

2023 Analysis of Microplastics in Bed Sediments of Elliot Bay near Seattle, WA



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INTRODUCTION & PURPOSE

Microplastics, polymers 5mm or smaller, in the ocean have been categorized into primary and secondary types (shown in Figure 1). Primary plastics have been manufactured for a specific use, while secondary comes from degradation of large plastics. Plastics broken down within our marine environments have the potential to be harmful to the marine life and harm the environment itself.

The purpose of this study was to determine the presence and amount of microplastics from eight sediment collection stations within Elliot Bay in Puget Sound (Figure 2). Analysis of microplastic content within the sediment samples would be helpful in determining specific areas containing a high buildup of harmful pollutants, as well as help monitor the waterways for any substantial changes.

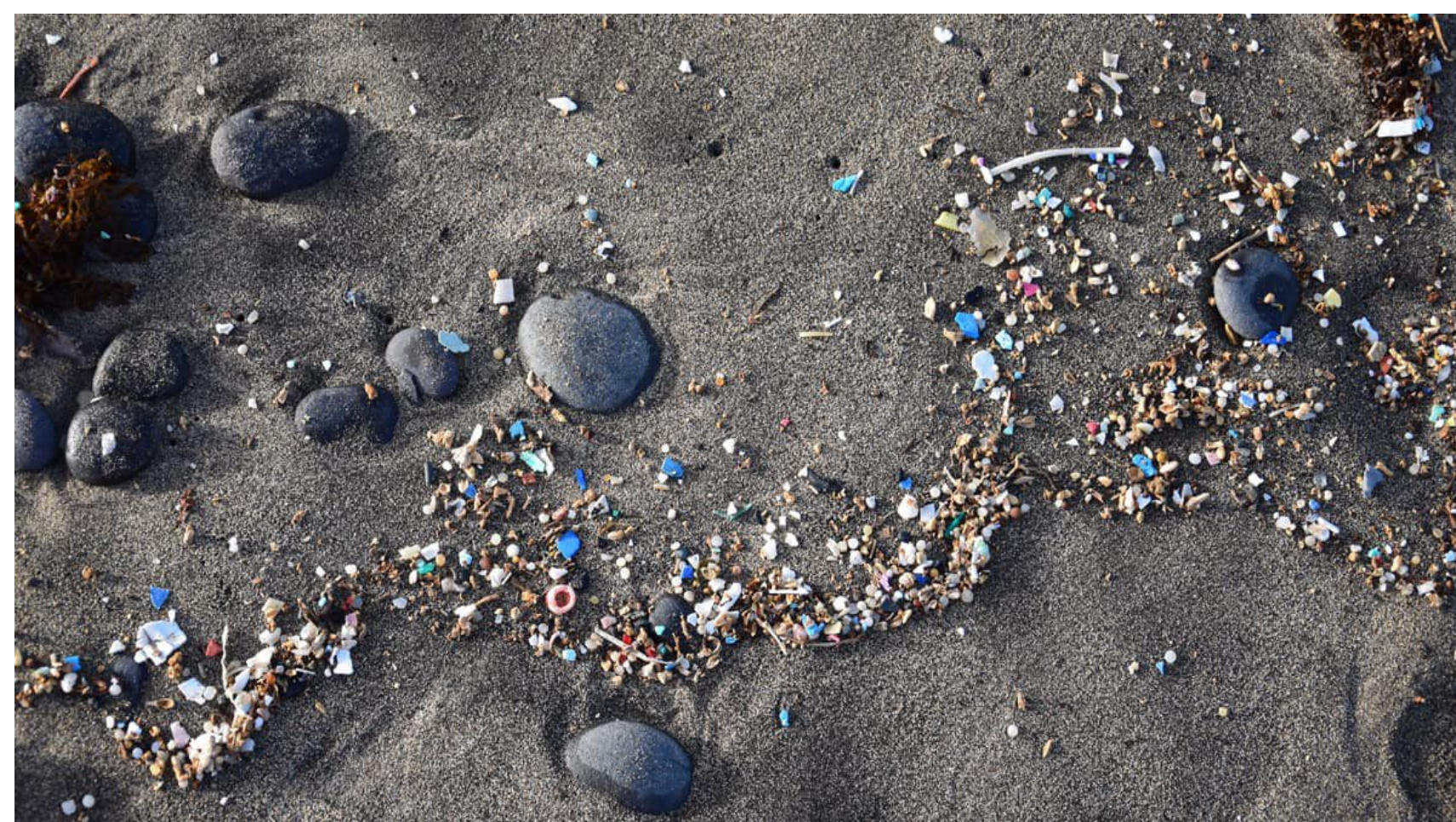


FIG 1. Image depicting primary and secondary microplastics (Seattle Aquarium 2021).

QUICK FACTS:

- There are five different categories that microplastics can be arranged into (fiber, fragment, film, foam and pellet)
- Aquatic animals in marine environments ingest microplastics, and once ingested they are both exposed to harmful chemicals and are at risk of physical injury
- Wastewater treatment plants can act like a barrier but also as an entrance for microplastic dispersion (Talvitie 2017).

METHODS

Collection: Eight sediment samples were collected from Elliot bay via Van Veen sediment grabber

Preparation: Sediment samples were disaggregated with potassium metaphosphate, sieved through a 0.33mm sieve and then dried

Density Separation: Lithium metatungstate was then utilized to promote microplastic buoyancy.

Wet Peroxide Oxidation: 20 mL of iron(II) sulfate, along with 20 mL of 30% hydrogen peroxide was added to digest organic material. This was repeated two more times or until any remaining organic material had been broken down

Density Separation II: Microplastics were drained through a 0.33mm sieve used for collection and dried overnight (Figure 5)

Microscope Exam: Sieves were placed under a microscope for hand collection. Any microplastics found were classified (type, color, length) and stored in glass vials (Figure 6).



FIG 2. Map of King County Collection Stations showcasing a comparison of MP content/m² wet vs. dry

RESULTS

Microplastic Distribution By Color

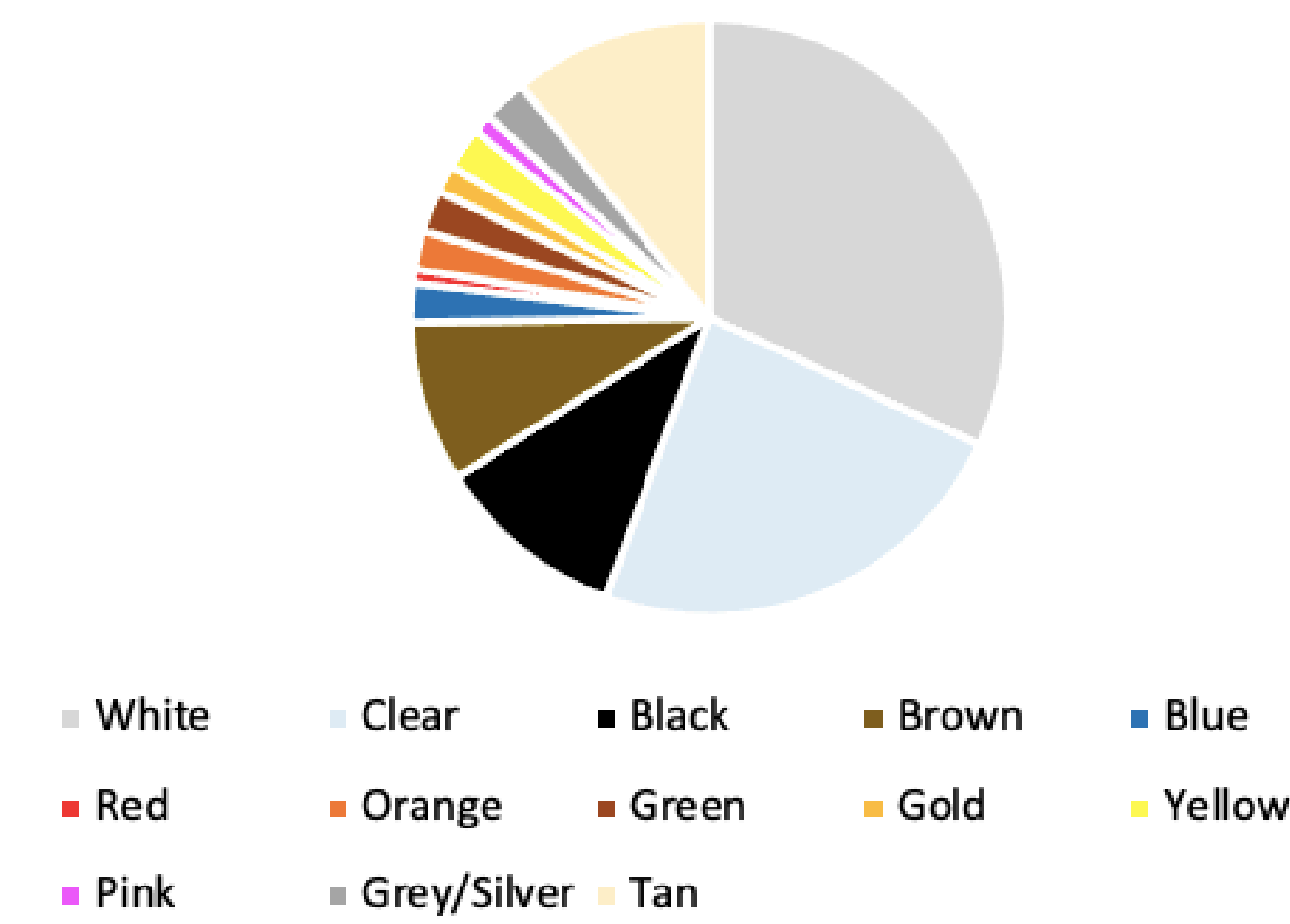


FIG 3. Microplastic Distribution by Color

Microplastic Distribution By Type

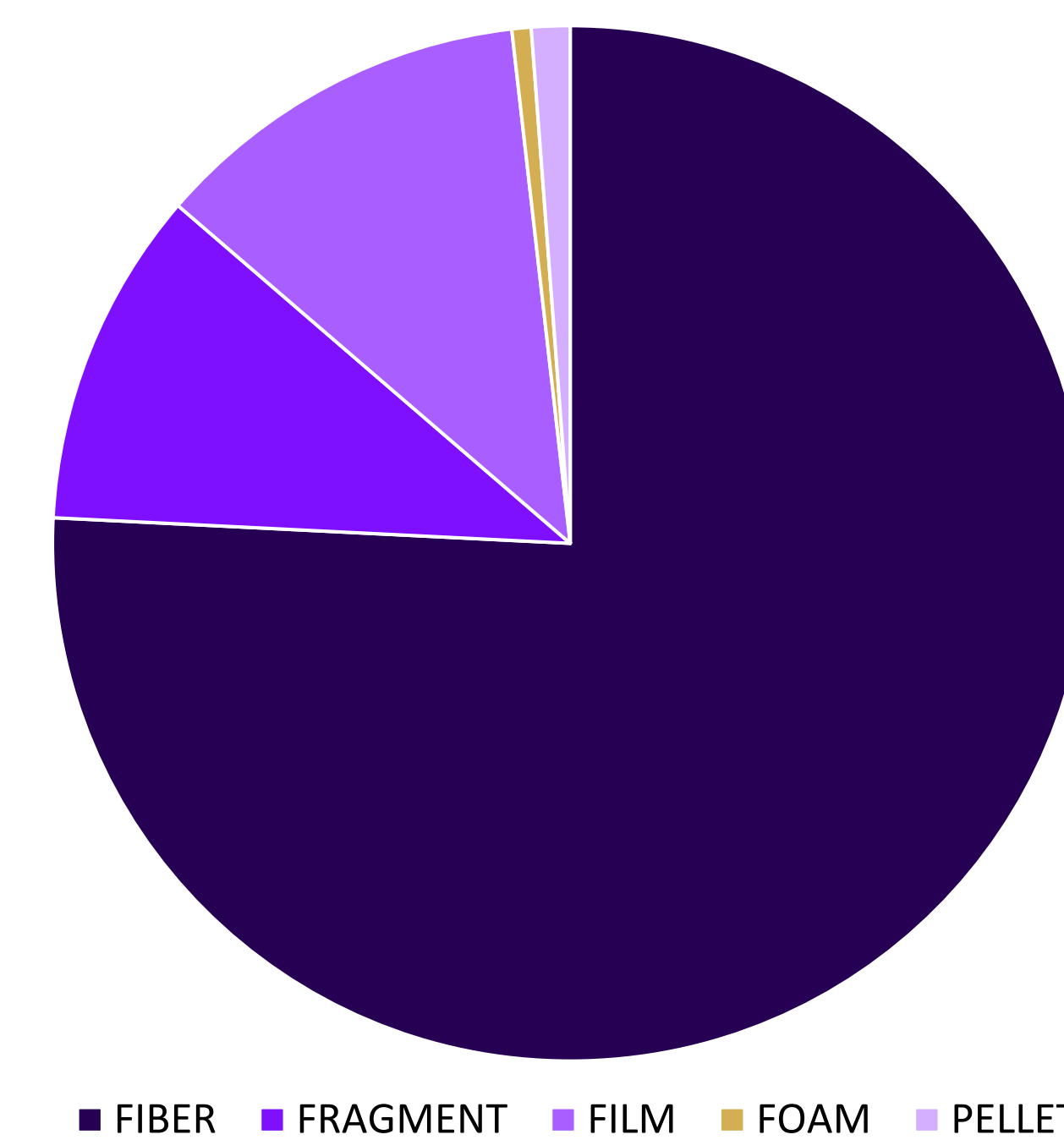


FIG 4. Percentages of microplastics by type (n=665)

- Fibers were the most abundant of all microplastic types with white being the most prevalent color (shown in Figures 3 & 4).
- Microplastic lengths ranged from 0.33mm-12.87mm



FIG 5. Density Separation II. Buoyant microplastics prepared for collection

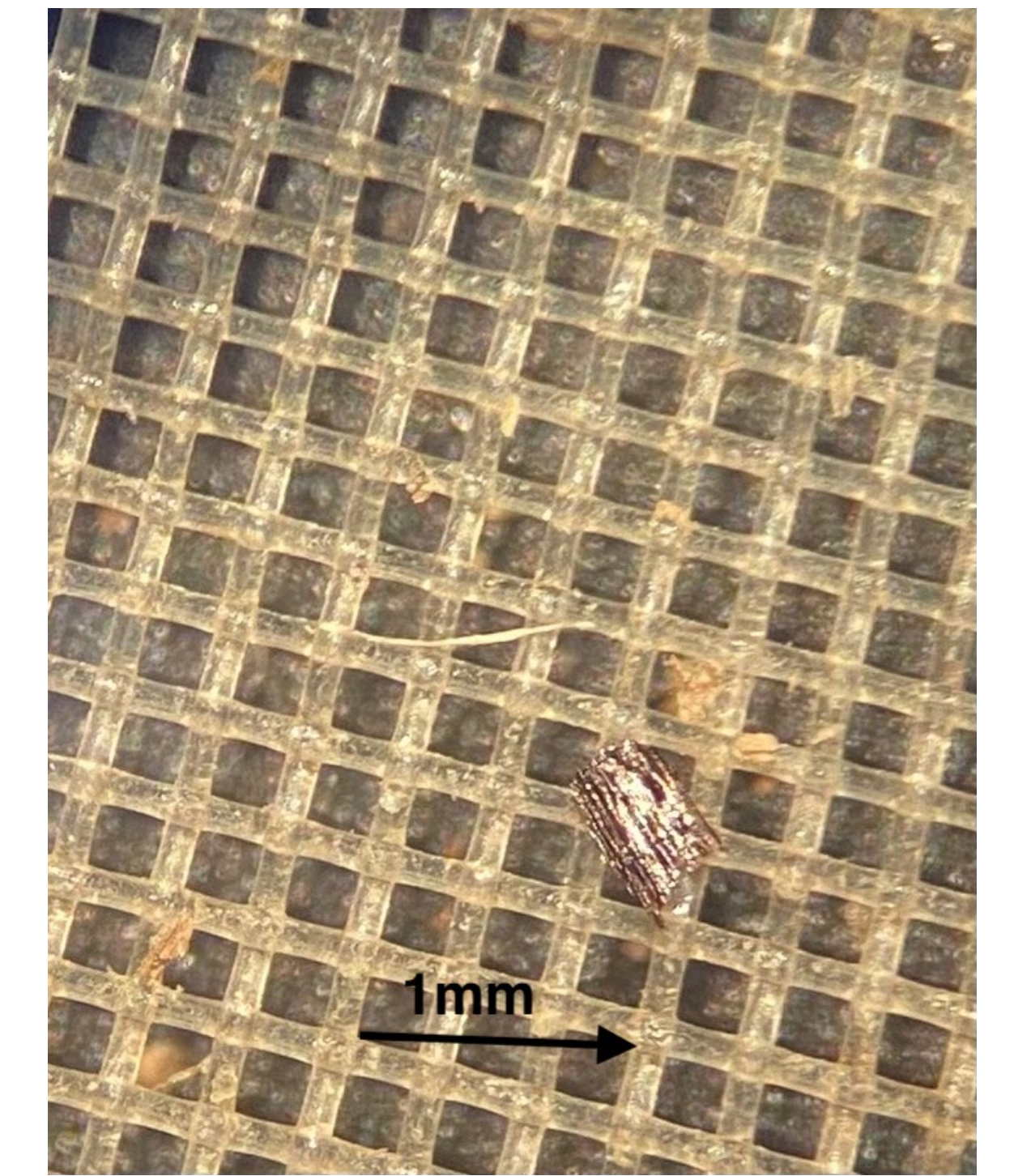


FIG 6. Image of an example fiber MP hand-picked by lab attendees

DISCUSSION AND FUTURE WORK

- Our analysis of microplastics found within bed sediments of Elliot Bay will contribute to prior studies that were conducted by assisting in our understanding of the correlation between presence of microplastics and the health of both marine ecosystems and aquatic wildlife.
- This study, conducted annually, helps monitor changes in quantities of microplastics throughout the Puget Sound.
- Data collected here can influence the enactment of stern environmental policies and regulations e.g. prohibition of products carrying microplastic components
- In the future, this study will look to expand with the aim of quantifying microplastic distribution in relation to different seasons.

Acknowledgements

We'd like to thank King County's Marine Monitoring Program for providing us with samples to process and analyze.

References



King County