Variation of Microplastic Abundance Between Coastal and Inland Sediments at Caven Point

Greener JC: Urban Ecology Research Program
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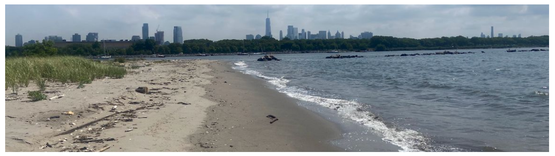
Introduction

Coastal ecosystems have been increasingly threatened by anthropogenic pollution, with microplastics emerging as a widespread and dangerous contaminant. These microplastics can accumulate in intertidal zones and further inland along the Jersey City waterfront, which becomes particularly threatening to the rich diversity of bird species that inhabit these zones, and can negatively affect feeding, breeding, and overall health. Understanding how microplastic levels fluctuate and change depending on their distance from tidal zones can help provide insight on the extent of this risk to species inhabiting the area, and is the question that this study will focus on. We hypothesize that microplastic concentrations will be higher in the inland grassy areas of Caven Point Beach compared to the open beach sand. We expect this because wind and storm events may transport plastics inland, where vegetation can trap and retain them more effectively than the exposed shoreline.



Background

Microplastics are plastic particles that are less than 5 millimeters in size. Their small nature results from the breakdown of larger plastic materials or their presence in specific, everyday use products. Since these plastics do not degrade easily due to their inability to be naturally decomposed, they remain in the environment for long periods of time. They enter terrestrial and aquatic ecosystems through infrequent littering, wastewater, runoff, etc. Studies show that microplastics are toxic to the environment due to their adsorption behavior, in which toxic materials are found as a thin layer/film on the microplastic. Furthermore, they are identified as disruptors in feeding and reproduction of multiple organisms. Understanding their distribution in coastal areas is important in our understanding of how to properly address the disposal and cleaning of affected areas.

Objectives

Observation Area

- Examine areas along the Caven Point for
  - Low or High Tide
  - Proximity to the body of water
  - Slope of the area

Microplastics

- Examine samples for
  - Presence/Quantity
  - Distribution
  - Origin of Substance
  - Size
  - Depth Buried
- Type of plastics
  - Microplastics (<5mm)
  - Regular Plastics (>5mm)
  - Other (non-plastic)

Methods

PROCEDURE

The collection site was determined based on the accessibility of an aquatic and terrestrial system border. The site observed was Caven Point Beach located in Jersey City, NJ.

Every 20 paces, a 289 in^2 (17 in x 17 in) quadrat was thrown randomly. The area inside the quadrat was visually inspected, and any suspected microplastics were collected and secured in a pre-labeled vial. Each quadrat was inspected for 5 minutes. 9 samples from the inland region were collected, while 6 samples from the beach region were collected.

The data was compiled. Each suspected microplastic was confirmed to be a plastic through a burn test. Non-microplastic contaminants were discarded. Each suspected microplastic was also measured to ensure it was <5mm in diameter. Other plastics or other material were discarded.

The data was recorded. The means for the two groups were compared using an independent sample t-test. The data was graphed.

IMAGES

Results

Graphs

Fig 1: Average Microplastic Mass per Quadrat ± SEM

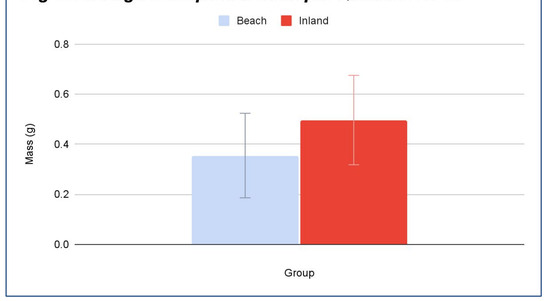
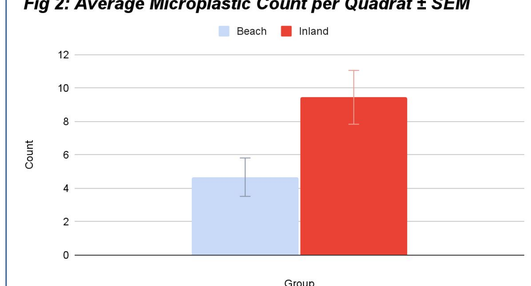


Fig 2: Average Microplastic Count per Quadrat ± SEM



Analysis

An independent sample t-test was conducted to analyze the statistical difference between the two groups for average microplastic mass (g) on the beach and inland, and the average microplastic count on the beach and inland.

The data was graphed and shown to the left in *Fig 1* and *Fig 2*, with error bars representing ± SEM.

The microplastic mass between samples collected on the beach ($\bar{x}$ = 0.355 g) and samples collected in the inland region ($\bar{x}$ = 0.497 g) were not statistically significant ($p > 0.05$).

On the other hand, the microplastic count between samples collected on the beach ($\bar{x}$ = 0.467) and samples collected in the inland region ($\bar{x}$ = 9.444) were statistically significant ($p < 0.05$).

The range of values for the microplastic mass on the beach (0.03 g - 1.07 g) per quadrat was less than the range of values for the microplastic mass in the inland region (0.04 g- 1.62 g) per quadrat.

The range of values for the microplastic count on the beach (2-9) per quadrat was less than the range of values for the microplastic count in the inland region (5-16) per quadrat.

Conclusions

- This study contributes to the body of literature surrounding microplastic abundance in coastal areas.
- The data indicated that the average microplastic mass per quadrat was not statistically different between the beach and inland area.
- However, since the average microplastic count per quadrat was greater in the inland area than the beach area, we can conclude that each individual plastic present in the inland area has less mass, and thus, likely smaller in size than those in the beach area
- This creates a larger problem for animal species living the inland area compared to those living in the beach area, since the larger quantity and smaller size of the microplastics present are more likely to be consumed and interfere with the animals feeding, breeding, and overall health
- A predicted reason for a larger number of individual plastics in the inland area is that the vegetation present in the inland area are able to more effectively trap and contain microplastics in comparison to the beach, where plastics are regularly brought in and out with tidal cycles

Future Directions

- Seasonal Variation
  - Conduct sampling during different seasons (i.e. weather patterns, temperature)
- Expand Geographic Sampling
  - Include other locations along Jersey City waterfront for comparative analysis
  - Compare microplastic levels in heavily urbanized areas vs. more protected shorelines
- Longitudinal Study
  - Monitor changes in microplastic accumulation over long periods of time to detect trends

Acknowledgements

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