Microplastics make marine worms sick

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Microscopic fragments of plastic -- or microplastics -- are pieces of plastic less than 5 mm in diameter and are a global marine pollutant. This image shows microplastic fragments and pre-production pellets collected from a sandy shoreline in Europe; these items are continually fragmenting in the environment. In this issue, experiments were conducted with sediment dwelling marine worms, showing that chemically inert microplastics of a size similar to sand grains from the beaches in which the worms lived caused physical harm (Wright et al.) whilst Browne et al. showed microplastic can move pollutants and additives to worms, reducing functions linked to health and biodiversity. Credit: *Current Biology*, Wright et al.

Tiny bits of plastic trash could spell big trouble for marine life, starting with the worms, say a team of researchers from Plymouth University and the University of Exeter who report their evidence in a pair of studies in the Cell Press journal *Current Biology* on December 2. Those marine worms play a key ecological role as an important source of food for other animals.

Work by Stephanie Wright from the University of Exeter found that if ocean sediments are heavily contaminated with microplastics, marine lugworms eat less and their energy levels suffer. A separate report, from Mark Anthony Browne on work performed at Plymouth University, shows that ingesting microplastic can also reduce the health of lugworms by delivering harmful chemicals, including hydrocarbons, antimicrobials, and flame retardants, to them.

"These chemicals are persistent, meaning they could accumulate in the tissue of organisms and take a long time to break down," says Richard Thompson of Plymouth University. "Our laboratory studies provide the first clear evidence that microplastics could cause harm and show that this could result from both the physical presence of ingested plastic and chemical transfer. Our next steps will be to establish the full implications of these findings for organisms in natural habitats."

In addition to their role in the food chain, "lugworms also feed on and churn the organic content in sediments, much as earthworms in the soil do," Wright explains. "If worms in contaminated environments were to reduce feeding levels by an amount comparable to that seen in that lab, it would mean significantly less turnover of sediment. In an area the size of the Wadden Sea, for instance, sediment turnover could drop by more than 130,000 liters each year."

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The microplastic levels used in the two papers approximate those found at highly contaminated sites. There are many other organisms—including starfish, sea cucumbers, and fiddler crabs—that may be similarly affected by the tiny bits of plastic.

Many plastics contain chemical additives, such as plasticizers, dyes, and antimicrobials, which can leach out into sediments and seawater. Microplastics also concentrate water-borne chemicals on their surfaces, such as pesticides and detergents. In other words, the problem with microplastics isn't just the plastic itself, but the complex mix of chemicals the plastics carry with them.

Plastic debris degrades into ever-smaller pieces, which means that a wider range of organisms can ingest this material, and particles of microplastic are now the most abundant form of solid-waste pollution on our planet. Although plastic debris is associated with some of the most persistent, bioaccumulative, and toxic chemicals regulated by the U.S. Environmental Protection Agency and the European Union, the debris is considered non-hazardous by policy makers.

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"The hazard ranking of plastic within policy about debris needs to be reassessed, and funding from industry, not just government, [needs to be] directed towards research that adequately tests the safety of plastics in relation to humans and wildlife," Browne says.

"We believe our study has highlighted the need to reduce the amount of plastic waste and therefore microplastics which enter our seas," says Tamara Galloway of the University of Exeter. "Plastics are enormously beneficial materials. However, if marine plastic pollution continues to increase, impacts such as those demonstrated in our laboratory studies could occur in the natural environment. It is therefore important that we prevent the accumulation of plastic and microplastic debris in marine habitats through better waste-handling practices and smarter choices in the materials we use."

More information: "Microplastic ingestion decreases energy reserves in marine worms" *Current Biology*, Wright et al. 2013.

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