Research on microplastic pollution (small particles of plastic <5 mm in size) has long focused on their largest sink: the ocean. More recently, however, researchers have expanded their focus to include freshwater and terrestrial environments. This is a welcome development, given that an estimated 80% of microplastic pollution in the ocean comes from land (1) and that rivers are one of the dominant pathways for microplastics to reach the oceans (2). Like other persistent pollutants, such as polychlorinated biphenyls (PCBs), microplastics are now recognized as being distributed across the globe. Detailed understanding of the fate and impacts of this ubiquitous environmental contaminant will thus require a concerted effort among scientists with expertise beyond the marine sciences.

Scientists sporadically reported the presence of small plastic particles in the ocean as early as the 1970s, but research into their distribution and impacts effectively began in 2004 with a pioneering study led by marine ecologist Richard Thompson (3). To describe small plastic particles and differentiate them from large plastic debris such as fishing nets, bottles, and bags, the authors dubbed them "microplastics." Recognizing that microplastics were both widespread and potentially unique in their impact on the environment, they encouraged scientists to include the fate, contamination, and effects of microplastics on Earth's natural cycles, ecosystems, and organisms in their studies of plastic pollution.

What resulted was a scientific explosion. Over the past 14 years, researchers have documented and studied microplastics across the globe, resulting in tremendous advances regarding the sources, fate, and effects of microplastics and their associated chemicals. Several hundred scientific publications now show that microplastics contaminate the world's oceans, including marine species at every level of the food chain, from pole to pole and from the surface to the seafloor. Yet, scientists have only just begun to document and study microplastics in freshwater and terrestrial systems.

Microplastics were first reported in freshwater lakes in 2013 (4). Since then, microplastics have been reported on freshwater beaches, in lakes, or in rivers in Africa, Europe, Asia, North America, and South America (5). Just like in the marine realm, microplastics are common in freshwater systems at a global scale. Although contamination tends to be greater near large population centers, microplastics—often in the form of microfibers—have also been found in remote locations (6), perhaps as a result of atmospheric deposition (7). Microplastic concentrations in freshwater ecosystems are highly variable, and even though these systems are less dilute than oceans, concentrations reported thus far appear to be in a range similar to those in the marine environment (5). Microplastic contamination, as seen in marine animals, has also been reported in freshwater animals, including insects, worms, clams, fish, and birds.

Researchers generally seem to expect the effects of microplastics on freshwater organisms to be similar to those on marine organisms. In fact, scientists have been testing impacts of microplastics on freshwater animals for many years because several of them—such as Japanese medaka, zebrafish, Daphnia, and Ceriodaphnia—are standard toxicity test species. As a result, impacts from exposure to microplastics have been demonstrated in freshwater plants, invertebrates, and several species of fish (5). Still, the research remains young, and most studies of freshwater systems and organisms aim to better understand the sources of microplastics to the environment and their effects on animals in general. Given that freshwater ecosystems are highly diverse, with roughly as many fish species as in the oceans, researchers must also ask questions about the unique fate and effects of microplastics in...
Microplastics everywhere

High amounts of microplastics have been found not just in the sea and on beaches, but also in rivers and soils around the world, demonstrating how pervasive this modern pollution is. Sources include leakage from landfills, plastic culture, littering, and sewage sludge. Data from (2).

REFERENCES

Microplastics research—from sink to source
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