State of California
Department of Fish and Wildlife

Memorandum

Date: November 28th, 2022

To: Erin Chappell
Regional Manager
Bay Delta Region

From: James White
Environmental Scientist
Bay Delta Region

Subject: 2022 Fall Midwater Trawl September-November fish abundance and distribution

The midseason abundance indices reported here are the sum of the first three (September-November) of the four planned monthly abundance indices that will comprise the annual FMWT abundance indices.

The Fall Midwater Trawl (FMWT) reports on the relative abundance and distribution of upper-estuary pelagic species including but not limited to Delta Smelt (*Hypomesus transpacificus*), age-0 Striped Bass (*Morone saxatilis*), Longfin Smelt (*Spirinchus thaleichthys*), Threadfin Shad (*Dorosoma petenense*), American Shad (*Alosa sapidissima*), and Splittail (*Pogonichthys macrolepidotus*). The FMWT samples 122 stations (see: FMWT station map) each month from September to December, and those stations range from San Pablo Bay upstream to Stockton on the San Joaquin River, to near Hood on the Sacramento River, and into Cache Slough and through the Sacramento River Deep Water Ship Channel (SRDWSC).

FMWT catch from a subset of stations (100 'index stations', which have been used since the inception of the FMWT) is used to calculate abundance indices (Figure 1). FMWT equipment and methods have remained consistent, which allows the comparison of abundance index trends. Monthly and annual abundance indices are calculated using catch data from index stations grouped into 14 regions. Monthly abundance indices are calculated by averaging catch per tow for index stations in each region, multiplying each regional average by its respective weighting factor (i.e., a scalar based on water volume) for each region, and summing those products for all 14 regions (White and Baxter 2022). The midseason abundance indices reported here are the sum of the first three (September-November) of the four planned monthly abundance indices that will comprise the annual FMWT abundance indices.

In 2022, the monthly FMWT surveys were conducted Sept. 6-21, Oct. 3-17, and Nov. 2-15. During each of the three months, 122 fish trawls were conducted with an additional 32 zooplankton tows. Here we report catch from index and non-index stations, species distributions by region, and midseason abundance indices. A map of species distribution by station is also publicly available online: (FMWT Species Distribution Map). Additional information on prior year indices, methods, and catch data can be found on our webpage: Fall Midwater Trawl (ca.gov) .

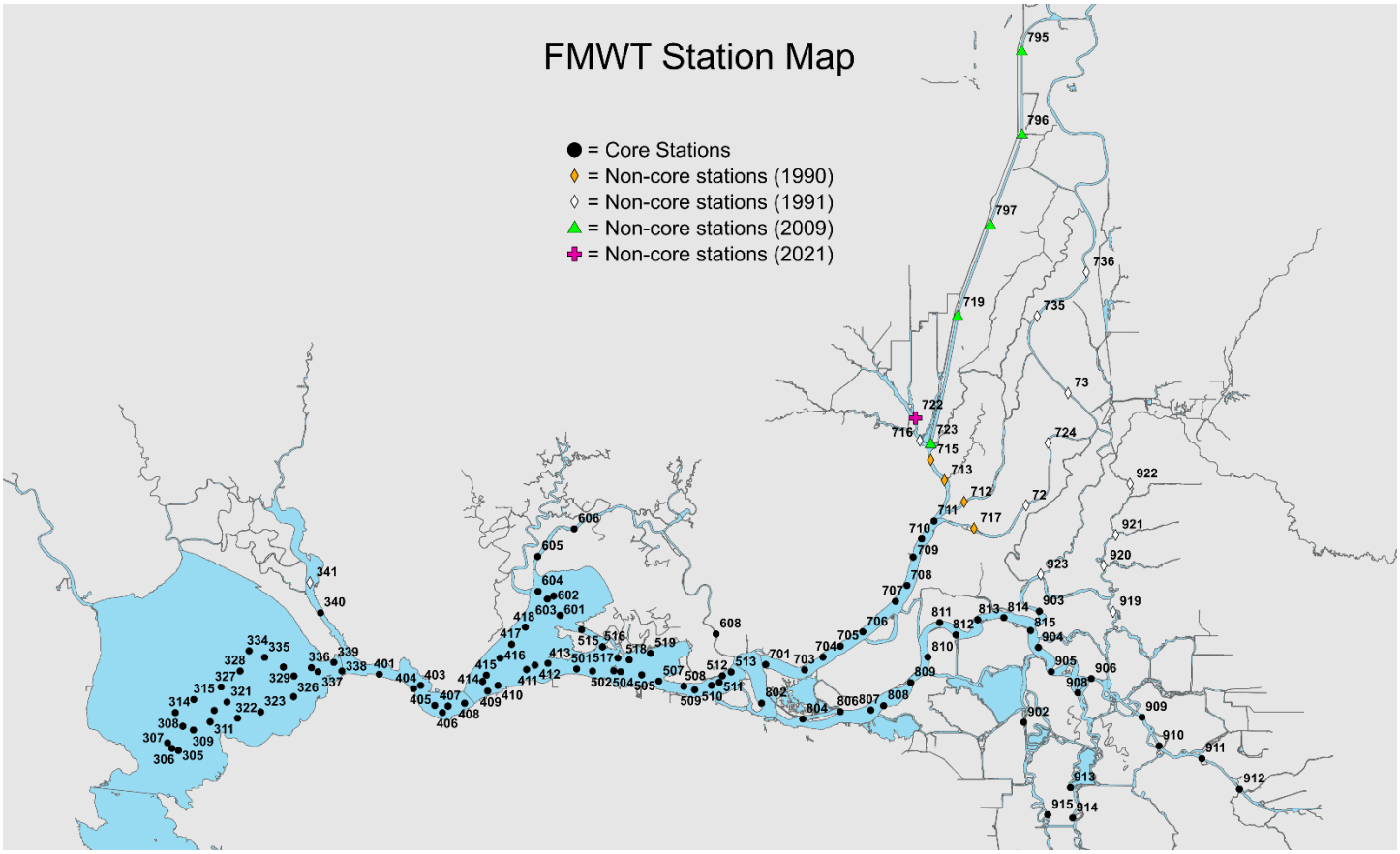

Figure 1. Map of CDFW Fall Midwater Trawl Survey monthly sampling sites among index and non-index stations in the upper San Francisco Estuary, California, USA.

Delta Smelt (*Hypomesus transpacificus*)

No Delta Smelt were collected at any stations from September through November. The 2022 September-November index (0) is tied with 2016 and 2018-2021 as the lowest index in FMWT history (Figure 2). An absence of Delta Smelt catch in the FMWT is consistent among other surveys in the estuary. For example, the Enhanced Delta Smelt Monitoring (EDSM) survey of the U.S. Fish and Wildlife Service (USFWS) caught 3 Delta Smelt among 11 sampling weeks (between 9/6 & 11/17) comprised of 1497 tows (U.S. Fish and Wildlife Service 2022).

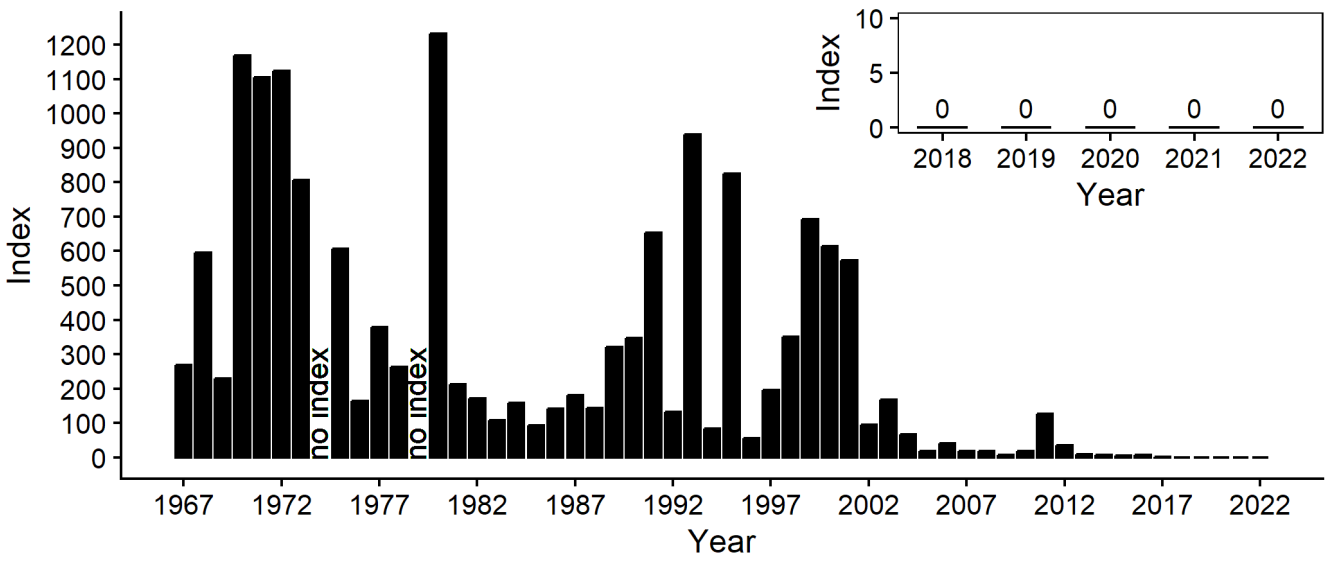

Figure 2. FMWT Delta Smelt September-November abundance indices, 1967-2022. Inset graph shows detailed view of previous 5 years.

Age-0 Striped Bass (*Morone saxatilis*)

The 2022 September-November index (55) is a 7% increase from the previous year (Figure 3). Nine age-0 Striped Bass were collected at index stations in September for an index of 10. In October, 26 were collected for an index of 34. In November, 10 were collected for an index of 11. 4 Striped Bass were collected at non-index stations during September, 0 were collected in October, and 1 was collected in November.

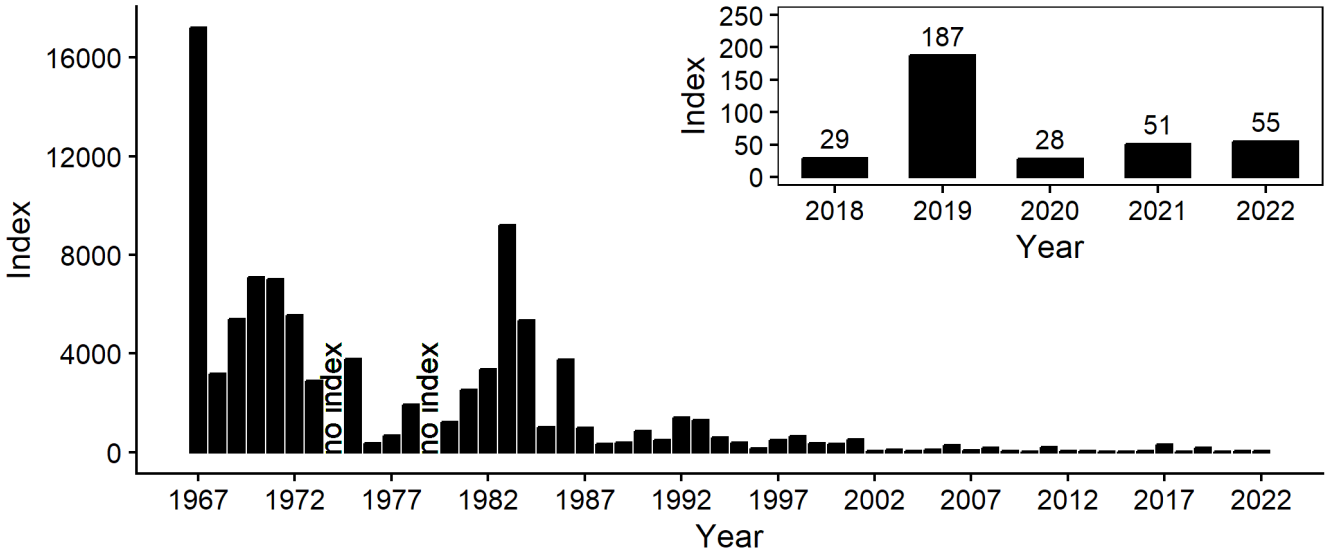

Figure 3. FMWT Age-0 Striped Bass September-November abundance indices, 1967-2022. Inset graph shows detailed view of previous 5 years.

Striped Bass catch was highest in Suisun Bay for all three-monthly surveys (Table 1).

Table 1. Age-0 Striped Bass catch among regions during the 2022 Fall Midwater Trawl survey sampling at index and non-index stations. *SRDWSC = Sacramento River Deepwater Shipping Channel.

Month	*Type*	*Region*	*Catch*
September	Index	Lower Sacramento River	2
September	Index	Suisun Bay	7
September	Non-Index	Mokelumne River	4
October	Index	Carquinez Strait	1
October	Index	Eastern Delta	8
October	Index	Lower Sacramento River	3
October	Index	Lower San Joaquin River	1
October	Index	Suisun Bay	13
November	Index	Lower Sacramento River	4
November	Index	Lower San Joaquin River	1
November	Index	Suisun Bay	5
November	Non-Index	SRDWSC	1
Total			**50**

Longfin Smelt (*Spirinchus thaleichthys*)

The 2022 September-November index (321) is a 31% increase from the previous year (Figure 4). Five Longfin Smelt were collected at index stations in September for an index of 7. In October, 99 were collected for an index of 261. In November, 29 were collected for an index of 53. No Longfin Smelt were collected at non-index stations during the three-monthly surveys.

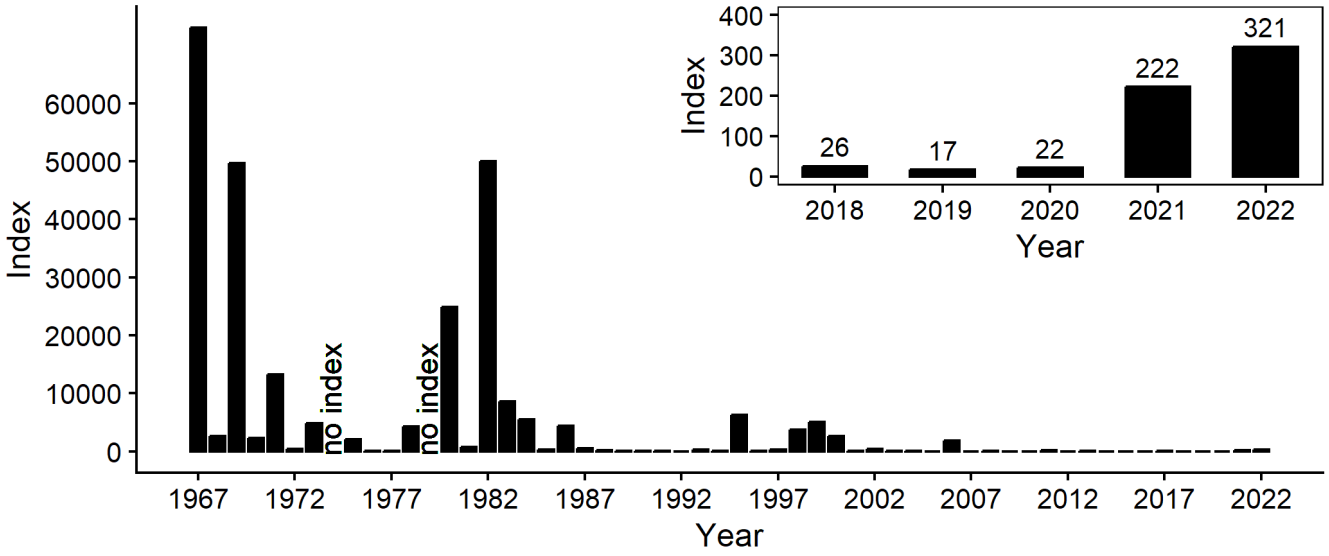

Figure 4. FMWT Longfin Smelt September-November abundance indices, 1967-2022. Inset graph shows detailed view of previous 5 years.

The majority (>93%) of Longfin Smelt caught thus far have been Age 0 (Table 3). Longfin Smelt catch was highest in September at Lower Sacramento River and Suisun Bay, highest in October at San Pablo Bay, and highest in November at Suisun Bay (Table 2). The Longfin Smelt index includes all ages. The FMWT only measures the first 50 individuals of any fish species caught during a tow. The adjusted length frequency adjusts for the fish not measured by calculating the ratio of total catch to the number of fish measured multiplied by the length frequency.

Table 2. Longfin Smelt catch among regions during the 2022 Fall Midwater Trawl survey sampling at index stations. No catch occurred at non-index stations.

Month	*Type*	*Region*	*Catch*
September	Index	Carquinez Strait	1
September	Index	Lower Sacramento River	2
September	Index	Suisun Bay	2
October	Index	San Pablo Bay	95
October	Index	Suisun Bay	4
November	Index	Lower Sacramento River	2
November	Index	Lower San Joaquin River	1
November	Index	San Pablo Bay	8
November	Index	Suisun Bay	18
Total			**133**

Table 3. Longfin Smelt catch per station, fork length (mm), frequency, and age class data during the 2022 Fall Midwater Trawl survey sampling at index stations September through November.

Month	*Station*	*Catch*	*Fork Length*	*Adjusted Length Frequency*	*Age Class*
September	408	1	54	1.00	Age 0
September	418	1	61	1.00	Age 0
September	503	1	101	1.00	Age 1+
September	704	1	50	1.00	Age 0
September	705	1	57	1.00	Age 0
October	307	86	44	1.72	Age 0
October	307	86	49	3.44	Age 0
October	307	86	50	1.72	Age 0
October	307	86	52	6.88	Age 0
October	307	86	53	15.48	Age 0
October	307	86	54	12.04	Age 0
October	307	86	55	3.44	Age 0
October	307	86	56	3.44	Age 0
October	307	86	57	10.32	Age 0
October	307	86	58	3.44	Age 0
October	307	86	59	1.72	Age 0
October	307	86	60	5.16	Age 0
October	307	86	61	1.72	Age 0
October	307	86	62	10.32	Age 0
October	307	86	66	1.72	Age 0
October	307	86	91	1.72	Age 1+
October	307	86	95	1.72	Age 1+
October	309	2	55	1.00	Age 0
October	309	2	56	1.00	Age 0
October	311	3	56	1.00	Age 0
October	311	3	57	1.00	Age 0
October	311	3	65	1.00	Age 0

Month	*Station*	*Catch*	*Fork Length*	*Adjusted Length Frequency*	*Age Class*
October	314	3	55	1.00	Age 0
October	314	3	57	1.00	Age 0
October	314	3	64	1.00	Age 0
October	325	1	53	1.00	Age 0
October	515	1	80	1.00	Age 1+
October	601	1	68	1.00	Age 0
October	603	1	83	1.00	Age 1+
October	606	1	61	1.00	Age 0
November	315	4	59	1.00	Age 0
November	315	4	67	1.00	Age 0
November	315	4	68	1.00	Age 0
November	315	4	72	1.00	Age 0
November	323	1	60	1.00	Age 0
November	328	1	60	1.00	Age 0
November	329	1	56	1.00	Age 0
November	336	1	62	1.00	Age 0
November	411	1	64	1.00	Age 0
November	415	1	55	1.00	Age 0
November	417	1	65	1.00	Age 0
November	418	1	100	1.00	Age 1+
November	503	1	66	1.00	Age 0
November	509	5	56	1.00	Age 0
November	509	5	59	2.00	Age 0
November	509	5	63	1.00	Age 0
November	509	5	67	1.00	Age 0
November	510	2	63	1.00	Age 0
November	510	2	64	1.00	Age 0
November	511	1	72	1.00	Age 0
November	512	1	95	1.00	Age 1+

Month	*Station*	*Catch*	*Fork Length*	*Adjusted Length Frequency*	*Age Class*
November	513	1	70	1.00	Age 0
November	515	2	57	1.00	Age 0
November	515	2	63	1.00	Age 0
November	603	1	63	1.00	Age 0
November	704	1	74	1.00	Age 0
November	706	1	63	1.00	Age 0
November	802	1	66	1.00	Age 0

Threadfin Shad (*Dorosoma petenense*)

The 2022 September-November index (119) is a 4% decrease from the previous year (Figure 5). Six Threadfin Shad were collected at index stations in September for an index of 7. In October, 33 were collected for an index of 39. In November, 64 were collected for an index of 73. 495 Threadfin Shad were collected at non-index stations during September, 336 were collected in October, and 36 were collected in November.

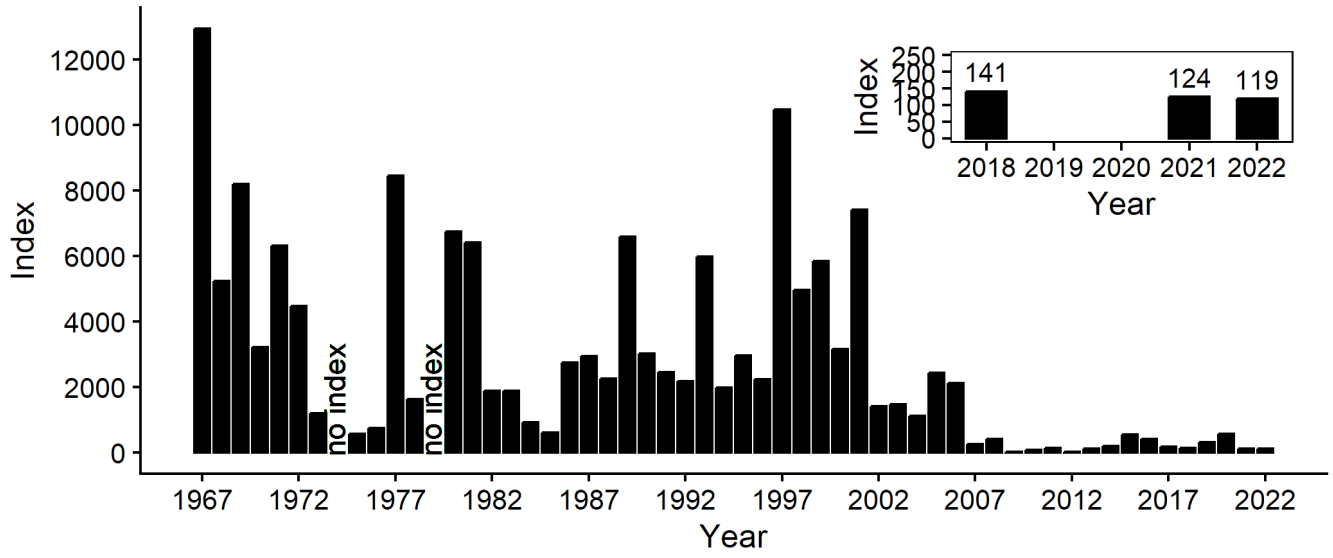

Figure 5. FMWT Threadfin Shad September-November abundance indices, 1967-2022. Inset graph shows detailed view of previous 5 years.

Threadfin Shad catch was highest in September and October at SRDWSC. Catch was highest in November at Lower San Joaquin River, SRDWSC (Table 4).

Table 4. Threadfin Shad catch among regions during the 2022 Fall Midwater Trawl survey sampling at index and non-index stations. *SRDWSC = Sacramento River Deepwater Shipping Channel.

Month	*Type*	*Region*	*Catch*
September	Index	Lower Sacramento River	2
September	Index	Lower San Joaquin River	4
September	Non-Index	SRDWSC	495
October	Index	Lower Sacramento River	24
October	Index	Lower San Joaquin River	4
October	Index	Suisun Bay	5
October	Non-Index	SRDWSC	336
November	Index	Lower Sacramento River	20
November	Index	Lower San Joaquin River	36
November	Index	San Pablo Bay	1
November	Index	Suisun Bay	7
November	Non-Index	SRDWSC	36
Total			**970**

American Shad (*Alosa sapidissima*)

The 2022 September-November index (463) is a 37% increase from the previous year (Figure 6). 56 American Shad were collected at index stations in September for an index of 110. In October, 120 were collected for an index of 155. In November, 113 were collected for an index of 198. 55 American Shad were collected at non-index stations during September, 33 were collected in October, and 35 were collected in November.

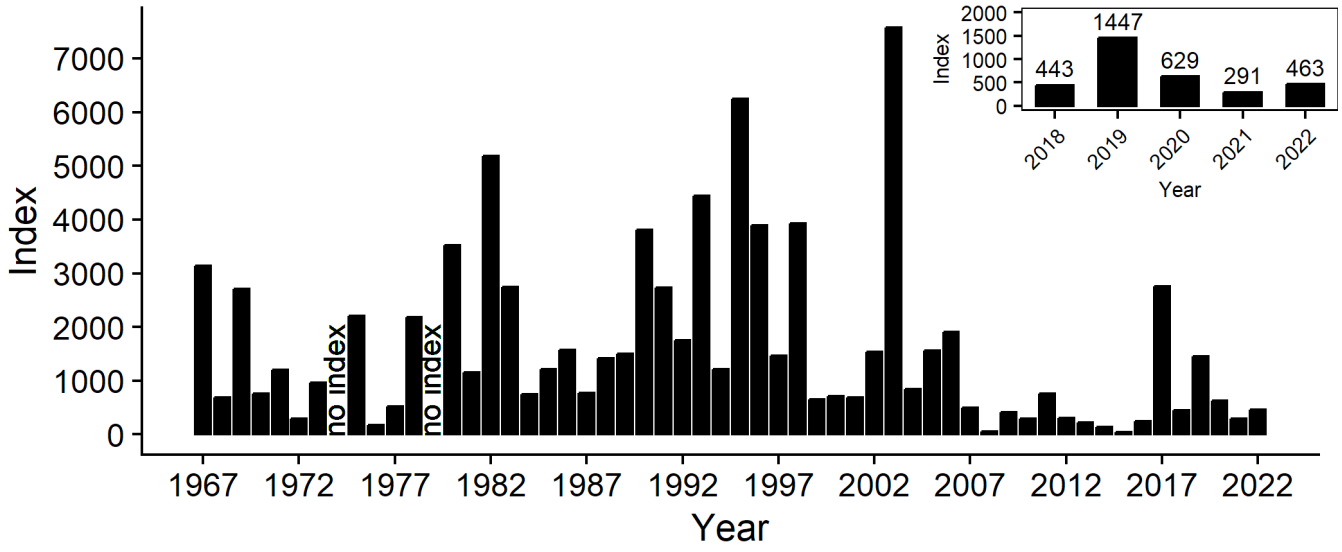

Figure 6. FMWT American Shad September-November abundance indices, 1967-2022. Inset graph shows detailed view of previous 5 years.

American Shad catch was highest in September and October at SRDWSC while highest in November at Suisun Bay (Table 5).

Table 5. American Shad catch among regions during the 2022 Fall Midwater Trawl survey sampling at index and non-index stations. *SRDWSC = Sacramento River Deepwater Shipping Channel.

Month	*Type*	*Region*	*Catch*
September	Index	Carquinez Strait	35
September	Index	Lower Sacramento River	9
September	Index	Lower San Joaquin River	1
September	Index	San Pablo Bay	4
September	Index	Suisun Bay	7
September	Non-Index	Mokelumne River	1
September	Non-Index	SRDWSC	45
September	Non-Index	Steamboat Slough	9
October	Index	Carquinez Strait	20
October	Index	Lower Sacramento River	25
October	Index	Lower San Joaquin River	4
October	Index	San Pablo Bay	2
October	Index	Suisun Bay	69
October	Non-Index	SRDWSC	33

Month	*Type*	*Region*	*Catch*
November	Index	Carquinez Strait	17
November	Index	Lower Sacramento River	10
November	Index	Lower San Joaquin River	3
November	Index	San Pablo Bay	32
November	Index	Suisun Bay	51
November	Non-Index	SRDWSC	35
Total			**412**

Splittail (*Pogonichthys macrolepidotus*)

No Splittail were collected at index or non-index stations in September through November for an index of 0. The 2022 September-November index (0) is a continuation of low to zero catch in recent years (Figure 7). The Splittail FMWT index tends to be low or zero except in relatively wet years, such as 2011, when age-0 fish tend to be abundant. FMWT operates in water >2 m deep, whereas Splittail, particularly age-0 fish, appear to primarily inhabit water <2 m deep (Sommer et al. 1997; Moyle et al. 2004).

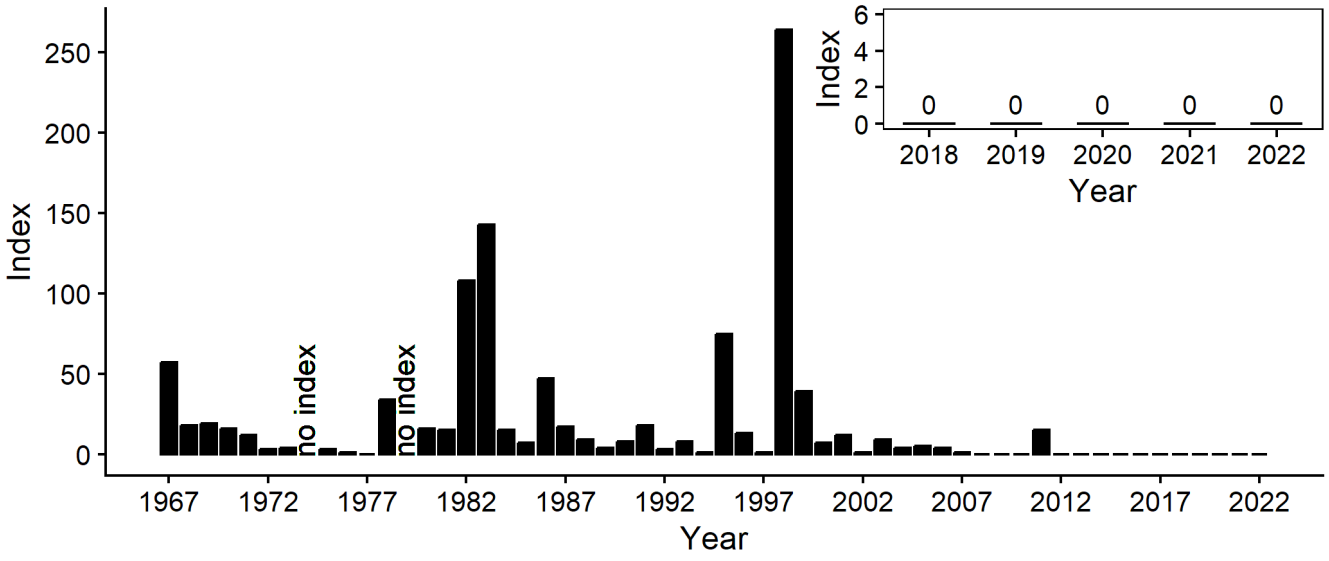

Figure 7. FMWT Splittail September-November abundance indices, 1967-2022. Inset graph shows detailed view of previous 5 years.

cc: Jim Hobbs, Steve Slater, Lauren Damon, Kathy Hieb

References

Moyle PB, Baxter RD, Sommer TR, Foin TC, Matern SA. 2004. Biology and Population Dynamics of Sacramento Splittail (*Pogonichthys macrolepidotus*) in the San Francisco Estuary: A Review. San Francisco Estuary and Watershed Science. 2(2):1–47. doi:10.15447/sfews.2004v2iss2art3.

Sommer TR, Baxter RD, Herbold B. 1997. Resilience of Splittail in the Sacramento–San Joaquin Estuary. Transactions of the American Fisheries Society. 126(6):961–976. doi:cm4253.

U.S. Fish and Wildlife Service. 2022. Enhanced Delta Smelt Monitoring. Lodi, CA Report No.: 2022 Phase 3 Sampling Preliminary Analysis. https://www.fws.gov/sites/default/files/documents/EDSM_report_223_2022_11_18.docx.

White JR, Baxter RD. 2022. Incorporating expanded sampling into an alternative abundance index for the Fall Midwater Trawl survey. California Fish and Wildlife Journal. 108(4):1–16. doi:10.51492/cfwj.108.21.