
Mussel power: developing a nature-based solution to marine microplastics

Penelope Lindeque^{*1}, Matthew Cole , and Rachel Coppock

¹Plymouth Marine Laboratory (PML) – Marine Ecology and Biodiversity, Plymouth Marine Laboratory, Prospect Place, West Hoe, Plymouth, United Kingdom

Abstract

Microplastics are a prolific environmental contaminant that can adversely impact sensitive marine organisms. Curbing marine microplastic pollution requires an array of globally relevant interventions, both upstream (i.e. reducing waste, preventing waste entering the natural environment) and downstream (i.e. removing waste from the natural environment). We are currently scoping whether a nature-based solution using bivalve shellfish as biofilters could be deployed to remove and sequester microplastics that have entered the marine environment and have the potential to cause harm to sensitive biota. Here, we report the results of a feasibility study in which we: (1) establish microplastic removal rates for mussels (*Mytilus edulis*) under controlled laboratory settings; (2) establish the fate of ingested microplastics; and (3) test the efficacy of a pilot set-up for removing microplastics under environmental conditions. To establish microplastic removal efficacies under controlled conditions, mussels were exposed to representative polystyrene microbeads and nylon microfibres at a combined initial concentration of 1000 microplastics L⁻¹ in a flume tank under low flow conditions; we identified 5.0 kg of mussels have the capacity to remove an average of 651.0±16.6 microplastics L⁻¹ h⁻¹ from flowing water. Microplastics consumed by mussels were observed to be subsequently repackaged into mussel faeces; measurement of faecal sinking velocities demonstrated that microplastics have no significant impact on faecal sinking rates and will sink out at rates of 223-266 m day⁻¹. Finally, we deployed a prototype system in a local marina to evaluate the efficacy of using mussels as a nature-based solution to remove and collect microplastics under environmental conditions; our results showed 5.0 kg mussels remove 4.5-fold greater numbers of microplastic than systems without mussels. These results provide a basis for scaling up the use of mussels as a nature-based solution in real-world settings.

Keywords: Nature, Based solutions, mussels, microplastic removal

^{*}Speaker