

# Multiple ocean threats



**Plastic pollution has rapidly risen to the top of public and policy discourse on the environment. For World Environment Day on 5 June and World Oceans Day on 8 June, we reflect on its intersection with other ocean threats from biodiversity loss and climate change.**

The theme for this year's [World Environment Day](#) on 5 June is beating plastic pollution. Initiatives at many levels, from personal to governmental, are attempting to reduce plastic waste. However, both the use and disposal of plastics are increasing and are [projected](#) to triple by 2060 under a business as usual scenario. Plastic pollution affects terrestrial, freshwater and marine ecosystems, but it is perhaps the effects in the marine environment that are most notorious.

The predominant form of marine plastic is microplastics, which derive both from plastics that are manufactured in small sizes and from the breakdown of larger plastic debris. Microplastics pervade marine ecosystems, including the deepest parts of the oceans<sup>1</sup>, and they can affect multiple ecological processes<sup>2</sup>. An example published recently in this journal reports the effect of microplastics on the gut microbiomes of two seabird species<sup>3</sup>. Fackelmann et al. looked at the gut microbiomes of northern fulmars and Cory's shearwaters, and found that microplastics were associated with decreases in commensal microbial species and increases in pathogens and antibiotic-resistant strains. Given the increasing appreciation of the microbiome contribution to many aspects of ecology and physiology, these effects are concerning.

Larger marine plastic debris can accumulate in patches as a result of permanent ocean

circulations or gyres. Two recent studies have shown how the Northern Pacific Garbage Patch is actually providing a novel habitat. Writing in this journal, Haram et al.<sup>4</sup> showed that coastal taxa are thriving on plastic debris in pelagic environments, many hundreds of kilometres from their natural habitats. And writing in *PLoS Biology*, Chong et al.<sup>5</sup> found high densities of obligate surface-dwelling neuston (floating life), also in the Northern Pacific Garbage Patch. These studies show how marine plastics are altering the entire nature of marine ecosystems and there are likely to be wider consequences across trophic levels and spatial scales that have yet to be studied.

Among efforts to reduce plastic waste are moves to replace plastics with biodegradable polymers. This is welcome, but we do need to understand how and where these novel materials are decomposing and what traces they leave behind. A 2022 horizon scan of emerging threats to marine biodiversity identified the toxicity of the breakdown products from such polymers as a potential threat – noting, for example, that some naturally derived microfibrils such as lyocell may be more toxic to marine life than are their plastic counterparts<sup>6,7</sup>.

The focus this year for [World Oceans Day](#) is meeting the 30×30 protected-area targets for biodiversity conservation. Both biodiversity loss and climate change threaten the oceans in a more encompassing manner than plastic pollution and this has led some to argue that discussions around plastic pollution are a distraction from tackling climate change<sup>8</sup>. One concern is that a focus on targeted, small-scale actions such as reducing single-use plastic use – whether at a household, corporate or governmental level – makes people complacent when it comes to the need for wider systemic actions to tackle climate change. However,

behavioural data are needed on how people actually react to these competing priorities<sup>9</sup>.

In a recent study, Waters et al.<sup>10</sup> looked at the potential for spillover between plastic and climate messaging in the context of the Great Barrier Reef. The authors tested whether people who were exposed to environmental messaging about plastic pollution had an increased chance of adopting climate-positive behaviours. The answer depended on the target group: overall there was evidence of positive spillover, but this did not occur in people who are already environmentally engaged – with a suggestion of a negative effect for this group. Although this is only a single study in one region, it seems reasonable to draw the conclusion that campaigns about plastic pollution and other environmental issues should be tailored to specific audiences and circumstances to try to ensure synergistic rather than antagonistic results.

At a wider policy level, a similar multilateral principle applies. The plastic focus of World Environment Day is welcome and should encourage action across levels of society, and the broader conservation focus of World Oceans Day needs to remain at the forefront of national and international policy agendas.

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## References

- Jamieson, A. J. et al. *R. Soc. Open Sci.* **6**, 180997 (2019).
- Galloway, T. S., Cole, M. & Lewis, C. *Nat. Ecol. Evol.* **1**, 0116 (2017).
- Fackelmann, G. et al. *Nat. Ecol. Evol.* **7**, 698–706 (2023).
- Haram, L. E. et al. *Nat. Ecol. Evol.* **7**, 687–697 (2023).
- Chong, F. et al. *PLoS Biol.* **21**, e3001646 (2023).
- Herbert-Read, J. E. et al. *Nat. Ecol. Evol.* **6**, 1262–1270 (2022).
- Kim, D., Kim, H. & An, Y.-J. *Aquat. Toxicol.* **240**, 105968 (2021).
- Stafford, R. & Jones, P. J. S. *Mar. Policy* **103**, 187–191 (2019).
- Pahl, S., Wyles, K. J. & Thompson, R. C. *Nat. Hum. Behav.* **1**, 697–699 (2017).
- Walters, Y. L., Wilson, K. A. & Dean, A. J. *Mar. Policy* **152**, 105580 (2023).