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Dissolved oxygen dynamics in a eutrophic estuary, Upper Newport Bay, California

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ABSTRACT

Eutrophication often causes hypoxia in estuarine and coastal systems, but the mechanisms that control hypoxic events vary among estuaries and are often difficult to discern. We monitored surface and bottom dissolved oxygen (DO) in the Upper Newport Bay (UNB), a tidally mixed estuary in southern California subject to anthropogenic nutrient loading, eutrophication and hypoxia. Our goal was to identify the environmental factors regulating DO dynamics. Six hypoxic events occurred between June and November and were associated with a combination of low solar radiation, increased freshwater discharge following precipitation, and enhanced haline stratification during reduced tidal range periods. At the head of the estuary, high macroalgal biomass and pronounced haline stratification resulted in high DO in the surface layer and low DO in the bottom layer. Oxygen-rich and oxygen-poor waters were transported down-estuary by ebb tides, resulting in DO heterogeneity throughout the UNB. Cross-wavelet analysis illustrated the down-estuary propagation of high/low DO signal correlated with the phases of diurnal photosynthetic and semi-diurnal tidal cycles.