Evaluating Hydrosphere Protocols in Correlation with Microplastic Levels in the Rouge River

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Abstract

Microplastic pollution poses a growing threat to freshwater ecosystems, yet its relationship with key **water quality** parameters remains poorly understood. This study investigates the correlation between microplastic concentrations and hydrosphere protocols, including pH, turbidity, total solids, conductivity, and temperature in the Rouge River. The researchers collected and analyzed water samples from two sites: Parr Wayside, an urban recreational area, and Riverside/Park Drive, a downstream location with residential and agricultural influence. The study aimed to determine whether seasonal variations and precipitation patterns affect microplastic levels and how microplastics interact with water quality factors. The researchers hypothesized that increased rainfall would not significantly impact microplastic concentrations and that higher levels of microplastics would correspond with increased **turbidity** and **total solids** while showing no significant relationship with pH or temperature. Samples were collected over several months and analyzed using standard hydrosphere testing protocols, microplastic filtration, and microscopy. Results revealed a positive correlation between microplastic concentrations and both turbidity and total solids, suggesting that higher suspended particle content is associated with increased microplastic pollution. Conversely, electrical **conductivity** and air and water temperatures showed an inverse relationship with microplastics, while pH exhibited no clear correlation. These findings indicate that microplastic contamination may be influenced more by particulate matter in or temperature changes. This research contributes valuable data to local environmental initiatives, informing conservation efforts and emphasizing the need for continued monitoring. The study underscores the importance of mitigating plastic pollution to protect freshwater ecosystems**.**

Discussion

This study explored the correlation between microplastic concentrations and various environmental and water quality parameters in the Rouge River, specifically at the Parr Wayside and Riverside/Park Drive sites. The analysis revealed that turbidity, total solids, and electrical conductivity was strongly associated with microplastic concentrations, while temperature and pH showed weaker or no significant relationships. The first research question asked how seasonal variations and related precipitation patterns influence microplastic concentrations. Although the study spanned several months, there was no clear pattern showing that increased rainfall or seasonal variations directly impacted microplastic concentrations in the river. This lack of correlation suggests that other factors, such as local pollution sources, runoff, and water flow, may have a more immediate influence on microplastic levels than seasonal variations alone. Regarding the second research question, which examined how microplastic concentrations affect pH, turbidity, total solids, conductivity, and water and air temperatures, the study found significant relationships between microplastic levels and turbidity as well as total solids. Higher turbidity and total solids were associated with higher microplastic concentrations, indicating that as the number of suspended particles in the water increases, so do microplastic levels. This finding suggests that turbidity could serve as an indicator of microplastic contamination. Electrical conductivity showed an inverse relationship with microplastic concentrations, with higher conductivity linked to lower microplastic levels. This inverse correlation may be due to the presence of dissolved solids, which could reduce the detection of microplastics or affect their behavior in the water. However, no significant correlation was found between pH, temperature, or air temperature and microplastic concentrations. For the third research question, which addressed how different types of microplastics vary in concentration across two sites, the study did not differentiate between man-made and biological microplastics. However, based on the urban and rural differences between the sites, it is reasonable to hypothesize that the Parr Wayside site, closer to urban areas, may have higher levels of man-made microplastics, while Riverside/Park Drive, which is more agricultural, could have more biological microplastics. In terms of the null hypothesis, the study did not find a significant relationship between increased rainfall and microplastic concentrations in the river water. Potential errors in this study could stem from sampling variability, as microplastic concentrations can fluctuate even within the same location. Environmental factors such as local pollution sources, runoff, and seasonal changes might have influenced the data, causing variability that was not fully accounted for.

Methodology

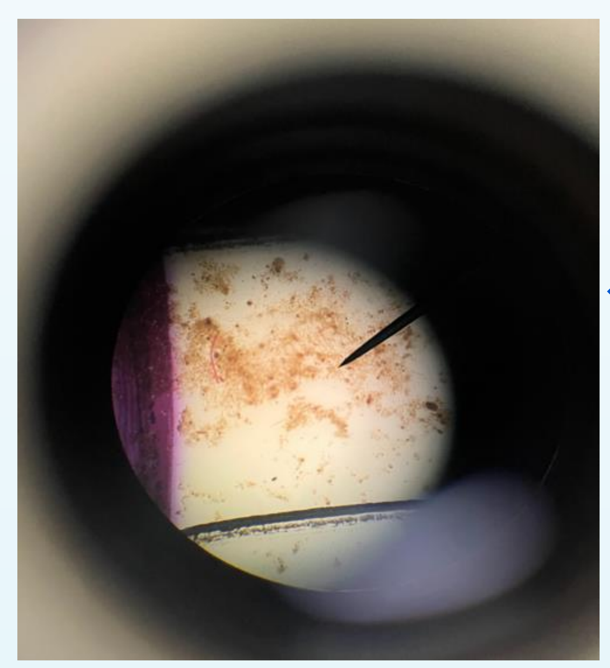
Student researcher collecting water from the Wayside Parr testing location.

Student researcher collecting one of the atmospheric parameters - Air Temperature.

Student researcher collecting data on total solids.

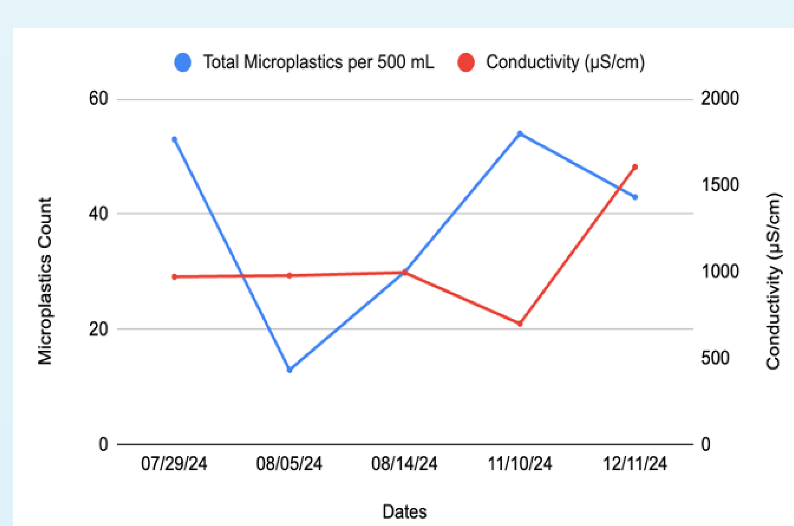
Student researcher using a vacuum filter to draw out microplastic from sampled water

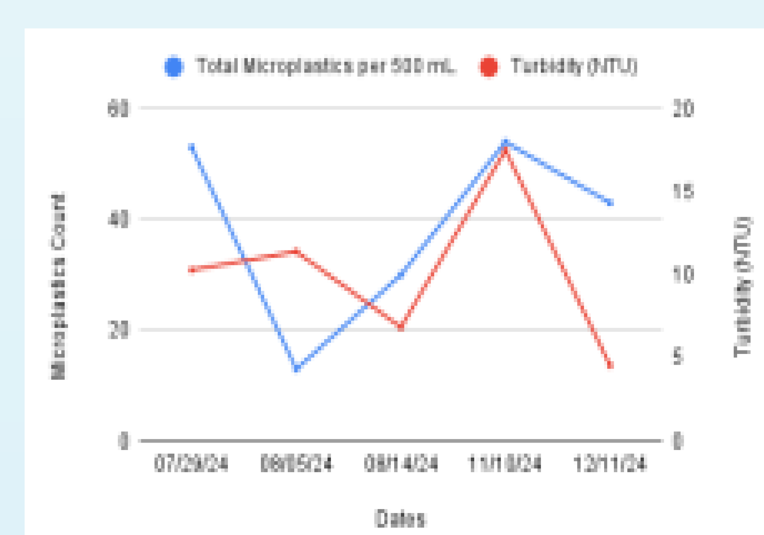
Student researchers analyzing Petri dishes of filtered microplastics.

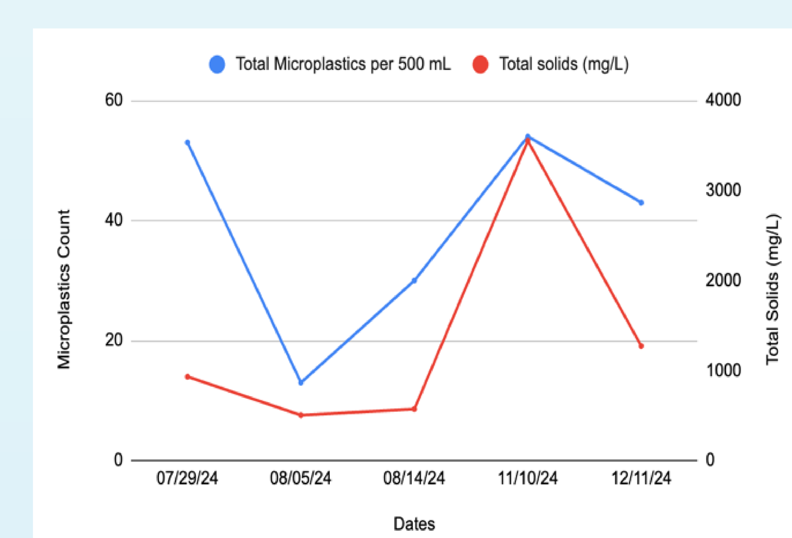


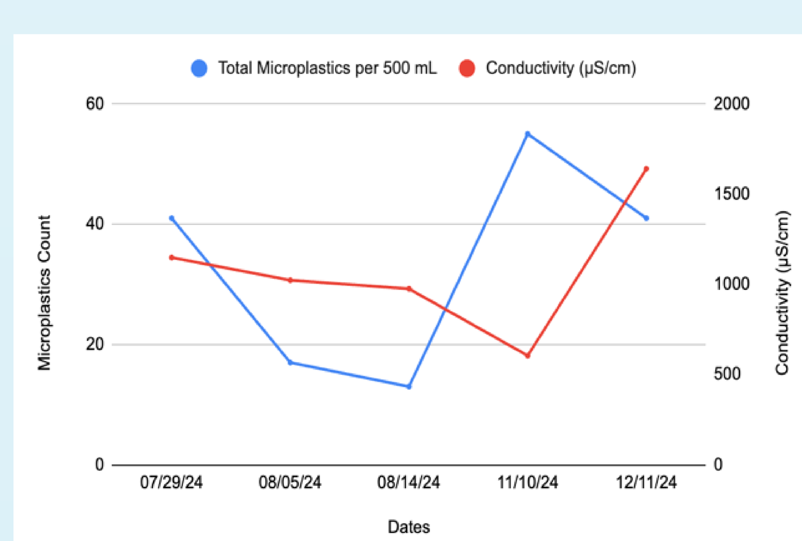
A filter paper under the microplastic showing the microplastics identified.

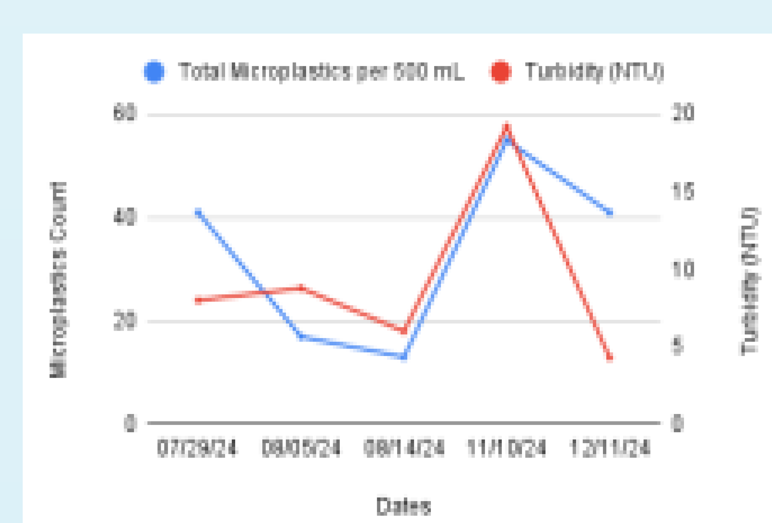
Results

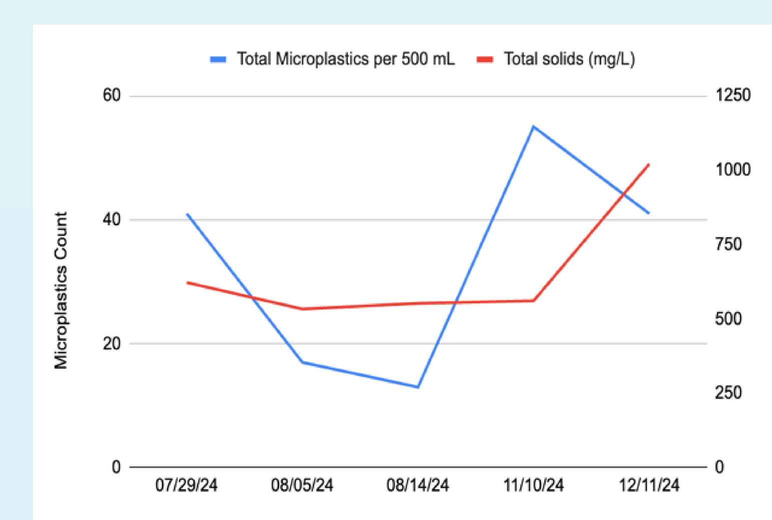












Conclusion

This study aimed to evaluate the correlation between microplastic concentrations and various environmental and water quality parameters in the Rouge River, with data collected from Parr Wayside and Riverside/Park Drive. The results indicate that microplastic concentrations are more closely associated with turbidity, total solids, and electrical conductivity than with factors like temperature and pH. The positive correlations between turbidity and total solids with microplastic concentrations suggest that areas with higher levels of suspended particles in the water tend to have more microplastics. This finding supports the idea that turbidity could serve as an indicator of microplastic contamination. The inverse relationship between electrical conductivity and microplastic concentrations suggests that higher ionic content in the water could affect the detectability of microplastics. The lack of correlation between temperature, pH, and microplastics suggests that these factors do not have a direct impact on microplastic concentrations in the Rouge River. The findings also support the hypothesis that microplastic contamination is more strongly influenced by suspended particles and dissolved solids in the water rather than environmental factors like seasonal variations or temperature. The study's limitations, including sampling variability and instrument sensitivity, highlight areas for improvement in future research. Expanding the study to include more sites and increasing the frequency of sampling would provide more robust data and better insights into the dynamics of microplastic pollution in urban and rural environments. Overall, this research provides valuable information about the factors that contribute to microplastic contamination in the Rouge River. By sharing the results with local organizations such as the Friends of the Rouge and the Dearborn Heights Watershed Commission, the team hopes to contribute to ongoing efforts to reduce microplastic pollution and protect local water ecosystems. Future research should explore the impacts of microplastics on aquatic life and their potential risks to human health, which will be crucial for developing effective solutions to the growing problem of plastic pollution in local waterways.

Acknowledgements

First and foremost, the research team would like to express their gratitude to Mrs. Diana Johns and Ms. Abbas for her time, support, and direction during their entire research project. Furthermore, the team would also like to thank the Friends of the Rouge for assisting the team in purchasing much-needed filtration equipment and expendables needed to process water samples collected during this research. Lastly, the researchers would like to express their gratitude to the GLOBE Program for hosting a worldwide program that encourages young people to investigate the natural world around them and share their data with others interested in similar research.

Citations

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