Diversity and thermal affinity of benthic macrophyte communities revealed by beach wrack monitoring

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Abstract

Marine species and ecosystems are highly threatened by many drivers of biodiversity loss, among which climate change plays a key role. Bending the curve of marine biodiversity loss requires the development of decision-making tools, such as indicators that inform community responses to these anthropogenic threats. However, monitoring marine environments, such as benthic habitats, by applying conventional approaches in order to produce indicators is highly challenging, especially because of economic and logistic constraints. Beach wrack monitoring may provide an alternative and complementary approach to inform changes in proximate benthic habitats, but the relationship between beach-cast and benthic macrophyte communities is not fully understood. Here, we assessed the latitudinal and temporal (inter- and intra-annual) patterns of α-diversity and thermal affinity of macroalgae and seagrass communities (84 taxa) in beach wrack monitored at 172 sites (from Saint-Jean-de-Luz, latitude 43.39∘N, to Calais, latitude 50.89∘N) along the Channel and Atlantic French coast from 2017 to 2023, and compared them with macroecological patterns of benthic macrophyte communities and physico-chemical patterns documented in previous studies. We found that thermal affinity of macrophyte communities in beach wrack decreased with latitude, driven by red and brown algae. We also observed latitudinal variations in their α-diversity, with a peak in the Brittany region. Finally, several temporal patterns of macrophyte communities were also detected. Our findings provide additional evidence of the ability of beach wrack to inform changes in proximate benthic macrophyte communities, especially their changes in composition under climate warming. Expanding this protocol to new audiences, although challenging, could strengthen our ability to inform on dynamics of benthic macrophyte communities under global change, but could also raise awareness among participants of the importance and vulnerability of coastal and beach wrack ecosystems.

Keywords: Climate change, Coastal ecosystems, Community Temperature Index, Ecological Indicator, Macroalgae, Macrophyte wrack, Marine environment, Seagrass

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