Analyzing Select Hydrosphere Protocols on Seasonal Samples of Microplastic Concentrations Among Southeast's Rouge River

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Abstract

This research investigates the potential effects of seasonal changes on concentrations of microplastics and the influence of microplastic concentrations on select hydrosphere and atmospheric parameters. Three samples were taken from the Parr Wayside site located in the Middle Branch of the Rouge River. This site was selected due to its proximity to various urban outlets, such as an elementary school, suburban communities, and public parks. Select hydrosphere parameters included conductivity, pH, turbidity, and water temperature. The air temperature was taken as well for each sample. The Vernier series helped analyze conductivity, water temperature, and air temperature. In addition, the Hach 2100N Turbidimeter and Hach Phenol Red Test Kit were used to measure turbidity and pH, respectively. The researchers' findings concluded that turbidity and conductivity are inversely proportional to microplastic concentrations. Though pH levels did increase with every sample taken, the correlation was modest. In the future, the researchers hope to expand the research to include additional hydrosphere parameters and multiple sites along the Lower Branch of the Rouge River to establish possible sources of microplastics in the Rouge River. Increasing the level of understanding in these areas is essential to develop appropriate policy and management tools to address this emerging issue. Thus, to extend the scope of this research, the researchers hope for the implementation of regulations to monitor the impacts of microplastics as they are still poorly understood.

Discussion

The results of these experiments varied in supporting the hypotheses made. Through the hypothesis, parameters like water temperature, air temperature and pH levels were accepted due to not displaying correlation with microplastic concentrations. Turbidity and conductivity presented clear relations based on microplastic concentrations. As microplastic concentrations increased, turbidity and conductivity decreased. This could be as result of the increased sediment in Sample 2 which hindered the visibility of microplastics, landing to a decreased quantity documented. The researchers' third hypothesis of potential urban effects on microplastic concentrations could not be concluded due to the limited number of samples.

Considering the insufficient number of samples, implementing a more frequent testing schedule is a critical goal of establishing concrete correlation between all four seasons on microplastic concentration. A longitudinal study would be preferable as it would account for the potential correlation between seasonal changes and microplastic densities which in turn can affect concentrations. A larger data sample would allow a more comprehensive and statistically significant conclusion as it will reduce standard error and outliers. In addition, the researchers would also like to expand testing locations, having made plans to test at two additional locations located in the Lower Branch and Main Branch. Expanding testing locations to include other branches of the Rouge River allows us to conclusively analyze the distribution of microplastics and the possible source of these microplastics. Testing in the Lower Branch where the river flows through the Detroit River Wastewater Treatment Plant can help identify potential sources of microplastic input. The researchers could also confirm the causes of the increased microplastic types due to the seasonal factors surrounding the testing location. With all these modifications, the researchers know that the project can be monumental for their community.

Methodology

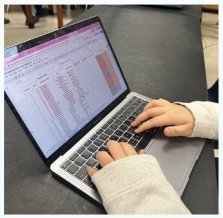
Student researcher collecting a sample from the testing location

Student researchers analyzing their sample at the testing location

Researchers filtering their sample to draw out the microplastics for counting

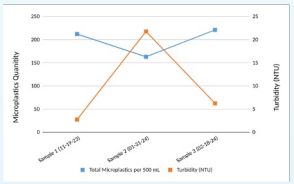
Student researcher taking images of the filter paper under the microscope

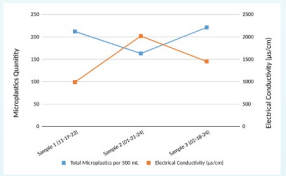
A filter paper under the microscope showing microplastics

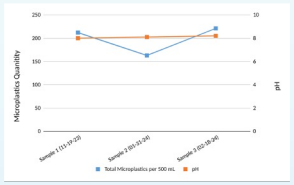


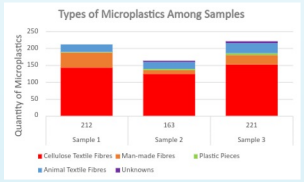
Student researcher inputting data into an Excel sheet

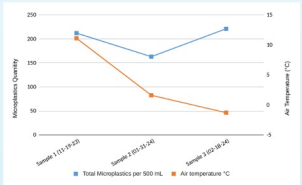
Results

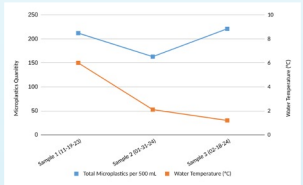












Conclusion

The researchers conducted experiments to determine whether environmental factors were influenced by microplastic concentrations. The team also researched whether human interactions with the environment influence microplastic concentrations within the Rouge River. Since the samples are taken from the Middle Branch of the Rouge River, where there are no wastewater treatment plants, the team cannot determine a possible source of microplastics besides normal urban runoff. To determine the effect of treated sewage effluent on microplastic levels, samples would need to be taken from the Lower Branch of the Rouge River which drains the water coming from the Ypsilanti Sewage Treatment Plant found upstream. It will also be important to conduct a period of extended testing to determine the potential effect of environmental factors, such as air and water temperature, electrical conductivity, turbidity, and pH on microplastics. However, with the research gathered, the team determined that pH is independent of microplastic concentrations. The pH of the water samples was relatively constant, but microplastic concentrations fluctuated. These findings allow the team to conclude that pH is an environmental factor that does not influence the concentration of microplastics, which supports the null hypothesis rather than rejecting it. The data appeared to indicate that the higher the turbidity of a sample, the less microplastics were present. It is important to note that in turbid Sample 2, some microplastics may have been embedded in the sediment and subsequently not counted. All other microplastic counts are assumed to be highly accurate since careful protocols were implemented. The results also indicated the influence of the concentration of microplastics. Due to limited sampling data, the researchers cannot derive conclusions on the impact of water temperature and air temperature on microplastic concentrations. While it was expected microplastic concentrations would decrease with colder air and water temperatures, the opposite effect occurred within the data gathered, which supported the null hypothesis. While the findings provide mixed results on environmental factors impacting microplastic concentrations, it was concluded that some environmental factors are influenced by microplastic concentrations while others are not.

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