Calanoids, Cyclopoids, and Cladocerans, Oh My! **Zooplankton Trends in the San Francisco Estuary from 2011-2019**



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Introduction:

- Zooplankton are prey for many fish species in the San Francisco Estuary (SFE).
- Species in the SFE vary by salinity tolerance and season.
- Regular zooplankton monitoring allows for the detection of community changes and seasonal trends.
- The California Department of Fish and Wildlife's (CDFW) Summer Townet Survey (STN) and Fall Midwater Trawl (FMWT) added consistent zooplankton sampling in 2011.

Results:

Regional Species Composition and Salinity

- Zooplankton abundance and species composition varied by location, season, and water year type (Fig. 2).
- Suisun Bay and Suisun Marsh had the highest species diversity compared to other regions.
- Years with lower salinity had higher species abundance, except in the South Delta.
- Freshwater species (Bosmina, Sinocalanus) were found in Suisun Bay, Marsh and Confluence during wet years (2011, 2017, 2019).
- There was an increase in higher salinity tolerant species (Tortanus, O. davisae) during dry years (2013-2015) in these regions.
- The status and trends of zooplankton abundance from these two surveys from 2011-2019 are presented here.



Methods

- Summer Townet conducts samples twice monthly from June to August (Fig. 1).
- Fall Midwater Trawl samples monthly from September to December (Fig.1).
- Zooplankton was collected using a 10-min oblique tow and processed in lab.



- Pseudodiaptomus forbesi dominated in all regions.
- Acartiella sinensis abundance was the second highest in Suisun Bay, Suisun Marsh, and the Confluence.



Figure 2: Average CPUE and surface salinity (ppt) for (A) Suisun Bay, Suisun Marsh, and the Confluence. (B) Sacramento River, SDWSC, and the South Delta. Note the different y-axis scales.

Regional Monthly Trends from 2011-2019

- In most regions the highest abundances occurred during summer and fall and decreased in winter months (Fig. 3).
- This was mostly due to *Pseudodiaptomus forbesi* and *Acartiella sinensis*.
- Cyclopoids had higher abundances in winter compared to summer months.
- Overall the South Delta had the highest zooplankton average CPUE, due to Cladocerans and Rotifers. 2019 was the year with the highest average CPUE for Suisun Bay and Marsh, due *Pseudodiaptomus* adults and copepodids.

Figure 1. Locations of zooplankton sampling stations for FMWT and STN.



Discussion:

- P. forbesi and A. sinensis are more abundant in summer to fall in the SFE. ^{1, 2, 3}.
- A. sinensis and P. forbesi both inhabit brackish to fresh water. ^{1, 3}
- Wet water years, especially 2017, allowed for freshwater species to move further downstream and increase in abundance in these regions.
- Dry years allowed more brackish species to move further upstream.
- Detecting changes in the zooplankton community can help assist

- 2019 had higher abundances than 2018 in all regions, except the South Delta and Sacramento River.
- Zooplankton abundance decreased in 2019 in the South Delta compared to 2018. Both years were higher than 2017.



with the management of endangered fish species in this region.



Acknowledgements:

We would like to thank the countless people that helped process and collect these samples, Tricia Bippus for the zooplankton pictures, and our funding sources, USBR and DWR.

References:

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Sacramento Deep Water Ship Channel

Calanoid Copepodids

Cyclopoid Copepodids

7 9 11

2015

7 9 11

2016

Other

7 9 11

2017

Rotifers

7 9 11 7 9 11

2014

2013

Calanoid Adults

☐ Cyclopoid Adults

7 9 11 7 9 11

2012

2011

■ Cladocerans

25,000

20,000

10,000

5,000

CPUE (#/m3) 15,000

South Delta

