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First comprehensive microplastic survey in the Baltic Sea underway

On August 17, 2015, a research team from the Leibniz Institute for Baltic Sea Research Warnemünde (IOW) headed out on the research vessel POSEIDON for the first comprehensive survey of microplastic in the Baltic Sea, which will include up to 50 stations in the sampling campaign. Furthermore, the scientists will investigate, whether microbial communities alter their composition or show any other reaction to environmental pollution, which would be reflected in their genetic fingerprint.

The POSEIDON, a research vessel of the ocean research institute GEOMAR in Kiel, started its expedition in Rostock and will cruise along the coast to circle the Baltic Sea once completely. "Whether we will be able to complete the full round trip with all 50 stations, depends on the weather conditions," says Dr. Sonja Oberbeckmann, who coordinates the expedition as chief scientist. During the cruise, the marine microbiologist from the IOW working group Environmental Microbiology is also responsible for the research focus on microplastic. „At every station we will sample the surface waters as well as the sediment to get a comprehensive overview, where and how much microplastic is present and which types of plastic materials can be found. This makes our expedition the first microplastic survey in the Baltic Sea of such comprehensiveness," Sonja Oberbeckmann explains.

It has been recognized since the 1970s, that so-called microplastic – small to microscopic plastic particles with a diameter smaller than 5 millimeters – accumulates in marine environments. However, only for the last decade more extensive research is being done. Many products of daily use, for instance clothes and cosmetics, contain microplastic particles, which are released into the environment via domestic waste waters. Furthermore, these micro-sized plastic particles are formed, when larger plastic fragments break down through photo-, thermal and/or biological degradation. Due to their small size, microplastic can readily be ingested by a wide range of marine organisms. Not solely the ingestion of the particles themselves, but also associated toxins might pose a threat to the marine foodweb. Moreover, the floating particles – despite their small size – provide marine microorganisms with a solid surface, which they can colonize and where they can form dense biofilms. Marine microbial communities may contain pathogenic or toxic microbes, often anthropogenically introduced. They remain unproblematic as long as they occur in the water column in low densities. Microplastic therefore poses a possible threat, if such harmful organisms accumulate on the particles as biofilm.

"So far we have no actual evidence that microplastic contributes to the accumulation of pathogens or is acting as a transport vector for such microorganisms. However, there is no doubt that the man-made factor 'microplastic' as an additional habitat has the potential to impact marine microbial communities," Sonja Oberbeckmann states. To better understand this impact potential, the research team will conduct experiments aboard ship, in which new sterile microplastic pellets are incubated with water and sediment samples to analyze the biofilms that develop under controlled conditions. "The compar-

ison of the experimental biofilms with those of microplastic particles isolated from the Baltic Sea at the same sampling site will provide us with additional insight into the conditions for and the speed of biofilm development. The experiments will also provide us with information about biofilm interaction with the environment," Oberbeckmann explains. The microplastic research on the POSEIDON is part of the joint project MikrOMIK (www.io-warnemuende.de/mikromik-home.html) under the lead of IOW marine microbiologist Dr. Matthias Labrenz, which merges the efforts of nine major research institutions in Germany and is funded by the Leibniz Association.

The second research focus of the POSEIDON expedition also concentrates on the microbial communities of the Baltic Sea. Here, the researchers aim at a comprehensive genetic characterization of those communities, especially in areas that are frequently exposed to pollution by environmental toxins. "In the Baltic Sea, such polluted zones particularly can be found in the inflow areas of big tributaries such as the Oder, the Vistula or the Neman river," says environmental microbiologist Dr. Christin Bennke, who also participates in the expedition and coordinates this part of the research. „During the expedition, we will systematically sample all big river plumes to see, whether the environmental stress has an impact on the composition of the microbial communities or even leads to genetic adaptations or other responses of the organisms, which are detectable in their overall genetic fingerprint," the IOW scientist outlines her approach. The research is part of the European research cooperation Blueprint (http://blueprint-project.org), which focuses on microbial communities as principal drivers of marine biogeochemistry to develop new concepts of deducing the environmental status of the Baltic Sea based on biodiversity and genetic profiles of microbes in seawater samples.

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