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TITLE: Interactive effects of marine heatwaves and eutrophication on the ecophysiology of a widespread and ecologically important macroalga

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ABSTRACT:

Abstract Extreme temperature events are becoming more recurrent and are more frequent with major impacts on coastal ecosystems, which are additionally impacted by increasing urbanization, resulting in high nutrient load. So far little is known about cumulative and/or interactive effects of global and local stressors on species' performance. Here, we evaluated the single and combined effects of simulated heatwaves and eutrophication on the ecophysiology of Laurencia catarinensis in a bi?factorial mesocosm experiment. The algae were exposed for 30 d to three different temperatures (20°C, 24°C, 28°C) and nutrient concentrations (low, intermediate, high) and their nutrient uptake rates, photosynthetic performance, growth rates, pigment and phenolic compound concentrations, as well as antioxidant capacity was determined and compared between treatments. Under low nutrient concentration, physiological performance and growth decreased with increasing temperatures. In contrast, they increased with higher nutrient availability and moderate temperature increase close to the summer average temperature, but largely declined upon exposure to higher temperature (28°C). This decline seemed to be related to oxidative stress, as indicated by an increase of compounds with antioxidant properties (lutein, zeaxanthin, phenols). Our data show that all measured parameters were affected by temperature and nutrient availability, with an interactive effect between these two factors, indicating that increasing temperature will influence macroalgal performance, and even more dramatically in coastal systems that are highly impacted by urbanization. However, the direction of the response will be determined by nutrient availability and will also depend on the magnitude of the temperature increase, that is, whether it surpasses the thermal threshold of the species.

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