



The effects of nutrients and herbivory on competition between a hard coral (*Porites cylindrica*) and a brown alga (*Lobophora variegata*)

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ABSTRACT: Coral reef degradation often involves a phase shift from coral- to macroalgal-dominated reefs. Declining levels of herbivory or increasing supply of nutrients have both been suggested as a cause of increased algal abundance and consequent competitive overgrowth of corals. However, explicit demonstration of the processes involved and their relative strengths requires simultaneous tests of all three factors: competition, herbivory, and nutrient effects. We experimentally tested the factorial effects of nutrients and herbivory on the competitive interaction between a brown alga *Lobophora variegata* and a scleractinian coral *Porites cylindrica*. The results of the experiment show that coral tissue mortality was strongly enhanced by the presence of the competitor (*L. variegata*), and this effect was significantly greater when herbivores were excluded. In contrast, the coral growth (skeletal extension) of *P. cylindrica* was not significantly affected by any treatments. The addition of nutrients did not have a significant effect on corals overall, but had a small effect on algal growth and consequent coral tissue mortality when herbivores were excluded. The factorial combination of treatments in this experiment allows interpretation of the causal relationships between each factor, demonstrating that nutrient effects on algal growth only led to competitive effects on corals when herbivory was insufficient to consume excess algal growth and that both herbivore and nutrient effects on corals were dependent on the strength and outcome of the competitive interaction between corals and algae.

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