# 6. Microplastic - Environment

The issue of microplastics represents one of the most insidious environmental challenges of the 21st century. While a recent study indicates that Chennai's beaches have lower concentrations compared to some global hotspots, the qualitative risk to marine ecosystems and human health remains critically high.

## 1. Background

### What are Microplastics?

Microplastics are tiny plastic particles or synthetic fibers that measure less than 5 millimetres in diameter. Many are microscopic and invisible to the naked eye, making them nearly impossible to remove once they enter the water column.

**Scale of the Threat -** In 2020 alone, approximately 2.7 million tonnes of microplastics entered the global environment. This volume is projected to double by 2040 if current consumption and waste patterns persist.

**Physical Forms -** They manifest in diverse shapes, including -

1. Beads and Pellets - Spherical particles.
2. Fragments - Jagged pieces from broken items.
3. Fibers - Thread-like strands from textiles.
4. Film and Foam **-** Thin sheets or aerated plastic bits.

## 2. Classification of Microplastics

Microplastics are categorized based on their origin rather than their chemical composition.

| Type | Origin | Common Examples |
|---|---|---|
| Primary Microplastics | Manufactured specifically to be small for industrial or consumer use. | Microbeads in face scrubs, toothpastes, and industrial "nurdles" (plastic pellets). |
| Secondary Microplastics | Created through the fragmentation of larger plastic debris via weathering. | Breakdown of plastic bottles, bags, fishing nets, and tires due to UV radiation and wave action. |

## 3. Major Sources of Pollution

Microplastics enter the marine environment through both direct coastal activity and indirect inland pathways.

**Synthetic Textiles -** The laundering of synthetic clothes (polyester, nylon) is responsible for 35% of the microplastic burden in oceans.

**Fishing Activities -** Abandoned or lost fishing gear ("ghost gear") accounts for roughly 10% of marine litter, with nearly 1 million tons entering the ocean annually.

**Urban Sewage and Runoff -** While wastewater treatment plants can remove up to 90% of microplastics, the remaining 10% still results in billions of particles being discharged into water bodies daily.

**Tourism and Beach Use -** High volumes of single-use plastics generated by coastal tourism contribute significantly to the local plastic load.

## 4. The "Low Abundance vs. High Risk" Paradox

Even in areas like Chennai where the *quantity* of particles might be lower than global averages, the *risk* remains extreme due to the following factors -

**Toxic Carriers -** Microplastics act as "chemical sponges," absorbing persistent organic pollutants (POPs) and heavy metals at concentrations 10^5 to 10^6 times higher than the surrounding seawater.

**Persistence of Nylon -** Nylon microfibers are exceptionally durable and toxic, making up 35% of ocean microplastics.

**The Food Chain (Biomagnification) -** Because they are mistaken for food by plankton, they move upward through fish to humans. This leads to biomagnification, where the concentration of toxins increases at each higher level of the food chain.

## 5. Environmental and Health Impacts

### Marine Biodiversity and Ecosystems

**Ingestion -** Over 1,300 marine species are known to ingest microplastics. This causes internal blockages, physical injuries, and a false sense of fullness that leads to starvation.

**Seabirds -** It is estimated that 90% of seabirds have ingested plastic.

**Carbon Cycle Disruption -** When zooplankton consume microplastics, their fecal pellets become less dense and sink slower. This prevents carbon from reaching the deep seafloor, disrupting the ocean's ability to act as a carbon sink and sequester carbon permanently.

### Human Health

Microplastics have recently been detected in human tissue and blood. While the long-term toxicological effects are still being studied, their presence indicates a direct breach of the human biological barrier.

## 6. Global and National Initiatives

### India's Action Plan

**Single-Use Plastic Ban (2022) -** Prohibits specific high-utility, low-value plastic items to stop pollution at the source.

**Extended Producer Responsibility (EPR) -** Legally mandates that producers manage the entire lifecycle of their plastic packaging.

**National Centre for Coastal Research (NCCR) -** Actively monitors microplastic levels along the Indian coastline to provide data-driven policy recommendations.

### Global Frameworks

**MARPOL Convention -** An International Maritime Organization (IMO) framework that strictly regulates the disposal of garbage and plastics from ships.

**Global Plastics Treaty -** A UNEP-negotiated, legally binding agreement aimed at ending plastic pollution by 2040.

## 7. Conclusion

Addressing microplastic pollution requires a transition from a "linear" plastic economy to a "circular" one. This involves strengthening scientific research, mandating better filtration in washing machines, improving municipal wastewater treatment, and fostering a global shift toward truly biodegradable alternatives. Protecting marine life and the carbon cycle is not just an environmental goal but a necessity for human survival.

Source - https -//www.thehindu.com/sci-tech/energy-and-environment/why-is-chennais-microplastic-problem-bigger-than-it-looks-explained/article70784316.ece