

# The impact of anthropogenic plastic pollution on marine life

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Plastic pollution is the accumulation and fragmentation of plastic debris in the environment to an extent that it results in adverse effects for wildlife, habitats and human inhabitants (Moore, 2020). Currently, in the world's oceans there are 150 million tons of plastic, by 2025 there will be 1 ton of plastic per 3 tons of fish and by 2050 there will be more plastic than fish in the ocean (MacArthur *et al.*, 2016). Plastic debris has become a significant threat to marine life, killing millions of animals each year (Bowker, 1986). These fatalities can only be expected to increase concurrently with plastic debris in the oceans. This essay will explore the link between human consumption of plastic, plastic pollution in the oceans and its impacts on marine life. It will also discuss individual and institutional changes that could be adopted to reduce oceanic plastic pollution.

## **Consumption and disposal of plastics**

Increased acceleration and widespread use of plastic production began in the 1940's and 1950's. Since then, the production rate of plastic has increased 200 times; from 2 million tons to 381 million tons annually in 2015 (Ritchie and Roser, 2018). In 2015, 42% of plastics produced from new materials (i.e., not recycled) entered the use-phase as packaging, however, packaging's single-use or non-reusable design resulted in most of that same packaging being disposed of within a year (Gayer *et al.*, 2017). Out of all plastic waste produced only 9% is recycled whilst 79% is sent to landfills (Gayer *et al.*, 2017); where due to plastics durability, instead of decomposing in landfills, it just accumulates (Barnes *et al.*, 2009). Potentially as a result of mismanagement of landfill sites, improper waste disposal (e.g. unsuitable items flushed down toilets) and illegal cooperate and individual littering, annually 8 million tons of plastics leak into the oceans (MacArthur *et al.*, 2017).

Unsurprisingly the most common plastic debris found in the ocean is packaging; plastic bags, yokes (six pack rings), bottles/bottle caps, netting, drinking straws, rope, milk/juice jugs, plastic film (Andrady, 2011). Out of all the plastic debris polluting the oceans, 80% has leaked from land-based sources whilst the remaining 20% comes from ocean-based sources which is majorly comprised of commercial fishing debris (Li *et al.*, 2016). Evidently, plastic pollution in the oceans is almost entirely anthropogenic.

## **Impacts of plastic pollution on marine life**

Plastic pollution threatens marine species in two main ways: entanglement and ingestion. Kühn *et al.* (2015) documented 344 species affected by entanglement and 331 species affected by ingestion of marine debris, highlighting the extent to which plastic pollution is affecting marine life. Entanglement is predominantly caused by animals becoming caught in plastic rope and netting (ghost nets); reported cases indicate marine mammals, sea turtles and sea birds are at greater risk (Gall and Thompson, 2015). The behavioral traits and

adaptions of these species most likely influence this. For example, sea turtle hatchlings face the threat of entanglement in debris on beaches that has been directly discarded or washed up from the ocean (Triessnig, 2012). Similarly, seabirds nesting behaviours has resulted in plastic debris being collected to use as nesting material, resulting in increased risk of entanglement particularly for hatchlings (Votier *et al.*, 2011). Entanglement in plastic debris can be fatal, it can prevent an animal from hunting/foraging resulting in starvation, reduces mobility therefore affecting ability to escape from predators and can prevent species from surfacing leading to suffocation. Even if an animal escapes from plastic debris it could have caused injuries resulting in infection or reduced mobility leaving it more vulnerable to predation. Accumulation of plastic debris on the ocean floor can have a 'smothering' effect on flora affecting growth rates (Kuhn *et al.*, 2015).



**Figure 1:** Dead albatross with stomach filled with plastic (Jordon, 2017).



**Figure 2:** Turtle entangled in fishing ropes (Charles, 2017).

Ingestion of plastic debris commonly occurs when animals misidentify plastic as prey. Sea turtle's preference for jellyfish as a source of food has been linked to ingestion of plastic bags due to resembling characteristics such as flexibility and translucency (Schuyler *et al.*, 2014). Foraging strategies have also been linked to increased ingestion of plastic debris such as surface seizing and diving seabirds (Roman *et al.*, 2019) and filter feeders (Germanov *et al.*, 2018); potentially due to reduced visibility and specificity of prey. Ingestion of plastic debris can directly cause death by causing serious internal damage; however, it can also indirectly cause death by causing internal blockages which kills the animals slowly. Blockages in the digestive tract can limit food intake or prevent it entirely resulting in nutritional deficiencies (leading to diminished body condition) or prolonged starvation. Plastic sitting in the stomach could produce a feeling of 'fullness', therefore reducing an animals' motivation to hunt/forage and ingest more food which also could lead to nutritional deficiencies.

### **Solutions to plastic pollution**

A vital first step in tackling plastic pollution is a large scale clean up off the oceans, however this is a short-term solution that fails to address the problem itself. In order, to significantly reduce plastic pollution long-term, their needs to be a change in mindsets and habits through education and accessibility. Particularly surrounding the consumption and disposal of single-use plastics and packaging.

**Reduce-** Legislation needs to be created to limit or even prevent the production of single use and non-reusable plastic products; certain governments including the UK have already started to take this step (GOV.UK, 2020). Companies and institutions (e.g. educational) need to provide, affordable, accessible and alternative options to plastic products (e.g. in workplaces and schools change plastic water bottles for glass water bottles and offer and promote the option of reusable bottles). Individuals need to make changes to everyday habits (e.g. carrying a reusable canvas bag for shopping) which will be prompted by less plastic options available and the promotion of alternatives by companies.

**Reuse-** Companies need to start offering consumers the option to refill empty product bottles (e.g. Shampoo bottles) or use their own containers. Companies such as Ecover (2020) have already taken this initiative by offering refill stations; this needs to become more mainstream. Companies could inspire consumers to creatively reuse packaging by providing fun ideas and suggestions on labels (e.g. bird feeders), this would be particularly beneficial and educational for families with young children.

**Recycle-** Councils need to provide more information to residents about what products are recyclable and create more efficient and specialist recycling centers so more than 9% of plastic waste gets recycled. More companies need to start using recycled materials to make products and packaging; this year girlfriend collective (2020) recycled 7,189,943 water bottles into clothes which in the process saved 16,035,982 gallons of water and prevented 6,270,956 pounds of carbon dioxide being produced.

**Responsibility -** Everybody must take responsibility for their consumption and disposal of plastic. As well as taking on the responsibility to educate the next generation and others.

Anthropogenic plastic pollution in the oceans adversely impacts hundreds of species and millions of individuals each year. If steps aren't taken to reduce plastic consumption these numbers will only increase. Humans created and exacerbated this problem; therefore, it is our responsibility to solve it.

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