State of California
Department of Fish and Wildlife

Memorandum

Date: December 31, 2020

To: Gregg Erickson
Regional Manager
Bay Delta Region

From: James White
Environmental Scientist
Bay Delta Region

Subject: Fall Midwater Trawl 2020 Annual Fish Abundance 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, we expect that our 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. During each monthly survey, one 12-minute oblique midwater trawl tow is conducted at each of 100 index stations used for index calculation and at an additional 22 non-index stations that provide enhanced distribution information (Figure 1). All fish are identified and counted at each station.

The 2020 sampling season began September 8 and was completed on December 15. Field crews successfully conducted tows at most stations during the four survey months. In September, October, November, and December, a non-index station in Cache Slough (station 721) was not sampled due to dense aquatic vegetation.

The following summary for the 2020 FMWT surveys contains the annual abundance index, monthly collections, and monthly distribution information for six pelagic fish species; Delta Smelt (native), Striped Bass (introduced), Longfin Smelt (native), American Shad (introduced), Threadfin Shad (introduced), and Splittail (native). Most native and introduced pelagic species indexed in 2020 had deceasing indices or a

relative index value of zero. Only Threadfin Shad had increasing relative index values compared to last year.

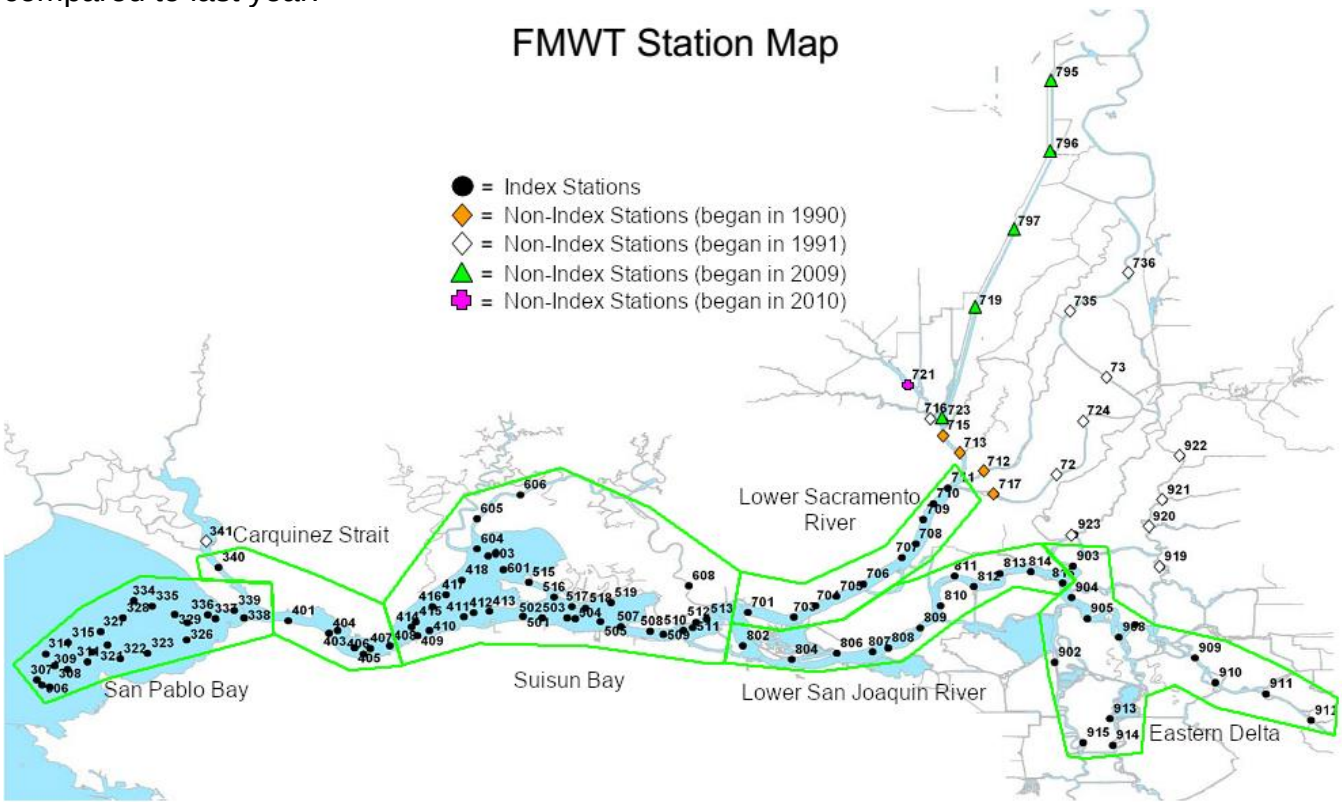

Figure 1. Map of CDFW Fall Midwater Trawl Survey monthly sampling sites among index and non-index stations in the upper San Francisco Estuary, California, USA. Polygons represent regional groupings of index stations.

Delta Smelt *(Hypomesus transpacificus)*

The 2020 abundance index was zero and was tied with 2018 and 2019 for the lowest in FMWT history (Figure 2). This is a continuation of a pattern of low indices, 7, 8, and 2, that occurred in years 2015, 2016, and 2017, respectively. No Delta Smelt were collected from any stations during our survey months of September- December 2020. While this survey 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. The Enhanced Delta Smelt Monitoring (EDSM) survey of the U.S. Fish and Wildlife Service (USFWS) caught two Delta Smelt among 14 sample weeks (n=1727 tows) conducted between September 8- December 11, 2020 (data available at the USFWS Delta Juvenile Fish Monitoring Program website). Likewise, the Fish Culture and Conservation Laboratory run by UC Davis aims to capture wild broodstock every year to maintain their hatchery reared Delta Smelt population. This year, they have conducted 151 tows since November 17 and have caught zero Delta Smelt.

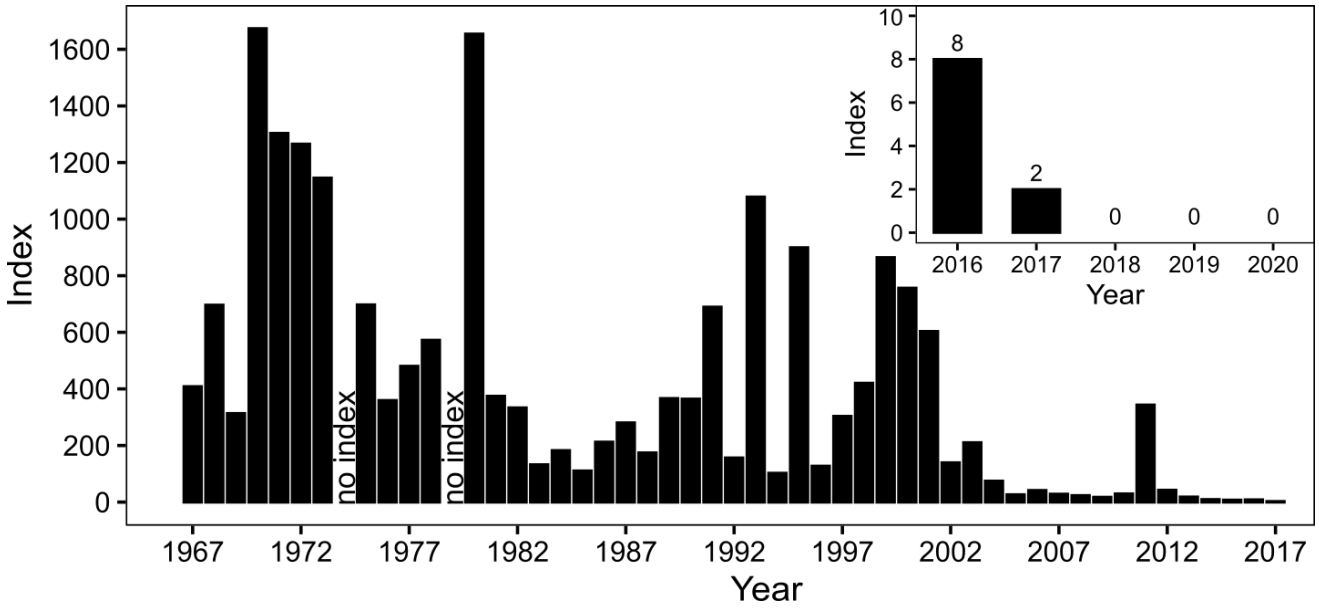

Figure 2. Fall Midwater Trawl Delta Smelt annual abundance indices (all ages), 1967-2020.

Age-0 Striped Bass (*Morone saxatilis*)

The 2020 abundance index was 52, representing an 80% decrease from last year's index (Figure 3).

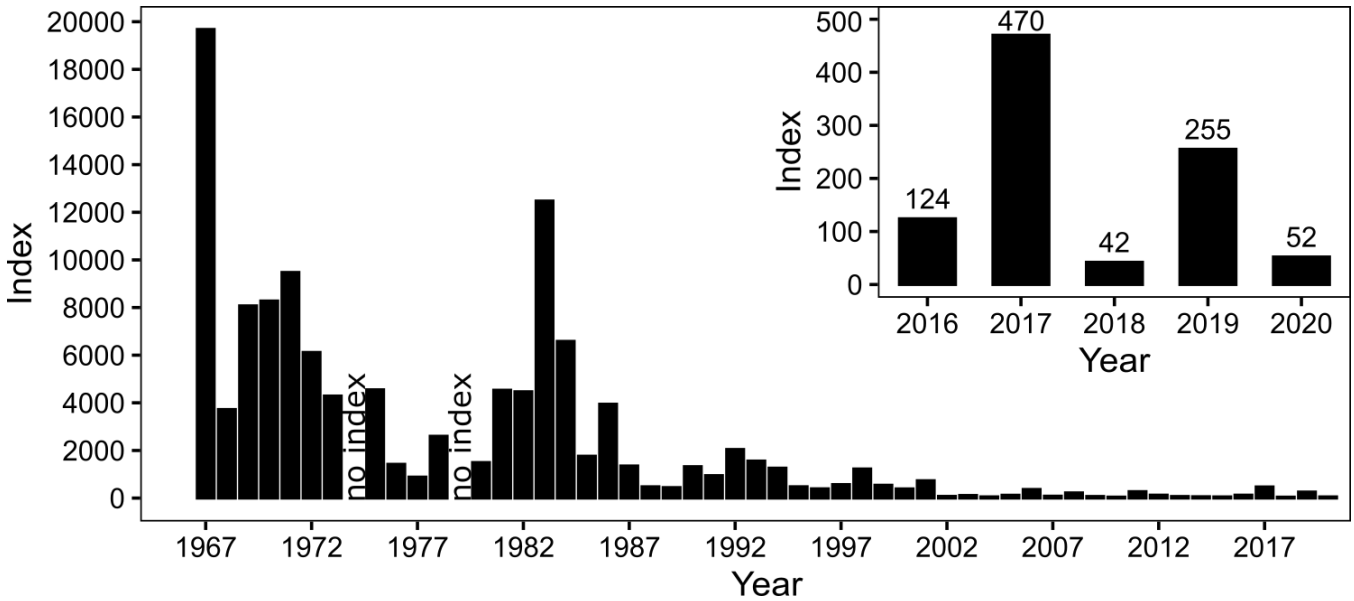

Figure 3. Fall Midwater Trawl Age-0 Striped Bass annual abundance indices, 1967-2020.

Striped Bass were collected every month during September-December. Forty-five age-0 Striped Bass were collected at index stations and 4 from non-index stations. Monthly catch was highest in December, with catch being highest in Suisun Bay and the lower Sacramento River among months (Table 1).

Table 1. Age-0 Striped Bass (*Morone saxatilis*) catch among regions during the 2020 Fall Midwater Trawl survey monthly sampling at index and non-index stations.

*SRDWSC = Sacramento River Deepwater Shipping Channel.

Month	Type	Region	Catch
September	Index	San Pablo Bay	0
		Suisun Bay	8
		Lower Sacramento River	1
		Lower San Joaquin River	1
		Eastern Delta	0
	Sub-total		***10***
	Non-Index	*SRDWSC	1
	Sub-total		***1***
October	Index	San Pablo Bay	0
		Carquinez Strait	0
		Suisun Bay	3
		Lower Sacramento River	0
		Lower San Joaquin River	0
	Sub-total		***3***
	Non-Index	*SRDWSC	1
	Sub-total		***1***
November	Index	San Pablo Bay	1
		Carquinez Strait	0
		Suisun Bay	3
		Lower Sacramento River	9
		Lower San Joaquin River	0
	Sub-total		***13***
	Non-Index	*SRDWSC	1
	Sub-total		***1***
December	Index	San Pablo Bay	1
		Carquinez Strait	0
		Suisun Bay	5
		Lower Sacramento River	7
		Lower San Joaquin River	0
		Eastern Delta	6
	Sub-total		***19***
	Non-Index	*SRDWSC	1
	Sub-total		***1***
Grand Total			***49***

Longfin Smelt (*Spirinchus thaleichthys*)

The 2020 abundance index was 28, representing a 36% reduction from the previous year (Figure 4). This is the third year of decline following the recent high index of 141 that occurred in 2017.

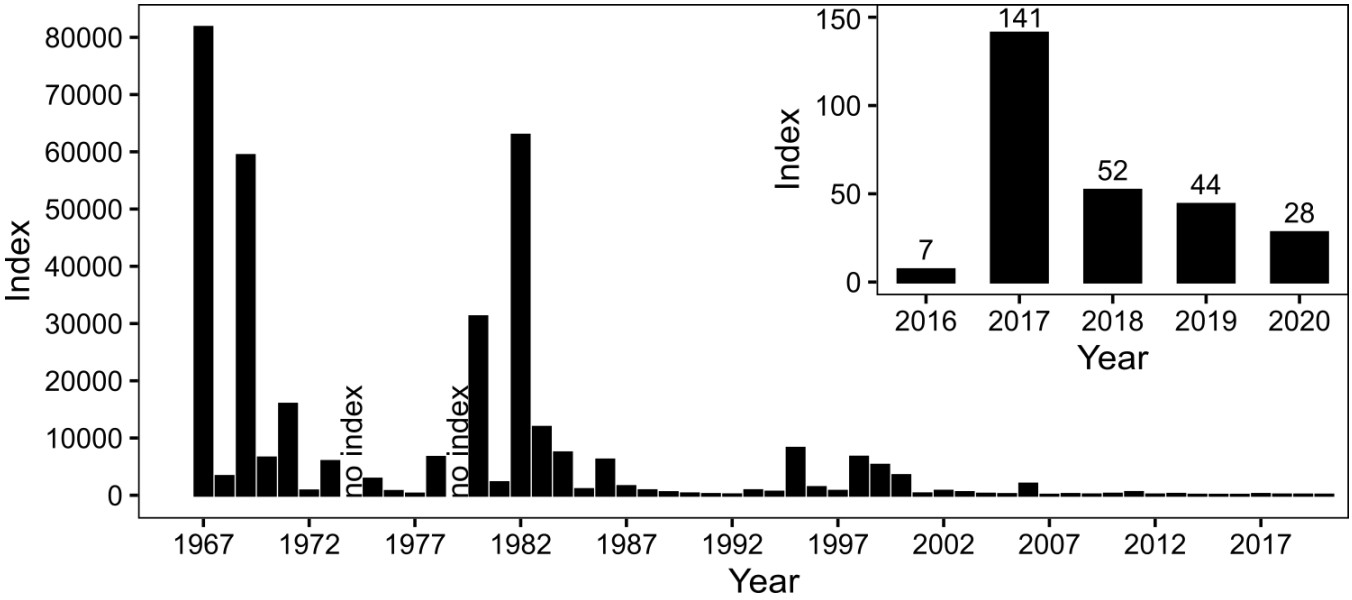

Figure 4. Fall Midwater Trawl Longfin Smelt annual abundance indices, 1967-2020.

A total of 11 Longfin Smelt were collected at index stations and zero from non-index stations. Low numbers of Longfin Smelt were collected in San Pablo Bay and Suisun Bay during November-December (Table 2). 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.

Table 2. Longfin Smelt (*Spirinchus thaleichthys*) catch among regions during the 2020 Fall Midwater Trawl survey monthly sampling at index and non-index stations.

Month	Type	Region	Catch
September	Index	Carquinez Strait	0
		Suisun Bay	0
	Sub-total		***0***
October	Index	Carquinez Strait	0
		Suisun Bay	0
	Sub-total		***0***
November	Index	San Pablo Bay	4
		Carquinez Strait	0
		Suisun Bay	3
	Sub-total		***7***

December	Index	San Pablo Bay	1
		Carquinez Strait	0
		Suisun Bay	2
		Lower Sacramento River	1
		Lower San Joaquin River	0
	Sub-total		***4***
	Non-Index	Napa River	0
	Sub-total		***0***
Grand Total			***11***

Threadfin Shad (*Dorosoma petenense*)

The 2020 abundance index was 635, representing an 85% increase from the previous year (Figure 5). During the period 2015-2018, indices declined each year (806, 660, 291, and 198, respectively) but increased slightly in the past two years.

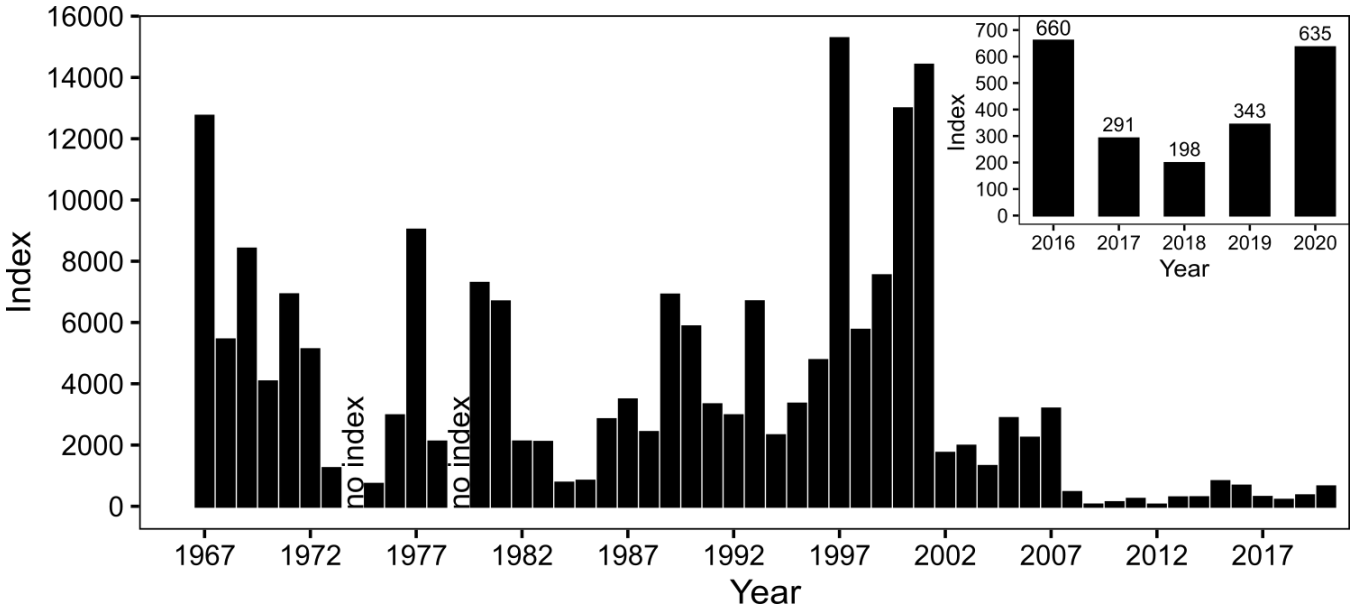

Figure 5. Fall Midwater Trawl Threadfin Shad annual abundance indices, 1967-2020.

A total of 534 Threadfin Shad were collected at index stations and 1157 from non-index stations (Table 3). The majority of index catch occurred in the lower Sacramento River and non-index catch occurred in the SRDWSC.

Table 3. Threadfin Shad (*Dorosoma petenense*) catch among regions during the 2020 Fall Midwater Trawl survey monthly sampling at index and non-index stations.

*SRDWSC = Sacramento River Deepwater Shipping Channel.

Month	Type	Region	Catch
September	Index	San Pablo Bay	0
		Suisun Bay	0
		Lower Sacramento River	33
		Lower San Joaquin River	3
		Eastern Delta	0
	Sub-total		***36***
	Non-Index	*SRDWSC	231
	Sub-total		***231***
October	Index	Suisun Bay	5
		Lower Sacramento River	1
	Sub-total		***6***
	Non-Index	*SRDWSC	274
	Sub-total		***274***
November	Index	Suisun Bay	8
		Lower Sacramento River	424
		Lower San Joaquin River	4
	Sub-total		***436***
	Non-Index	*SRDWSC	605
	Sub-total		***605***
December	Index	San Pablo Bay	1
		Carquinez Strait	0
		Suisun Bay	31
		Lower Sacramento River	8
		Lower San Joaquin River	16
		Eastern Delta	0
	Sub-total		***56***
	Non-Index	*SRDWSC	47
	Sub-total		***47***
Grand Total			***1691***

American Shad (*Alosa sapidissima*)

The 2020 abundance index was 1098, representing a 44% decrease from the previous year (Figure 6). Abundance indices have fluctuated substantially during the period 2016-2020, ranging from a low of 313 to a high of 3,086. American Shad were collected mostly from Suisun Bay and the lower Sacramento River from September-November. In December, American Shad were distributed more broadly throughout the Estuary. Catch at index stations was 860 with additional 143 from non-index stations (Table 4).

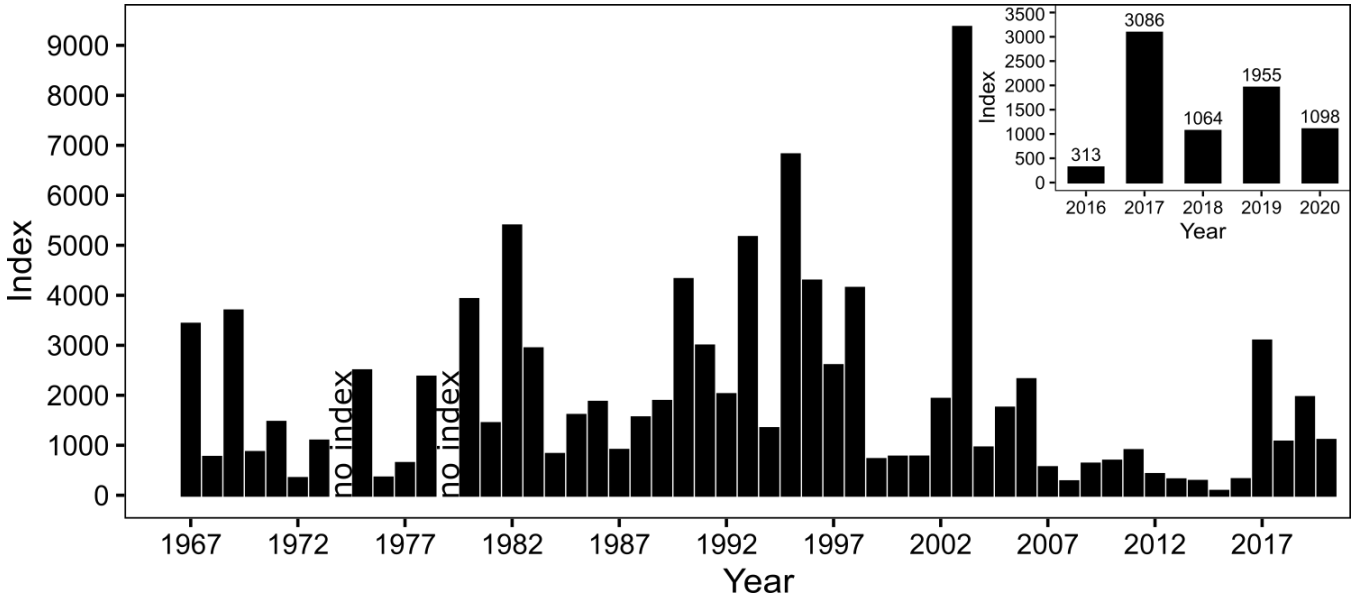

Figure 6. Fall Midwater Trawl American Shad annual abundance indices, 1967-2020.

Table 4. American Shad (*Alosa sapidissima*) catch among regions during the 2020 Fall Midwater Trawl survey monthly sampling at index and non-index stations.

*SRDWSC = Sacramento River Deepwater Shipping Channel.

Month	Type	Region	Catch
September	Index	San Pablo Bay	3
		Carquinez Strait	8
		Suisun Bay	62
		Lower Sacramento River	86
		Lower San Joaquin River	4
	Sub-total		***163***
	Non-Index	*SRDWSC	82
		Napa River	1
		Sacramento River	1
	Sub-total		***84***
October	Index	San Pablo Bay	0
		Carquinez Strait	0

		Suisun Bay	97
		Lower Sacramento River	15
		Lower San Joaquin River	1
	Sub-total		***113***
	Non-Index	*SRDWSC	3
	Sub-total		***3***
November	Index	San Pablo Bay	0
		Carquinez Strait	8
		Suisun Bay	125
		Lower Sacramento River	138
		Lower San Joaquin River	3
	Sub-total		***274***
	Non-Index	*SRDWSC	42
	Sub-total		***42***
December	Index	San Pablo Bay	21
		Carquinez Strait	23
		Suisun Bay	209
		Lower Sacramento River	31
		Lower San Joaquin River	22
		Eastern Delta	4
	Sub-total		***310***
	Non-Index	*SRDWSC	4
		Napa River	10
	Sub-total		***14***
Grand Total			***1003***

Splittail (*Pogonichthys macrolepidotus*)

The 2020 abundance index was zero and shows a continuing trend of very little to no catch of Splittail in FMWT (Figure 7). No splittail were caught at any index or non-index stations the whole survey. 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). Thus, during most years, FMWT data probably does not accurately reflect trends in age-0 Splittail abundance. However, FMWT does effectively detect strong year classes, such as the one in 1998 and the most recent one in 2011.

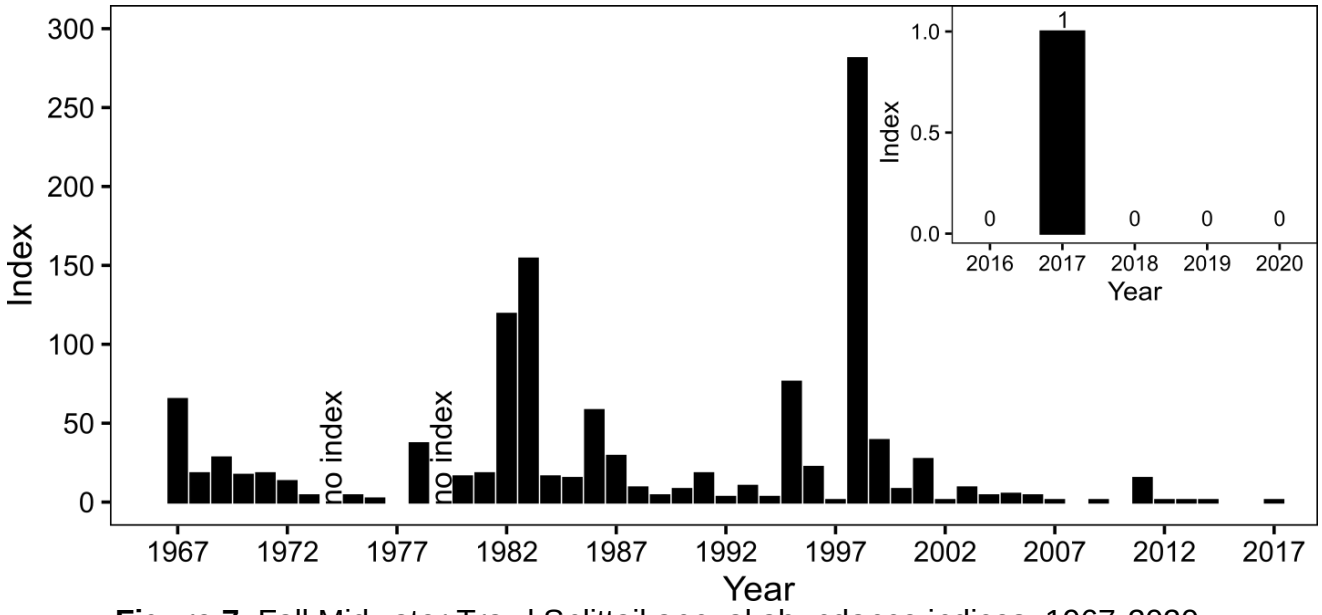

Figure 7. Fall Midwater Trawl Splittail annual abundance indices, 1967-2020.

References

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Polansky L, Mitchell L, Newman KB. 2019. Using Multistage Design-Based Methods to Construct Abundance Indices and Uncertainty Measures for Delta Smelt. Transactions of the American Fisheries Society. 148(4):710–724. doi:10/gf6d7j.

Sommer T, Baxter R, Herbold B. 1997. Resilience of splittail in the Sacramento–San Joaquin estuary. Transactions of the American Fisheries Society. 126(6):961–976. doi:10.1577/1548-8659(1997)126<0961:ROSITS>2.3.CO;2.

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