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Presence of Microplastics in Ephemeroptera, Plecoptera, and Trichoptera of North Cascades National Park

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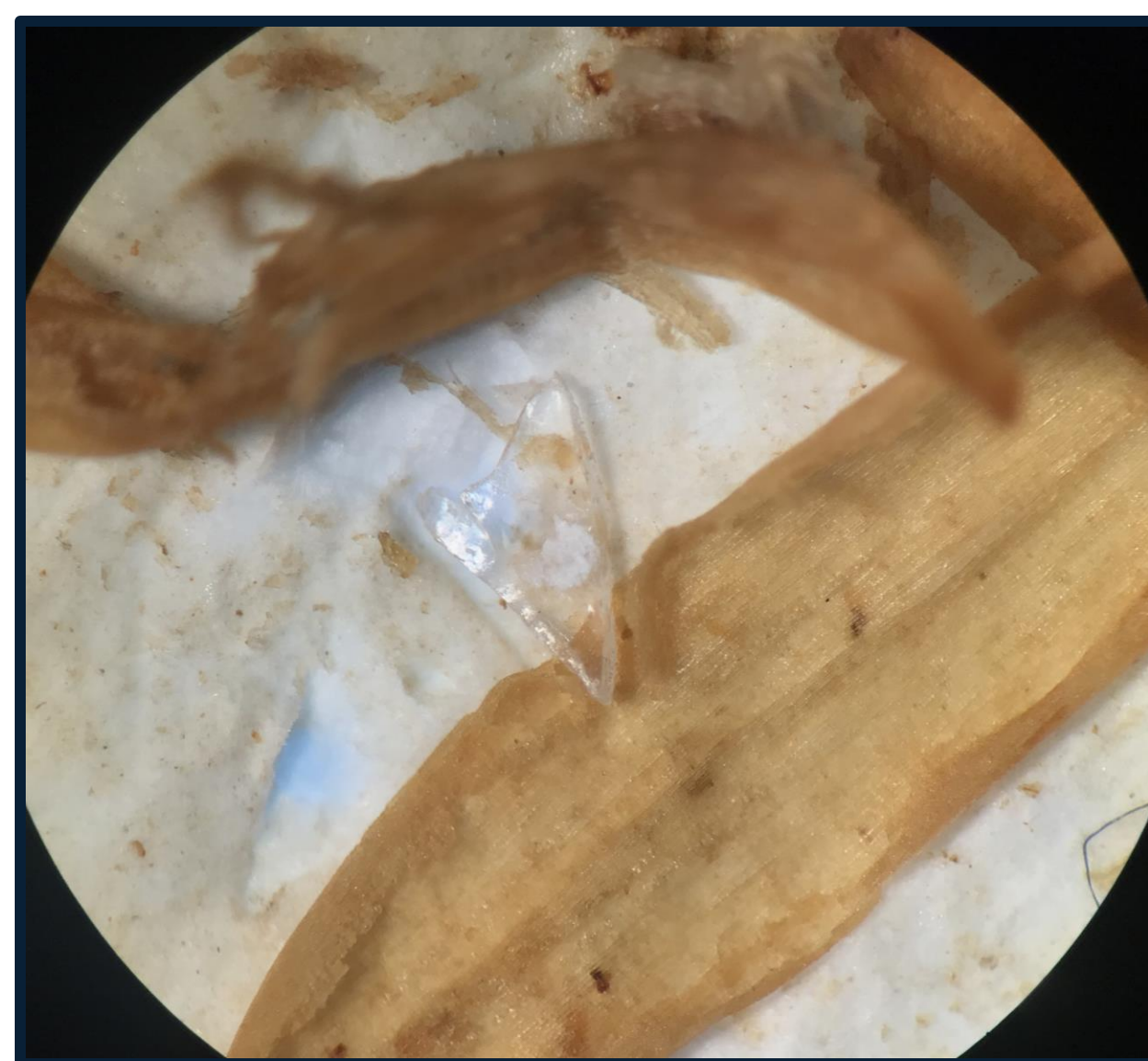
PRESENCE OF MICROPLASTICS IN EPHEMEROPTERA, PLECOPTERA, AND TRICHOPTERA OF NORTH CASCADES NATIONAL PARK



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ABSTRACT

The presence of microplastics in glaciers has led to concern for freshwater systems connected to the glaciers. In areas such as the North Cascades (WA), glacier runoff could transport these microplastics into the watershed and into organisms in the streams. Benthic macroinvertebrates are good indicators of water quality because they may be sensitive to pollution. Their low trophic status on the freshwater food chain suggests the possibility for accumulated microplastics in macroinvertebrates to be a source of microplastics to predators. Samples analyzed in this study were Ephemeroptera, Plecoptera, and Trichoptera collected from several streams and lakes in the North Cascades National Park. Samples were collected in 2018 and preserved in ethanol. Presently, microplastics have been recovered from 98.1% of the 40 samples analyzed. A total of 365 microplastics were recovered. Fibers constitute the majority of recovered microplastics (99.2%). The three most common fibers are blue, black, and transparent. Blue fibers account for 31.0% of fibers, black 26.3%, and transparent 25.2%. Three fragments were recovered, and no films, foams, or pellets were observed.



Transparent fragment at 40X magnification

METHODS

Samples were composited by macroinvertebrates of the same Order and from the same collection site and date. Digestions were done using 10% potassium hydroxide on whole organisms.

- Archived samples in ethanol from 2018 were rinsed, identified, counted, and weighed
- 10% KOH was added to samples and digestions took place in a drying oven at 40 degrees Celsius (Thiele et al. 2019)
- Digested samples were neutralized to a pH of 6.8 – 7.5 using 1 M citric acid (Thiele et al. 2019)
- Neutralized samples were vacuum filtered through a 1.2 μm borosilicate filter
- Plastics were identified under a microscope at 40x magnification
- Classified plastics by type (fiber, fragment, foam, film, and pellet) and color using MERI (2017) guidance

QUALITY CONTROL

- 100% cotton clothing
- 100% cotton lab coats
- Wipe down workstation with Simple Green before and after lab work
- Weekly deep cleaning of the lab
- Microscope blank
 - Keep a blank filter pad out by microscope when counting plastics to account for any airborne contamination
- Process controls
 - Every 10 samples – run a beaker containing only 10% KOH through digestion and filtering process

INTRODUCTION

Aquatic macroinvertebrates are used as water quality indicators because some varieties are susceptible to environmental changes such as pollution (Haney et al., 2013). The Orders Ephemeroptera, Plecoptera and trichoptera (EPT) are particularly useful in water quality assessment because they are easily identified and can be sensitive to pollution (Watershed Science Institute, 1997). For these reasons, EPT macroinvertebrates were selected to understand the presence and types of microplastics found in streams surrounding Ross Lake in northern Washington. Ross Lake is situated in the North Cascade National Park and is fed by surrounding glaciers. Concern about the prevalence of microplastics is growing, yet there is still much to learn about their distribution and ecological impacts because this is a relatively new area of research.

RESULTS

- Microplastics have been recovered from 98.1% of samples of 54 analyzed
- 365 total microplastics
- 99.2% of microplastics were fibers
- The three most common fiber colors were blue, black, and transparent (Figure 1)
- Three transparent fragments were recovered
- There was no significant differences between the number of microplastics/sample between orders (Figure 2)
 - Ephemeroptera, Trichoptera ($p = 0.799$)
 - Ephemeroptera, Plecoptera ($p = 0.057$)
 - Plecoptera, Trichoptera ($p = 0.154$)

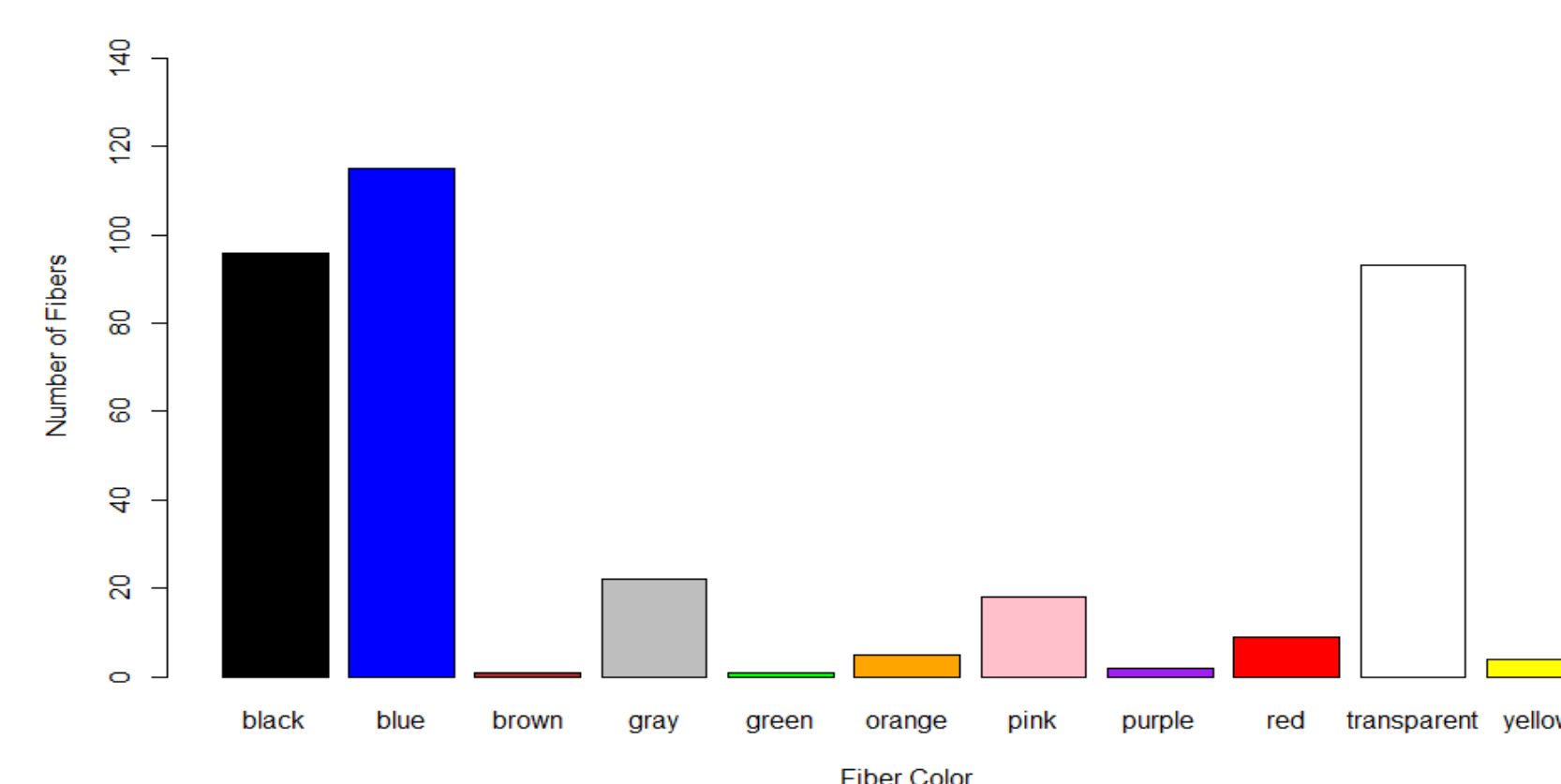


Figure 1. Microplastic fibers found in all samples classified by color.

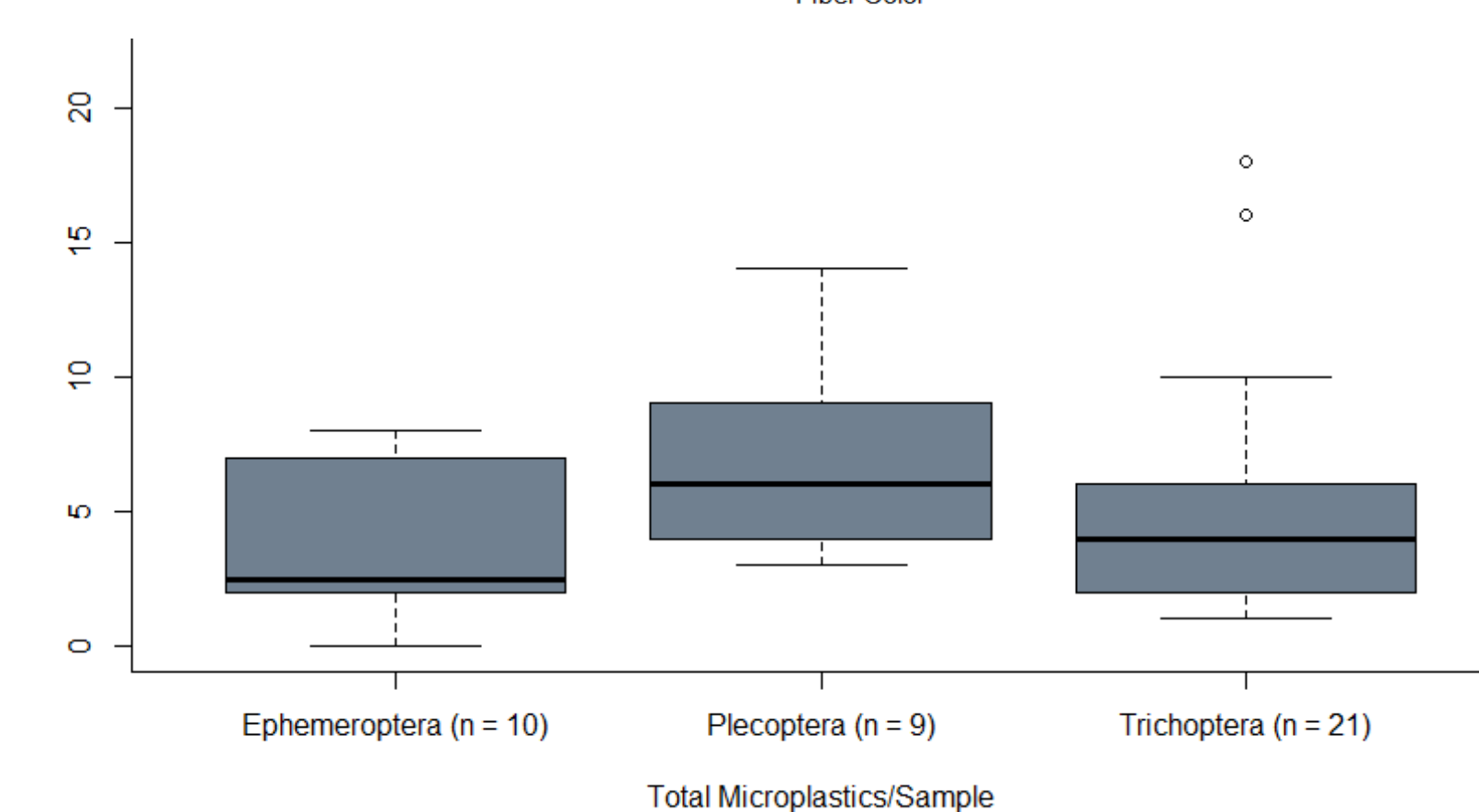


Figure 2. Total number of microplastics recovered per sample by Order.

ACKNOWLEDGEMENTS

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