The travelling particles: community dynamics of biofilms on microplastics transferred along a salinity gradient

Jessica Song* , Lukas Beule , Elanor Jongmans-Hochschulz , Antje Wichels , and Gunnar Gerdts*[1]

[1]Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research (AWI) – Biologische Anstalt Helgoland Kurpromenade 201 27498 Helgoland, Germany

Abstract

Microplastics (MP), as novel substrata for microbial colonization within aquatic ecosystems, are a matter of growing concern due to their potential to propagate foreign or invasive species across different environments. MP are known to harbour a diversity of microorganisms, yet little is understood of the dynamics of their biofilms and their capacity to successfully displace these microorganisms across different aquatic ecosystems typically marked by steep salinity gradients. To address this, we performed an in situ sequential incubation experiment to simulate MP transport from riverine to coastal seawaters using synthetic (high-density polyethylene, HDPE and tyre wear, TW) and natural (Wood) substrata. Bacterial communities on incubated particles were compared to each other as well as to those in surrounding waters, and their dynamics along the gradient investigated. All communities differed significantly from each other in their overall structure along the salinity gradient and were shaped by different ecological processes. While HDPE communities were governed by environmental selection, those on TW and Wood were dominated by stochastic events of dispersal and drift. Upon transfer into coastal seawaters, an almost complete turnover was observed among HDPE and TW communities. While synthetic particles displaced a minor proportion of communities across the salinity gradient, some of these comprised putatively pathogenic and resistant taxa. Our findings present an extensive assessment of MP biofilms and their dynamics upon displacement across different aquatic systems, presenting new insights into the role of MP as transport vectors.

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*Speaker