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Evaluating the ability of eastern oysters (*Crassostrea virginica*) to mitigate coastal nitrogen over-enrichment.

Abstract: Human actions have resulted in a doubling of the rate of bio-available nitrogen production in the biosphere, leading to over-fertilization of coastal ecosystems worldwide. Such over-fertilization has numerous negative consequences for coastal ecosystems, such as excessive algal growth, hypoxia, and fish kills. Oyster habitat is hypothesized to mitigate excess nitrogen in these systems by creating favorable conditions for denitrifying bacteria, thus stimulating the removal of bio-available nitrogen (i.e. nitrate). Using novel *in-situ* benthic chamber experiments, we quantified the influence of oyster aquaculture, oyster reef restoration, and cultch placement on N_2 fluxes across the sediment-water interface. Using the N_2/Ar technique and flow-through batch chambers, we conducted both dark and light incubations seasonally (spring, summer, fall) in a shallow (~1m) estuary in southern New England, USA. Net denitrification rates were consistently highest at the restored oyster reef compared to other treatments (maximum of 701 μmol N_2 m^{-1} hr^{-1} in spring), whereas the cultch placement appears not to stimulate denitrification significantly over ambient conditions. Elevated net N-fixation rates (maximum of -1312 μmol N_2 m^{-1} hr^{-1} in summer) were observed at the aquaculture site. We relate our net N_2 fluxes to differences in site-specific environmental factors, such as sediment oxygen demand, sediment Chl *a*, dissolved inorganic nutrient (N, P) availability, and benthic organism abundance and diversity. Considering that oyster aquaculture and restoration are prevalent and on-going in the Northeast US, the results of this study are timely and of critical importance to environmental managers.