The Sedimentary History of a Backbarrier Lagoon and Its Influence on Mollusk Community Distribution

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Coastal lagoon settings commonly experience acute shifts in their physical regime related to processes such as storms, overwash, and barrier breaches. Lagoons typically support productive ecosystems and economically significant shellfish populations. Because benthic communities are linked closely with specific seabed habitats, this study sought to reconstruct how sediment distribution and associated fauna have changed with the evolution of Great South Bay backbarrier lagoon on Long Island, New York. Specifically, the goals of this study were 1) to examine the sedimentary record to reconstruct past energy regimes and the frequency and magnitude of deposition/erosion events; 2) to relate mollusk communities with sediment regimes and determine if these communities have changed with evolution of the coastal lagoon; 3) determine the extent to which the economically important species *Mercenaria mercenaria* and *Crassostrea virginica* have been present in GSB. The study approach involved subbottom sonar profiling (CHIRP) to identify subbottom features, followed by the collection of 34 vibracores (2-5 m long) at sites chosen from the CHIRP data. Multidisciplinary analyses of the core samples consisted of water, organic, and carbonate content, radiocarbon dating, X-radiography for physical and biological structures, and quantification and identification of molluskan shells preserved in the core sediments.

Results from the CHIRP data allowed us to identify and track depositional or erosional horizons across the bay, as well as extensive shell layers. These data further revealed modern and past distributions of sandy benthic habitats associated with Long Island's glacial outwash plain, the location of incised channels that have supported muddy habitats for most of the lagoon's history as well as previously undescribed relict inlets along Fire Island. Cores located toward the west and east of the study area often contained woody peat that indicated freshwater environments were situated adjacent to marine-influenced portions of the lagoon. Sedimentary and molluskan evidence in these cores reveal the long term influence of Fire Island Inlet and Old Inlet on habitat and organism distribution. Cores collected from the center of the study area generally have the longest estuarine sequences, dating to 4,000 years ago. Notably these sites contained the most molluskan remains, suggesting that these more stable physical settings support a more abundant molluskan fauna, as well as an indication of a shift in the dominant community assemblage as related to sedimentation through time. In contrast, cores collected toward the barrier side of the lagoon were sandier in composition and had fewer mollusk remains that were fragmented or worn from reworking and transport. A collective view of the Great South Bay benthic community through time reveals that both hard clams and oysters have been present for at least the past 3000 years. The most abundant bivalves, however, were *Mulinia lateralis* and *Gemma gemma*, which were consistently found in muddy and muddy sand environments, respectively. Such historical and multidisciplinary investigations appear to yield unique and important insights on the response of complex ecosystems to coastal zone dynamics and habitat distribution.