
Fate of microplastics among estuarine habitats utilized by intertidal crabs

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Abstract

The high accumulation potential of estuaries for plastics, particularly microplastics, poses a threat to the high societal value and biodiversity they provide. To support a spatially refined evaluation of the risk that microplastic pollution poses to estuarine fauna utilizing different parts of the estuarine habitat mosaic, our study investigated the fate of microplastics at the sediment surface of two dominant estuarine habitats, and compared this with microplastic abundance in deeper sediment layers and within two sediment-dwelling crabs species. Our results suggest that the presence of vegetation needs to be accounted for in risk assessments with microplastics on average 2.6 times more prevalent within reed beds compared to mudflats. This comparison, however, was further influenced by sediment properties with an exponential decrease in abundance with increasing sediment grain size and organic matter content, and an increased abundance with increasing water content. Polymer composition between microplastics (> 80% low density polymers) was highly comparable to the composition of macro-plastics. Moreover, microplastic abundance increased with an exponent of 2.7 with decreasing plastic size, hinting at three-dimensional fragmentation. These results suggest that at specific locations, such as our study area, local sources can provide a substantial contribution to microplastics concentrations. Finally, in order to translate these habitat- and site-specific differences into a risk assessment relevant for macroinvertebrates, the ecological traits such as differences in feeding modes should be accounted for, as we found substantial differences in both size and abundance of microplastics in gastrointestinal tracts of two crab species, *Chiromantes dehaani* and *Chasmagnathus convexus*, with different feeding modes.

Keywords: Plastic ingestion, decapod crustaceans, estuarine wetland landscapes, sediment granulometry, power law size distribution, ecotoxicological risk assessment.

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