

Marine Plastic pollution

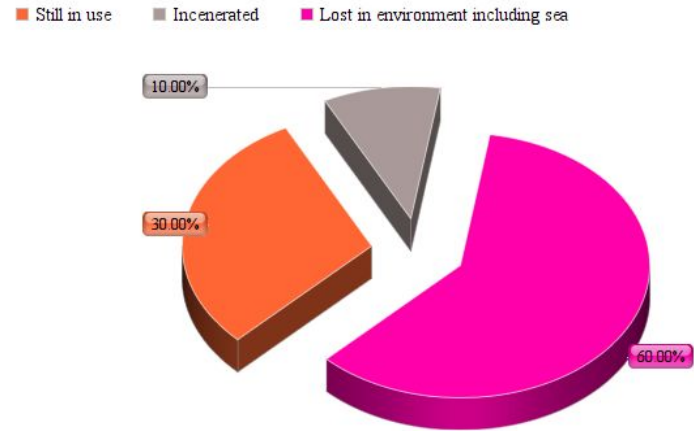
Aayush, Prabhat

Motivation

- UN theme for world environment day 2018
- Severity of the issue
- Negligence and unawareness

Introduction

- Plastic - First introduced in 1950.
- World wide production - **2 million MT(1950) to 380 million MT(2015)**
- **8 billion MT** - total plastic produced since 1950s
- 30% still in use, 10% incinerated, 60% gone into the environment (including ocean).



[Geyger et al., 2017]

Introduction

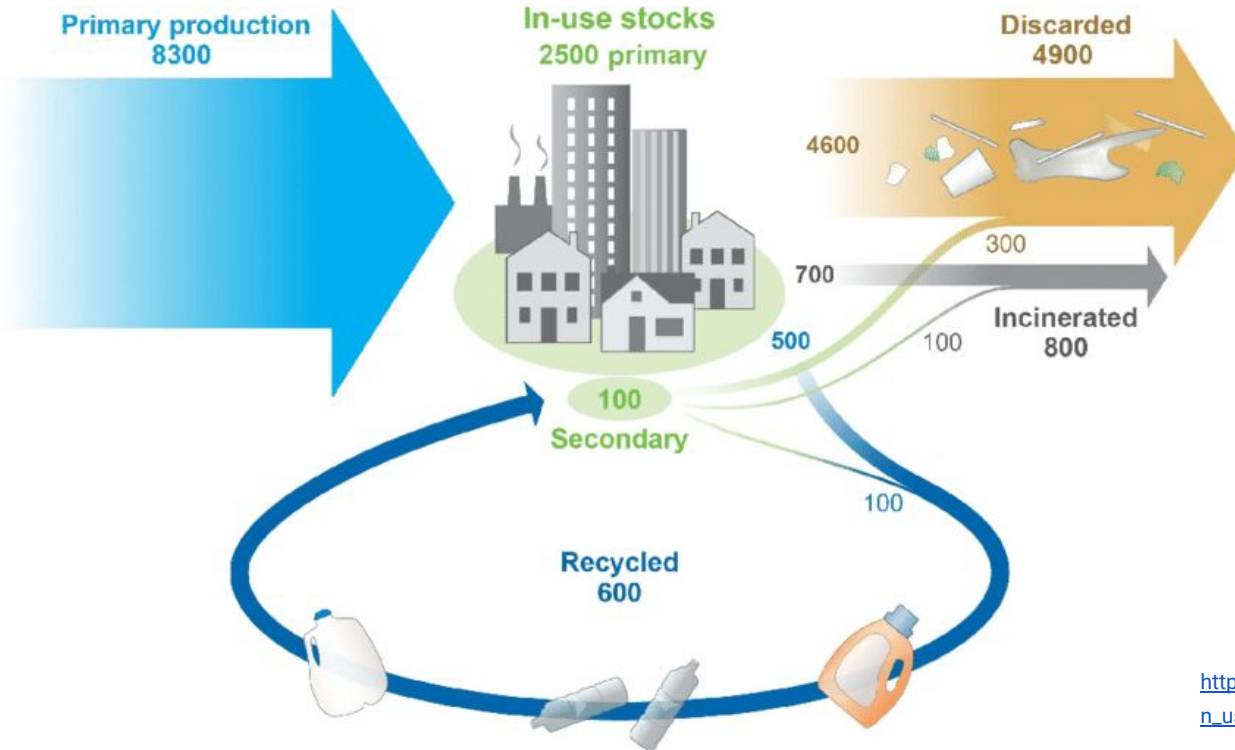


Fig. Global production, use, and the fate of polymer resins, synthetic fibres, and additives (1950 to 2015; in million metric tons).

[Geyger et al., 2017]

https://www.researchgate.net/publication/318567844_Production_use_and_fate_of_all_plastics_ever_made/figures

Introduction

- Threat to marine life
- Formation of PoP (persistent organic pollutant)
- Carry microbes
- Risk to fishing industry
- Health risk to coastline countries
- Risk to coastal tourism
- See food issue
- Marine navigation

Identification of Plastic Waste

Classification

- Based on size

1	Macro Plastic	> 5 mm in size	<i>Fishing nets, plastic bottles, plastic bags, plastic utensils or any other visible plastic form.</i>
2	Microplastic	<5 mm to 1nm	Primary Microplastic- <i>microbeads(from cosmetic products, textile industry, fibres) pellets etc.</i> Secondary microplastic- <i>Result of the breakdown of larger plastic into smaller pieces due to sunlight and weather.</i>
3	Nano Plastic	<1nm	<i>These are extremely small plastic fragments.</i>

Classification

- Based on chemical composition

	<i>Types</i>	<i>Common examples</i>
1	<i>Polyethylene terephthalate</i>	<i>Drinking Bottles</i>
2	<i>Polyester</i>	<i>Cloths</i>
3	<i>Polyethylene</i>	<i>Carry bags</i>
4	<i>High-density polyethylene</i>	<i>Shampoo/Detergent bottles</i>
5	<i>Polyvinyl chloride</i>	<i>PVC plumbing pipes</i>
6	<i>Polypropylene</i>	<i>Straws</i>
7	<i>Polyamide</i>	<i>Bristles of brushes</i>
8	<i>Polystyrene</i>	<i>Food container</i>

Origin

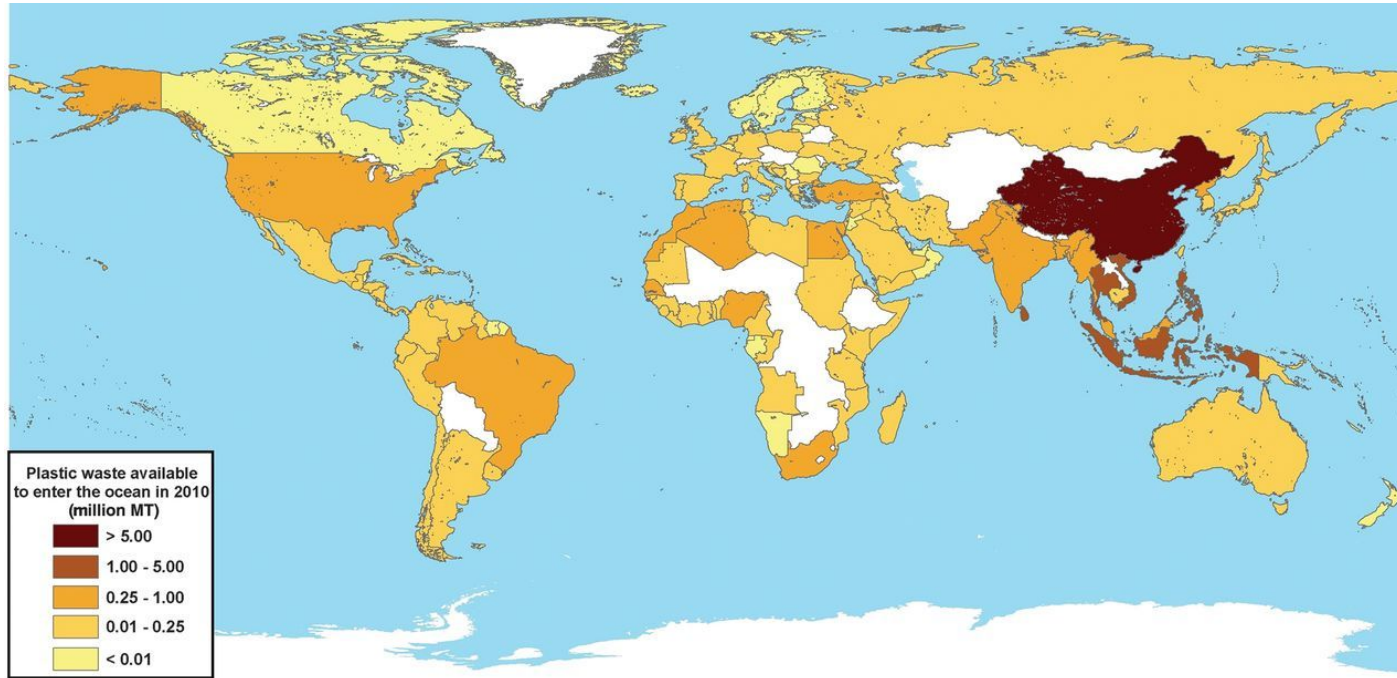


Fig. Global map with each country shaded according to the estimated mass of mismanaged plastic waste [millions of metric tons (MT)] generated in 2010 by populations living within 50 km of the coast

<http://science.sciencemag.org/content/sci/347/6223/768/F1.large.jpg?width=800&height=600&carousel=1>

Origin

- Largest amount of plastic from coastline of **China** and **USA**.
- \approx 275 million MT generated by coastal countries
- 4.8- 12.7 million MT endup in sea.

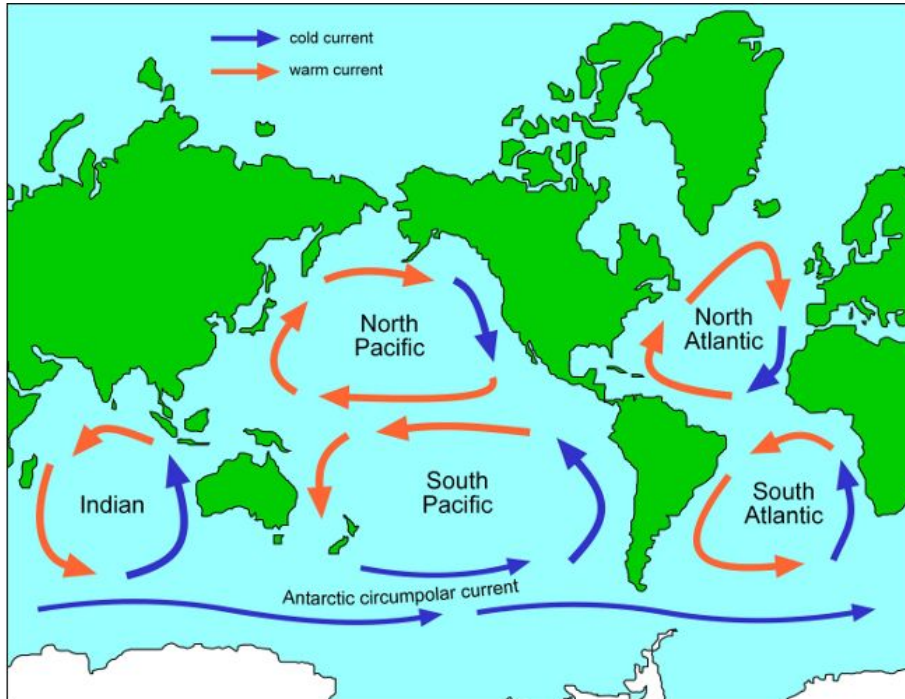
[Jambeck et al., 2015]

- Huge amount of plastic pollution also comes from river
- 90% comes from only 10 major rivers
- It includes 3 major rivers of India (Ganga, Indus & Brahmaputra)

[Schmitt et al., 2017]

Locations

Gyre: Large system of circular ocean currents formed due to winds and rotation of the earth.



Major Ocean Gyre

Also major garbage patch.

Location

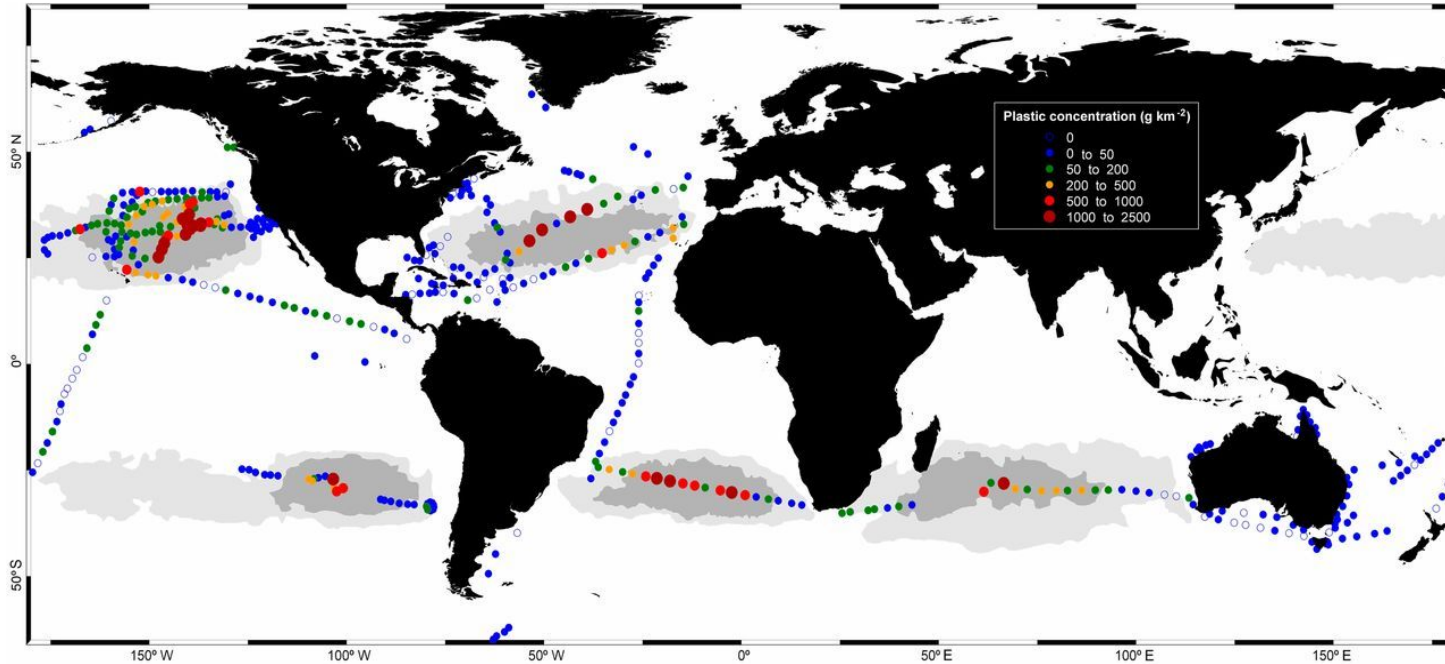


Fig. Concentrations of plastic debris in surface waters of the global ocean. Coloured circles indicate mass concentrations (legend on top right).

Location

- High concentration of plastic found in **Mediterranean sea** and **Bay of Bengal**.

[Eriksen et al., 2014]

- Low concentration are also found in **Greenland Sea** and **Barent Sea (Arctic)**.

[Cozar et al. 2017]

Effects

Chemical Pollution

- Many harmful chemicals are used for special properties in plastic eg bacterial resistance
- Microplastic could absorb man made pollutants including POPs
- Some of the examples are
 - DDT
 - PCBs
 - PAH
- These chemicals often end up in food web of organisms resulting in biomagnification and food chain breakdown

Effects on Aquatic Life

- Macroplastic

- The effect of plastic pollution is highly observed in organisms at upper level eg whales
- Ingestion of plastic(both direct and Indirect) can harm their metabolic activity and reproducibility.
- Dead whales, turtles or birds washed at the shores indicates the amount of plastic in our food chains
- Entanglement of organisms in plastics(especially discarded fishing equipments; fishing nets fishing wires etc)
- These materials are very strong and animals entangled with them are often seen with stunted growth and in most cases, death occurs

Contd...



Fig. Stunted growth due to plastic entanglement.
Source: Google

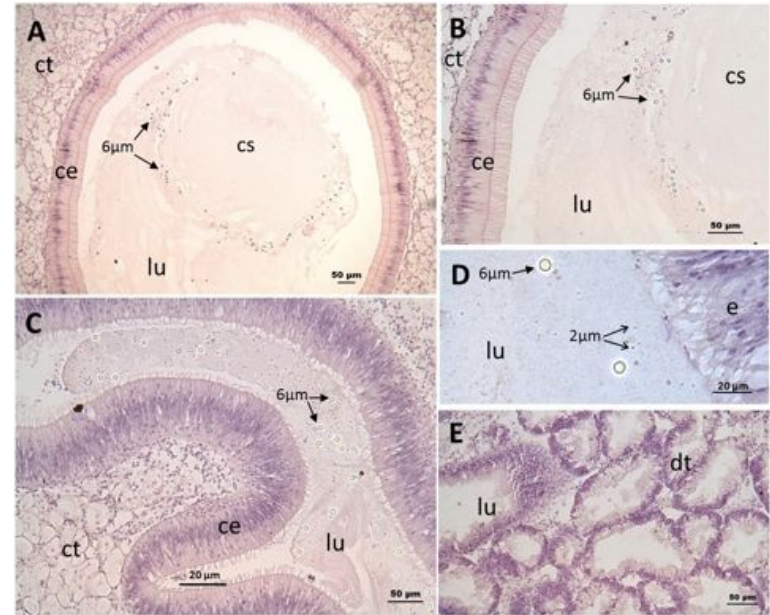


Fig. Dead whale made of plastic symbolic of high ingestion of plastic in marine animals

Contd...

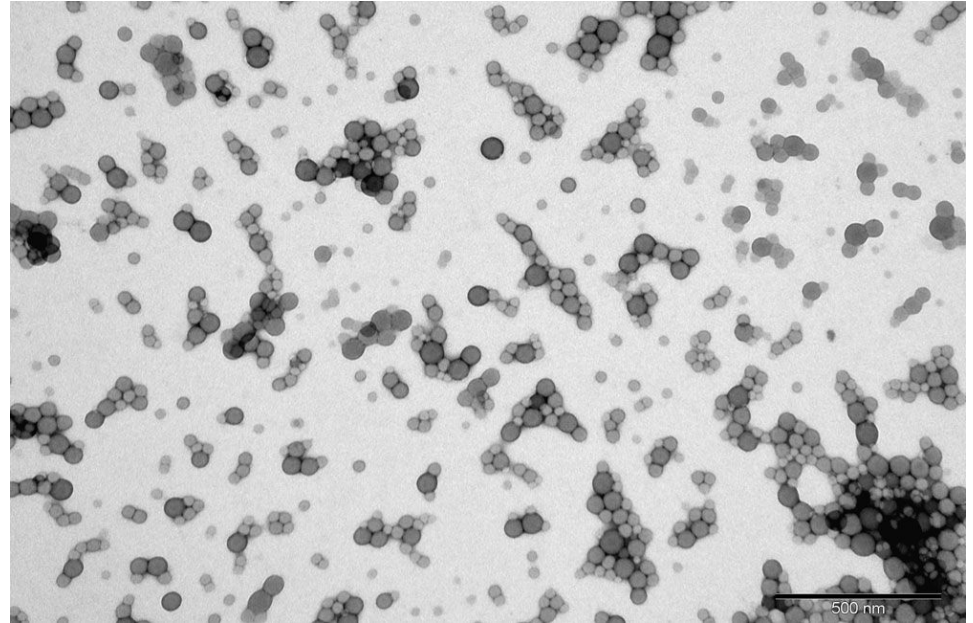
- Microplastics

- It interferes with the ability to feed, reproduce and growth of organisms
- It can end-up in animal gut and can result in reproductive impairment
- Figure:
 - Micro Polystyrene beads of 2 and 6 μm were observed in the stomach lumen (A and B) and intestine (C and D) of exposed oysters but not in the digestive tubules (E).
 - No beads were observed in control oysters.



Contd...

- Nano-plastic
 - Due to small size can easily enter food chain
 - Can easily enter in the circulatory system through the gut and may induce behavioural disorders



Effects on Human Life

- Marine Litter
 - Shores are getting filled with garbage from ocean
 - They contain harmful chemical and sharp objects like contaminated needles, scraps glass pieces
 - It is a threat to swimmers
 - Entanglement of propeller of the ships
 - Difficulty in navigation; collision with any debris



Contd...

- Seafood
 - Eating whole small fish including gut, exposes humans more to the microplastics
 - Microplastics contains various chemicals attached to them and have potential health hazards
 - Contaminated nanoplastics may also enter human tissue increasing the risk of health hazards



Contd...

- Contaminated litter
 - Microbes grow on plastic surfaces
 - These travel large distances without degradation and can take microbes with them
 - Passing through sewage increases the amount of contamination
 - If assimilated by marine animals can spread more





Microplastics found in human poop for the first time: Study

short by Shifa Naseer / 06:26 pm on 24 Oct 2018, Wednesday

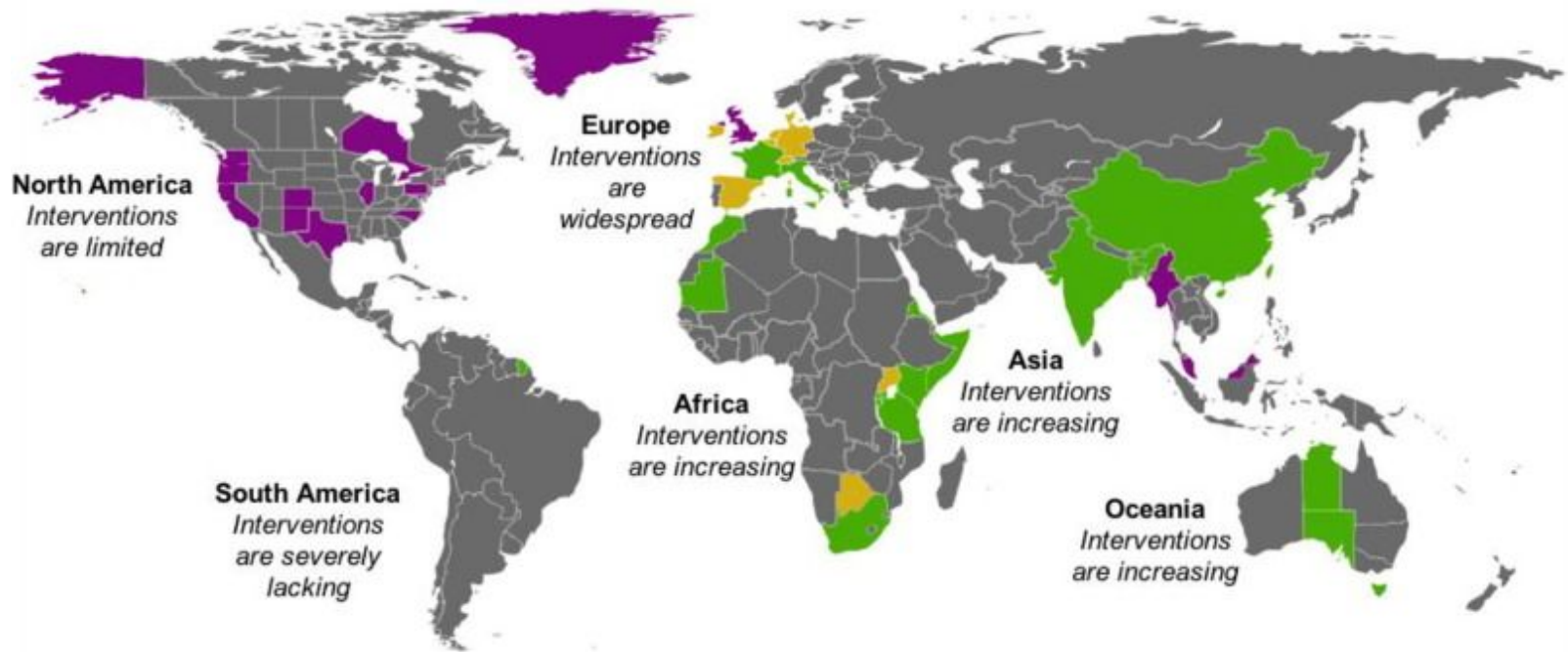
Researchers from the Medical University of Vienna and the Environment Agency Austria have discovered microplastics in human poop for the first time, according to a study. The study found all eight participants had microplastics in their stool samples, and identified nine separate types of plastic. On average, the researchers said they found 20 microplastic particles per 10 grams of stool.

[read more at UEG](#)

Policies and Awareness

Policies

- Around the world there are many Governments who took different measures and implemented policies to reduce the use of single use plastic. Some of the common measures were:
 - Levying taxes on manufacturers and retail stores using them
 - Imposing direct fees on plastic bags
 - Partial or full banning in some countries like USA, UK and Australia
 - Although there is less intervention against microbeads but countries in Europe like Netherlands etc. are serious about the goal of microbeads free cosmetics
 - US and Canada are also acting towards microbead free cosmetics



■ Plastic bags are banned or serious intervention ■ Partial tax or ban (municipal or regional level)
■ Taxes on some plastic bags

Fig: Phase out of Lightweight plastics around the world

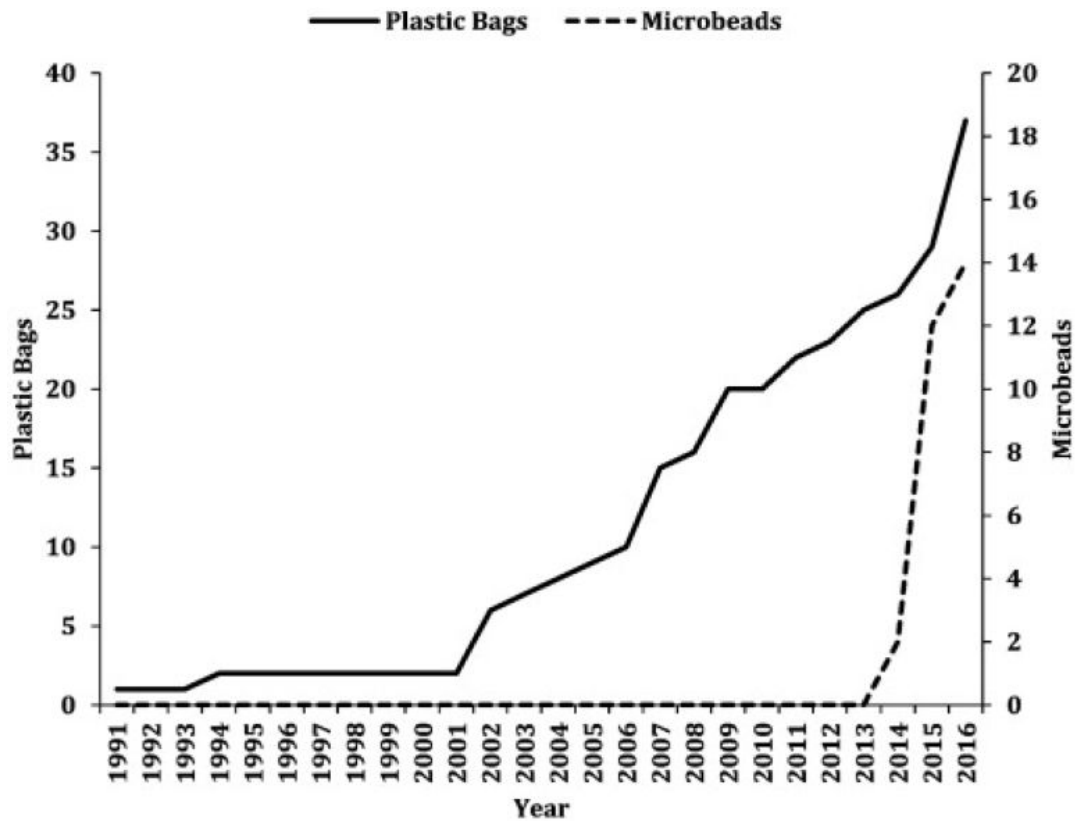


Fig: Number of Global acts against Plastic bags and microbeads with time

Awareness

- Awareness among common people plays a major role in reducing the plastic usage
 - Beach cleanups - successful cleanup of Versova Beach
 - Education and outreach programs in schools, colleges and communities
 - Targets like India's vow to abolish single use plastic by 2020
 - Separating and collecting plastic garbage at initial stage and sending it disposing it properly

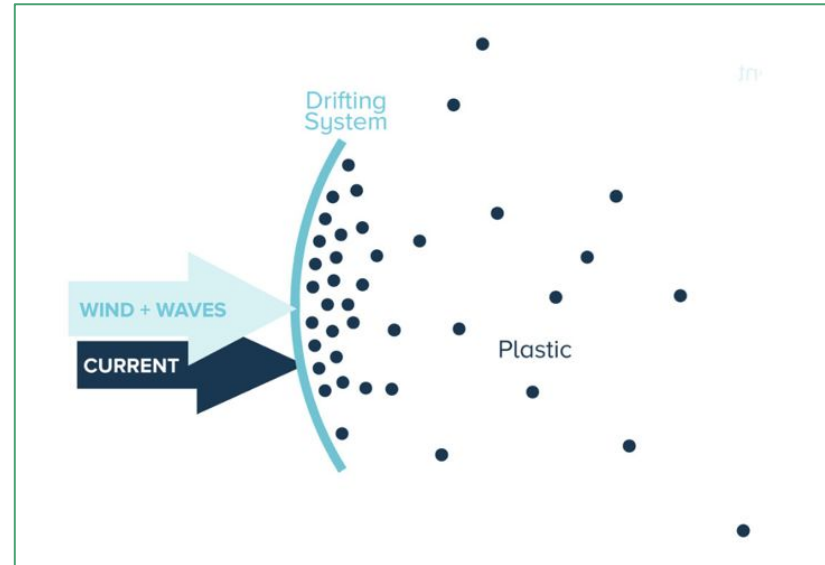


Say **No To
Single Use
Plastic Bags**



Innovation: The Ocean Cleanup

- It is one of the largest projects to collect trash from the 'Great Pacific Garbage Patch'
- It is an autonomous system, which uses ocean currents to collect plastic, moving in the same direction as plastic
- The collected plastic can be recycled, selling which would make the project self sustainable.



Our Views

- Current scenario of plastic pollution is very alarming
- Present rules and policies are there but aren't that effective
- Effect of plastic on ocean has not been quantified accurately
- Many developed countries like Sweden and New Zealand still don't have any policies against plastic, stricter international law
- Innovation in disposing plastics is required, we can't keep dumping plastics.
Also, we should work on alternative substitute of plastic

As ocean has no boundaries, there should be active cooperation between the countries to tackle with the issue of marine plastic waste.

References



Our Report

https://github.com/prabhat496/marine_plastic_pollution/blob/master/Final_Report.pdf

Marine Plastic Pollution

Case study as course project for Environmental Management (ES401), IIT Bombay

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