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It's snowing plastic in the sea

GEOMAR study models how particles are transported into the deeper sea levels by the food web for the first time

7 October 2020 / Kiel. Every year, about four percent of the world's plastic waste end up in the ocean. While the spread of bigger pieces of plastic can be accurately modelled, the journey of microplastic is still rather mysterious. Scientists from GEOMAR Helmholtz Centre for Ocean Research have for the first time shown how and where biological uptake transports microplastic into the depths of the sea. The study suggests which biological processes might be responsible for most of the microplastic transportation. It has now been published in the international journal *Scientific Reports*.

Plastic waste polluting our ocean is a problem that is acknowledged worldwide. In order to find solutions for this, it is important to keep track of the amount of plastic that is currently in the water and to follow its movements. But during their research, scientists noticed that part of the plastic went missing: the amount of plastic found on the surface of the oceans did not even closely match the amount of plastic that was supposed to be there, especially when it came to microplastic. It is incredibly small: microplastic is up to 5mm in diameter, but can also be only a few micrometers in size. It is brought into the oceans either directly via rivers, boats or wind or forms during the breakdown of larger plastic items.

While missing on the surface, microplastic seems to be all over the oceans, as it was found in the Arctic and in the Mariana Trench, the deepest known place in the sea. The question that remains is how it got there. To help answer this question, for the first time a research team from GEOMAR modelled how microplastic is transported to the deeper levels of the sea via biological processes – for example by binding it to the so-called marine snow. The scientists simulated the movement of the microplastic particles in the oceans by using an earth system model. The results were recently published in the international journal *Scientific Reports*.

There are different ways for the microplastic to sink into deeper sea levels, the most obvious one being the buoyancy. If the plastic lacks it, it sinks to the seafloor. But the scientists also found that a huge portion of these particles can be transported into depth by biological processes. The main motor for this is the plankton near the surface. Its feces, dead cells or other organic matter bind with the microplastic and sink into the depth, resembling snowflakes. There, these organic particles are degraded by bacteria, releasing the microplastic to either rise back to the surface or just float away in the depths.

“At first, this kind of transport seems highly ineffective: our study showed that for out of two, in some regions even three, microplastic particles bound by organic structures, only one will be transported into the deeper levels. The rest will remain near the surface”, says Dr Karin Kvale, main author of the study. But the process is widespread enough to still remove enough microplastic from the surface ocean to account for the missing plastic fraction. “The marine snow has a great impact on the shape of the global microplastic distributions”, explains the modeler.

Explicit modelling of biological interactions with microplastic in an earth system model offers the possibility to predict how these interactions could change in the future, as climate change alters the

ocean circulation and ecosystem. Dr Kvale stresses: “It is important to understand how plastic moves through our oceans. This knowledge is fundamental in order to find ways to deal with the growing pollution and to understand what effects microplastic might have on ocean ecosystems at a global scale.”

Reference:

Kvale K, AEF Prowe, C-T Chien, A Landolfi, A Oschlies (2020): The global biological microplastic particle sink. Scientific Reports. DOI: <https://doi.org/10.1038/s41598-020-72898-4>

Links:

www.geomar.de GEOMAR Helmholtz Centre for Ocean Research Kiel

Images:

At <http://www.geomar.de/n7301> images are available for download.

Kontakt:

Marie Gundlach (GEOMAR, Communication and Media), Tel.: +49 0431 600-1816, presse@geomar.de