State of California
Department of Fish and Wildlife

Memorandum

Date: January 2, 2025

To: Erin Chappell
Regional Manager
Bay Delta Region

From: Taylor Rohlin
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Bay Delta Region

Subject: 2024 Fall Midwater Trawl Survey annual (September-December) fish abundance and distribution summary

The California Department of Fish and Wildlife (CDFW) has conducted the Fall Midwater Trawl Survey (FMWT) to index the fall abundance of pelagic fishes annually since 1967 (except 1974 and 1979). FMWT equipment and methods have remained consistent since the survey's inception, allowing the indices to be compared across time. These relative abundance indices are not intended to approximate population sizes; however, indices reflect general patterns in population change (Polansky et al. 2019).

Presently, the FMWT conducts 4 monthly surveys from September through December and calculates a monthly abundance index for each survey. The annual abundance index, for each pelagic species, is the sum of the monthly survey indices. 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. Sampling regions 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) near West Sacramento. During each monthly survey, one 12-minute oblique midwater trawl tow is conducted at each of 100 stations used for index calculation and at an additional 30 non-index stations that provide enhanced distribution information (Figure 1). All fish are identified and counted at each station.

The 2024 sampling season began September 3rd and was completed on December 20th. During all four months, all 130 fish tows were conducted. Here we report catch from index and non-index stations, species distributions by region, and annual abundance indices for seven pelagic fish species; Delta Smelt (native), Longfin Smelt (native), Striped Bass (introduced), American Shad (introduced), Threadfin Shad (introduced), Splittail (native), and Wakasagi (introduced). A map of species distribution by station is also publicly available online: FMWT Fish Distribution Map. Additional information on prior year indices, methods, and catch data can be found on our webpage: Fall Midwater Trawl.

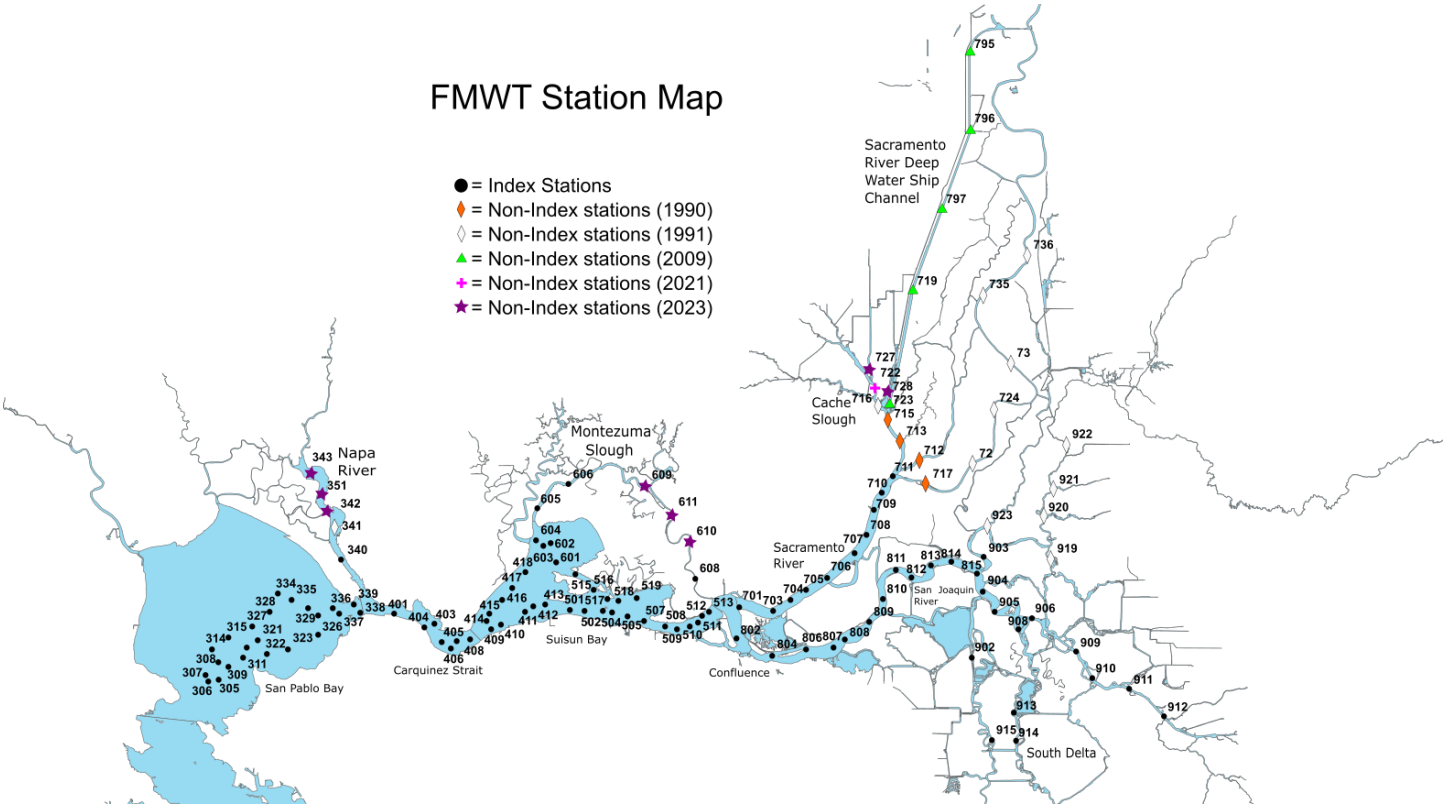

Figure 1. Map of CDFW Fall Midwater Trawl Survey monthly sampling sites among index and non-index stations in the upper San Francisco Estuary, California, USA.

Delta Smelt (*Hypomesus transpacificus*)

The 2024 abundance index was 0 and continues the trend of no catch in the FMWT since 2017 (Figure 2). No Delta Smelt were collected from any stations during our survey months of September-December. While FMWT did not catch any Delta Smelt, it does not mean there were no smelt present, but the numbers are very low and below the effective detection threshold by most sampling methods.

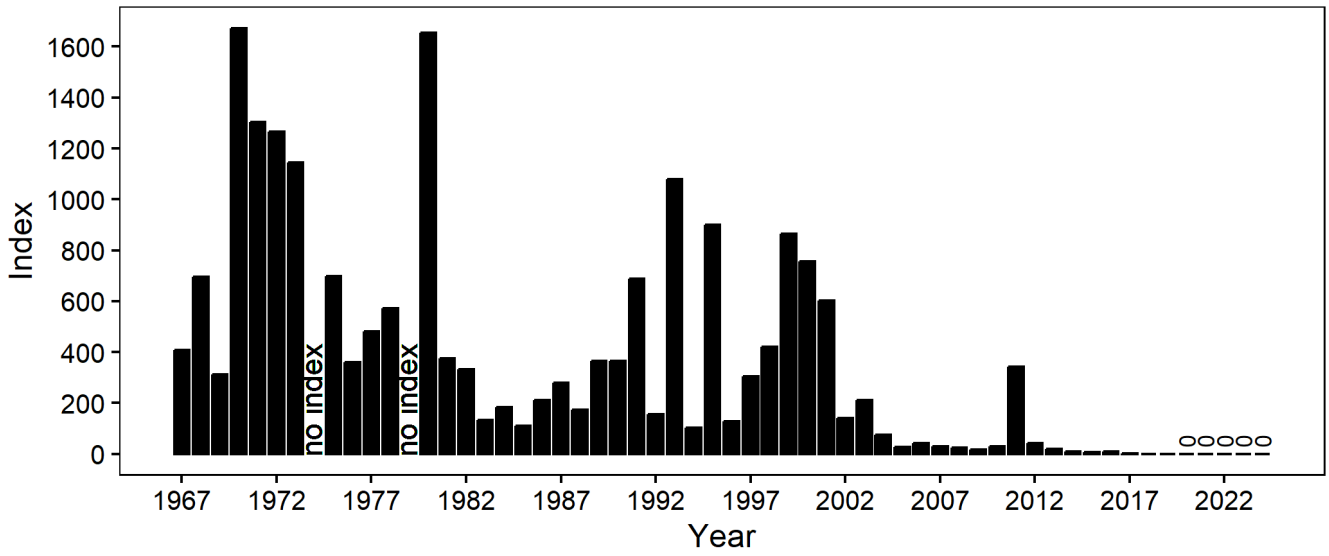

Figure 2. FMWT Delta Smelt annual abundance indices (all ages), 1967-2024. Index values for the past 5 years are shown in detail.

Longfin Smelt (*Spirinchus thaleichthys*)

The 2024 abundance index was 175, representing a 62% decrease from last year's index (Figure 3).

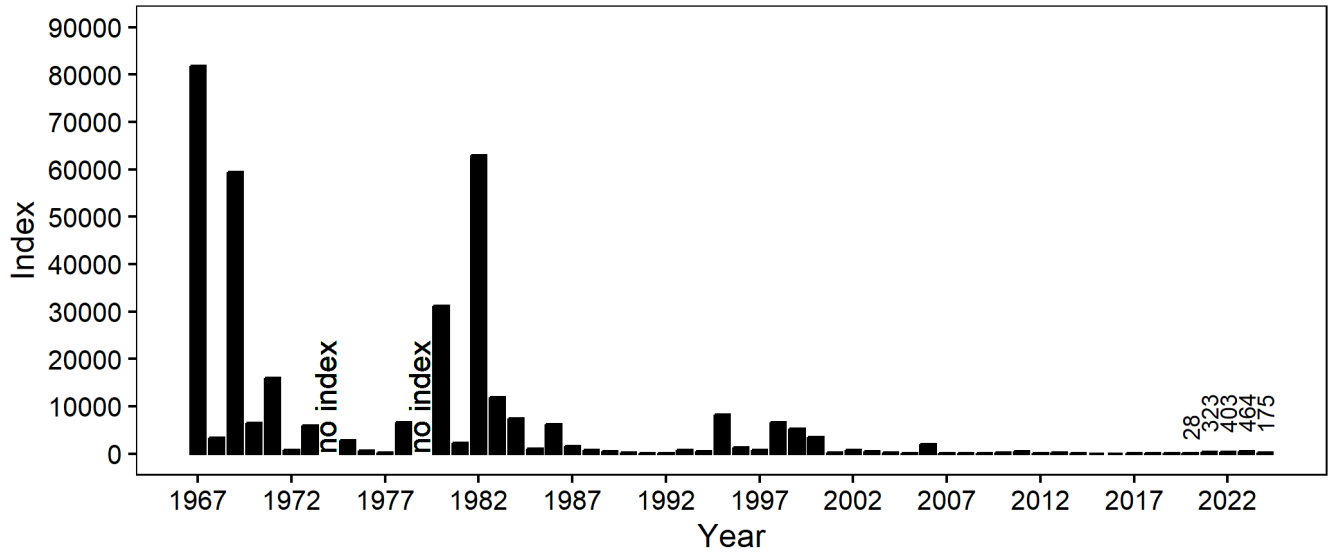

Figure 3. FMWT Longfin Smelt annual abundance indices, 1967-2024. Index values for the past 5 years are shown in detail.

A total of 100 Longfin Smelt were collected at index stations and 13 from non-index stations. Monthly catch was highest in December, with catch being highest in Suisun Bay among months (Table 1). Higher catch is usually expected in December as Longfin Smelt adults return to the estuary from the ocean to spawn as water temperatures drop in the late fall or winter. The majority (74%) of Longfin Smelt caught have been age-0 (Table 2). 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 1. Longfin Smelt catch among regions during the 2024 Fall Midwater Trawl survey sampling at index and non-index stations.

Month	*Type*	*Region*	*Catch*
September	Index	San Pablo Bay	16
September	Index	Suisun Bay	6
October	Index	San Pablo Bay	7
October	Index	Suisun Bay	3
November	Index	Carquinez Strait	1
November	Index	Lower Sacramento River	4
November	Index	Montezuma Slough	1
November	Index	San Pablo Bay	3
November	Index	Suisun Bay	15
November	Non-Index	Montezuma Slough	2
December	Index	Carquinez Strait	2

Month	*Type*	*Region*	*Catch*
December	Index	Lower Sacramento River	1
December	Index	Lower San Joaquin River	2
December	Index	Montezuma Slough	1
December	Index	Suisun Bay	38
December	Non-Index	Napa River	11
Total			**113**

Table 2. Longfin Smelt catch per station, fork length (mm), frequency, and age class data during the 2024 Fall Midwater Trawl survey sampling at all stations.

Month	*Station*	*Catch*	*Fork Length*	*Adjusted Length Frequency*	*Age Class*
September	305	1	61	1	age-0
September	314	1	54	1	age-0
September	327	11	40	1	age-0
September	327	11	41	1	age-0
September	327	11	50	3	age-0
September	327	11	53	2	age-0
September	327	11	58	1	age-0
September	327	11	60	2	age-0
September	327	11	90	1	age-1+
September	335	3	50	1	age-0
September	335	3	52	1	age-0
September	335	3	53	1	age-0
September	410	1	54	1	age-0
September	411	1	24	1	age-0
September	412	1	40	1	age-0
September	417	1	52	1	age-0
September	418	1	103	1	age-1+
September	505	1	44	1	age-0
October	314	2	63	1	age-0
October	314	2	66	1	age-0
October	325	3	54	2	age-0

Month	*Station*	*Catch*	*Fork Length*	*Adjusted Length Frequency*	*Age Class*
October	325	3	60	1	age-0
October	335	2	55	1	age-0
October	335	2	59	1	age-0
October	416	1	60	1	age-0
October	418	1	60	1	age-0
October	519	1	58	1	age-0
November	322	1	53	1	age-0
November	336	1	59	1	age-0
November	337	1	62	1	age-0
November	406	1	60	1	age-0
November	411	1	60	1	age-0
November	416	1	59	1	age-0
November	418	3	58	1	age-0
November	418	3	60	1	age-0
November	418	3	61	1	age-0
November	504	1	95	1	age-1+
November	508	1	57	1	age-0
November	509	1	67	1	age-0
November	511	1	69	1	age-0
November	512	3	60	1	age-0
November	512	3	62	1	age-0
November	512	3	86	1	age-1+
November	513	1	59	1	age-0
November	515	2	55	1	age-0
November	515	2	64	1	age-0
November	606	1	104	1	age-1+
November	609	2	66	1	age-0
November	609	2	105	1	age-1+
November	703	3	59	1	age-0
November	703	3	65	2	age-0

Month	*Station*	*Catch*	*Fork Length*	*Adjusted Length Frequency*	*Age Class*
November	704	1	58	1	age-0
December	341	1	110	1	age-1+
December	342	5	61	1	age-0
December	342	5	69	1	age-0
December	342	5	71	1	age-0
December	342	5	102	1	age-1+
December	342	5	106	1	age-1+
December	351	5	63	2	age-0
December	351	5	67	1	age-0
December	351	5	68	1	age-0
December	351	5	100	1	age-1+
December	404	1	60	1	age-0
December	405	1	60	1	age-0
December	410	5	95	1	age-1+
December	410	5	98	1	age-1+
December	410	5	100	1	age-1+
December	410	5	105	1	age-1+
December	410	5	113	1	age-1+
December	413	1	117	1	age-1+
December	414	1	110	1	age-1+
December	416	1	110	1	age-1+
December	417	1	73	1	age-0
December	418	3	60	1	age-0
December	418	3	66	1	age-0
December	418	3	70	1	age-0
December	502	2	65	1	age-0
December	502	2	74	1	age-0
December	503	3	63	1	age-0
December	503	3	112	1	age-1+
December	503	3	118	1	age-1+

Month	*Station*	*Catch*	*Fork Length*	*Adjusted Length Frequency*	*Age Class*
December	504	2	58	1	age-0
December	504	2	60	1	age-0
December	505	3	64	1	age-0
December	505	3	113	1	age-1+
December	505	3	117	1	age-1+
December	507	1	113	1	age-1+
December	508	2	64	1	age-0
December	508	2	75	1	age-0
December	511	3	61	1	age-0
December	511	3	68	1	age-0
December	511	3	112	1	age-1+
December	515	1	60	1	age-0
December	517	3	65	1	age-0
December	517	3	114	1	age-1+
December	517	3	118	1	age-1+
December	518	2	53	1	age-0
December	518	2	75	1	age-0
December	519	1	66	1	age-0
December	601	2	62	1	age-0
December	601	2	68	1	age-0
December	603	1	56	1	age-0
December	605	1	61	1	age-0
December	701	1	110	1	age-1+
December	808	1	113	1	age-1+
December	812	1	101	1	age-1+

Age-0 Striped Bass (*Morone saxatilis*)

The 2024 abundance index was 136, representing a 49% decrease from last year's index (Figure 4).

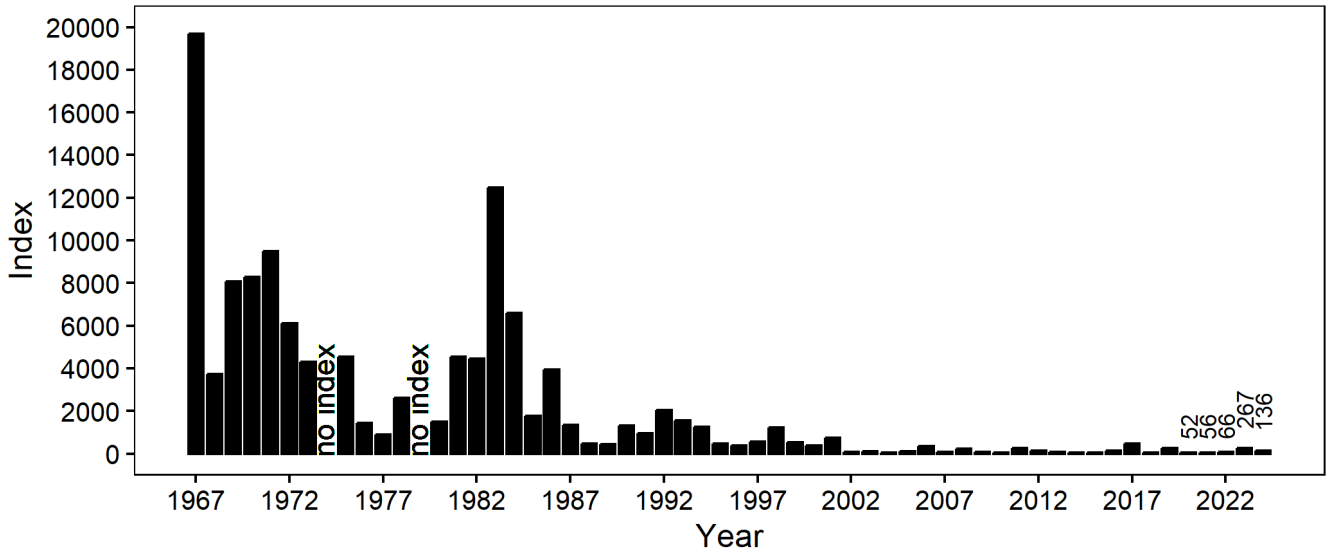

Figure 4. FMWT age-0 Striped Bass annual abundance indices, 1967-2024. Index values for the past 5 years are shown in detail.

Striped Bass were collected every month during September-December. A total of 120 age-0 Striped Bass were collected at index stations and 6 from non-index stations. Monthly catch was highest in November, with catch being highest in Suisun Bay among months (Table 3).

Table 3. Age-0 Striped Bass catch among regions during the 2024 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	1
September	Index	Lower Sacramento River	1
September	Index	Montezuma Slough	4
September	Index	Suisun Bay	30
September	Non-Index	Mokelumne River	1
September	Non-Index	Montezuma Slough	1
October	Index	Carquinez Strait	2
October	Index	Montezuma Slough	1
October	Index	San Pablo Bay	1
October	Index	Suisun Bay	10
October	Non-Index	Montezuma Slough	1
November	Index	Carquinez Strait	1
November	Index	Lower Sacramento River	2

Month	*Type*	*Region*	*Catch*
November	Index	Montezuma Slough	8
November	Index	South Delta	2
November	Index	Suisun Bay	25
November	Non-Index	Montezuma Slough	2
November	Non-Index	SRDWSC	1
December	Index	Carquinez Strait	4
December	Index	Lower Sacramento River	2
December	Index	Lower San Joaquin River	4
December	Index	Montezuma Slough	2
December	Index	San Pablo Bay	2
December	Index	Suisun Bay	18
Total			**126**

Threadfin Shad (*Dorosoma petenense*)

The 2024 abundance index was 577, representing a 12% increase from last year's index (Figure 5).

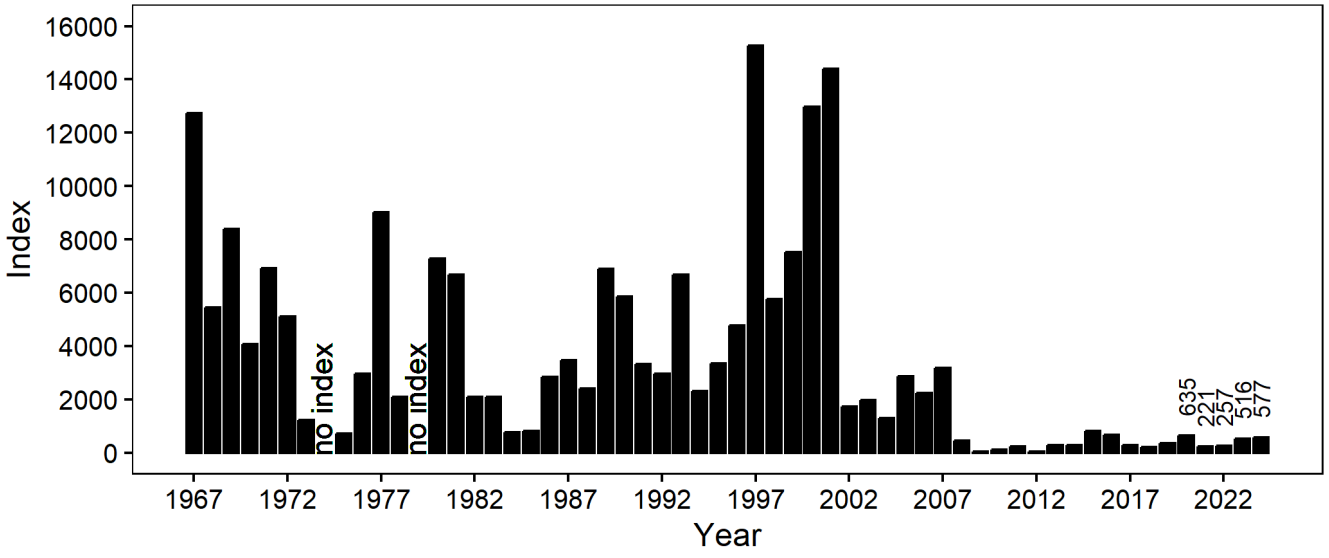

Figure 5. FMWT Threadfin Shad annual abundance indices, 1967-2024. Index values for the past 5 years are shown in detail.

A total of 429 Threadfin Shad were collected at index stations and 1534 from non-index stations. The greatest monthly catch was in September, with catch being highest in SRDWSC among months (Table 4).

Table 4. Threadfin Shad catch among regions during the 2024 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	7
September	Index	Montezuma Slough	2
September	Index	South Delta	11
September	Index	Suisun Bay	4
September	Non-Index	Mokelumne River	48
September	Non-Index	SRDWSC	649
October	Index	Lower Sacramento River	31
October	Index	Montezuma Slough	1
October	Non-Index	Montezuma Slough	11
October	Non-Index	SRDWSC	369
November	Index	Carquinez Strait	1
November	Index	Lower Sacramento River	114
November	Index	Montezuma Slough	16
November	Index	San Pablo Bay	2
November	Index	South Delta	1
November	Index	Suisun Bay	11
November	Non-Index	Montezuma Slough	8
November	Non-Index	SRDWSC	205
December	Index	Carquinez Strait	1
December	Index	Lower Sacramento River	2
December	Index	Lower San Joaquin River	39
December	Index	Montezuma Slough	6
December	Index	San Pablo Bay	4
December	Index	South Delta	167
December	Index	Suisun Bay	9
December	Non-Index	Cache Slough	2
December	Non-Index	Montezuma Slough	9
December	Non-Index	SRDWSC	233
Total			**1,963**

American Shad (*Alosa sapidissima*)

The 2024 abundance index was 1341, representing a 45% decrease from last year's index (Figure 6). Abundance indices have fluctuated substantially during the period 2020-2024, ranging from a low of 398 to a high of 2421.

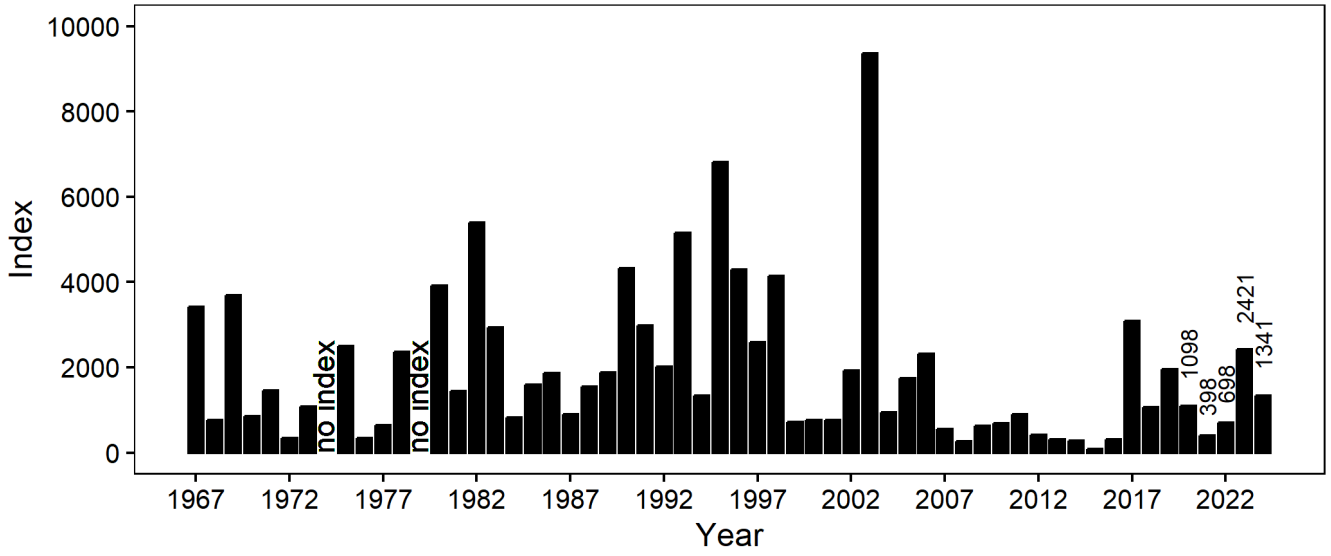

Figure 6. FMWT American Shad annual abundance indices, 1967-2024. Index values for the past 5 years are shown in detail.

A total of 852 American Shad were collected at index stations and 163 from non-index stations. American Shad were collected mostly from Suisun Bay with the greatest monthly catch in December (Table 5).

Table 5. American Shad catch among regions during the 2024 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	4
September	Index	Lower Sacramento River	2
September	Index	Montezuma Slough	8
September	Index	San Pablo Bay	10
September	Index	South Delta	4
September	Index	Suisun Bay	145
September	Non-Index	Cache Slough	1
September	Non-Index	Mokelumne River	36
September	Non-Index	Napa River	1
September	Non-Index	SRDWSC	23
October	Index	Carquinez Strait	21
October	Index	Lower Sacramento River	9
October	Index	Montezuma Slough	5

Month	*Type*	*Region*	*Catch*
October	Index	San Pablo Bay	17
October	Index	Suisun Bay	125
October	Non-Index	Mokelumne River	1
October	Non-Index	Montezuma Slough	10
October	Non-Index	Napa River	11
October	Non-Index	SRDWSC	33
November	Index	Carquinez Strait	1
November	Index	Lower Sacramento River	46
November	Index	Lower San Joaquin River	4
November	Index	Montezuma Slough	25
November	Index	San Pablo Bay	37
November	Index	Suisun Bay	115
November	Non-Index	Montezuma Slough	3
November	Non-Index	SRDWSC	6
December	Index	Carquinez Strait	30
December	Index	Lower Sacramento River	3
December	Index	Lower San Joaquin River	32
December	Index	Montezuma Slough	18
December	Index	San Pablo Bay	83
December	Index	South Delta	14
December	Index	Suisun Bay	94
December	Non-Index	Cache Slough	2
December	Non-Index	Montezuma Slough	2
December	Non-Index	Napa River	33
December	Non-Index	SRDWSC	1
Total			**1,015**

Splittail (*Pogonichthys macrolepidotus*)

The 2024 Splittail abundance index was 0, with 0 fish caught (Figure 7). During most years, FMWT data probably does not accurately reflect trends in age-0 Splittail abundance, as the index is 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). However, FMWT does effectively detect strong year classes, such as the one in 1998 and the most recent one in 2011.

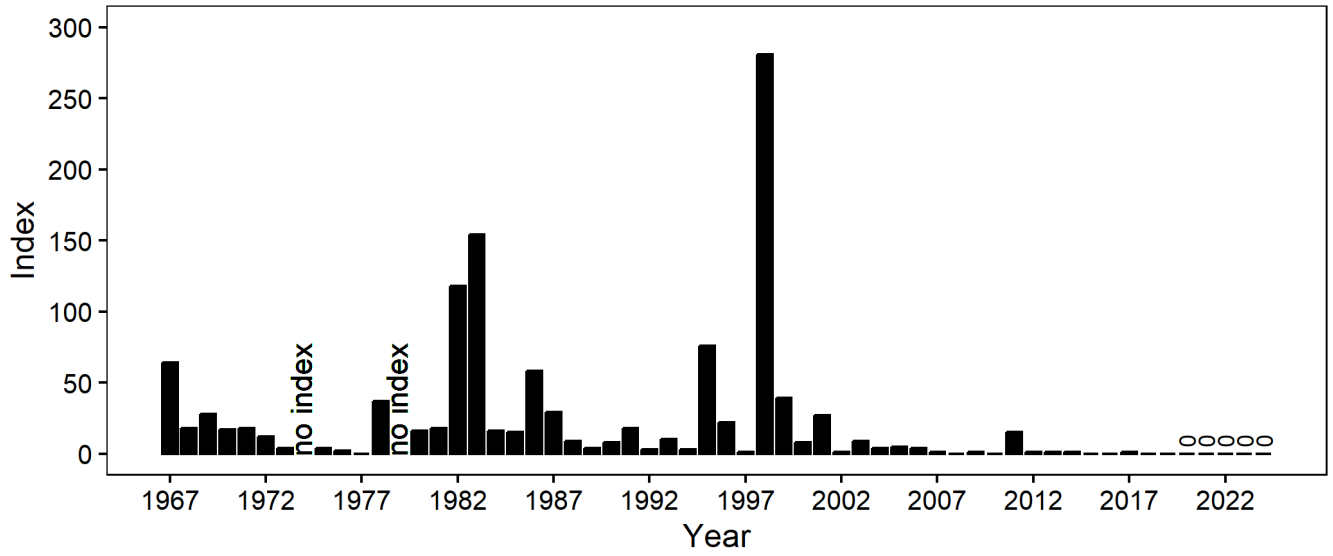

Figure 7. FMWT Splittail annual abundance indices, 1967-2024. Index values for the past 5 years are shown in detail.

Wakasagi (*Hypomesus nipponensis*)

Wakasagi were first introduced to northern California reservoirs by California Fish & Game in 1959 to provide forage for rainbow trout and other salmonids. It is believed they were present in the SF Estuary as early as 1974, but they were not detected in the Estuary until 1990 by other surveys (Moyle 2002). The first detection of Wakasagi by the FMWT survey was in 1995. The 2024 abundance index was 0 because Wakasagi were only caught at non-index stations (Figure 8).

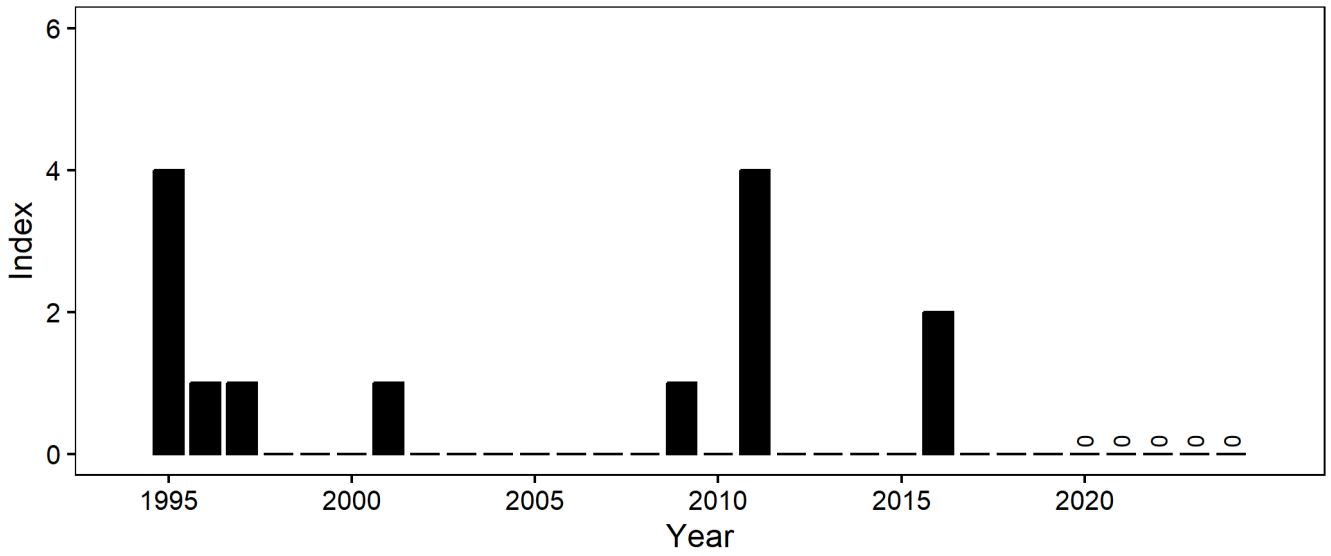

Figure 8. FMWT Wakasagi annual abundance indices, 1995-2024. Index values for the past 5 years are shown in detail.

A total of 0 Wakasagi were collected at index stations and 27 from non-index stations. Monthly catch was highest in October and December, with catch being highest in SRDWSC among months (Table 6). Little is known about the life history of the California population of Wakasagi compared to the Japanese populations. Wakasagi in the SF Estuary have yet to experience extensive and prolific spatial expansion, despite broad temperature (2-29°C) and salinity (0-29 ppt) tolerances (Moyle 2002).

Table 6. Wakasagi catch among regions during the 2024 Fall Midwater Trawl survey sampling at index and non-index stations. SRDWSC = Sacramento River Deepwater Shipping Channel.

Month	*Type*	*Region*	*Catch*
September	Non-Index	SRDWSC	13
October	Non-Index	SRDWSC	8
November	Non-Index	SRDWSC	2
December	Non-Index	Cache Slough	1
December	Non-Index	SRDWSC	3
Total			**27**

References

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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.