Assessing the Influence of Breakwaters on Salt Marsh Denitrification Ecosystem Services

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In coastal environments, nature-based solutions like breakwaters are increasingly used to protect shorelines from erosion and promote marsh resilience to sea-level rise. While breakwaters are designed to decrease wave height and energy, they may also alter patterns of sediment deposition, marsh plant distribution, and carbon storage, with potential consequences for other ecosystem services. Here, we investigate how breakwaters impact nitrogen removal and retention. To assess the impact of breakwaters on nitrogen dynamics, we measured potential rates of denitrification (DNF) and dissimilatory nitrate reduction to ammonium (DNRA) using sediment incubations that employ the isotope pairing technique in three marshes along the Swift Tract shoreline in Bon Secour Bay, AL. One marsh had no breakwaters (control), one marsh had breakwaters established in 2012 (TNC), and one had breakwaters established in 2017 (NRDA). Within each marsh, we measured potential DNF and DNRA rates in both unvegetated and vegetated sites to identify potential plant-mediated effects on nitrate reduction. Preliminary results indicate there were no differences in DNF or DNRA in the unvegetated control marshes relative to unvegetated breakwater marshes, suggesting physical changes behind breakwaters may not affect nitrate reduction, although variation was high. We also found no differences in DNF in vegetated control marshes relative to vegetated breakwater marshes. Across all marshes, DNF was higher in unvegetated sites relative to vegetated sites. Overall, these results suggest that marshes behind breakwaters function similarly to marshes without breakwaters, as breakwaters did not enhance nitrogen removal ecosystem services.