Size Variability of Microplastics Pollution in St. Andrews Bay, Florida

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Introduction

- Plastics are synthetic polymers that are non-biodegradable. Once plastics are introduced into oceanic environments, the waste can break down into numerous debris called microplastics. Microplastics are harmful to marine life because if they are ingested, it can result in asphyxiation, transgenerational toxicity, and biological magnification (Wagner et al., 2014).
- Microplastics typically mimic the pathways developed by the accumulation of sediment. Thus, making estuaries, oceans, and other coastal areas hot spots for the abundance of MP pollution. Using these marine ecosystems as testing sites for MP research is the first step to addressing the issue of exponential growth of MP pollution in our environment (Allen et al., 1980).
- Current research that assesses MP in the ocean typically focuses on larger MPs (500 micrometers or greater in size), but there are plenty of plastics that are smaller than 500 micrometers that are more detrimental to microorganisms such as meiofauna and microbes who inhabit the ocean (Wagner et al., 2014).
- Wastewater treatment plants are major sources or MP pollution, and which makes us believe the microplastic size will decrease as we move further away from the input source within a coastal embayment.

Methods

- Sediment samples were washed through 500-micron and 63-micron sieves to remove large particles
- Microplastics were extracted from sediment samples retained on the 63-micron sieve using NaI (D = 1.7 g/cm^3) and cleaned using a Fenton type 1 reaction to remove any biological materials from the plastics to ensure accurate particle identification.
- We measured the size of each microplastic's (s) length (l), which was represented as the longest dimension, and the width (w) as the shorter dimension.
- The length and width of the MPs were measured in triplicate using ImageJ and then averaged.
- We input our measurements into the equation: $s=\sqrt{l \, x \, w}$ to determine the size of each MP and excluded any MP > 5000 um from analysis.
- All data were analyzed in R Studio and plot using the "gplots" package (Warnes et al., 2020)

Results

Figure 1. Sampling locations within the St. Andrews Bay system, St. Andrews Bay, Florida. Sediment samples were collected from three reference sites (East Bay, North Bay, and West Bay) and two sites of WWTPs (Watson Bayou and Lynn Haven). Red x's represent sampling stations along a 1 km transect at each site.

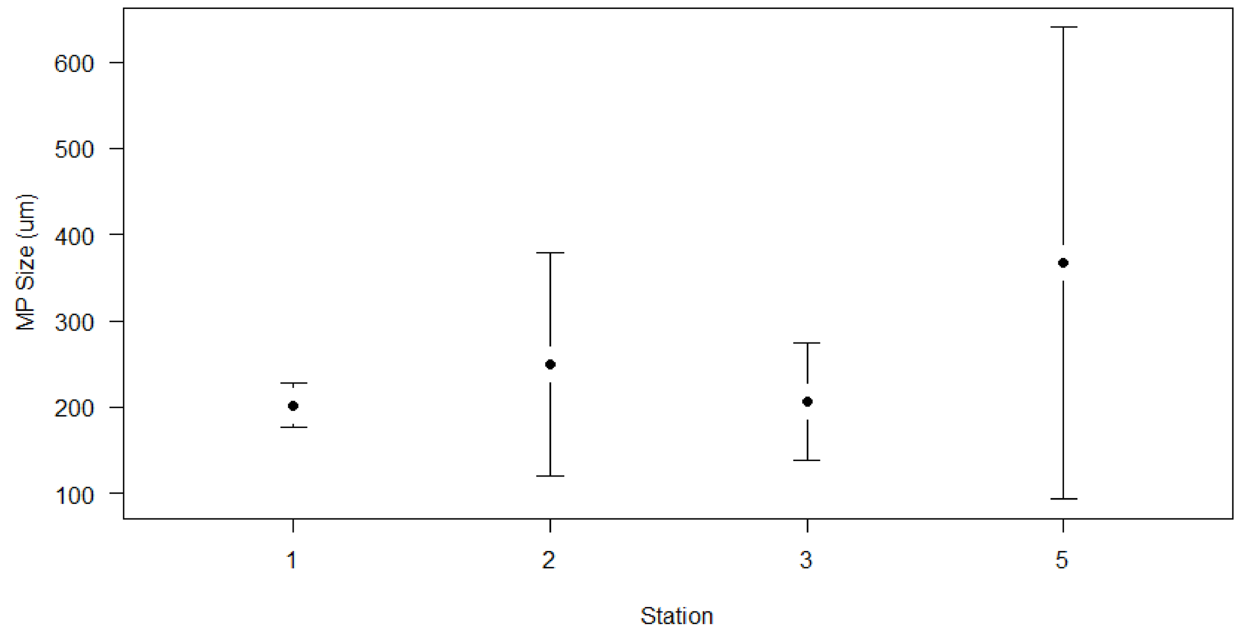

Figure 2. Average MP size (um) at each station. There was no significant difference between the mean values. (M = 219.6 um, p = 0.2721).

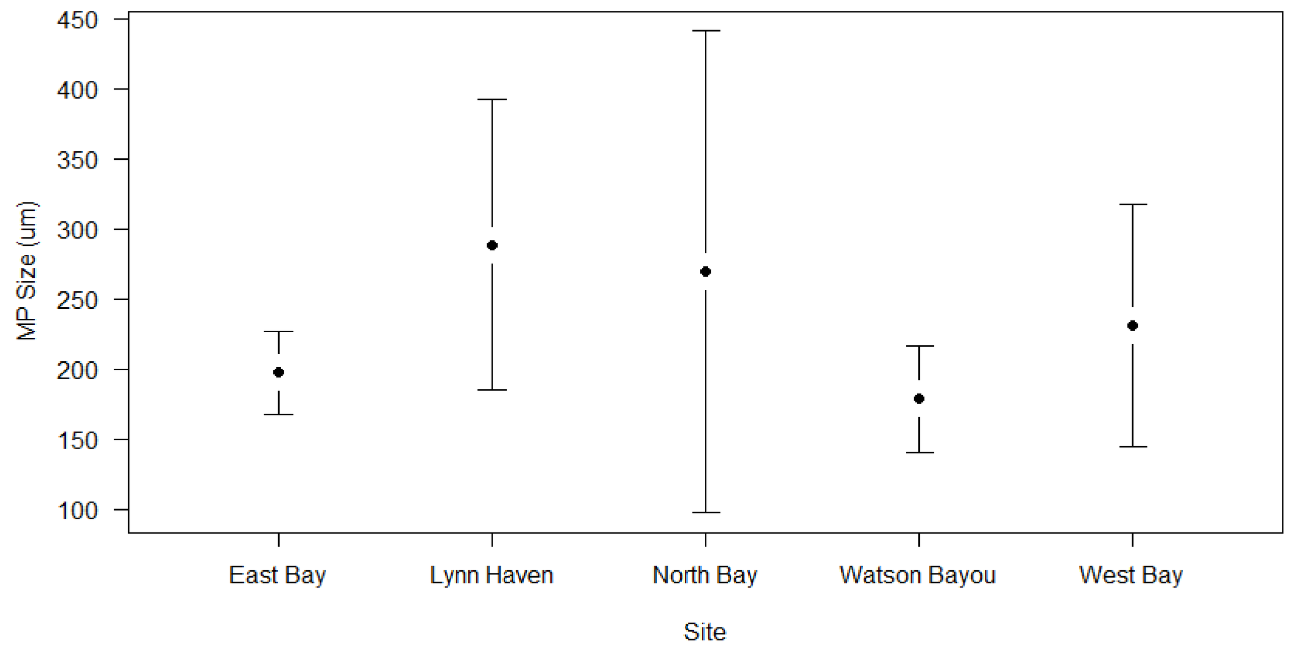

Figure 3. Average MP size (um) at each site. There is no significant difference between the mean values. (M = 219.6 um, p = 0.1578).

Discussion

- Our hypothesis was not supported by our data which showed there was no significant correlation between MP size as you move further away from the input source.
- There is no significant difference between MP size anywhere across St. Andrews Bay system.
- There is a much higher abundance of the particles at the input source, which is a cause for concern.
- In a similar study performed by Kazour et al. (2019) , their findings showed a strong correlation between the distance from wastewater treatment plants and MP abundance as well.
- To gain a better understanding if there is a correlation between input source and MP size, we can test against an alternate input source other than wastewater treatment plants.
- A study performed by Ben-David et al. (2021) shows that seasonal variability affects the abundance of MPs. In the winter, there was a higher abundance than in warmer seasons.
- We could continue this experiment in the summer to determine if the wastewater treatment plant affected the abundance of the MPs found, or if the cooler temperature played a bigger role in this discovery.

References

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