



Trophic Transfer of Microplastics in Invertebrates, Fish, and Cormorants of Lake Champlain

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heating/stirring of wet peroxide oxidation.

- and stirred to initiate tissue breakdown.

- added to samples, heated at 75°C while stirring at 350 rpm. Aliquots of 20 ml H_2O_2 were added as needed for clearing.

- fragment, foam, pellet/bead, and nurdle) using Leica Ez4 and Zeiss Stemi 2000-c stereomicroscopes, and stored in 5 mL shell vials and DI water.
- Polymeric confirmation will proceed in the future with Fourier Transform Infrared Spectroscopy (FT-IR).





P) rainbow smelt, and representative invertebrates.

Size separation via sieves (excluding amphipods and zebra mussels): • **1 mm** \rightarrow 341 fibers, 24 films, 14 fragments, 7 foams, and 3 pellets • **355** μ m \rightarrow 476 fibers, 38 films, 29 fragments, 8 foam, and 2 pellets • 125 μ m \rightarrow 499 fibers, 33 films, 115 fragments, 8 foams, and 8 pellets

Discussion

Presence of MP was noted in macroinvertebrates ($\bar{x} = 0.52$), 15 fish species $(\overline{x} = 5.91)$, and double-crested cormorants ($\overline{x} = 22.93$) demonstrating trophic transfer of MP's in Lake Champlain species (Figs. 6A,7).

Bowfin contained the greatest mean MP abundance (\bar{x} = 29.67), followed by lake trout (\bar{x} = 22), and northern pike (\bar{x} = 18.42) (Fig. 6B).

Among fish, stomachs contained the greatest mean MP abundance (\bar{x} = 5.84), followed by the esophagus ($\bar{x} = 5.49$), and intestines ($\bar{x} = 4.76$) (Fig. 6C).

Fibers (82.0%) were the most common particulate type in all organisms. Other particles included fragments (12.5%), films (3.95%), foams (1.29%), and

> 87% of MP found in freshwater tubifex worms (*Tubifex tubifex*) were fibers ranging from 55 um- 4.1 mm (Hurley et al. 2017).

With the use of FT-IR, Ashline et al. (2018) noted that polyester (PET) was the most common polymer uptaken by organisms. This polymer can originate from food and beverage packaging and synthetic clothing.

Most abundant plastics in North Sea fish digestive tracts were rayon and polyamide textile fibers (Lusher et al. 2013).

Many organisms mistake MP for food (Foekema et al. 2013).

Studies have shown that MP adheres to algae (Gutow et al. 2016).

➢ 61% surveyed zooplankton contained MP (Frias et al. 2014). > 19.8% of fish, across 17 species, ingested MP and 32.7% had more than one

MP. Fish length/age and proximity to urbanization increased particulate load (Neves et al. 2015).

> MP gut retention time is likely linked to the capacity of a chemical to bioaccumulate (Santana et al. 2017).

Negative impacts of MP exposure in aquatic systems have been reported, including reduced feeding activity, enhanced adsorption of contaminants (Besseling et al. 2012), reduced energy reserves (Write et al. 2013), and lesser reproductive output (Ziajahromi et al. 2017).

Human risks range from consumption of seafood (Van Cauwenberghe and Janssen 2014), beer (Liebezeit and Liebezeit 2014), and sea salt (Yang et al. 2015), to pathogentic spread (Keswani et al. 2016).

We suggest that aquatic and semi-aquatic organisms uptake MP via both trophic transfer and direct consumption within the water media.

Future Directions	
ue polymerically characterizing plastics FT-IR.	AB 2379 $-2-$ This bill would require that clothing made from fabric that is more than 50% polyester bear a conspicuous label stating that the garment sheds plastic microfibers when washed and recommending hand washing. The bill would prohibit a person, on and after January 1, 2020, from selling or offering for sale clothing made from fabric that is more than 50% polyester that does not bear that label
processing digestive tracts to increase ty across feeding guilds.	Vote: majority. Appropriation: no. Fiscal committee: no. State-mandated local program: no. The people of the State of California do enact as follows: 1 SECTION 1. (a) The Legislature finds and declares all of the 2 following: 3 (1) Microfiber is a subcategory of microplastic that is shed from 4 synthetic fabric when that fabric is washed.
2379) and CT (341) have proposed ably bills to add warning labels to synthetic g. Continue outreach efforts concerning er pollution problem (Fig. 8).	 (2) These small, nondegradable fibers that are less than 5 millimeters in length are a major category of plastic pollution in water, pose a serious threat to the environment, and have been found within fish and shellfish that are consumed by humans. (3) Garments made from synthetic fabrics, such as polyester, can shed up to 1,900 microfibers per wash. (4) Polyester is the most widely used fiber in the textiles industry and accounts for about 50 percent of the total fiber market. (5) Effluent from washing machines and wastewater treatment plants is a significant source of microfiber pollution that enters waterways and the ocean. (b) It is therefore the intent of the Legislature to do both of the following: (1) Recognize the emerging threat that microfibers pose to the
Patagonia's Guppy Friend bag and a Project's Cora Ball microfiber catcher aundering.	 environment and water quality and provide information to the general public about the sources of microfiber pollution. (2) Reduce the amount of microfiber that enters the environment and is subsequently consumed by wildlife. SEC. 2. Chapter 6 (commencing with Section 42368) is added to Part 3 of Division 30 of the Public Resources Code, to read: Fig. 8. CA Assembly bill 2379
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