Fish Guts: Open for a View of Cyclopoids in the San Francisco Estuary

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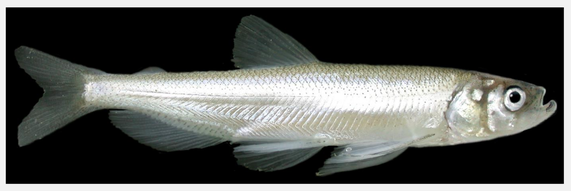
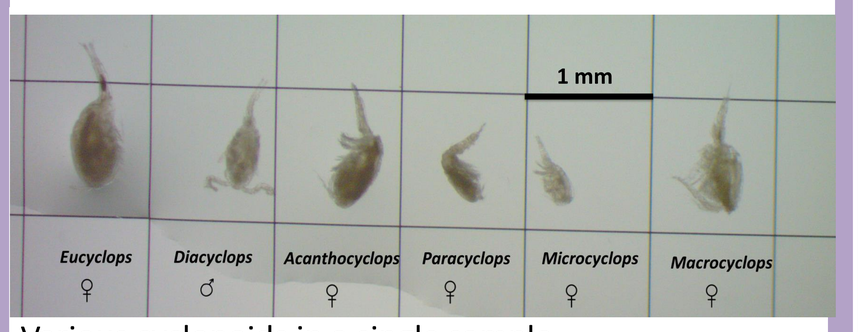


Introduction

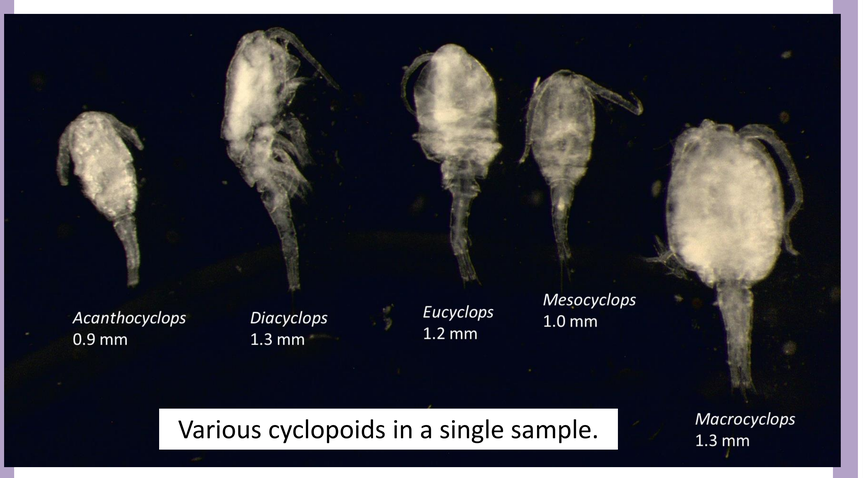
- Multiple projects within the Interagency Ecological Program (IEP) collect and identify zooplankton in the San Francisco Estuary (SFE).
- Zooplankton are essential prey items for fishes in the SFE including Delta Smelt (DS) and Longfin Smelt (LFS).
- One of the essential prey items are Cyclopoid copepods.
- Cyclopoid copepods are less studied than Calanoid copepods, despite their similar appearance in some genera.
- Cyclopoid genera can resemble each other at various life stages and are difficult to identify, especially in a digested state as the California Department of Fish and Wildlife (CDFW) Diet Study identifies them.
- Other zooplankton monitoring projects within IEP identify *Acanthocyclops*, *Limnoithona*, and *Oithona* to genus or species, and classify many cyclopoid genera as “other cyclopoid”.
- This poster addresses the importance of identifying these “other cyclopoids” to genus.



Various cyclopoids in a single sample.

Methods

- Fish were collected by several long-term monitoring projects conducted by the US Fish and Wildlife Service and CDFW
- Gut content analyses were conducted by the CDFW Diet Study from years 2012 to 2019.
- All stomach contents were identified to the lowest practical taxonomic level.
- The CDFW Diet Study currently identifies:
  - *Acanthocyclops* and *Limnoithona* to genus
  - *Oithona* to species
  - 9 cyclopoid genera as “Other Cyclopoids”
- Genus of “Other Cyclopoids” were consistently commented from years 2012 to 2019.

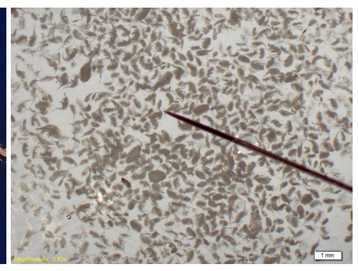


Various cyclopoids in a single sample.

Results

Open stomach sample

Cyclopoid heavy sample



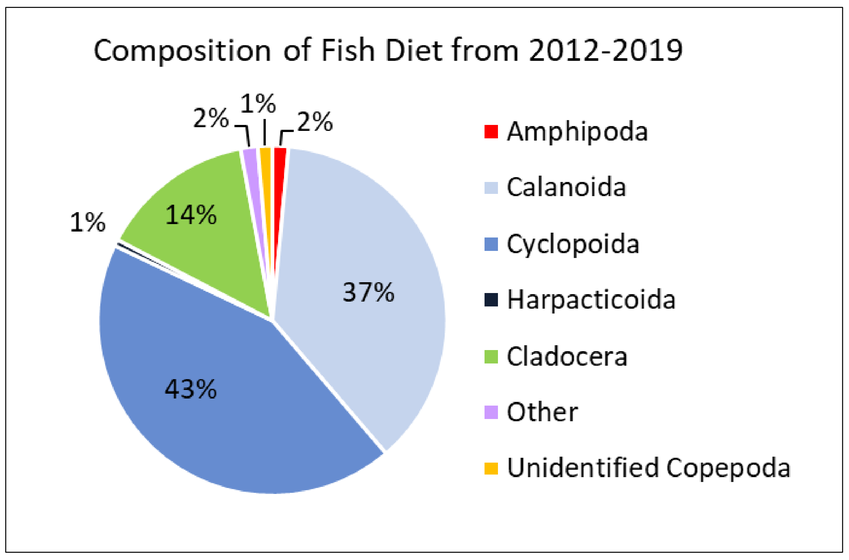


Figure 1. Total diet composition by number of Delta Smelt and Longfin Smelt from years 2012 to 2019.

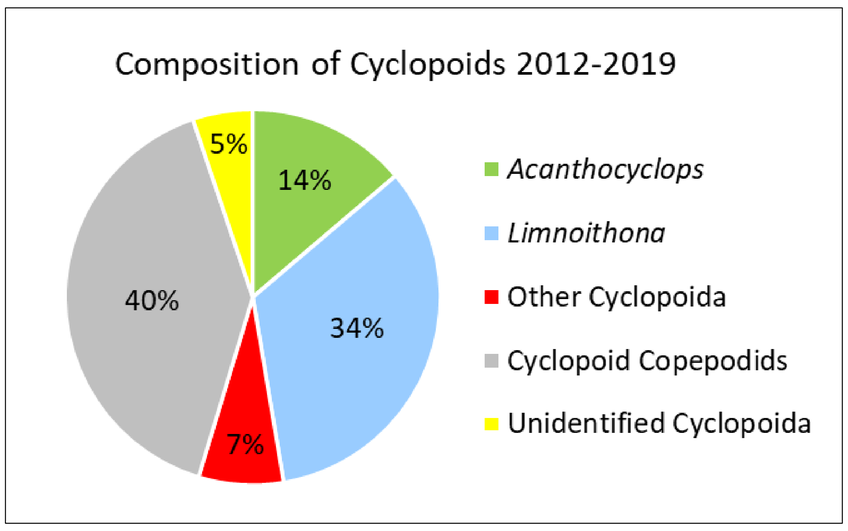
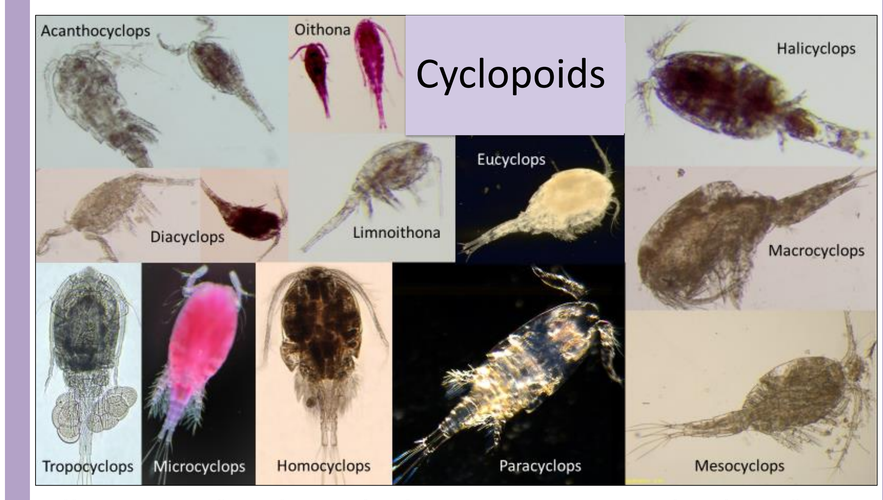


Figure 2. Composition of cyclopoids in Delta Smelt and Longfin Smelt diets from years 2012 to 2019.



All genera of cyclopoids the CDFW Diet Study identifies.

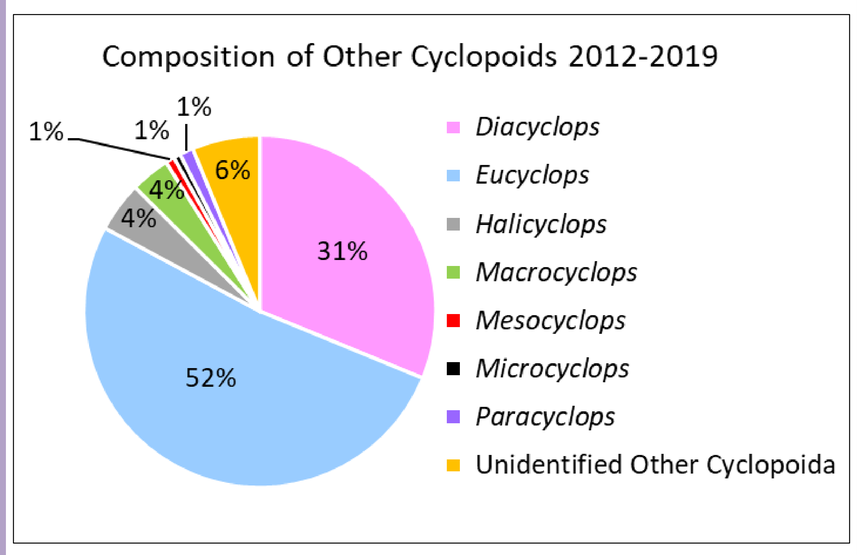
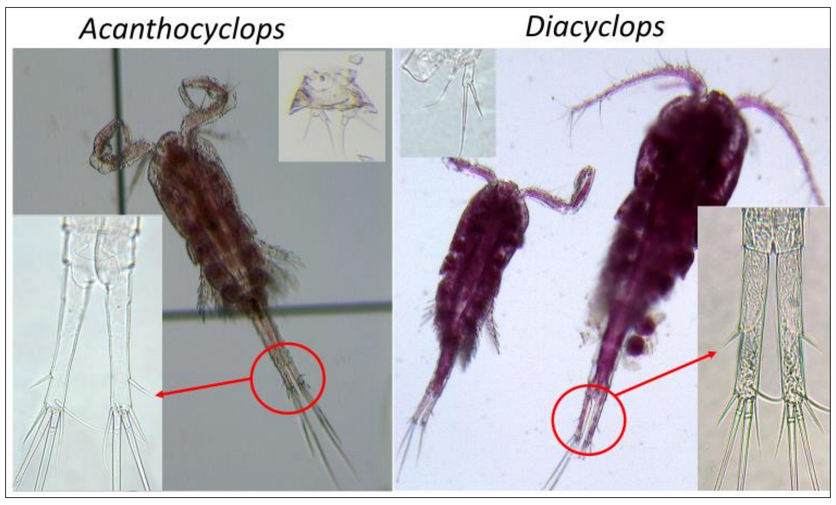


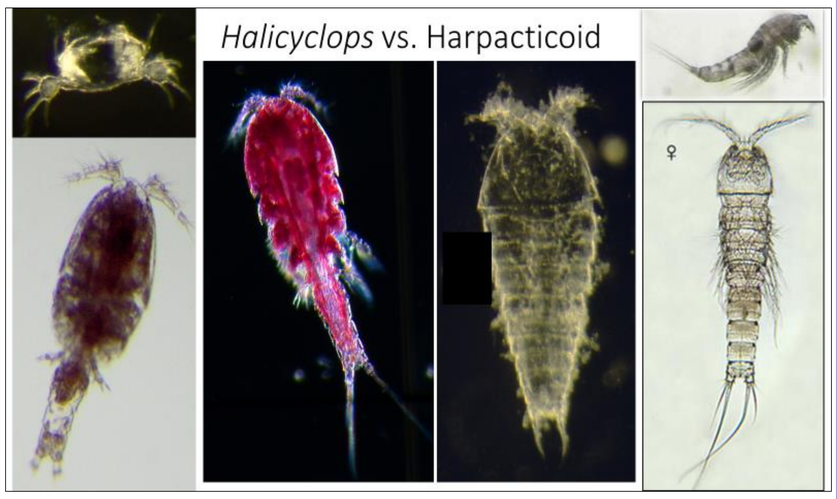
Figure 3. Composition of other cyclopoids in Delta Smelt and Longfin Smelt diets from years 2012 to 2019.

Results continued

- *Acanthocyclops* look very similar to *Diacyclops*, a cyclopoid classified as “other”. Lateral spine placement is a key identifying feature.



- Cyclopoid genera can also look similar to other orders of zooplankton. Halicyclops can look like harpacticoids, a different copepod order.



Discussion

- Further identification of these “Other Cyclopoids” is important as they can easily be confused with *Acanthocyclops* and some calanoid genera.
- In addition to ensuring correct identification, focusing on lower cyclopoid taxa levels brings greater clarity to the dynamics of cyclopoid communities.
- Over time, detection of changes in cyclopoid composition could reflect changes in food availability, the environment, or the introduction of non-native species.
- A future study could examine cyclopoid life histories and their environmental tolerances compared to where our fish were eating these important prey items within the SFE.

Acknowledgements

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References

- Hudson, Patrick L., and Lynn T. Lesko. 2003. Free-living and Parasitic Copepods of the Laurentian Great Lakes: Keys and Details on Individual Species. Ann Arbor, MI: Great Lakes Science Center Home Page. http://www.glsc.usgs.gov/greatlakescopepods/