

Microplastics: Small Objects with Big Consequences

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GPB 377 – Environmental Impact Assessment

Microplastics in our oceans

- Microplastics are one of the leading threats to marine ecosystems, as the problem is most prevalent in our oceans. Macroplastics, which are often wrappers, plastic bottles, and plastic that has not been broken down are the visible problem of our plastic dumping, microplastics are the unseen problem. Unlike floating or big pieces of plastic, microplastics are harder to see and catch, because of their size and tendency to sink instead of float. While solutions are being made to solve the oceans macroplastic problem, the microplastics will require different tactics to remove them from the environment. (Kosior, E., & Crescenzi, I. (2020)
- Once plastic has been broken down to around 5mm, it can be consumed by most marine life. Plankton, small invertebrates, and small fish will often eat the microplastics, mistaking them as food. Over time, as one organism consumes another, the plastic ends up in the predator's stomach, and the farther you go up the food chain, the higher amounts of plastic materials you will find. (Lusher, A. et al, 2017)
- In a study conducted in a fish market in China, caught bivalve species were dissected and trace amounts of microplastics were found in their digestive systems. Inside, common microplastic formations such as beads, fibers, and fragments. The number of pieces ranged from 2.1 to 10.5 items/g and from 4.3 to 57.2 items/individual for bivalves. Below are examples of the shape of various plastic material found in bivalve organisms. (Li, Jiana, et al. 2015)

Plastic in our food

- Because of bioaccumulation of plastic material in large fish and shellfish, humans end up being a part of the bioaccumulation as plastic from our seafood ends up in our body. Whether by skin absorption, inhalation, or ingestion, microplastics can enter the human body. Once entered, these plastics can build up over time, and can cause potential health problems. Plastic particles often attract microbes to their surfaces, as well as absorb other hazardous chemicals in the water, leading to both pathogens and toxins access to the human body. (Amelia, TS, 2021)
- When plastic is made in factory, several thousand distinct additives are used, including plasticizers, flame retardants, pigments, antimicrobial agents, heat stabilizers, UV stabilizers, fillers, and flame retardants. (Smith, M. et al, 2018). This means that these same additives can end up in the human body, which some are known to be hazardous to human health.

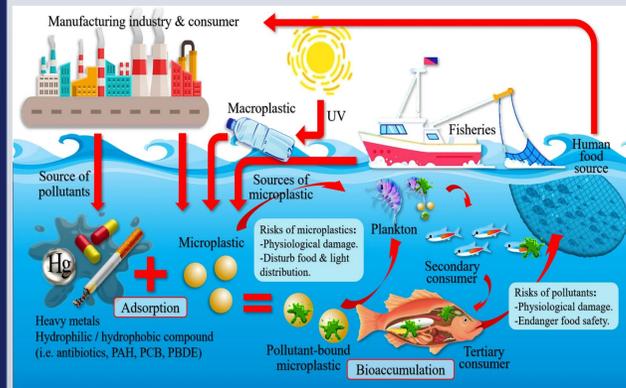


Thompson, Andrea. "From Fish to Humans, A Microplastic Invasion May Be Taking a Toll." *Scientific American*, Scientific American, 4 Sept. 2018,

Abstract

A microplastic is a small fragment of a synthetic material that has been broken down by various means and has entered the environment. Both on land and in water, microplastics pose serious threats to both the health of our ecosystems and to our own personal health. Plastic materials cannot be broken down like organic materials and absorbed back into the environment, and instead are broken down by wave movements, sunlight, chemical reactions, and other forms of erosion. Because of their synthetic nature, microplastics are not biodegradable, and will continue to break apart into smaller pieces until they are microscopic. The smaller the pieces get, the easier it is for them to be consumed by other organisms. From small animals like plankton to large animals like whales, plastic is entering the bodies of both marine and terrestrial life, as well as the bodies of humans. Coming from a variety of sources, ranging from clothing, building materials, packaging, etc, potentially biologically and chemically hazardous materials are accumulating in ecosystems around the world.

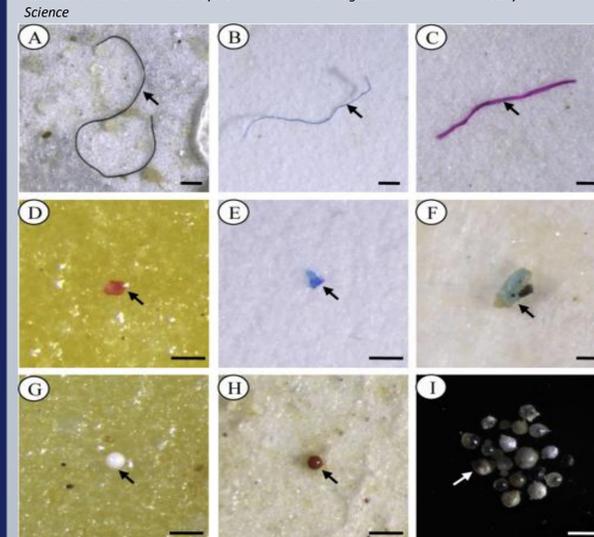
Throughout the world, microplastics are being created and distributed in a multitude of ecosystems, organisms, and food sources. As we continue to dump millions of pounds of plastic waste into the ocean every year, that plastic will only get smaller and smaller over time, becoming problematic over time. Plastic will be harder to collect, and easier to become hazardous the longer it is in the environment, so a priority should be put on researching ways to track and dispose of microplastics and reducing the amount we collect.



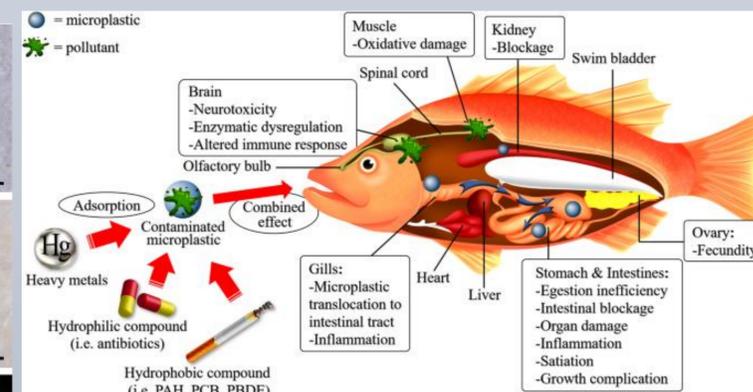
(Amelia, T. S., et al, 2021.) Marine microplastics as vectors of major ocean pollutants and its hazards to the marine ecosystem and humans. *Progress in Earth and Planetary Science*



Kosior, E., & Crescenzi, I. (2020). Solutions to the plastic waste problem on land and in the oceans



(Li, Jiana, et al. 2015) "Microplastics in Commercial Bivalves from China"



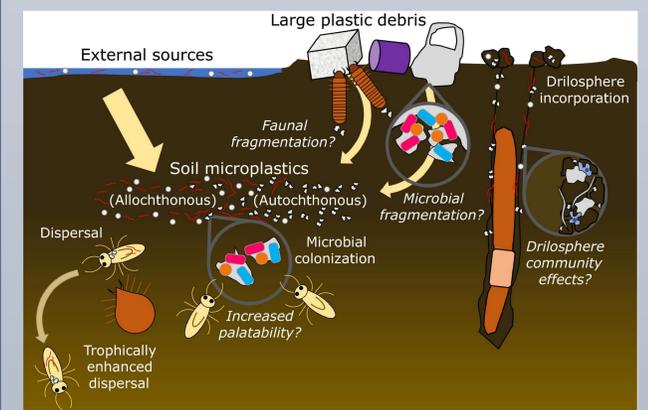
(Amelia, T. S., et al, 2021.) Marine microplastics as vectors of major ocean pollutants and its hazards to the marine ecosystem and humans. *Progress in Earth and Planetary Science*

How our laundry produces microplastics

- A primary contributor to microplastics and fiber in our water systems are laundry machines. When clothes are washed, loose fibers and materials become loose in the washing process and are carried out by the water into the sewage system. From there, the fibers will pass filtration systems due to their extremely small size, and end up in rivers, lakes, and oceans or back into our drinking water. Organisms end up consuming the fibers and other clothing-based plastic and will cause harm in the health of marine life and contribute to bioaccumulation. (Napper, I. E., & Thompson, R. C., 2016)
- For an average wash load of 6 kg, studies show that over 700,000 fibers of clothing could be released into a water system. Of those fibers, polyester and synthetic based clothing contributed the most particles. Clothing material such as glitter and other cosmetic materials are contributors to microplastics coming from our laundry. (Falco, F. D, 2019)

Microplastics in our soil

- The research into the effects of microplastics in soil is lacking, but in recent studies there have been studies showing the potential impact microplastics can have on soil quality and organisms. When common plastics such as polyacrylic fiber, polyamide beads, polyester fibers, and polyethylene high-density fragments are dispersed in loamy soil, there are signs of changes in nutrient and water retention, as well as possible signs of chemical leaching from plastics that can potentially harm the health of soil organisms. When soil is flooded by water, microplastics can enter the ground and become a part of the terrestrial ecosystem. (Machado, Anderson Abel De Souza, et al., 2018)
- Because plastic cannot biodegrade, the plastic travels throughout soil ecosystems, and accumulates in various animals and plants. Over time, microplastics can accumulate to a degree that could harm organisms, can have reaching implications to the rest of the food chain. However, some studies have shown that when microplastics are ingested by worms or insects, the plastics are broken down, and fully degrade within the organism, effectively rendering the microplastic harmless to the rest of the ecosystem. (Helmberger, M. S., 2019)



Helmberger, M. S, 2019. "Towards an ecology of soil microplastics"