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The Pacific is drowning in plastic

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ABSTRACT

The world is facing a plastic pollution crisis. Plastic has reached the most remote areas of our lands, seas and oceans. The scientists from The Ocean Cleanup thoroughly characterize one of the major pollution zones in the Pacific Ocean.

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Halfway between the coastal beaches of Southern California and the paradise islands of Hawaii lies the Great Pacific Garbage Patch (GPGP) - a patch of plastic debris covering a vast area of the oceanic surface. Despite the name, it is not a compact garbage island or mountain. It resembles a “plastic soup” as described by the oceanographer Captain Charles Moore, who crossed this stretch of the Pacific Ocean on one of his sailing expeditions. Pieces of plastic in all sizes float on the surface in high concentrations. The persisting plastic threatens ocean wildlife, but also ourselves. The animals can get entangled in soft plastics or eat the small pieces that look like food. Plastic can also absorb and accumulate toxins. Once they enter the food chain they can go all the way up to our plates.

The entire GPGP is too large to be measured and the varying size of floating debris make its studying challenging. To overcome these problems – which led to discrepancies in the previous studies - the scientist from the non-profit organization The Ocean Cleanup combined two approaches. They collected the data on pollution on site and created a computational model of the GPGP. Boats dragging fishing nets on the water surface collected small and medium debris samples. Some objects in the GPGP are too bulky to capture in nets. To count and estimate the weight of those objects, the scientists took pictures from planes and then analysed the images. To infer the GPGP’s total size, weight and other global parameters the team used their computational model. It simulated how the plastic entered and travelled the seas and oceans to end accumulating in the area. The authors confirmed that the model’s outcomes are valid by comparing them to the collected data.

The authors estimated that the GPGP spans over 1.6 million km^2, an area 4.5 times the size of Germany. The accumulated debris weighs 79 000 tonnes, roughly the mass of eight Eiffel Towers. They also found that these numbers will continue to grow at a fast pace. According to the model, the position of GPGP shifts slightly between seasons and years. The exact position depends on the periodic climatic oscillation El Niño-Southern Oscillation and Pacific Decadal Oscillation. This shifting may further explain why previous measurements differed.

The analysis of the samples confirmed that plastic makes up almost all the material in the GPGP. Microplastic outnumbered any other size category accounting for over 90% pieces forming the GPGP. This category encloses objects smaller than 0.5 cm such as microbeads from exfoliating cosmetics and toothpaste, synthetic fibres, nurdles or fragments of degrading larger objects. Scientists across the globe detected traces of microplastic in seafood, table salt, bottled water, and even beer. Due to its large volume, however, it is megaplastic that makes up over half of the GPGP's mass. The mega debris exceed 50 cm at their larger dimension. Most of them were lost or discarded 'ghost' fishing nets.

The area of the GPGP coincides with an oceanic gyre – a pattern of circular water surface currents that concentrate the garbage. The authors tested if other environmental forces, such as waves or winds, push the trash into the GPGP. The simulation revealed that the gyre currents contribute to the greatest extent to the creation of the garbage patch. Materials susceptible to be transported by wind (such as foams and buoys) are actually likely to escape the GPGP.

Millions of tonnes of garbage reach - deliberately or accidentally - our planet's oceans. In the Pacific Ocean, some of it accumulates in the GPGP. Similar patches exist in other parts of the Earth's oceans. Although many (including the authors of the study) attempt to clean them up, their size, mass, and international localization makes it almost impossible. Experts also worry that, as a side effect, the clean-up could harm the wildlife. Floating debris is only one aspect of the ocean pollution problem: plastic can also wash out on beaches, sink to the seafloor or end up eaten by animals. The easiest and most impactful way to fight all the types of pollution in the plastic soup our oceans have become is to reduce the amount of plastic we produce and discard.