# Comparing the Amount of Microplastics between the Wrangell Drinking Water Reservoir & Pats Lake Recreation Site

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## Introduction

Microplastics are plastic particles or fibers smaller than 5 millimeters. Primary microplastics are manufactured at small sizes, and secondary microplastics originate from larger plastic waste breaking down (Wang et al., 2022). They can also originate from recreational equipment and synthetic fibers in clothing. Wind, water runoff, and human activity can transport microplastics long distances, allowing them to spread across many environments (Evangeliou et al., 2020; Atugoda et al., 2022). Studies have found that microplastics accumulate harmful substances on their surface and have toxic effects on fish (Wang et al., 2022; Bhuyan, 2022).

Most research on microplastics has focused on marine microplastics, with fewer studies on freshwater environments (Wang et al., 2022). Microplastics accumulate in water, sediment, and organisms in freshwater systems (Eerkes-Medrano et al., 2015). Freshwater systems such as lakes serve as drinking water sources for communities, recreation sites, and important environments for plant and animal life. However, there are still knowledge gaps regarding the sources and distribution of microplastics in freshwater lakes, especially across varying levels of human activity.

The Wrangell drinking water reservoir provides municipal drinking water to the community of Wrangell, Alaska, and Pats Lake is a very popular local recreational site. This study aimed to compare the amount of microplastics between the reservoir and Pats Lake, focusing on the difference in human activity. Comparing these two sites provides insight into how levels of human activity may influence the presence of microplastics in freshwater lakes.

## Hypothesis

**We predict that Pats Lake will contain a higher concentration of microplastics than the Wrangell drinking water reservoir because Pats Lake experiences more direct human recreational activity, which introduces plastics from clothing fibers, recreation equipment, fishing gear, and trash.**

## Methods

- In February 2026, three water samples from the Wrangell drinking water reservoir and three from Pats Lake were collected. Samples were collected using a #20 micromesh plankton tow net that was submerged for three minutes at each site.
- Since the reservoir was frozen, the reservoir sample was taken from the nearby water treatment plant's raw water inflow pipe.
- The collected water was transferred into glass jars for transport. Each sample amounted to roughly 200 ml.

FIG. 1


FIG. 2

**Figure 1:** Map of sampling locations relative to Wrangell, AK.
**Figure 2:** Sampling at Pats Lake.

- Before collection, all equipment was rinsed three times in the source. Natural fabric lab coats and glass containers were used to minimize potential contamination.
- All samples were later processed in the Wrangell Cooperative Association (WCA) building. Each sample was poured into a filtration flask and vacuum-filtered through a membrane filter to concentrate debris. The filters were then examined under 10-20x dissecting microscopes to identify and count microplastics, fibers, and particles. The hot needle test was applied to each fiber to distinguish plastic fibers from organic material. The total number of microplastics on each filter was recorded as data for comparison between the two sites.

Citations:

Atugoda, T., Piyumali, H., Liyanage, S., Mahatantila, K., Vithanage, M. (2022). Fate and Behavior of Microplastics in Freshwater Systems. In: Rocha-Santos, T., Costa, M.F., Mouneyrac, C. (eds) Handbook of Microplastics in the Environment. Springer, Cham. https://doi.org/10.1007/978-3-030-39041-9_42

Bhuyan, MS. (2022) Effects of Microplastics on Fish and in Human Health. Front. Environ. Sci. 10:827289. doi: 10.3389/fenvs.2022.827289

Eerkes-Medrano, D., Thompson, R., Aldridge, D. (2015). Microplastics in freshwater systems: A review of the emerging threats, identification of knowledge gaps and prioritisation of research needs, Water Research, Volume 75, Pages 63-82, ISSN 0043-1354, https://doi.org/10.1016/j.watres.2015.02.012.

Evangeliou, N., Grythe, H., Klimont, Z. *et al.* (2020). Atmospheric transport is a major pathway of microplastics to remote regions. *Nat Commun* 11, 3381. https://doi.org/10.1038/s41467-020-17201-9

Wang, Y., Zhou, B., Chen, H., Yuan, R., Wang, F. (2022). Distribution, biological effects and biofilms of microplastics in freshwater systems - A review. *Chemosphere*, Volume 299, 134370, ISSN 0045-6535, https://doi.org/10.1016/j.chemosphere.2022.134370.

## Results

Fig. 3

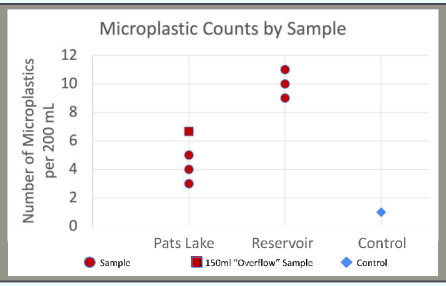



Fig. 4

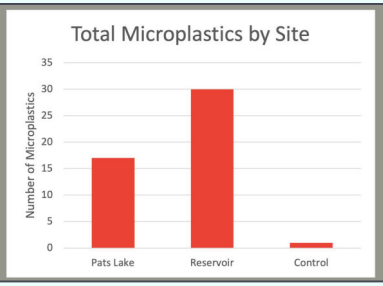



Fig. 5

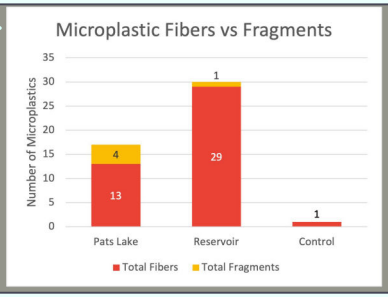
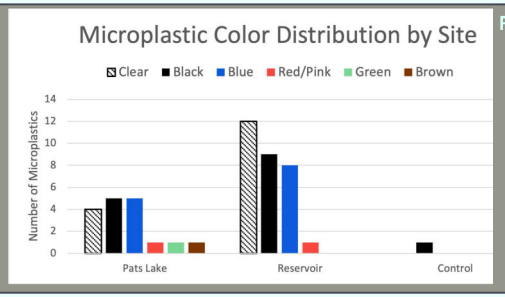



Fig. 6




- Our data showed nearly twice as many microplastics in the reservoir than in Pats Lake.
- Every sample from Pats Lake had fewer microplastics than any of the samples from the reservoir (Fig. 3).
- Approximately 90% of the microplastics we recorded were fibers (Fig. 5).
- Most of the microplastics were clear, black, or blue (Fig. 6). We found many similar clear & black fibers across all our reservoir samples.

## Discussion

Our hypothesis was not supported by the data. These results suggest that factors beyond direct human activity, such as wind transport, may play a role in introducing microplastics into lakes. Additionally, the reservoir samples were taken from the water treatment plant's inflow pipe, meaning the volume of water flowing through the net for each sample may have been different than at Pats Lake. Our findings may be affected by time of year and past weather. Above-average snowfall and frozen sampling sites limited our sampling ability. Using a higher magnification microscope would allow us to see smaller particles and determine their properties. Taking more samples could better represent each sample site with lower variability, and further research could determine the sources of the different microplastics we recorded.

As part of our project, we presented our findings to the Wrangell Cooperative Association board. They were very interested to hear about how microplastics and recreational activities are affecting our community's water resources. These findings highlight that microplastics can be found everywhere. Members of the community may not have thought about how their recreational activities or even their clothes may introduce microplastics into the environment, and this study emphasizes the importance of understanding your impact and valuing our shared water resources. Protecting freshwater ecosystems is essential for maintaining human health and traditional subsistence practices in communities like Wrangell.

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