THE SPRING RIVER WATERSHED, MO: ESTABLISHING **BASELINE LEVELS OF MICROPLASTICS IN BENTHIC SEDIMENT**

Author: Avery Cozens
Faculty Mentor: M. Perkins, T. Boman and R. Heth
Department: Biology and Environmental Health
Competition Category: Physical and Biological Sciences

Introduction

Plastics have been in industrial production for decades and humans produce millions of tons of it per year. In 2016 alone humans produced 322 million tons globally (Europe, 2016). Sometimes these plastics can be very small. Plastics that are less than 5 mm across in size are known as microplastics (Arthur & Baker, 2010). These microplastics have only recently come to the forefront of scientific thought , and so far very little study and standardization has been done in the field.

Keeping this in mind, there were two primary goals of this project. The first was to establish baseline results in the area validate a repeatable process which future researchers could use, and the second was to test the hypothesis.

The hypothesis: does the benthic sediment of waterways have a higher microplastic concentration after passing through higher population areas.

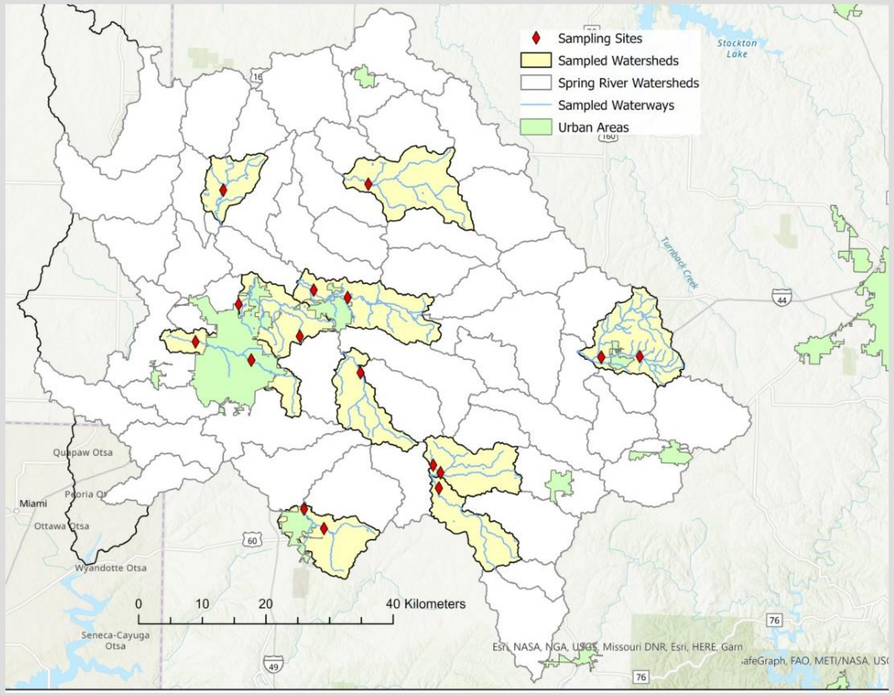

Figure 1: Spring River Watershed with 16 sample locations noted within subwatersheds.

Methods

The sediment sampling protocols were adapted from Dikareva and Simon (2019) and Claessens et al. (2013). In the winter of 2020/2021 sediment samples were collected from sixteen different locations within the Spring River Watershed. Sampling locations were chosen with focus on higher population areas. Samples were collected at baseflow over approximately one month and included three total days of sampling. At each location 15 sediment subsamples were obtained and then combined to create a representative sample for the location. These samples were then analyzed for microplastics following the two-step protocol validated by Claessens et al. (2013).

The primary step of this isolation process utilized the principle of elutriation, and an elutriation column based on the design seen in figure 2 was build to act as a density separator. This column allows the more dense substances like rock to be physically separated from the less dense substances, like microplastics. The upward flow of the water allows the less dense substances to flow with it and out the top, where the water and substances are fed through a fine mesh sieve to catch the Microplastics and allow the water through

For the secondary step of this isolation process the 30 mL of a high density 3.0 molarity solution of NaI was added to 50mL centrifuge tubes containing approximately 15 mL of the sample collected from the primary separation. That mixture was agitated thoroughly for five minutes and then the test tubes were placed in a centrifuge on 3500 RPM for five minutes. After this centrifuge process Using a wide mouthed pipette the NaI solution and everything floating atop it was drawn off the top of the sample in the centrifuge tube. All of the samples from each sample site was then filtered through a glass fiber filter paper. Finally, in order to ensure no microplastics were lost in the first separation, each centrifuge had another 30mL of NaI solution added to them. They were then all agitated, centrifuged, drawn off and filtered again. At the end of this process all of the microplastics from each location were isolated to one filter paper per sample site.

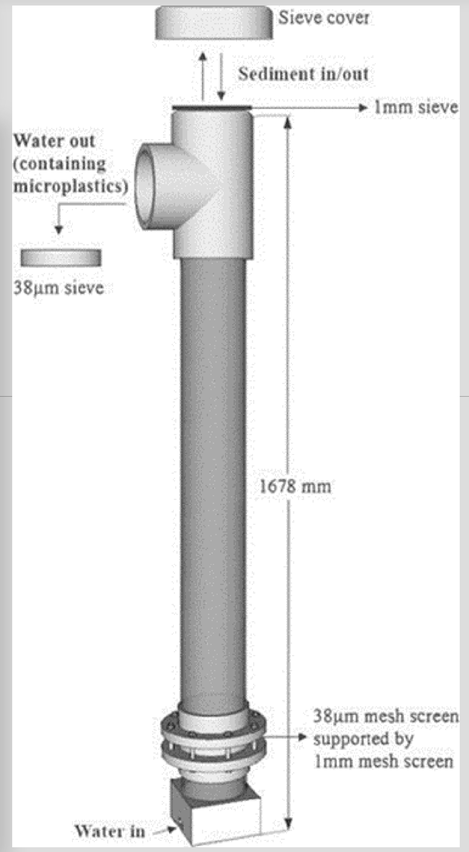

Figure 2: Example of an elutriation column (Claessens et al. 2013)

Results

Upon the final inspection of processed sediment filters, we were able to determine that there was no presence of microplastics in any of our sample locations. These results indicate that the projects initial hypothesis was not supported. In the Spring River Watershed sedimentary microplastic concentrations are not greater downstream of higher population areas than upstream of those areas.

Discussion

This project was originally outlined with two foundational goals in mind. The first of which was to establish baseline results in the area as well as verify a repeatable process for future research. And the second was to test the original hypothesis, that after flowing through a higher population density area there would be a greater concentration of microplastics in benthic sediment of rivers and streams.

There are some important assumptions that can be made based on the results collected. Before any assumptions can be made however it is important to address that there is currently a possibility that there was a flaw in the methodology or the execution. To address this fact future research projects are planned to test both our isolation process and sampling locations. If our results are supported by the future research we can begin to reasonably draw conclusions from this research.

One conclusion that could be drawn is the idea that the movement of the current keeps the microplastics suspended and prevents them from being able to settle out into the benthic sediment. We will be able to draw that conclusion thanks to the work of the sister project of this one, which tested for microplastics in the water column at the same site locations as we tested the benthic sediment.

Acknowledgments

Thank you to Missouri Southern State University and the Department of Biology and Environmental health for providing the funding and resources for this project. A special thank you to M. Perkins, T. Boman and R. Heth for their continuing and completely invaluable engagement with this project. Lastly, to Dr. Mary Kilmer for creating our watershed map.

References

Dikareva, N., & Simon, K. S. (2019). Microplastic pollution in streams spanning an urbanisation gradient. Environmental Pollution, 250, 292-299. doi:10.1016/j.envpol.2019.03.105

Department of Natural Resources. (2013) Spring River Watershed https://dnr.mo.gov/omw/spring.htm

Europe, P. (2016). Plasticsdthe Facts 2016 an Analysis of European Plastics Production, Demand and Waste Data. Association of Plastic Manufacturers, Brussels.

Claessens, M., Van Cauwenberghe, L., Vandegehuchte, M.B., Janssen, C.R., 2013. New techniques for the detection of microplastics in sediments and field collected organisms. Mar. Pollut. Bull. 70 (1)

STUDENT RESEARCH SYMPOSIUM
MISSOURI SOUTHERN STATE UNIVERSITY