Microplastic pollution prevalent in lakes too

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EPFL researchers have detected microplastic pollution in one of Western Europe's largest lakes, Lake Geneva, in large enough quantities to raise concern. While studies in the ocean have shown that these small bits of plastic can be harmful to fish and birds that feed on plankton or other small waterborne organisms, the full extent of their consequences in lakes and rivers is only now being investigated. The study, which is being extending under a mandate by the Swiss Federal Office for the Environment, was published in the latest issue of the journal *Archives des Sciences*.

"We were surprised to find such high concentrations of microplastics, especially in an environmentally aware country like Switzerland," says first author Florian Faure from EPFL. Faure's study focused on Lake Geneva, where both beaches and lake water were shown to contain significant amounts of microplastic contamination - pieces of plastic waste up to 5 mm in diameter. The study is one of the first of its kind to focus on a continental freshwater lake. And according to Faure, given the massive efforts put into protecting the lakes shores over the past decades, both on its French and the Swiss shores, the situation is likely to be representative of fresh water bodies around the world.

Microplastics in continental waters may be the main source of microplastic pollution in oceans, where huge hotspots containing high concentrations of these pollutants have formed. Scientists estimate that only around 20 percent of oceanic microplastics are dumped straight into the sea. The remaining 80 percent are estimated to originate from terrestrial sources, such as waste dumps, street litter, and sewage.

Microplastic pollution is also a strain to lake and river ecosystems, threatening the animals that inhabit these aquatic ecosystems both physically and chemically. When inadvertently swallowed by aquatic birds and fish, the tiny bits of plastic can wind up stuck in the animals' intestines, where they obstruct their digestive tracts, or cause them to suffocate by blocking their airways. Ingested plastics may also leach toxic additives and other pollutants stuck to their surface into the animals that swallow them, such as bisphenol A (BPA) and phthalates, two carcinogenic agents used in transparent plastics, or other hydrophobic water pollutants, such as PCBs.

Like counting needles in a haystack

Florian Faure and his collaborators used a variety of approaches to quantify plastic and microplastic pollution in and around the lake, from combing beaches along Lake Geneva for plastic litter to dissecting animals, fishes (pikes, roaches and breams) and birds from the aquatic environment, and observing bird droppings around the lake.

To measure the concentration of microplastics in the water, Faure worked in collaboration with Oceaneye, a Geneva-based non-profit organization. Using an approach developed to study plastic pollution in the Mediterranean Sea, they pulled a manta trawl - a floating thin-meshed net - behind a boat in Lake Geneva to pick up any solid matter in the top layer of the water. The samples were then sorted out, dried and the solid compounds were analyzed for their composition.

"We found plastic in every sample we took from the beaches," says Faure. Polystyrene beads were the most common culprits, but hard plastics, plastic membranes, and bits of fishing line were also widespread. In this preliminary study, the amount of debris caught in Lake Geneva using the manta trawl was comparable to measurements made in the Mediterranean Sea.

The scientists are now extending their focus to lakes and rivers across the country, backed by a mandate from the Swiss Federal Office for the Environment. According to the lab's director, Luiz Felippe de Alencastro, this will involve studying microplastic pollution in lakes, rivers, and biota across the country, as well as the associated micropollutants, such as PCBs, which have already been found stuck on microplastics from Lake Geneva in significant concentrations.

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