

## Memorandum

**Date:** January 13, 2020

**To:** Gregg Erickson  
Regional Manager  
Bay Delta Region

**From:** James White  
Environmental Scientist  
Bay Delta Region

**Subject:** **Fall Midwater Trawl 2019 Annual Fish Abundance Summary**

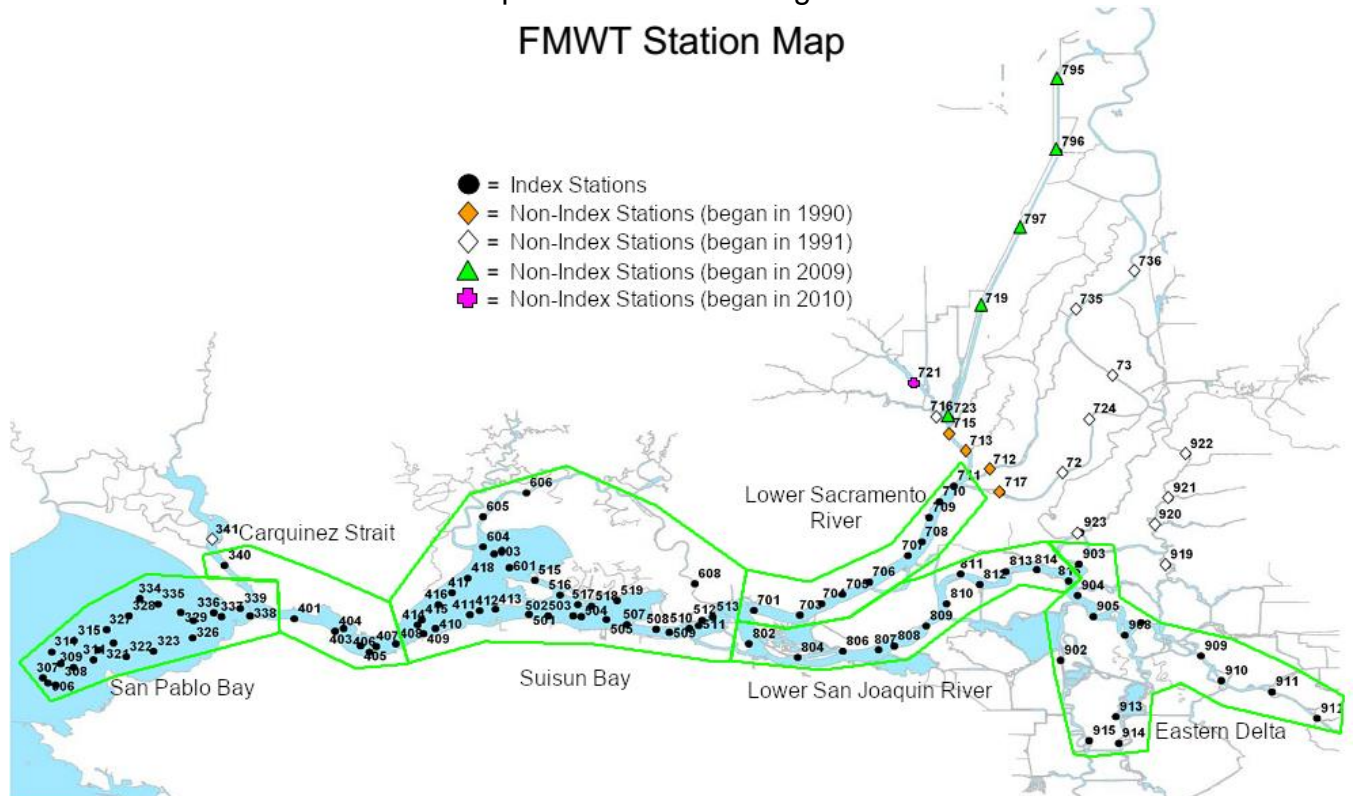
The California Department of Fish and Wildlife (CDFW) has conducted the Fall Midwater Trawl Survey (FMWT) to index the fall abundance of pelagic fishes annually since 1967 (except 1974 and 1979). FMWT equipment and methods have remained consistent since the survey's inception, allowing the indices to 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).

The 2019 sampling season was completed on December 18. Field crews successfully conducted tows at most stations during the four survey months. In September, an index station (station 915) in the southern Delta was skipped due to debris consistently snagging the net. In October, November, and December, a non-index station in Cache Slough (station 721) was not sampled due to dense aquatic vegetation. Also, in November, a non-index station in the Mokelumne River (station 921) was skipped due to debris snagging the net.

The following summary for the 2019 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),

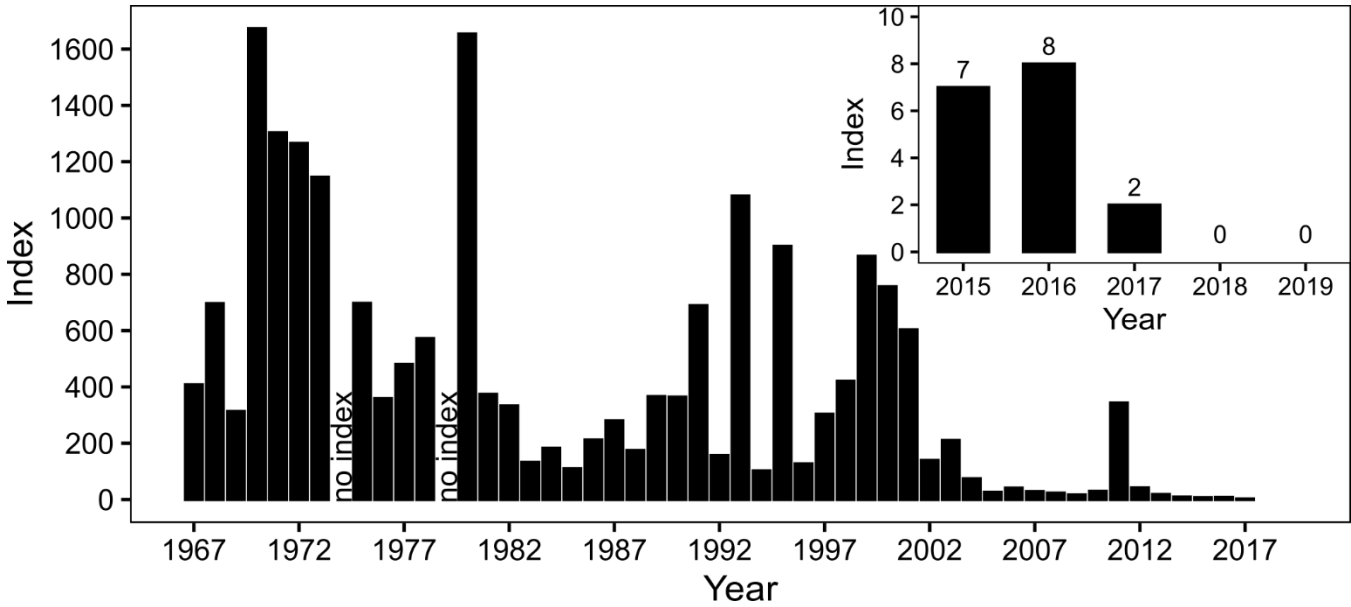
American Shad (introduced), Threadfin Shad (introduced), and Splittail (native). All native pelagic species indexed in 2019 had decreasing indices or a relative index value of zero. All introduced non-native species had increasing relative index values.



**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*)**

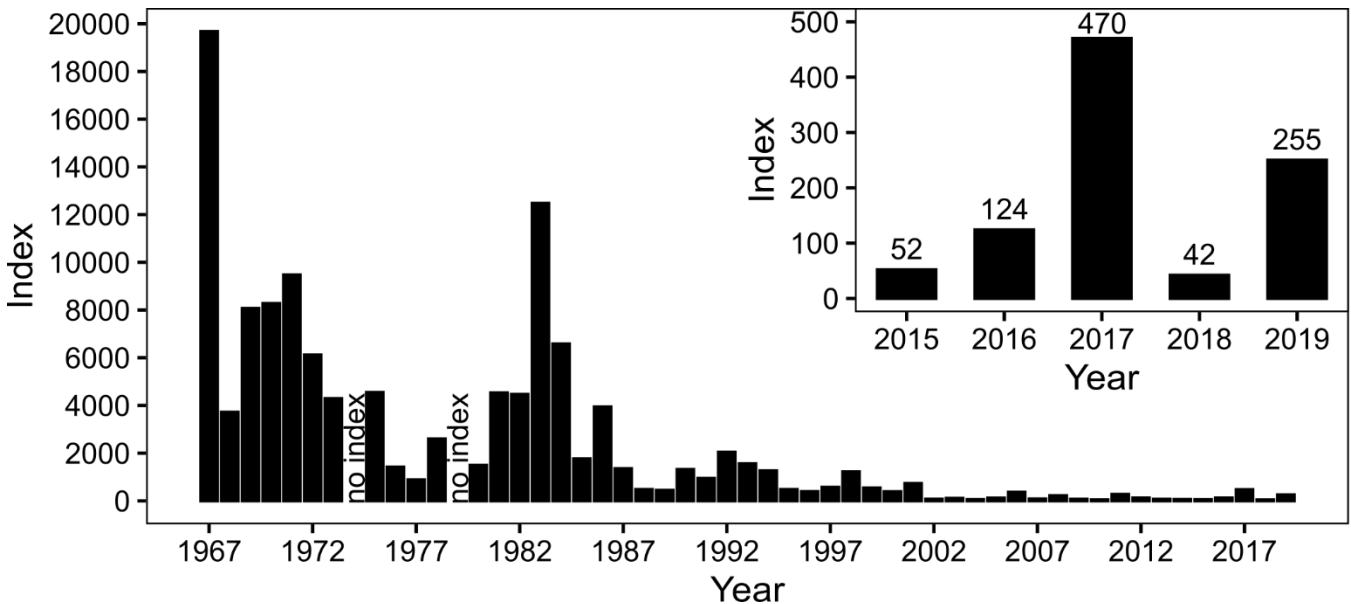
The 2019 abundance index was zero and was tied with 2018 for the lowest in FMWT history (Figure 2). This is a continuation of a pattern of low indices, 7, 8, and 2, that occurred in years 2015, 2016, and 2017, respectively. No Delta Smelt were collected from any stations during our survey months of September- December 2019. While this survey did not catch any Delta Smelt, it does not mean they are not present. The Enhanced Delta Smelt Monitoring (EDSM) survey of the U.S. Fish and Wildlife Service (USFWS) caught 9 Delta Smelt among 4 sample weeks (n=574 tows) conducted between December 2-28, 2019 ([data available at the USFWS Delta Juvenile Fish Monitoring Program website](#)).



**Figure 2.** Fall Midwater Trawl Delta Smelt annual abundance indices (all ages), 1967-2019.

**Age-0 Striped Bass (*Morone saxatilis*)**

The 2019 abundance index was 255, representing a 6-fold increase from last year's index (Figure 3).



**Figure 3.** Fall Midwater Trawl Age-0 Striped Bass annual abundance indices, 1967-2019.

Striped Bass were collected every month during September-December. 208 age-0 Striped Bass were collected at index stations and 16 from non-index stations. Monthly catch was highest in September, with catch being highest in Suisun Bay among months (Table 1).

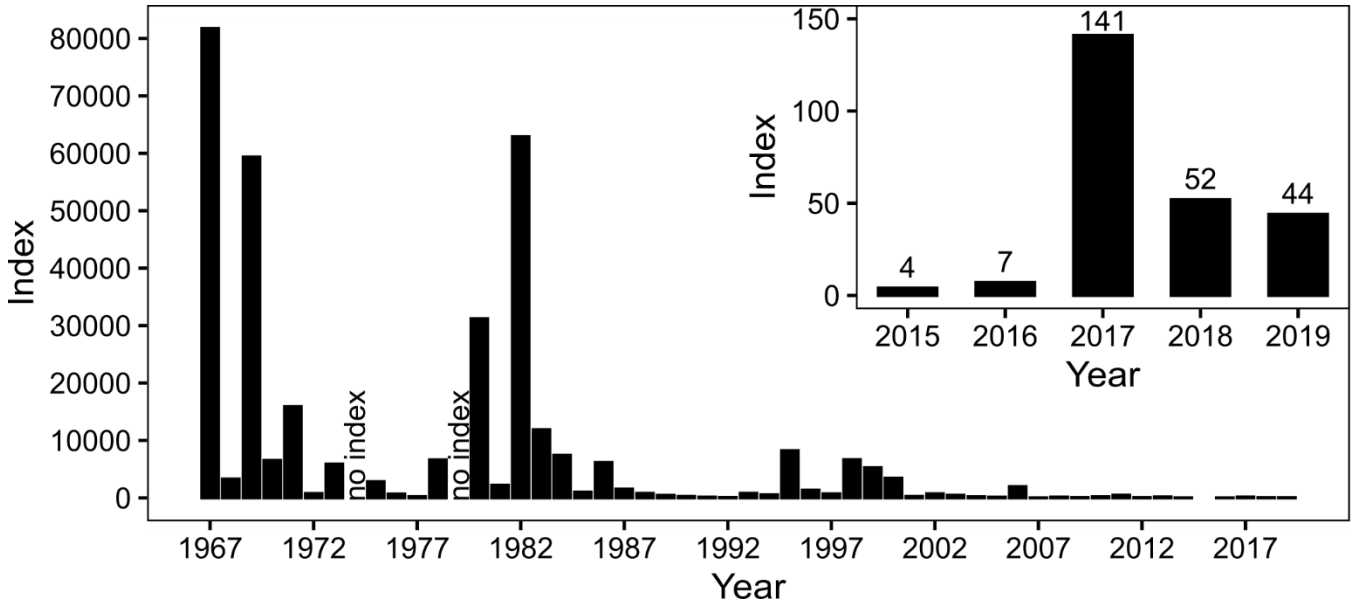
**Table 1.** Age-0 Striped Bass (*Morone saxatilis*) catch among regions during the 2019 Fall Midwater Trawl survey monthly sampling at index and non-index stations.

\*SRDWSC = Sacramento River Deepwater Shipping Channel.

Month	Type	Region	Catch
September	Index	San Pablo Bay	2
		Suisun Bay	74
		Lower Sacramento River	1
		Lower San Joaquin River	1
		Eastern Delta	1
	<b>Sub-total</b>		<b>79</b>
Non-Index	*SRDWSC	11	
	<b>Sub-total</b>	<b>11</b>	
October	Index	San Pablo Bay	2
		Carquinez Strait	4
		Suisun Bay	26
		Lower Sacramento River	1
		Lower San Joaquin River	2
	<b>Sub-total</b>		<b>33</b>
Non-Index	*SRDWSC	1	
	<b>Sub-total</b>	<b>1</b>	
November	Index	San Pablo Bay	2
		Carquinez Strait	6
		Suisun Bay	31
		Lower Sacramento River	4
		Lower San Joaquin River	2
	<b>Sub-total</b>		<b>45</b>
Non-Index	*SRDWSC	2	
	<b>Sub-total</b>	<b>2</b>	
December	Index	San Pablo Bay	1
		Carquinez Strait	8
		Suisun Bay	23
		Lower Sacramento River	9
		Lower San Joaquin River	4
	Eastern Delta	4	
<b>Sub-total</b>		<b>49</b>	
Non-Index	*SRDWSC	2	
	<b>Sub-total</b>	<b>2</b>	
<b>Grand Total</b>			<b>222</b>

### Longfin Smelt (*Spirinchus thaleichthys*)

The 2019 abundance index was 44, representing a 15% reduction from the previous year (Figure 4). This is the second year of decline following the recent high index of 141 that occurred in 2017.



**Figure 4.** Fall Midwater Trawl Longfin Smelt annual abundance indices, 1967-2019.

A total of 30 Longfin Smelt were collected at index stations and 1 from non-index stations. Low numbers of Longfin Smelt were collected in Carquinez Strait and Suisun Bay during September-November (Table 2). Catch expanded upstream in December into the lower Sacramento and San Joaquin rivers. Higher catch is typical 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.

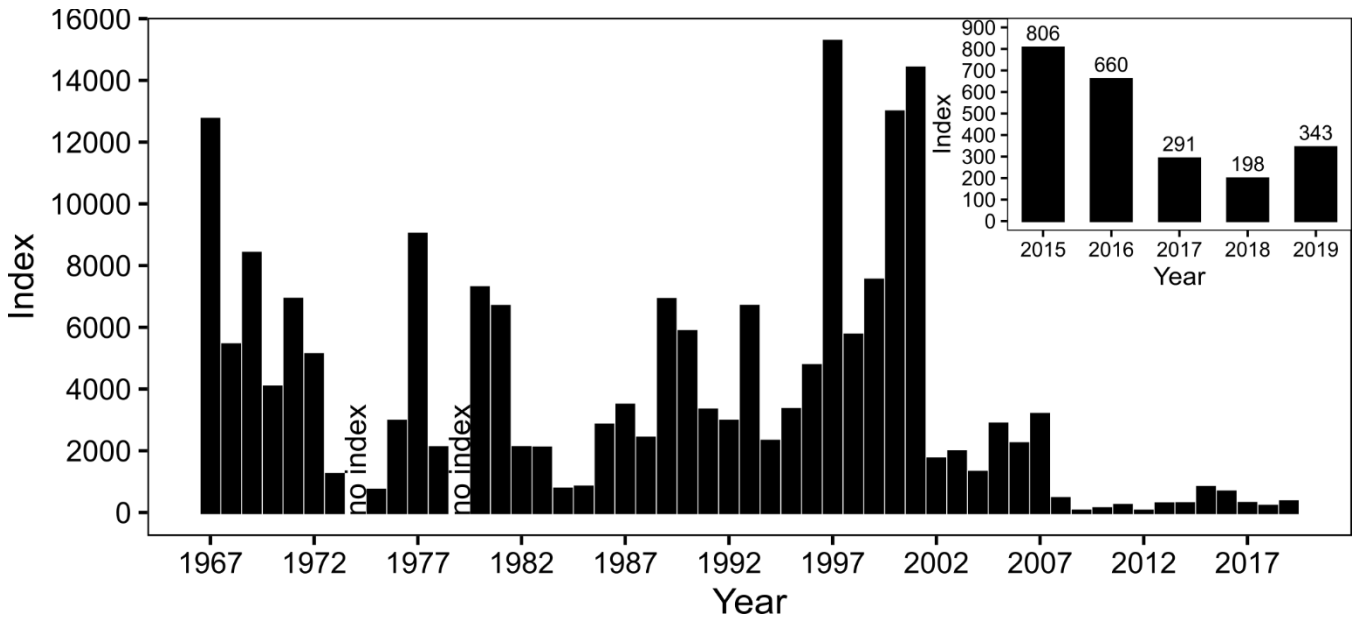
**Table 2.** Longfin Smelt (*Spirinchus thaleichthys*) catch among regions during the 2019 Fall Midwater Trawl survey monthly sampling at index and non-index stations.

Month	Type	Region	Catch
September	Index	Carquinez Strait	2
		Suisun Bay	5
	<b>Sub-total</b>		<b>7</b>
October	Index	Suisun Bay	2
	<b>Sub-total</b>		<b>2</b>
November	Index	Carquinez Strait	1
		Suisun Bay	2
	<b>Sub-total</b>		<b>3</b>
December	Index	San Pablo Bay	3

		Carquinez Strait	3
		Suisun Bay	7
		Lower Sacramento River	4
		Lower San Joaquin River	1
	<b>Sub-total</b>		<b>18</b>
	Non-Index	Napa River	1
	<b>Sub-total</b>		<b>1</b>
<b>Grand Total</b>			<b>31</b>

**Threadfin Shad (*Dorosoma petenense*)**

The 2019 abundance index was 343, representing a 73% 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 2019.



**Figure 5.** Fall Midwater Trawl Threadfin Shad annual abundance indices, 1967-2019.

A total of 279 Threadfin Shad were collected at index stations and 1281 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.

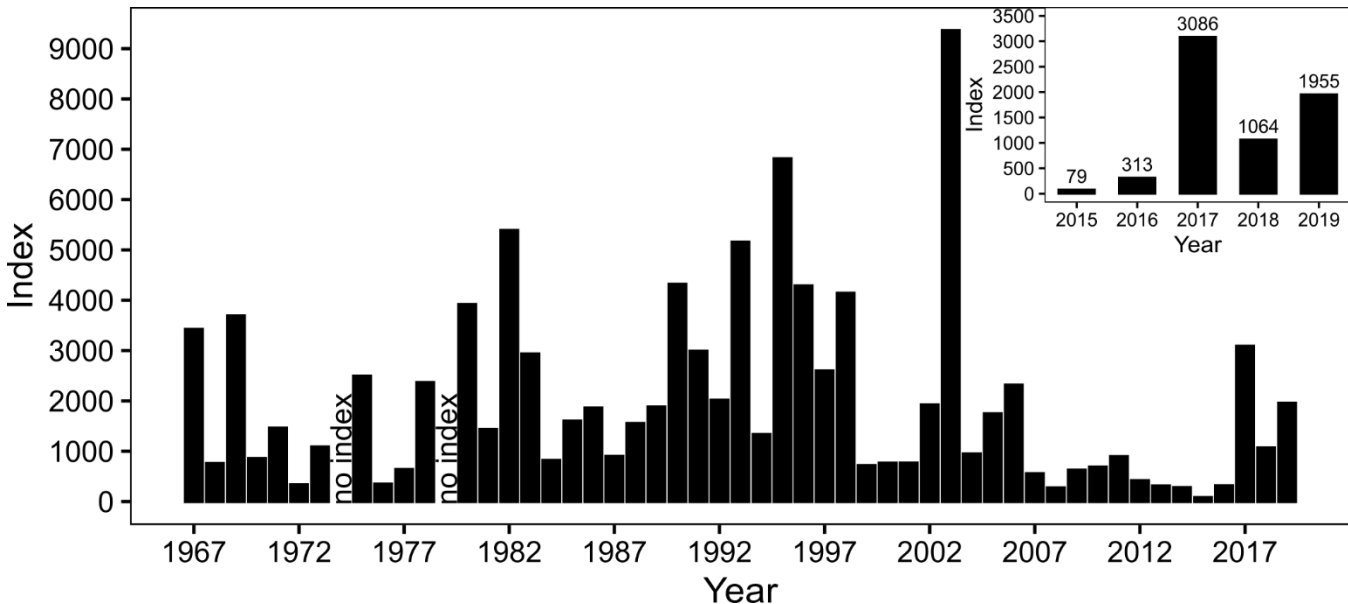
**Table 3.** Threadfin Shad (*Dorosoma petenense*) catch among regions during the 2019 Fall Midwater Trawl survey monthly sampling at index and non-index stations.

\*SRDWSC = Sacramento River Deepwater Shipping Channel.

<b>Month</b>	<b>Type</b>	<b>Region</b>	<b>Catch</b>
September	Index	San Pablo Bay	4
		Suisun Bay	12
		Lower Sacramento River	2
		Eastern Delta	4
	<b>Sub-total</b>		<b>22</b>
Non-Index	*SRDWSC	95	
	<b>Sub-total</b>	<b>95</b>	
October	Index	Suisun Bay	10
		Lower San Joaquin River	6
	<b>Sub-total</b>	<b>16</b>	
	Non-Index	*SRDWSC	1046
		Steamboat Slough	2
<b>Sub-total</b>	<b>1048</b>		
November	Index	Suisun Bay	28
		Lower Sacramento River	182
		Lower San Joaquin River	7
	<b>Sub-total</b>	<b>217</b>	
	Non-Index	*SRDWSC	128
<b>Sub-total</b>	<b>128</b>		
December	Index	San Pablo Bay	2
		Suisun Bay	9
		Lower Sacramento River	5
		Lower San Joaquin River	1
		Eastern Delta	7
	<b>Sub-total</b>	<b>24</b>	
Non-Index	*SRDWSC	10	
<b>Sub-total</b>	<b>10</b>		
<b>Grand Total</b>		<b>1560</b>	

### American Shad (*Alosa sapidissima*)

The 2019 abundance index was 1955, representing an 84% increase from the previous year (Figure 6). Abundance indices have fluctuated substantially during the period 2015-2019, ranging from a low of 79 to a high of 3,086. American shad were collected broadly throughout the upper Estuary September-December. Catch at index stations was 1,465 with additional 90 from non-index stations (Table 4).



**Figure 6.** Fall Midwater Trawl American Shad annual abundance indices, 1967-2019.

**Table 4.** American Shad (*Alosa sapidissima*) catch among regions during the 2019 Fall Midwater Trawl survey monthly sampling at index and non-index stations.

\*SRDWSC = Sacramento River Deepwater Shipping Channel.

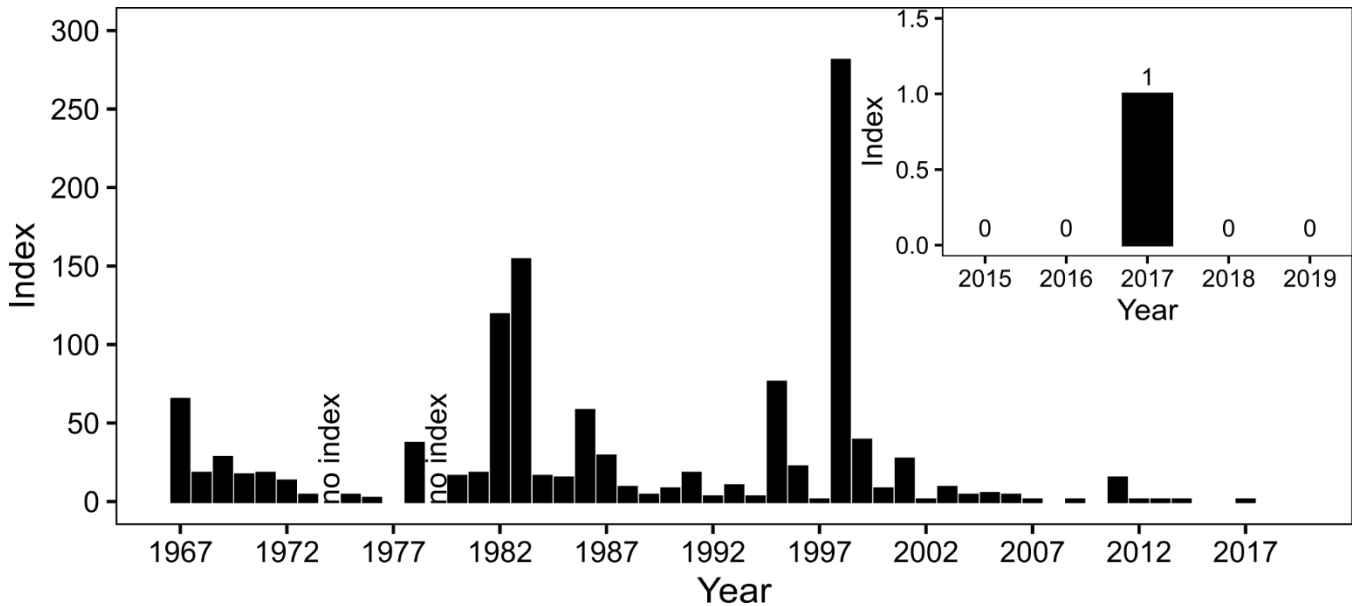
Month	Type	Region	Catch
September	Index	San Pablo Bay	33
		Carquinez Strait	15
		Suisun Bay	252
		Lower Sacramento River	60
		Lower San Joaquin River	78
	<b>Sub-total</b>		<b>438</b>
	Non-Index	*SRDWSC	10
		Napa River	3
		Cache Slough	1
		Little Potato Slough	1
Mokelumne River		3	
<b>Sub-total</b>		<b>18</b>	
October	Index	San Pablo Bay	6
		Carquinez Strait	3



		Suisun Bay	188
		Lower Sacramento River	16
		Lower San Joaquin River	4
	<b>Sub-total</b>		<b>217</b>
	Non-Index	*SRDWSC	31
		Steamboat Slough	8
	<b>Sub-total</b>		<b>39</b>
November	Index	San Pablo Bay	7
		Carquinez Strait	21
		Suisun Bay	261
		Lower Sacramento River	181
		Lower San Joaquin River	26
	<b>Sub-total</b>		<b>496</b>
	Non-Index	*SRDWSC	9
	<b>Sub-total</b>		<b>9</b>
December	Index	San Pablo Bay	48
		Carquinez Strait	55
		Suisun Bay	146
		Lower Sacramento River	12
		Lower San Joaquin River	26
		Eastern Delta	27
	<b>Sub-total</b>		<b>314</b>
	Non-Index	Cache Slough	23
		Napa River	1
	<b>Sub-total</b>		<b>24</b>
<b>Grand Total</b>			<b>1555</b>

### **Splittail (*Pogonichthys macrolepidotus*)**

The 2019 abundance index was zero and shows a continuing trend of very little to no catch of Splittail in FMWT (Figure 7). Two splittail were caught at a non-index station in SRDWSC in September. 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. CDFW Bay Study caught 3 from September-December. From October through December, salvage from the State (SWP) and Federal (CVP) pumping facilities caught 48 and 16 Splittail, respectively.



**Figure 7.** Fall Midwater Trawl Splittail annual abundance indices, 1967-2019.

## References

- Moyle P, Baxter R, Sommer T, Foin T, Matern S. 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.
- 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.
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