Microplastics in the surface seawater of the Monterey Bay National Marine Sanctuary

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Introduction

Microplastics, (100nm-5mm) are the most common size class of plastics in marine environments. They can enter the food web and have consequences both in individual physiology and community ecology.

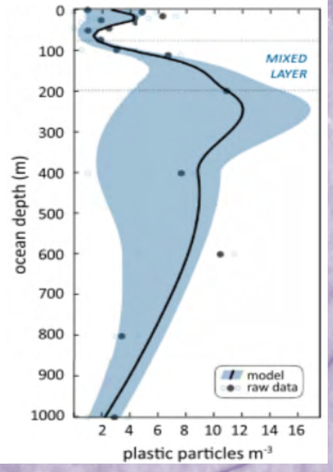
The Monterey Bay National Marine Sanctuary (MBNMS) is the largest marine protected area in the United States, relying heavily on ecotourism and fisheries.

Recent research[1] in the MBNMS sampled for microplastics at depth (5-1000m)

Found highest concentrations between 200-600m, see figure →

Concentrations were higher in offshore samples compared to nearshore

Most common type were PETs



Methods

Sample Collection

- Surface seawater samples (n=27) collected from 2017-2019
- Used a manta trawl net (355µm mesh size, see inset on Figure 1 at right) and a metal sieve (300µm)
- Nearshore (Santa Cruz Boardwalk & Marina Outfall) & 2 offshore (Sur Ridge & Davidson Seamount)

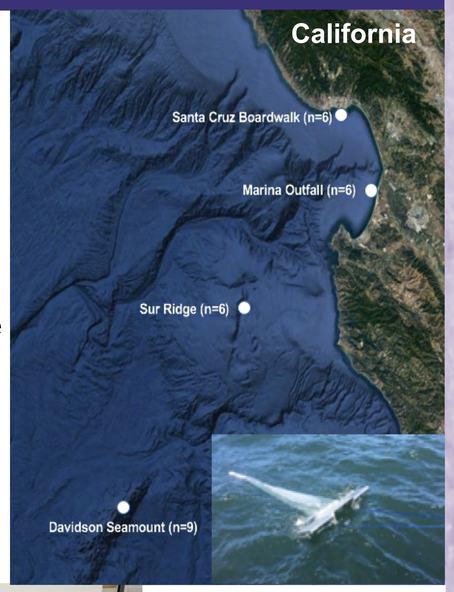


Figure 1 (Above), Map of sampling locations and image of manta trawl net

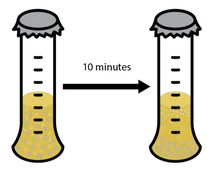
Figure 2 (Left). Sample jars at the MBNMS, NOAA office in Pacific Grove, CA

Methods Continued

Microplastic Isolation

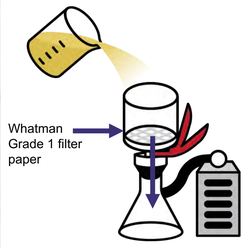
1. Initial filtration:

2. Density separation:



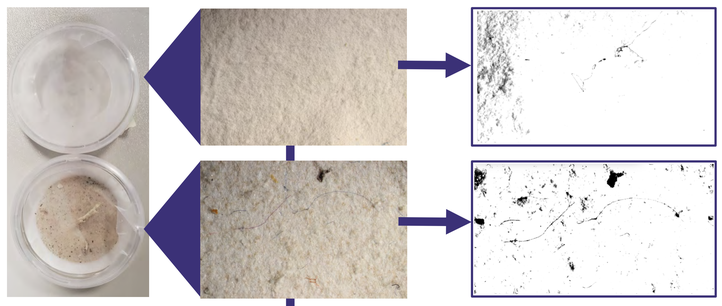
3. Digestion:

4. Final filtration:

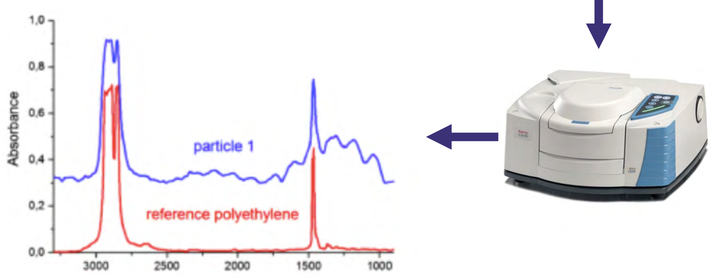


Quantify/Confirm Microplastics

1. High-resolution microscopy and ImageJ software to quantify particle number



2. Fourier-transform infrared spectroscopy (FT-IR) to confirm polymer[2] type



Results

There does not appear to be a significant difference between particle concentrations in nearshore and offshore samples (Figure 3.)

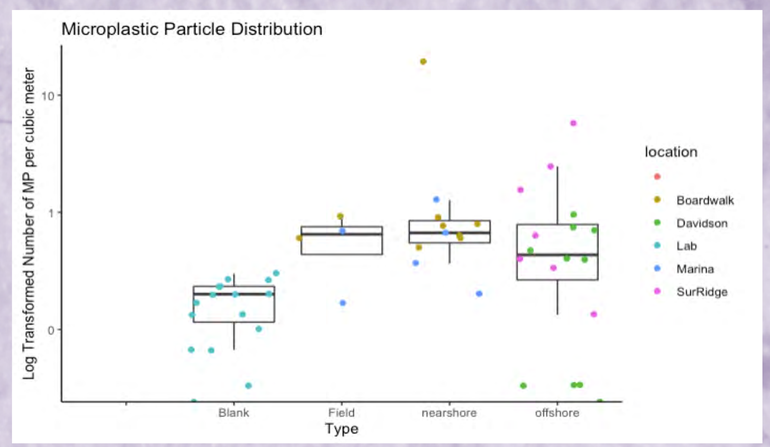


Figure 3. Displays microplastic particle counts per cubic meter of seawater in nearshore and offshore samples. Different color points also represent different sampling locations

Future Work

- Are microplastics entering the MBNMS biota and how microplastic particles are moving through the food web?
- Model the risk of microplastic ingestion to top predators (baleen whales) in this ecosystem
- Sample krill, anchovy, and whale GI contents for microplastics (Figure 5).
- Consider seasonal oceanographic features

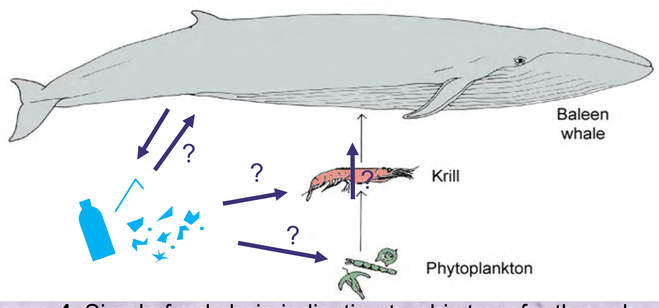


Figure 4. Simple food chain indicating trophic transfer through phytoplankton, krill, up to baleen whales.

Acknowledgments

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References: [1]Choy C. A., Robison B. H., Gagne T. O., Erwin B., Firl E., Halden R. U., Hamilton J. A., Kajita K., Lisin S. E., Rolsky C., Van Houtan K. S., (2019) The vertical distribution and biological transport of marine microplastics across the epipelagic and mesopelagic water column. Nat. 9: 7483
[2]Kapler A., Fischer D., Oberbeckmann S., Schernewski G., Labrenz M., Eichhorn K. J., Voit B., (2016) Analysis of environmental microplastics by vibrational microscpectroscopy: FTIR, Raman or both?. Anal Bioanal Chem. 408: 8399-8391