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Nutrient and sediment loading affect multiple facets of functionality in a tropical branching coral

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Abstract:

Coral reefs, one of the most diverse ecosystems in the world, face increasing pressures from global and local anthropogenic stressors. Therefore, a better understanding of ecological ramifications of warming and land-based inputs (e.g. sedimentation and nutrient loading) on coral reef ecosystems is necessary. In this study, we measured how a natural nutrient and sedimentation gradient affected multiple facets of coral functionality, including endosymbiont and coral host response variables, holobiont metabolic responses and percent cover of *Pocillopora acuta* colonies in Mo'orea, French Polynesia. We used thermal performance curves to quantify the relationship between metabolic rates and temperature along the environmental gradient. We found that algal endosymbiont percent nitrogen content, endosymbiont densities and total chlorophyll a content increased with nutrient input, while endosymbiont nitrogen content per cell decreased, likely representing competition among the algal endosymbionts. Nutrient and sediment loading decreased coral metabolic responses to thermal stress in terms of their thermal performance and metabolic rate processes. The acute thermal optimum for dark respiration decreased, along with the maximal performance for gross photosynthetic and calcification rates. Gross photosynthetic and calcification rates normalized to a reference temperature (26.8 °C) decreased along the gradient. Lastly, percent cover of *P. acuta* colonies decreased by nearly two orders of magnitude along the nutrient gradient. These findings illustrate that nutrient and sediment loading affect multiple levels of coral functionality. Understanding how local-scale anthropogenic stressors influence the responses of corals to temperature can inform coral reef management, particularly in relation to the mediation of land-based inputs into coastal coral reef ecosystems.

Keywords: nutrient loading, sediment loading, Pocillopora acuta, thermal performance curve, land-based inputs, coral physiology