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Changes in metabolic rates of Mediterranean seagrass meadows affected by invasive species and global warming

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Increased anthropogenic pressures on coastal marine ecosystems during the last century are threatening their biodiversity and functioning. Two main stressors that are affecting these systems are global warming and invasive species. The Mediterranean Sea is warming at a faster rate than the global ocean and is a hotspot for invasive species, with more than 500 invasive species established in at least one area of the Mediterranean Sea. Global warming favours the colonization of tropical species such as the green algae Halimeda incrassata, which has been reported to rapidly colonize the coastal waters of the Balearic Islands. Here, we experimentally determine the effects of global warming on benthic community metabolism in areas dominated by the seagrass Cymodocea nodosa, in similar meadows invaded by Halimeda incrassata and communities of the invasive macroalgae alone. Predictions of how global warming and the presence of invasive species will affect metabolic rates and dissolved oxygen dynamics are needed to elucidate the consequences of the combined effects of these two pressures on ecosystem functioning and environmental variability. In our experimental setting, respiration rates tended to increase faster than primary production with warming. Net community production changed from positive values (autotrophic communities) to negative values (heterotrophic communities) with temperature increases. Separate measurements of pCO_2 showed a steady increase at warmer temperatures when the invasive species was present, probably due to calcification. The combined effect of warming and colonization by invasive species reversed the role of this ecosystem to act as a source of CO_2 instead of a sink, with its consequent negative effects for the environment.