The role of sea ice for plastic pollution in the Arctic

Ilka Peeken¹, Elisa Bergami², Ilaria Corsi², Benedikt Hufnagl³, Christian Katlein¹, Thomas Krumpen¹, Martin Löder⁴, Qiuang Wang¹, and Claudia Wekerle¹

¹Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung, Germany (ilka.peeken@awi.de)
²University of Siena, Italy
³Purency GmbH Vienna, Australia
⁴University of Bayreuth, Germany

Marine plastic pollution is a growing worldwide environmental concern as recent reports indicate that increasing quantities of litter disperse into secluded environments, including Polar Regions. Plastic degrades into smaller fragments under the influence of sunlight, temperature changes, mechanic abrasion and wave action resulting in small particles < 5mm called microplastics (MP). Sea ice cores, collected in the Arctic Ocean have so far revealed extremely high concentrations of very small microplastic particles, which might be transferred in the ecosystem with so far unknown consequences for the ice dependant marine food chain. Sea ice has long been recognised as a transport vehicle for any contaminates entering the Arctic Ocean from various long range and local sources. The Fram Strait is hereby both, a major inflow gateway of warm Atlantic water, with any anthropogenic imprints and the major outflow region of sea ice originating from the Siberian shelves and carried via the Transpolar Drift. The studied sea ice revealed a unique footprint of microplastic pollution, which were related to different water masses and indicating different source regions. Climate change in the Arctic include loss of sea ice, therefore, large fractions of the embedded plastic particles might be released and have an impact on living systems. By combining modeling of sea ice origin and growth, MP particle trajectories in the water column as well as MPs long-range transport via particle tracking and transport models we get first insights about the sources and pathways of MP in the Arctic Ocean and beyond and how this might affect the Arctic ecosystem.