Fish Salvage at the Tracy Fish Collection Facility during the 2012 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 2012 water year (10/1/2011-9/30/2012) 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

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. Water year (WY) exports for the Central Valley Project (CVP) from 1981 through 2012 were noted. Salvage data from WY 1981 to 2012 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 expanding routine sample counts by the duration that water was pumped:

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

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 2012.

The annual and monthly salvage estimates for Chinook salmon and steelhead were made 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 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 fish sampling was done 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 sampling ran from February 16 through June 30. Larval fish were identified to species by TFCF personnel and reported the next working day.

Water Exports

The CVP exported 2,076,833 acre feet (AF) of water (Figure 1). The annual export in WY 2012 was comparable to WY 2008-2010 which ranged from 1,861,746 to 2,105,748 AF, but a decrease in exports from WY 2011 (2,539,025) and WY 2002-2007.

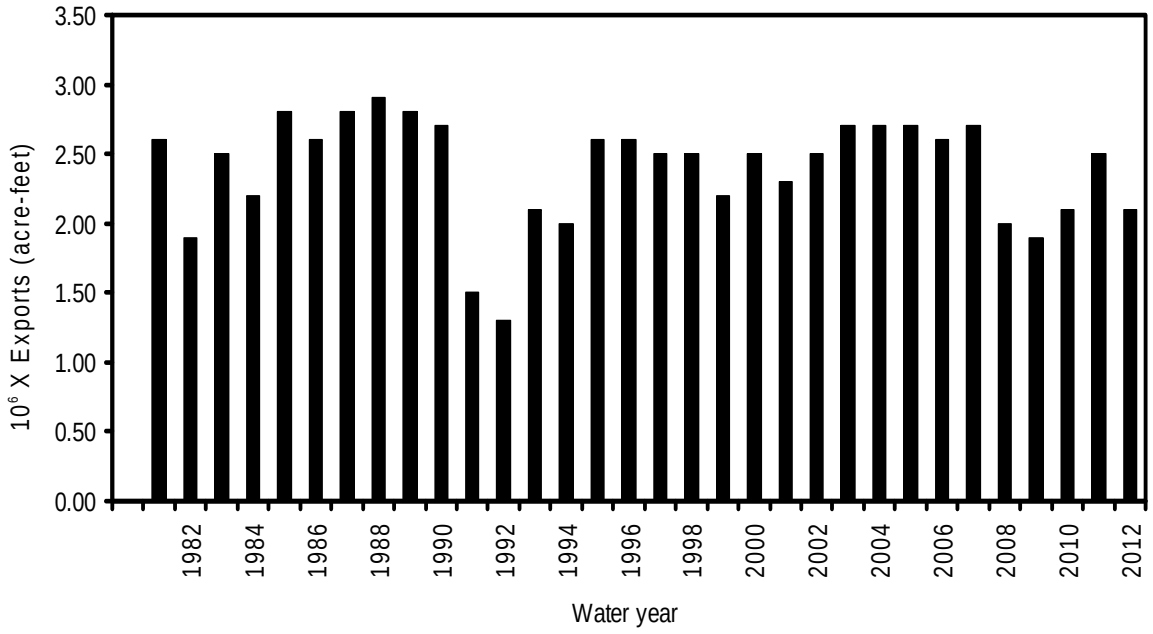

Figure 1 Annual exports (by water year; WY) in millions of acre-feet for the Central Valley Project, WY 1981 – 2012

The majority of water exports occurred in October-December 2011 and July-September 2012 (Figure 2). During this period, a total of 1,445,935 AF was exported, accounting for 69.6 % of the annual export. Monthly exports ranged from 54,782 to 267,602 AF. Combined export for April-June was 265,994 AF which was comparable to the same period during WY 2008-2011 (174,096-439,633 AF), but a decrease from WY 2004-2007 (358,873-439,833 AF) and WY 2011 (439,633AF).

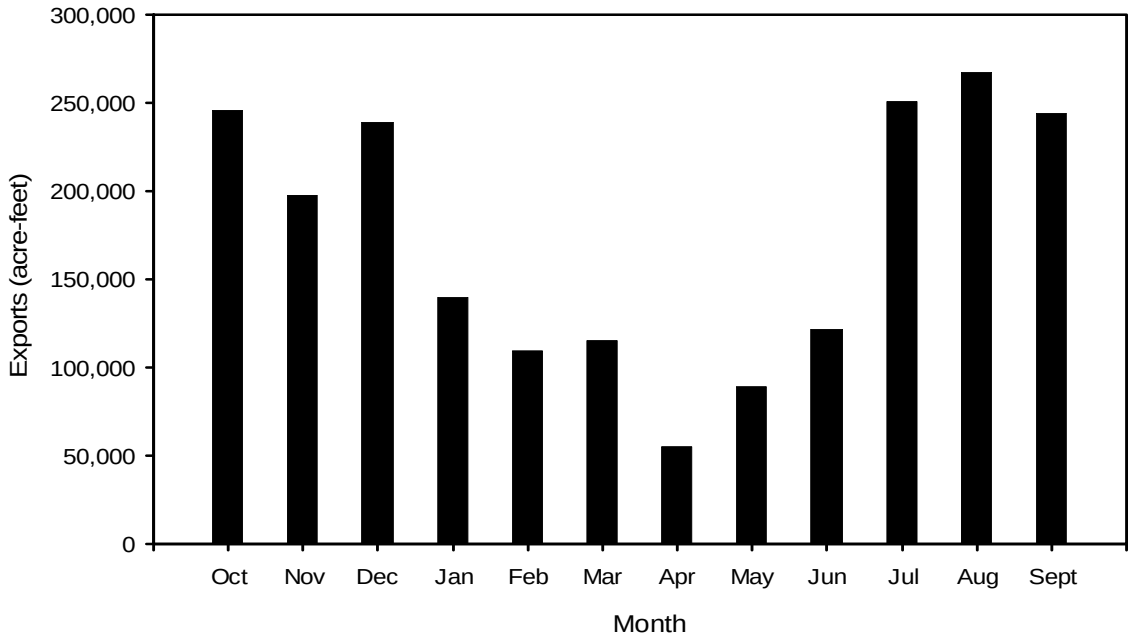

Figure 2 Monthly exports (in acre-feet) for the Central Valley Project, WY 2012

Total Salvage and Prevalent Species

Fish salvage (all fish combined) at the TFCF was a record low at 475,082 (Figure 3). TFCF salvage decreased from WY 2011 (8,724,498), and was well below the record

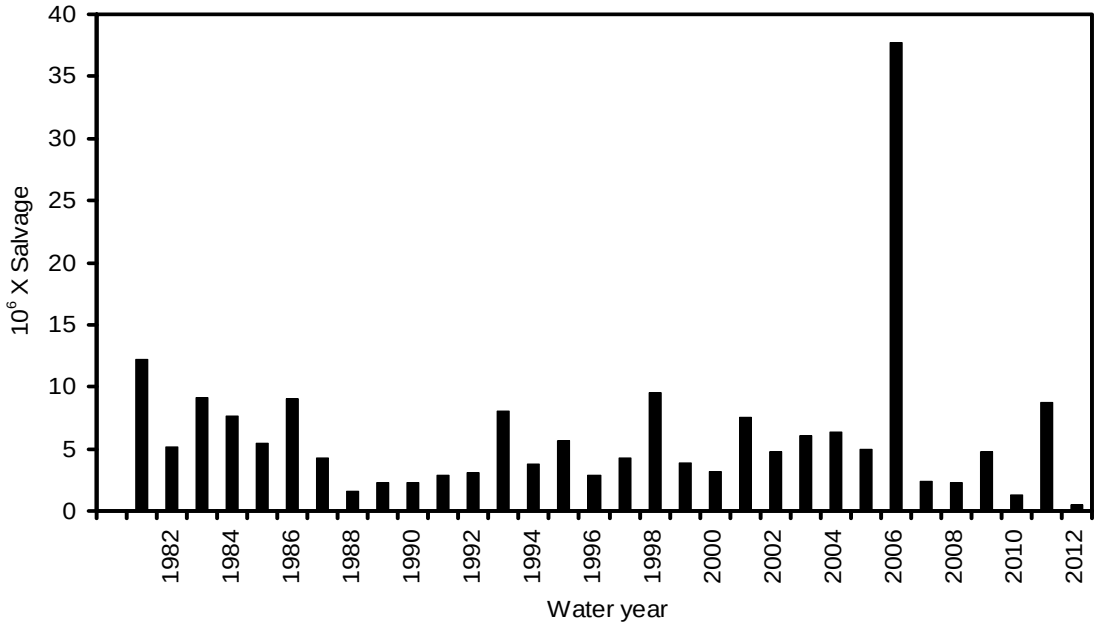

Figure 3 Annual salvage (in millions) of all fish taxa combined at the TFCF, WY 1981 – 2012

high salvage of 37,659,835 in WY 2006. Threadfin shad accounted for 23.1 % of the annual 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 only other species to be salvaged in substantial numbers were striped bass (22.3 %), American shad (15.3 %), largemouth bass (13.4 %), and bluegill (11.2 %). Striped bass percent salvage increased compared to WY 2011 (0.5 %) and WY 2010 (6.7 %). Native species comprised 2.9 % of annual fish salvage. Chinook salmon, steelhead, delta smelt, and longfin smelt accounted for 0.8 % of salvage.

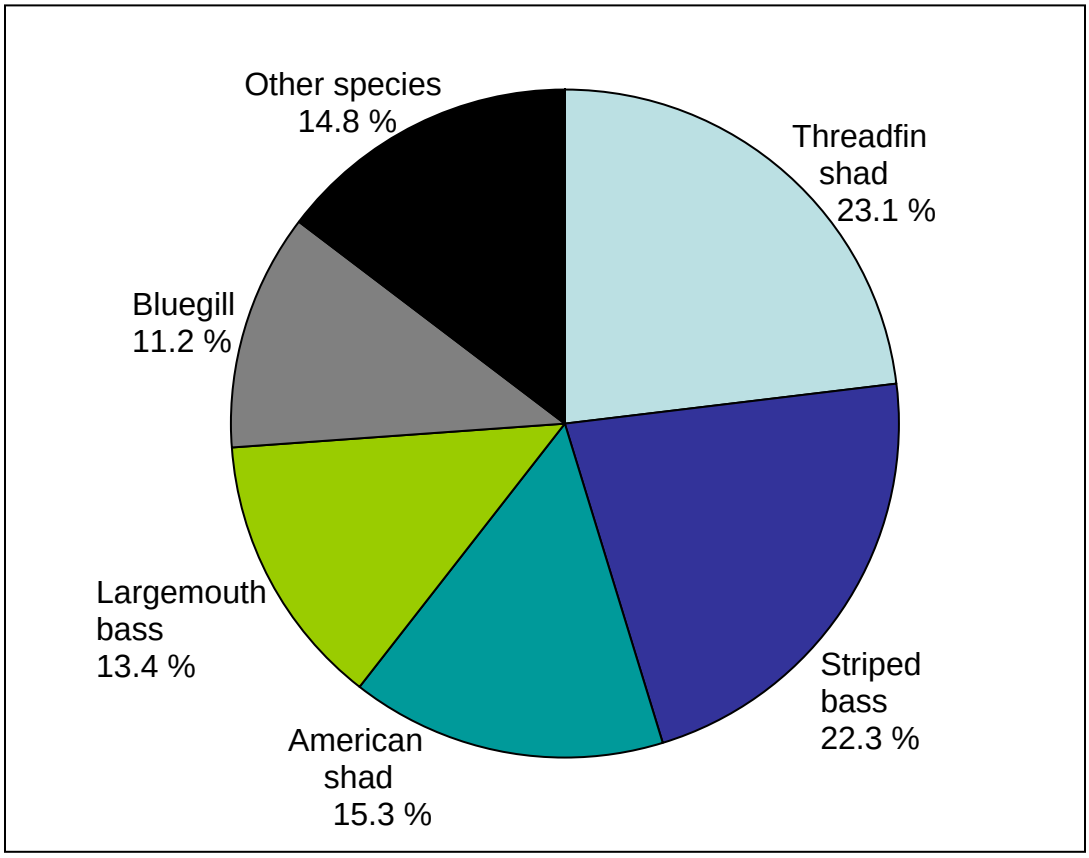

Figure 4 Percentages of annual salvage for the 5 most-prevalent species and other species combined at the TFCF, WY 2012

Chinook Salmon

Record low salvage (all races and origins combined) of Chinook salmon (1,965) continued the low salvage trend since WY 2001 (Figure 5). Salvage of Chinook salmon at the TFCF (1,965) was substantially lower than in WY 2011 (18,135) and WY 2010 (7,463). Mean WY 2001-2011 salvage was about one-seventh lower than salvage in the 1980's and the late 1990's.

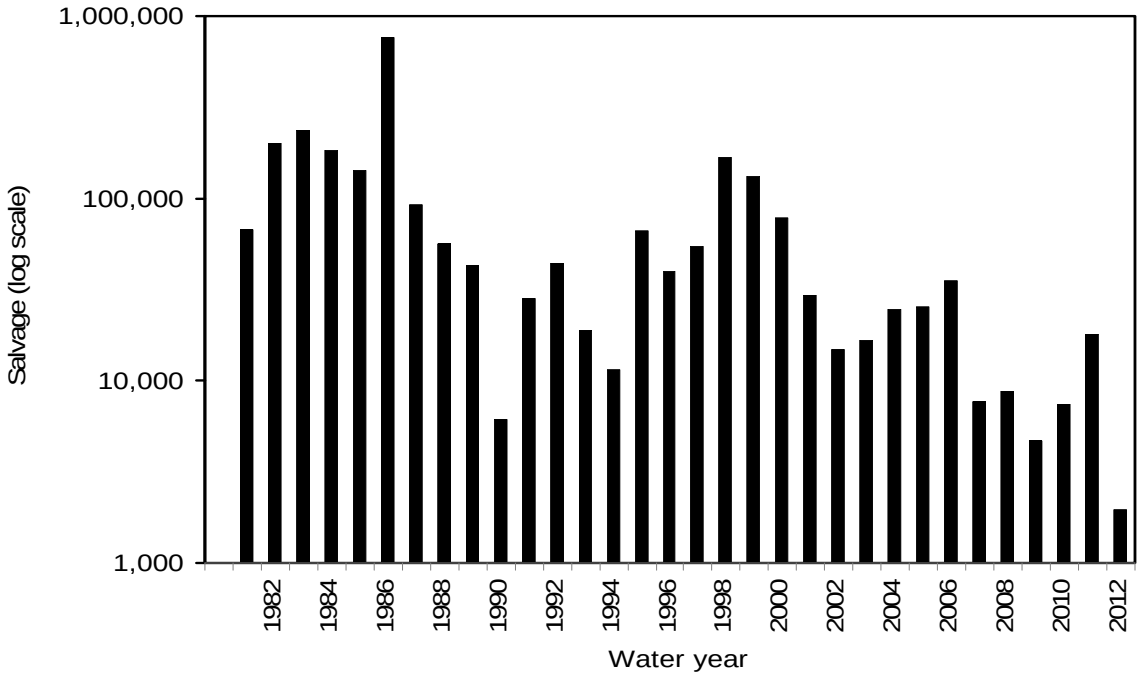

Figure 5 Annual salvage of Chinook salmon (all races and origins combined) at the TFCF, WY 1981 – 2012

Wild Chinook salmon consisted primarily of spring run salmon (39.2 %; Table 1) followed by fall run salmon (30.6 %). Wild spring run salmon were salvaged March-June (Figure 6). Wild fall run salmon were salvaged April-July. The majority of wild spring run salmon (70.1 %) were salvaged in April and wild fall run salmon (52.3 %) were salvaged in May. The estimated loss of salmon was 1,511 (Table 1).

Steelhead

Annual salvage (wild and hatchery) of steelhead (493) continued the pattern of mostly low salvage observed since WY 2005 (Figure 7). Salvage decreased from WY 2008-2011 which ranged from 445 to 3,088. Annual steelhead salvage in WY 2007 (4,068) was greater than in WY 2005 (1,359) and WY 2006 (2,516).

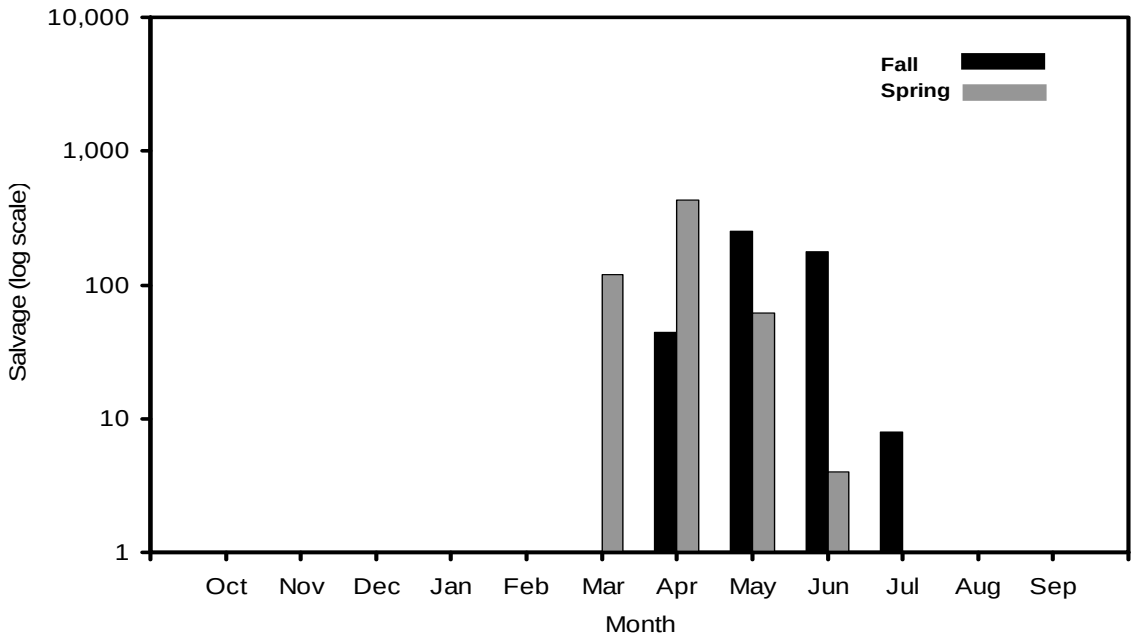

Figure 6 Monthly salvage of wild fall and spring Chinook salmon at the TFCF, WY 2012

Table 1 Chinook salmon annual salvage, percentage of annual salvage, race and origin (wild or hatchery), and loss at the TFCF, WY 2012

Origin	Race	Salvage	Percentage	Loss
Wild	Fall	483	30.6	337
	Late-fall	20	1.3	14
	Spring	618	39.2	495
	Winter	453	28.7	377
	Unknown Race	4	0.2	4
Total Wild		**1,578**		**1,227**
Hatchery	Fall	40	10.3	26
	Late-fall	24	6.2	20
	Spring	96	24.8	63
	Winter	227	58.7	175
Total Hatchery		**387**		**284**
Grand Total		***1,965***		**1,511**

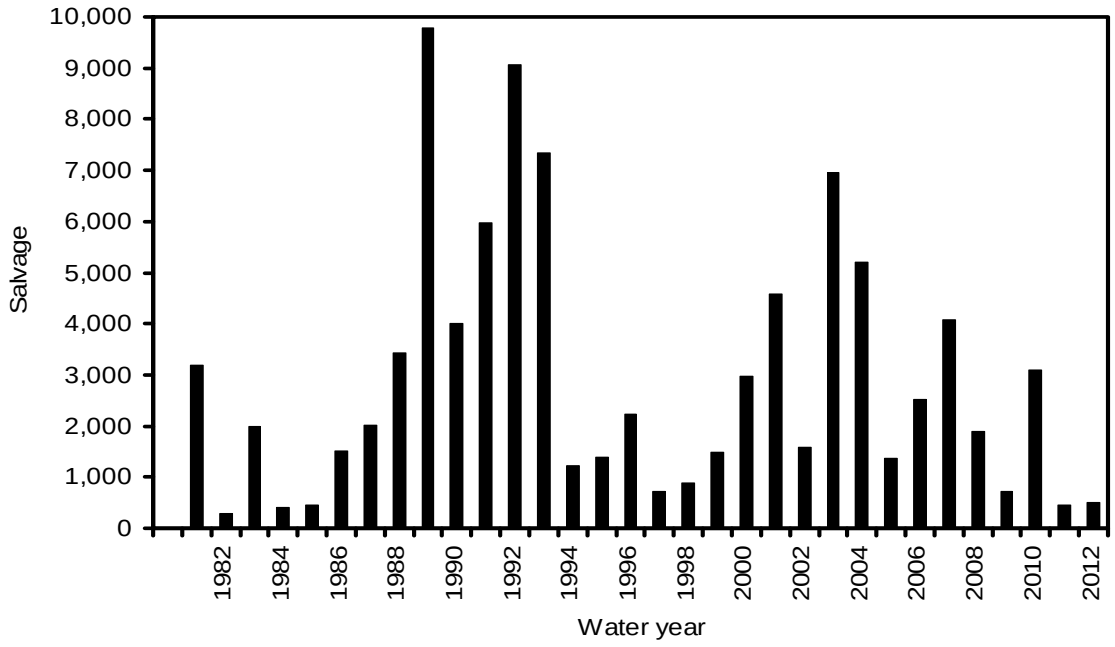

Figure 7 Annual salvage of steelhead (all origins combined) at the TFCF, WY 1981 – 2012

The majority of salvaged steelhead were of hatchery origin. The salvage composition was 404 hatchery and 89 wild fish.

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

Striped Bass

The annual salvage of 105,760 striped bass continued the low salvage trend

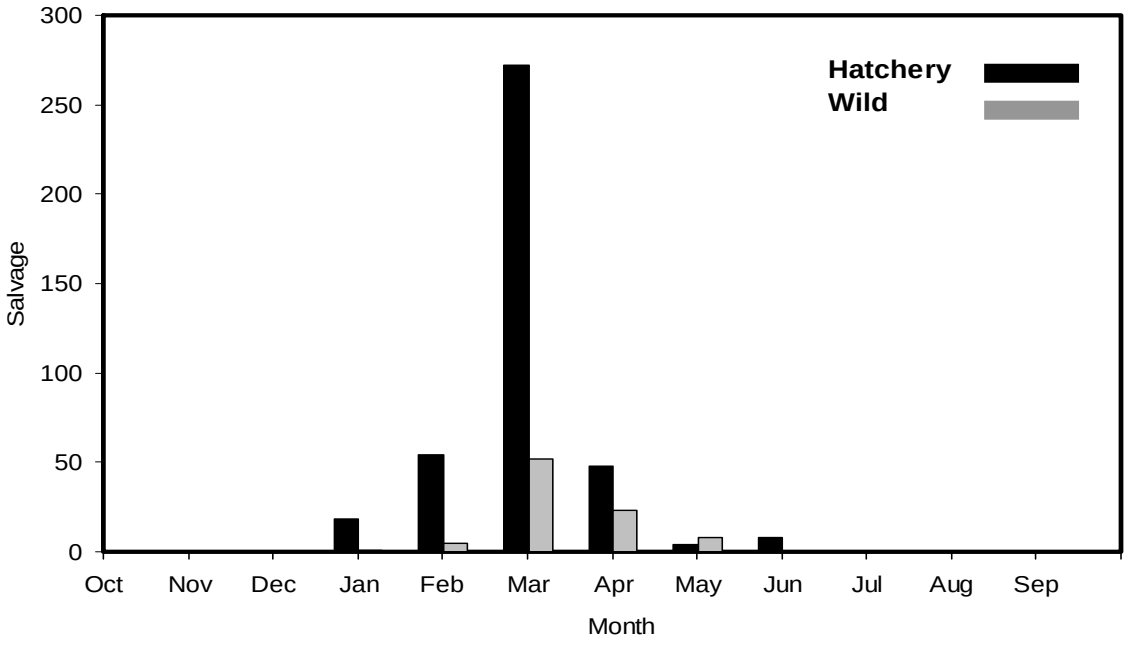

Figure 8 Monthly salvage of hatchery and wild steelhead at the TFCF, WY 2012

observed since WY 1995 (Figure 9). Annual salvage in WY 2001 (1,204,519) was a large increase from the WY 1995-2000 salvage but decreased again from WY 2002-2012 salvage. Prior to WY 1995 and except for WY 1983 and WY 1988, annual striped bass salvage was generally above 1,000,000.

Most striped bass were salvaged in June and July (Figure 10). Low salvage in April coincided with low monthly water export. The June salvage (53,999) and July salvage (44,893) accounted for 93.5 % of the annual salvage. Striped bass were salvaged every month and the lowest salvage occurred in April (12).

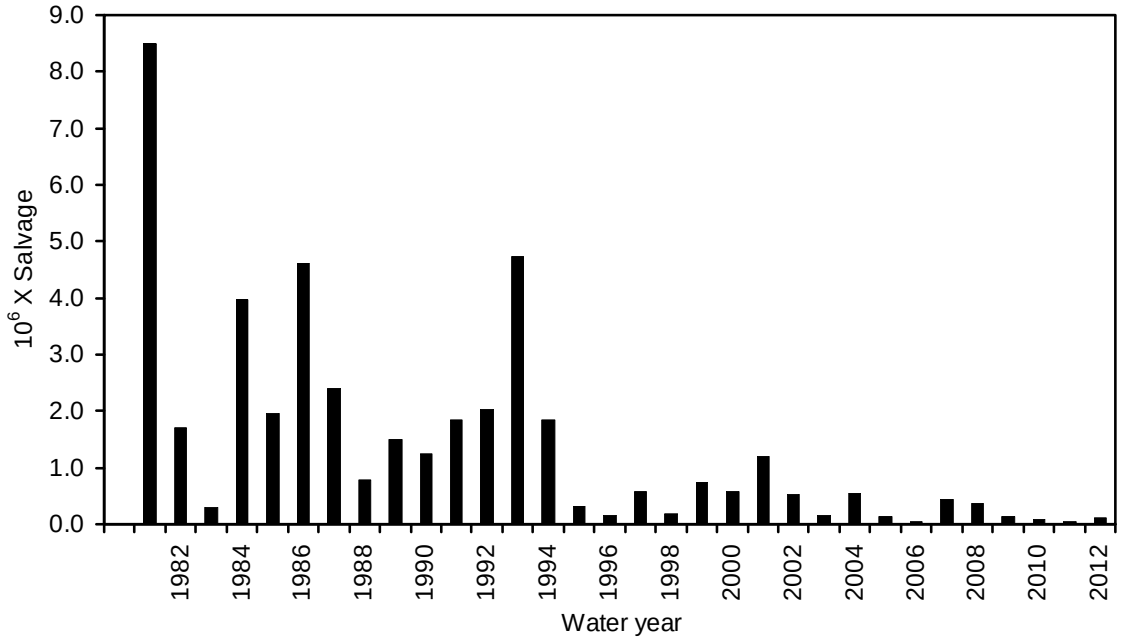

Figure 9 Annual salvage (in millions) of striped bass at the TFCF, WY 1981 – 2012

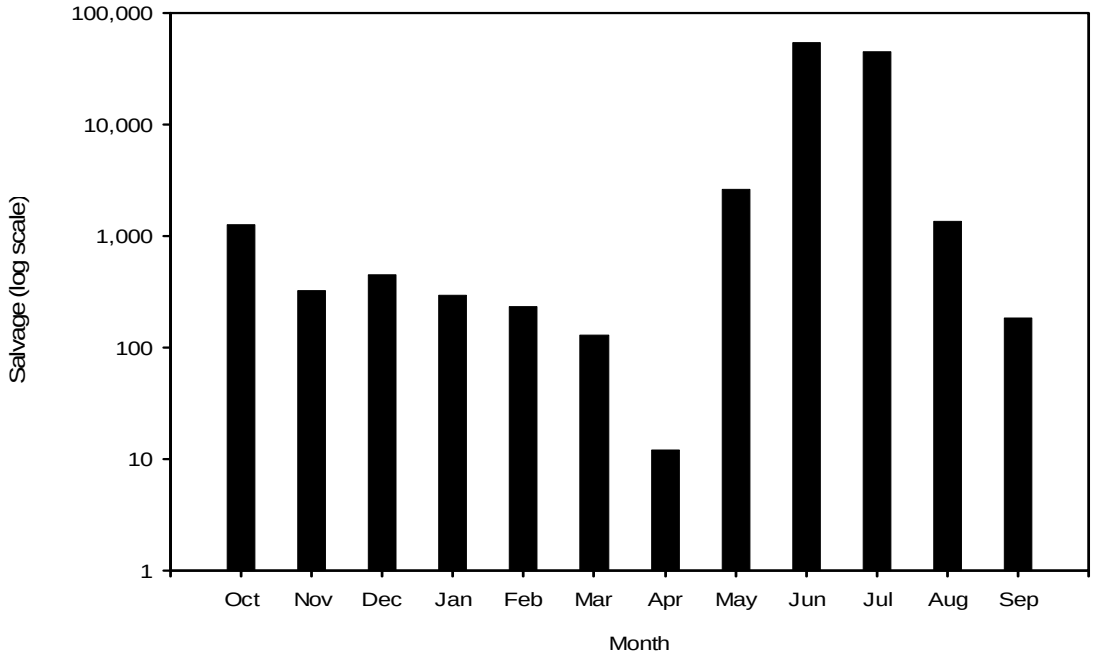

Figure 10 Monthly salvage of striped bass at the TFCF, WY 2012

Delta Smelt

Salvage at the TFCF (355) increased from the record low in WY 2011 (51) and WY 2010 (99), and was the highest salvage since WY 2008 (1,009) (Figure 11). Salvage during 2005 to 2012 (51-1,009) was the lowest 8-year period of salvage on record.

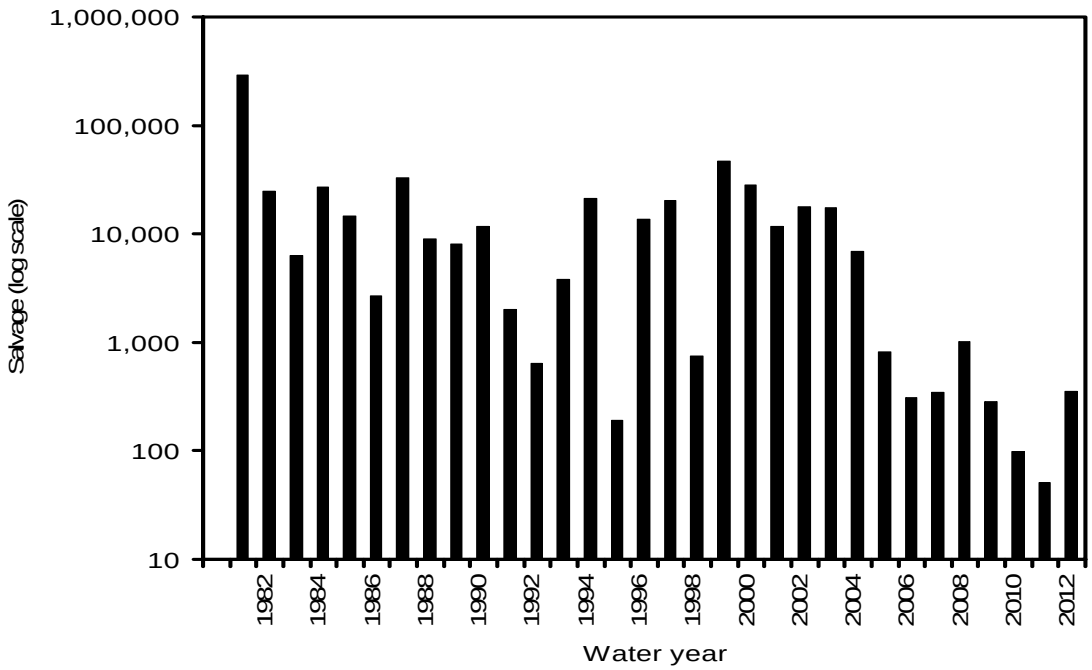

Figure 11 Annual salvage of delta smelt at the TFCF, WY 1981 – 2012

Salvage of delta smelt occurred in the middle of the water year (Figure 12). Adult delta smelt were salvaged January- April. Juvenile delta smelt were salvaged April-June, where May salvage (187) accounted for 52.7 % of the total annual salvage.

Delta smelt less than 20 mm were first detected at the TFCF on April 26 and

were observed on 42 days of monitoring (Table 2). The longest period of consecutive daily detections was June 5-14. The period with most daily detections occurred in May (22 days).

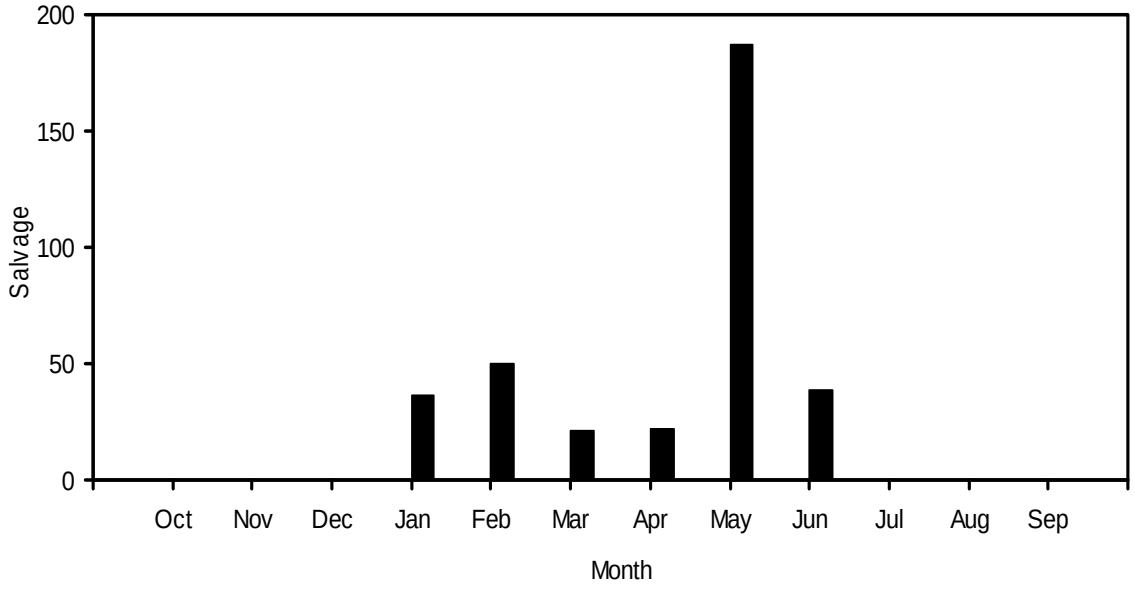

Figure 12 Monthly salvage of delta smelt at the TFCF, WY 2012

Longfin Smelt

Salvage at the TFCF (898) increased from WY 2011 (4) and WY 2010 (31), and was the highest salvage since WY 2003 (4,598). 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 February-May at the TFCF. April salvage (635) accounted for 70.7 % of the total annual salvage (Figure 14).

Table 2 Smelt less than 20 mm fork length (FL) observed in larval samples collected from TFCF in WY 2012. A "Y' indicates that delta or longfin smelt < 20 mm FL were found while an "N" indicates no detection. Number of smelt per day were recorded in parenthesis

Date	Delta smelt larvae	Longfin smelt larvae
2/20	N	Y
2/24	N	Y
2/25	N	Y
2/26	N	Y
2/28	N	Y (2)
2/29	N	Y (2)
3/1	N	Y (4)
3/3	N	Y
3/5	N	Y (5)
3/6	N	Y (18)
3/8	N	Y (2)
3/9	N	Y
3/10	N	Y (2)
3/11	N	Y (5)
3/12	N	Y
3/13	N	Y
3/14	N	Y (4)
3/16	N	Y
3/21	N	Y
3/22	N	Y (5)
3/27	N	Y (2)
3/31	N	Y (2)
4/9	N	Y
4/10	N	Y
4/12	N	Y (6)
4/13	N	Y
4/15	N	Y
4/16	N	Y
4/26	Y (3)	N
4/28	Y	Y
4/29	Y (3)	Y
5/1	Y (3)	N
5/3	N	Y
5/4	Y	N
5/5	Y (3)	N
5/6	Y	N

Table 2 (Cont) Smelt less than 20 mm fork length (FL) observed in larval samples collected from TFCF in WY 2012. A “Y’ indicates that delta or longfin smelt < 20 mm FL were found while an “N” indicates no detection. Number of smelt per day were recorded in parenthesis

Date	Delta smelt larvae	Longfin smelt larvae
5/7	Y (4)	N
5/8	Y	N
5/9	Y (2)	N
5/10	Y	N
5/11	Y (4)	N
5/14	Y	N
5/15	Y	N
5/18	Y	N
5/20	Y	N
5/22	Y	N
5/23	Y	N
5/24	Y (2)	N
5/25	Y (4)	N
5/26	Y	N
5/27	Y (4)	N
5/29	Y	N
5/30	Y (5)	N
5/31	Y (8)	N
6/1	Y (6)	N
6/2	Y (4)	N
6/3	Y (12)	N
6/5	Y (8)	N
6/6	Y (7)	N
6/7	Y (4)	N
6/8	Y	N
6/9	Y	N
6/10	Y (2)	N
6/11	Y (3)	N
6/12	Y	N
6/13	Y	N
6/14	Y	N
6/16	Y	N
6/18	Y (3)	N
6/22	Y	N
6/25	Y	N

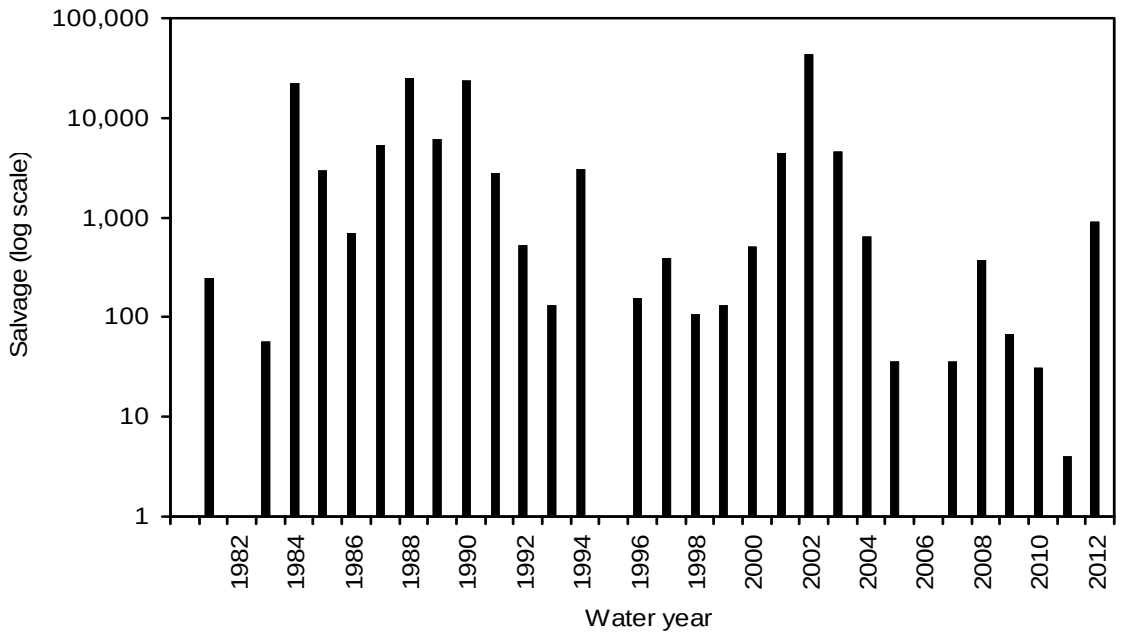

Figure 13 Annual salvage of longfin smelt at the TFCF, WY 1981 – 2012

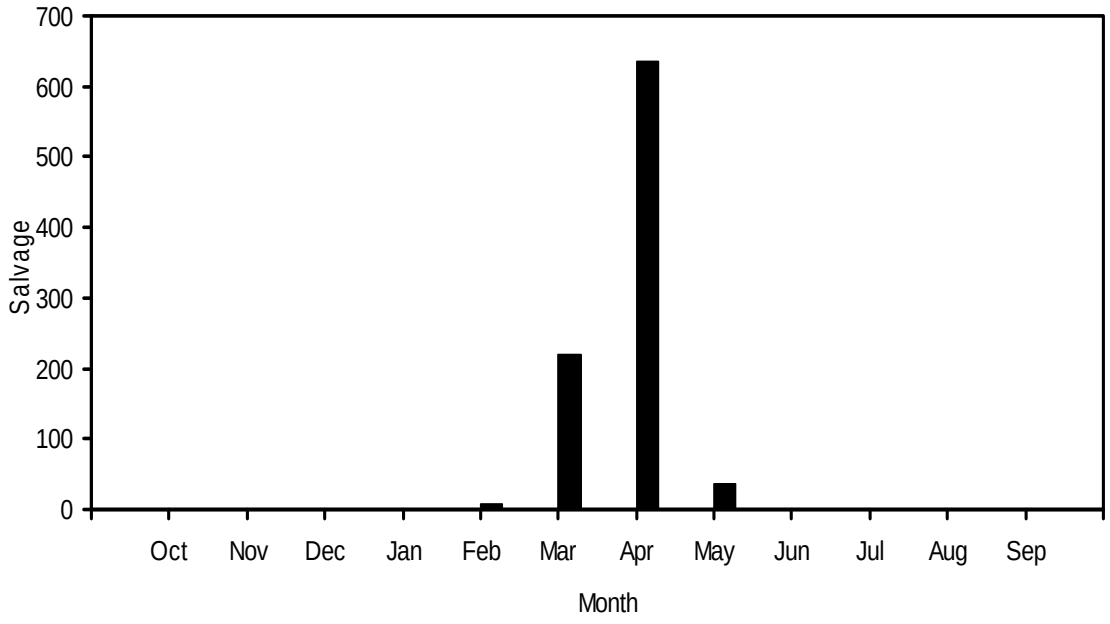

Figure 14 Monthly salvage of longfin smelt at the TFCF, WY 2012

Longfin smelt less than 20 mm were first detected at the TFCF on February 20 and were observed on 31 days of monitoring (Table 2). The longest period of consecutive daily detections was March 8-14. The period with most daily detections also occurred in March (16 days).

Splittail

The near record low salvage of splittail (929) was markedly lower than in WY 2011 (7,660,024) and WY 2010 (160,929). Salvage in WY 2007 (780) was the lowest in recent record. Splittail salvage has followed a boom-or-bust pattern, often varying year to year by several orders of magnitude (Figure 15).

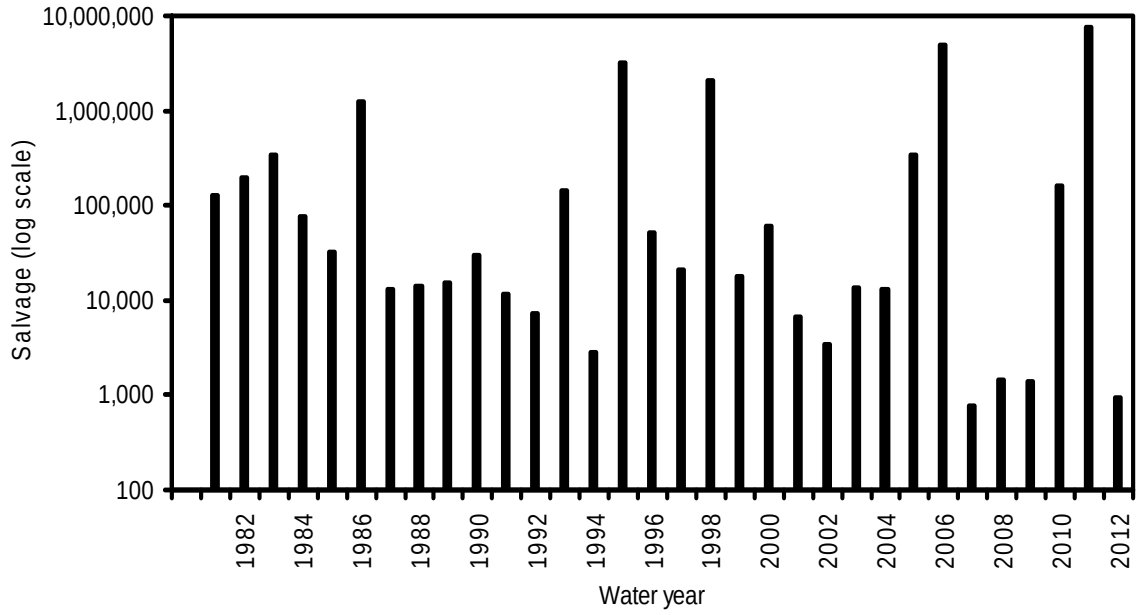

Figure 15 Annual salvage of splittail at the TFCF, WY 1981 – 2012

Threadfin Shad

Salvage of threadfin shad was a record low (109,610) and was a substantial decrease from WY 2010 (591,111) and WY 2010 (763,105). Similar to splittail, annual salvage of threadfin shad has varied greatly through time (Figure 16). Prior to WY 2005, the WY 2001-2004 salvage (3.6-5.2 million) was the highest 4-year period of salvage on record.

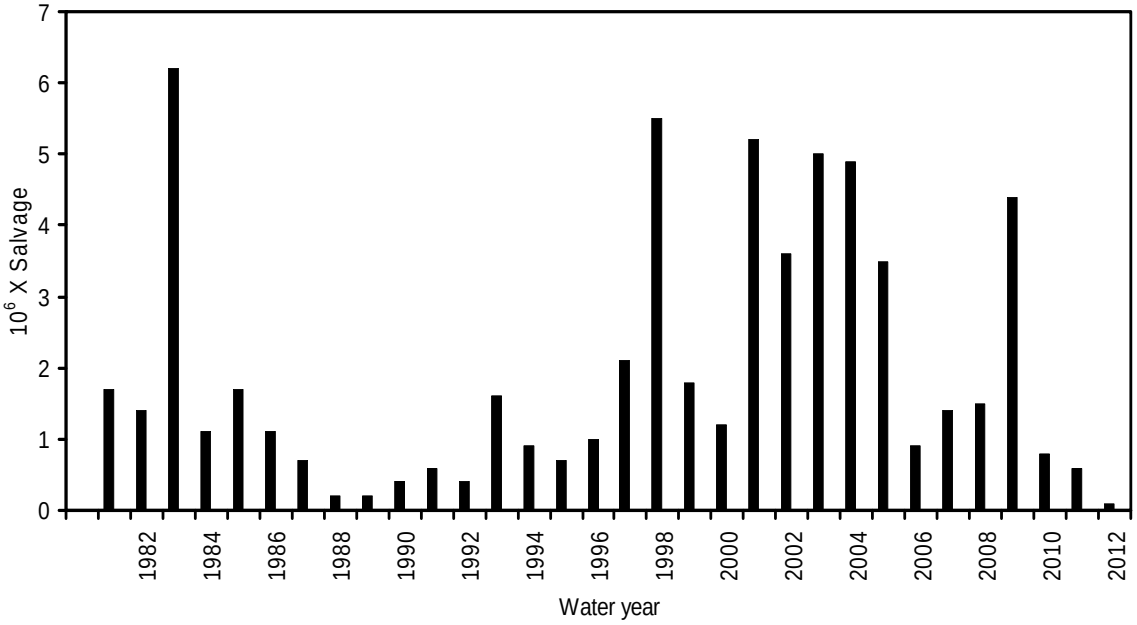

Figure 16 Annual salvage (in millions) of threadfin shad at the TFCF, WY 1981 – 2012

FOOTNOTES

1. Pelagic Organism Decline (POD) species

Appendix A Annual salvage (salvage) and percentage of annual salvage (%) for fish collected from the TFCF in WY 2012 and WY 2011

Species	2012 Salvage	% Composition	2011 Salvage	% Composition
Threadfin shad	109,610	23.1	591,111	6.8
Striped bass	105,760	22.3	39,583	0.5
American shad	72,603	15.3	100,233	1.1
Largemouth bass	63,670	13.4	29,096	0.3
Bluegill	52,986	11.2	86,932	1
White catfish	29,069	6.1	74,193	0.9
Channel catfish	10,121	2.1	40,288	0.5
Prickly sculpin	8,606	1.8	1,680	<0.1
Rainwater killifish	6,025	1.3	1,921	<0.1
Inland silverside	5,954	1.3	8,359	<0.1
Chinook salmon	1,965	0.4	18,135	0.2
Yellowfin goby	1,755	0.4	22,081	0.3
Golden shiner	1,281	0.3	3,200	<0.1
Splittail	929	0.2	7,660,024	87.8
Longfin smelt	898	0.2	4	<0.1
Redear sunfish	840	0.2	1,454	<0.1
Black crappie	629	0.1	1,909	<0.1
Steelhead	493	0.1	445	<0.1
Delta smelt	355	0.1	51	<0.1
Warmouth	318	0.1	796	<0.1
Bigscale logperch	244	0.1	104	<0.1
Western mosquitofish	212	<0.1	408	<0.1
Shimofuri goby	162	<0.1	2,080	<0.1
Common carp	148	<0.1	8,841	<0.1
Tule perch	118	<0.1	102	<0.1
White sturgeon	64	<0.1	133	<0.1
Brown bullhead	54	<0.1	132	<0.1
Threespine stickleback	47	<0.1	123	<0.1
Black bullhead	35	<0.1	57	<0.1
Lamprey, unknown	31	<0.1	2,651	<0.1
Fathead minnow	28	<0.1	108	<0.1
Wakasagi	24	<0.1	0	0.0
Pacific staghorn sculpin	17	<0.1	12	<0.1
Green sunfish	13	<0.1	9	<0.1
Starry flounder	8	<0.1	11	<0.1
Red shiner	5	<0.1	12	<0.1
Sacramento pikeminnow	4	<0.1	12	<0.1
Hitch	1	<0.1	4	<0.1

Appendix A (Cont) Annual salvage (salvage) and percentage of annual salvage (%) for fish collected from the TFCF in WY 2012 and WY 2011

Species	2012 Salvage	% Composition	2011 Salvage	% Composition
Sacramento sucker	0	0.0	27,362	0.3
Goldfish	0	0.0	40	<0.1
Pacific brook lamprey	0	0.0	28	<0.1
White crappie	0	0.0	24	<0.1
Sacramento blackfish	0	0.0	12	<0.1
Green sturgeon	0	0.0	12	<0.1
Blue catfish	0	0.0	8	<0.1