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Searching for the missing plastic: a global surface mass budget for floating ocean plastics.

Laurent Lebreton and Matthias Egger
The Ocean Cleanup, Rotterdam, NL

Predicted global figures for plastic debris accumulation in the ocean surface layer range on the order of hundreds of thousands of metric tons, representing only a few percent of estimated annual emissions into the marine environment. A commonly accepted explanation for this difference is that positively buoyant macroplastic objects do not persist on the ocean surface. Subject to degradation into microplastics, the major part of the mass is predicted to have settled below the surface. However, we argue that such emission-degradation model cannot explain the occurrence of decades-old objects collected by oceanic expeditions. We show that debris circulation dynamics in coastal environments may be a better explanation for this difference. The results presented here suggest that there is a significant time interval, on the order of several years to decades, between terrestrial emissions and representative accumulation in offshore waters. Importantly, our results also indicate that the current generation of secondary microplastics in the global ocean is mostly a result of the degradation of objects produced in the 1990s and earlier.