European Commission

SCIENCE FOR ENVIRONMENT POLICY

Sea cucumbers eat different plastic microparticles due to local habitat features

9th November 2020 /
Issue 552

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Source:
Renzi, M. and Blašković, A., (2020) Chemical fingerprint of plastic litter in sediments and holothurians from Croatia: Assessment & relation to different environmental factors. Marine Pollution Bulletin, 153: 110994.

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The accumulation of plastics in the marine environment is an issue of great concern, with bottom-feeding species eating plastic microparticles (MPs) they find in the sediment of their habitats. To understand what influences the entry of MPs into the marine food web, a study took samples from the vicinity of two Croatian islands, exploring the impact of MPs on a marine species: the sea cucumber.

It is estimated that more than 150 million tonnes of plastics have accumulated in the world's oceans, with a further 4.6-12.7 million tonnes added every year[1]. Marine plastic pollution can release toxic chemicals into its surroundings, and pollutants stick readily to plastic surfaces. Understanding how plastics transfer from aquatic environments into the food web is directly relevant for the implementation of the EU Marine Strategy Framework Directive, while pollution of the seas from plastics and MPs is an area of focus for the European Strategy for Plastics (adopted in January 2018).

The researchers assessed the presence and type of MPs found at 17 marine sites near two Croatian islands in the Mediterranean Sea (Silba and Telašćica) and considered the varying levels of marine protection and differing habitat features present at the sites.

The study took samples from a species of bottom-feeding holothurians, or sea cucumbers[2], as well as from the surrounding sediments. The samples were collected in 2017 from sites with different levels of protection (marine protected area (MPA): designated as a future MPA, or unprotected/touristic), different levels of exposure (completely exposed, lagoon or gulf) and different habitat features (morphology, cardinal points, and coverage by seagrass P. oceanica meadows). Plastics were recorded as items per kilogram (dry weight) for sediments and as items per individual for sea cucumbers, and the chemical make-up of the MPs was recorded as a percentage of the total amount of particles collected. Finally, a statistical analysis was performed to identify trends between the data from the Silba and Telašćica sampling sites (considering location, different levels of protection and habitat types).

Overall, the results showed between 113 and 378 MP items per kilogram in sediment (dry weight), and 0.6 to 9.4 MP items per sea cucumber, with sizes ranging from 1.4–10 493 micrometres (µm). The MPs in sediments from both islands, and in sea cucumber stomach contents, consisted largely of fibres, suggesting a direct relation between the two. The propensity of nylon fibre MPs implies that the

Sea cucumbers eat different plastic microparticles due to local habitat features (continued)

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To cite this article/service:
"Science for Environment Policy": European Commission DG Environment News Alert Service, edited by SCU, The University of the West of England, Bristol..

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prominent source of pollution at both these islands is from household wastewater — the washing of synthetic fabrics. Sea cucumbers ingesting these nylon fibres can pass them on to the next trophic level in the food web.

The type of MPs present in sea cucumbers was influenced by habitat type and orientation, with different results for open sea or enclosed lagoon sites, for instance, and sites with no P. Oceanica meadow differing significantly to those with a 50% coverage of meadow. The chemical composition of MPs differed significantly between MPA and designated-MPA sampling sites, suggesting that local pollution sources (or the absence of them) may notably affect the fingerprint of MPs in these areas.

This study shows that local marine habitats play an important role in the intake of MPs by benthic marine life, and MPs' subsequent entry into the food web. The results can inform marine conservation organisations and policymakers on how species, such as holothurians, are affected by MPs, and to what extent such pollution affects MPAs. Additionally, understanding the types of plastics present in different marine habitats can elucidate the main source of litter being ingested, and inform policy to reduce the amount of such plastics entering the food chain.

1. Jambeck, J., Geyer, R., Wilcox, C., Siegler, T., Perryman, M., Andrady, A., Narayan, R. and Law, K., (2015) Plastic waste inputs from land into the ocean. Science, 347(6223): 768–771.

2. In 2018 Italy declared a moratorium on all fishing and transport of sea cucumbers until December 2019.