

Marine Invertebrate Zoology Summer A 2025

Copepods have unique roles in the trophic system, in which they act as a bridge between phytoplankton and the broader macroscopic food net. Being predator and prey, the number of variable copepod species may indicate an area's wider biodiversity. For analysis surrounding copepod research, the species first needs to be identified. This analysis approaches the identification of two copepod species through a variety of visual keying techniques.

Copepods were sourced through a plankton tow performed on July 10th, at approximately 4 am. Afterwards, samples were manually sorted from the collection solution, catalogued, photographed, and preserved in 95% ethanol for Scanning Electron Microscopy (SEM) imaging. One additional 95% ethanol wash was done to dissolve lingering salt crystals. T, Previous plankton barcoding data from 2021 and 2025, and the guide *Copepod Key: British Columbia Pelagic Marine Copepoda: An Identification Manual and Annotated Bibliography* were used to cross-reference specific morphology. Through this, a morphological analysis of two local copepod species was performed, determining at least the genus in both.

The two copepod species especially abundant amongst the plankton tow performed were clear with a red eye and clear with a red eye and two red bands. After ethanol preservation, specimens were mounted on an SEM stub through a drop of ethanol and sputter-coated. The SEM Imaging of either species was largely unsuccessful, as once the ethanol evaporated, the samples desiccated and did not retain the oval body plan of the hydrated copepods. Because of this, the SEM images collected were mainly unusable. The photos taken of the clear copepods included an accurate scale bar, which assisted with total body length estimations; However, this was not properly calculated within the imaging software for the red banded copepods, and therefore, a size approximation is not available. For the clear copepods overall, SEM revealed approximate sizes of 400-950 μm , similar morphologies were noted from previous identifications, and the key confirming that no rostrum, postero-lateral corner projections, and an overall oval, calanoid shape indicate this organism is likely *Acartia longiremis*. For the red-banded copepods, similar morphologies from the 2021 plankton data, which have confirmed DNA sequences. The short antennae (Length less than total body length), short caudal rami (Length is less than three times its width), and rounded postero-lateral corner and head indicate the organism is likely in the genus *Pseudocalanus*.

For future research involving the surveying of copepods, I'd emphasize image capture. If SEM is considered, I'd recommend exploring different imaging methods with compound or dissection microscopes first, then researching alternative ways of mounting other than the technique described here. Additionally, when photos are taken, it is incredibly important to capture multiple angles, ideally dorsally and laterally, of the copepod. This is to capture its antennae, body segments, and legs, all imperative morphological derivatives for speciation. Identifying common copepod species will be important for future population and morphological studies of copepod populations at Friday Harbor Labs.

Keywords: Copepod, Morphology, Scanning Electron Microscopy(SEM)

References

Gardner G. A., Szabo I. (1982). *British Columbia Pelagic Marine Copepoda: An Identification Manual and Annotated Bibliography*. Minister of Supply Services Canada, Sci: 62: 536

Ruppert E. E., Fox R. S., Barnes R. D., (2004). *Invertebrate Zoology, A Functional Evolutionary Approach, Seventh Edition*. Brooks/Cole-Thomson Learning, 669-674.

Kozloff E. N., (1996). *Marine Invertebrates of the Pacific Northwest*. University of Washington Press, 303-310.

FHL Plankton DNA Barcoding Literature Folder

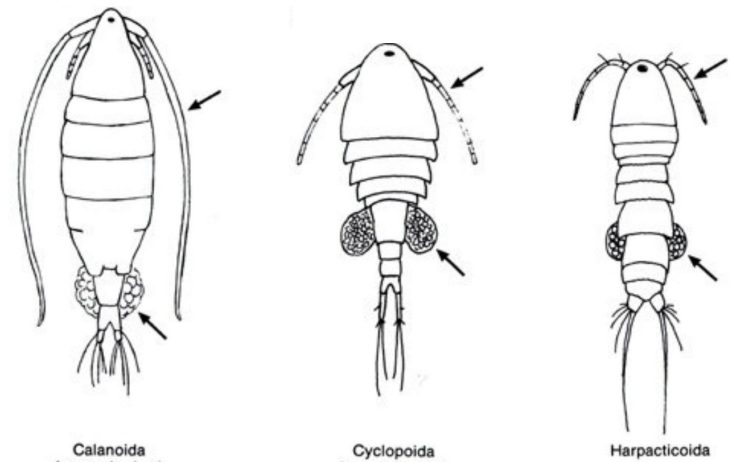
The background of the slide is a collage of six microscopic images of copepods. The top row shows three copepods: a dark, rounded one on the left, a transparent one in the center, and another dark one on the right. The bottom row shows three more copepods: a light-colored one on the left, a transparent one in the center, and a dark one on the right. The text is overlaid on a semi-transparent dark grey background.

Morphological Analysis of Local Copepod Species

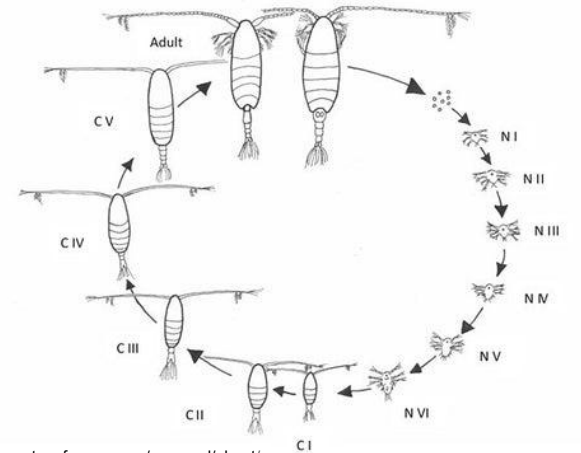
Amanda Schupner
Marine Invertebrate Zoology
FHL 432
July 17 2025

Background

- Phylum: Arthropoda, Class: Copepoda, Orders: Calanoida, Cyclopoida, Harpacticoida
- General Morphology: 1-5mm oval shape, transparent exoskeleton, long antennae
- Inhabit most marine environments, saltwater, freshwater, even other organisms!
- Consume phytoplankton, detritus, bacteria
- Females release fertilized egg sacks, Nauplius larvae hatch and molt until adulthood, remain planktonic
- Diel Vertical Migration (DVM)



https://www.researchgate.net/publication/304990172_Live_feed_for_marine_fish_and_shellfish_culture



<https://www.st.nmfs.noaa.gov/copepod/about/>

Why Study Copepods?

- Unique and imperative role in trophic system
 - Act as a bridge between phytoplankton and macroscopic food net
- Indicator of biodiversity
 - Extension of class project
- Morphological analysis of local copepod species, examining copepods present around the FHL dock.
 - Goal to identify two species of abundant copepods



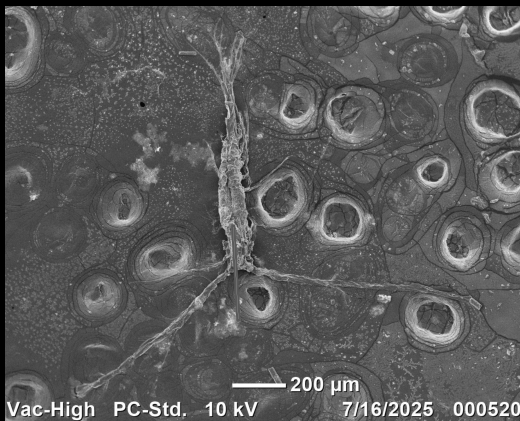
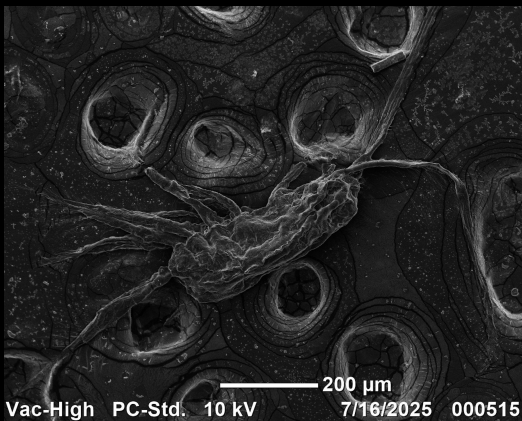
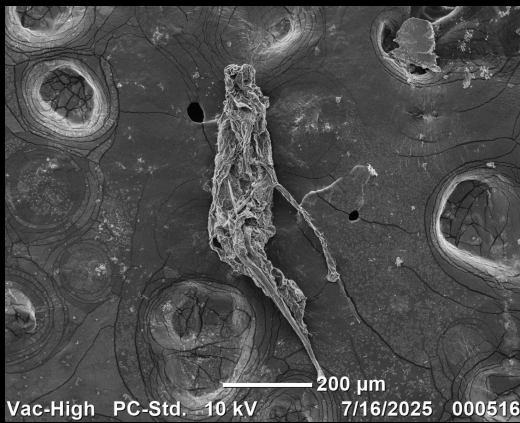
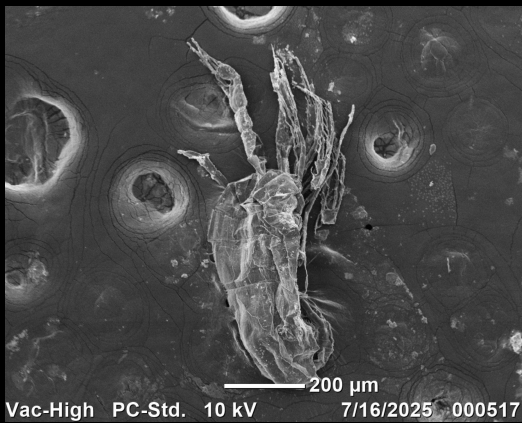
Methods

- Copepods sourced via plankton tow July 10th, approximately 4am
- Sorted, catalogued, and photographed species of interest. Collected samples were preserved in 90% ethanol and imaged with SEM
- Collected samples cross referenced with:
 - Previous plankton barcoding data from 2021 and 2025
 - Copepod Key: *British Columbia Pelagic Marine Copepoda: An Identification Manual and Annotated Bibliography*

Dissection Microscope Images



SEM Imaging Results



Analysis

SEM: Approximate sizes of 400–950 μm

Key:

- No rostrum
- Postero-lateral Corner projections
- Overall oval, calanoid shape

eDNA:

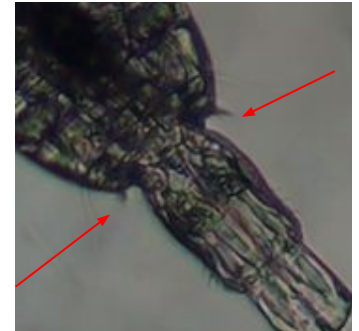
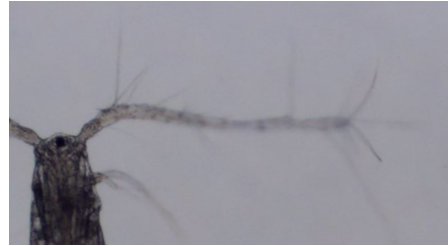
- Similar morphologies, previous identification

Likely *Acartia longiremis*

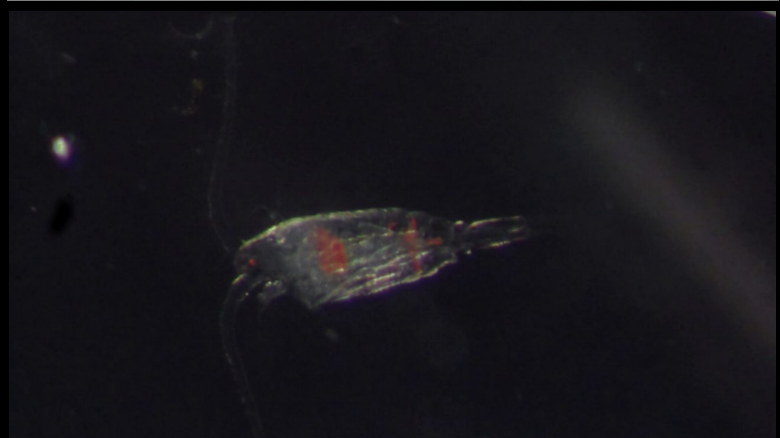
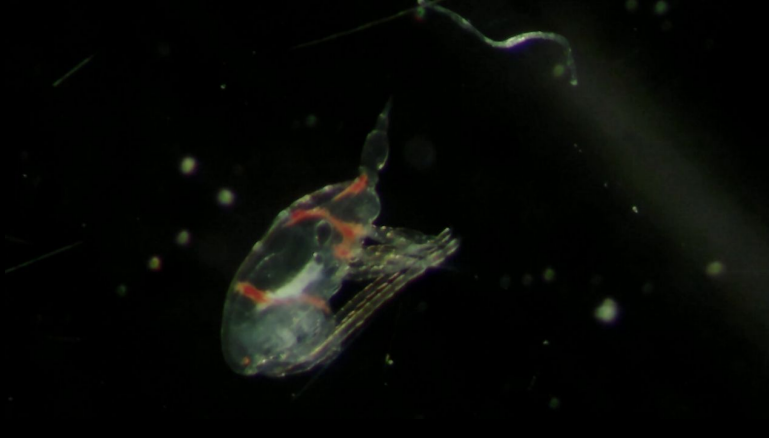
2021



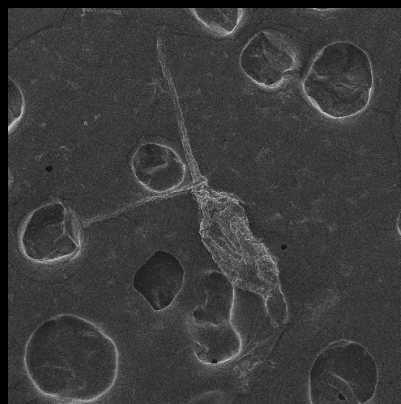
2025



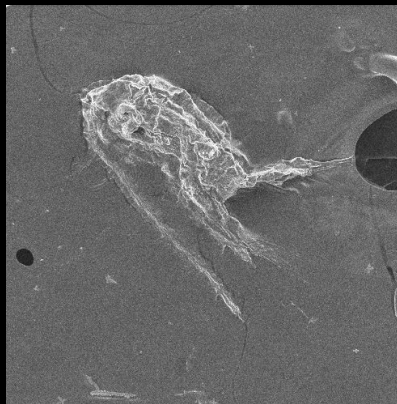
Dissection Microscope Images



Imaging Results



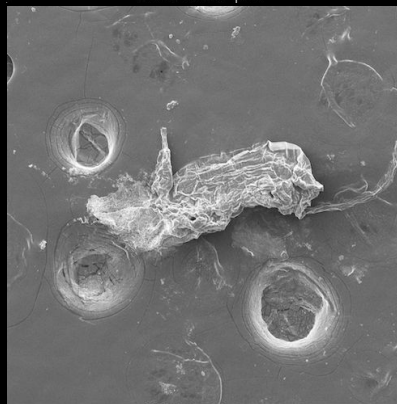
29220.00 μm



29220.00 μm



29220.00 μm



29220.00 μm

Analysis

SEM: Approximate sizes unavailable, images taken without note of proper magnification

eDNA:

- Similar morphologies, multiple identifications

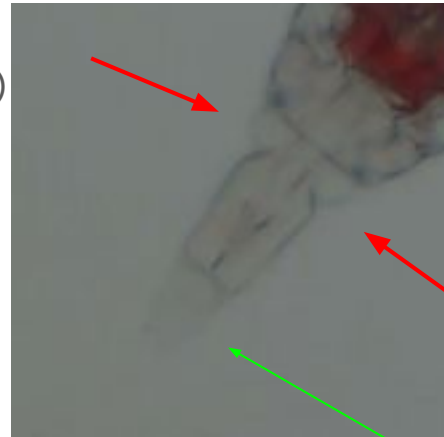
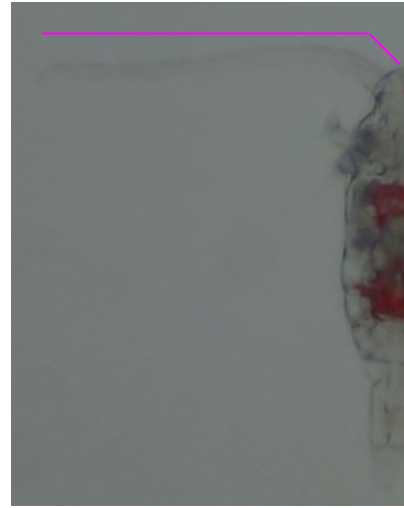
Key:

- Short antennae (Length less than total)
- Short Caudal Rami (Length $< 3 \times$ width)
- Postero-lateral corner and head

are rounded

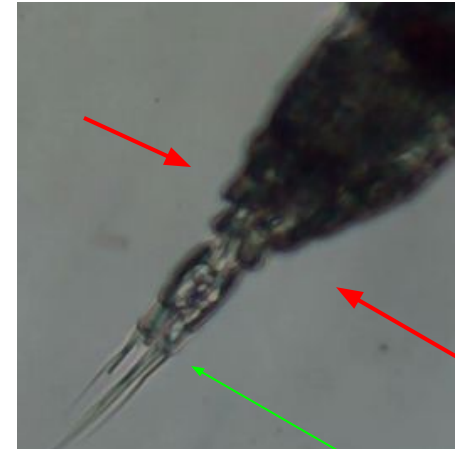
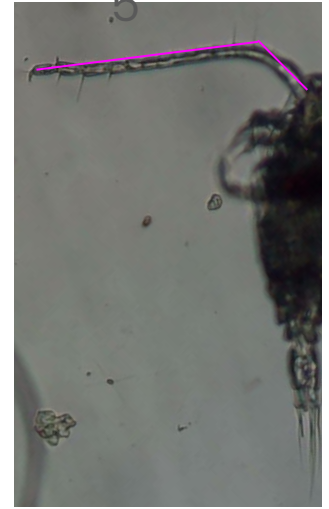
Likely *Psuedocalanus* sp.

2021



202

.5



Conclusion

- Clear copepods collected are likely *Acartia longiremis*
- Red banded copepods are likely *Pseudocalanus sp.*

Future Research

- Alternative SEM mounting techniques or imaging methods
- Take clear photos with multiple angles, emphasis antennae, body segments, and legs

Acknowledgments

- Friday Harbor Labs
- Our Lovely Professors, Dr.Rebecca and Dr.Megan
- Plankton Support Team
- Invert Class



References

Gardner G. A., Szabo I. (1982). British Columbia Pelagic Marine Copepoda: An Identification Manual and Annotated Bibliography. Minister of Supply Services Canada, Sci: 62: 536

Ruppert E. E., Fox R. S., Barnes R. D., (2004). Invertebrate Zoology, A Functional Evolutionary Approach, Seventh Edition. Brooks/Cole–Thomson Learning, 669–674.

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