



# BEWARE MERMAID'S TEARS

About 70 per cent of the surface of our planet is ocean. We depend on it to regulate the climate, as a source of food, for transport, and as a place to enjoy, especially along the coast. We have also tended to regard it as a convenient place to dispose of our unwanted waste. The type of waste we produce, and the way in which we dispose of it, reflect a combination of technological advances, the increasing demands of a growing population, economic growth and attitudes towards stewardship of the environment. The acute impacts of such marine pollution are relatively easy to demonstrate, but longer-term or more chronic effects — such as those caused by plastic debris, micro-plastic particles and the contaminants they may carry — can be very difficult to identify and quantify.

Plastics began being produced at an increasingly industrial scale midway through the 20th century, and scientists began reporting the spread of plastic debris in the oceans from the early 1970s. Many plastics are buoyant and very durable, and their debris is common on coastlines worldwide. Several assessments by UNEP and others — and many local and international beach ‘clean-up’ campaigns — have helped raise awareness of the problem and reduced local impacts, for a time.



PETER JOHN KERSHAW

Principal Research Scientist, Environment & Ecosystems, Centre for Environment, Fisheries and Aquaculture Science, Lowestoft, UK

Plastic, including discarded or lost fishing gear, threatens marine life, and much discarded plastic ends up on the seabed. There have also been media reports of mid-ocean ‘garbage patches’ and ‘floating islands’ of plastic debris, ‘as big as Texas’ or ‘twice the size of France’. Most of this debris consists of relatively small fragments, or micro-plastics, distributed through the upper few metres of the ocean, concentrated in five regions known as convergence zones or ocean gyres, as a result of known oceanographic processes.

It is generally assumed that the problem is increasing, but we lack reliable and comprehensive estimates of the material’s sources, quantities, distribution, fate and effects. Some of the most comprehensive studies have indicated no change in the quantities of debris in the ocean surface, but we are largely ignorant of the eventual fate of what enters the ocean every year.

Micro-plastics — defined as any plastic particle less than 5mm in diameter, which can readily be ingested by an organism — mostly arise from the breakdown of larger fragments. Others consist of plastic resin pellets — used as a raw material in the plastics industry, and sometimes referred to as ‘Mermaid’s Tears’ when found on the beach — which reach the ocean through poor waste management and accidental losses in transport. Industry moves to reduce these have been partially successful, but the pellets already released will persist for many years to come. A third, more recent, source arises from the use of plastic micro- and nano-particles in such products as toothpaste and hand cleaners, which are not retained by wastewater treatment so end up in the ocean.

Particles may damage or block an animal’s digestive tract or other organs, depending on its lifestyle and the quantities involved. Even more worryingly plastics can absorb persistent organic pollutants (POPs), such as PCBs and DDT, concentrating them by up to a million times before being ingested. And nano-sized particles can cross cell membranes and may have additional impacts, though this is an issue of great scientific uncertainty.

There are many different types of plastic but only a limited number are produced in very large quantities: polyethylene, polypropylene, poly-vinyl chloride, polystyrene, poly-amide (nylon) and polyethylene terephthalate (PET), used for the ubiquitous soft drinks bottles. Per capita use of plastic is predicted to reach 140 kg per year in North America and Europe, and 36 kg per year in Asia by 2015.

There have many advantages for the change. Switching from glass to plastic food containers, for example, or using a greater proportion of plastic in cars and planes, reduces emissions of CO<sub>2</sub> from transport. Life-cycle analysis shows that plastic single-use shopping bags can have a lower environmental impact than paper ones, in terms of energy and resource use. But, while a paper bag will disintegrate rapidly in seawater, the plastic bag will remain intact for much longer and will pose a threat to sea life. There are many reported examples of turtles, seals and whales dying as a result of ingesting plastic bags, perhaps mistaking them for jelly fish or another food.

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but the claims can be misleading. In many cases, the plastic will not truly degrade (i.e. reduce to carbon dioxide, methane and water) unless it is subject to the temperature and chemical conditions found in an industrial compostor — quite unlike those in the ocean. Some 'degradable' plastic bags are designed to disintegrate into smaller pieces, which will be just as persistent. Bio-plastic produced from crops, once polymerised, can have the same durable properties as material made from petrochemicals. And promoting so-called 'bio-

degradable' plastics may cause people to show even less willingness to improve waste management. Clear labelling and applying proper testing standards are critical.

Developed countries generally have the technical know-how to manage waste effectively, but there is often a lack of coordination or willingness in local government and industry to bring this about. The results are very patchy, with several European countries recycling or re-using (for example by burning for energy) over 80 per cent of waste plastic while in others the figure is less than 25 per cent. In developing countries, infrastructure is often lacking and managing plastic waste has to compete with other demands for limited resources.

Plastic pollution may gradually become less of a problem if waste is considered a valuable resource — for recycling, reuse or energy generation — and if people accept more personal responsibility for the waste they generate. This would require political commitment and investment — and an integrated approach from politicians, the plastics industry, major users of plastics, retailers, user groups and the general public.

