Microplastic intake in epi- and mesopelagic fish and squid species from an oceanic environment (NE Atlantic)

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Abstract

Open oceanic systems are affected by the contamination from microplastics (MPs; plastic particles $<$ 5 mm). These particles can resemble plankton in size and colour, and thus be ingested, directly or indirectly, by marine organisms. Few studies exist on the presence of this contaminant in oceanic epipelagic organisms, such as small planktivorous fish, and almost none focused on squid species. The present study investigated MPs abundance and characteristics in five ecologically and commercially important epi- and mesopelagic species from the North-East Atlantic collected off Madeira Island (*Scomber colias, Trachurus picturatus, Stenoteuthis pteropus, Ommastrephes caroli, Loligo vulgaris*). Visual analysis performed after digestion of the organic material found MPs in 98% of the fish (n=75) with an average content of 8.7 MPs per individual (stomach+intestine). In the three squid species analysed, MPs were found in 100% of the individuals (n=20), with an average content of 8.5 MPs per individual (stomach+gills+ink sac). Fibres were the main particle found, representing over 90% of the MPs in all the species. Differences in MPs content were found between

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species and between different body compartments. The present results indicate that squids are vulnerable to MPs ingestion as much as planktivorous fish, which have already been suggested as bioindicators for MPs monitoring in pelagic ecosystems. For squids, however, indirect ingestion of MPs through diet might be the primary mechanism of MPs intake. We suggest that trophic transfer of MPs occurs in these marine species. This study provides new knowledge into the level of contamination by MPs in poorly studied species (squids) inhabiting open oceanic waters, an environment still relatively unexplored. These are essential information to understand the ecological threat MPs pose to the marine ecosystem and humans.

Keywords: Atlantic Ocean, cephalopods, gastrointestinal tract, gills, ink sac, Macaronesia, marine biota, marine food web, pelagic environment, planktivorous fish, stomach content, trophic transfer