

Microplastics

Problem Statement: Due to the increasing level of microplastic pollution in lake water, the ingestion of microplastics by aquatic life has been increasing, which in turn causes microplastics to be present in the human food system. We seek to find solutions that will reduce the amount of microplastics used in human products as well as improve waste management systems.

Justification: Clean accessible water is a very limited resource and must be protected in order to sustain life. Microplastics put the health of freshwater systems at extreme risk by affecting the wellbeing of aquatic animals and productivity of plants needed in the fresh-water ecosystems. The issue of microplastics in freshwater systems is a human-created issue and can be minimized by decreasing the consumption of plastics and being cognizant of the material of certain clothes that may contain plastics and may be released to water systems in laundry washes.

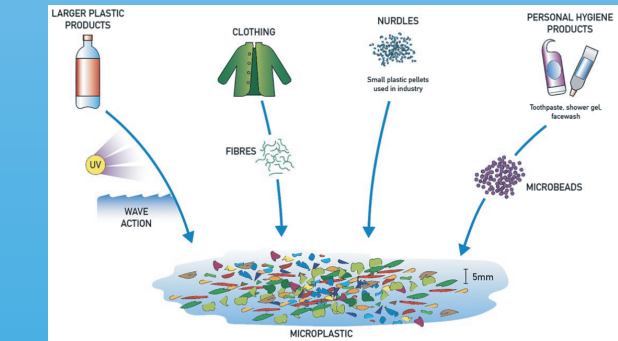
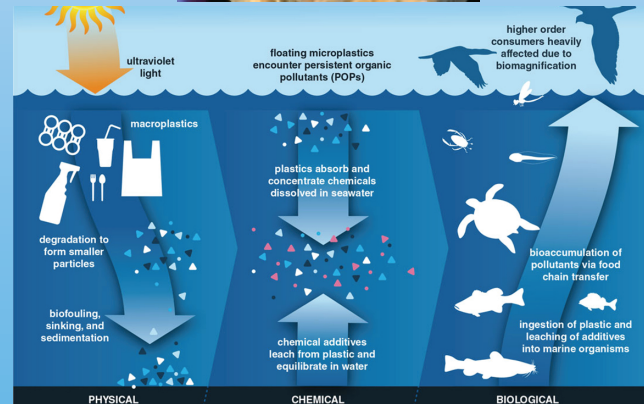
Sources of micro plastics (less than 5 mm length):

- A primary source of microplastics mean they were made to be 5 mm
- A secondary source means it is broken off of a larger piece of plastic
- Abrasions of larger plastic pieces in the ocean and waterways from day to day life
 - Soda bottles, plastic bags, general plastic pollution. (secondary)
- Industrial uses like air blasting that uses microplastics like sandpaper (primary)
- Cosmetics and clothing



Where Microplastics are found:

- Variability in the composition, shape, and density of microplastics makes for many different buoyancy levels, resulting in their presence being seen throughout the water column.
- Microplastics are dispersed by ocean currents, winds, river outflows, and drift. Through these transportation methods, microplastics end up in remote locations such as mid-ocean islands and the poles.
- The durability of plastic allows it to persist and accumulate in marine environments, leading microplastics to be considered a ubiquitous contaminant of the world's oceans.
- The effects of this far reaching contamination are seen in a new analysis of some of the world's most popular bottled water brands, which found that more than 90% contained tiny pieces of plastic.

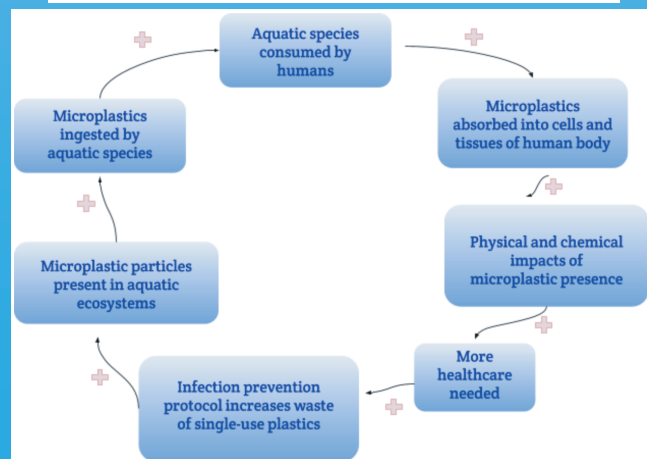


Effects on Ecosystem:

- Easily ingested by wildlife which means easy entrance into the food web.
- Leaches chemicals including endocrine disruption chemicals, such as bisphenol A and phthalates.
- In general, ingestion does not directly imply fatal effects for organisms, but chronic effects (e.g., oxidative stress, starvation) can be problematic.
- The chemicals used in plastic polymers have been shown to have endocrine disruptor properties
 - Can reduce fertility and in general affect hormone production because the endocrine system governs hormone production and distribution
- As well as sources, microplastics can be sinks of waterborne contaminants: because of the nature of the plastic surface, hydrophobic pollutants (PCBs, DDT, PAHs, dioxins, metals and other PBT substances)
- The production of plastics can also involve metals that are released into the water when plastic degrades

Effects on Human Health:

- In European countries with high consumption rates of shellfish, it is probable that those who eat these species ingest 11,000 particles of microplastic each year
- Microplastics are also very effective at absorbing toxic metals which means that we may be absorbing elements like mercury when we ingest microplastics
- These negative impacts on human health will create more demand for healthcare. Current healthcare systems are not sustainable and the primary means of infection prevention comes in the form of single-use plastics. This creates more plastic and potential microplastic waste, and a positive feedback loop.
- The negative effects of plastic waste by the health care system will likely impact those without the means and opportunities to receive treatment. This puts those who are already disadvantaged at even larger setbacks.



Identify Solutions: Solutions can be as simple as providing lids for recycling bins and placement of trash and recycling containers in public areas (especially near water bodies, shorelines or stormwater drains). Community clean up initiatives can help with removing large plastics from aquatic ecosystems before they deteriorate into microplastic particles. Other solutions such as market-based bans and fees for single-use plastic items (e.g, bags, water bottles), and enforcement of litter laws may be a useful tool to reduce microplastics. Education and programs should be supported to improve environmental knowledge of plastic/microplastic issues, such as proper disposal and recycling of plastic materials; understanding pathways for entry of microplastics to the environment (e.g. wastewater from homes, stormwater); and impacts of consumer choices. The economic impacts of these regulations would generally affect the taxes people pay in these areas as well as corporations having to pay fines if they sell single-use plastics.

Potential Next Steps: Wastewater and drinking-water treatments are highly efficient in getting rid of microplastics. Studies show they remove more than 90% of microplastics. But there is a lot that individuals can do to reduce microplastics too. As simple as air drying your clothes, avoiding plastic containers or any single use plastic, and avoiding beauty products with microbeads.