

## What are microplastics?

- Microplastics are between 100nm and 5mm in size. There are also even smaller nanoplastics, defined as less than 100nm.
- Microplastics are classified as primary (intentionally manufactured to be small) or secondary (degraded from larger plastics) ([Environmental Toxicology and Chemistry](#)).
- All plastics (including microplastics) often contain chemical additives like fillers, plasticizers, pigments, antimicrobials, heat and UV stabilizers, or flame retardants to give them certain properties such as flexibility and durability ([Environmental Science and Technology](#)).

### The most common types of microplastics are:

- Fragments: Formed when larger plastics break into small pieces. It is estimated that they account for ~22% of microplastics in marine environments ([Water, Air and Soil Pollution](#)).
- Paint particles: Created when surfaces shed paint flakes or are sandblasted, a 2022 report showed that synthetic paint may be the largest source of microplastics in aquatic environments, with an estimated 2.9 million tonnes entering aquatic environments every year ([Environment Earth](#)).
- Films: Come from thin, flexible plastics such as grocery or chip bags. Microfilms are commonly encountered on land, as plastic films are used in agriculture for mulching soils and other applications ([Environmental Pollution](#)).
- Nurdles: Also known as pre-production plastic pellets, form the foundation of many plastic products we use in our daily lives. During manufacturing, handling and transportation, these tiny plastics are frequently spilled into the environment ([Marine Pollution Bulletin](#)).

- Microbeads: Manufactured plastic beads less than 1mm in size that have been used as exfoliators in personal care products such as face wash and toothpaste. Recently, international policies supported by scientific evidence have been introduced to ban them ([Marine Pollution Bulletin](#); [Society for Conservation Biology](#)).
- Tire wear particles: Created by the friction between tires and roads and are one of the most common sources of microplastics in the coastal waters of California ([San Francisco Estuary Institute](#)). Toxins in tire particles have been found to reduce the survival rate of some fish hatchlings and cause deformities in their embryos ([Environmental Science & Technology](#)).
- Microfibers: Originating from clothing, home fabrics, personal care products, fishing nets and rope, cigarette filters, and other fibrous materials ([Chemosphere](#); [Environmental Science and Pollution Research](#); [Science of the Total Environment](#); [Marine Pollution Bulletin](#)).
  - Up to 18 million microfibers may be released from a 13lb load of synthetic fabric laundry ([Environmental Science and Pollution Research](#)).
  - One study reported 5.6 million tonnes of synthetic microfibers have been released from apparel washing between 1950 and 2016, with half of this amount emitted in the last 10 years ([PLOS ONE](#)).
  - Every year, global cigarette butt pollution releases roughly 300,000 tons of microfibers into the environment ([Science of The Total Environment](#)). Microfibers from cigarette butts can contain more than 4,000 toxic chemicals including tar, arsenic, lead, heavy metals, and other harmful substances ([Waste Management](#)).

## Prevalence

- Microplastics have been found in every marine habitat where scientists have looked ([Marine Pollution Bulletin](#)). Researchers reported that of the total microplastic pollution in the global oceans, 34.8% are generated from synthetic fabrics and 28.3% are generated by the friction of tires ([Journal of the American Institute for Conservation](#))
- Microplastics are small, lightweight and sometimes airborne. When they enter the environment, they move between air, freshwater, land, animals, humans and the marine environment, forming a global microplastic cycle ([Science](#)).

## Environmental Impact

- To date, about 1,300 marine species have been found to ingest plastics ([Science](#)).
- A review of research published from 2019-2020 revealed 60% of fish studied globally contained microplastics, and carnivorous fish tend to contain more microplastics than omnivores ([Marine Pollution Bulletin](#)).
- Microfibers are the most prevalent category of microplastics ingested by marine fish, crustaceans, and bivalves (e.g., oysters and clams) in most field studies to date (e.g., [Marine Pollution Bulletin](#); [Scientific Reports](#); [Environmental Pollution](#)).
- Microplastics are also ingested by birds and mammals. Blue whales – the largest living marine animal – consume up to 10 million pieces of microplastic per day ([Marine Pollution Bulletin](#); [Nature Communications](#)).
- Plastic additives can leach into surrounding waters. Phthalates, polybrominated diphenyl ethers (PBDEs), nonylphenols (NP), Bisphenol-A (BPA) and antioxidants are the most common plastic additives in the ocean ([Chemosphere](#)).
- Microplastics can also collect and retain pollutants like industrial chemicals, pharmaceuticals and heavy metals ([Environmental Science and Technology](#)).
- Ingestion of microplastics by animals has been associated with negative health outcomes including reduced food consumption, impaired growth and behavior, decreased reproductive

output, reduced energy for growth, altered gene expression and damage to cells and DNA ([Water; Environmental Science and Pollution Research](#)).

## Human Health

- While humans are likely able to clear the vast majority (>90%) of ingested microplastics from their systems ([Current Environmental Health Reports](#)), questions still remain about chemicals entering the body from microplastics, and the fate of microplastics that we do not excrete.
- We are mostly exposed through inhalation but also from our food and beverages ([Frontiers in Chemistry](#); [Springer](#)). A recent study estimated adults take in up to 121,000 microplastic particles per year through air, food and beverages. ([Environmental Science and Technology](#)).
- Microplastics have been detected in human organs including in the colon and placenta ([JGH Open: Environment International](#)).
- Inhaled microfibers have been found in lung tissues, where they can cause inflammation, cell and tissue damage or respiratory lesions ([Science of the Total Environment](#); [Science of the Total Environment](#)).
- Many microplastic chemical additives are associated with well-established human health risks ([Environmental Science and Technology](#); [Environmental Science and Technology](#)).
  - One such additive, BPA, known to disrupt our hormonal system, has troubling correlations with chronic illnesses such as cardiovascular disease and type 2 diabetes in humans ([Current Environmental Health Reports](#)).
- Bacteria and pathogens can be found on the surface of microplastics, and when ingested by animals and humans have the potential to spread disease ([Trends on Food Science and Technology](#); [Trends in Microbiology](#)).