Regional environmental conditions determine tolerance to future warming of a marine macroalgae forests

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In the Mediterranean Sea, many species of *Cystoseira*, which are important habitat-forming species on shallow rocky bottoms, have gone missing from many coastal areas, impairing essential ecosystem services. *Cystoseira crinita* forests thrive in very shallow waters from sheltered environments and are currently regressing in several European shores. In the actual scenario of ocean warming it is essential to determine the vulnerability of these populations to thermal stress in order to design future conservation actions. Since the response of this macroalgae to thermal stress may be site-specific, here we compared the thermal tolerance of populations dwelling in the coldest and warmest areas of the Mediterranean Sea. We show that *C. crinita* populations from warmer areas (Eastern Mediterranean) had a temperature tolerance threshold 2ºC higher than Northwestern Mediterranean populations. There is a strong correlation between the observed differential phenotypic responses and the local temperature regimes experienced by each population. This is the first evidence for the role of thermal history in shaping the thermotolerance responses marine habitat-forming macroalgae under contrasting temperature environments.

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