

# MPA NEWS



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## The Skimmer: A brief primer on marine litter and ocean plastics



The following is a roundup of some of the latest scientific knowledge on marine litter and ocean plastics. It is based in part on a [longer, more detailed article](#) from November 2017 by MPA News' affiliated service [Marine Ecosystems and Management \(MEAM\)](#).

If you are interested in this topic, please note that OCTO – the organization that produces MPA News and MEAM – also runs the global discussion list on marine litter and ocean plastics: MarineDebris.Info. It is a thriving community. In April 2018, for example, there were over 170 member posts to the list. To subscribe to the MarineDebris.Info email discussion list, [click here](#).

### How much plastic is out there?

A 2017 global analysis of all mass-produced plastics ever manufactured estimated that [8.3 billion metric tons of virgin plastics have been produced to date](#). This same study estimated that, as of 2015, approximately 6.3 billion metric tons of plastic waste had been generated. Of that, 9% was recycled, 12% was incinerated, and 79% was either in landfills or somewhere in the natural environment.

A [landmark 2015 study by Jambeck et al. on plastic waste inputs from land into the ocean](#) estimated that in 2010 alone, 4.8 to 12.7 million metric tons of plastic waste entered the ocean worldwide.

Discarded, lost, or abandoned fishing gear is another major source of ocean plastic. Modern nets are now made mostly of nylon and similar nonbiodegradable plastics, as opposed to natural materials like cotton. So when discarded, lost, or abandoned, the gear tends to continue fishing without breaking down – continually re-baiting itself with newly caught marine life, over and over for years or decades. The [Global Ghost Gear Initiative](#), an alliance of organizations working to understand and address the problem, estimates 640,000 metric tons of fishing gear (around 10% of global marine litter) is added to oceans annually.

### Of the plastic that enters the ocean from land, where does it come from?

Most of the plastic entering the ocean is coming from places with large populations and poor waste management. Most of it is from Asian countries.

The 2015 Jambeck et al. study [estimated the top 20 contributors of mismanaged plastic waste, considering populations within 50 km of the coast](#) in 2010. Nations on the Asian continent represented 12 of the top 20 countries, with China way out ahead of the pack. The African continent was runner-up with five countries in the mix, and Turkey, Brazil, and the US also made it onto the scoreboard.

Two 2017 studies have helped refine numbers for river discharge into the ocean. One of these studies estimated that rivers [contribute between 410,000 and 4 million metric tons a year to oceanic plastic debris](#). Of this total, 88%-95% is coming from eight rivers in Asia – the Yangtze, Yellow, Hai He, Pearl, Amur, Mekong, Indus, and Ganges – and two in Africa – the Niger and Nile. The second study used somewhat different datasets and methods and [estimated that 1.27 to 2.66 million metric tons of plastic waste](#) is entering the ocean every year from rivers, with 67% of that from the top 20 polluting rivers – 15 of which are in Asia.

### Where does the plastic go once it is in the ocean?

Floating ocean plastic is mostly composed of polyethylene and polypropylene — common plastic types with a density less than that of seawater. Other plastic types, with densities greater than seawater, generally sink to the sea floor when they reach the ocean.

Most of the plastic in the ocean is not floating on the surface, according to [one analysis](#). The majority of it is on the sea floor or distributed vertically throughout the water column.

[One study](#) found that microplastic – in the form of microfibers (of which [hundreds of thousands can be produced in each laundering](#) of a polyester fleece jacket) – is relatively abundant in deep sea sediments in the Atlantic Ocean, Mediterranean Sea, and Indian Ocean. It was four times more abundant in sediments than in surface waters in these regions.

Microplastics are also in deep sea organisms. One study showed that [plastic microfibers are ingested and internalized by deep sea organisms](#) with four different feeding mechanisms – suspension feeders, deposit feeders, detritivores, and predators. Another study found that [nearly half of marine invertebrates living below 2200 meters in the Rockall Trough](#) in the North Atlantic had ingested microplastics.

At the poles: while plastic pollution is scarce or absent in a lot of Arctic waters, there is [quite a bit of it in the Greenland and Barents seas](#), perhaps due to transfer from the North Atlantic. In the Southern Ocean, studies have found [microplastics in deep sea sediments and surface waters](#).

And, finally, one of the most remote islands on earth, Henderson Island in the South Pacific's Pitcairn Islands, is littered with an estimated [37.7 million pieces of plastic](#) despite being uninhabited by humans.

## What happens physically to plastic once it is in the ocean?

A [2017 article reviews what is known and unknown about marine weathering of plastics](#). Once it is in the ocean, plastic is exposed to physical stress (from turbulence, abrasion with other particles, etc.), ultraviolet radiation, changing temperatures, salt, oxidizing conditions, and colonization by microorganisms such as phytoplankton, bacteria, and fungi. Plastics break down into progressively smaller bits or "secondary microplastics"; release chemical additives with which they are manufactured; absorb and adsorb chemicals from the ambient water; get eaten and potentially passed along in the food chain; move with currents; and, eventually, sink.

These occurrences can interact in complex ways. For instance, biofouling increases the density of plastic debris and leads to its sinking. Biofouling can also increase uptake of plastic particles into the food web and slow the leaching of chemicals into seawater. Sinking lower in the water column or to the seabed can reduce exposure to ultraviolet radiation and physical stress and slow further weathering.

## What impacts are plastics having on marine organisms and habitats?

We have all seen the photos of marine life tangled in plastic, or the stomachs of seabirds or other animals filled with litter. Recent years have observed [an increase in the roster of animals](#) known to be affected by entanglement with, and ingestion of, plastic. [One study examined which plastic trash items](#) had the greatest impact on seabirds, marine mammals, and sea turtles. The biggest culprits were fishing gear, balloons, plastic bags, and plastic utensils.

Chronic exposure to microplastics [can change the way marine organisms eat, grow, and reproduce](#). (For example, [eating microplastics decreases the reproductive capability of Pacific oysters](#).) And this may mean bigger changes to marine populations, trophic structures, and ecosystems over time.

While most of the literature focuses on the impact of plastics on organisms, plastics can also alter habitats including sandy beaches, salt marshes, mangrove forests, coral reefs, seagrass beds, and oyster reefs. A review of these impacts by habitat [is here](#). In 2018 [a study on the impact of plastic litter on coral reefs](#) found that contact with plastic can make corals more than 20 times more susceptible to disease.

Plastic has also been enabling an extraordinary rafting event in recent years, carrying species-laden debris from the 2011 tsunami in eastern Japan across the Pacific Ocean to Hawai'i and North America. Researchers [have documented 289 Japanese coastal marine species arriving alive on eastern Pacific shores](#), setting new records for transoceanic survival and dispersal of coastal species by rafting.

### For additional information

[MarineDebris.Info](#): global discussion list on marine litter research, management, and prevention

[Global Ghost Gear Initiative](#): Working to ensure safer, cleaner oceans by driving sustainable solutions to the problem of ghost fishing gear globally

[UN Clean Seas Programme](#): Engaging governments, the private sector, and the general public in the global fight against marine plastic litter.

[ALBATROSS the film](#): filmed on location in Papahānaumokuākea Marine National Monument

[Short video](#): plastics in US coastal national parks

[Webinar recording](#): Ghost Fishing Gear: The Global Problem and the Global Solution

[Webinar recording](#): Engaging governments, businesses, and the public in the fight against marine plastic litter: the #CleanSeas campaign

[Webinar recording](#): The African Marine Waste Network: Inviting Participation

[Webinar recording](#): Accelerating the solutions to ocean plastic: Trends and lessons from five years of the Marine Plastics Innovation Challenge

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