

# Delta smelt conditions report

*Delta Science Program*

*Oct 28, 2019*

## Introduction

Delta Smelt (*Hypomesus transpacificus*) is a pelagic species that prefers cooler temperatures in low salinity, turbid habitats. Some additional habitat concerns are food availability, invasive species, contaminants and harmful algal blooms.

Delta Smelt is generally described as a semi-anadromous species, migrating from brackish low salinity (1-6 PSU) habitats to tidal fresh water habitats to spawn. This spawning migration occurs in the winter, after the “first-flush” of turbid freshwater following the first major precipitation event. A small proportion of the population exhibit a resident life history, residing in freshwater or brackish water to adulthood.

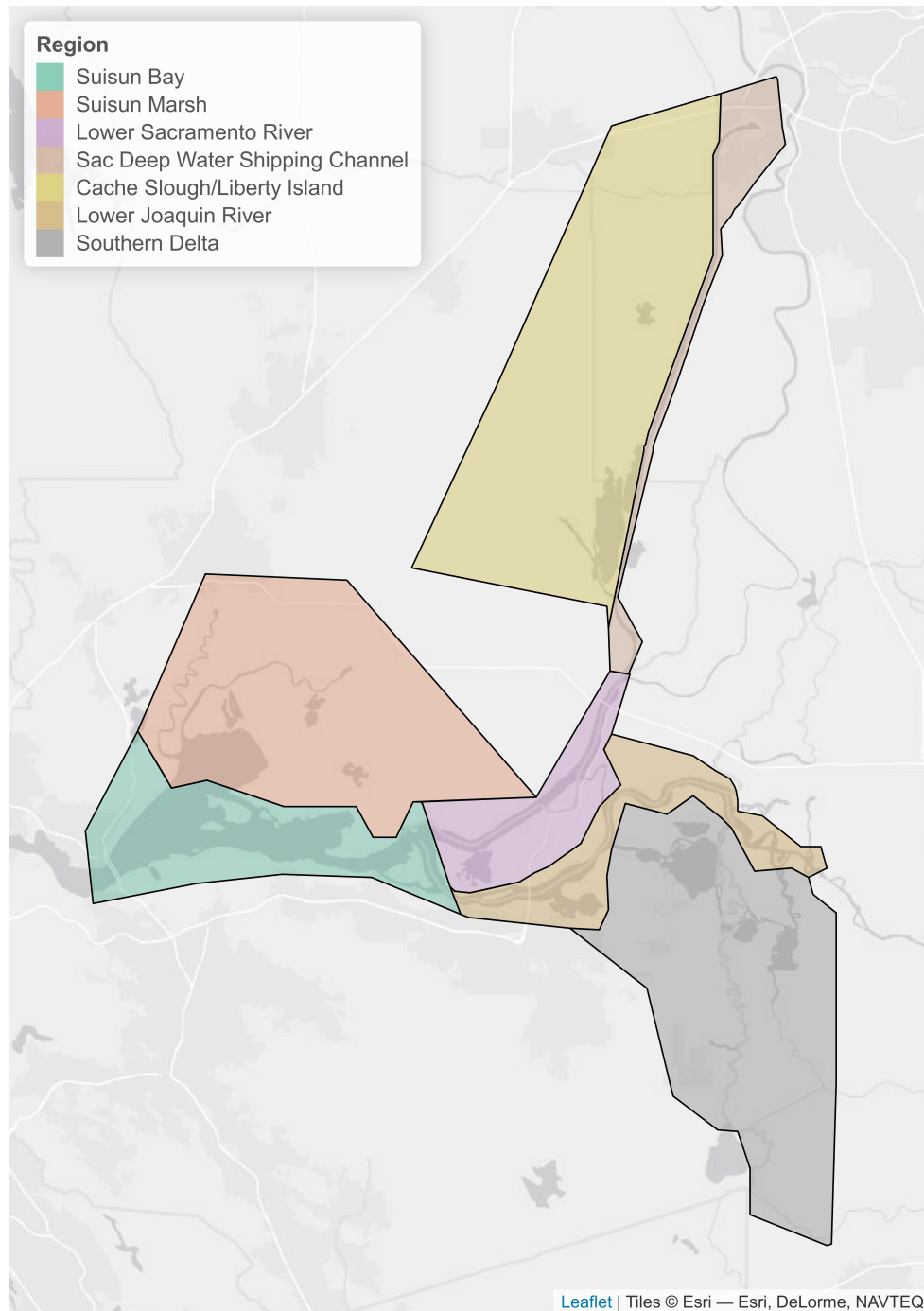
Delta Smelt are most commonly found in the North Delta region (Cache Slough/Liberty Island & Sac Deep Water Shipping Channel) during the winter spawning season. Larval and juvenile fish start moving into the Low Salinity Zone (Suisun Bay & Marsh, Lower Sacramento River) during the spring and early summer and remain there until their winter spawning migration takes them back up to the North Delta. The Lower Joaquin River and Southern Delta are highly modified habitats, which in combination with the proximity to the water export facilities, makes it largely unsuitable habitat.



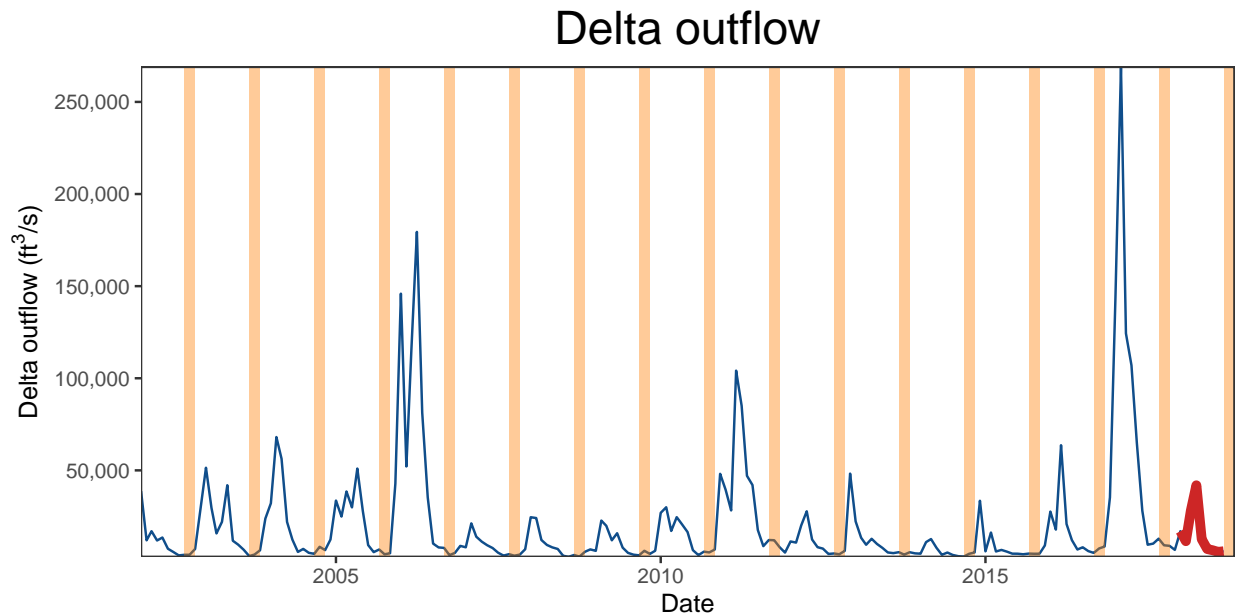
Juvenile Delta Smelt Dale Kolke / DWR

## Methods

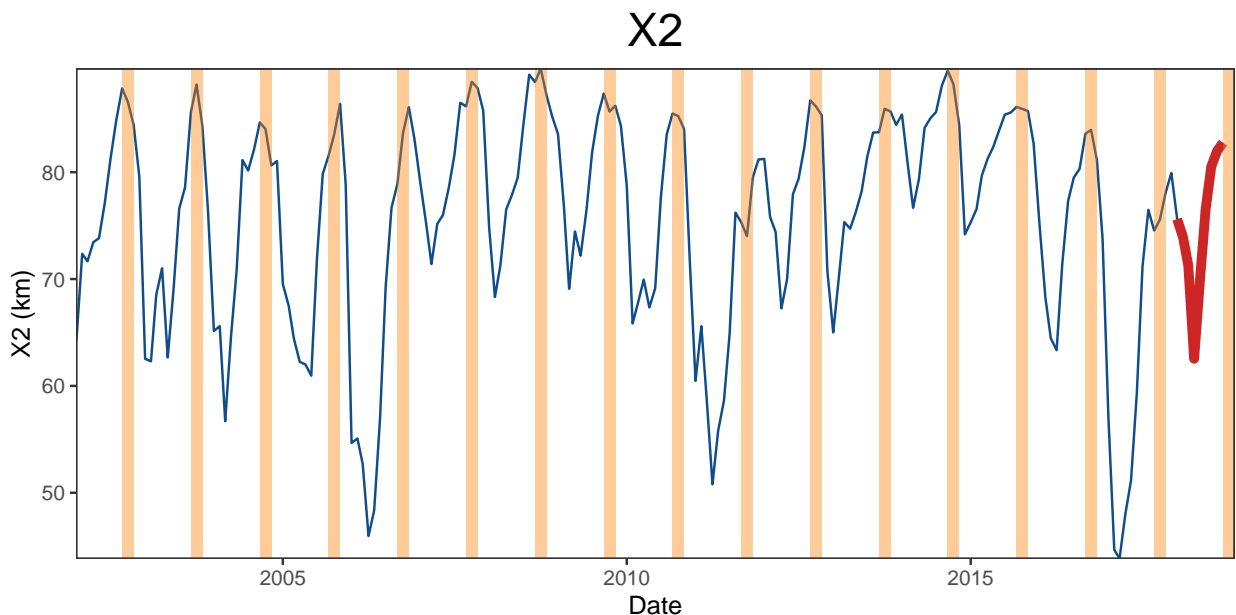
Most variables are divided among 7 regions from the EDSM 2018-19 phase I strata. Missing data are denoted by vertical dashed lines. To focus on recent trends after the pelagic organismal decline (POD), data are plotted from 2002 (or the start of data collection) until present. Data from 2018 are highlighted to facilitate comparisons across variables.



## Abiotic drivers

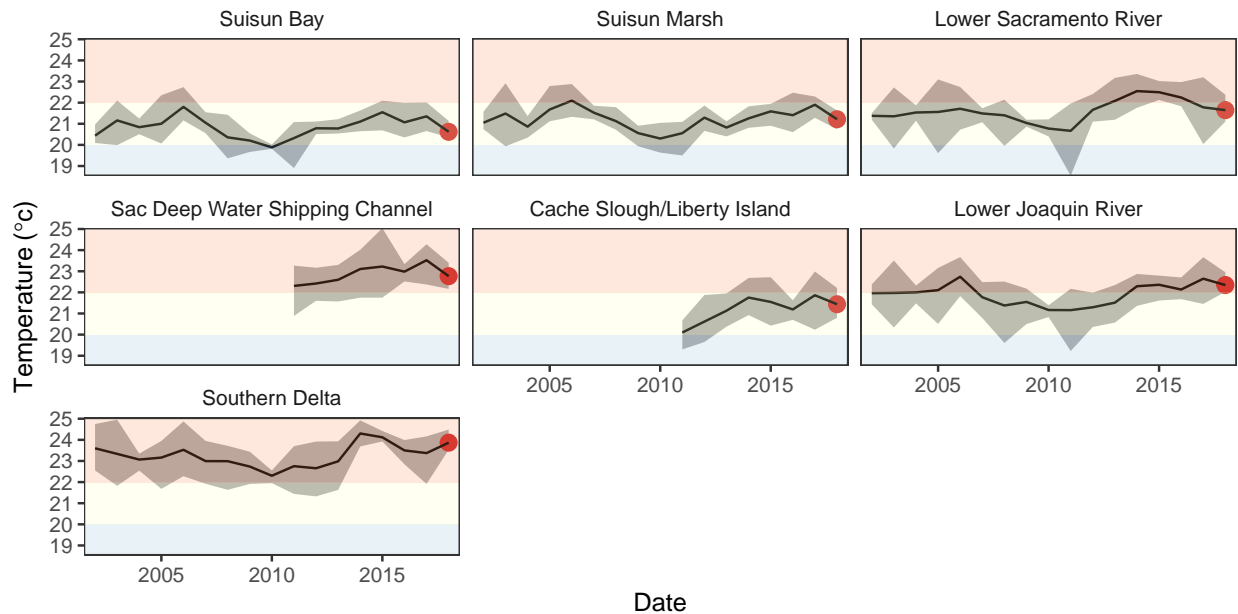


Delta Smelt habitat is determined largely by freshwater flow because Delta Smelt occupy the low salinity portion of the SFE during the summer and fall. **High Delta outflow in the fall is favorable for Delta Smelt because it increases the amount of available low salinity habitat.** High outflow may also improve abiotic environmental conditions, reduce harmful algal blooms, and increase food production. Fall months are highlighted in orange.



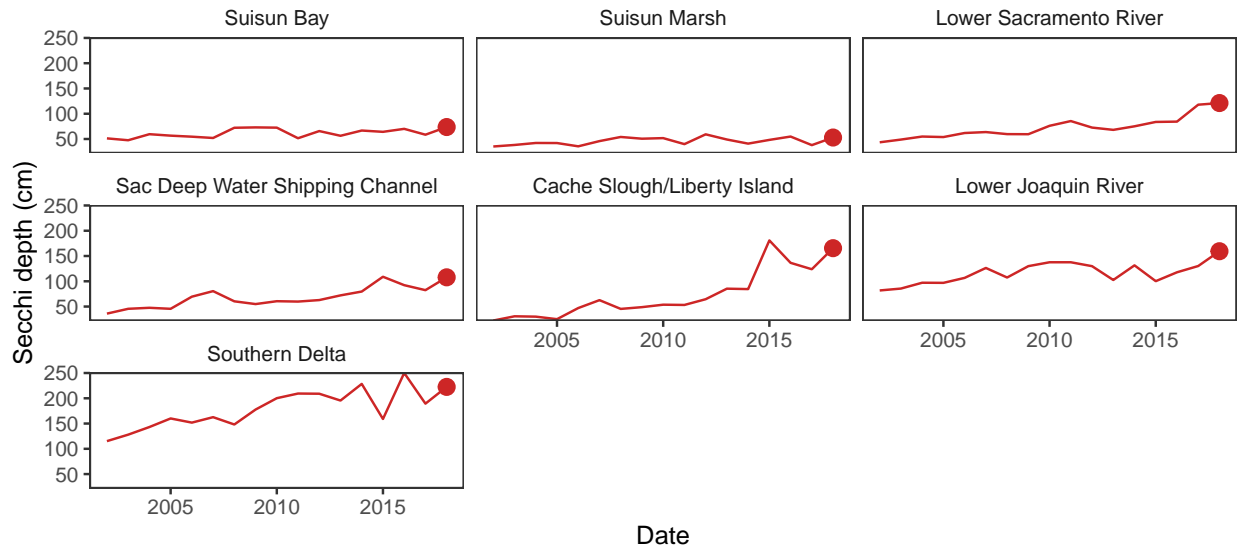
X2 is a measure of salinity intrusion defined as the distance from the golden gate to where the salinity of the bottom water reaches 2. X2 is used as a proxy for the amount of low salinity habitat in the Delta; **lower X2 means more habitat is available for Delta Smelt.** Fall months are highlighted in orange.

## Summer temperature



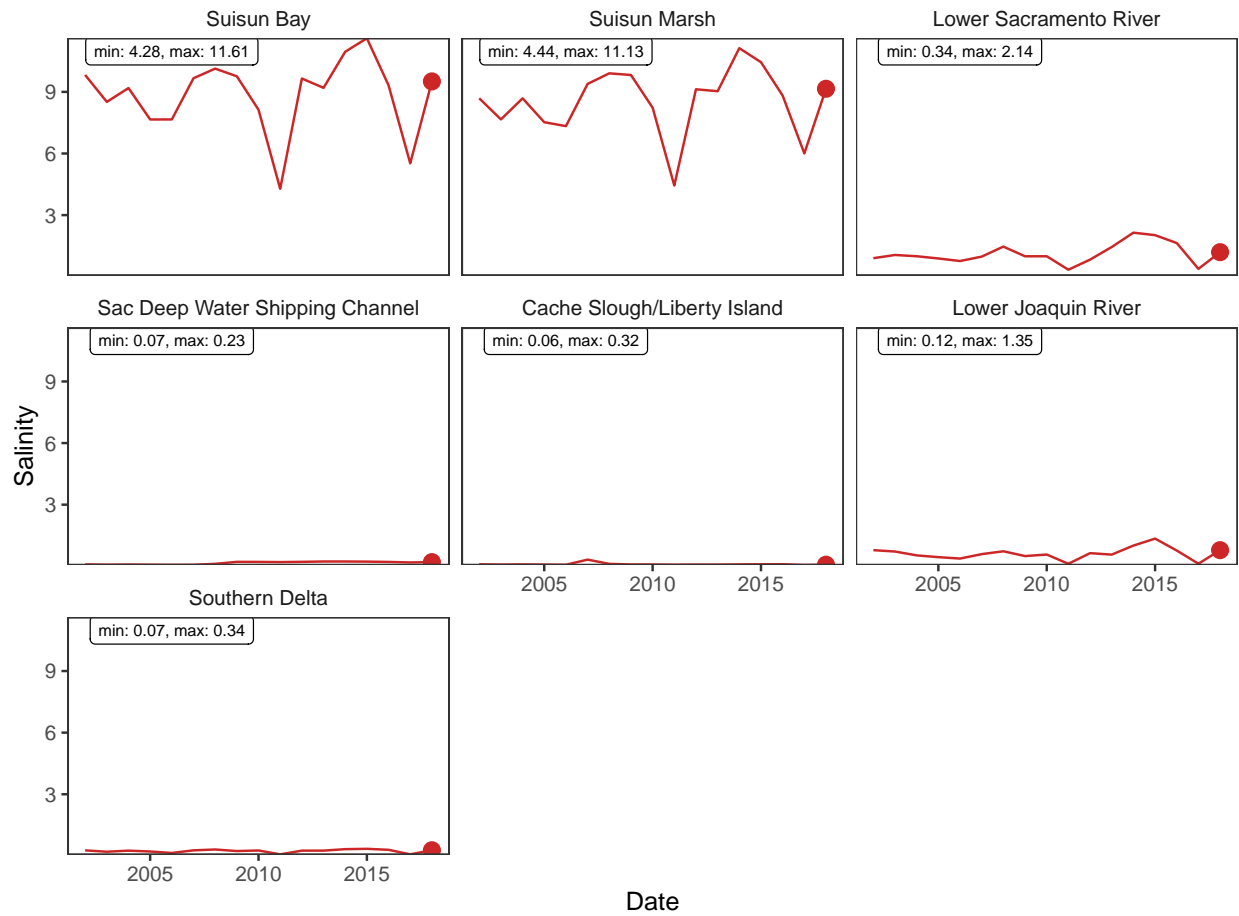
Delta smelt are sensitive to high water temperatures. **Optimal growth is achieved below 20 °C**, growth is poor and stress induced at 22 °C, and temperatures above 26 °C are likely fatal. Delta smelt are rarely captured above 22 °C. This graph displays the mean water temperature of the coldest, average, and hottest months of the summer, shaded by suitability for Delta Smelt.

## Fall secchi depth



Secchi depth is a measure of turbidity. **Lower secchi depth indicates higher turbidity, which is preferred by Delta Smelt.** Delta smelt distributions are clustered around areas with low secchi depth (high turbidity) in the fall. Delta Smelt evolved in the historically turbid San Francisco Estuary and rely on this turbidity to effectively feed and hide from predators.

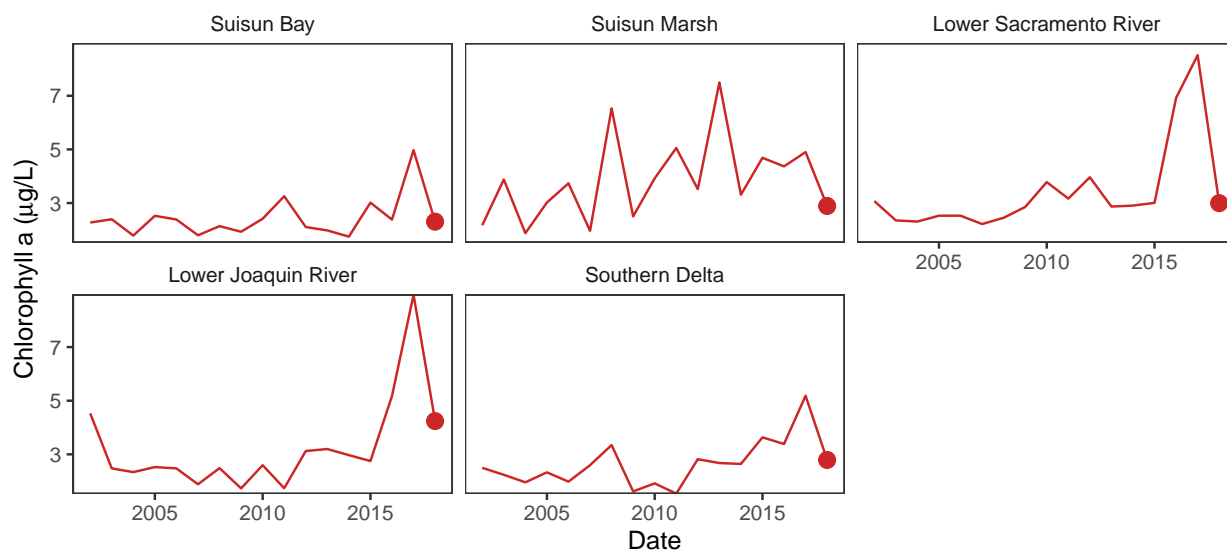
## Fall salinity



**Delta smelt prefer fresh to brackish water and are most abundant in salinities of 1-2 ppt**, are rare in salinities higher than 6 ppt, and are not found in salinities above 14 ppt. Juveniles rely on low salinity habitat in the fall to feed, grow, and mature into adults.

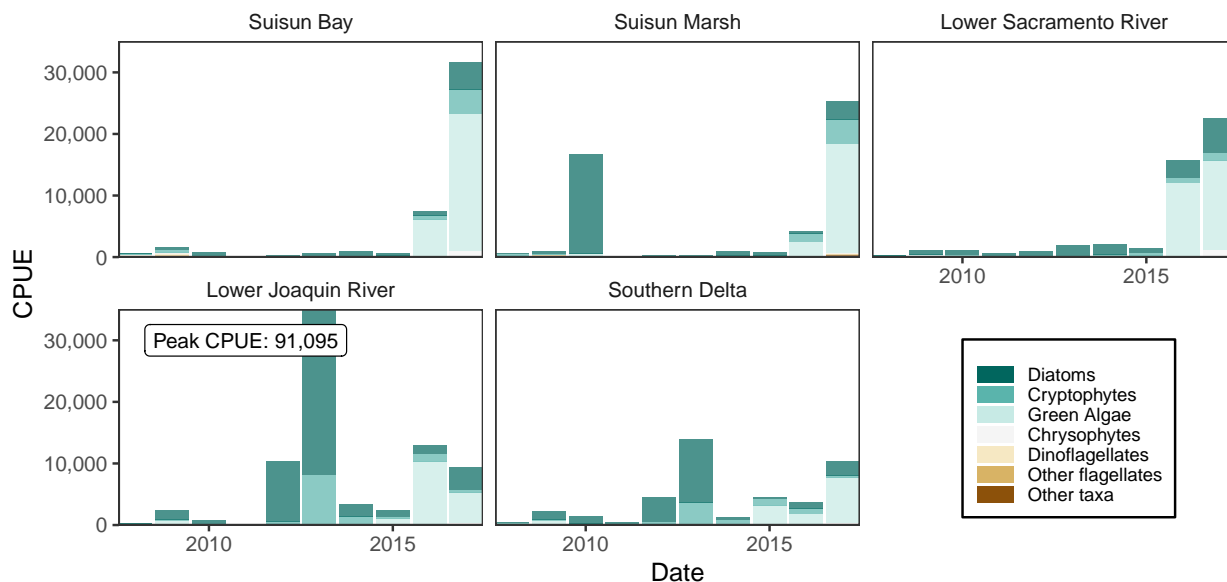
## Biotic drivers

### Summer chlorophyll



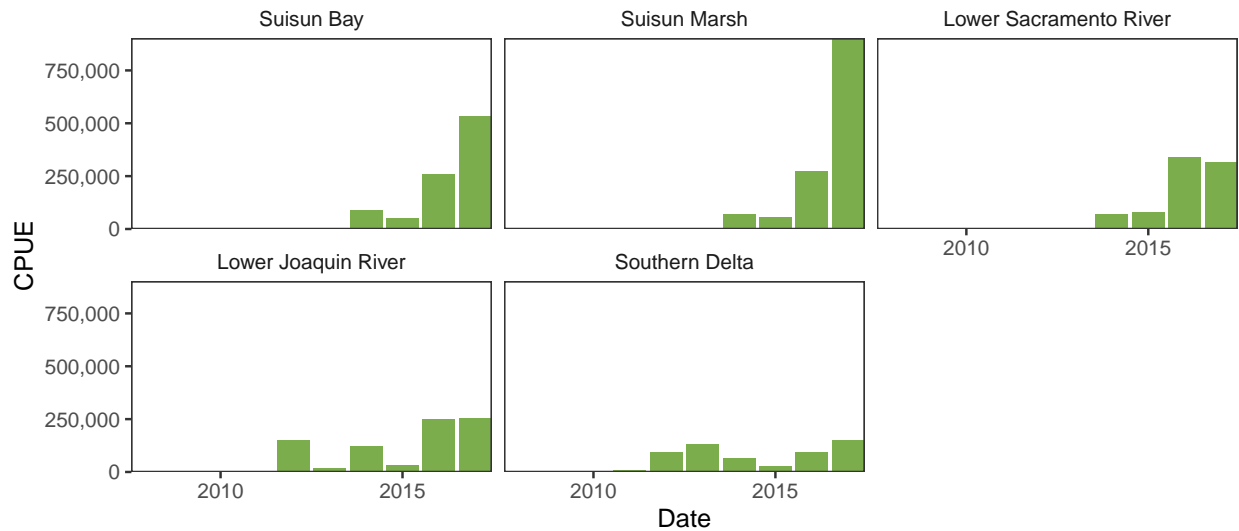
Chlorophyll is a measure of productivity at the base of the food web. **Higher chlorophyll indicates more food is available for zooplankton, which are important prey for many fish including Delta Smelt.** No data are available from the Sac Deep Water Shipping Channel or Cache/Slough/Liberty Island regions.

### Summer phytoplankton



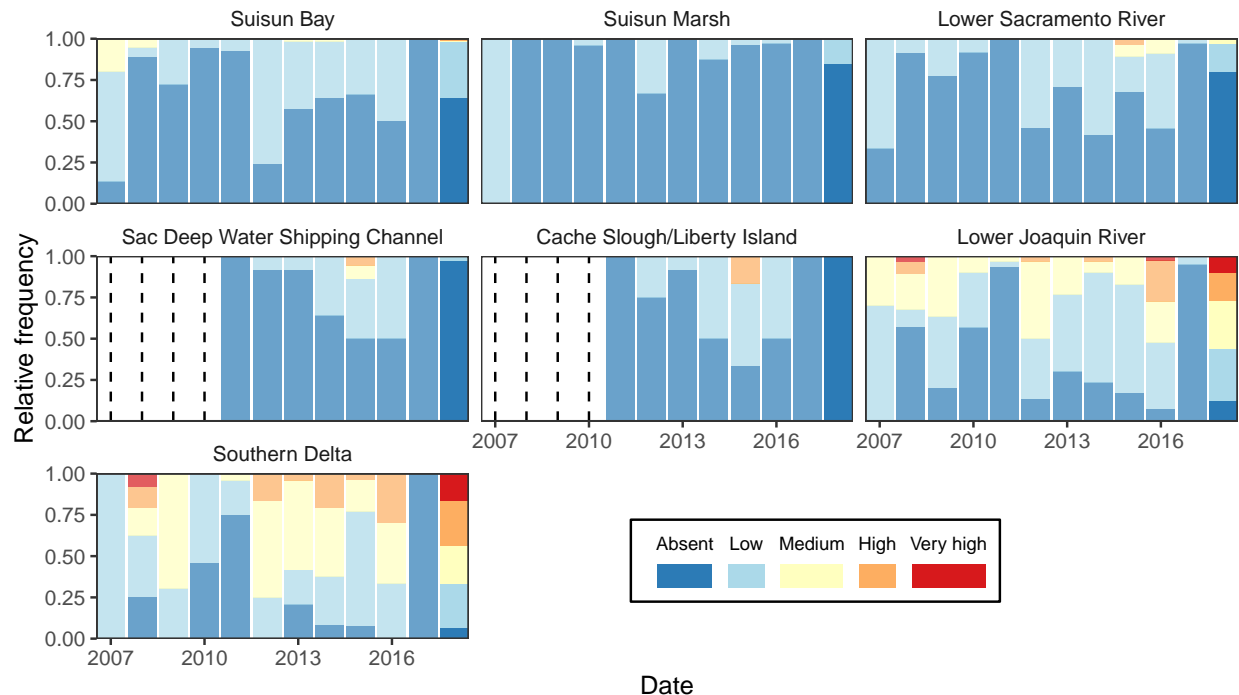
Phytoplankton are the base of the aquatic food web. They provide food for zooplankton, which are important prey for Delta Smelt. **Diatoms and cryptophytes are considered the best quality zooplankton food.** No data are available from the Sac Deep Water Shipping Channel or Cache/Slough/Liberty Island regions.

## Summer cyanobacteria



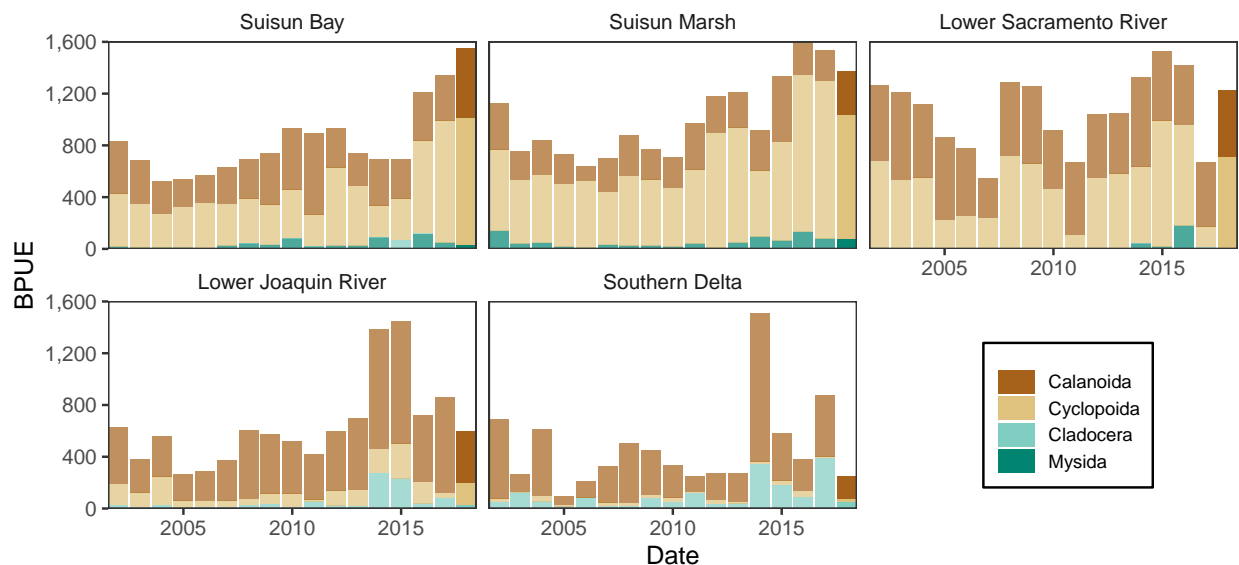
**Cyanobacteria are an unfavorable type of phytoplankton** Cyanobacteria are poor quality zooplankton food and can produce toxins such as microcystis. No data are available from the Sac Deep Water Shipping Channel or Cache/Slough/Liberty Island regions.

## Summer Microcystis



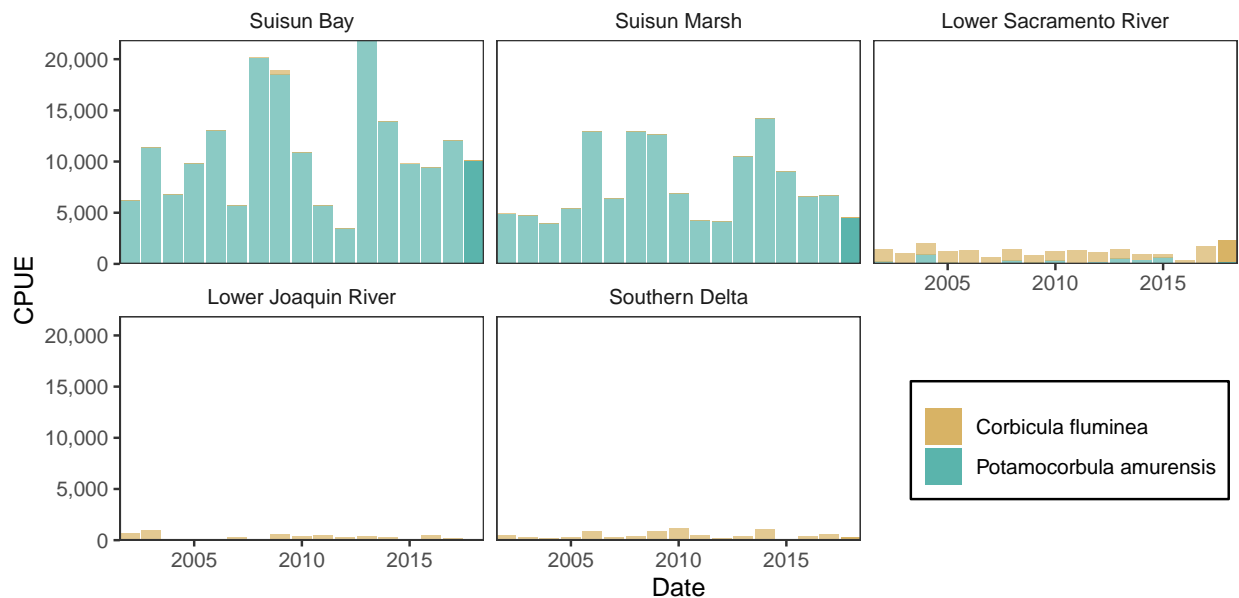
Microcystis is a toxin-producing cyanobacteria harmful to human and animal health. **Microcystis toxins can directly harm Delta Smelt and its zooplankton food.** Blooms occur yearly in the summer and fall. Microcystis presence and intensity are measured on a qualitative scale from 1-5.

## Fall zooplankton



Delta Smelt rely on zooplankton for food throughout their entire lives. **Calanoid copepods and Mysids are particularly important in the diet of Delta Smelt.** No data are available from the Sac Deep Water Shipping Channel or Cache/Slough/Liberty Island regions.

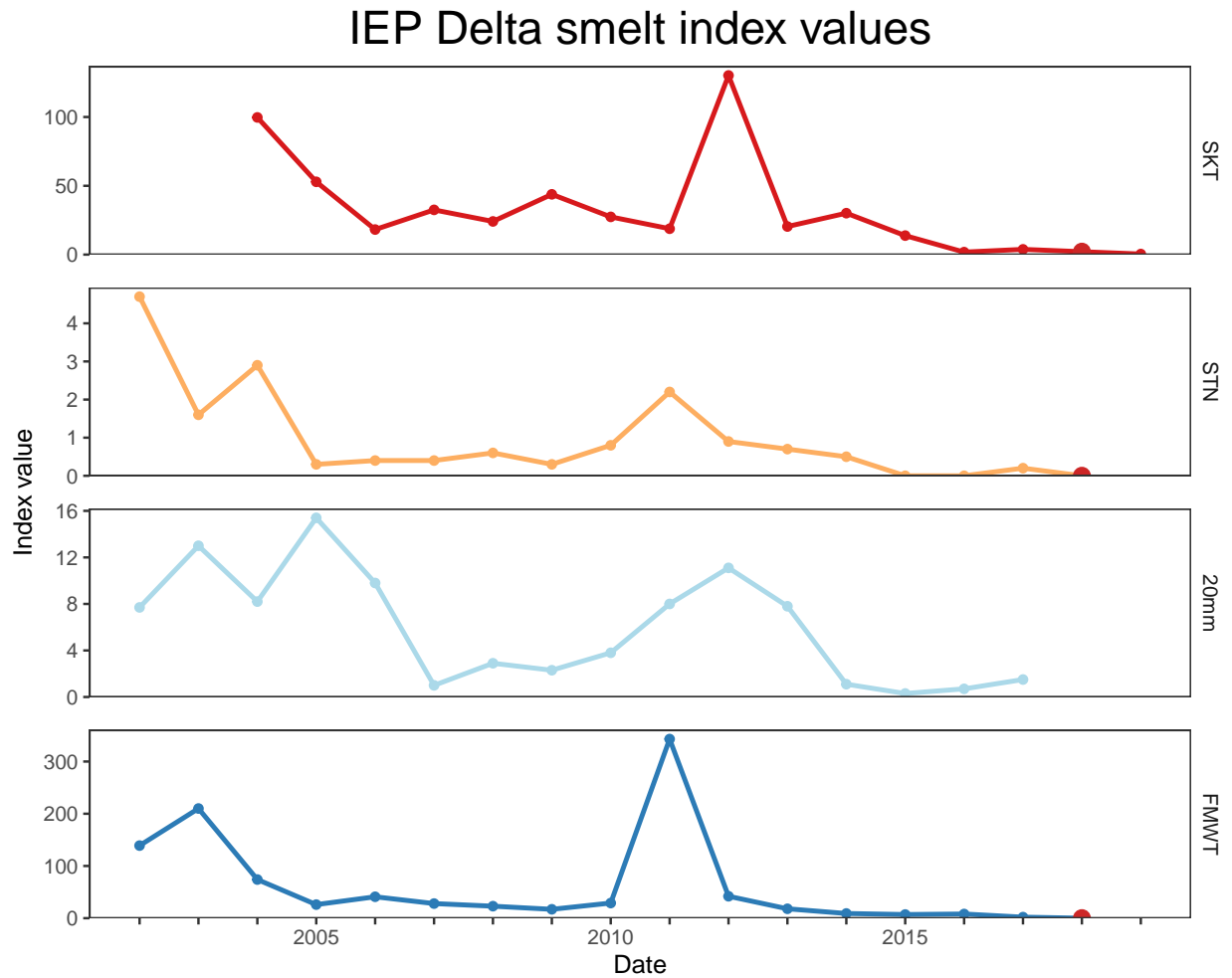
## Fall invasive bivalve abundance



**Invasive bivalves (clams) consume phytoplankton and zooplankton, reducing the amount of food available for fishes.** The overbite clam *Potamocorbula amurensis* invaded the estuary in 1987, prefers brackish waters, and feeds on both zooplankton and phytoplankton. The freshwater clam *Corbicula fluminea* invaded sometime before 1945, prefers freshwater, and feeds primarily on phytoplankton. No data are available from the Sac Deep Water Shipping Channel or Cache/Slough/Liberty Island regions.

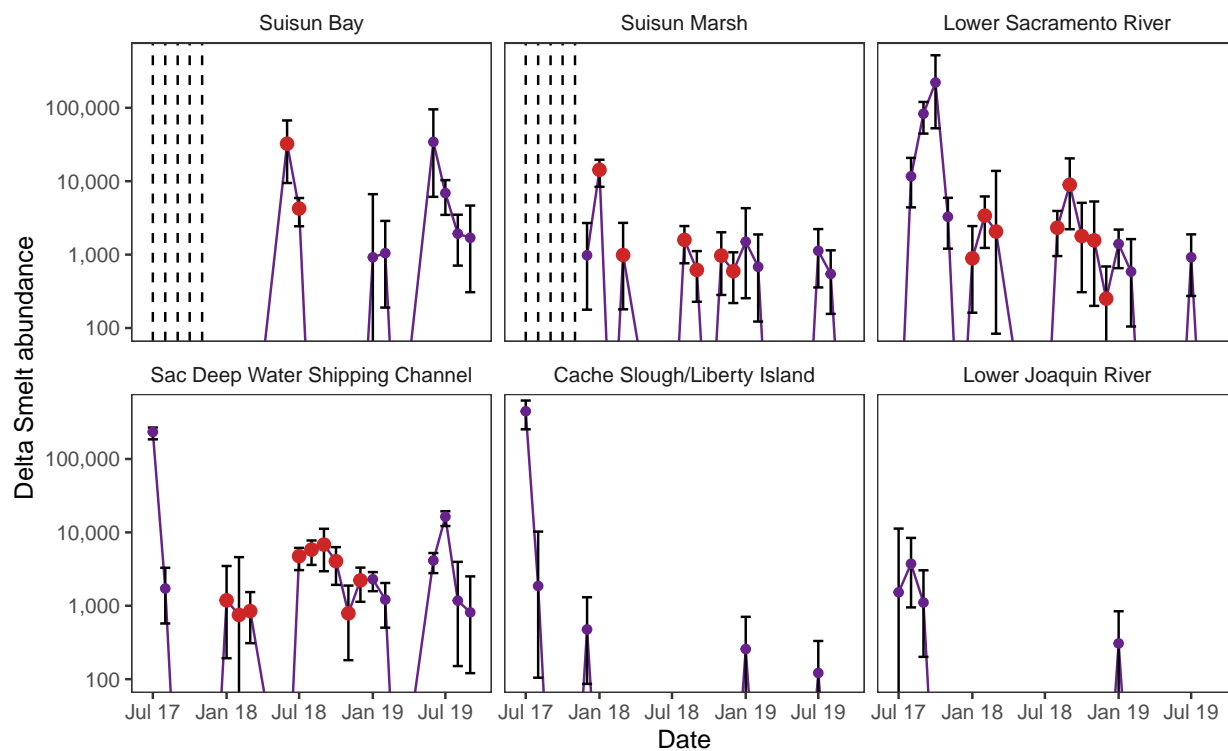


## Delta Smelt



Delta smelt abundance is estimated by 4 IEP surveys that target different life stages. The Spring Kodiak Trawl (SKT) estimates spawning adult Delta Smelt abundance from January through May, the Summer Townet Survey (STN) estimates juvenile Delta Smelt abundance in June, the 20mm survey estimates larval and juvenile Delta Smelt abundance from March through August, and the Fall Midwater Trawl (FMWT) estimates juvenile and adult Delta Smelt abundance from September through December. The 20mm index could not be calculated in 2018 due to low catch.

## EDSM Delta Smelt Abundance



EDSM calculates Delta Smelt abundance estimates throughout the year. *Note that the y-axis is on the log scale and the x axis starts in mid 2017. The y axis starts at the lowest estimated detection value; all values below the limit are 0s.* No Delta Smelt were collected from the Southern Delta.