

Making Zooplankton Research Relevant

Address Management Needs

What do habitat and water managers need to make effective decisions?

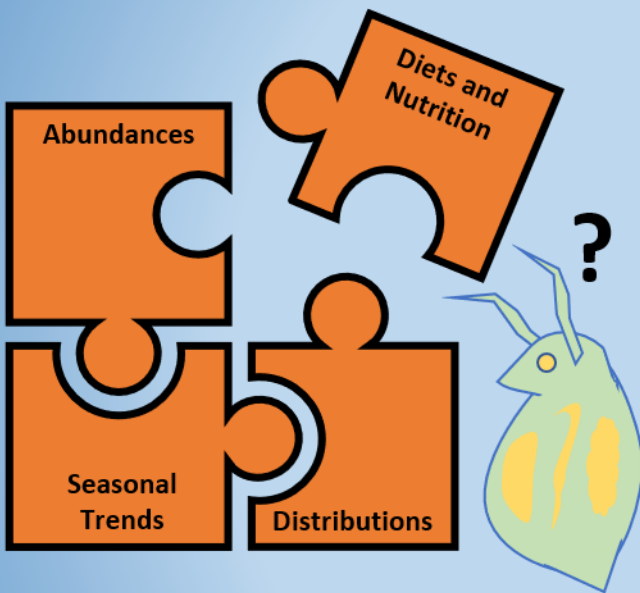
- **Indices of success:** can we use zooplankton data to address the success or effectiveness of management actions?
- **Density thresholds:** do fish of interest require a specific density of zooplankton prey to ensure feeding success?
- **Food web structure:** what are the primary zooplankton prey taxa for species of interest?



Fill in Research Gaps

Can your research fill in the existing gaps in zooplankton knowledge?

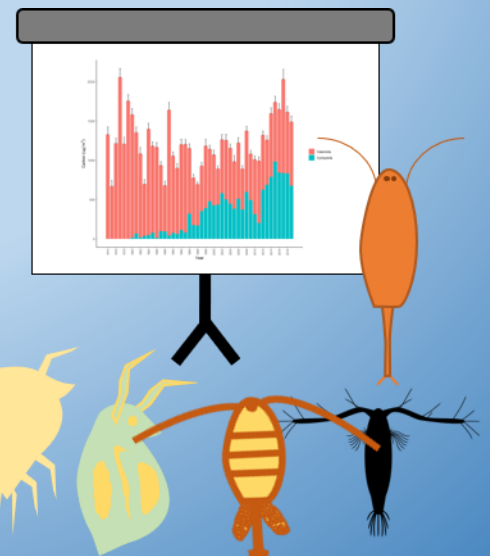
- **Zooplankton mass/weights:** current biomass estimates for zooplankton in the estuary are limited in their scope, and most rely on fixed conversion values, which are likely inaccurate.
- **Diets and nutrition:** while the diets of many fish species have been well researched, the diets and nutritional requirements of zooplankton are much less understood.
- **DNA primers:** primer libraries for zooplankton species in the estuary are lacking in detail and breadth of taxa coverage.



Communicate with Managers

Make sure to keep communication avenues open between researchers and managers:

- **Publish data in an accessible format and make it publicly available.**
- **Detail the capabilities of zooplankton data to answer relevant management questions.**
- **Communicate results outside of publications at conferences and symposiums.** The 2020 Zooplankton Symposium had a mix of over 100 researchers and managers participate in both days!



Enhancing Your Zooplankton Research

Utilize Publicly Available Monitoring Data

Before starting a new zooplankton study, check what data is already available. In the San Francisco Estuary, there are decades of available zooplankton data spanning the region:

[IEP Zooplankton Study](https://wildlife.ca.gov/Conservation/Delta/Zooplankton-Study)

(<https://wildlife.ca.gov/Conservation/Delta/Zooplankton-Study>)

[CDFW 20-mm Survey](https://wildlife.ca.gov/Conservation/Delta/20mm-Survey)

(<https://wildlife.ca.gov/Conservation/Delta/20mm-Survey>)

[CDFW Summer Trawl and Fall Midwater Trawl Zooplankton Monitoring](https://iep.ca.gov/Science-Synthesis-Service/Monitoring-Programs/Fall-Midwater-Trawl)

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[CDFW Fish Restoration Program](https://portal.edirepository.org/nis/mapbrowse?packageid=edi.269.2)

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[DWR Zooplankton for Yolo Bypass Fish Monitoring](https://portal.edirepository.org/nis/mapbrowse?packageid=edi.494.1)

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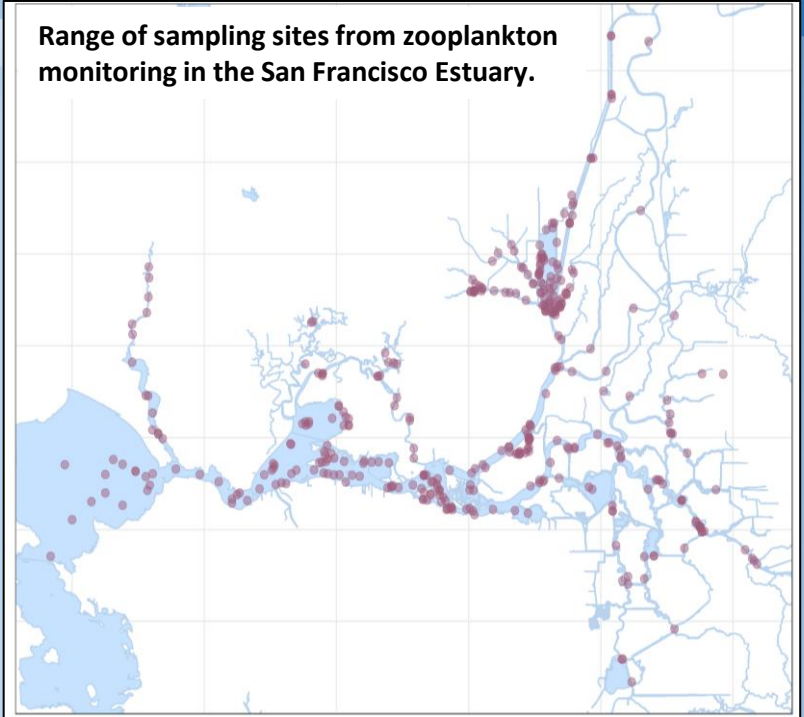
Much of the data from these studies has been synthesized in the Zooper package on [GitHub](https://github.com/InteragencyEcologicalProgram/zooper) and [EDI](https://portal.edirepository.org/nis/mapbrowse?scope=edi&identifier=539), and in a [web application](https://deltascience.shinyapps.io/ZoopSynth/).

(<https://github.com/InteragencyEcologicalProgram/zooper>)

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(<https://deltascience.shinyapps.io/ZoopSynth/>)

Range of sampling sites from zooplankton monitoring in the San Francisco Estuary.



Invest in New Technologies

Two branches of emerging technologies are changing the way in which zooplankton monitoring and research is conducted:

1. Modular, low-cost, and opensource devices like the PlanktonScope, allow for cheap imaging and identification of zooplankton samples, geared towards encouraging citizen science.
2. Autonomous underwater vehicles like the *Dorado* AUV used by the Monterey Bay Aquarium Research Institute, allow for near continuous, non-invasive sampling of zooplankton using state of the art imaging and machine learning.

PlanktonScope

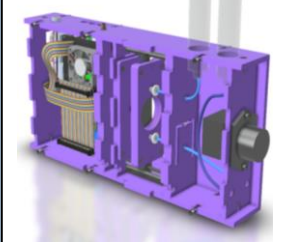


Image credit: planktonscope.org

Dorado AUV



Image credit: Monterey Bay Aquarium Research Institute:
https://www3.mbari.org/aosn/AOSN_MB2003table.htm

Learn From Prior Research

- Use comparable methods.
- Publish data in an accessible format (i.e. .csv files instead of access database).
- Document which taxa are identified and when methods change.
- Maximize taxonomic resolution.
- Be explicit about zeros and blank data.
- Provide detailed location information, including GPS coordinates.