THE CONVERSATION

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Marine debris: biodiversity impacts and potential solutions

Pollution from human activities has major impact on the world's marine ecosystems. Plastic refuse is one of the most pervasive types of pollution.

More than 80 million tons of plastics are estimated to be produced globally each year. These plastics are durable, requiring about 500 years to decompose in the ocean. Their durability and buoyancy allows them to be carried far from their sources.

Plastic gets into the ocean, into marine species and into us

For instance, the ratio of plastic to zooplankton in the major ocean gyres, which tend to concentrate floating material, is estimated to be up to 6:1 by weight.

Whales, fish and other marine species depend on zooplankton for food, as they are the fundamental link to the phytoplankton who the capture sun's energy. Researchers currently believe plastics are taken up by zooplankton, thus entering the food chain.

Plastics also bring toxins into the food chain. When plastics break down, they produce toxic products. They also aggregate pollutants in the environment. Both are released when animals digest the plastic.

Globally more than 200 species are known to be affected by marine rubbish including whales, seals, dugong, seabirds, turtles, crabs, seasnakes, sharks, rays and other fish.

When plastics break down, they produce toxic products. (tedxgp/Flickr)

While many of these species are threatened, still others form part of our diet. This means that plastic ingested by wildlife not only affect them – their guts may be perforated and they may starve – but toxins from the plastics may also be absorbed by humans.

Tangled up in blue

Entanglement is also a significant threat to marine species. For example, up to 40,000 fur seals are killed each year when they get tangled in debris. This contributes to a population decline of 4-6% per year.

Entanglement affects nearly all groups of marine vertebrates. We know that in Australian waters turtles, cetaceans, seals, sea lions, seabirds, sharks and rays, crabs and other animals are affected.

Lost fishing gear and related refuse in particular is a major issue. Globally it is estimated that at least 6.4 million tons of commercial fishing gear is lost into the ocean each year.

The Gulf of Carpentaria, at the top end of Australia, provides a stunning example of this. More than 8,000 derelict fishing nets – which add up to 90,000 metres of net – have been cleaned up on beaches in the region.

Our oceanographic modelling suggests that these nets drift over large areas of the region, likely impacting six of the world's seven marine turtle species which occur there. Many other species are probably also affected, but decay before the nets wash ashore and are found.

Where does it all come from and how did it get here?

Most importantly, despite recycling and other efforts, the problem is rapidly intensifying. Plastics production has grown 500% over the last 30 years. It is still increasing at a rate of 3-5% per year.

The amount of plastic in the environment is increasing at an exponential rate. This suggests both total volume of production and failures to appropriately dispose of plastics are contributing to plastics into

the environment. Shockingly, the highest average plastic count on record is 334,271 pieces per square kilometer – and this is from a survey completed more than a decade ago.

Researchers are beginning to tackle this problem. They are trying to understand why plastics enter the environment, where they go once they are lost, and what impacts they have on marine species and ecosystems.

Encouraging people to recycle plastic bottles can make a real difference. (tedxgp/Flickr)

In our research, for instance, we are assessing the marine debris that washes up on shores around Australia. We're comparing types of marine rubbish in urban areas versus those in remote locations to identify likely domestic versus foreign contributions to marine debris.

This work relies heavily upon the countless volunteers and community groups that conduct beach clean ups in their area. It is an excellent example of the value of citizen scientists/volunteer collected data.

We use these data with oceanographic models to track likely sources and sinks of marine rubbish through space and time. We see seasonal differences in marine rubbish washing up along the coastline, much of which is likely due to differences in ocean current patterns that differ at different times of the year. And we're learning about what types of debris are found near urban centers (plastic bags, cigarette butts, sundry items) and in more remote areas (such as fishing gear off the west coast of Tasmania).

How can we solve the problem?

Tackling marine debris will require cultural change via a mix of education, incentives, and regulation. Plastic bottle recycling is an excellent example – it has increased every year since 1990 to 2.2 trillion pounds in 2006.

Educational tools, such as the plastics identification code on bottles, provided essential knowledge for the public and increased participation. Bottle deposits, an economic incentive, resulted in a 75%

reduction in losses into the environment. Regulations, such as recent prohibitions on disposable drink bottles may further reduce the problem.

However, our lack of information makes it hard to target education, incentives and regulation. Linking plastic in the environment to particular factories, stores, fishers or consumers is currently impossible. This means that our tools for cultural change must be broadly targeted, while losses into the environment are likely due to an irresponsible minority, as in many other types of pollution.

Human behaviour needs to change from the current throwaway culture being status quo, and accountability is a fundamental ingredient in this change.

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