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Microplastic pollution's effects explored for two key marine species: mussels and lugworms

Mussels exposed to high levels of microplastic pollution display signs of stress, new research has shown. However, levels of exposure were higher than found in the wild and no effect on the energy reserves of either mussels or lugworms was observed in the lab. tests. The researchers caution that longer experiments may be needed to reveal microplastics' full effects.

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Worldwide, plastics production has risen to staggeringly high levels: from 1.7 million tonnes a year in the 1950s, to 299 million tonnes in 2013. It is estimated that 5 to 13 million tonnes end up in our oceans every year, with devastating effects for marine wildlife. Many species, from mussels to turtles, may ingest fragments either accidently or because it resembles their prey.

For this study, researchers investigated the effects of microplastics — defined here as fragments smaller than 1 mm — on the lugworm (*Arenicola marina*) and the blue mussel (*Mytilus edulis*). Lugworms are common in tidal flats where they ingest and aerate the sediment, helping maintain it for a large variety of other marine organisms. Mussels also play an important role in marine ecosystems by filtering water, which removes bacteria and toxins. They are also a source of food for a variety of birds.

The researchers first measured microplastic concentrations found in the environment. They collected lugworms, mussels, seawater and sediment from six sites along the French, Belgian and Dutch North Sea coast in 2011.

Microplastics were found in seawater at an average concentration of 0.4 particles per litre and in sediments at 6 particles per kilogram. The particles were made up of low-density polyethylene (used to make plastic bags), high-density polyethylene (used for bottle tops and pipes) and polystyrene (used for packaging).

All lugworms and mussels contained microplastics. Mussels contained, on average, 0.2 particles per gram of tissue. Lugworms contained a higher amount, at 1.2 particles per gram on average, with a maximum of 11 particles per gram. The researchers note, however, that they did not count microplastic fibres because they could not rule out contamination with airborne fibres in the lab. Therefore the concentrations recorded may be underestimates.

The researchers then studied the effects of microplastics in controlled experiments. There are concerns that ingestion of microplastics may cause stress in these creatures, with knock-on effects for their overall health. This was investigated by keeping mussels and lugworms in clean, artificial seawater for two weeks and then assigning them to one of two treatments.

Mussels were either exposed to concentrations of 110000 particles of polystyrene per litre or placed in a control group with no plastic contamination. Lugworms were either given a treatment of 110 particles of polystyrene per gram of sediment or were again placed in an uncontaminated control group.

Mussels in the contaminated water showed higher energy consumption than those in the control group, which can be linked to increased stress and respiration rates. However, there was no significant difference in energy reserves (levels of proteins, fats or carbohydrates) between the contaminated and control groups.

For lugworms there was no significant difference in respiration rates or energy reserves between the contaminated and control groups. This is somewhat surprising, as a previous study found substantial impacts of microplastic contamination on lugworms' energy reserves. The researchers caution, however, that their experiment was short, lasting only 14 days where the other study had lasted 28 days.