

The sea as a rubbish tip

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Biologists have prepared guidelines for a more precise investigation into marine pollution from microplastic particles.

Large quantities of globally produced plastics end up in the oceans where they represent a growing risk. Above all very small objects, so-called microplastic particles, are endangering the lives of the many [sea creatures](#). An estimate of how greatly the oceans are polluted with microplastic particles has so far failed in the absence of globally comparable methods of investigation and data. Together with British and Chilean colleagues, scientists of the German Alfred Wegener Institute for Polar and Marine Research in the Helmholtz Association have now analysed all published studies on this topic and have proposed standardised guidelines for the recording and characterisation of microplastic particles in the sea.

[Plastic bottles](#) washed on to the beach are as much a part of the coast as the sound of [seagulls](#). What the eye does not see are the innumerable ultra-small [plastic](#) objects which float in the water, are washed on to the beach or settle on the [sea bed](#). Scientists refer to these plastic particles as "microplastic particles", understanding these to mean plastic objects whose diameter is less than five millimetres – whereby the majority of microplastic particles are smaller than a grain of sand or the tip of a needle. It is this property that also makes them so dangerous to the sea dwellers. "Microplastic particles are swallowed by organisms and absorbed via the digestive tract. It has been possible, for example, to detect them in the tissue of mussels or other animals", says Dr. Lars Gutow, biologist at the Alfred Wegener Institute for Polar and Marine

Research in the Helmholtz Association. Toxic substances also attach to the small particles in the sea which then enter the food chain in this way and may therefore ultimately be dangerous to humans.

Lars Gutow and colleagues from the Universidad Católica del Norte in Chile and the School of Marine Science and Engineering in Plymouth have now jointly addressed the question as to how greatly the oceans of the world are polluted with microplastic particles. The [biologists](#) analysed 68 scientific publications on this subject and determined that the results are difficult to compare. "Very different methods were used in these studies which is why it could not be understood whether the observed regional differences in the distribution of the plastic particles are real or whether they are attributable to the methods of recording", explains Prof. Martin Thiel, initiator of the now published comparative study and scientist at the Universidad Católica del Norte. It emerged that 100,000 times more microplastic particles could be fished out of the water column if a net with a mesh of 85 micrometres was used instead of one with 450 micrometres.

Based on these findings the international team of researchers has now for the first time prepared guidelines for the recording and characterisation of microplastic particles and has published these in the *Environmental Science & Technology* journal in which the scientists also explain the possible origins of the plastic waste. "Microplastic particles reach the seas in different ways. A large share is accounted for by so-called plastic pellets used as a raw material in the manufacture of plastic products such as computer housings and other everyday articles. If these pellets are handled carelessly, during ship loading for example, many may be blown away by the wind and fall into the sea", explains Lars Gutow.

Microplastic particles are also to be found in cosmetics and cleaning agents, however. "Very small [plastic particles](#) are used as "abrasives" in

many a peeling product. They then reach the sea via sewage water and rivers", says the biologist. And finally every plastic bottle, every plastic bag floating on the sea, one day disintegrates into countless microparticles. "It can take years for larger plastic parts to disintegrate primarily through physical processes. The UV radiation of the sun makes the plastic brittle. It is then broken down into ever smaller parts from the waves and friction processes", says Lars Gutow.

The smallest particles so far detected had a diameter of one micrometre which is one thousandth of a millimetre. Complex investigations are required to be able to determine such tiny plastic objects exactly and clarify their origins. "We recommend to every scientist to analyse very small microplastic particles using an infrared spectroscope. This procedure uncovers the constituents and permits an exact identification as a plastic", says Lars Gutow.

The scientists also point out gaps in their knowledge in their research guidelines. "The topic of plastics in the sea has become considerably more important in recent years. There is a lot of research going on. Nevertheless we do not know, for example, whether and in which quantity microplastic particles are deposited on rocky shores and in salt marshes. The latter are above all known for having a high retention potential for particles. Whether this also applies to microplastic particles is not so far known", says Martin Thiel who is examining the contamination of the Chilean coast with microplastic particles.

If in the future all marine researchers used standardised methods to record the microplastic particles based on the recommendations of this comparative study, then not only the reliability of their results ought to increase considerably. This then offers the chance of determining the final fate of microplastic [particles](#) accumulating in the world's oceans and to uncover the consequences of this pollution for the ecological systems and therefore for humans.

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