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From pollution to solution – Are we there yet?

The history of plastic is full of important inventions that have changed many parts of our lives. From everyday convenience to a danger to the planet, it is a material that continues to shape our world. As plastic use has grown, so have the environmental concerns. The United Nations Environment Programme (UNEP) argues succinctly that plastic pollution “can alter habitats and natural processes, reducing ecosystems’ ability to adapt to climate change, directly affecting millions of people’s livelihoods, food production capabilities and social well-being.”¹

Globally, about one million plastic bottles are bought every minute and up to five trillion plastic bags are used every year. Half of the plastic that is produced is designed for single-use purposes. Plastic can be seen easily everywhere in our natural environment. It is becoming part of the Earth’s fossil and a marker of the Anthropocene, our current geological era².

A threat multiplier

The scale of global plastic pollution is significant and growing, that has gone from a de minimis quantity prior to 1950 to a staggering 60m tons in 2020. Regrettably, less than 10% of plastic waste is ever recycled, with most plastic waste discarded or incinerated.³ The challenge of discarded plastic waste has proven to be pervasive, with plastic debris found in the deepest part of the world’s ocean including the Marina Trench⁴ and embedded in snow and water in the world’s highest peaks including on Mt. Everest⁵.



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A further challenge with discarded plastic is that it takes between 20-500 (not a typo) years for plastic to decompose⁶, regrettably even then it does not vanish but simply gets broken down into smaller and smaller particles. Current scientific research shows that concerningly these smaller particles are increasingly ending up in human blood, where a recent peer reviewed study showed these to be present in ~80% of people assessed⁷; in the placentas of human babies⁸; and embedded in human lung tissue⁹. Thus, the adverse impact of plastic on human health is likely to be material.

In parallel, plastic is a material contributor to greenhouse gases (GHG) emission and climate change. The production, conversion and waste management of plastic generates about 4% of GHG emissions. Of these, 90% can be qualified to the production and conversion stage of the plastics lifecycle.

In 2019, total GHG emissions related to fossil-based plastics throughout their lifecycle were 1.8 gigatonnes of carbon dioxide equivalent (GtCO₂ e), or 3.4% of global emissions. With increasing plastics use and waste, these emissions are projected to more than double by 2060, reaching 4.3 GtCO₂ e.¹⁰

¹ <https://www.unep.org/plastic-pollution#:~:text=Plastic%20pollution%20can%20alter%20habitats,capabilities%20and%20social%20well%2Dbeing>

² Chen, H., Zou, X., Ding, Y. et al. Are microplastics the ‘technofossils’ of the Anthropocene?. *Anthropocene Coasts* 5, 8 (2022). <https://doi.org/10.1007/s44218-022-00007-1>.

³ Geyer, R. (2020). Production, use and fate of synthetic polymers in plastic waste and recycling. In *Plastic Waste and Recycling: Environmental Impact, Societal Issues, Prevention, and Solutions*. Letcher, T.M. (ed.). Cambridge, MA: Academic Press.13-32.

⁴ Peng, X., Chen, M., Chen, S., Dasgupta, S., Xu, H., Ta, K., Du, M., Li, J., Guo, Z. and Bai, S., 2018. Microplastics contaminate the deepest part of the world’s ocean. *Geochemical Perspectives Letters*, 9(1), pp.1-5.

⁵ Napper, I.E., Davies, B.F., Clifford, H., Elvin, S., Koldewey, H.J., Mayewski, P.A., Miner, K.R., Potocki, M., Elmore, A.C., Gajurel, A.P. and Thompson, R.C., 2020. Reaching new heights in plastic pollution—preliminary findings of microplastics on Mount Everest. *One Earth*, 3(5), pp.621-630.

⁶ United Nations Environmental Program.

⁷ Leslie, H.A., Van Velzen, M.J., Brandsma, S.H., Vethaak, A.D., Garcia-Vallejo, J.J. and Lamoree, M.H., 2022. Discovery and quantification of plastic particle pollution in human blood. *Environment international*, 163, p.107199.

⁸ Ragusa, A., Svelato, A., Santacroce, C., Catalano, P., Notarstefano, V., Carnevali, O., Papa, F., Rongioletti, M.C.A., Baiocco, F., Draghi, S. and D’Amore, E., 2021. Plasticenta: First evidence of microplastics in human placenta. *Environment international*, 146, p.106274.

⁹ Amato-Lourenço, L.F., Carvalho-Oliveira, R., Júnior, G.R., dos Santos Galvão, L., Ando, R.A. and Mauad, T., 2021. Presence of airborne microplastics in human lung tissue. *Journal of Hazardous Materials*, 416, p.126124.

¹⁰ Global Plastics Outlook: Policy Scenarios to 2060 (OECD, 2022).

To be clear, reducing plastic-related emissions alone will be far from sufficient, to achieve ambitious climate mitigation goals such as net-zero emissions, but nevertheless represents a key component on the road map to achieving these goals.

Put simply, plastic pollution is a “threat multiplier”. This is a term borrowed from the US military, because not only does plastic have standalone adverse consequences, but also has the potential to exacerbate many existing challenges such as those focused on human health, the biodiversity crisis, and GHG emissions.

Impact on Marine Life

Marine plastic pollution is increasingly recognised as a significant threat to marine ecosystems, including phytoplankton, which are the foundation of the marine food web. If phytoplankton are affected by plastic pollution, it can have cascading effects through the food web, impacting the species that feed on them and the overall health of marine ecosystems.

Marine animals often ingest plastic debris, mistaking it for food. This can increase physical harm, and lead to blockages in the digestive system, malnutrition, and even death. Additionally, animals can become entangled in larger plastic items like nets and six-pack rings, leading to injury, impaired movement, and drowning.

Plastic in the ocean breaks down into microplastics, which are small plastic pieces less than 5mm long, which are swallowed by a wide range of marine organisms. They made up 88% of global plastic leakage to the environment in 2019, around 20 million metric tons, polluting all ecosystems. When phytoplankton encounter these contaminated microplastics, they can absorb these toxic substances, which can affect their growth and reproduction.

An estimated 300,000 whales, dolphins, and porpoises a year die from ghost nets.¹¹ A recent study done by University of Exeter found that all seven species of sea turtle from the Atlantic and Pacific Oceans and the Mediterranean Sea had traces of microplastics in their gut.¹² Plastic debris is said to cause the deaths of more than a million seabirds each year.¹³ In a meta study conducted across over 100 scientifically robust studies on fish and plastic ingestion among 508 fish species, over two-thirds of these had records of plastic ingestion.¹⁴ Explicitly, fish often mistake small plastic pieces, such as pellets, for food with often catastrophic consequences.

Plan of action

The increasing impact from marine litter has created international concern over the effect on marine ecosystems. Whilst quite clearly much more needs to be done, as the scale of the plastic pollution challenge is increasingly understood, we have started to see some signs of global co-operation aim to tackle plastic pollution. As illustrative, in March 2022, the United Nations Environment Assembly adopted a historic resolution to develop an international legally binding instrument with the ambition to complete negotiations by the end of 2024¹⁵.

Similarly, also in March 2022, the Declaration of The Organisation for Economic Cooperation and Development (OECD) Environment Ministerial Meeting committed to develop comprehensive and coherent lifecycle approaches to tackle plastic pollution and promote co-operation internationally. Importantly, the same OECD meeting took a system thinking approach, emphasizing the interconnectedness of the climate and the plastic waste pollution challenges, featuring them in this instance as dual central focus areas.

Ultimately, cleaning up plastic pollution from marine environments is a costly and ongoing process. This includes the removal of large debris, restoration of habitats, and mitigation of long-term environmental damage. The degradation of marine ecosystems results in the loss of valuable services such as carbon sequestration, water purification, and coastal protection, which have significant economic implications. Despite the scale of the challenge, we can not be discouraged and in fact we need to be intentional in helping crowd in capital into this mission critical area.

Latterly, we have started to see unique capital market backed solutions, where the bond market for example brings its heft towards funding resilient plastic waste collection and recycling projects, in this instance through contingent payout instruments. A recent exciting example is the World Bank, plastic waste collection and reduction bond, which select fixed income portfolios at T. Rowe Price purchased at new issue and which we have discussed elsewhere¹⁶.

¹¹ Ramp, C., Gaspard, D., Gavrilchuk, K., Unger, M., Schleimer, A., Delarue, J., Landry, S. and Sears, R., 2021. Up in the air: drone images reveal underestimation of entanglement rates in large rorqual whales. *Endangered Species Research*, 44, pp.33-44.

¹² Duncan, E.M., Broderick, A.C., Fuller, W.J., Galloway, T.S., Godfrey, M.H., Hamann, M., Limpus, C.J., Lindeque, P.K., Mayes, A.G., Omeyer, L.C. and Santillo, D., 2019. Microplastic ingestion ubiquitous in marine turtles. *Global change biology*, 25(2), pp.744-752.

¹³ <https://www.unesco.org/en/ocean>

¹⁴ Savoca, M.S., McInturf, A.G. and Hazen, E.L., 2021. Plastic ingestion by marine fish is widespread and increasing. *Global Change Biology*, 27(10), pp.2188-2199.

¹⁵ <https://www.unep.org/news-and-stories/press-release/historic-day-campaign-beat-plastic-pollution-nations-commit-develop>

¹⁶ <https://www.troweprice.com/financial-intermediary/uk/en/thinking/articles/2024/q1/case-study-the-plastic-waste-reduction-linked-bond.html>

Final thought

Climate change, the biodiversity challenge, and plastic pollution are among the most pressing environmental challenges of the 21st century. Addressing these issues requires systematic thinking and comprehensive joined-up strategies. Collective efforts from governments, businesses, and individuals are essential to mitigate these environmental threats.

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