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Assessing the Impact of Heatwaves on Intertidal Mudflat Colonized by an Exotic Mussel

Authors : Marie Fouet, Olivier Maire, Cécile Masse, Hugues Blanchet, Salomé Coignard, Nicolas Lavesque, Guillaume Bernard

Abstract : Exacerbated by global change, extreme climatic events such as atmospheric and marine heat waves may interact with the spread of non-indigenous species and their associated impacts on marine ecosystems. Since the 1970's, the introduction of non-indigenous species due to oyster exchanges has been numerous. Among them, the Asian date mussel Arcuatula senhousia has colonized a large number of ecosystems worldwide (e.g., California, New Zealand, Italy). In these places, A.senhousia led to important habitat modifications in the benthic compartment through physical, biological, and biogeochemical effects associated with the development of dense mussel populations. In Arcachon Bay (France), a coastal lagoon of the French Atlantic and hotspot of oyster farming, abundances of A. senhousia recently increased, following a lag time of ca. 20 years since the first record of the species in 2002. Here, we addressed the potential effects of the interaction between A. senhousia invasion and heatwave intensity on ecosystem functioning within an intertidal mudflat. More precisely, two realistic intensities ("High" and "Severe") of combined marine and atmospheric heatwaves have been simulated in an experimental tidal mesocosm system onto which naturally varying densities of A. senhousia and associated benthic communities were exposed in sediment cores collected in situ. Following a six-day exposure, community-scale responses were assessed by measuring benthic metabolism (oxygen and nutrient fluxes) in each core. Results show that besides significantly enhanced benthic metabolism with increasing heatwave intensity, mussel density clearly mediated the magnitude of the community-scale response, thereby highlighting the importance of understanding the interactive effects of environmental stressors co-occurring with non-indigenous species and their dependencies for a better assessment of their impacts.

Keywords : arcuatula senhousia, benthic habitat, ecosystem functioning, heatwaves, metabolism
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