KEY MESSAGES

SOURCES, DISTRIBUTION AND FATE OF PLASTIC POLLUTION IN THE SEA

1. Among the 8 billion tons of plastic produced since 1950, 60% have been discarded in landfills or in the natural environment. In some compartments of the marine environment, plastic represents up to 95% of marine litter.

2. Plastic waste from land represents the predominant contributor of marine plastic litter; it has been estimated that an average of 8 million tons of marine plastic stems from land-based sources each year. The amount of plastic waste discarded directly into the marine environment is difficult to ascertain.

3. Rivers act as conduits between the land and sea, and have been estimated to contribute 1.15–2.41 million tons annually; around 90% of this input from rivers is estimated to come from 10 rivers in the world.

4. Once in the environment, plastic can break down into smaller and smaller pieces—including large microplastics (1 – 5 mm) small microplastics (25 μm – 1 mm) and nanoplastics (<1000 nm). Currently, we have very few data about small microplastic occurrence in the ocean, as for nanoplastic data are even scarcer.

5. Plastic microbeads manufactured as exfoliating particles in cosmetics will invariably end up in wastewater, and can eventually find their way out into the ocean. However, secondary microplastics can derive from a vast range of sources, including tire wear, paints, synthetic clothing and the degradation of larger plastic.

6. There are five zones of high accumulation of plastic debris in correspondence of subtropical oceanic gyres (North and South Pacific, North and South Atlantic, and Indian Ocean). Other zones with high plastic concentration, not stable but variable in time, have been found in the Mediterranean Sea and the Gulf of Bengal.

7. Labelling the subtropical gyres as “garbage patches” or the “seventh continent” is misleading. These regions coalesce large numbers of microplastics floating at the sea surface or suspended throughout the water column, however they are barely visible to the naked eye and do not form a solid continuous mass.

8. It has been estimated that 1% of the plastic that entered the ocean is today present at the sea surface as large microplastics. The rest might have broken down into smaller particles (small microplastics and nanoplastics), have been ingested by marine organisms, have been redeposited on shores or has sunk in the water column and it is now resting at the seabed.

IMPACTS OF PLASTIC POLLUTION ON MARINE ECOSYSTEMS, ENVIRONMENTAL AND HUMAN HEALTH

9. All marine ecosystems are affected by plastic debris. The physical effects (suffocation, entanglement, ingestion) depend on the size of the animal and the size of the plastic.

10. Microplastics are usually excreted after ingestion but laboratory experiments have shown that at high doses microplastics are retained within an animal's intestinal tract and can transfer from a prey organism to a predator. Experiments have also demonstrated that nanoplastics can pass across cellular membranes and might translocate to tissues. It is currently unclear to what extent these phenomena might occur in the marine environment, where the observed concentrations of plastics are lower than in the experimental settings.

11. Plastics contain a suite of toxic additives and can accumulate persistent organic pollutants from their surroundings. Small doses of these chemicals can affect the hormonal balance in animals and can accumulate up the food chain. It is currently unknown to what extent plastics contribute to contamination of marine organisms in respect to seawater, the main source for persistent organic pollutants and other toxic chemicals.

12. Negative effects of plastic on individuals may have consequences at the ecosystem level. For example, reduced growth, reproduction and survival can limit population size. These populations can have vital roles in carbon fluxes in the ocean-atmosphere system and for populations (including humans) depending on them.

13. Plastic debris can transport microorganisms and invertebrates over long distances. Rafting on plastic can facilitate dispersal of potentially invasive species outside of their natural environment. Plastic can also transport pathogenic microorganisms and offer a substrate over which they can concentrate over time.

14. The effects of plastic pollution on human health are relatively unknown. There is widespread evidence of seafood being contaminated by microplastic, and nano- and microscopic plastics are prevalent in the air we breathe, but the effects this might have on humans are untested.

HOW TO GET RID OF THE PLASTIC POLLUTION IN THE SEA ?

15. The degradation time for plastics varies greatly, being dependent on the intrinsic physiochemical characteristics of the plastic, environmental parameters such as temperature, salinity and humidity, and the presence of micro-organisms (fungi and bacteria). This complexity makes it difficult to predict plastic degradation rates in the natural environment. Estimates of plastic degradation times in the marine environment vary between a few years and a few centuries; in some cases (in sediment, in cold water, without light, without oxygen) the degradation of certain plastics might take much longer.

16. There is limited scientific evidence regarding degradation rates of plastic that is commercialized as "biodegradable" under different conditions in the marine environment and it is unknown whether this type of plastic causes less harm to marine organisms than conventional plastic.

17. It is practically impossible to extract plastic from the ocean on a large scale.

18. Efforts to control plastic pollution in the ocean need to address land-based sources of waste by implementing action plans to reduce plastic discharge to the ocean around the world, rather than addressing pollution once it reaches the ocean.