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The relative importance of sediment and water column supplies of nutrients to the green macroalga *Enteromorpha intestinalis* across an estuarine resource gradient

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ABSTRACT

Large blooms of opportunistic green macroalgae such as *Enteromorpha intestinalis* are a common problem in estuaries worldwide. Macroalgae derive their nutrients from the water column, but estuarine sediments may also be an important nutrient source. We hypothesized that the importance of these sources to *E. intestinalis* varies along a nutrient resource gradient within an estuary. We tested this by constructing experimental units using water and sediments collected from three sites, in Upper Newport Bay estuary, California, that varied greatly in water column nutrient concentrations. For each site, there were three treatments: sediments + water, sediments + water + *Enteromorpha intestinalis* (algae), and inert sand + water + algae. Water in units was exchanged weekly, simulating the low turnover characteristic of poorly flushed estuaries. The importance of the water column versus sediments as sources of nutrients to *E. intestinalis* varied with the magnitude of the different sources. When initial water column dissolved inorganic nitrogen (DIN) and soluble reactive phosphorus (SRP) levels were low, estuarine sediments increased *E. intestinalis* growth and tissue nutrient content. In units from sites where initial water column DIN was high, there was no effect of estuarine sediments on algal growth or tissue N content. However, salinity was low in these units and may have inhibited algal growth. Water column DIN was depleted each week of the experiment. Thus, the water column was a primary source of nutrients to the algae when water column nutrient supply was high, and the sediments supplemented nutrient supply to the algae when water column nutrient sources were low. Depletion of water column DIN in sediment + water units indicated that the sediments acted as a nutrient sink in the absence of algae in this experiment. Previous studies have demonstrated the potential importance of sediments as a source of nutrients to primary producers; our data provide direct experimental evidence that macroalgae utilize and ecologically benefit from nutrients stored in estuarine sediments.

Full Text

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