Potential impacts of microplastic on zooplankton at the global scale

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Abstract

Experimental studies have recently shown that microplastics (MPs) may negatively impact ocean zooplankton. In response to high concentrations of MP, zooplankton may switch their grazing preferences towards smaller prey in order to avoid accidental MP ingestion. Moreover, MP ingestion decreases overall grazing rates of zooplankton. Such modifications of zooplankton activity may have profound biogeochemical impacts since zooplankton grazing is a key step for the regulation of ocean biogeochemical cycles.

In this study, we used a 3D coupled physical-biogeochemical model that represents microplastic distribution (NEMO/PISCES-PLASTIC) in order to simulate MP impacts on zooplankton grazing at the global scale. Moreover, our simulations produced an upper estimate of the global MP sink from zooplankton grazing.

Our results indicate that impacts of MP on zooplankton are limited to MP accumulation areas (e.g. the subtropical gyres). In these regions, we observed that MP impacts led to a decrease in zooplankton grazing rates over 10%, which led to a somewhat counter-intuitive decrease in primary production. This decrease is explained by the loss of recycling and remineralization of nutrient following the decline of zooplankton grazing activity. Additionally, our results indicate that MP ingestion by zooplankton may constitute an important sink which may impact MP budget over the entire water column.

Keywords: Zooplankton, Biogeochemistry, modeling, ocean, microplastic, grazing

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