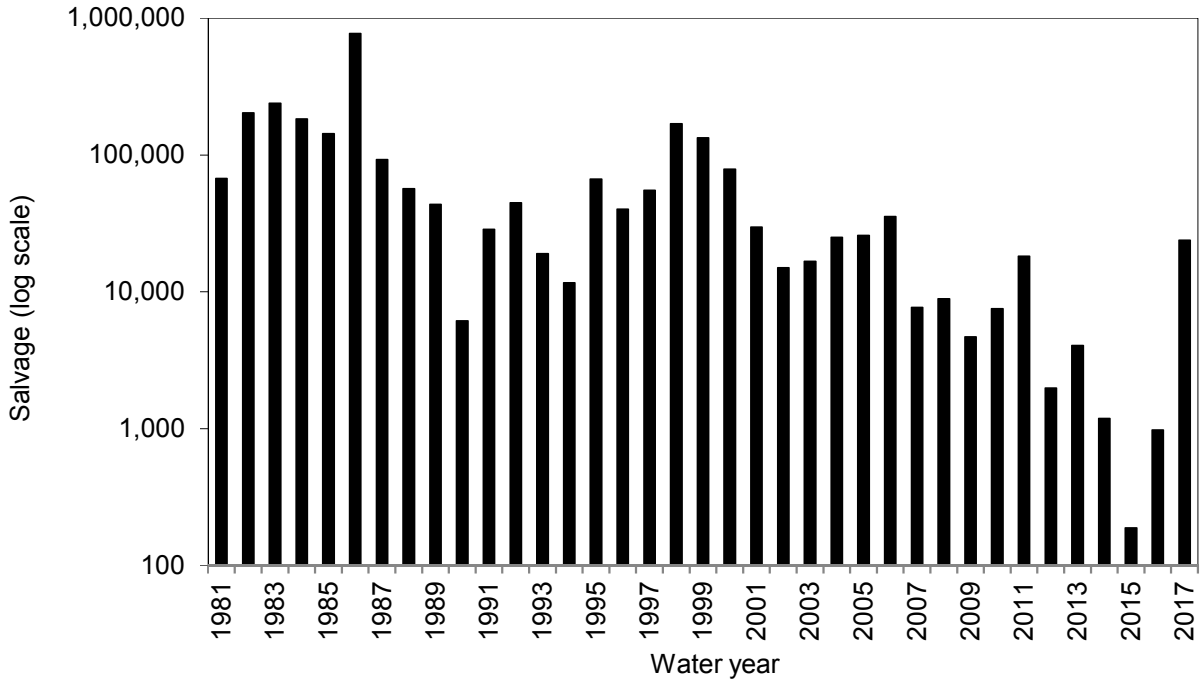

Figure 5 Annual salvage of Chinook Salmon (all races and origins combined) at the TFCF, WYs 1981–2017

Wild Chinook Salmon consisted primarily of spring run sized fish (56.0%) followed by fall run sized fish (43.9%, Table 1). Wild spring run fish were salvaged in March-June while fall run fish were salvaged in December 2016-August 2017 (Figure 6). The most of wild spring run sized fish (90.5%) were salvaged in April and May. The largest proportion of wild fall run sized fish (35.2%) was salvaged in January. The estimated loss of Chinook Salmon was 15,867 (Table 1).

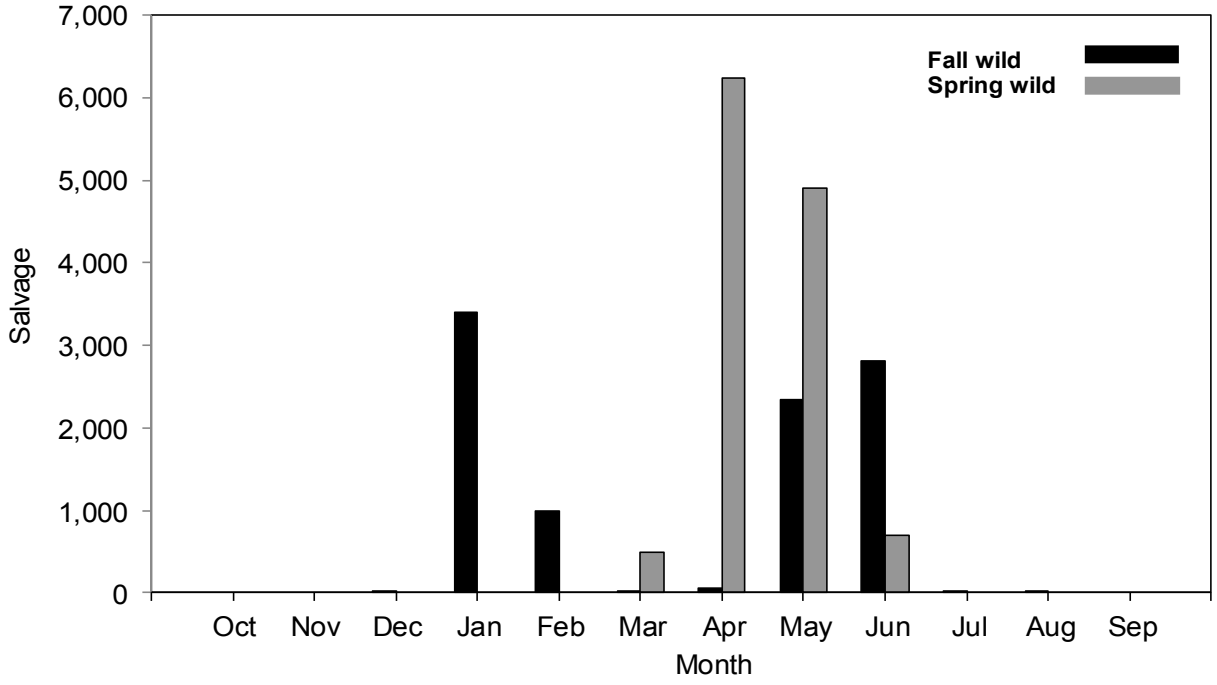

Figure 6 Monthly salvage of wild spring and fall run sized Chinook Salmon at the TFCF, WY 2017

Table 1 Chinook Salmon annual salvage, percentages of annual salvage, and losses at the TFCF, WY 2017, by race and origin (wild or hatchery)

Origin	Race	Salvage	Percentage	Loss
Wild	Fall	9,648	43.9	6,107
	Late-fall	4	>0.1	3
	Spring	12,325	56.0	8,598
	Winter	24	0.1	17
Total Wild		**22,001**		**14,725**
Hatchery	Fall	436	26.7	301
	Late-fall	544	33.3	379
	Spring	648	39.7	459
	Winter	4	0.3	3
Total Hatchery		**1,632**		**1,142**
Grand Total		***23,633***		***15,867***

Steelhead

Salvage of wild and hatchery Steelhead (30) was a record low and a marked decrease from WYs 2016 (652) and 2015 (124) and continued the pattern of mostly low salvage observed since WY 2005 (Figure 7).

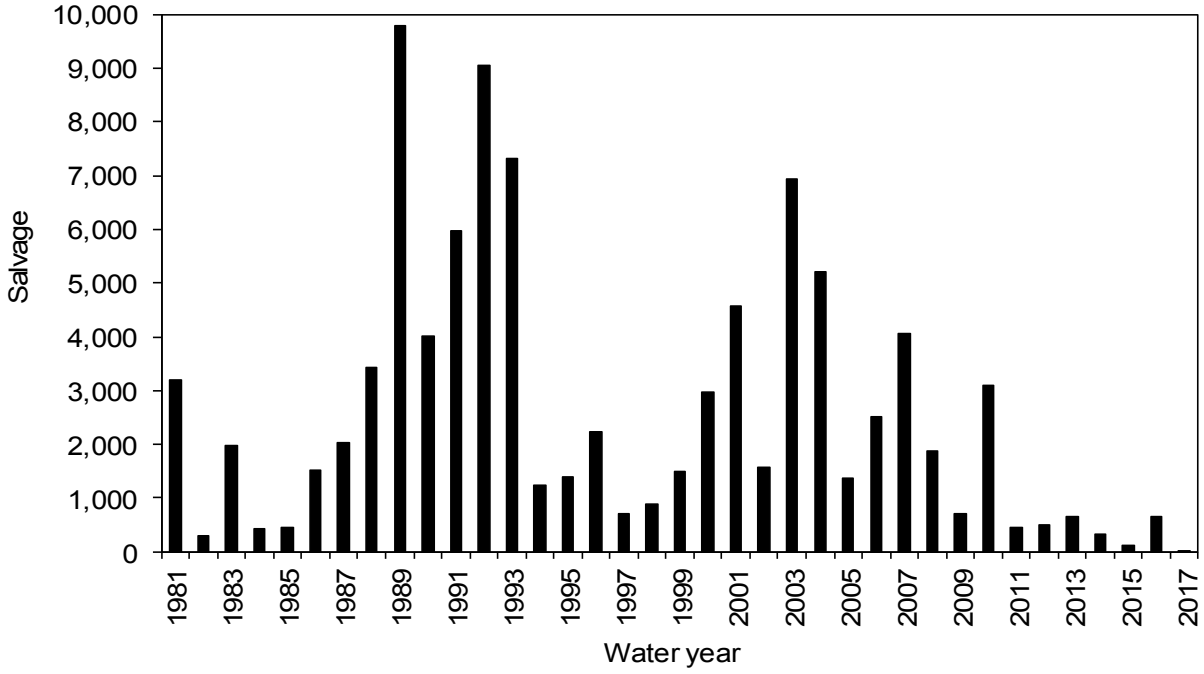

Figure 7 Annual salvage of Steelhead (all origins combined) at the TFCF, WYs 1981–2017

Juvenile Steelhead salvage estimates were primarily of wild origin. The salvage composition was 24 wild and 6 hatchery fish.

Wild Steelhead were salvaged in December-February and May-June while hatchery Steelhead were salvaged in January-February and June (Figure 8). Hatchery and wild Steelhead were most frequently salvaged in June.

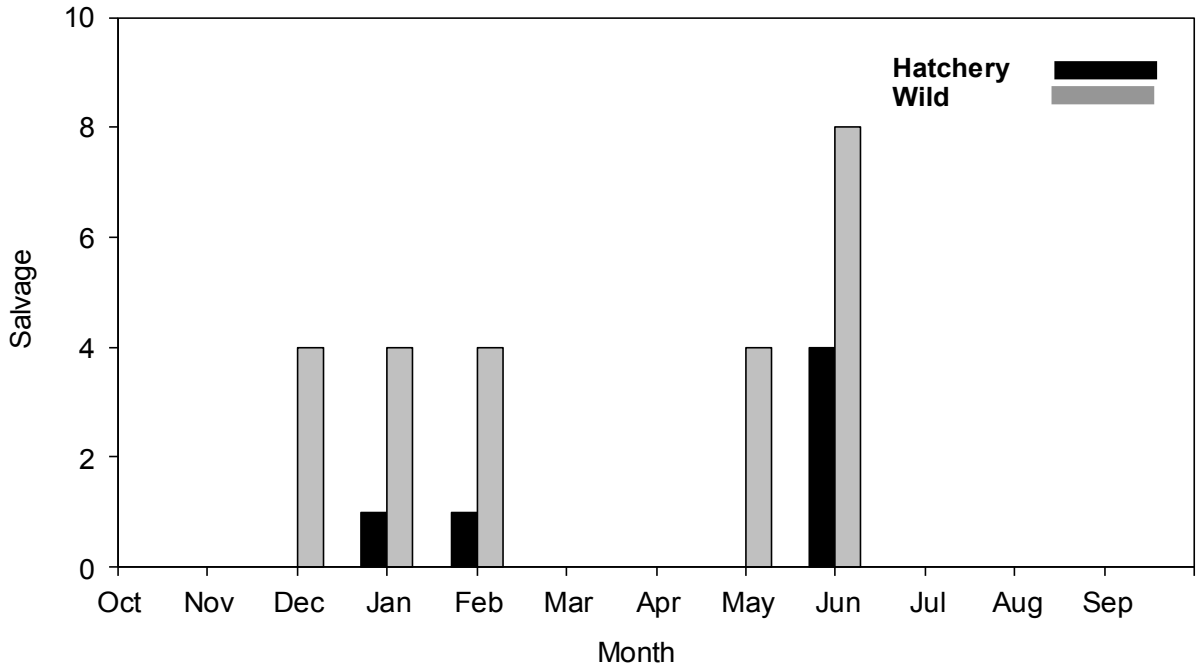

Figure 8 Monthly salvage of hatchery and wild Steelhead at the TFCF, WY 2017

Striped Bass

The annual salvage of 94,467 Striped Bass continued the low salvage trend observed since WY 1995 (Figure 9). Prior to WY 1995, annual Striped Bass salvages were above 1,000,000, except for WYs 1983 and 1988.

Most Striped Bass were salvaged in July-August (Figure 10). The July salvage (24,774) and August salvage (39,783) accounted for 68.3% of the total salvage. Striped Bass were salvaged every month and the lowest salvage occurred in May (28).

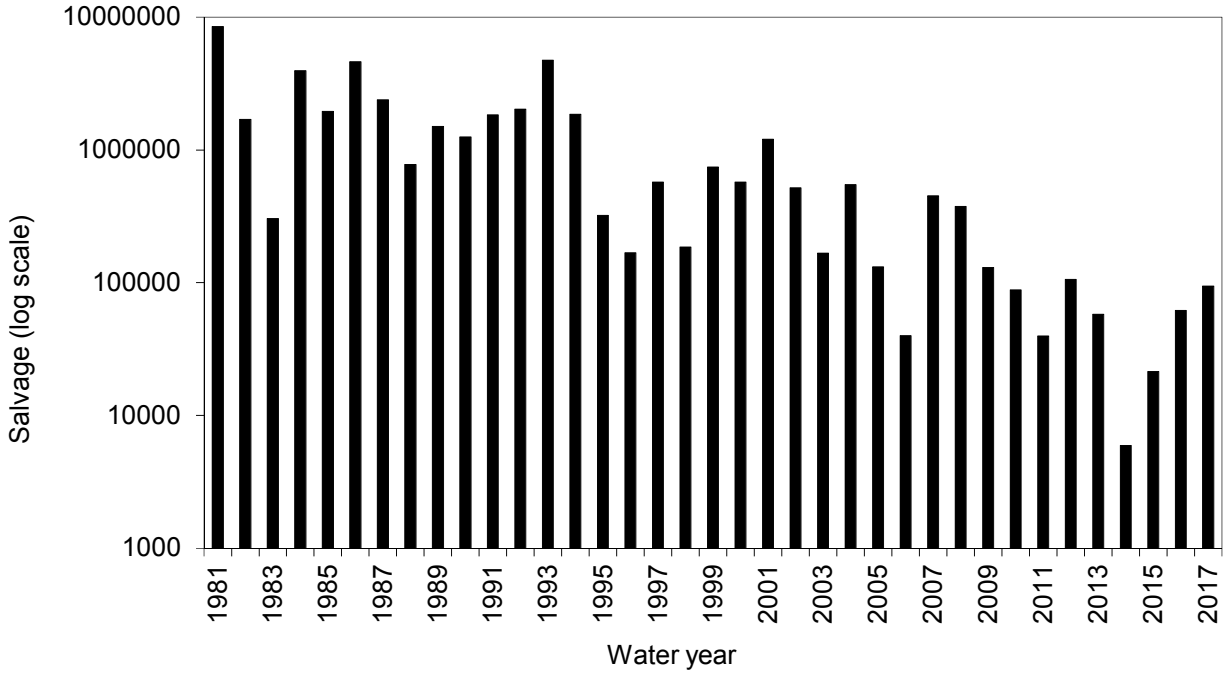

Figure 9 Annual salvage of Striped Bass at the TFCF, WYs 1981–2017

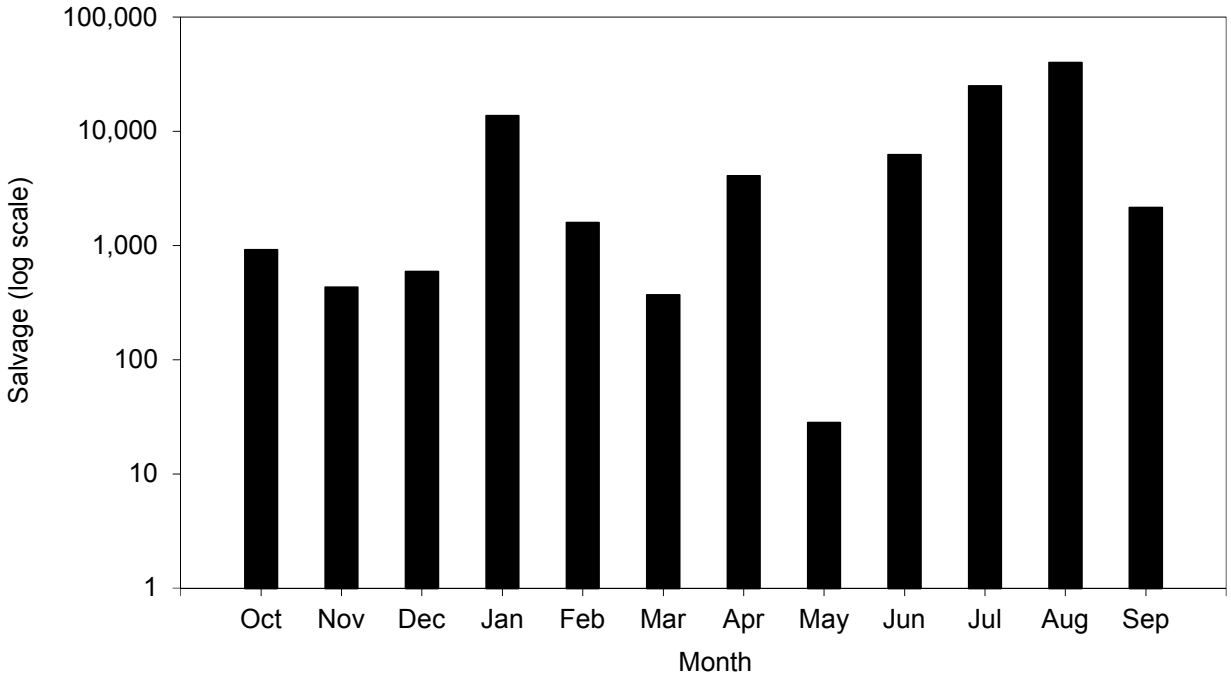

Figure 10 Monthly salvage of Striped Bass at the TFCF, WY 2017

Delta Smelt

Salvage of Delta Smelt (32) was an increase from the record low in WY 2016 (12) but a decrease from WY 2015 (68; Figure 11). WYs 2005-2017 was the lowest 13-year period of annual salvage on record (12-1,009).

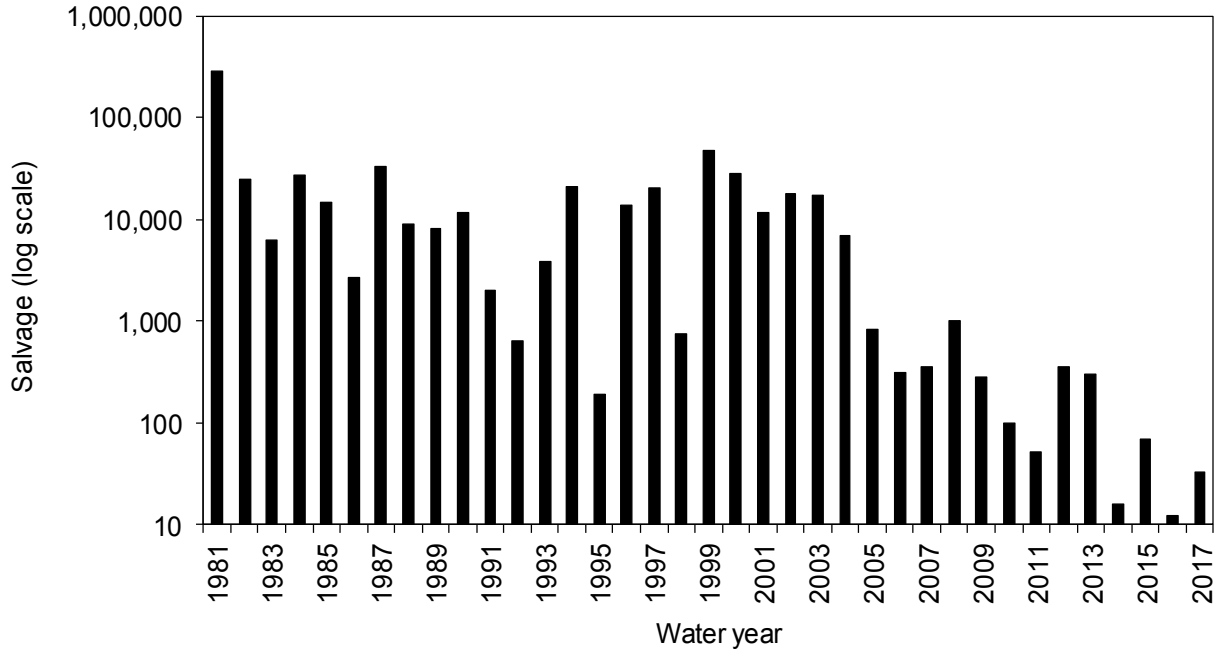

Figure 11 Annual salvage of Delta Smelt at the TFCF, WYs 1981–2017

Adult Delta Smelt were salvaged in January (4), February (4), and most frequently in March (24) which accounted for 75.0% of the total WY salvage. No juvenile Delta Smelt were salvaged in WY 2017. No Delta Smelt less than 20 mm FL were detected in WY 2017, as in WYs 2016 and 2015.

Longfin Smelt

No Longfin Smelt were salvaged at the TFCF in WY 2017. This was a decrease from WY 2016 (8) and WY 2015 (28). No salvage of Longfin Smelt also occurred in WY 2006, WY 1995, and WY 1982. Low annual salvages have generally been observed since 1991, with the exception of 43,056 salvaged in WY 2002 (Figure 12). No Longfin Smelt less than 20 mm FL were detected which was a small decrease from WYs 2016 (1) and 2015 (5).

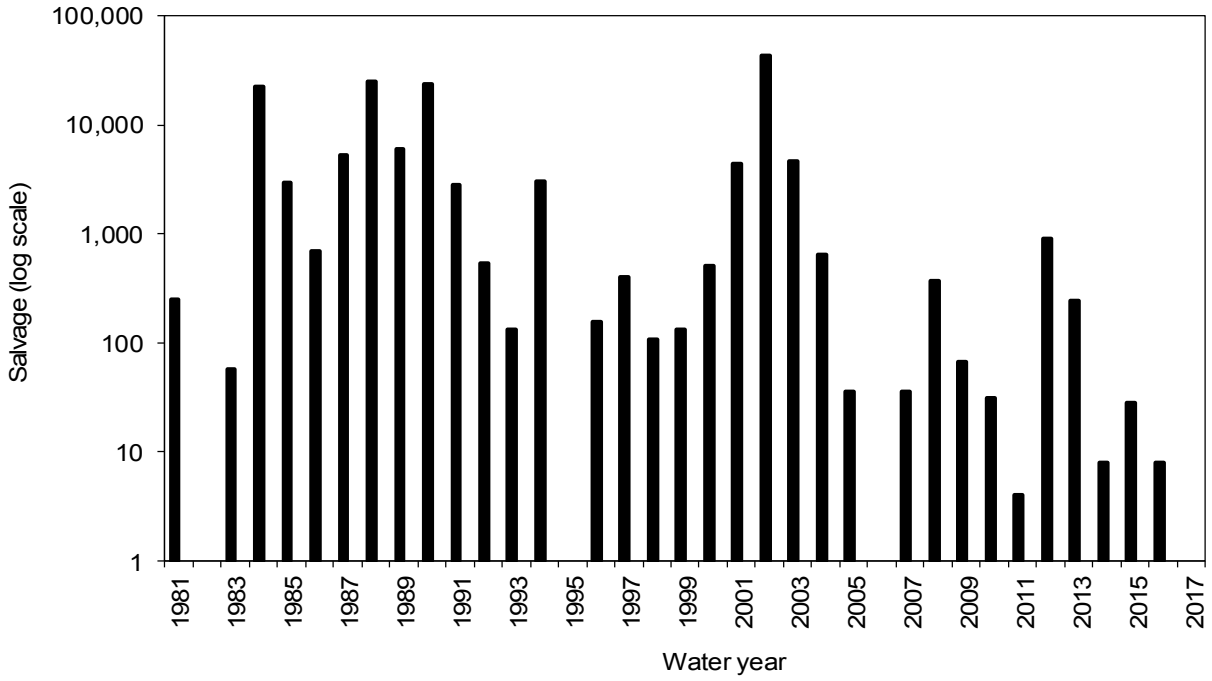

Figure 12 Annual salvage of Longfin Smelt at the TFCF, WYs 1981–2017

Splittail

The salvage of Splittail (415,517) was a marked increase from WY 2016 (109) and the record lows in WYs 2015 (12) and 2014 (12), but 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 13). High Splittail salvage is generally associated with wet years.

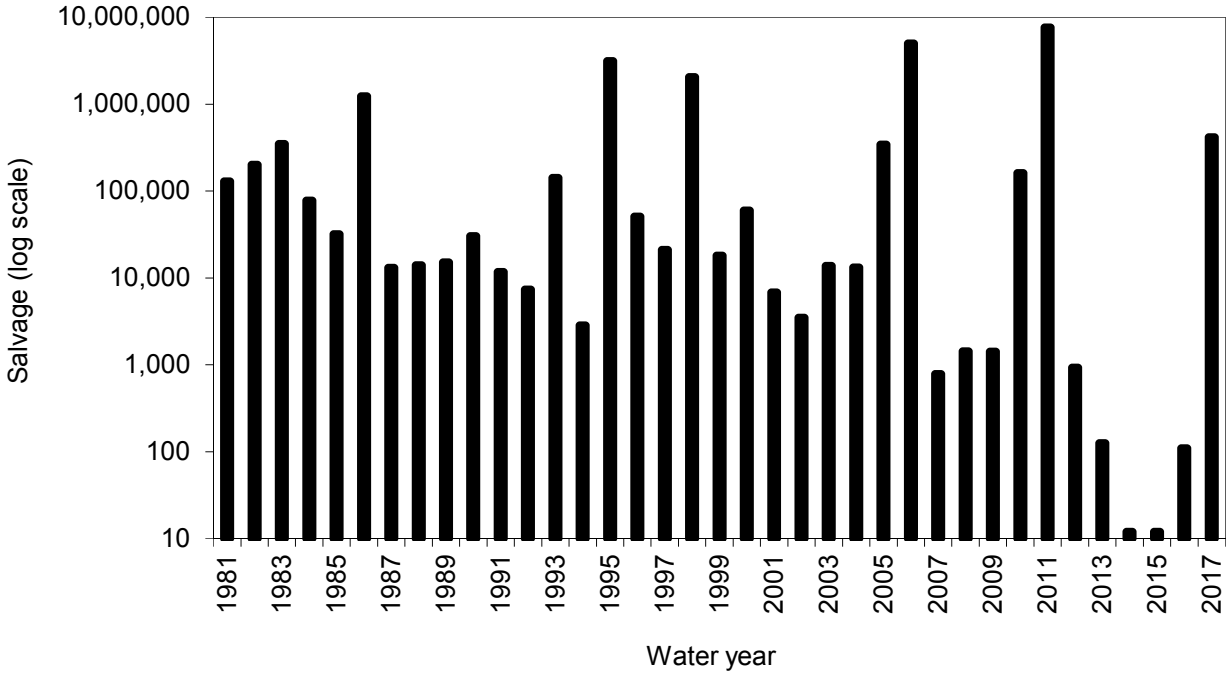

Figure 13 Annual salvage of Splittail at the TFCF, WYs 1981–2017

Threadfin Shad

The near record low salvage of juvenile and adult Threadfin Shad (731,760) was a decrease from WY 2016 (1,127,956), a large increase from the record low in WY 2015 (114,804), but a substantial decrease from WY 2013 (2,463,695). Similar to Splittail,

annual salvages of Threadfin Shad have varied greatly through time (Figure 14). Prior to WY 2005, WYs 2001-2004 was the highest 4 year period of annual salvage on record (3.5-5.2 million).

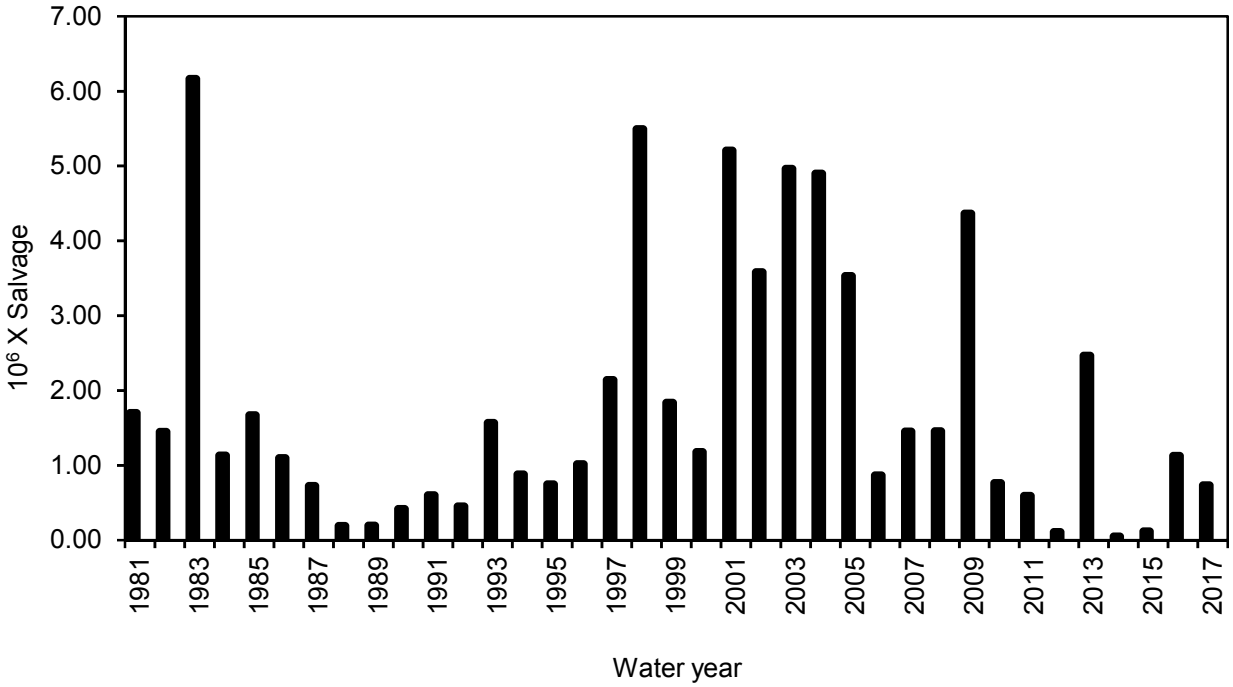

Figure 14 Annual salvage (in millions) of Threadfin Shad at the TFCF, WYs 1981–2017

Threadfin Shad salvage in WY 2017 followed the same trend as observed in past years. Adult Threadfin Shad were mostly salvaged in fall, winter, and early spring. Juvenile Threadfin Shad were mostly salvaged in summer and fall where July-August salvage (583,794) accounted for 79.8% of the total WY salvage (Figure 15).

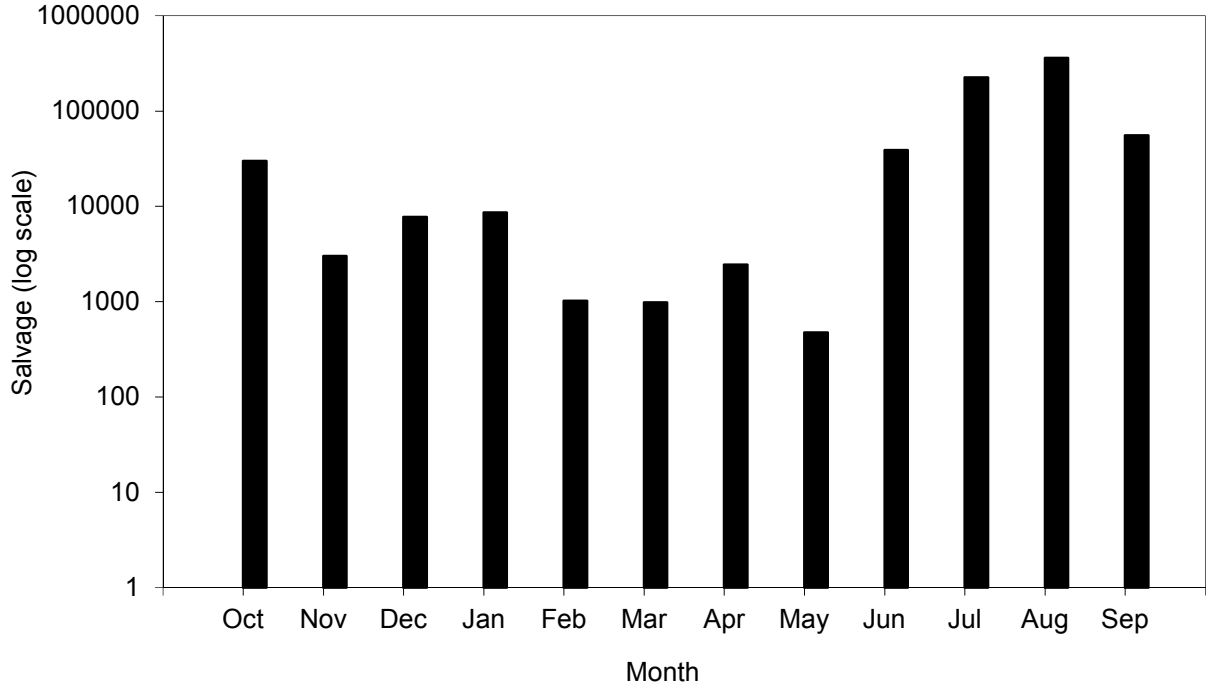

Figure 15 Monthly salvage of Threadfin Shad at the TFCF, WY 2017

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 WYs 2017 and 2016

Species	2017 Salvage	% Composition	2016 Salvage	% Composition
Threadfin Shad	731,760	35.5	1,127,956	78.5
Splittail	415,517	20.2	109	<0.1
American Shad	405,336	19.7	4,553	0.3
Bluegill	123,970	6.0	131,079	9.1
White Catfish	107,330	5.2	15,165	1.1
Striped Bass	94,467	4.6	61,787	4.3
Largemouth Bass	47,643	2.3	47,736	3.3
Chinook Salmon	23,633	1.1	970	<0.1
Common Carp	21,952	1.1	8	<0.1
Channel Catfish	21,350	1.0	1,859	0.1
Shimofuri Goby	17,114	0.8	8,443	0.6
Lamprey Unknown	13,559	0.7	2,356	0.2
Inland Silverside	11,181	0.5	11,223	0.8
Golden Shiner	7,013	0.3	4,985	0.3
Rainwater Killifish	4,151	0.2	6,869	0.5
Redear Sunfish	3,496	0.2	1,381	0.1
Black Crappie	2,981	0.1	1,208	<0.1
Yellowfin Goby	2,468	0.1	532	<0.1
Western Mosquitofish	1,711	<0.1	1,776	0.1
Prickly Sculpin	1,189	<0.1	2,069	0.1
Sacramento Sucker	836	<0.1	661	<0.1
Goldfish	596	<0.1	0	0.0
Threespine Stickleback	475	<0.1	217	<0.1
Black Bullhead	452	<0.1	58	<0.1
Pacific Lamprey	164	<0.1	2,418	0.2
Bigscale Logperch	162	<0.1	277	<0.1
Warmouth	113	<0.1	96	<0.1
Brown Bullhead	88	<0.1	36	<0.1
Red Shiner	76	<0.1	886	<0.1
White Sturgeon	68	<0.1	0	0.0
Sacramento Pikeminnow	40	<0.1	0	0.0
Green Sunfish	32	<0.1	36	<0.1
Delta Smelt	32	<0.1	12	<0.1
Steelhead	30	<0.1	652	<0.1

Appendix A (Cont.) Annual salvages and percentages of annual salvage (%) for fish collected from the TFCF in WYs 2017 and 2016

Species	2017 Salvage	% Composition	2016 Salvage	% Composition
Shokihaze Goby	28	<0.1	16	<0.1
Starry Flounder	24	<0.1	8	<0.1
White Crappie	20	<0.1	2	<0.1
Sacramento Blackfish	16	<0.1	8	<0.1
Tule Perch	12	<0.1	4	<0.1
Fathead Minnow	12	<0.1	8	<0.1
Large-Scale Loach	12	<0.1	0	0.0
Spotted Bass	8	<0.1	20	<0.1
Hitch	4	<0.1	0	0.0
Green Sturgeon	4	<0.1	0	0.0
Wakasagi	4	<0.1	0	0.0
River Lamprey	4	<0.1	16	<0.1
Striped Mullet	0	0.0	28	<0.1
Smallmouth Bass	0	0.0	16	<0.1
Longfin Smelt	0	0.0	8	<0.1
Pacific Staghorn Sculpin	0	0.0	4	<0.1