Quantifying Microplastics in Migratory Birds: Loyola University Chicago Campus

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Abstract

Each fall and spring seasons, close to 5-million migratory birds use the Mississippi flyway to fly over Chicago as they travel thousands of miles to nesting or wintering grounds. Traveling primarily at night, birds use rest stops throughout North and South America to forage and refuel for their travels. Unfortunately, many birds will perish during this travel due to light pollution coupled with large, glass-covered buildings such as those in Chicago. Loyola's SOAR program has been collecting and documenting these fatalities for years. Microplastics pose possible health risks to foraging birds, and with the vast expanse of land and water that migratory birds cover, they are likely to accumulate microplastics in their gastrointestinal (GI) tracts as they forage. This study examined the GI tracts of eight (8) different migratory bird species to determine if different feeding niches accumulate different amounts of microplastics in their bodies. The study showed that microplastic fibers may be found in any of the species examined, but no statistically significant trends across species or their respective feeding niches were discovered. A greater sample size for the canopy and understory feeding species may contribute to a more clear idea of whether or not there are differences.

Introduction

Each autumn, approximately 4-billion migratory birds move from Canada into the U.S., while 4.7-billion birds move from the U.S. into South America (Dokter et al. 2018). Approximately the same quantity of birds will make the reverse direction of this migration in the spring. These birds fly during the night, and rest and feed on insects, seeds, berries, and other food sources during the day. The city of Chicago is situated in one of the largest migratory flyways in North America, known as the Mississippi flyway (USFWS). Approximately 5 million birds, including 250 species, migrate through the greater Chicago area alone each spring and fall (CBCM). Unfortunately, a large cityscape provides little habitat for resting birds during the day, and light pollution may cause errors in flight direction. Urban environments such as Chicago create light pollution which disorients and attracts migratory birds, resulting in collisions and ultimately mortality (Ralph 2005). Reflective and translucent surfaces have been found to pose greater risks (Klem & Saenger 2013). It is hypothesized that birds perceive these surfaces as their surroundings when reflective, or as a material is not present when translucent. Tall, glass-covered buildings paired with ALAN during migrations seasons ultimately lead to increased migratory bird fatalities in the city of Chicago, and the Loyola University Chicago lakeshore campus. The primary goal of this study is to determine if different migratory bird species ingest different amounts of plastic based on their feeding niches. It is well-studied that different species have different diets as well as feeding locations. The anatomical structure of a bird's digestive system also makes it possible to discover MPs in the GI tract. Lacking teeth, birds are equipped with a gizzard, which grinds food for digestion. The gizzard often contains sand or small rocks to aid in the grinding process, which creates another area for MPs to be contained in the bird's GI tract.

Methods

During the spring (April-May) and autumn (September-November), Loyola students participate in morning bird collections through the SOAR program (Student Operation for Avian Relief). Collections begin at sunrise. Students follow a pre-determined path to collect any window fatalities (birds which are injured but not deceased are reported to the CBCM hotline for injured birds). The path takes approximately forty (40) minutes to walk. Birds found are collected in plastic zip-top bags. Collectors fill out a paper slip indicating the bird number for the day, date, time of collection, collector name, species (if possible), and location found. The locations are pre-determined based on the largest windows on campus accessible by students and are indicated on the map provided to the students. Birds are kept frozen until dissection. The birds analyzed are as follows: 14 White-throated Sparrows, 7 Tennessee Warblers, 12 Swamp Sparrows, 4 Swainson's Thrush, 8 Ovenbirds, 7 Hermit Thrush, 9 Dark-eyed Juncos, 6 Common Yellowthroats. Birds are dissected in a clean workspace using clean scalpel and forceps. The intestines and gizzard are dissolved in 30% hydrogen peroxide solution for 24 – 48 hours on a 55°C hot plate. Dissolved solution is then filtered through a Whatman GF/C glass microfiber filter. Filters are stored in new culture dishes and labeled accordingly. Filters are then observed under a microscope and all plastic fragments and fibers were counted and recorded. Data was analyzed in RStudio using an ANOVA model and a TukeyHSD post hoc test.

Findings

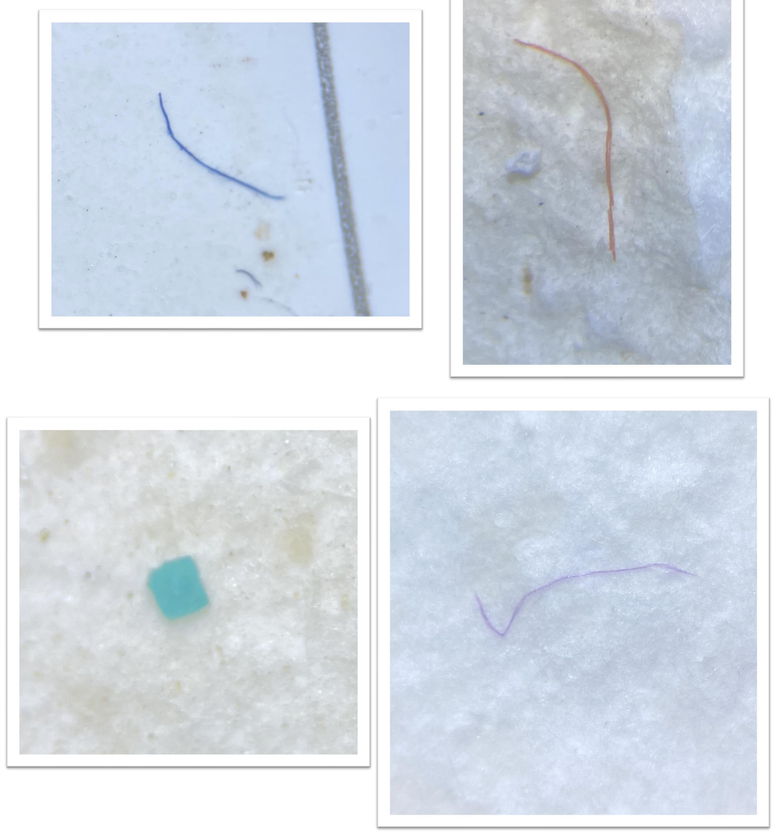

Figure 1: (from left to right and top to bottom) blue microfiber, red microfiber, light blue microfragment, purple microfiber.

Results and Conclusion

Birds were compared by species examining their total microplastic counts across all species (Figure 3). The mean was found to be 6.50 MPs/bird across all species, with a maximum of 33 MPs and a minimum of 0 in an individual bird. 83% of all birds analyzed in the study (57 of 69) were found to contain microplastics in their GI tract. A greater amount of microfibers (mean = 5.43) were also found relative to fragments (mean = 1.07). No significant differences were detected between different feeding niches, but due to sample size for each niche the statistical strength would not be sufficient. Further analyses of birds which feed in the understory and canopy must be completed in the future. Ultimately, this study showed evidence that a large portion of migratory birds may contain microplastics. More in-depth research may show what types of plastics are most common in birds, or determine what food sources contribute to the ingestion of more microplastics.

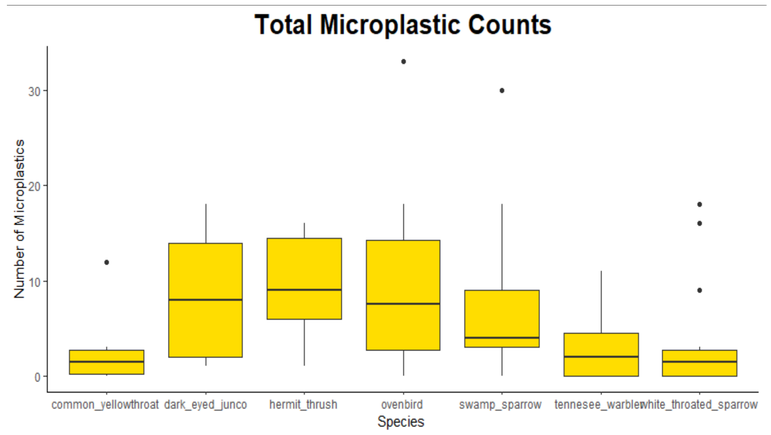

Figure 2: displays the microplastic counts for each species.

No significant difference was found between different species.

Citations

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