Microplastics harm freshwater fauna

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A water flea with microplastic particles in its gut (white spots). Credit: Saskia

Rehse/IGB

Microplastics—tiny particles of plastic less than five millimeters in size—are polluting rivers and ponds along with chemical contaminants. The particles come from cosmetics such as exfoliating body scrubs or are washed out of synthetic fabrics. Until now, scientists have primarily investigated the concentrations and effects of microplastics in seawater. Professor Christiane Zarfl of the Center for Applied Geosciences (ZAG) of the University of Tübingen has cooperated with Saskia Rehse and Werner Kloas from the Leibniz Institute of Freshwater Ecology and Inland Fisheries (IGB) in Berlin in testing how high concentrations of standardized plastic particles affect water fleas. Their experiments showed that the ubiquitous residents of bodies of freshwater ingest tiny particles of a micrometer, or one thousandth of a millimeter in size. This clearly limited the water fleas' mobility, and as a result, their intake of nutrients. Larger particles had no measurable effect. The results of the study have been published in the scientific journal, *Chemosphere*. The scientists see this as the first of further, necessary research into the effects of microplastic pollution of freshwater. One of their further research directions will focus on the interactions of plastics with various chemicals that also end up in the environment. They say the experiments must also be extended to include entire ecosystems.

Research into the presence of microplastics in seawater has shown that they are found almost everywhere—on ocean surfaces, near the mouths of rivers, on coasts and even in deep sea sediments. Only recently have scientists turned their attention to lakes and rivers. Says Christiane Zarfl, "Measurements taken in Europe, South and North America, Africa and Asia show that up to several hundred-thousand particles of microplastic can be found per square kilometer of water." In addition, concentrations were higher in areas that are densely populated, intensively farmed and

where industry is nearby. Sewage treatment plants are not yet filtering out microplastics. Zarfl explains, "Depending on the type of plastic, the particles remain in the water or they are deposited in lake or riverbed sediment."

She adds that until now there have been few suitable methods of analysis to record the full range of microplastics in freshwater. "We want our systematic investigation to provide a foundation for better understanding of the effects of microplastics on freshwater organisms." During their experiments with the Daphnia magna the scientists used standardized materials, sizes and shapes in order to obtain robust results of the physical effects of microplastics on the organism. "We also tested using high concentrations of plastic particles in order to determine the critical levels damaging to water fleas. This is, to start with, independent of how high the actual level of microplastic contamination of freshwater is," says Zarfl.

The professor adds that plastic products made of polyethylene or polystyrene are as a rule made to be long-lasting and often contain dyes and solvents. She says, furthermore, that microplastic particles also come into contact with other chemicals. If and to what degree there are interactions is for the most part unknown. She says, "What also remains to be tested is if and how microplastic particles augment the food chain of rivers and lakes. Until now, research of this type has been done in particular on sea fauna, for example, plastic particles have been found in seals and whales."

More information: Saskia Rehse et al. Short-term exposure with high concentrations of pristine microplastic particles leads to immobilisation of Daphnia magna, *Chemosphere* (2016). DOI: 10.1016/j.chemosphere.2016.02.133

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