Microplastic abundance in Silver Carp, Bluegill, and Gizzard Shad of the Upper Mississippi River System

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Introduction

In a world that is constantly creating waste, a concern for many is water pollution. In 2019, microplastics (MPs) were rated as one of the top 12 emerging threats to freshwater biodiversity[1].

MPs are plastic pieces in the size range of 0.3-5.0 mm[2]. Fish can mistake them for food and the chemicals that are associated with them, such as PCBs or BPA, can leech into the fish and act as endocrine disruptors[3,4]. There are currently no published studies on how MPs accumulate in the Upper Mississippi River System (UMRS). This study aims to fill in those knowledge gaps by creating a cumulative database of MP concentrations in Silver Carp, Bluegill, and Gizzard Shad collected from the UMRS field stations (shown in red in Figure 1).

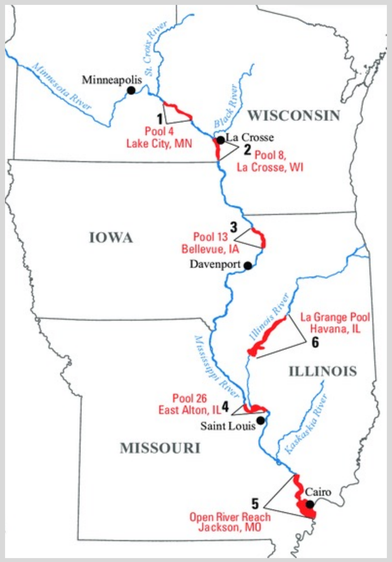
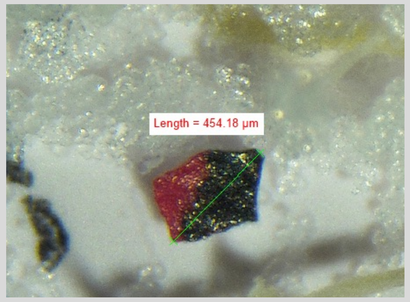


Figure 1. UMR study area (Ickes et al., 2014[5])

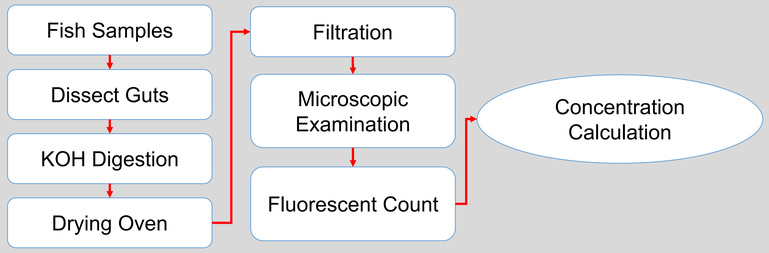
Objectives

- Determine if different species of fish have different levels of MPs in their gut based on feeding mechanism
- Explore the relationship between habitat strata and concentration of microplastics in the gut
- Establish patterns between body length and body mass and the number of MPs in the gut
- Determine which morphological category of MPs is more often found in the gut of fish
- Determine if MP ingestion varies regionally in the UMRS



Figures 2 & 3. Microplastics fragments

Materials & Methods



- Dissection of three fish species from six field stations
- Samples dyed using Nile Red to induce fluorescence under GFP filter
- Count MPs using a Nikon SMZ18 microscope

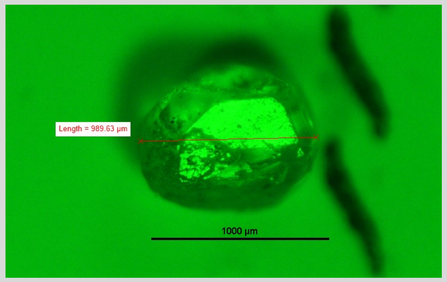


Figure 4. Fluorescing microbead

Hypothesized Results

- Fish that filter feed will have a greater number of MPs present in their gut
- Fish living in the main channel will have greater numbers of MPs present in their gut because higher turbulence presumably maintains MPs suspended in the water column
- Number of MPs in the gut of fish will be positively related to fish body size (mass and length)
- Density of MPs in the gut of fish will be negatively related to fish body size (# particles/body size vs. body size)
- Fibers will be the most dominant category of MPs found in fish gut samples due to their documented high prevalence in aquatic ecosystems
- Fish collected from the farthest reaches of the Mississippi River (the Open River) will have the greatest number of MPs in their gut due to this reach having the greatest volume of upstream water inputs from both terrestrial ecosystems and tributaries

Acknowledgements

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Literature Cited

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4 Granby, K., S. Rainieri, R. R. Rasmussen, M. J. J. Kotterman, J. J. Sloth, T. L. Cederberg, A. Barranco, A. Marques, and B. K. Larsen. 2018. The influence of microplastics and halogenated contaminants in feed on toxicokinetics and gene expression in European Seabass (*Dicentrarchus labrax*). Environmental Research 164:430-443.

5 Ickes, B. S., J. S. Sauer, and J. T. Rogala. 2014. Monitoring rationale, strategy, issues, and methods: UMRR-EMP LTRMP Fish Component. U.S. Army Corps of Engineers.

Current Results

Table 1. Current microplastic totals for Bluegills collected from the UMRS. Sample codes are the barcodes paired with each fish.

Sample Barcode	Sampling Location (Pool)	Microplastics (no./fish)
VR601678	La Grange	26
VR200793	8	5
VR100751	4	5
VR301069	13	16
VR103540	4	36

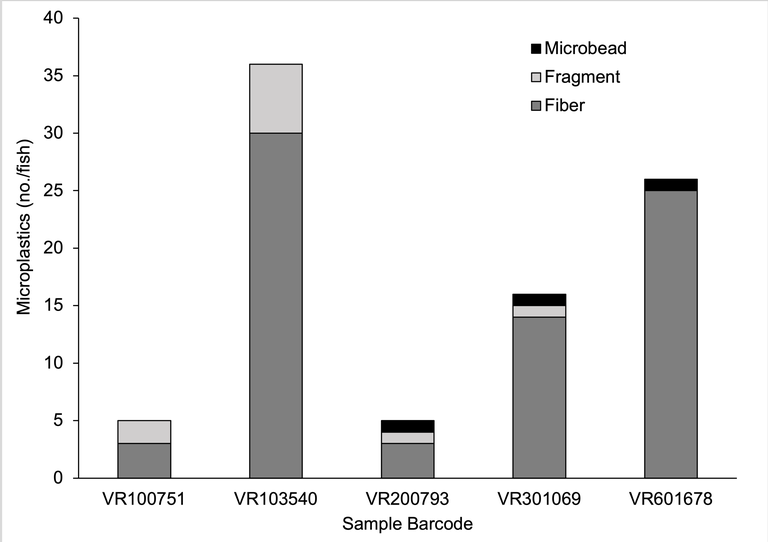

Figure 5. Current MP morphological category distributions among samples

- MPs have been found in all samples so far, with fibers being the dominant morphological category (Figure 5)
- Bluegills are consuming MPs, but no pattern of ingestion is discernable yet
- Fish length and weight data will be used to create density values using the counts of MPs per sample once counting is complete to avoid bias

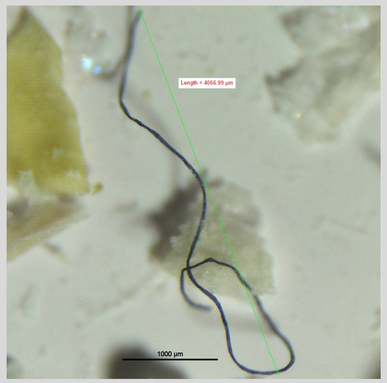

Figure 6. Microplastic fiber