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WHY IS PLASTIC POLLUTION A PROBLEM?

Once consumed, plastic particles can harm marine wildlife. CREDIT: THE 5GYRES

The sheer scale of our oceans means that often we take them for granted. But today, escalating levels of marine pollution, unrelenting overexploitation of fish stocks, destruction of coastal habitats and the impacts of global climate change are rapidly degrading the health of marine ecosystems around the world.

It has been estimated that poor ocean management costs us at least US$200 billion per year, and – in the absence of mitigation measures – the impacts of climate change will cause this figure to rise by an additional US$322 billion by 2050[1].

"Plastic soup"

Plastic pollution in the world's oceans is ubiquitous. The physical properties of plastic means that in the marine environment, microplastics are unlikely to ever fully degrade. Rather, they will simply break down into ever decreasing sizes through UV exposure, wave action, hydrolysis and oxidation, and mechanical grinding.

The EU estimates that there are 100,000 tonnes of plastic in the world oceans; a recent study on plastic accumulation in the North Atlantic and Caribbean found the highest concentration of plastic debris to exceed 200,000 pieces per square kilometre[2]. The watery realm, upon which so much life depends, has quite simply become a plastic soup.

Once they reach the marine environment, most plastics fall to the mercy of ocean currents and circulatory patterns, and can be transported thousands of miles around the globe.

Did you know? In 1992, a container ship en route from Hong Kong to the United States lost some 30,000 rubber ducks during rough seas. Fifteen years later, these ducks have been recorded around the world – including on the UK shoreline.

How does plastic affect wildlife?

Marine plastic pollution, in its traditional sense, is a well-known, well-publicised issue and generally relates to macroplastic pollution – large, visible pieces of debris. Haunting images of injured and entangled marine wildlife have flooded the media for many years and efforts are being made around the world to curb the increasing levels of macroplastic pollution.

In 2012, the Convention on Biological Diversity reported that a total of 247 species of marine fauna have either ingested or become entangled in marine debris; over 80% of these instances are associated with plastic debris and 15% of the species affected are listed on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species[3].

But a less publicised but equally serious threat has emerged in recent years: that of microplastic pollution (microplastics are defined as plastic particles smaller than 5mm – for more information, see fact sheet *What is plastic?*).

Once they reach the sea, the surface of these microplastic particles often become colonised by micro-organisms, which alter the properties of the plastic, causing it to sink through the water column and become embedded in the seabed, shoreline, and plant matter. Clean-up operations thus become virtually impossible.

When they reach the seabed, these plastic particles can obstruct the flow of oxygen through the sediment, causing anoxic conditions (the total depletion of oxygen) and the death of oxygen-dependent fauna and flora that live there.

Additionally, seabed filter feeders such as lugworms and mussels have been proven to consume microplastic particles, which can cause circulatory blockages. Not only is this harmful for the animals themselves, but there are also human health concerns about eating mussels contaminated with microplastics.

The effects of microplastic consumption are not just restricted to filter feeders either. Pre-production pellets, in particular, resemble floating fish eggs and are regularly mistaken as a food source by a multitude of marine fauna. Seabirds are particularly affected; for example, it is estimated that 95% of northern fulmars contain microplastics in their stomachs[4].

In all cases, once consumed, these particles can lead to physical blockages, malnutrition, choking and even starvation. Several studies have shown some seabirds even regurgitate microplastics to their young during feeding.

And as these microplastics break down they become more readily available to a greater number of species, exacerbating the problem.

Plastics have also been proven to adsorb persistent, bio-accumulating and toxic chemicals (such as DDT), while toxic additives used during the production and manufacturing stages of plastic are likely to leach out over time.

Some of these toxic additives (together with toxins already present in the marine environment) are known to accumulate and magnify up the food chain. This has significant implications for global ecosystems, fisheries and – ultimately – human health. At the very least, it raises questions about the labelling of ‘organic’ seafood products.

Impacts on biodiversity – evidence

Investigations into the effects of microplastics on marine species are still in the early days, however the following conclusions and discoveries have been made to date:

- **Northern Fulmars**[4]
  - From 2003-2007, 1,295 northern fulmars (a seabird from the North Sea) were sampled, and 95% were found to have plastic in the stomach (on average 35 pieces weighing 0.31 g). Long-term data for the Netherlands since the 1980s show a decrease in industrial plastics, but an increase in user plastics, with shipping and fisheries as the main sources.

- **Lugworms**[5]
  - Lugworms (*Arenicola marina*) kept in aquaria (in sediment containing 1.5g of microplastic) showed evidence of microplastic ingestion after a few days.

- **Mussels**[6]
  - Blue mussels (*Mytilus edulis*) were exposed to treatments containing seawater and microplastic. Initial experiments showed that upon ingestion, microplastic accumulated in the gut.
  - After transfer to clean conditions, particles translocated from the gut to the circulatory system within three days and persisted for over 48 days.
  - The ingestion and translocation of microplastic particles is thought to negatively affect the mussel's immune and circulatory systems and reduce feeding activity.

- **Fur Seals**[7]
  - 164 microplastic particles (in this case formed from the breakdown of larger particles) were recovered from fur seal scats on Macquarie Island.
  - It is hypothesised that the plastic particles were consumed by pelagic fish species (*Electrona subaspera*), which in turn were consumed by the fur seals.
  - Thus, the particles were accumulated both by the fish and the seals in the usual process of their feeding.

Fauna & Flora International is working to tackle the direct sources of microplastic pollution, starting with the Good Scrub Guide, which allows consumers to find plastic-free facial scrubs. For more information, see www.goodscrubguide.org.

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