NITROGEN FIXATION IN A NATURAL AND A CONSTRUCTED SOUTHERN CALIFORNIA SALT MARSH

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ABSTRACT

Significant differences in nitrogenase activity were measured between a constructed and an adjacent natural salt marsh at San Diego Bay. Patterns of nitrogenase activity differed for sediments at 1cm and at 10cm depth. Significant positive relationships were detected between nitrogen fixation and two environmental factors that represent an energy source for the fixers: belowground biomass and soil organic matter content.

Nitrogenase activity was measured with the acetylene reduction technique on soil cores of the sediment surface (1cm depth) and of the root zone of *Spartina foliosa* (10cm depth). Soil cores in both the natural and the constructed salt marsh were collected along a single elevation contour (0.42m above MSL) every two months for about a year. Assays for acetylene reduction employed short-term incubations (<24h) with 10% (v/v) acetylene. Surface cores were incubated under light to include the activity of the heterotrophic and the photosynthetic nitrogen fixers. Root zone cores were incubated in the dark.

Higher rates of nitrogen fixation at 1cm depth were measured in the natural marsh and were attributed, at least in part, to higher levels of organic matter found in the natural system. Nitrogen fixing microorganisms residing in the surface sediments appeared to be more limited by metabolizable carbon compounds in the constructed marsh which had lower organic matter content. In winter and spring, before *Spartina foliosa* reached maximum biomass, higher rates of nitrogen fixation were measured at 10cm depth in the natural marsh and were attributed to the higher levels of organic matter. During maximum growth

of *Spartina foliosa* and at the beginning of its senescence, greater nitrogen fixation was measured at 10cm depth in the constructed marsh and was attributed to higher amounts of belowground biomass found in this system. It is suggested that the measurements of higher belowground biomass in the constructed marsh result from differences in root profiles and/or differences in root:shoot ratios between the two ecosystems.

The above findings are consistent with the hypothesis that the function of nitrogen fixation may differ between a natural and a constructed salt marsh. Nitrogen fixation can play an important role in the stability and maintenance of salt marsh ecosystems, since nitrogen is generally the main growth-limiting nutrient for cordgrass. Lower rates of nitrogen fixation in constructed salt marshes, where levels of soil organic matter tend to be low, can therefore affect other critical functions such as primary production.