# Microplastic pollution of *Ulothrix* filamentous algae in Western Lake Superior


Anakah Denison, Zoe Rylander | Dr. Todd Wellnitz, Research Mentor | Biology

## Introduction

Lake Superior and the St. Louis River Estuary (SLRE) are important ecological and economical resources for the Upper Midwest as waterways, fisheries, and recreation destinations—however, these essential waterbodies may be contaminated with microplastics. Microplastics (MPs) are small, pervasive (< 5mm) pieces of plastic that take the form of fibers, films and fragments. Microplastics have been found in Lake Superior, but their source and distribution is still unclear (Eriksen et al. 2013). This project is part of a collaboration between UW-Madison and UW-Superior investigating this question on a large scale in the water column, beach sediment, and aquatic organisms. We collected 30 samples of shoreline filamentous algae (*Ulothrix*) from 5 sites in the SLRE and Two Harbors during June 2021 in order to investigate the distribution and presence of MPs in aquatic organisms.

Filamentous algae at Barker's Island site

## Methods

### Sample Collection

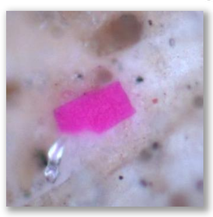
*Ulothrix* filamentous algae were collected by hand on rocky shoreline substrate from five sites in Western Lake Superior and St. Louis River Estuary during June 2021. Sites were selected for their proclivity for pollution as they were either near concentrated human activity (shipping lane, highway, city) or near the outlet of a wastewater treatment plant (Two Harbors). Six samples were collected along the shoreline at each site. Algae was pulled from submerged rocks by hand. Algae was stored in paper envelopes and allowed to air-dry before lab processing.

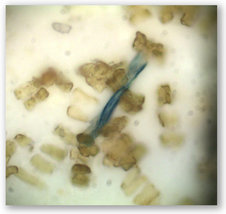
### Sample Processing

Algae samples were removed from envelopes and dried in aluminum dishes for 24 hours at 60°C. Samples were then chopped with scissors and ground in a glass hand mill until homogenized. Samples were then digested using the Wet Peroxide Oxidation method (Masura et al., 2015, Herrara et al. 2018). Digested material was vacuum filtered onto membrane filters and allowed to dry for at least 24 hours before counting. All tools and materials used were thoroughly rinsed with deionized (MP-free) water and all samples were covered with aluminum foil when not being counted.

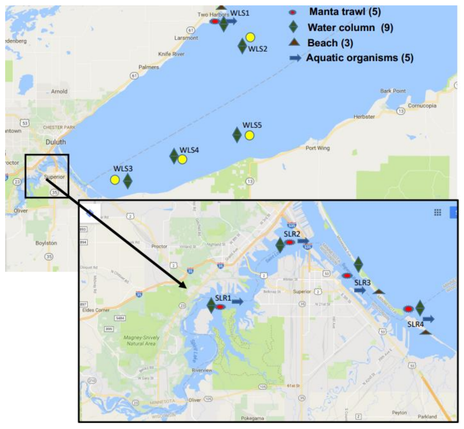
### Microplastic Identification

Plastic fibers were identified under a dissecting microscope using the five criteria in Roblin & Aherne (2020). Plastics were distinguished from natural fibers (e.g., cotton) using a hot needle test. Microplastics were counted and categorized as fluorescing or non-fluorescing under UVA light and by their color under white light.





Pink plastic flecks (left) and blue non-plastic fiber (right)




Map of the study site; arrows indicate algae sample sites

## Results

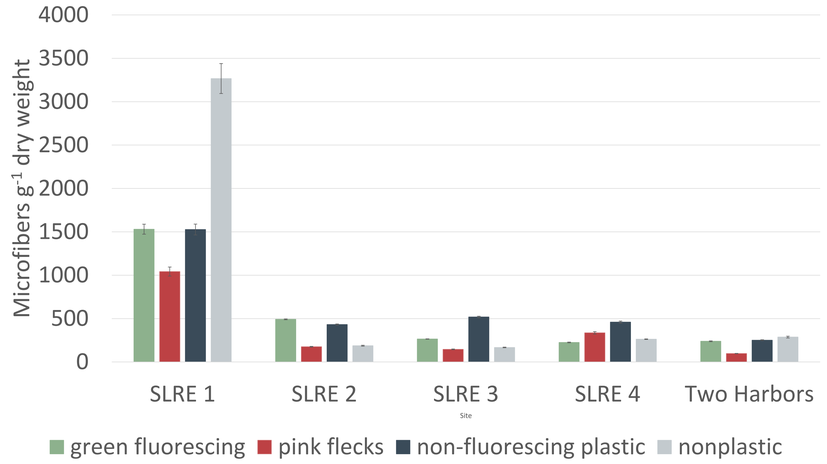



**Figure 1.** Mean counts of microplastics and other fibers in *Ulothrix* filamentous algae collected from SLRE and Lake Superior rocky shoreline sites. n=30 total samples, 6 samples per site. No significant difference was found in counts between sites. Error bars represent ± 1 SE. Blank control oxidations contained 4 green fluorescing fibers.

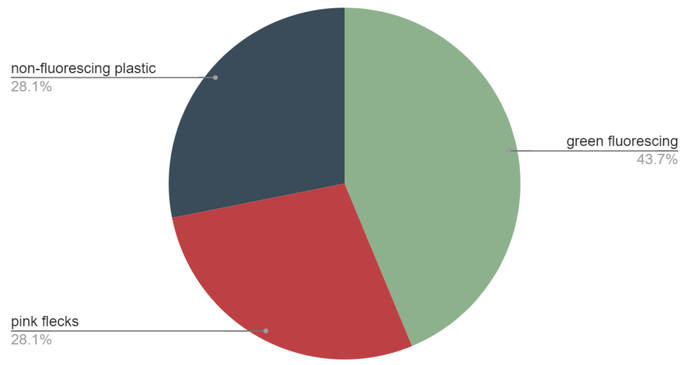



**Figure 2.** Fractions of the three main types of plastics observed in *Ulothrix* algae from SLRE and Two Harbors sites. n=30 total samples.

No significant difference was found in counts between sites. However, when a principal component analysis was conducted, PC1 and PC2 explained 90% of the cumulative variation in the data and correlated strongly with all four types of particles.

This correlation increased further when outliers from SLRE 1 were removed. This suggests an underlying correlation not explored in the current study. This project is part of a still-ongoing research project encompassing microplastics in zooplankton and further analysis of algal microplastic samples. The original scope of this project included chemical analysis via Raman spectroscopy, which was observed to be not possible due to the nature of the samples.

## Discussion

The SLRE sites experience much less traffic than the Two Harbors site, but the lack of significant difference in counts between sites could indicate that MPs are distributed homogenously throughout developed Lake Superior/SLRE shorelines. Clear, green-fluorescing fibers composed the majority of plastics found, possibly indicating that clear, fluorescing MPs are either a more common pollutant, or that colored MPs may lose color and turn clear over time.

The presence of MPs in living organisms is of particular concern, as microplastics are currently centered in the public eye due to recent studies finding microplastics in human lung tissue and blood. MPs are likely to continue to be an environmental and public health concern due to their ubiquity, pervasiveness, and ability to transport soluble chemicals into organisms, and establishing if and how aquatic organisms take up MPs is essential to understanding the effects they may have on larger aquatic ecosystem.

## Literature Cited

Eriksen, M., Mason, S., Wilson, S., Box, C., Zellers, A., Edwards, W., Farley, H., & Amato, S. (2013). Microplastic pollution in the surface waters of the Laurentian Great Lakes. Marine pollution bulletin, 77(1-2), 177-182.

Herrera A., Garrido-Amador P., Martínez I., Dolores Samper M., López-Martínez J, Gómez M., Packard T.T.(2018). Novel methodology to isolate microplastics from vegetal-rich samples, Marine Pollution Bulletin 129, 1.

Masura, J., et al. 2015. Laboratory methods for the analysis of microplastics in the marine environment: recommendations for quantifying synthetic particles in waters and sediments. NOAA Technical Memorandum NOS-OR&R-48.

Roblin, B. & Aherne, J. (2020). Moss as a biomonitor for the atmospheric deposition of anthropogenic microfibres. *Science of the Total Environment* **715**, 6.

## Acknowledgements

This research was funded by the UW-Madison Freshwater Collaborative Grant and Blugold Commitment Differential Tuition. Thanks to Dr. Laurel Mc Ellistrem and the Materials Science Department for the use of Raman Spectrometer and Confocal Microscope, as well as research support, and Dr. Evan Weiher for statistical analysis assistance. Thanks to Dr. Dustin Haines and the Lake Superior Estuarium for technical field support and Dr. Lorena M Rios Mendoza of UW-Superior and Dr. Nimish Pujara of UW-Madison for their collaboration.

*We thank the Office of Research and Sponsored Programs for supporting this research, and Learning & Technology Services for printing this poster.*