Fish Salvage at the Tracy Fish Collection Facility during the 2020 Water Year

by

Geir Aasen

And

Trishelle Tempel

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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) fish from water exported from the southern portion of the Sacramento-San Joaquin Delta. After fish have been salvaged at the TFCF, the C.W. “Bill” Jones Pumping Plant (JPP) pumps water into the Delta Mendota Canal. Both the TFCF and JPP are integral parts of the Central Valley Project (CVP) which provides water for agriculture on the western side of the San Joaquin Valley. The fish are loaded into tanker trucks and trucked to release sites away from the immediate influence of the export pumps to be released into the western Delta. This report summarizes the 2020 water year (10/1/2019-9/30/2020) operational and biological information gathered from the TFCF. The following species are given individual consideration: Chinook Salmon (*Oncorhynchus tshawytscha*), Steelhead (*O. mykiss*), Striped Bass (*Morone saxatilis*), Delta Smelt (*Hypomesus transpacificus*), Longfin Smelt (*Spirinchus thaleichthys*), Splittail (*Pogonichthys macrolepidotus*), and Threadfin Shad (*Dorosoma petenense*).

Methods

Daily volumes of water exported were reported from gauge readings at the JPP in Byron. Monthly water exports were plotted and examined for time trends. Water year (WY) exports for the CVP from 1981 through 2020 were noted. Salvage data from WYs 1981 to 2020 were examined for long and short-term trends.

Diverted fish are subsampled and enumerated at the TFCF. The subsamples are expanded and reported as “estimated salvage” to quantify the fish abundance at the

facility. It should be noted that some fish species including Delta Smelt have a low survival rate through the salvage process. 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:

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

Predator removals were not expanded since they are removed with no salvage minutes:

$$SALVAGE_{PREDATOR\ REMOVAL/SECONDARY\ FLUSH} = COUNT_{PREDATOR\ REMOVAL/SECONDARY\ FLUSH.} \quad (2)$$

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 2020.

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. If DNA race information was available, the race of wild 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 (California Dept. of Fish and Wildlife 2013). 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.

Larval fish sampling was conducted during March 16 through June 17 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 at 0400, 1000, 1600, and 2200 hours counts. Larval fish were identified to species by TFCF personnel and reported the next working day.

Water Exports

The CVP exported 1,968,291 acre feet (AF) of water, which was a decrease from WY 2019 (2,361,826 AF), WY 2018 (2,291,049 AF), WY 2017 (2,679,464 AF), but an increase from WY 2016 (1,360,026 AF) and the record low in WY 2015 (695,650 AF; Figure 1). The WY 2020 export, which was a drought year, fell within the range of exports from drought years WYs 2012-2016 (695,650 to 2,076,833 AF). Increases in exports in WYs 2017-2019 coincided with increased rainfall following five years of drought conditions in California. The highest monthly water exports occurred in January and July-September (Figure 2). During these periods, a total of 993,348 AF was exported, accounting for 50% of the total export. Monthly exports ranged from 57,291 AF in May to 256,214 AF in January.

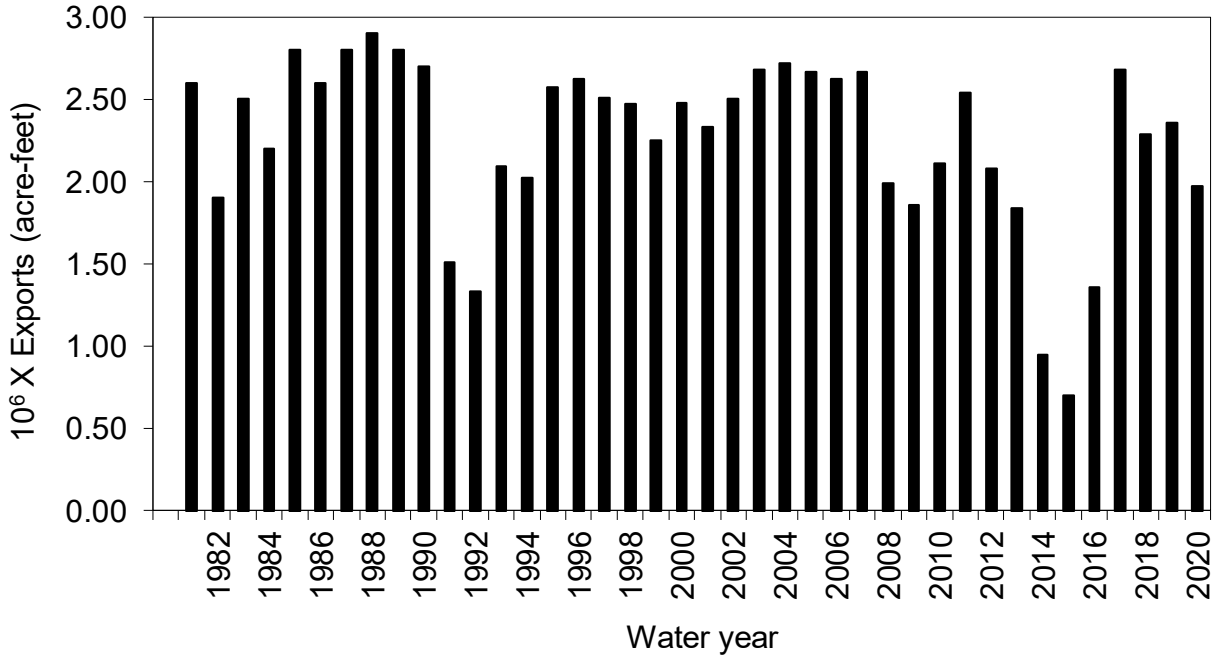

Figure 1. Annual exports (by water year; WY) in millions of acre-feet for the Central Valley Project, WYs 1981–2020.

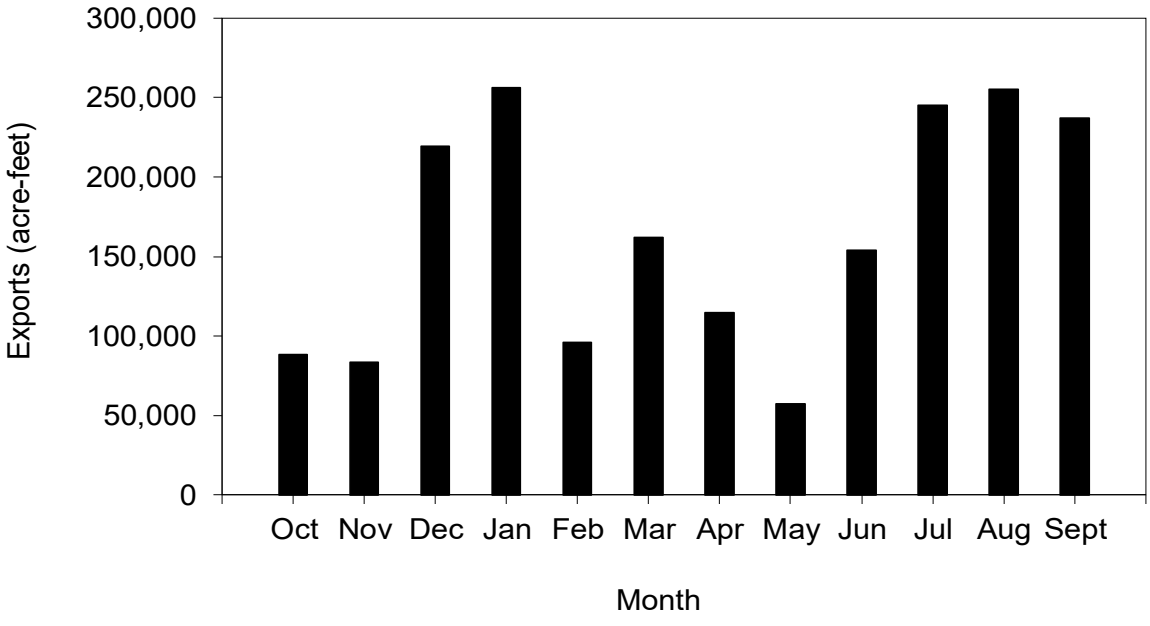

Figure 2. Monthly exports (in acre-feet) for the Central Valley Project, WY 2020

Total Salvage and Prevalent Species

Total fish salvage (all fish combined) at the TFCF was 1,679,609 (Figure 3). This total was a small increase from WY 2019 (1,463,817), WY 2018 (1,432,489) but a small decrease from WY 2017 (2,061,133). WY 2020 salvage was a substantial increase from the record low salvage in WY 2014 (160,681). The WY 2020 total was well below the record high salvage of 37,659,835 in WY 2006, most of which were Common Carp.

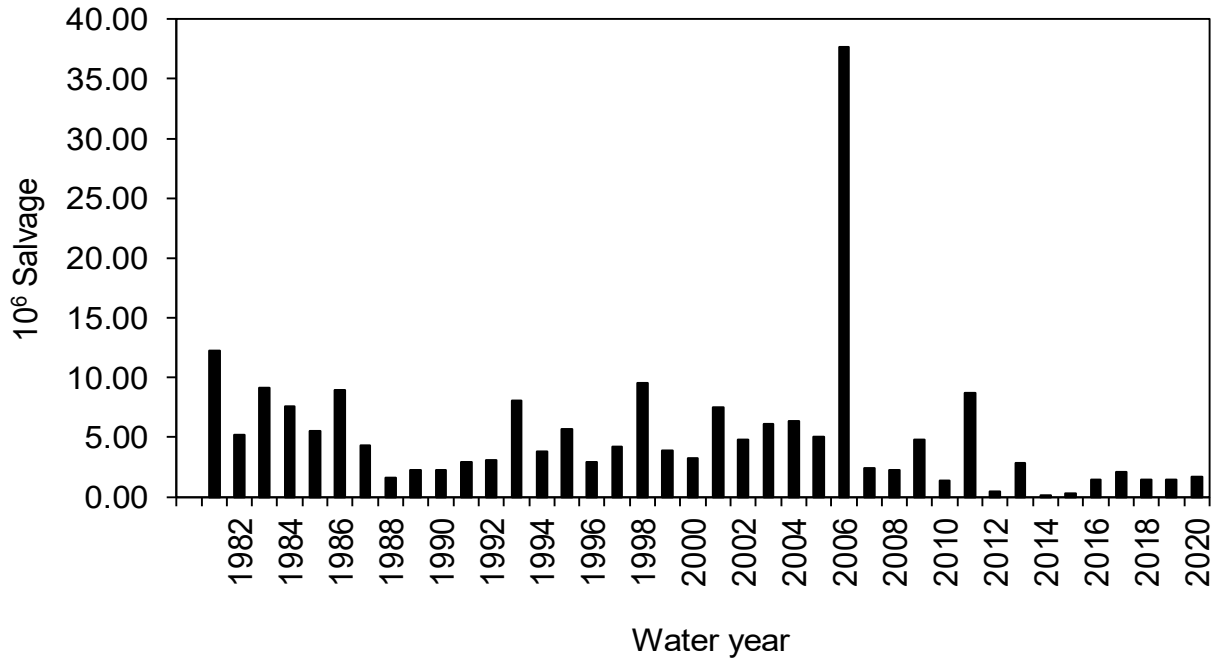

Figure 3. Annual salvage (by water year, WY; in millions) of all fish taxa combined at the TFCF, WYs 1981–2020

Threadfin Shad accounted for 69.2% 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 American Shad (8.1%), Largemouth Bass

(7.2%), Striped Bass (4.5%), and Bluegill (2.8%). Native species comprised 3.2% of total fish salvage. This was a decrease from WY 2019 when native species comprised 6.1% of salvage. Listed species including Chinook Salmon, Steelhead, Green Sturgeon, and Longfin Smelt accounted for 0.3% of salvage. This was a decrease from WY 2019 when these species comprised 0.7% of salvage.

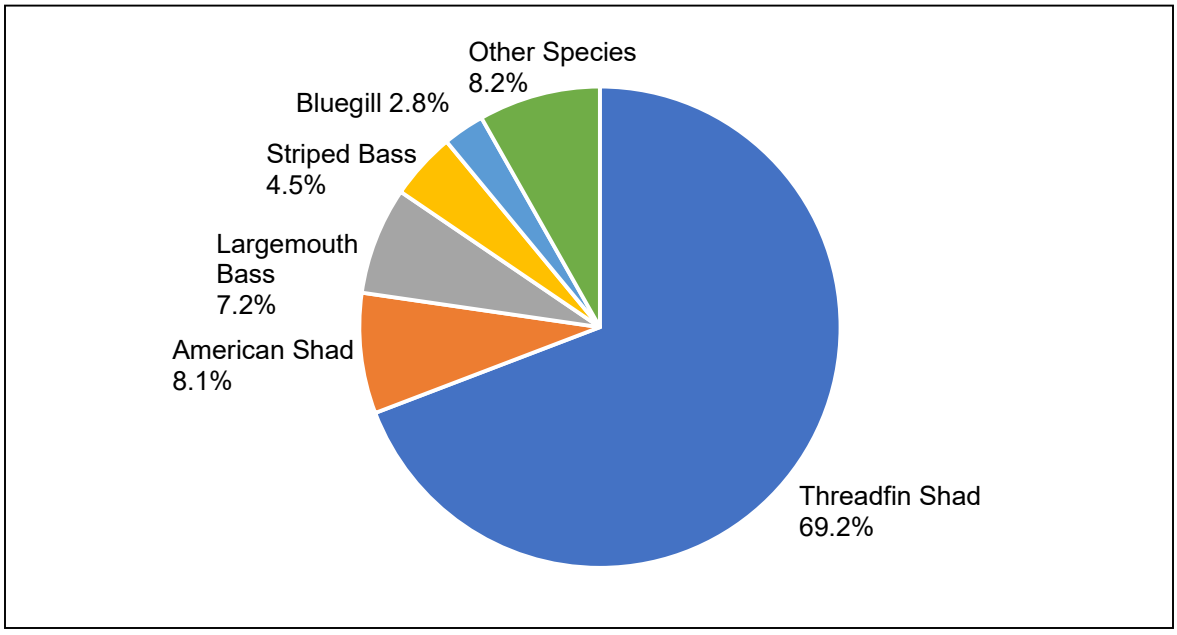

Figure 4. Percentages of annual salvage for the 5 most-prevalent species and other species combined at the TFCF, WY 2020

Chinook Salmon

The annual salvage of juvenile (>300 mm FL) Chinook Salmon was 3,690 for all races and origins combined (Figure 5; Appendix A). Salvage of Chinook Salmon in WY 2020 was a decrease from WY 2019 (9,083), WY 2018 (14,315) and WY 2017 (23,633), but a

large increase from WY 2016 (970) and the record low in WY 2015 (187). Mean salvage for WYs 2001-2020 was only 10.4% of the mean salvage for WYs 1981-2000.

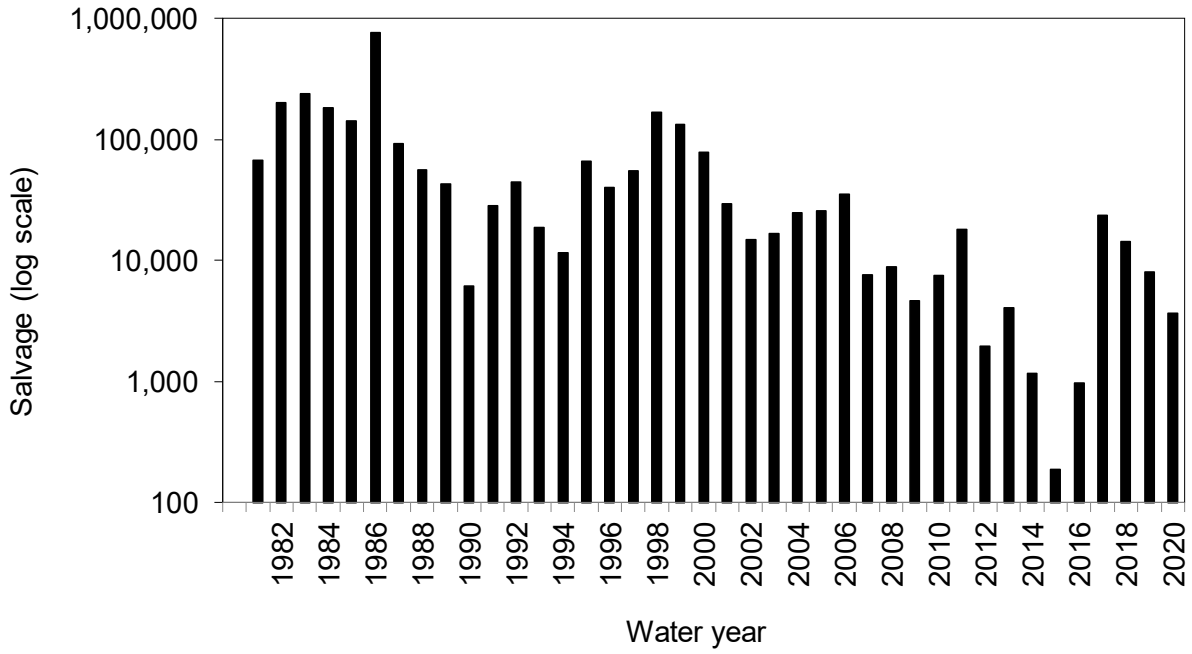

Figure 5. Annual salvage of Chinook Salmon (all races and origins combined) at the TFCF, WYs 1981–2020

Wild Chinook Salmon consisted primarily of fall run sized fish (96.8%) followed by spring run sized fish (Table 1). Wild fall run fish were salvaged in December 2019 to June 2020 (Figure 6). The largest proportion of wild fall run sized fish was salvaged in April (1,823). The estimated loss of wild Chinook Salmon was 1,871 (Table 1).

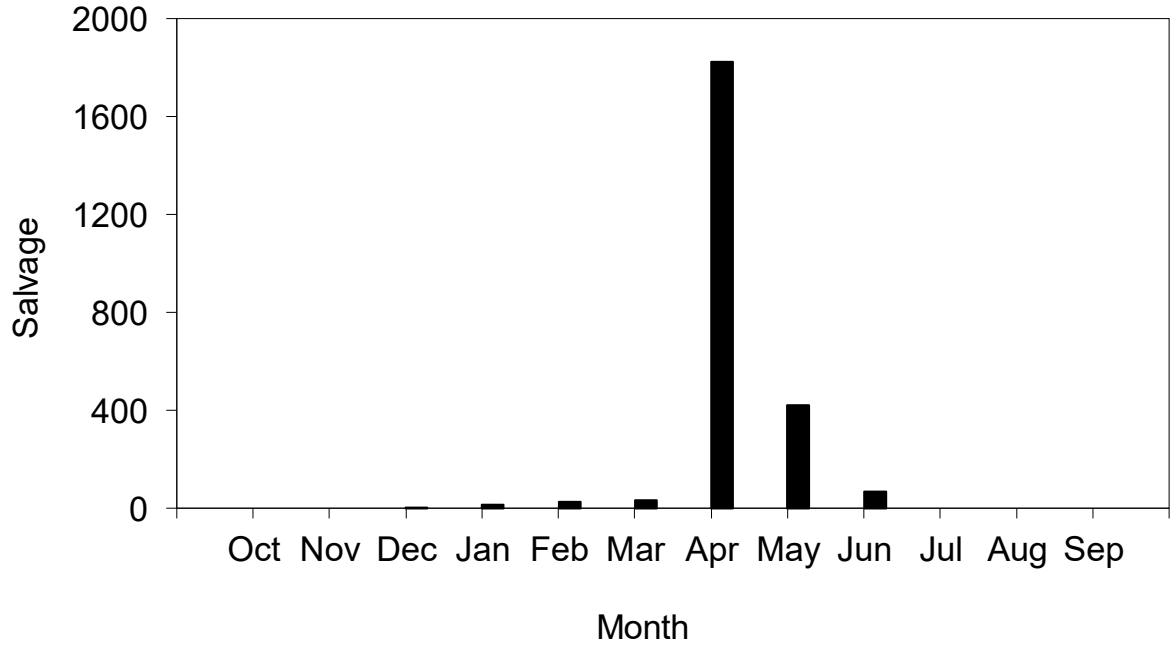

Figure 6. Monthly salvage of wild fall run Chinook Salmon at the TFCF, WY 2020.

Table 1. Chinook Salmon annual salvage, percentages of annual salvage, and losses at the TFCF, WY 2020, by race and origin (wild or hatchery)

Origin	Race	Salvage	Percentage	Loss
Wild	Fall	2,395	96.8	1,812
	Late-fall	12	0.5	8
	Spring	36	1.4	27
	Winter	32	1.3	24
Total Wild		**2,475**		**1,871**
Hatchery	Fall	41	3.4	29
	Late-fall	189	15.6	127
	Spring	968	79.6	685
	Winter	17	1.4	12
Total Hatchery		**1,215**		**853**
Grand Total		***3,690***		***2,724***

Steelhead

Salvage of wild and hatchery Steelhead (488) was a decrease from WY 2019 (725) and WY 2018 (740), but a large increase from the record low in WY 2017 (30), which continued the pattern of mostly low salvage observed since WY 2005 (Figure 7).

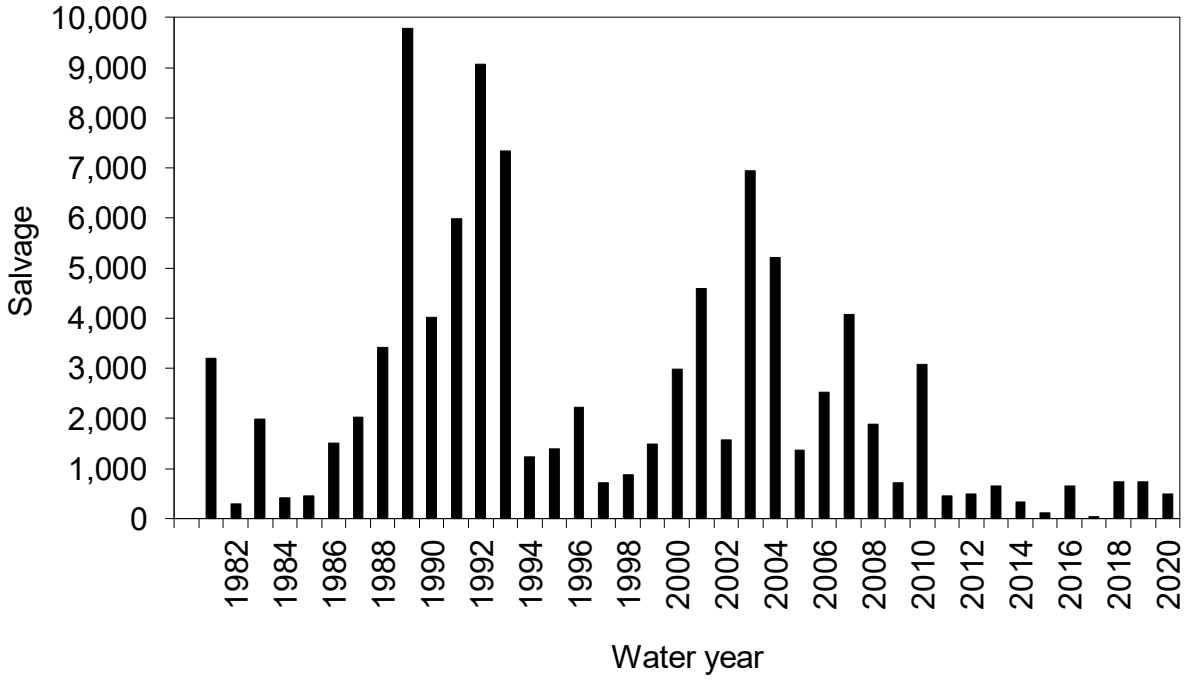

Figure 7. Annual salvage of Steelhead (all origins combined) at the TFCF, WYs 1981–2020

Juvenile Steelhead salvage estimates, as in WY 2019, were primarily of hatchery origin, which was a shift from WY's 2018-2017 when wild steelhead were most salvaged. The salvage composition was 161 wild and 327 hatchery fish.

Wild Steelhead were salvaged in March-May and July while hatchery Steelhead were salvaged in October and January-April (Figure 8). Hatchery Steelhead were most frequently salvaged in April and wild Steelhead were most frequently salvaged in March.

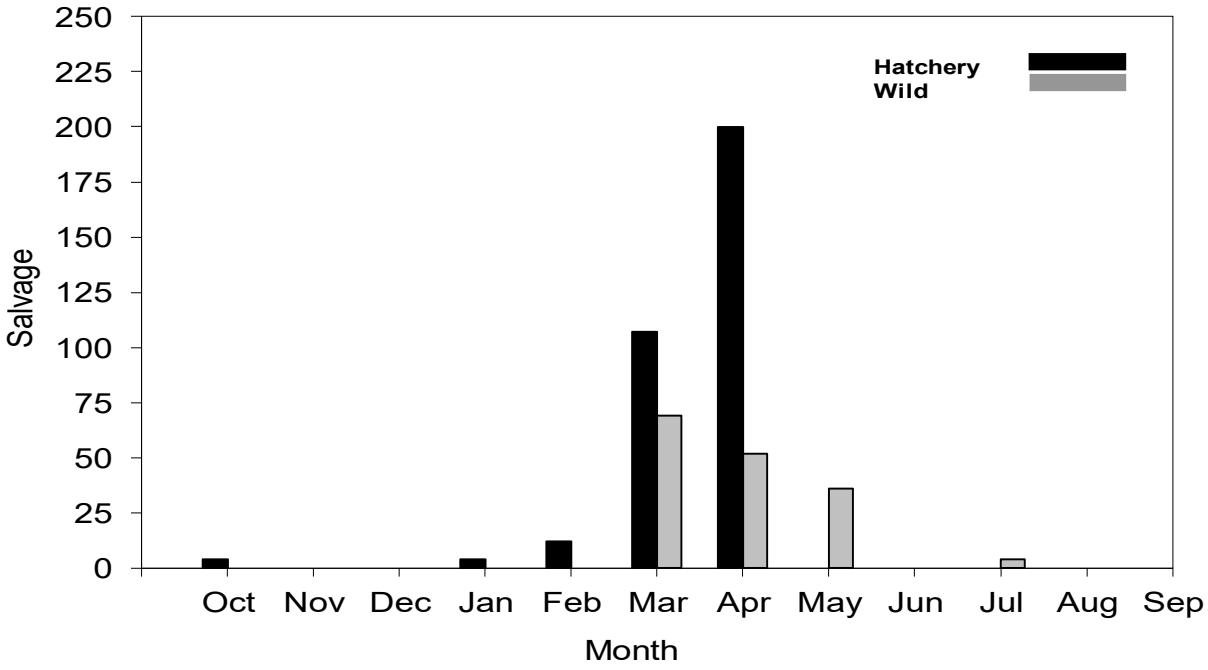

Figure 8. Monthly salvage of hatchery and wild Steelhead at the TFCF, WY 2020

Striped Bass

The annual salvage of Striped Bass (74,759) 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 May-July (Figure 10). The May salvage (8,716), June salvage (52,949), and July salvage (8,967) accounted for 94.5% of the total

salvage. Striped Bass were salvaged every month and the lowest salvage occurred in February (19).

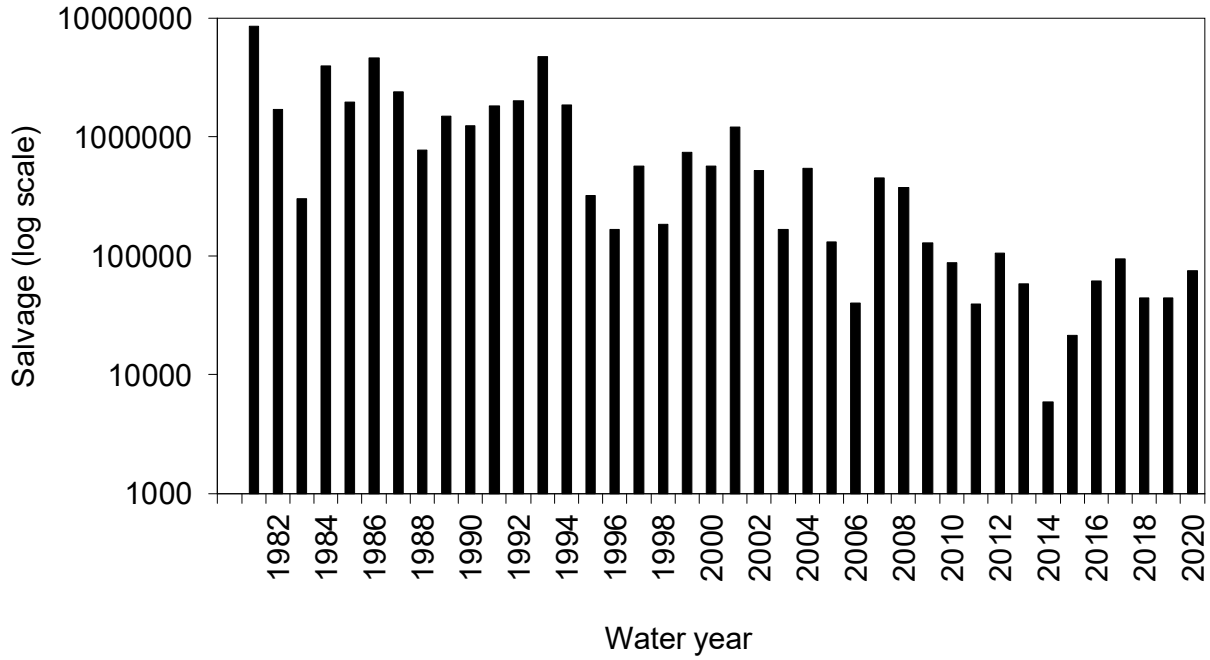

Figure 9. Annual salvage of Striped Bass at the TFCF, WYs 1981–2020

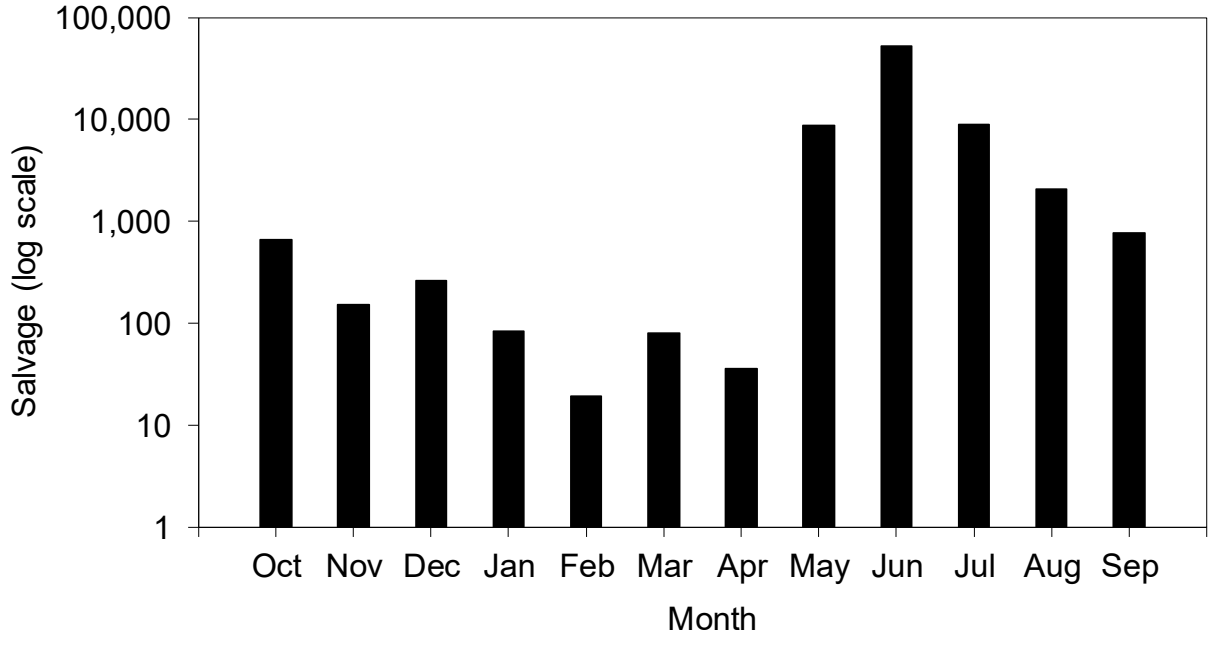

Figure 10. Monthly salvage of Striped Bass at the TFCF, WY 2020

Delta Smelt

No Delta Smelt were salvaged in WY 2020 which was a record low and a small decrease from WY 2019 (8) and the previous record low in WY 2018 (4; Figure 11). Delta smelt salvage has steadily declined since 2005 and has generally followed the same declining annual populations for this species. 2005-2020 was the lowest 15-year period of annual salvage on record (0-1,009).

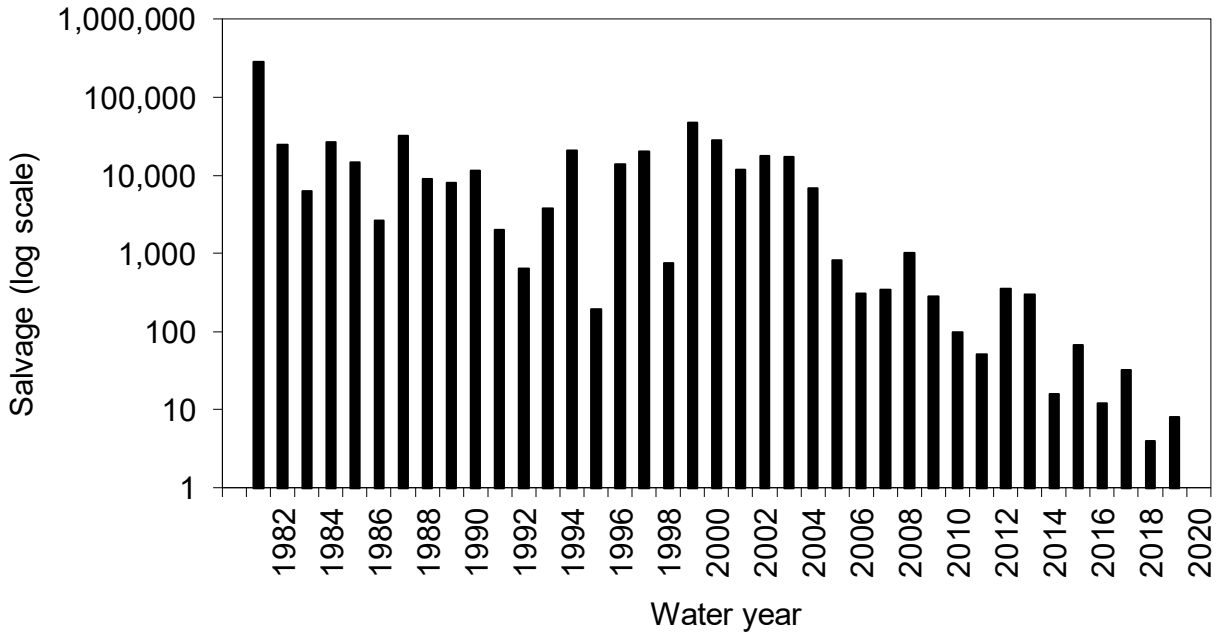

Figure 11. Annual salvage of Delta Smelt at the TFCF, WYs 1981–2020

Delta Smelt less than 20 mm FL were detected only on April 13 which was a small increase from WYs 2016-2019 where none were sampled.

Longfin Smelt

The salvage of Longfin Smelt (1,486) was a large increase from WY 2019 (8) and the record lows in WY 2018 (0) and WY 2017 (0; Figure 12). The WY 2020 salvage is the

largest increase in Longfin Smelt salvage since WYs 2001-2003. Low annual salvages have generally been observed since 1995, with the exception of 43,056 salvaged in WY 2002, and generally coincides with the declining annual populations of Longfin Smelt.

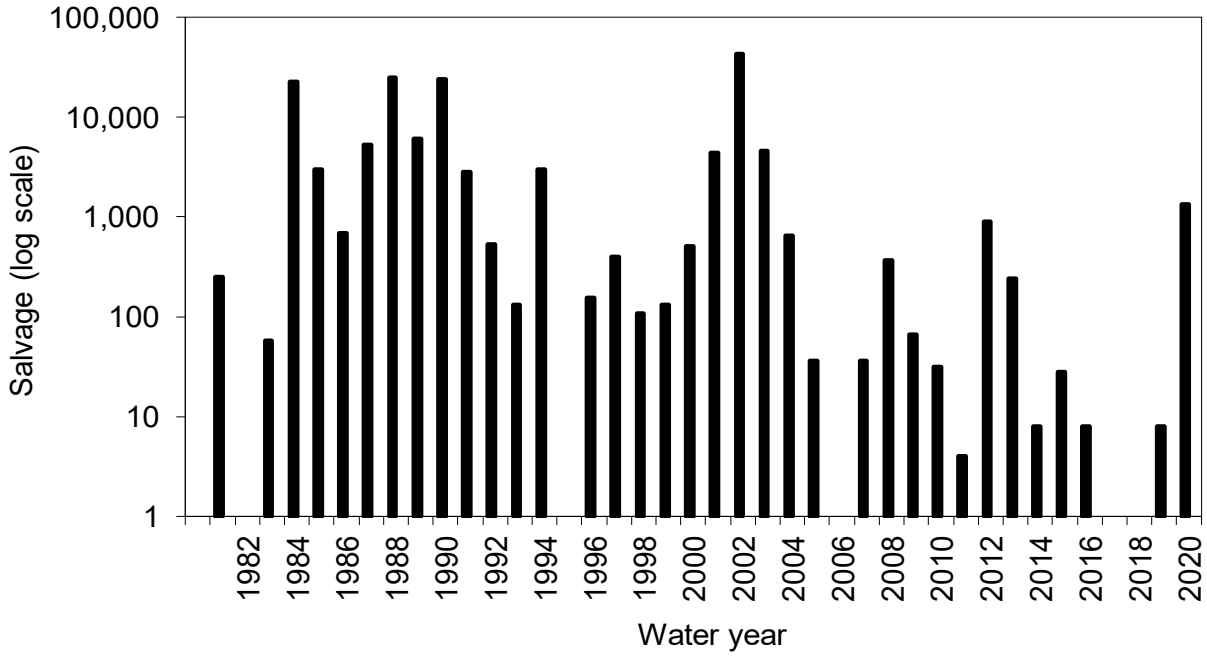

Figure 12. Annual salvage of Longfin Smelt at the TFCF, WYs 1981–2020

Juvenile Longfin Smelt were salvaged during March-May with peak salvage in April (1,426). No adult Longfin Smelt were salvaged in WY 2019. Longfin Smelt less than 20 mm FL were detected in during March-April with peak numbers in April, which was in contrast to WY's 2019-2017 when none were sampled.

Splittail

The salvage of juvenile and adult Splittail (1,960) was a large decrease from WY 2019 (66,962) and WY 2018 (7,788), but an large increase from WY 2016 (109), and the record lows in WY 2015 (12) and WY 2014 (12). However, WY 2020 salvage was a marked decrease from WY 2017 (415,517) and 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.

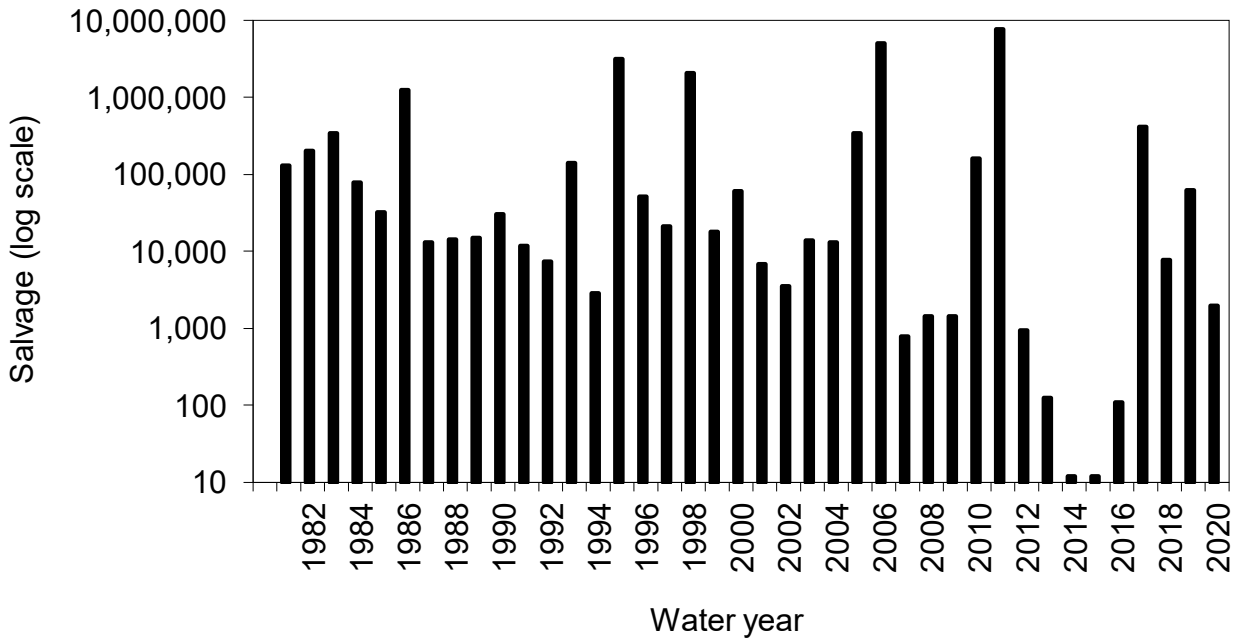

Figure 13. Annual salvage of Splittail at the TFCF, WYs 1981–2020

Threadfin Shad

The salvage of juvenile and adult Threadfin Shad (1,161,551) was an increase from WY 2019 (739,723), 2018 (1,068,584), WY 2016 (1,127,956), and WY 2017 (731,760). WY

2020 salvage was markedly higher from WY 2015 (114,804) and WY 2014 (47,603). 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 four year period of annual salvage on record (3.5-5.2 million).

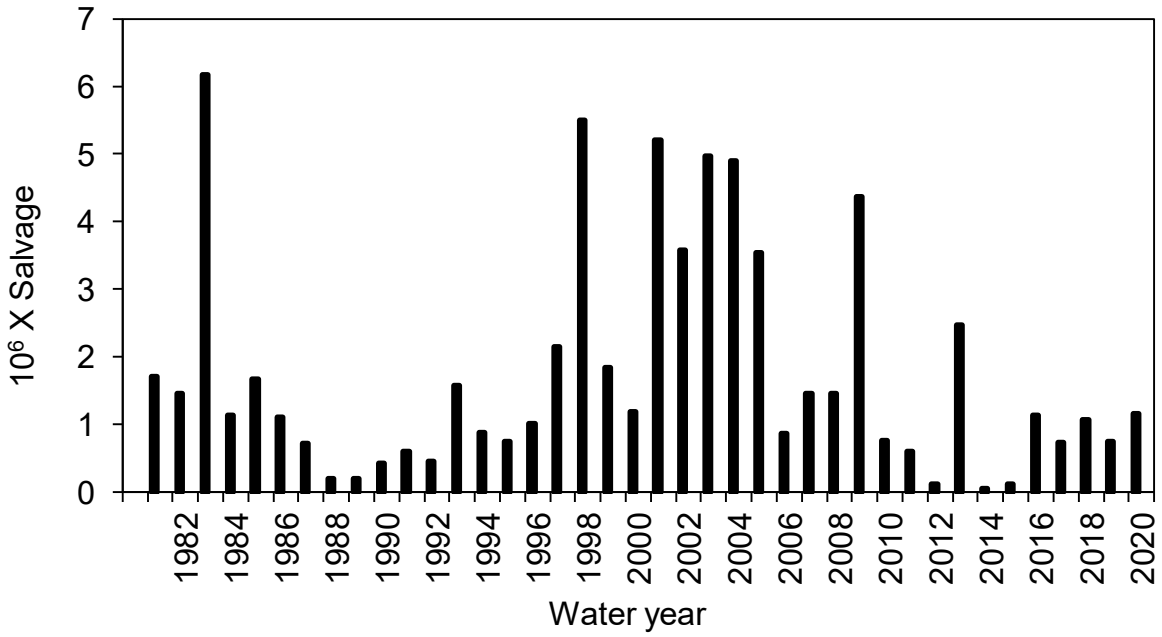

Figure 14. Annual salvage (in millions) of Threadfin Shad at the TFCF, WYs 1981–2020

The monthly salvage of Threadfin Shad in WY 2019 followed the same seasonal trend as observed in past years. The highest salvage of Threadfin Shad occurred in July-August (Figure 15). Threadfin Shad were salvaged every month of the year. Adult Threadfin Shad were mostly salvaged in fall and winter. Juvenile Threadfin Shad were mostly salvaged in summer and fall.

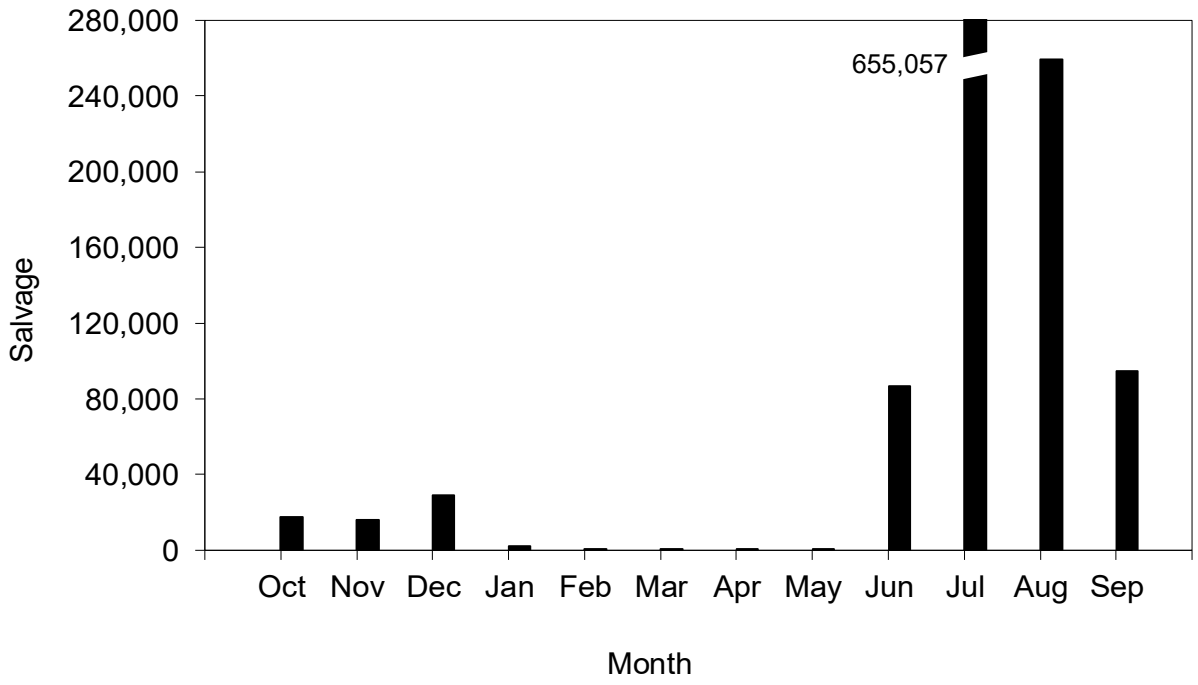

Figure 15. Monthly salvage of Threadfin Shad at the TFCF, WY 2020

References

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

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

California Dept. of Fish and Wildlife. 2013. Salmon loss estimation.

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

Appendix A. Annual salvages and percentages of annual salvage (%) for fish collected from the TFCF in WYs 2020 and 2019

Species	2020 Salvage	% Composition	2019 Salvage	% Composition
Threadfin Shad	1,161,551	69.2	739,723	50.5
American Shad	136,257	8.1	208,897	14.3
Largemouth Bass	120,502	7.2	56,224	3.8
Striped Bass	74,759	4.5	44,584	3.0
Bluegill	47,507	2.8	186,443	12.7
Prickly Sculpin	43,234	2.6	7,362	0.5
White Catfish	39,833	2.4	68,270	4.7
Inland Silverside	15,877	0.9	16,113	1.1
Channel Catfish	11,612	0.7	13,485	0.9
Black Crappie	4,985	0.3	8,398	0.6
Rainwater Killifish	3,772	0.2	3,248	0.2
Chinook Salmon	3,690	0.2	9,083	0.6
Lamprey Unknown	2,204	0.1	5,155	0.4
Yellowfin Goby	2,116	0.1	2,920	0.2
Splittail	1,960	0.1	66,962	4.6
Redear Sunfish	1,781	0.1	2,593	0.2
Shimofuri Goby	1,614	<0.1	3,651	0.2
Longfin Smelt	1,486	<0.1	8	<0.1
Western Mosquitofish	1,182	<0.1	3,551	0.2
Golden Shiner	969	<0.1	4,498	0.3
Pacific Lamprey	500	<0.1	28	<0.1
Steelhead	488	<0.1	725	<0.1
Sacramento Sucker	481	<0.1	32	<0.1
Bigscale Logperch	453	<0.1	88	<0.1
Red Shiner	220	<0.1	1,058	<0.1
Common Carp	190	<0.1	8,868	0.6
Black Bullhead	86	<0.1	97	<0.1
Brown Bullhead	76	<0.1	509	<0.1
Threespine Stickleback	60	<0.1	216	<0.1
Warmouth	52	<0.1	629	<0.1
Wakasagi	32	<0.1	0	0.0
Tule Perch	30	<0.1	8	<0.1

Appendix A. (Cont.) Annual salvages and percentages of annual salvage (%) for fish collected from the TFCF in WYs 2020 and 2019

Species	2020 Salvage	% Composition	2019 Salvage	% Composition
Blue catfish	22	<0.1	175	<0.1
Fathead Minnow	8	<0.1	1	<0.1
Goldfish	8	<0.1	20	<0.1
Green Sturgeon	8	<0.1	0	0.0
Chameleon Goby	4	<0.1	0	0.0
Sacramento Pikeminnow	0	0.0	97	<0.1
White Crappie	0	0.0	24	0.0
Green Sunfish	0	0.0	17	<0.1
White Sturgeon	0	0.0	16	<0.1
Delta Smelt	0	0.0	8	<0.1
Pacific Staghorn Sculpin	0	0.0	8	<0.1
Spotted Bass	0	0.0	8	<0.1
Starry Flounder	0	0.0	8	0.0
Sacramento Blackfish	0	0.0	4	<0.1
Shokihaze Goby	0	0.0	4	<0.1