Microplastic Distribution & Impact on Eastern Oysters and Blue Mussels in the Harpswell Sound
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Introduction

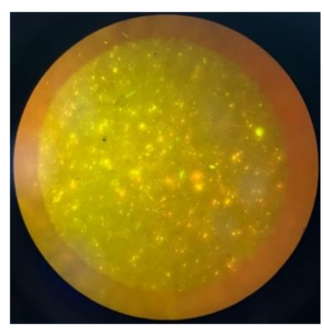
Eastern oysters (*Crassostrea virginica*) and blue mussels (*Mytilus edulis*) are filter feeders that draw up their food and nutrients from their surrounding water, making them both a sustainable, low-effort marine farming species. Eastern oysters and blue mussels are bioindicators for the health of a marine environment since they are susceptible to water column pollution. The Gulf of Maine is one of the most rapidly warming locations in the ocean, leading to a growing aquaculture industry, creating 44% of marine edible products by 2050 (Costello et al., 2020). The Harpswell Sound has a reverse estuary gradient, meaning the river inputs from the Kennebec River wraparound and flow up the estuary instead of down (True and Manning, 2005). This system's uniqueness means there is limited knowledge on the movement of microplastics across the sound. In estuary environments, river flow impacts microplastic accumulation, and across estuaries complex environmental factors affect the distribution of plastic particles making tracking microplastics an important study (Malli et al., 2022). In eastern oysters and blue mussels, the impact of microplastics is not yet well studied, especially in an estuary setting with known microplastic concentrations. In controlled settings, bivalves have been shown to most efficiently consume microplastic beads compared to other aquatic feeding types, making bivalves at risk for high microplastic concentrations (Setälä et al., 2016). Understanding the impacts of microplastics on the aquaculture species of oysters and mussels makes this research especially relevant and unique in understanding the impacts of tides and planning location of aquaculture farms. For my research, my advisor and I studied the uptake of microplastics in blue mussels and eastern oysters compared to the water microplastic levels to gain a better understand on how microplastics impact aquaculture and filter feeders.

Methods

Biweekly water samples along five points, with each point measured at surface and mid water column, on the Harpswell Sound were collected and processed for the microplastic distribution in the water along ebb and flood tide. Then, buoys at the first last and middle points along the Harpswell Sound were deployed and collected on the same biweekly schedule to compare the water microplastic levels to that of each filter feeder sample. On each buoy, two bait bags containing 6 eastern oysters (*Crassostrea virginica*) and 6 blue mussels (*Mytilus edulis*) were deployed 1 meter below the surface. The oysters and mussel sample were cleaned and shucked to isolate the body tissue which was dried out and then digested. The digested samples were then density separated and vacuum filtered to capture the microplastics contained in each organism. These microplastics were stained with Nile Red and then visually analyzed through microscopy. The filters were then photographed and will be analyzed on image J for size, number, and types of microplastics across the sites and samplings.

Future Directions

We are at the stage where we have photographed stained microplastics on filters (as seen in the image to the right). This fall, I will continue data analysis and sorting of the microplastic filters along with water sample collection and processing as an independent study.



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References: **Costello, C., Cao, L., Gelcich, S., Cisneros-Mata, M. Á., Free, C. M., Froehlich, H. E., Golden, C. D., Ishimura, G., Maier, J., Macadam-Somer, I., et al.** (2020). *Nature* **588**, 95–100; **Malli, A., Corella-Puertas, E., Hajjar, C. and Boulay, A.-M.** (2022). *Marine Pollution Bulletin* **177**, 113553; **Setälä, O., Norkko, J. and Lehtiniemi, M.** (2016). *Marine Pollution Bulletin* **102**, 95–101. **True ED, Manning JP.** (2005). 1:28.