

2023 Analysis of Microplastics in Bed Sediments of Bainbridge Basin (Bainbridge Island, WA)



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INTRODUCTION & PURPOSE

Microplastics, polymers 5mm or smaller, in the ocean have been categorized into primary and secondary types (fig. 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 thirty-three sediment collection stations within Bainbridge Basin of the Puget Sound (fig. 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.

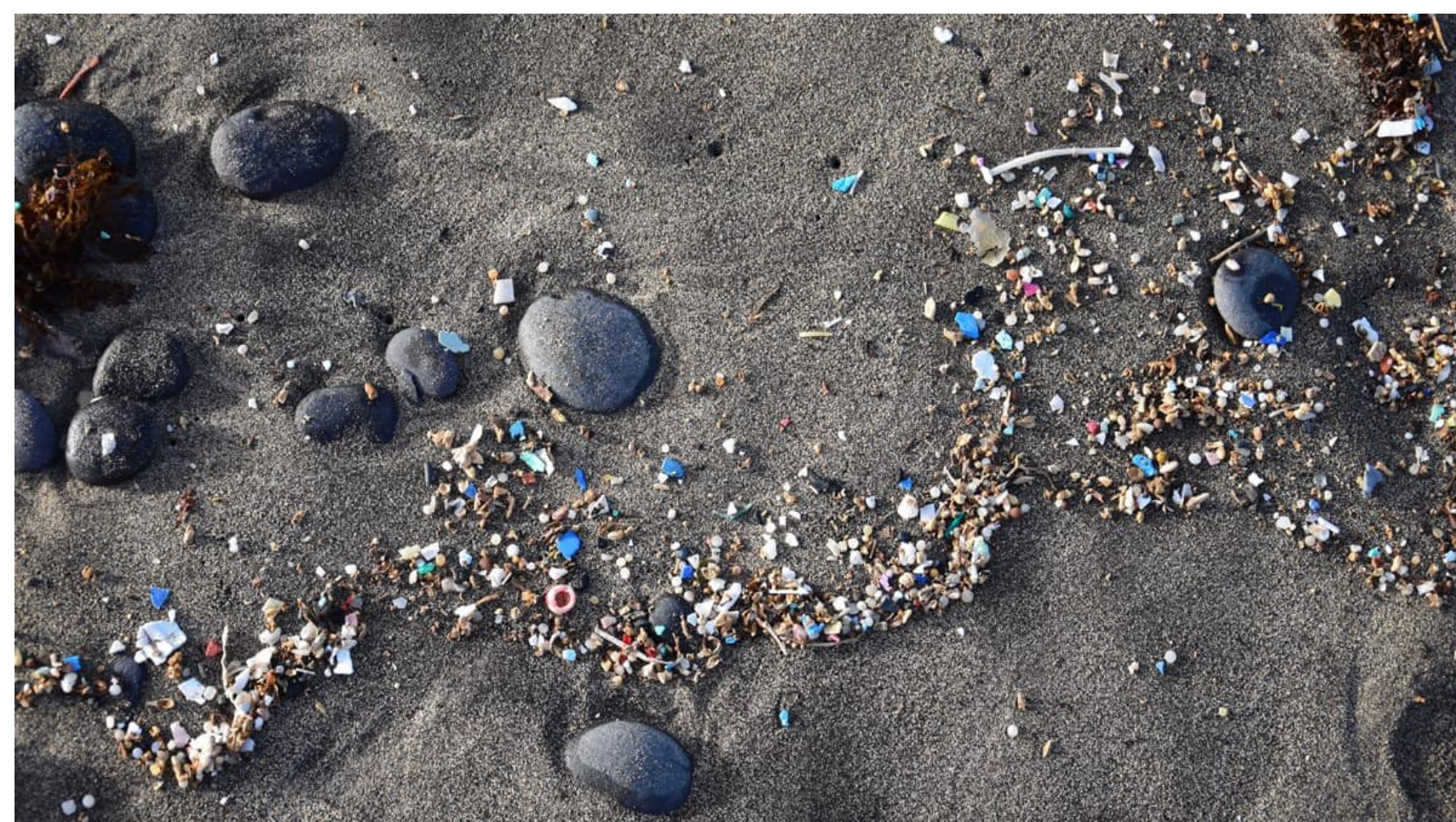


FIG 1. Primary and secondary microplastics from strandline on beach (Seattle Aquarium 2021).

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 have the potential to be 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: Thirty-three sediment samples were collected from Bainbridge Basin 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. ~6g of sodium chloride (NaCl) was added per 20 mL of beaker contents to increase the density of the solution and heated at 75°C on a hot plate until dissolved into the solution.

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

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

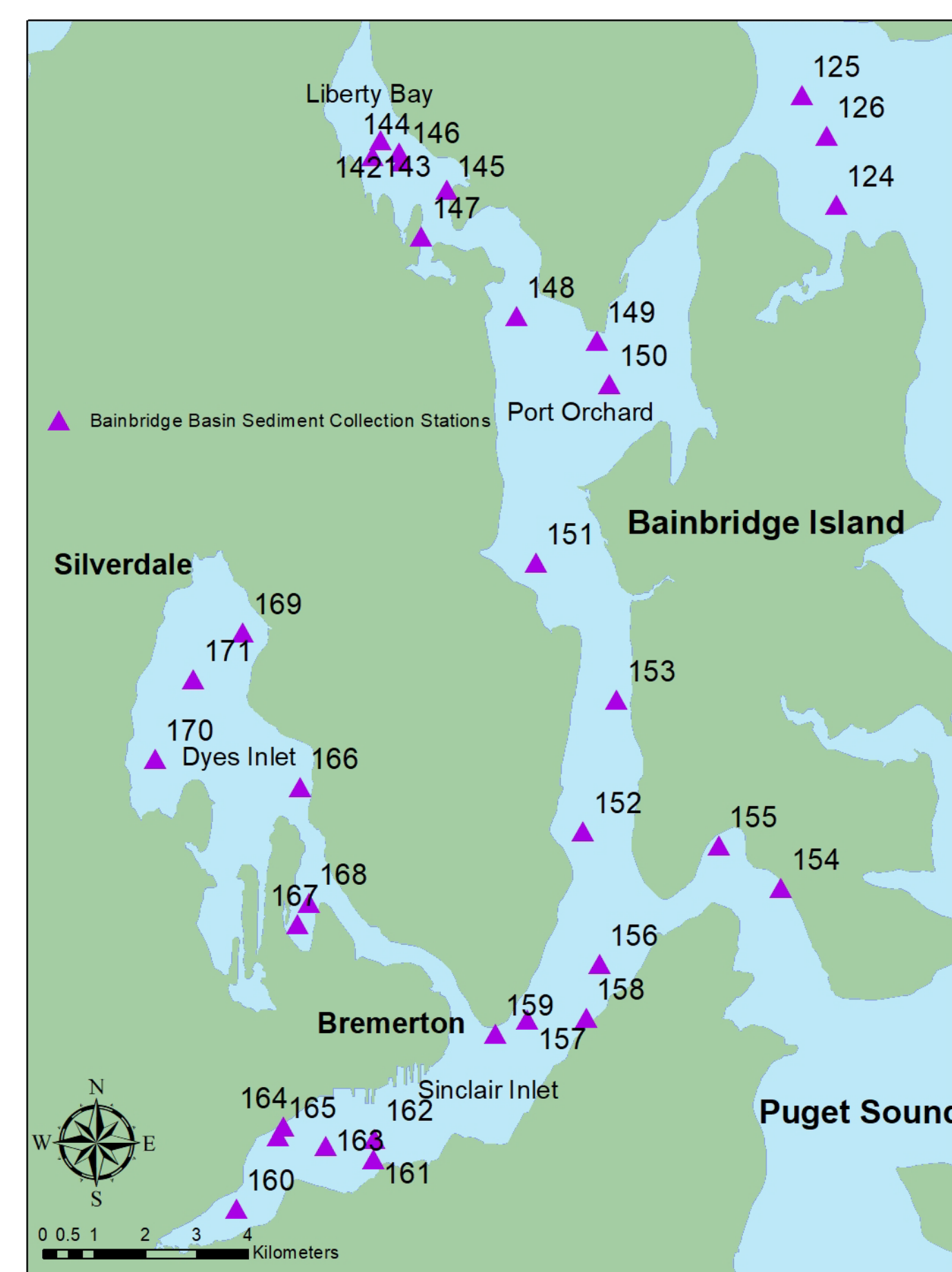


FIG 2. Map of Bainbridge Basin Sediment Collection Stations

RESULTS

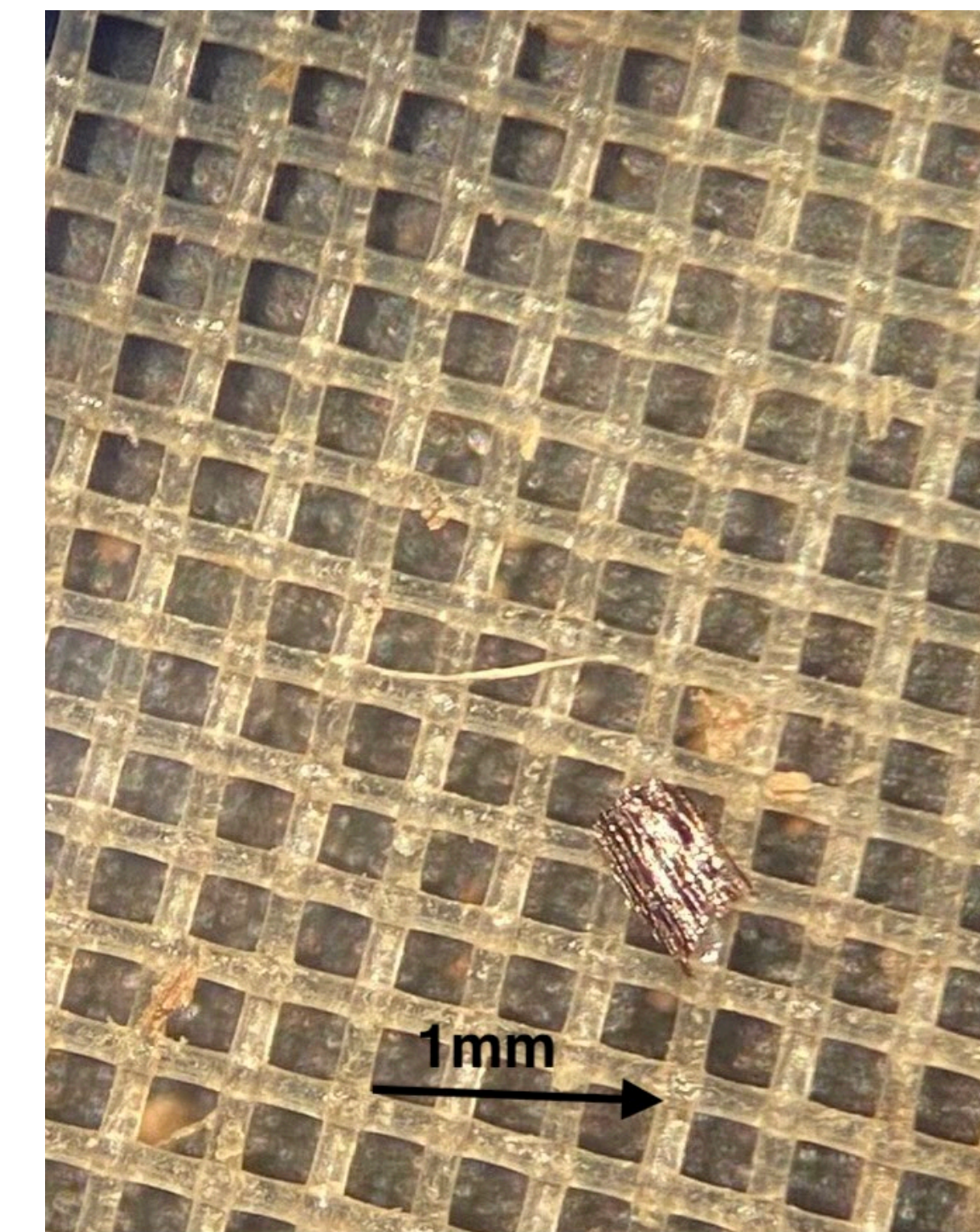


FIG 6. Image of an example fiber MP hand-picked by lab attendees

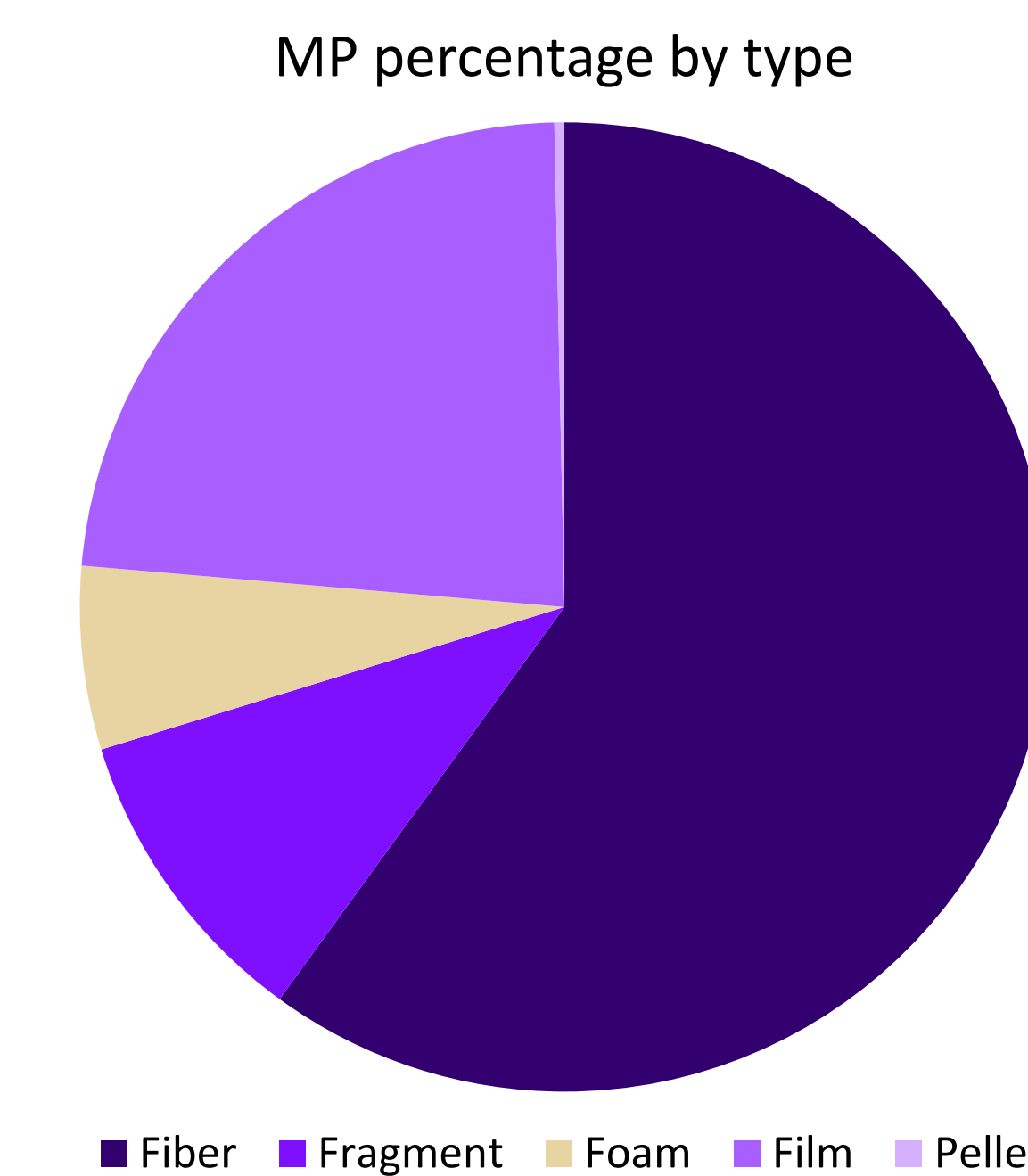


FIG 4. Percentages of microplastics by type (n=605)

Microplastic Distribution By Color

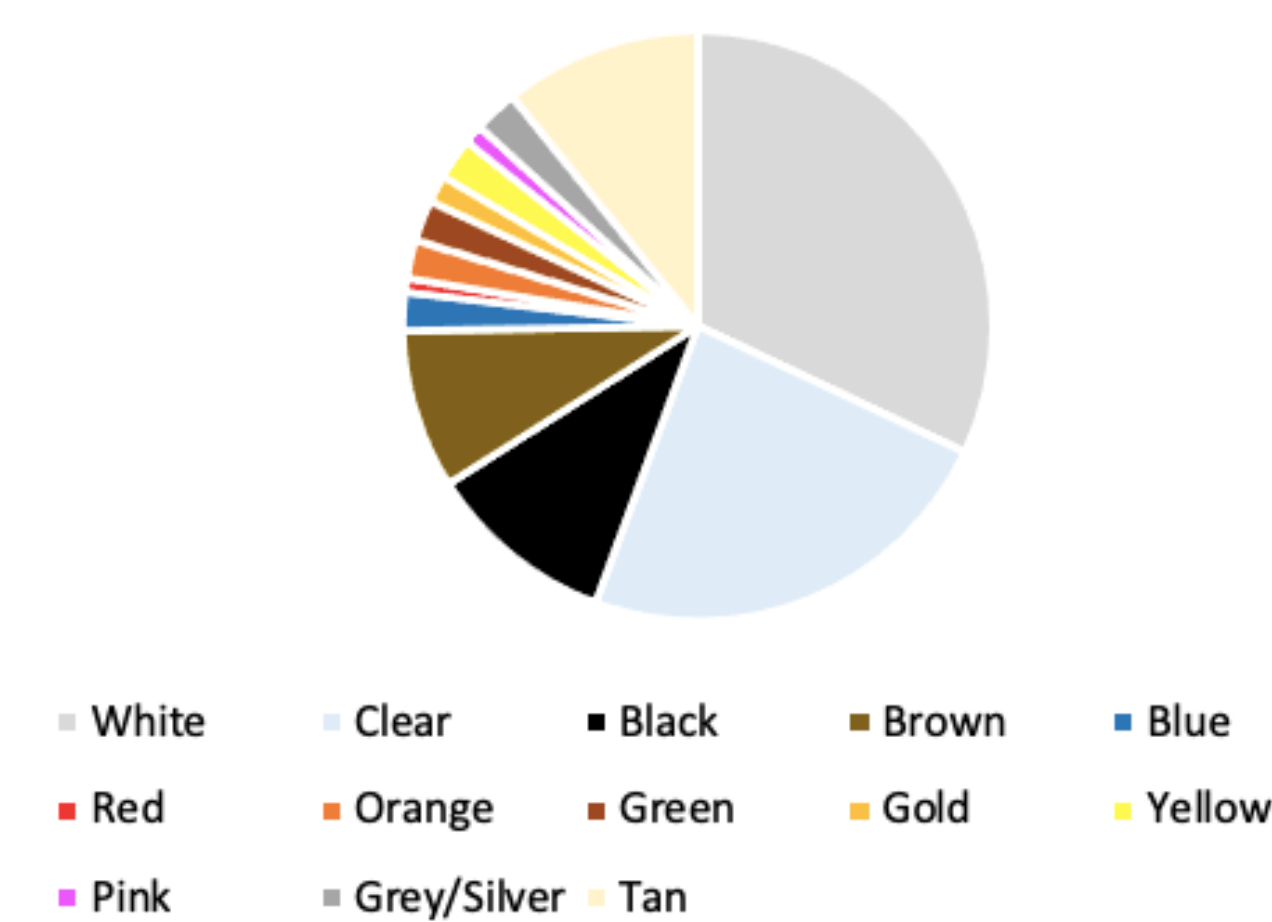


FIG 3. Microplastic Distribution by Color

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

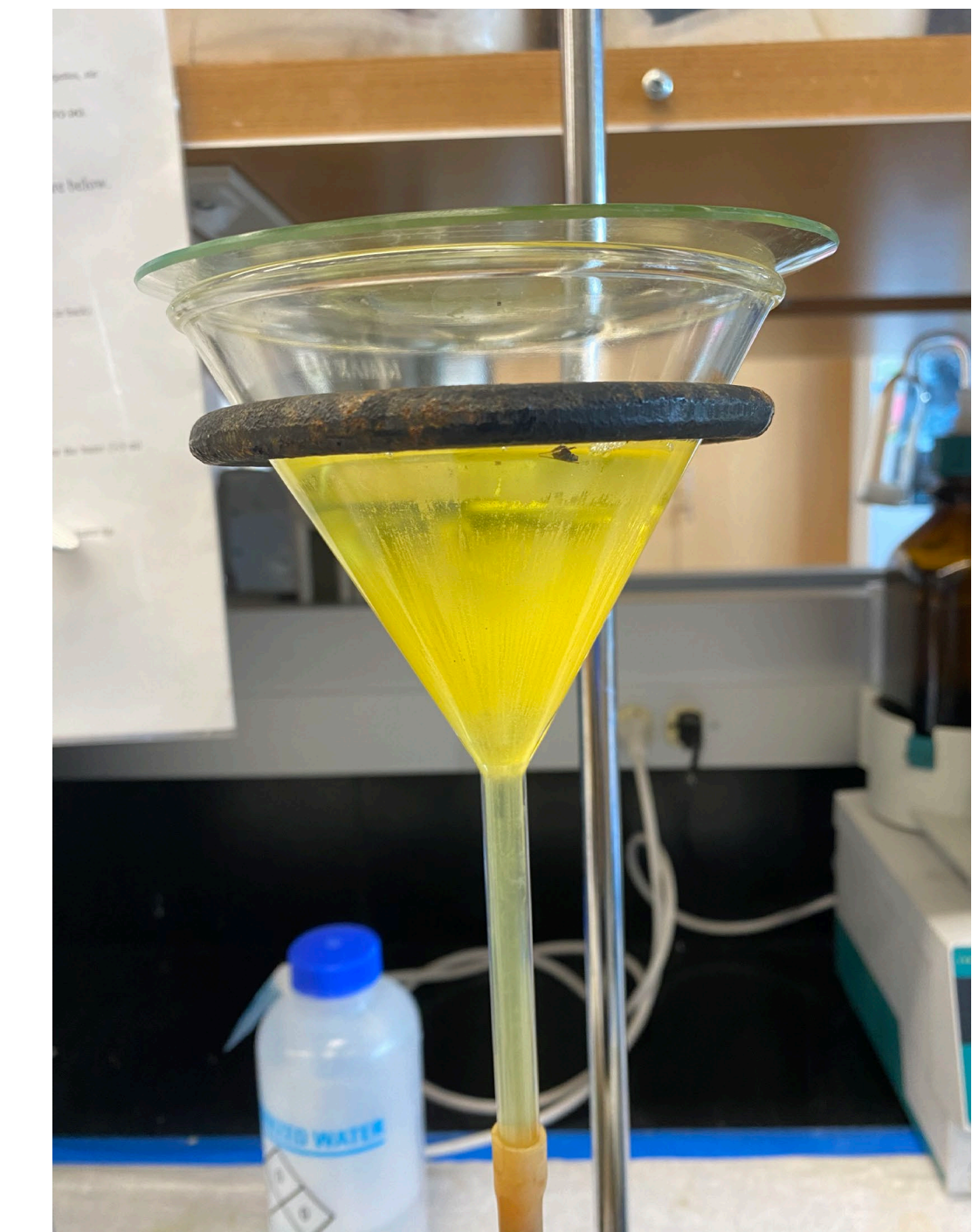


FIG 5. Density Separation II. Buoyant microplastics prepared for collection

DISCUSSION AND FUTURE WORK

- Our analysis of microplastics found within the bed sediments of Bainbridge Basin will add on to annual data from prior microplastic analyses and help in assisting our understanding of a correlation between presence of microplastics and the health of both marine ecosystems and aquatic wildlife.
- This study, conducted annually, helps monitor changes in the 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.
- For future studies, I suggest that we look to expand, with the aim of quantifying microplastic distribution in relation to different seasons.

Acknowledgements

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References



PUGET SOUND ECOSYSTEM MONITORING PROGRAM