



Stream Team Academy Fact Sheet Series

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Collect this entire educational series for future reference! Contact us at 1-800-781-1989 if you'd like copies of previous Fact Sheets and a binder for storing them.

MICROPLASTICS

An Educational Series For Stream Teams To Learn and Collect

By Amy Meier, MDC Stream Team Biologist

Take a look around you. Plastic is everywhere. It is the trademark material found in nearly everything we touch in our modern daily lives, from the vehicles we ride in to the containers in which we carry our food. It's simply a fact of life. However, it's increasingly clear that plastic pollution is a persistent problem in our oceans and waterways on a global scale. In the last several years, the emerging issue of microplastics is setting forth new research to determine just how much plastic pollution affects our health and aquatic environment.

What are microplastics?

Microplastics are considered any plastic particles under 5 millimeters in size and can be put in two broad categories:

- *Secondary microplastics:* Tiny pieces of plastic derived from larger objects such as bottles or plastic bags that have broken down over time.
- *Primary microplastics:* Manufactured to be miniscule for an intended purpose such as exfoliating microbeads found in personal care products like face scrubs, body washes, and toothpastes.



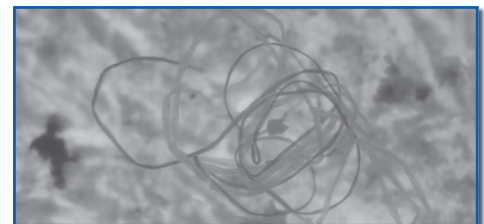
Microbeads are tiny pieces of polyethylene plastic added to health and beauty products, such as some cleansers and toothpastes. Source: <https://oceanservice.noaa.gov/facts/microplastics.html>

Most plastic materials never fully decompose; they simply break down into smaller and smaller pieces, persisting in the environment for hundreds, perhaps even thousands, of years. Some biodegradable plastics may break down in landfills, compost, or in the sun, but most

are not designed to decompose in water, where much of our plastic waste ends up residing.

There are seven primary types of plastic that find their way into our aquatic environments:

Name	Industrial or Consumer Uses
Polycarbonate	Roofing, eyewear, electronic components
Polyethylene	Plastic bags, packaging
Polyethylene terephthalate	Plastic bottles
Polypropylene	Packaging, moldings, fittings
Polystyrene	Styrofoam®, insulating foam
Polyurethane	Paint products, adhesives, coatings
Polyvinyl chloride	Construction materials, PVC piping



Microplastic fibers identified in the marine environment. Source: <https://commons.wikimedia.org/wiki/File:Snap-40.jpg>

Additionally, it was discovered that another plentiful material is making its way into our streams and oceans: microfibers. These are fibers used in moisture-wicking clothing made of materials that include polyester and nylon. These materials have been available for decades, but we are just now beginning to see the effects of this universal material on aquatic environments. Researchers have found that microfibers are by far the most abundant microplastics, consisting of up to 85% of the plastic pollution found along shorelines globally.

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How do microplastics get into our waterways?

Microplastics have the ability to enter waterways through multiple pathways including stormwater runoff, littering, and direct discharge from wastewater treatment plants (WWTPs). Microfibers and microbeads found in personal care products are too small for WWTPs to filter out before treated effluent is released into the receiving stream. Therefore, these tiny particles drain into our wastewater systems directly from our sinks and washing machines and then in turn are discharged as effluent. In one study, researchers sampled 17 freshwater streams below WWTPs across the country, and the results indicated that wastewater facilities release upwards of 4 million micro-particles per facility, per day. Most WWTPs are not designed to address these microplastics. It is estimated, based on the number of wastewater facilities present in the U.S., that an average of 13 billion of these particles are released into US waterways every day (Mason 2016). Fibers were discovered to be the most abundant type of material in the study.

How do microplastics affect aquatic and marine life?

Due to the tiny size of these particles, small aquatic and marine organisms such as zooplankton can mistake the tiny fibers and pellets for food, which can then be transferred to their predators and so on up the food chain, all the way to humans. The particles themselves may pass through the organism, cause gastrointestinal blockage, or permanently inhabit intestinal tissue. But, more concerning is the ability for microplastics to accumulate persistent organic pollutants (POPs). These POPs may consist of toxins such as polychlorinated biphenyls (PCBs), dioxins, pesticides, and other carcinogens that are drawn to the microplastics directly from the water (McCormick 2014). If ingested in high concentrations, the health of all organisms affected in the food chain could face serious implications.

Conclusions

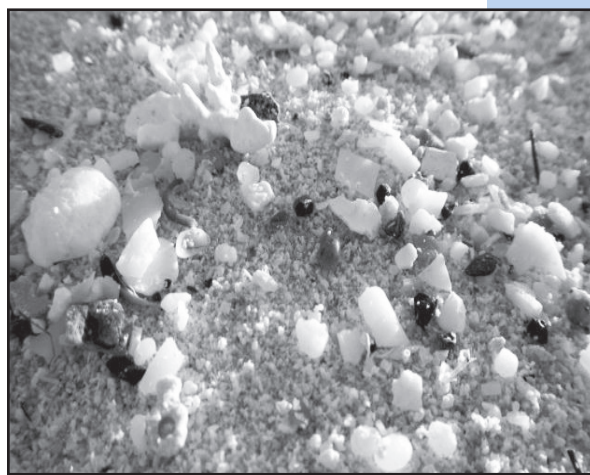
All in all, the true impacts of microplastics on aquatic life are yet

to be fully determined. Researchers are conducting more research than ever due to the vast and widespread problem of plastics entering our waterways and becoming a permanent fixture in our ecosystem. Aquatic and marine life, both alive and dead, are known to have been found with stomachs containing plastic particles, some even interwoven into gastrointestinal tissue. Toxicology studies, behavioral studies, and additional field observations are needed to develop a full understanding of how microplastics may affect our health. Humans have played the leading role in causing this issue; we can also help prevent further contamination by avoiding personal care products with microbeads, avoiding synthetic fabrics, and educating others on the problems with microplastics in waterways.

Citations:

Mason, S.A. et al., Microplastic pollution is widely detected in US municipal wastewater treatment plant effluent, *Environmental Pollution* (2016), <http://dx.doi.org/10.2016/j.envpol.2016.08.056>

McCormick, A. et al., Microplastic is an abundant and distinct microbial habitat in an urban river, *Env. Sci. Technol.* (2014), <https://pubs.acs.org/doi/10.1021/es503610r>



Secondary plastics collecting in an ocean garbage patch.
Source: <https://marinedebris.noaa.gov>

