

# 22 million pounds of plastics enter the Great Lakes each year

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Credit: CC0 Public Domain

On a sunny August morning at 31st Street Beach, Tyrone Dobson assembled 20 volunteers to pick up litter from the shores of Lake Michigan.

At first glance, the effort seemed unwarranted. After all, the tire tracks from a Chicago Park District beach groomer were still fresh in what appeared to be pristine sand.

But Dobson, senior volunteer engagement manager for the Alliance for the Great Lakes, knew better. He instructed the volunteers to take a closer look. Peering around their feet, the group noticed myriad pieces of trash enmeshed in the sand. They meticulously plucked [plastic straws](#), [plastic bottles](#), plastic spoons, plastic wrappers and plastic bottle caps. After two hours of scouring the area, the group had collected 56 pounds of trash.

"Every beach has its own persona," Dobson said. "Loyola is family friendly so there will be diapers and toys. Montrose and North Avenue is party central so there will be beer cans. But on the whole, it's always a lot plastic."

Plastics pollution in global waters has become one of the most complex issues of the 21st century. Scientists have identified giant gyres of garbage accumulating in offshore ocean currents. Examinations of dead whales and other large marine animals show they've ingested plastic items, like garbage bags. Researchers say that plastic litter in the oceans is poised to outweigh the amount of fish by 2050.

Meanwhile, microplastics, particles that start out smaller than 5 millimeters or are broken down from larger items, have been found in the falling rain in Colorado, carried by the wind to remote regions of the Pyrenees mountains in France and surfaced in drifting snow in the Arctic.

However, it's only been in the last decade that research into plastics pollution has gained urgency in the Great Lakes, the planet's largest system of freshwater.

Plastic debris makes up about 80% of the litter on Great Lakes shorelines. Nearly 22 million pounds enter the Great Lakes each year—more than half of which pours into Lake Michigan, according to estimates calculated by the Rochester Institute of Technology. Regardless of size, as plastics linger in the water, they continue to break down from exposure to sunlight and abrasive waves.

Microplastics have been observed in the guts of many Lake Michigan fish, in drinking water and even in beer. Perhaps the most worrisome aspect is that the impact of microplastics on human health remains unclear. Plastics are known to attract industrial contaminants already in the water, like PCBs, while expelling their own chemical additives intended to make them durable, including flame retardants.

Because the problem is virtually invisible, sometimes it's hard to attract attention to it.

"I think seeing is believing, and you can't see a microplastic," Dobson said. "When I first started, I was talking to a volunteer and she said something that has always stuck with me. When you see a forest fire afterwards, it's black and charred, so you know that there's a problem. Some of the water issues don't follow that (rationale).

"To the naked eye, it's a beautiful day. So a lot of people don't think it's a problem because they can't see it at first glance."

In July, Illinois Gov. J.B. Pritzker signed into law a bill directing the state Environmental Protection Agency to examine the role of microplastics in drinking water and the Prairie Research Institute to make recommendations on the threat posed to human health and the environment. State Sen. Julie Morrison, the bill's sponsor, said when she learned the extent of the plastics issue, she stopped using plastic bags and was among the legislators who advocated for a statewide tax on them.

Though the tax failed, Morrison said she hopes education will spur more action on plastics pollution.

"We're leaving a mess to the next generation—just a mess," Morrison said. "We need to stop and understand the science behind plastics, especially the microplastics going into our bodies.

"I don't think people realize. If you went up to people on the street and asked them, 'When you drink water, do you think there are plastic bits in it?' Most would probably say, 'Well, no.'"

The Chicago Department of Water Management says it meets all state and federal regulations for drinking water, but it is not required to test for microplastics.

While there are still more questions than answers about potential health consequences, one thing is clear: Southern Lake Michigan is a hot spot for plastics.

Matthew Hoffman, the lead author of the Rochester Institute of Technology estimate, said population centers like Chicago and Milwaukee are large contributors to plastics pollution in Lake Michigan. In addition to trash that can drift into the water from beaches, wastewater treatment facilities are significant sources of microplastics.

Before a federal ban in 2017, some soaps and facial scrubs contained microbeads that were rinsed down the drain into waterways. The majority of microplastics are tiny fibers that break off from synthetic fabrics when people do laundry.

Once plastics enter the [lake](#), they follow lake currents, potentially migrating to other states but largely remaining trapped at the southern end.

"Things from Chicago might end up on the shores in the state of Michigan," Hoffman said. "In the Great Lakes, plastic could move to different states, different lakes, different countries. So that can be an interesting challenge if you want to clean up. Now you have to look at interstate regulations."

What goes into Lake Michigan typically stays there. While water from the other Great Lakes moves downstream, Lake Michigan's only major outflow is the Chicago River (and the water it intermittently exchanges with Lake Huron at the Straits of Mackinac). As a result, a drop of water that enters Lake Michigan stays for about 62 years, according to the National Oceanic and Atmospheric Administration.

Because some municipal sewage sludge is applied to farm fields, agricultural runoff can also be a significant contributor. Farmers who may use plastic materials to cover their seed beds (to regulate the soil temperature and moisture) may also be partly responsible for microplastics.

Tim Hoellein, an assistant professor of biology at Loyola University Chicago, has extensively studied litter on Great Lakes beaches and major waterways. Each, he said, poses its own threat to wildlife.

"The danger changes as it goes from macroplastic to microplastics," Hoellein said. "With microplastics, we think about potential chemical exposures, abrasions that might happen internally in the lining of the guts. With larger plastics, we worry about materials being stuck in the guts. That would be the concern for sport fish and birds."

In a study published last year, a team of researchers, including Hoellein, found that around 85% of fish caught from three major Lake Michigan tributaries—the Milwaukee, St. Joseph and Muskegon rivers—had microplastics in their digestive tracts.



In the sample size of 74 fish representing 11 species, the invasive round goby had the highest concentrations, possibly from eating filter-feeding quagga mussels, which scientists suspect may be accumulating microplastics. While detecting microplastics in the guts of Lake Michigan fish is significant, scientists are now studying if these pollutants build up or are excreted by the fish.

"One possibility is that it could just move through the digestive system and come out the other end without causing any harm," Hoellein said. "But we don't know how long particles stay in their gut. So I had a student do a project where she fed round gobies these acrylic fibers in fish food. She tracked how long it took to go in to out. It was pretty fast—faster than I thought. Within a couple days, plastics moved through. Not much was retained in their stomachs permanently."

Scientists believe microplastics could move up the food chain as trophy fish, such as lake trout, eat round gobies.

Considering fish are typically gutted before they are eaten, human consumption of plastics from seafood isn't a major concern.

But as microplastics break down into tinier and tinier pieces, the research is pivoting to nanoplastics, pieces of plastic so small they may be able to penetrate the membrane of blood cells. The concern then becomes if nanoplastics enter the bloodstream of fish, could they be passed onto humans who eat them.

At this point, however, research is thin.

For now, environmental organizations are focused on stemming pollution at the source. Laws, such as smoking bans and plastic bag taxes in Chicago, may be curbing some of the most prevalent litter. Consumers can take steps to mitigate their own plastics by reusing shopping bags,

forgoing single-use straws or bottles and using microfiber-capturing balls or mesh bags in their laundry.

And grassroots efforts like the Alliance for the Great Lakes' Adopt-a-Beach program help prevent shoreline trash from entering the water from Duluth, Minn., to Buffalo, N.Y. These programs become increasingly important at the end of beach season, when the Chicago Park District's beach groomers stop operations but the weather may still be pleasant enough to attract visitors.

"It's reasonable to imagine the scope of this problem and be daunted and depressed about it," Hoellein said. "But I also think there's more reason for optimism in freshwater. When [plastic](#) trash gets into the ocean, it's basically unrecoverable. It's hard for our brains to imagine the scale of the oceans and what it takes to clean it up. And even as vast as the Great Lakes are, they are still more manageable than the oceans, and we can begin to solve the problem here in a way that's more efficient and doable."

At every cleanup, Dobson, the alliance volunteer manager, tries to spread awareness and encourage participation in upcoming events.

Fortunately, his pitch is pretty easy.

"Everyone needs water," Dobson said. "It doesn't matter if you're rich, poor, black, white or Hispanic. That makes no difference. And the beauty of it is that, in Chicago, we all get it from the same place. So it isn't like you're doing something and it doesn't benefit you. This does.

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