

Cumulative effects of microplastics and organic enrichment on the macrofaunal community associated with *P. oceanica* meadows.

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Abstract

Microplastics (MPs) possess the potential for cumulative impacts when combined with other contaminants or organic enrichment, particularly in heavily human-influenced coastal regions, despite our limited understanding of their effects. This study conducted at two sites in southern Sicily aimed to investigate the abundance and characteristics (i.e. shape, color, and polymer type) of MPs, along with organic matter enrichment in sediment within *Posidonia oceanica* meadows at a depth of approximately -15 meters, and their consequential effects on associated macrofaunal communities. Our findings indicate a heightened impact of microplastics on the abundance and diversity of macrofaunal communities within *P. oceanica* meadows, particularly in sediments characterized by increased organic enrichment. The macrofaunal communities exhibited discernible responses to elevated organic loads and concentrations of MPs in stations most affected by urbanization. The observed high concentrations of biopolymeric carbon (BPC) and total phyto-pigments (CPE) in these sediments suggest eutrophication and anthropogenic organic matter input, as evidenced by the low contribution of autotrophic carbon to biopolymeric carbon (CPE/BPC %). This accumulation of highly refractory organic material appears to synergistically influence the impact of MPs contamination, resulting in a detrimental effect on the macrofaunal community within *P. oceanica* meadows. This study advances our understanding of the potential risks posed by MPs to coastal habitats, underscoring the necessity for further research to identify additional drivers that, in conjunction with microplastics, may contribute to cumulative effects on benthic faunal communities.