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DEEP-OCEAN STEWARDSHIP INITIATIVE

POLICY BRIEF
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Plastic Pollution in the Deep Ocean

Key Points

- Plastic pollution is everywhere, including the deep ocean. The deep ocean is the ultimate sink for marine plastic debris, where it remains harmful and unretrievable.
- The deep ocean supports immense biodiversity, providing vital ecosystem services, but is vulnerable to human impact.
- Plastic can persist for centuries. Therefore, the impact of plastic pollution on the deep ocean is long-lasting.
- Plastic can fragment into microplastics, which interfere with animal growth, behaviour and reproduction. Ingested plastic can transfer harmful chemicals up the food chain.
- Marine plastic comes from both land- and water-based activities. Better governance and management of these activities is required to prevent the arrival of plastic in the deep ocean.
- Political and practical efforts to reduce plastic consumption and better regulate plastic waste management are effective ways to prevent plastic reaching the deep ocean.

Background

Plastic is now ubiquitous in all of Earth's habitats, from the highest mountain peaks to the deepest ocean trenches; plastic is even in the air we breathe. The source of most visible plastic pollution is unregulated waste disposal on land, which, coupled with the prevalence of single-use plastic consumption, has led to unprecedented accumulation of plastic waste. As this waste finds its way into waterways, carried by wind, runoff and storm drains, rivers have become a major conduit of plastic debris to the ocean[i]. At-sea disposal, loss and accidental discharge of plastic (e.g., abandonment of snagged or damaged fishing gears, nurdle spillages, negligent port management) have also contributed to the problem. Entrained by currents, there are now vast amounts of plastic in suspension around coasts, at the centre of mid-ocean gyres, and settled on the seafloor[ii]. Floating plastic is colonised by marine organisms, becomes heavier and eventually sinks. The deep ocean is thus the ultimate sink for marine plastic debris, with an estimated 25-900 million metric tonnes of plastic accumulated globally between 1950 and 2010[iii].

Plastic can be mistakenly consumed by marine animals, often with fatal consequences for individuals, and potentially catastrophic effects for entire populations and species[iv]. Most victims sink to the sea floor, transporting the plastic with them and adding to the ecosystem's burden. Death by entanglement in plastic is also of significant concern given the durability of plastic in the marine environment, but as most fatalities go unobserved, they are likely underestimated.

Plastic exposed to sunlight and multiple impacts slowly degrades, breaking into ever-smaller pieces (microplastics) that present further problems. At a molecular scale, plastic particles can behave chemically like hormones, disrupting growth and reproductive processes in animals that ingest them. Plastic is produced using thousands of harmful chemicals[v] (e.g., Bisphenol A – BPA), and in the sea it can adsorb further contaminants from its surroundings (e.g., dissolved heavy metals, persistent pollutants). Successive inadvertent ingestion of such chemicals up the food chain could lead to the detrimental concentration of harmful substances in the flesh and organs of predators, including humans. Plastic pollution therefore threatens food safety and human health[vi]. Discharged plastic waste suppresses coastal tourism, increases costs for coastal communities (estimated at US$197bn in 2030[vii]), and contributes to climate change by prolonging fossil-based production of new plastic and through incineration[viii]. Moreover, plastic pollution in combination with other stressors, such as extraction activities and rising global temperatures, further reduce the resilience of deep-ocean ecosystem integrity. To date, efforts to survey, monitor, regulate and remedy plastic waste in the ocean have been minimal.

Current Policy Challenges

Discharging plastic into the sea is already prohibited under regulations for the prevention of pollution by garbage from ships and their associated infrastructure[1]; however, the shortcomings of these regulations are glaringly obvious. Under a business-as-usual scenario and in the absence of necessary interventions, the amount of plastic waste entering aquatic ecosystems could nearly triple from some 9-14 million tonnes per year in 2016 to a projected 23-37 million tonnes per year by 2040[ix].

Progress is being made at the international scale to improve regulations that curtail the flow of plastic debris reaching the sea. The International Maritime Organization (IMO), for example, has adopted an action plan and strategy to complete by 2025. Similarly, the United Nations Environment Programme (UNEP) has adopted a resolution to develop an international legally binding instrument on plastic pollution by 2024 that will consider the full lifecycle of plastic, including in the deep ocean. Many existing policies, however, do not acknowledge the abyssal fate of marine plastic waste or the long-term harm posed by plastic accumulating in the deep ocean. This shortfall may be, in part, due to the limited understanding by the scientific community of the long-term effects of plastic in the deep ocean, given the deep's inaccessibility and the relative novelty of the problem itself. Knowledge acquired so far has come mostly from opportunistic observations during other scientific or resource extraction missions. Designing future policies that address this shortcoming with dedicated research would go a long way toward generating better knowledge with which to inform and support better regulation, prevention, monitoring and mitigation of plastic pollution in the deep ocean. Habitat restoration (i.e., retrieval of plastic from the deep ocean) is unlikely ever to be viable, so creating effective policy to prevent plastic from reaching the deep ocean would be the best strategy to safeguard this vast yet vulnerable ecosystem.

[1] The London Convention, the London Protocol and the Protocol to the International Convention for the Prevention of Pollution from Ships (MARPOL).

Scientific Understanding

Scientific research on the topic of plastic pollution in the deep ocean is limited, but steadily increasing. Detailing all lines of research here would be impractical, however, initiatives do exist that compile and synthesise the findings of the research community into useful tools for policy, such as LITTERBASE (Box 1).

Another helpful tool is the Global Partnership in Plastic Pollution and Marine Litter (GPML), created by UNEP in 2012 as a platform for knowledge-sharing and cooperation. Specific objectives of the GPML include reducing the leakage of plastic into the ocean through improved product design, application of the waste hierarchy (reduce, re-use, recycle), encouraging 'closed-loop' systems and more circular production cycles, and maximisation of resource efficiency and minimisation of waste generation.

Guidelines for the harmonisation of monitoring and assessment practices for plastic waste and microplastics in the ocean have been published by the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP). The guidelines can be used by national, inter-governmental and international organisations with responsibilities for managing the social, economic and ecological consequences of land- and sea-based human activities on the marine environment.

Box 1: Recorded locations of marine plastic litter across the ocean

LITTERBASE is an online portal of marine debris. It compiles information from scientific publications to create continuously updated maps and figures on the global amount, distribution and composition of marine debris and its impacts on aquatic life.

This image shows a global map of plastic pollution observations on the seabed deeper than 200 m that have been submitted to LITTERBASE. An interactive version of the map is available **online**.

The source of all plastic pollution in the deep ocean is from land via rivers and the sea surface, so managing land- and ship-based activities on and near the sea will reduce the amount of plastic reaching the deep ocean. It is unlikely that recovery of plastic from the deep ocean will ever be viable, therefore, preventing plastic reaching the deep ocean seems the most sensible strategy for safeguarding this sensitive ecosystem and all those who depend on it, including ourselves[x]. The following recommendations – cross-referenced with UNEP's potential options for elements towards an international legally binding instrument – should help prevent a worsening of the problem of plastic waste polluting the deep ocean.

Recommendations

- Ensure that the fate and danger of plastic in the deep ocean is acknowledged as a growing matter of concern to all parties during the negotiations and establishment of an international legally binding instrument that addresses the full life cycle of plastics as called for by United Nations Environment Assembly resolution 5/14. (E1-2)

- Promote and implement IMO's strategy to achieve zero plastic waste discharges to sea from ships by 2025. (B9)

- Impose caps on virgin plastic production. Production caps can achieve a 59% reduction in terrestrial and aquatic plastic pollution relative to current growth trajectories, and can be implemented at low cost by all economies[ix,xi]. (B1)

- Simplify and standardise the design of plastic polymers to enable safe and effective recycling of necessary plastic[xii]. (B2)

- Encourage port-side adoption of the 'no-special-fee' system to disincentivise offshore plastic waste disposal[2]. (B5)

- Endorse mandatory use of owner-marked plastic fishing gear to discourage at-sea dumping. (B9)

- Impose a ban on the use of non-biodegradable plastic dolly ropes on trawls, which are designed to become abraded at the seafloor to protect towed fishing gear.

- Support research, monitoring and data-sharing schemes[3] in the deep ocean to enable the assessment of efficiency of remedial measures taken. (D1-4 and E3)

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About DOSI:

The Deep-Ocean Stewardship Initiative is a global network of experts that integrate science, technology, policy, law and economics to advise on ecosystem-based management of resource use in the deep ocean and strategies to maintain the integrity of deep-ocean ecosystems within and beyond national jurisdiction.

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[2] The 'no-special-fee' system is defined by HELCOM as a charging system where the cost of reception, handling and disposal of ship-generated wastes, originating from the normal operation of the ship, as well as of marine litter caught in fishing nets, is included in the harbour fee or otherwise charged to the ship irrespective of whether wastes are delivered or not.

[3] Such as establishing an Integrated Marine Debris Observing System (IMDOS) and the identification of plastic debris as an Essential Ocean Variable.

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