Shell Shocking Discoveries: Un-clamming the Truth About Microplastics in Freshwater Invertebrates

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Abstract

To study how prevalent microplastics are in our freshwater ecosystems, we chose the Asian Clam (*Corbicula fluminea*) as our model species. This is because clams are "filter feeders" meaning they suck water through their bodies, filtering out algae and other microfauna as food. If there are Microplastics in a body of water, these clams will likely have some in their stomachs (Mercogliano, Raffaelina, et al.). We collected specimens from two (2) freshwater lakes; Lake Cavanaugh and Flowing Lake. Using qualitative and quantitative analysis we were able to isolate some degree of Microplastics in all samples we collected (see data panel).

Introduction

One of the many environmental concerns in recent years is surrounding use of disposable plastic products, which ultimately result in the dreaded "Microplastic". Microplastics are of great concern because they are not biodegradable, causing a considerable health risk for humans worldwide (US Department of Commerce). Microplastics are being found in our water, food, vitamin supplements, skincare products, clothing, and even human tissues such as the placenta and umbilical cord. Microplastic frequency has been seen to affect cancer rates, fertility, dementia, digestion, and liver disease. By studying our local ecosystems and wildlife, we can begin to understand how microplastics effect the world around us, and what we can do to change it.

Acknowledgements/Sources

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- Mercogliano, Raffaelina, et al. "Extraction and Identification of Microplastics from Mussels: Method Development and Preliminary Results." *Italian Journal of Food Safety*, U.S. National Library of Medicine, 11 Mar. 2021, www.ncbi.nlm.nih.gov/pmc/articles/PMC7970397/.
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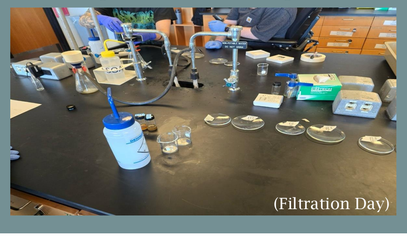
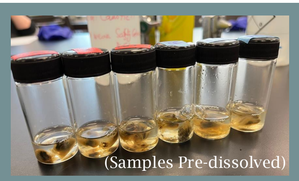
Procedure

1. Collect clams from each lake and rubber band their shells to keep them closed. Place them in labeled bags and then into the freezer to preserve the specimens.
2. The day before the experiment, take the clams out of the freezer and put pairs of them in the fridge in containers so they can defrost. Once defrosted remove interior contents. Weigh empty jars and then each pair of clams in the jars.
3. Place the pairs of clams in jars. Add 10% KOH to the jars, at least 3x the volume of the specimen material. Seal jars.
4. Place jars in a water bath at 60°C for approximately 48 hours, remove jars from the water bath.
5. Filter through 20 µm first, then a 11 µm final filter, using a Buchner funnel.
6. Observe each of the filter papers under the microscope.
7. Count the number of particles observed on each filter paper for each lake. Take the average of these numbers (for each lake) to determine the amount of microplastic in each sample.
8. Compare numbers and analysis of data.

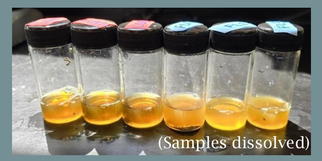
Materials

- 10% KOH
- 20µm & 11µm filter paper
- 6 Clams (per lake)
- Water Bath
- Glass vials
- Small rubber bands
- Scale
- Vacuum Funnel
- Knife
- Microscope

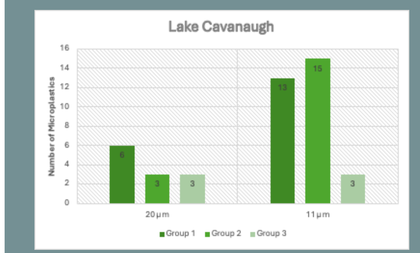

(Filtration Day)


(Samples Pre-dissolved)

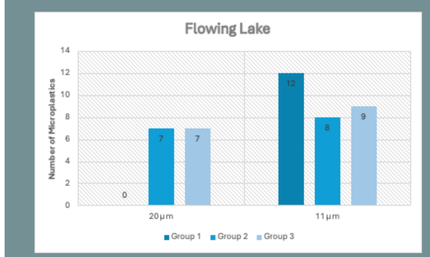
(Samples in water bath)


(Samples dissolved)

Data

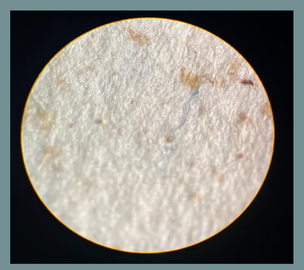


Total microplastics found, Lake Cavanaugh: 43

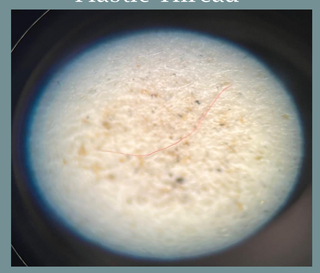


Total microplastics found, Flowing Lake: 43

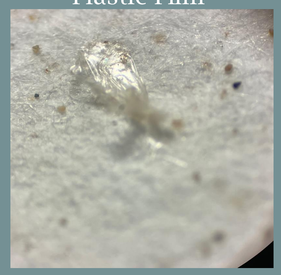
Plastic Thread



Plastic Thread



Plastic Film



Discussion

- A total of 43 individual microplastics were found in the samples for each of the lakes
- An average of 7 microplastics were found per clam per lake
- Overall, more microplastics were found using the smaller filter (11 µm)
- Particles counted included only what were able to be clearly determined as a microplastic, so it is possible more were present than could be identified
- Both lakes are in rural areas, yet a considerable number of microplastics were found in our samples

What exactly is a Microplastic?

Microplastics are fibers, beads, flakes and a variety of other different types of plastic with a size range of 0.1-5000 µm (5mm). They are small pieces of plastic that are found throughout our ecosystems and pollute our environment because of human activities. They don't decompose and the microplastics particles break off of larger pieces of plastic and other materials that are being left in our environments (Gabrielli).

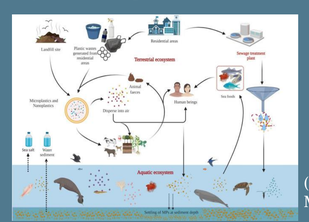
What is "a lot" of Microplastics?

When comparing to other experiments similar. The average amount of microplastics ranges from 0-3 pieces of microplastics in a single clam. So in comparison to these other experiments we found a lot of microplastics. Since we found at least 3 microplastics in a few of our samples. But we found some with 7-15 microplastics for 2 clams (Su, Lei, et al.).

Why should we care about Microplastics?

Environmental Impacts:
- Degradation of soil quality
- Introduction of heavy metals into aquatic environments
- Harm to organisms due to factors listed above, which ultimately results in ecosystem disruption and furthers climate change (Lamichhane)

Health Impacts:
- Reproductive and developmental harm
- Neurotoxicity
- Increased immune response and inflammation
- Metabolic disorder/disruption
- Associated with an increase in chronic diseases, such as inflammatory bowel disease
- Found to damage DNA and cause oxidative stress, which may lead to organ and tissue damage



(Life Cycle of Microplastics)