Mallori Standley
Marine Invertebrate Zoology Summer A 2025

Mysids of the Salish Sea: Utilizing eDNA to monitor zooplankton morphology and biodiversity.

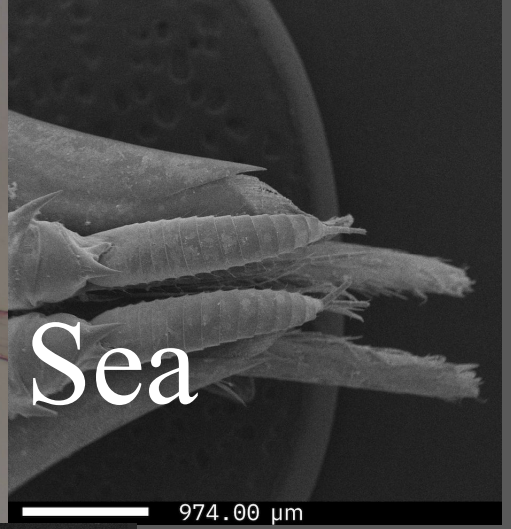
Abstract

The resilience of marine life is increasingly challenged by environmental changes. Due to exploitative fishing practices, urbanization along coastal regions, and other pollutive human actions, the structural and functional features of our marine environments have been sacrificed. At this accelerated rate of habitat loss, methods of fast and efficient biomonitoring are greatly needed in order to protect our marine ecosystems. Biodiversity assessment of marine zooplankton are beneficial for understanding environmental changes within marine ecosystems, as they play a crucial role in the pelagic food web and are rapid responders to ecological change.

To gather information on biodiversity within the Salish Sea we performed a plankton tow on June 28th, 2025 around 1330, located at the dock at Friday Harbor Laboratories (FHL). This was followed by another plankton tow shortly after dusk, at approximately 2300, which was compared to our daytime samples. These plankton samples were split into two divisions, half were sent for traditional environmental DNA (eDNA) metabarcoding and the remaining half were hand sorted to identify unique morphospecies.

As an extension of this metabarcoding project, I carried out a species focused project on identification of the order Mysida. There are approximately 1200 documented species of mysids currently, often under sampled in traditional methods of DNA barcoding. Mysid specimens were collected solely from the night time plankton tow. Given their horizontal and diel migration patterns, they are less likely to be found in day time plankton samples. Two morphologically different species of mysids were photographed using compound microscopy and sent for DNA sequencing. Eleven specimens were preserved in 95% ethanol and mounted for scanning electron microscopy. SEM was utilized to uncover diagnostic features, with the aim to identify each individual species. Specifically looking for spines on the antennal scale, telson morphology, and statocysts. Due to beam alignment malfunctioning on the NeoScope JCM 5000, electron microscopy images were limited given these recurrent maintenance issues. This unfortunately led to poor image quality, leading to an inability to ID the mysid specimens.

Nonetheless biodiversity assessments of marine zooplankton are essential, as they remain significantly underdocumented. Despite the long history of zoological research and routine DNA barcoding at FHL, prior DNA barcoding efforts revealed over 47% of daytime plankton samples were not barcoded. Given the significance of zooplankton for understanding environmental changes within marine ecosystems, eDNa serves as a powerful tool for non-invasive biodiversity assessments.



Mysids of The Salish Sea

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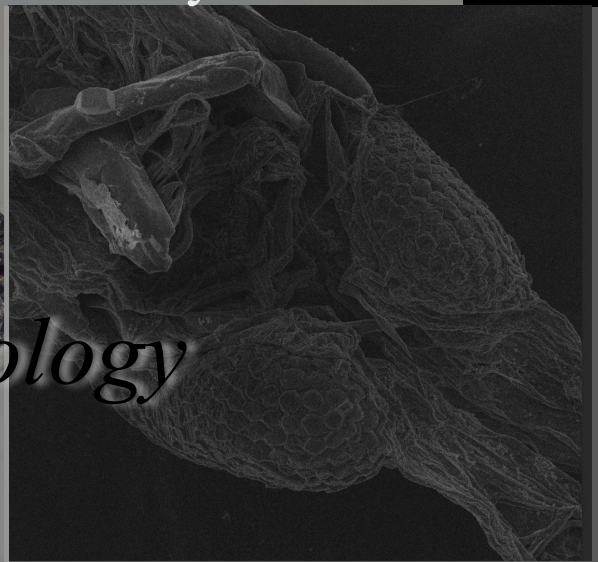
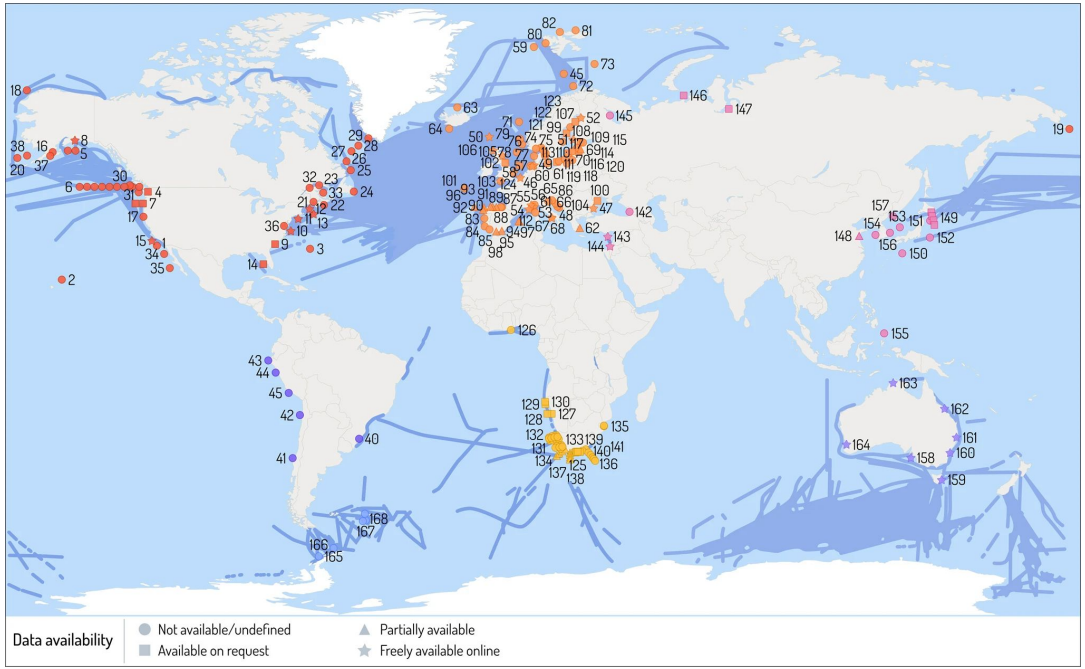
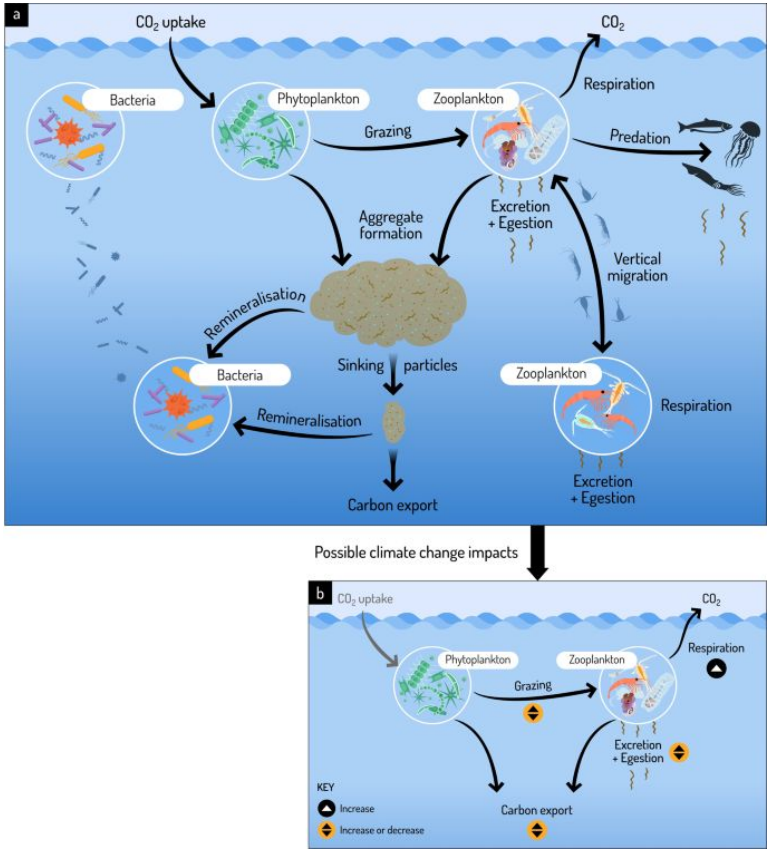


Marine Invertebrate Zoology

FHL 432

Zooplankton - Important Marker of Biodiversity





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Metabarcoding vs. Direct Sequencing

Metabarcoding Pros:

-Can see rare zooplankton morphospecies!

-Not all species barcodes are documented.

Direct Sequencing Pros:

- Less time consuming.

However direct sequencing methods often miss unique morphospecies

In Dr. Schwartz's prior study at FHL, during July 2021, over 47% of the day time plankton sample collected from the dock did not have DNA barcodes.

Of the nightime plankton samples two Mysida specimens resulted with no matching DNA barcodes across all databases.

Methods

Day plankton tow, performed around 1330 on 06/28/2025

Samples were divided into two, one was sent for eDNA and metabarcoding while the other half was analyzed by hand sorting.

Unique morphospecies were preserved in 95% ethanol, including 11 Mysida specimens. Utilized scanning electron microscopy (SEM) for species identification.

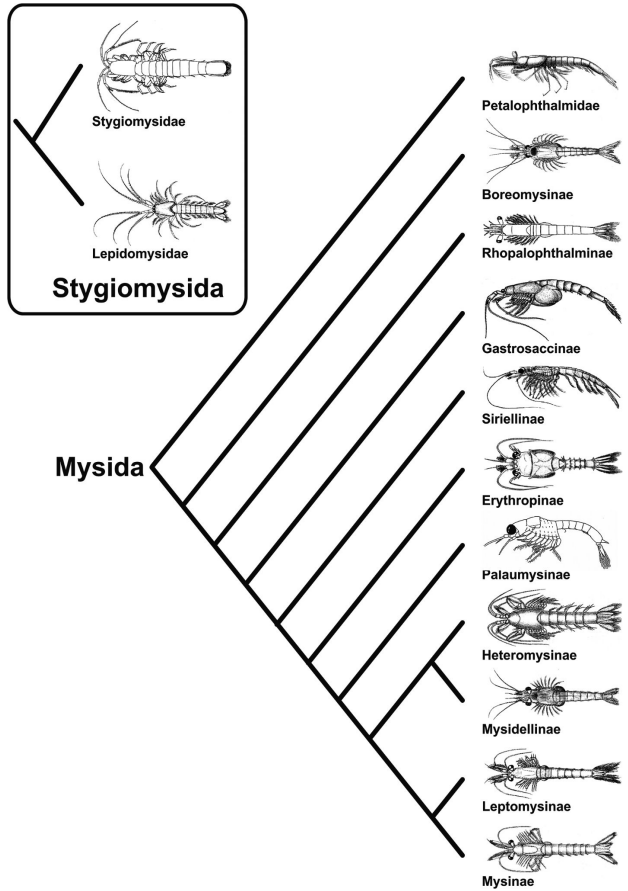
Night plankton tow, performed around 2330 on 06/28/2025

Mysida

Phylum: Arthropoda
Class: Malacostraca
Order: Mysida

Ecological Role
-Prey for fishes and birds
-Feed on algae and other zooplankton

Mysidopsis bahia is commonly used as a model for toxicity testing

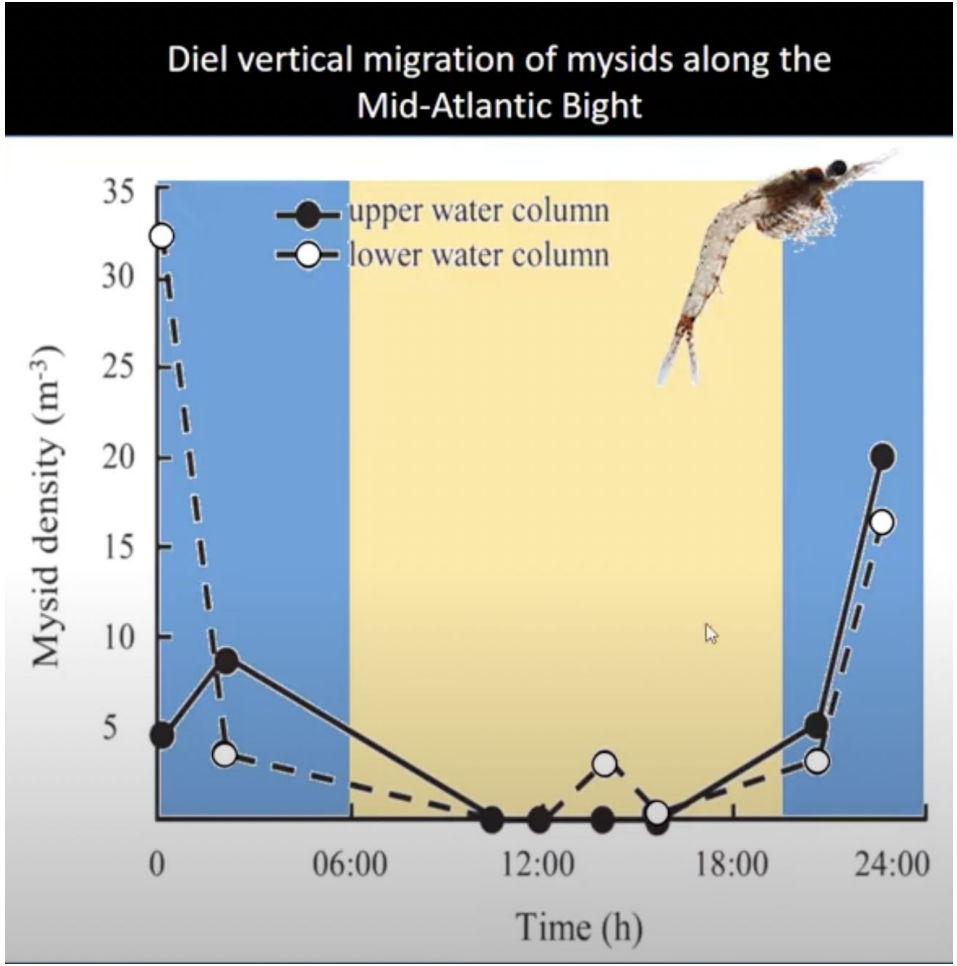


Meland K, Mees J, Porter M, Wittmann KJ (2015) Taxonomic Review of the Orders Mysida and Stygiomysida (Crustacea, Peracarida). PLOS ONE 10(4): e0124656. https://doi.org/10.1371/journal.pone.0124656

Migration Patterns

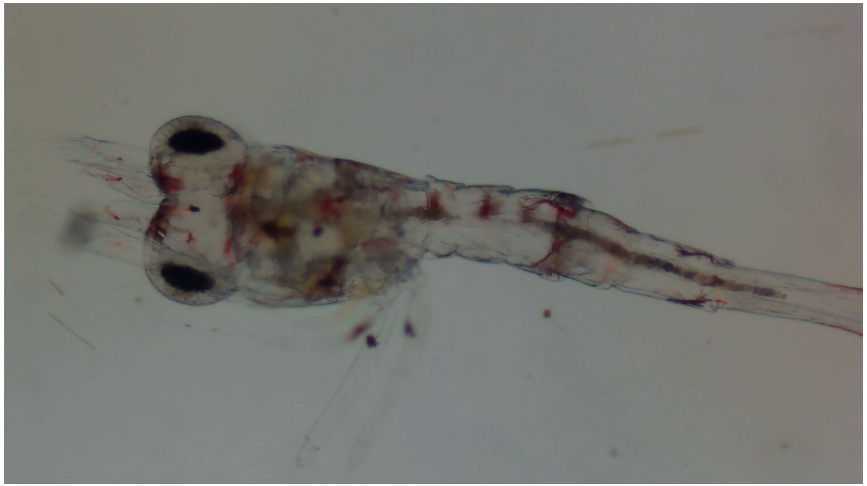
Tend to aggregate in the day time, partial dispersal at night

Horizontal Migration
-in-shore and offshore movements
-daily and seasonal migrations

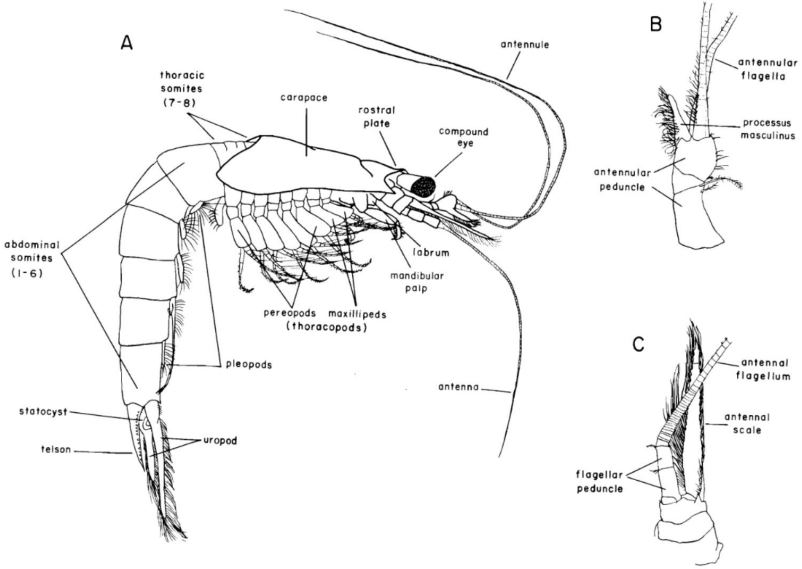


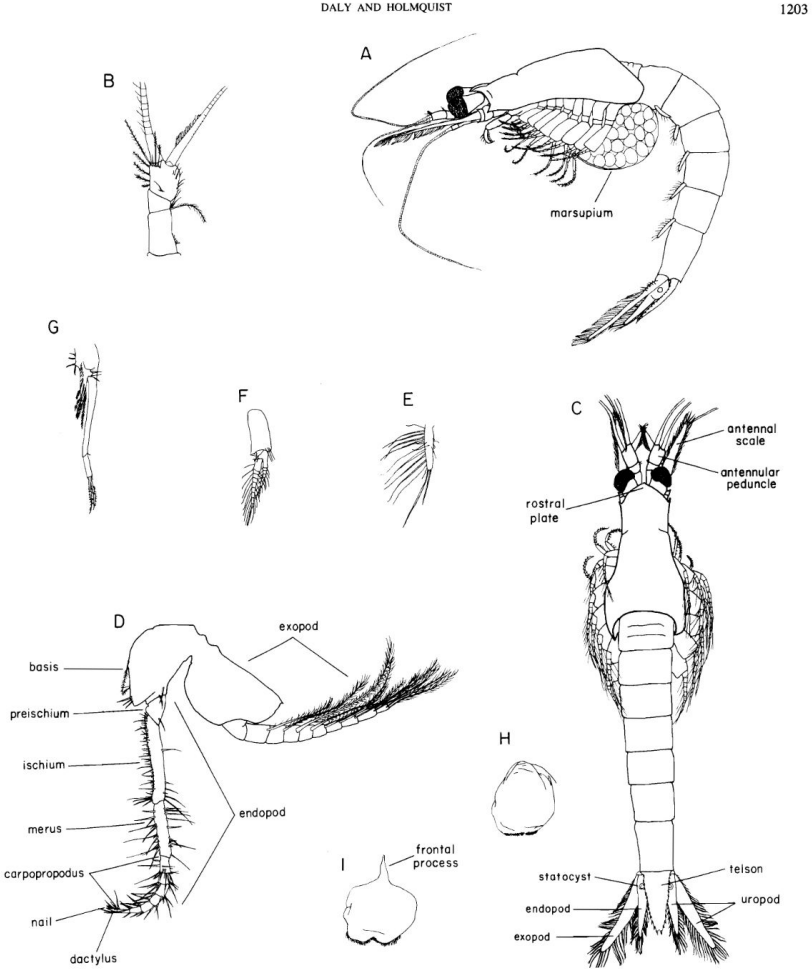
Gibson, R & Atkinson, R & Gordon, J & Editors, Taylor & In, Francis & Jumars, Peter. (2007). HABITAT COUPLING BY MID-LATITUDE, SUBTIDAL, MARINE MYSIDS: IMPORT-SUBSIDISED OMNIVORES. An Annual Review. 45. 89-138.

Mysids sent for DNA sequencing

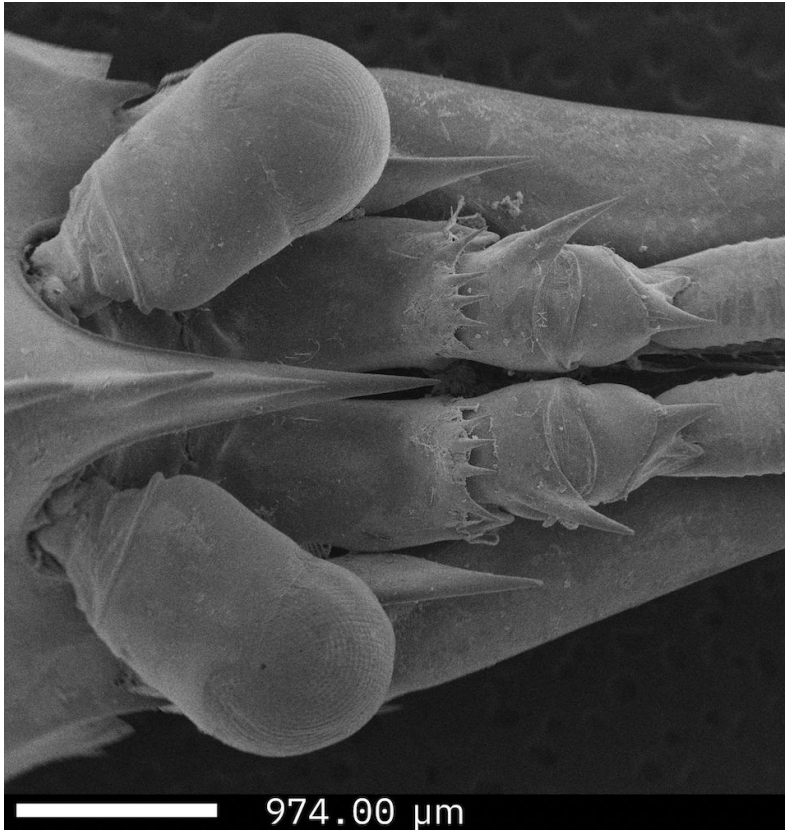


Morphology





Kendra L. Daly and Charlotte Holmquist. 1986. A key to the Mysidacea of the Pacific Northwest. *Canadian Journal of Zoology*. 64(6): 1201-1210. https://doi.org/10.1139/z86-179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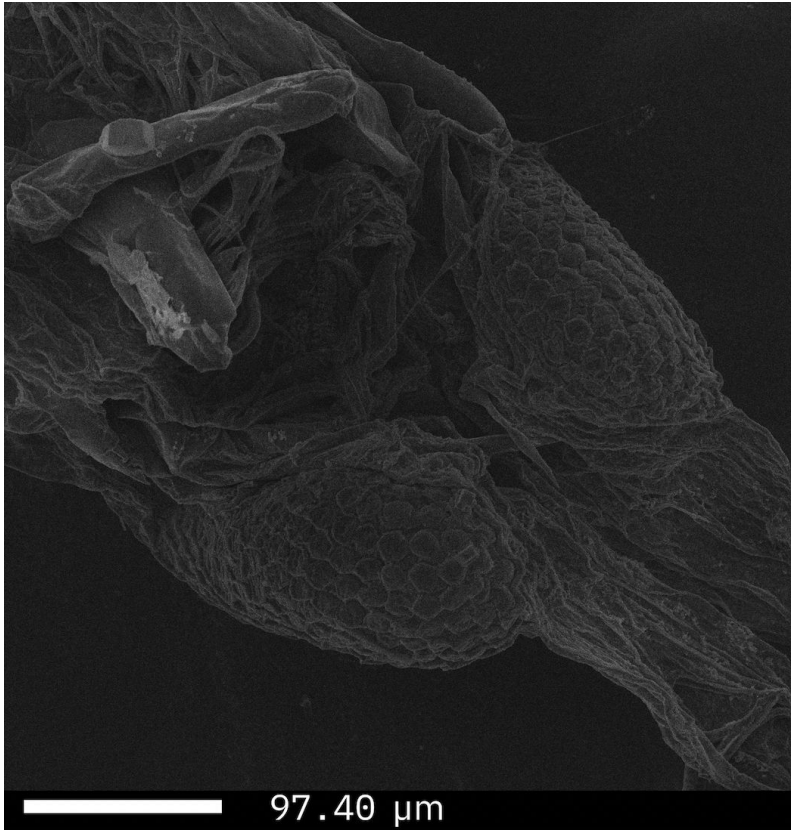
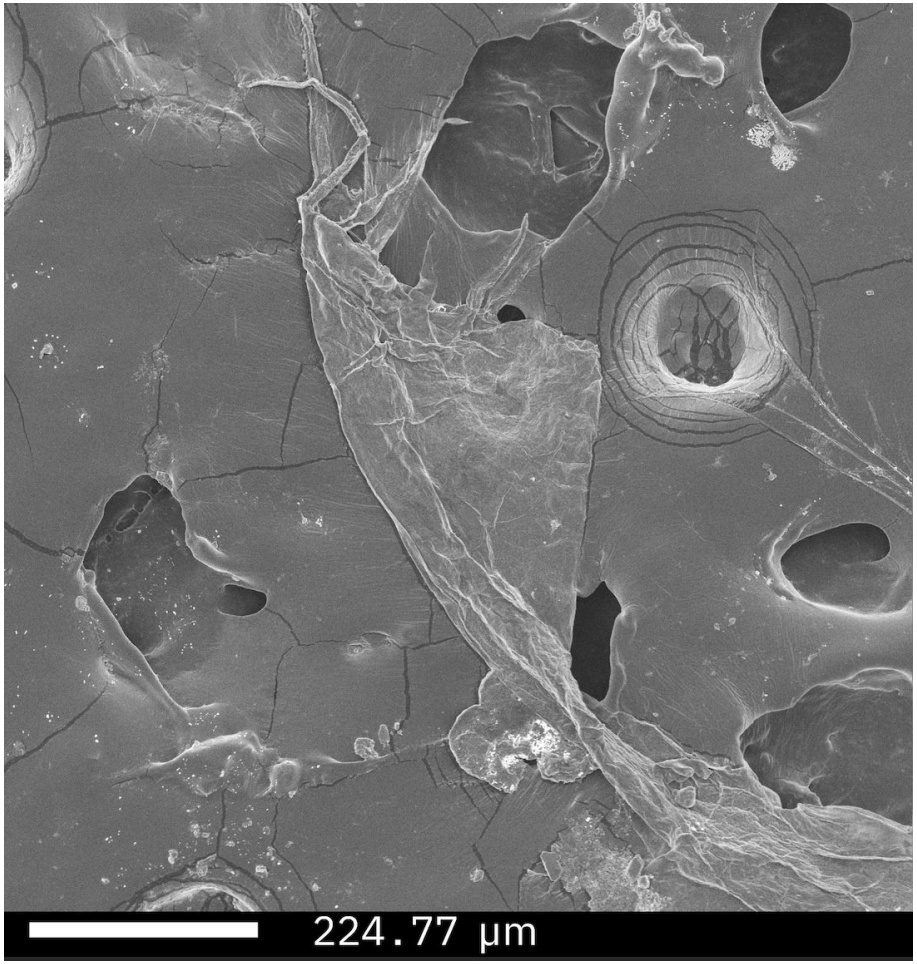
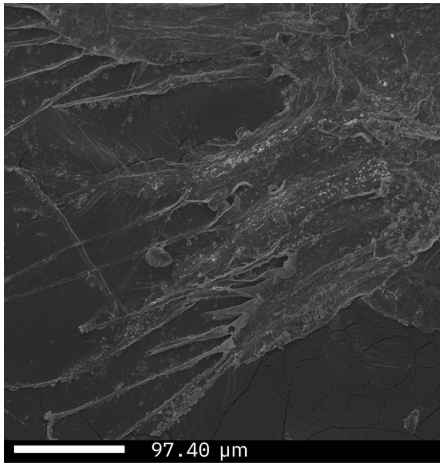
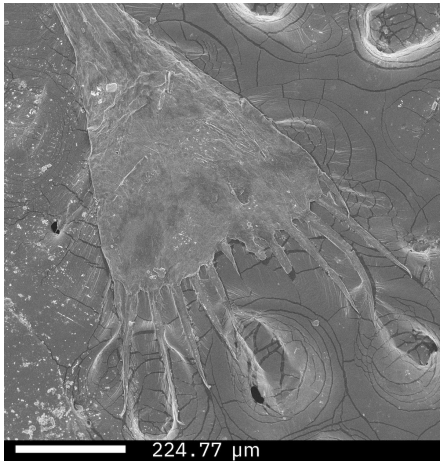
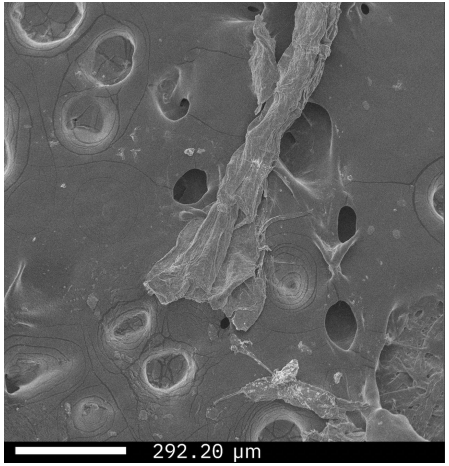
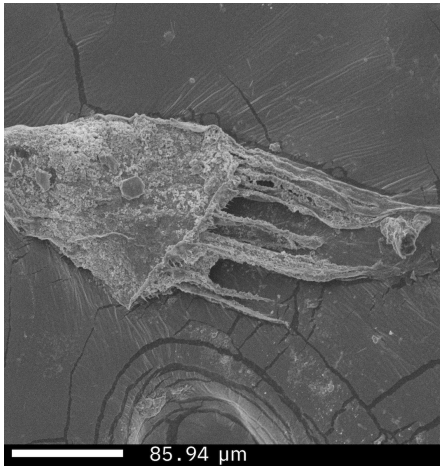

97.40 µm


224.77 µm


97.40 µm


224.77 µm


292.20 µm


85.94 µm

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Acknowledgements

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