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Nutrient dynamics and macroalgal blooms: A comparison of five southern California estuaries

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ABSTRACT

Macroalgal blooms are a common ecological problem in estuaries worldwide and often occur in response to increased nutrient loading from developed watersheds. Although macroalgae are common in southern California estuaries, local estuaries are relatively understudied, particularly with regard to nutrients. The unique characteristics of the southern California region warrant a regional investigation of estuarine nutrient-macroalgal relationships. The objective of this study was to determine the degree of similarity in spatial and temporal patterns of water column nitrogen (N) concentrations and macroalgal abundance in five southern California estuaries: Carpinteria Salt Marsh Reserve (CSMR), Mugu Lagoon (Mugu West and Mugu Calleguas Creek (Mugu CC)), Upper Newport Bay (UNB), Los Penasquitos Lagoon (LPL), and Tijuana River Estuary (TJ). These estuaries span a latitudinal gradient from San Diego to Santa Barbara and represent a range of estuarine area, watershed size, and dominant land use practices. Estuaries also differed in physical structure from having straight, narrow channels with high tidal flushing to having broad, flat benches with restricted flow and muted tidal flushing. Several consistencies found were higher water column N concentrations at the heads of systems (up to 2000 μM), and increased N availability during wet-season sampling events, probably due to precipitation. However, the dominant form of N changed among systems from NO_3 to NH_4 to dissolved organic N (DON). Spatial and temporal patterns in water column nutrients and salinity suggest that watersheds were important nutrient sources. Additionally, the proximity of specific land use practices, such as agriculture, to estuaries may have had significant impacts on water quality. *Enteromorpha* was found in each system and *Ulva* was found in four study areas. Macroalgal abundance ranged from <300 to >2,000 g wet wt m^{-2} . The time of year when abundance was greatest varied from system to system and even within a system from one site to another. However, no clear, consistent relationships were found between water column N and macroalgal abundance; likely, the physical characteristics of each estuary mitigated the response of macroalgal abundance to nutrient availability. Macroalgae proliferated in nutrient-rich areas with suitable habitat, such as broad mudflats and high light availability, and were less abundant in areas with increased tidal flushing, which may have prevented the algae from accumulating.

Full Text

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