



Future global ocean oxygen trends are potentially vulnerable to microplastic pollution

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Microplastic pollution in aquatic systems is an emerging threat to the health of ecosystems. Even microorganisms are vulnerable, with recent studies revealing uptake by zooplankton. Microplastics have also been shown to aggregate in marine snow, suggesting the potential to influence the biological pump by modifying remineralisation and particle sinking rates. I present a sensitivity study that applies the most relevant currently known effects of microplastic particles on marine microbiology (increased detrital sinking rates, decreased fecal pellet sinking rates, and decreased zooplankton feeding efficiency) to a business-as-usual increasing atmospheric CO₂ scenario in the University of Victoria Earth System Climate Model. Modifications to particle rates are applied globally from the year 2010 in order to simulate a worst-case scenario. By 2060, global ocean oxygen content has declined 2.8% relative to the year 1800 in the control scenario, which reflects changes to the biological and solubility pumps due to changes in the climate only. An increase in detrital sinking rates results in an additional 0.4% decline in global oxygen content. However, a decrease in fecal pellet sinking rate results in a 0.8% reduction of deoxygenation. Decreased zooplankton feeding efficiency has a similar effect, with a 0.6% reduction of deoxygenation. The combined effects nearly cancel out, with a net decline in ocean oxygen of 2.9% by 2060 when all rate adjustments are combined. This study offers a first look at the potential of microplastics to modify the biological pump. I look forward to revisions of these numbers in the coming years, as more data and better models become available.