Analyzing how Precipitation Affects Microplastic Concentration in the South River

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Abstract

The field of microplastics as a whole is relatively unstudied and unknown but it is found that the prevalence of microplastics is ubiquitous in the environment. Although the presence of microplastics is observed to have increased significantly, the concentration. Furthermore, the properties of microplastics and how they interact with the environment, such as how they clump together or how they move in the flow of water, is still being studied. The effect of environmental factors on the concentration of microplastics is unstudied and unknown. This project evaluates the impact of precipitation greater than ½ inch on the concentration of microplastics specifically in the South River. By doing this research, this could be used to study how microplastics interact with the environment.

Keywords: Microplastics, environment, concentration

Introduction

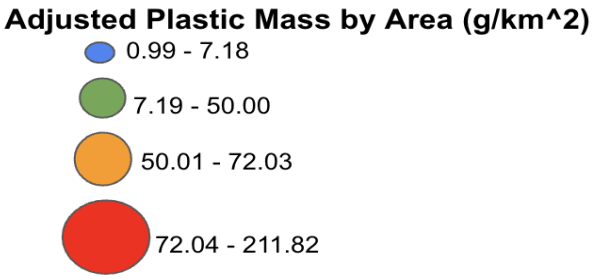
With the increase of plastic usage and production in the industrial world, more and more plastic is ending up in our water. Despite the evident dangers posed by the plastic to our environment, an even greater danger threatens our health in the micro-scale. Microplastics have been found in our food, in our body's, and even in our blood. The dangers posed by these miniature plastics are still unknown, however, an even greater question is how these plastics enter our water systems and how they interact with natural phenomena and the ecosystem. In our study, we will be examining the effects of precipitation on the concentration of microplastics in the South River.

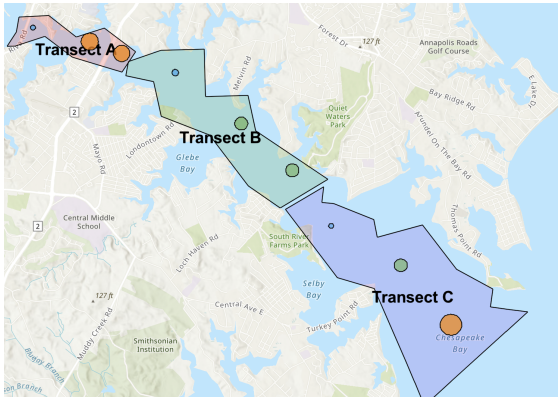
Method

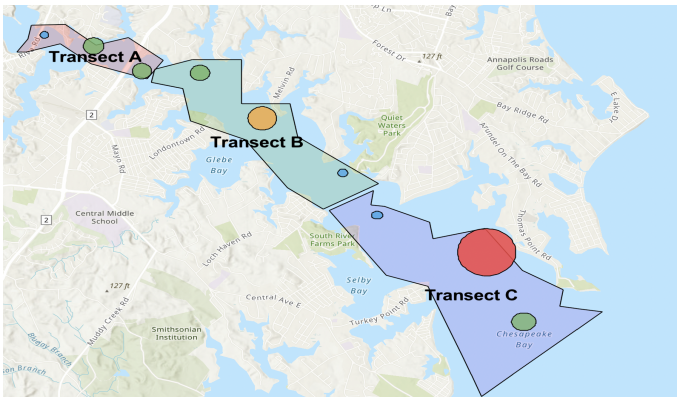
1. Identify locations of the South River with adequate accessibility and delineate portions into transects to be sampled.
2. Obtain materials and resources for sampling and analysis.
3. Conduct a tow test with the net trailing roughly 25 yards behind the vessel. Tow the net for about 500 meters for each test.
4. After each test empty the net into the sieves to separate the sample from unneeded biomass. Then dispense the sample into a storage container.
5. Take samples back to the lab to dry them. Afterward add chemicals to samples and place on a hot plate to burn off the biomass. Lastly, use pipette to place plastics in filters and use vacuum pumps to pump away excess water. After finishing store samples for later analysis.

6. Analyze each sample and identify weight of plastic found and number of particles using a scale and microscope.
7. Use the data from each of the samples to determine the distribution of microplastic pollution in the South River.

Legend







Results

After looking at our data that we obtained from the analysis process, we found that there were no significant differences between the pre-rain and post-rain samples. When looking at the microplastic concentrations for each transect we found that the range of concentrations did not have any significant abnormalities and that the pre-rain and post-rain samples were similar. This was further supported by our comparison of microplastic mass by area. We compared our data

with a fellow research group from the USNA and UMD and found no significant differences in our data. Our finding from this project is that the precipitation did not have an effect on the concentration of microplastics in the South River. Results show that microplastics exist in the South River and are comparable to other rivers in the region. Due to the countless external factors that impact this experiment, more testing is necessary to rule out potential sources of contamination and possible sources of error.

Site Name	Microplastic Concentrations g/km2 (Mean ± SD)
Pre Rain Lower	33.735 ± 23.189
Pre Rain Middle	13.192 ± 11.386
Pre Rain Upper	45.731 ± 42.109
Post Rain Lower	75.143 ± 118.447
Post Rain Middle	42.738 ± 36.886
Post Rain Upper	11.665 ± 9.0481

Discussion

The microplastics concentration within each transect and subsection displays incredibly high variability. In the Post Rain Lower subsection, the standard deviation was found to be higher than the mean microplastic concentration. As a result of this high standard deviation, we could not determine any patterns or trends within the data. However, this supports the idea that the behavior of microplastics in water is to tend to form patches and clumps rather than be evenly distributed.

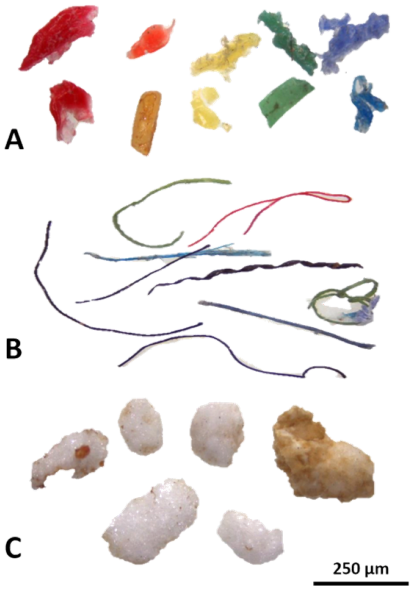
There seems to be no discernible pattern within the ranges of the data. However, these numbers are consistent with that of the research papers by the US Naval Academy and UMD. Evidently, there are samples that have incredibly low concentrations and other samples that are identified as outliers with incredibly high concentrations.

There were several confounding variables that could have contributed to much of the variability in the data. Notably, the phytoplankton bloom that occurred during the post rain sampling. Furthermore, during the growing season of the phytoplankton, they contained elements of iron which contaminated the samples in the analysis process. During the wet peroxide oxidation, the iron phosphorylated which accounted for the iron pieces in the sample. As a result, we had to manually remove the iron pieces which may greatly affect the analysis process.

Comparing Data from UMD and the US Naval Academy

Results demonstrate that microplastics exist in the South River and are comparable to other rivers in the region. Furthermore, results also show that there is no correlation between the concentration of microplastics before and after precipitation. Due to the countless external factors that impact this experiment, more testing needs to be done to rule out potential sources of contamination and possible sources of error. There is large variability between the data which can be attributed to the behavior of microplastics as well as other environmental factors. Results from our research are corroborated with data from the USNA and UMD. All three studies express high variability with several outliers. The ranges between the concentrations within the samples are very similar.

	Site	Date Range	Plastic Mass by Area (g/km²)
Yonkos et al. (2014)	Patapsco River	July – Nov 2011	10.6 – 238.1
	Magothy River	July – Nov 2011	5.2 – 245.7
	Rhode River	July – Nov 2011	3.2 – 56.1
	Corsica River	July – Nov 2011	2.7 – 19.2
USNA Projects	Severn River	Sept – Dec 2020	2.3 – 326.0
	Severn River	Sept – Nov 2021	0.05 – 148.9
	Annapolis Harbor	Feb 2022	10.2 – 95.5
Capstone Project	South River (Pre Rain)	March 2022	0.99 - 84.59
	South River (Post Rain)	March 2022	1.31 - 211.82



Conclusion

After looking at our data that we obtained from the analysis process, we found that there were no significant differences between the pre-rain and post-rain samples. When looking at the microplastic concentrations for each transect we found that the range of concentrations did not have any significant abnormalities and that the pre-rain and post-rain samples were similar. This was further supported by our comparison of microplastic mass by area. We compared our data with a fellow research group from the USNA and UMD and found several similarities that corroborated our conclusions with our data. There is no correlation that can be determined between precipitation and concentration of microplastics in the South River. More testing is necessary in order to determine a correlation between environmental factors and the concentration of microplastics.

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