MICROPLASTIC LEVELS IN THE LAKE ERIE WATERSHED

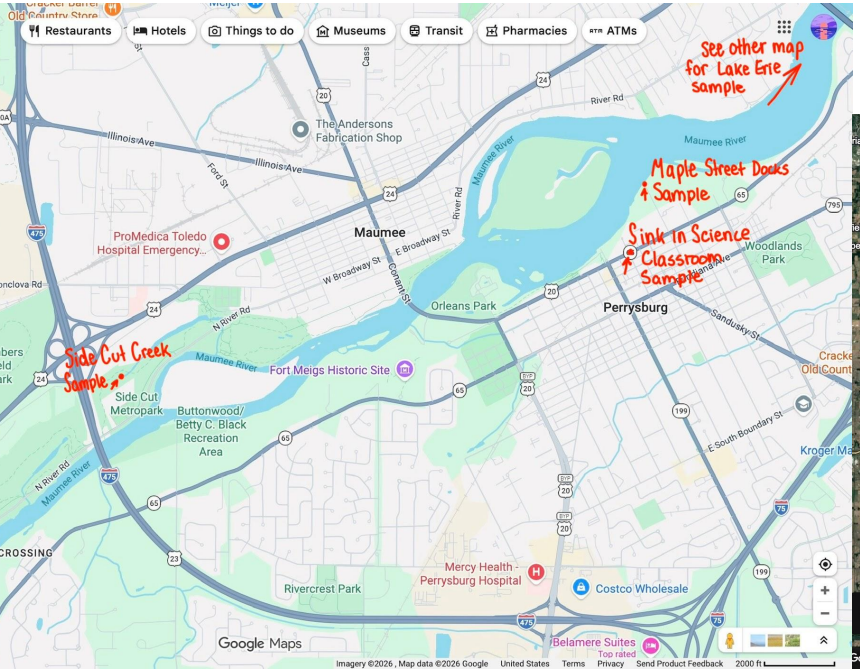
By: Gracie Borgelt

INTRODUCTION

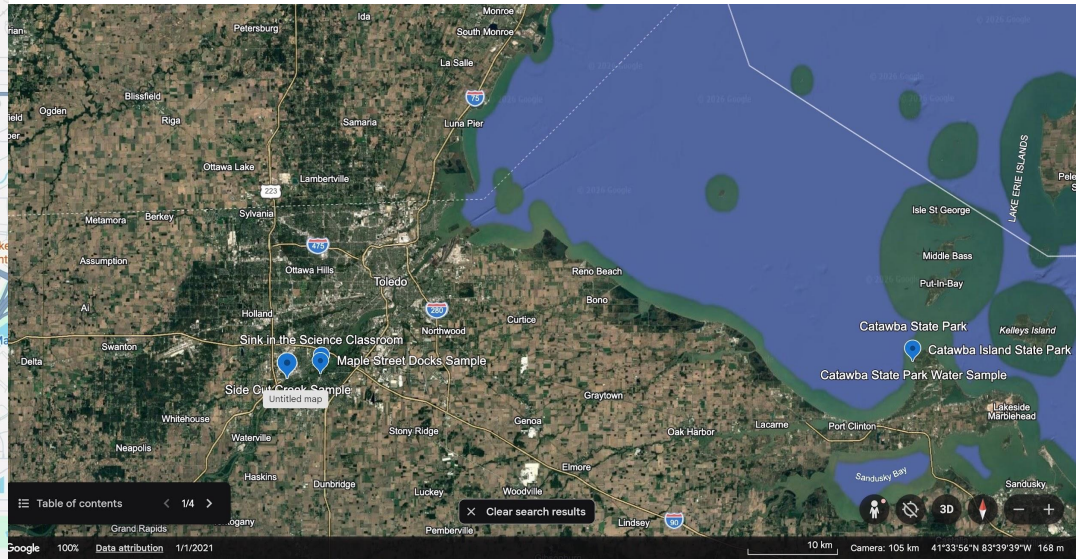
My project is on the levels of microplastics found in the Lake Erie watershed. I chose to do this project because Lake Erie is a large source of drinking water. Fish from Lake Erie are oftentimes consumed at restaurants and in peoples' homes. Microplastics have a very dangerous impact on the human body. I took water samples from Catawba State Park (Lake Erie), Maple Street Docks (Maumee River), Side Cut Creek (a tributary to the Maumee River), and the sink in my science classroom.

MAPS

Shows 3 water sample locations (excludes Lake Erie)



All 4 water sample locations



BACKGROUND INFORMATION

- Microplastics are plastic particles less than 5 millimeters long.
- Microplastics can be found in a large variety of everyday household items.
- The average adult human consumes about a credit card's worth of microplastics every year.
- Microplastics can lead to problems such as petroleum poisoning, death, heart attacks, strokes, and cancer.
- Water is a necessary part of life.
- If it is polluted with microplastics, there can be a very severe impact on humans.

RESEARCH QUESTION

How do microplastic levels vary throughout the Lake Erie Watershed?

HYPOTHESIS

My hypothesis is that Lake Erie will have the highest level of microplastics because it has many different sources of water flowing into it which may affect the microplastic levels. Lake Erie has also been tested by other scientists and found to have very high concentrations of microplastics.

EXPERIMENTAL DESIGN

My independent variable was the location of the water samples and my dependent variable was the amount of microplastics in each sample. For my controls, I took my water samples within 48 hours of each other, used the same size glass Mason jars to hold water samples, washed out the filter unit with distilled water before each testing, and put the pieces of filter paper with test results in identical Petri dishes. I was not able to repeat the experiment because I was limited in the number of pieces of filter paper available to me.

MATERIALS

- Glass Mason jars
- Filter unit
- Water samples
- .47 micron filter paper
- Tweezers
- Petri dish
- Safety goggles
- pH tester
- Distilled water
- Turbidity tube
- Parent's phone
- Thermometer
- Masking tape
- Black rubber tube
- Air pump
- Brass fasteners

METHODS

- Speak to Mrs. Tracey Ostrom about the microplastic filter and get some instruction from her
- Complete background research
- Take water samples at Catawba State Park (Lake Erie), Maple Street Docks (Maumee River), Side Cut Metropark (tributary), and the sink in my science classroom
- Take the temperature of the water and the turbidity of the water and then record that in my notebook
- Take note in my notebook of weather conditions
- Leave water to settle for at least two weeks

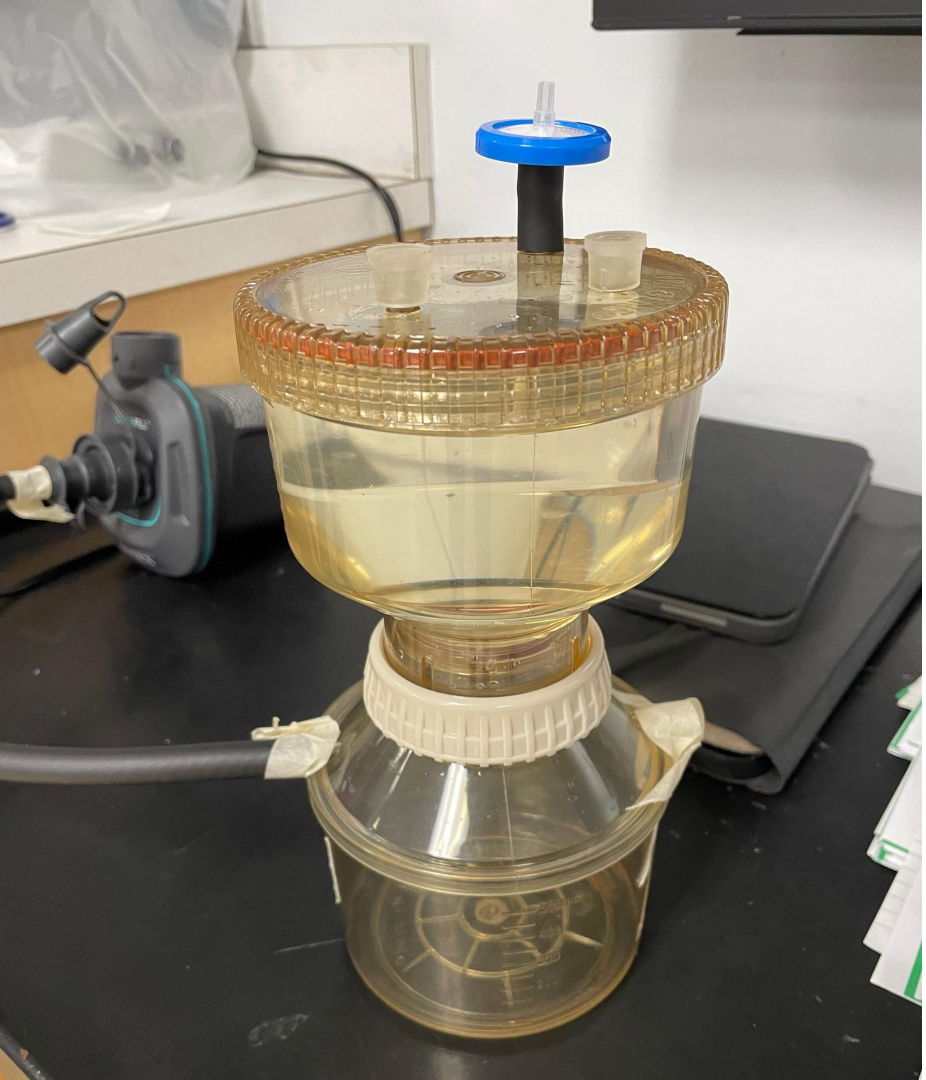
Taking water sample at Maple Street Docks.

Taking water sample at Catawba State Park.

Taking water sample at Side Cut Creek.

MICROPLASTIC FILTER UNIT SET-UP

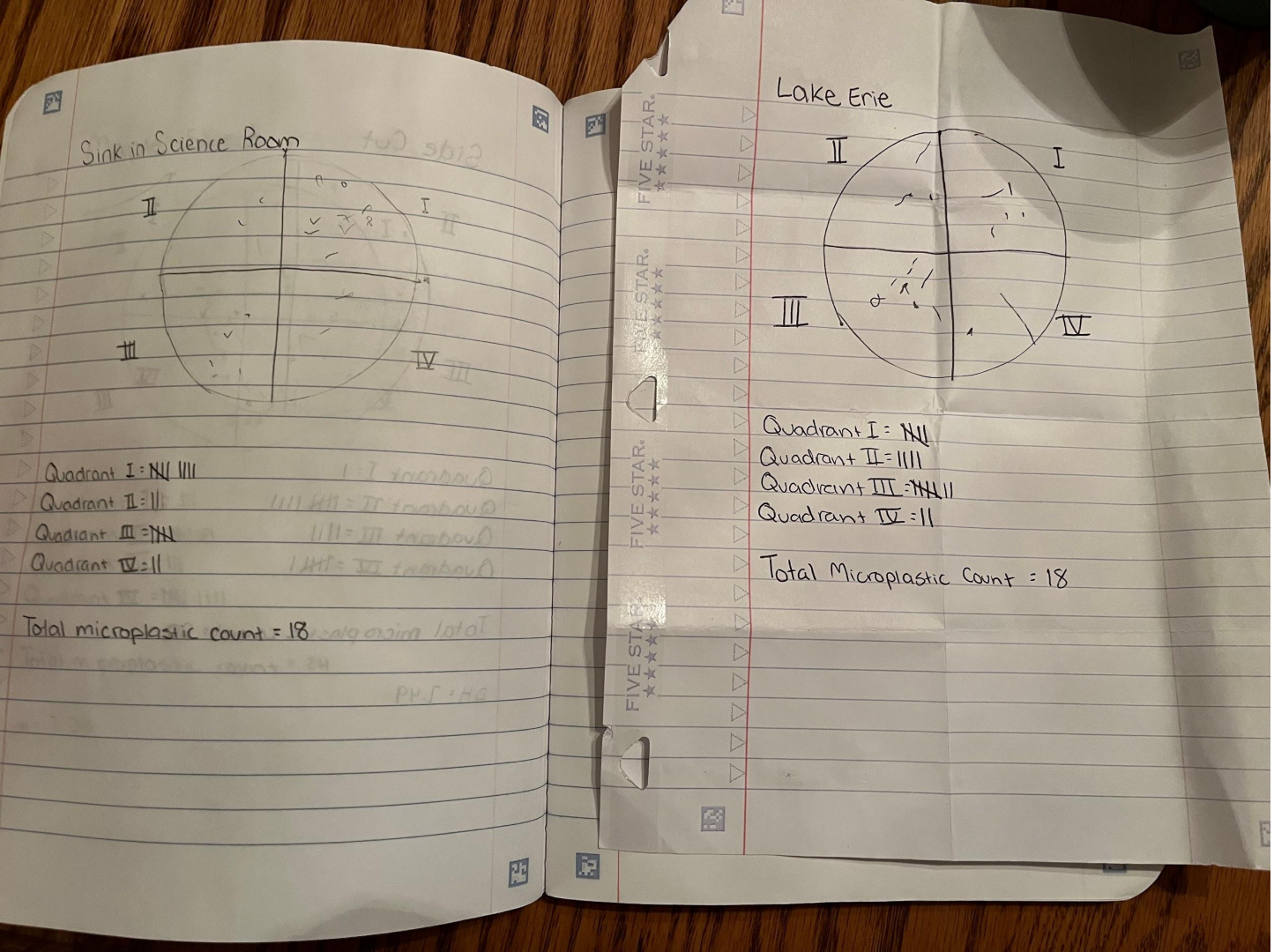
- Wash out upper chamber of filter with distilled water
- Mark filter paper with an x-axis and a y-axis
- Place filter paper on filter unit using tweezers (or brass fasteners)
- Screw the upper and lower chambers together with filter paper in between
- Attach vacuum system
    - Take a black rubber tube and connect it to the lower chamber
    - Connect the other end of the tube to air pump which will suck the air out of the bottom chamber, helping to create a vacuum to draw the water through the filter paper



The microplastic filter unit completely set up.

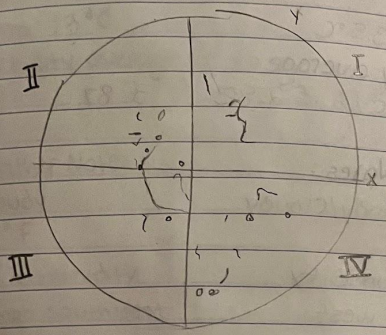
METHODS (CONTINUED)

- Pour exactly 500 mL of water into the upper chamber
- Screw lid back on top to seal up filter unit
- Turn on air pump and let it run until all the water has been filtered through the filter paper from the upper chamber
- Unscrew upper and lower chambers
- Remove filter paper from in between upper and lower chambers using tweezers (or brass fasteners)
- Place filter paper in a Petri dish
- Use masking tape to label Petri dish lid
- Put lid on Petri dish
- Repeat steps 7-12 (including subsections) three more times
- Open Petri dish and place under microscope at 4x magnification
- Going quadrant by quadrant, draw a detailed diagram of what I see in my notebook
- Keep track of the number of microplastics
- Repeat steps 14-16 three more times



Drawing of what I saw under the microscope from the sink in the science classroom and Lake Erie.

Maple Street

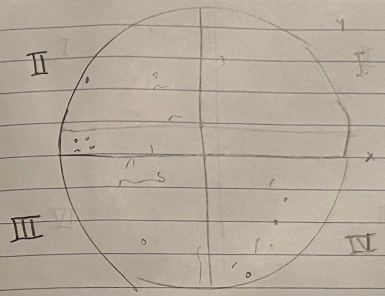


Quadrant I = III
Quadrant II = 𝍸 IIII
Quadrant III = III
Quadrant IV = 𝍸 IIII

Total microplastic count = 24

pH = 7.34

Side Cut



Quadrant I = I
Quadrant II = 𝍸 IIII
Quadrant III = IIII
Quadrant IV = 𝍸 I

Total microplastic count = 20

pH = 7.49

Drawing of what I saw under the microscope from Maple Street Docks and Side Cut Creek.

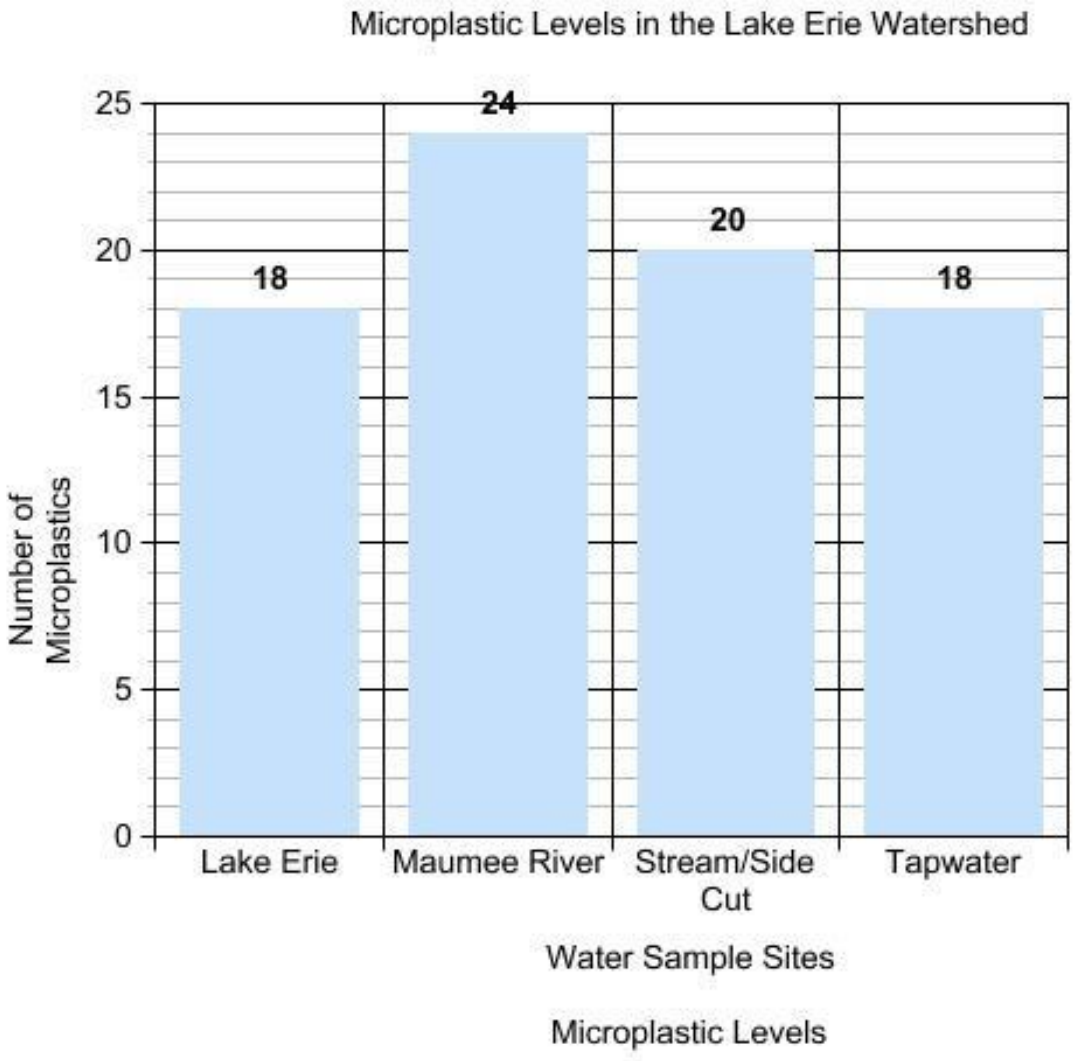
MICROPLASTIC TABLE

	Lake Erie - Catawba State Park	**Maumee River - Maple Street Docks**	**Tributary - Side Cut Creek**	**Sink in Science Classroom**
Microplastic Levels	18 microplastics	24 microplastics	20 microplastics	18 microplastics

*Microplastic levels per 500 mL water samples

EXTRA INFORMATION TABLE

	Lake Erie - Catawba State Park	**Maumee River - Maple Street Docks**	**Tributary - Side Cut Creek**	**Tap Water - Sink in Science Room**
pH	7.79	7.34	7.49	6
Water Temperature	13 degrees Celsius	13 degrees Celsius	13.5 degrees Celsius	21 degrees Celsius
Weather	Sunny	Cloudy	Rainy, Windy, Cloudy	N/A
Air Temperature	14 degrees Celsius	17 degrees Celsius	16 degrees Celsius	N/A
Humidity	45%	34%	50%	N/A
Wind	7 mph south	18 mph southwest	19 mph west	N/A
Turbidity Average	26.63 centimeters	18.17 centimeters	87.5 centimeters	>120 centimeters



GRAPH

*Microplastic levels per 500 mL water samples

STATISTICAL ANALYSIS

- **MEAN -** 20 microplastics per 500 mL water sample
- **RANGE -** 18 - 24 microplastics
- **STANDARD DEVIATION -** 2.8
- **CORRELATION COEFFICIENT -**
  - Between pH and microplastic levels: 0.354
  - Between turbidity and microplastic levels: -0.8245
  - Between temperature and microplastic levels: -0.5106

DISCUSSION

Problems	**What I Learned**	**What I Liked**
• I had trouble telling if a particle was a microplastic or not. • I was unable to take more than one water sample due to limited number of filter papers.	• I learned that microplastics pose a major threat to the health and safety of freshwater ecosystems and the world's health and safety.	• I liked being able to bring awareness to a problem that is important to the world today.

CONCLUSION

My hypothesis was not supported by my results. Lake Erie was actually tied with the sink in the science room for the least amount of microplastics (18 microplastics). The Maumee River had the greatest amount of microplastics (24 microplastics). I believe that this may be because the Maumee River is more turbid than Lake Erie (see turbidity comparison).

FURTHER RESEARCH

If I were able to repeat this experiment, I would take multiple water samples on different dates so that I could have more data to compare. I would also like to learn more about how to identify different types of microplastics so that I can better tell if what I am looking at is a microplastic or not. I would also like to do a project that specifically looks at how water quality relates to microplastic levels.

ACKNOWLEDGMENTS

Thank you to Mrs. Tracy Ostrom (UC Berkeley) for sending me the microplastic filter units and instructions.

Thank to you to my parents for taking pictures, driving me to collect water samples, and helping me figure out how to use the microplastic filter unit.

Thank you to Mr. Less for arranging for me to borrow the microplastic filter unit and helping me set it up.

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