

## Abstract

- Every year in the media we see more and more of the effects of plastics in the ocean, which has raised many environmental concerns. This research found our oceans contain an estimated 269,000 tons of anthropogenic plastic. Every year humans contaminate the oceans with 14 million pieces of plastic. Besides the oceans, we now find plastics within all four interconnecting spheres of our Earth system thus showing that our anthropogenic footprint is worldwide.

## Earth System Science

- Earth is viewed as a dynamic system, a combination of interrelated, interdependent or interacting parts forming a collective whole or entity. Earth consists of four interconnected spheres: Hydrosphere, Geosphere, Atmosphere and the Biosphere.



Plastics in our Earth system:

- Hydrosphere** - Plastic pollutes the water
- Geosphere** - Plastic toxins leach into the ground
- Biosphere** - Plastics kill wildlife
- Atmosphere** - Plastic pollutes the air

## Macro, Micro, and Nano plastics

- Macro-plastics** describes plastic items with a diameter greater than 5 mm.
- Microplastics** are tiny plastic particles that result from both commercial product development and the breakdown of larger plastics. As a pollutant, microplastics can be harmful to the environment and animal health.
- Nano-plastics** are synthetic polymers with dimensions ranging from 1 nm to 1 μm. They are directly released to the environment or secondarily derived from plastic disintegration in the environment.

## How are plastics made

- Plastics are made from raw materials like natural gas, oil or plants, which are refined into ethane and propane.
- Ethane and propane are then treated with heat in a process called "cracking" which turns them into ethylene and propylene.
- These materials are combined to create different polymers for plastics.



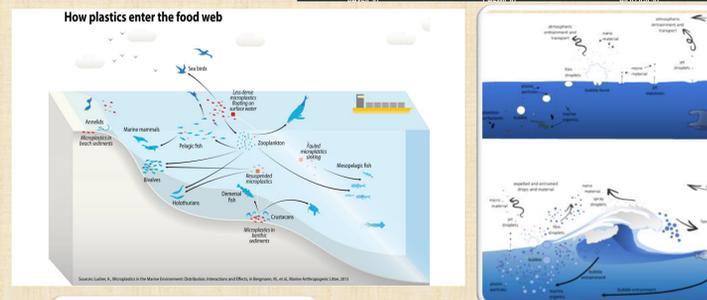
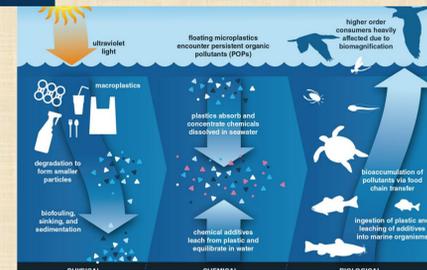
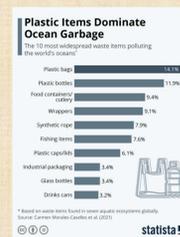
## When did we start using plastics

- We first started using plastics in 1907 when Belgian chemist and clever marketer **Leo Baekeland** pioneered the first fully synthetic plastic in 1907.
- In the early decades of the 20th century, the petroleum and chemical companies such as ExxonMobil and Dow began producing numerous plastic products.



## The importance plastic has on our society

- Plastics are critical to our modern society. Plastics made possible the development of computers, cell phones, and most of the lifesaving advances of modern medicine.
- Plastic packaging also plays a crucial role in the cheapening of industrial processes.
- Plastics are light and resistant, reducing the weight of the cargo and making transportation safer.



## Plastics in the Oceans

- Plastics consist of macro, micro, and nano sizes and come from a variety of sources.
- These also include larger plastic pieces that have broken apart, resin pellets used for plastic manufacturing, or in the form of microbeads, which are small, manufactured plastic beads used in health and beauty products.
- Plastics never fully disappear they just break down into smaller pieces over time. Ex. Macro, Micro, Nano.
- Plastic can take anywhere from 20 to 500 years to decompose, depending on the material's structure and environmental factors such as sunlight exposure.
- Every hour, 2.5 million plastic bottles are thrown away in the United States. Between 75 and 199 million tons of plastic are currently in our oceans.
- The most abundant materials are fragments of polyethylene (54.5 %), polypropylene (16.5 %) and polyester (9.7 %) are the most produced thermoplastic polymer worldwide- which float in marine waters.
- Plastics interact with the other spheres by infiltrating each one of the systems. Whether it's just with the presence or the toxic chemicals being released from them.

## Effects on the hydrosphere

- Once the plastic is in the ocean, it decomposes very slowly, breaking into tiny pieces known as microplastics, which can enter the marine food chain and become incredibly damaging to sea life.
- About 8 million tons of plastic from land sources enter the ocean every year and form large "garbage patches".
- These plastics are carried by ocean currents and broken down by waves and the Sun into small microplastics.

## Effects on the atmosphere

- Recent studies reveal that tiny pieces of plastic are constantly lofted into the atmosphere from the oceans.
- These particles can travel thousands of miles and affect the formation of clouds, which means they have the potential to impact temperature, rainfall, and even climate change.

## Effects on the biosphere

- Plastic is toxic and can kill wildlife or make them more susceptible to disease.
- Animals can become trapped and injured by plastic and it disrupts habitats, making it hard for some species to live and breed naturally, leading to depletions in populations.
- Plastic ingestion can block digestive tracts or pierce internal organs in wildlife.

## Effects on the geosphere

- Approximately 5% of marine plastics are deposited annually in coastal environments including beaches.
- Chlorinated plastic can release harmful chemicals into the surrounding soil, which can then seep into groundwater or other surrounding water sources, and the ecosystem.

## Reducing plastics in the oceans

- A plastic footprint is a measurement of the amount of plastic that someone uses and then throws away, considered in relation to the damage this causes to the environment
- One of the best solutions to avoiding plastic is by bringing reusable bags to grocery stores, switching from disposable to reusable drinking bottles, using a ceramic coffee mug, and reducing your consumption of single-use plastic bags, straws, cups, etc.
- Another way to reduce plastic use is by simply recycling the plastic you are using.

## Conclusion

Humans contaminate the oceans with millions of pieces of plastic annually. We now find plastics within all four interconnecting spheres of our Earth system thus showing that our anthropogenic footprint has environmental impacts are worldwide.