4-29-2021

Quantifying Microplastics Found in Canada Geese from Various Fredericksburg Locations

Zhanna Leavitt

Analyzing Microplastics Found in Canada Geese (*Branta canadensis*) from Various Fredericksburg Locations

Zhanna Leavitt and Dr. Andrew Dolby
Department of Biological Sciences, University of Mary Washington

Introduction

Plastic pollution has accumulated to a concerning degree in many of the world's ecosystems. Microplastics are some of the smallest plastic debris and are generally defined as plastic fragments less than 5mm in diameter. Secondary microplastics are formed from the disintegration of larger plastic debris such as fibers and fragment and originally come from larger plastic products. Populated urban areas are more likely to be introduced to microplastics than more rural environments. These plastic polymers can consequently flow into aquatic environments and negatively impact aquatic species such as waterfowl. However, the majority of microplastic research has focused on marine environments. The aim of this study is to quantify microplastics found in fecal samples of Canada Geese (*Branta canadensis*).

Methods

Fresh Canada Goose fecal samples were collected from Ficklen Island, Old Mill Park, and the Outback Steakhouse parking lot in Central Park. Samples were placed in glass beakers covered with aluminum foil, dried for 24 hours, and then their dry masses were recorded. The samples underwent digestion in 20 mL of aqueous 0.05 M Fe(II) solution and 20 mL of H_2O_2, for 30 minutes followed by a second dose of 20 mL H_2O for another 30 minutes. During digestion, samples were on a hot plate at 75ºC with the stir bar on. After digestion, samples were left to sit until they reached room temperature. Samples went through a mesh strainer to separate the aqueous solution from the remaining organic material and flushed with copious amounts of nanopure water. The remaining mixture was vacuum filtered onto Fisherbrand P4 grade filter paper. Samples were analyzed under a dissecting microscope. Microplastic type and color were recorded.

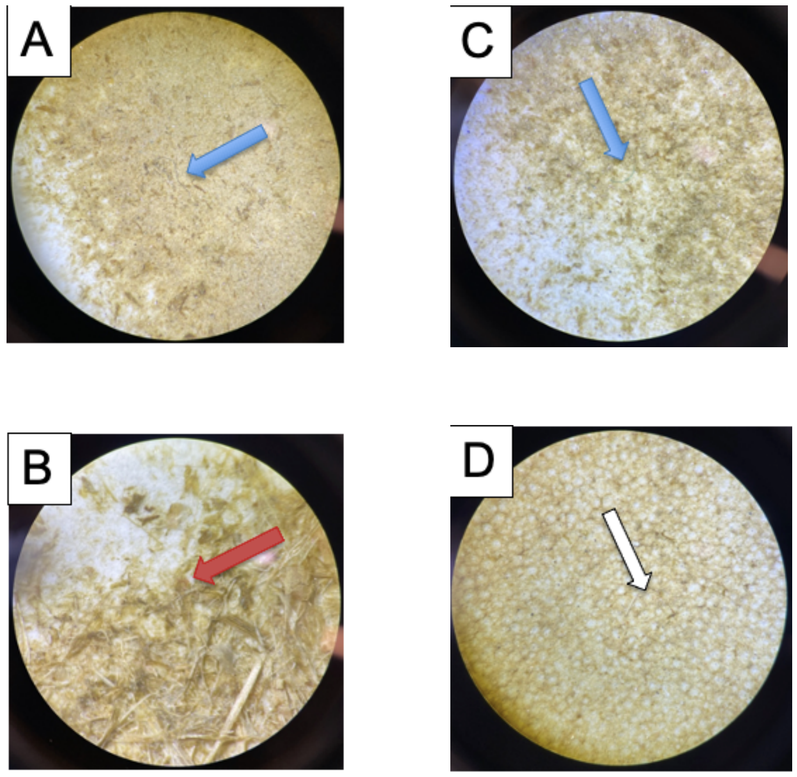

Figure 1. Photos of microplastic fibers found in Canada Goose fecal samples under a dissecting microscope. Photos A and C show blue fibers. Photo B shows a red fiber. Photo D shows a coiled clear fiber.

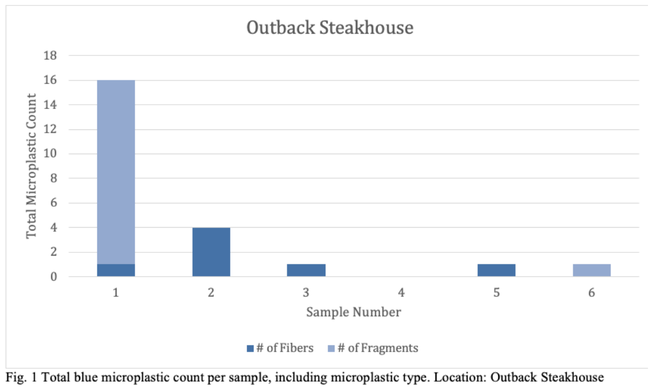

Fig. 1 Total blue microplastic count per sample, including microplastic type. Location: Outback Steakhouse

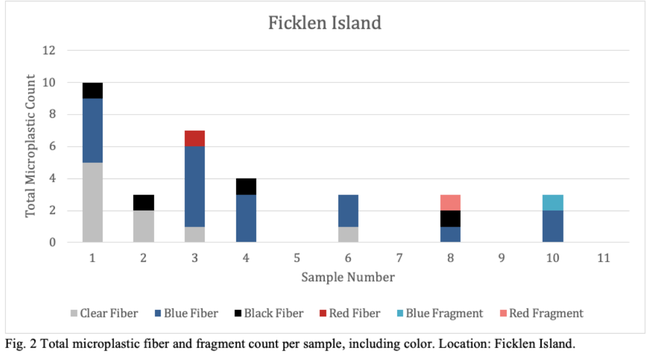

Fig. 2 Total microplastic fiber and fragment count per sample, including color. Location: Ficklen Island.

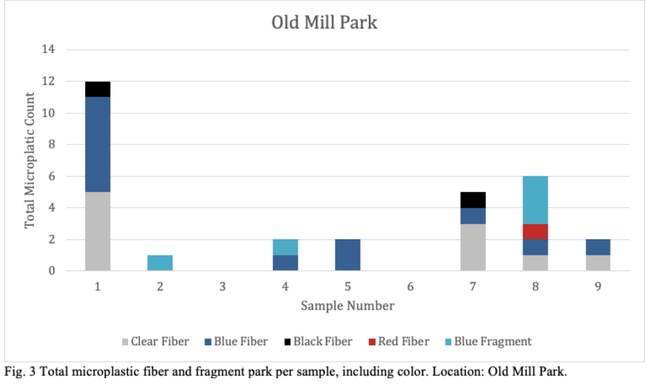

Fig. 3 Total microplastic fiber and fragment park per sample, including color. Location: Old Mill Park.

Results

I found 88 microplastics in 26 fecal samples. The majority of microplastics were blue fibers. 19 of the 26 samples contained at least one microplastic. All the microplastics from the Outback Steakhouse location were blue. The average number of microplastics from here was 3.83 ± 6.11. There was a slight correlation between dry mass of sample and total microplastic count in Outback samples (r=0.5996). 33 microplastics were found in 11 samples from Ficklen Island. 7 samples contained more than 2 microplastics. The average number of microplastics found in the samples from Ficklen Island was 1.17 ± 1.47. They were mostly blue fibers and 19 of the microplastics were blue. There was no correlation between dry mass of sample and total microplastic count (r=-0.2875). The majority of microplastics found in Old Mill Park samples were fibers, and most were blue. The average total microplastic count from Old Mill Park Samples was 2.25 ± 3.84. There was no correlation between dry mass of sample and total microplastic count (r=-0.2875).

Discussion

Though there was no correlation between sampling location and microplastic concentration in each sample, many samples contained microplastics. The three sampling locations all experience some degree of plastic littering which supports the presence of microplastics at all locations. Outback Steakhouse was expected to have the most microplastics since it is in a high trafficked area but had the lowest total microplastic count. Though I tried to collect fresh samples, sometimes it was hard to collect samples immediately as I did not want to disrupt and disturb the flocks. Producing an effective way to immediately collect samples may limit potential contamination from the surrounding soil. Like previous studies, my results did not suggest that the amount of microplastic debris ingestion/excretion is related to the geographic location of capture. More samples may be needed to determine whether a correlation exists between location site and microplastic count.

Future Studies

Analyzing fecal samples from more rural areas less subjected to vehicle traffic and plastic pollution need to be done to determine whether microplastic ingestion and secretion reflects the amount of microplastics in the surrounding environment. Analyzing soil samples will determine whether contamination is coming from the surrounding soil.

Citations

- Eerkes-Medrano, D, et al. Microplastics in Freshwater Systems: A Review of the Emerging Threats, Identification of Knowledge Gaps and Prioritisation of Research Needs. Water Research, vol. 75, 2015, pp. 63–82.
- Lambert S., Wagner M. Microplastics are Contaminants of Emerging Concern in Freshwater Environments: An Overview. In: Wagner M., Lambert S. (eds) Freshwater Microplastics. The Handbook of Environmental Chemistry, vol 58. Springer, Cham.
- Masura J, Baker J, Foster G, Arthur C. 2015. Laboratory Methods for the Analysis of Microplastics in the Marine Environment: Recommendations for quantifying synthetic particles in waters and sediments. NOAA Marine Debris Division.

Acknowledgements

I would like to thank the University of Mary Washington and Larry G. Valade for funding this research