
Why do zooplankton ingest plastic? Size-threshold for chemical discrimination of microplastics in planktonic copepods

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Abstract

Ingestion of microplastics (MPs) by zooplankton is the main route by which MPs enter marine pelagic food webs. However, zooplankton behavioral mechanisms related to the detection and ingestion of MPs are not well understood. We investigated the ability of copepods to discriminate between MPs and phytoplankton depending on the size, polymer type, and shape of the MPs using both video-observations of individual copepods and bottle incubations. Video-observations showed that the feeding-current generating copepod *Temora longicornis* captures and handles efficiently MPs of 20 and 30 μm but, after moving the MPs close to the mouth ("tasting"), 80-90% of the MPs were actively rejected. Similar rates of rejection were observed for irregular and spherical plastic particles and for polyethylene and polystyrene MPs of 20 μm and 30 μm . The rejection of similar sized prey offered simultaneously with the MPs was very low (0-4%). The rejection of MPs decreased to 30% when the MPs were 8 μm . Copepods did not detect or handle 4 μm MPs, which were passively ingested. Therefore, feeding-current generating copepods (1 mm length) can efficiently reject MPs when they are larger than a size-threshold for detection, handling, and chemical discrimination ($> 8 \mu\text{m}$). These results were corroborated by bottle incubations, which, taken together, indicates that the risk of entry and trophic transfer of MPs in marine plankton food webs is lower than expected since copepods can reject MPs that overlap with its prey size spectra.

Keywords: zooplankton, ingestion, behaviour, size, marine food webs

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