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Nutrient limitation of the macroalga *Enteromorpha intestinalis*, across a range of water column nutrients and initial tissue nutrient status

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ABSTRACT

A laboratory experiment was conducted to quantify nutrient (nitrogen [N] and phosphorus [P]) limitation of macroalgae collected along a gradient in water column nutrients in Upper Newport Bay (UNB) estuary, a relatively nutrient-rich system in southern California. *Enteromorpha intestinalis* and water were collected for use in the experiment from five sites ranging from the lower end of the estuary to the head. Portions of the water from each site were amended with nutrients. Algae from each site were assigned to one of four experimental treatments: control (C), nitrogen enrichment (+N), phosphorus enrichment (+P), and nitrogen and phosphorus enrichment (+N+P). Experimental units consisted of glass jars containing 800 mL of experimental solution and 8 g (wet weight) of *E. intestinalis*; replication was five-fold. Each week for three weeks, water column nutrient concentrations were measured in each experimental unit; at the end of the experiment, *E. intestinalis* biomass and tissue N and P concentrations were measured. Initial algal tissue N and P concentrations and molar N:P ratios, as well as water column NO₃ and TKN, increased along a spatial gradient from the lower end of the estuary toward the head. After three weeks, *E. intestinalis* collected from sites throughout UNB, spanning the range of background water column NO₃ and PO₄ concentrations, was nutrient limited. Biomass of *E. intestinalis* from three of five sites increased with N enrichment alone and increased further when P was added in combination with N. This indicated that N was the most limiting nutrient and that P was the next most limiting nutrient after N. Growth of *E. intestinalis* from the site closest to the head of the estuary was moderate relative to the other sites and may have been limited by a factor other than nutrients.

Full Text

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