At dawn a lone clammer gets an early start on Great South Bay, Long Island. This relatively shallow body of water, ringed by wetlands, is the site of ongoing efforts to restore the once bountiful hard clam industry.

Photo by Joe Dlhopolsky

Sea Grant New York

Coastlines

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Clammers use their rakes to harvest tasty shellfish on Long Island's Great South Bay. An international flight lands on a runway built adjacent to JoCo Marsh in Jamaica Bay. Weekend kayakers paddle silently along the Carmans River. Each of these wetlands is a unique coastal ecosystem, playing an important part in the environment and the economy of Long Island.

Concern for the health of Long Island wetlands has grown recently with documented losses of marshes. Factors such as exotic invasive species, dredging, and growing coastal urbanization currently impact wetland health. Future threats may include increased rates of sea-level rise.

How can planners and managers develop effective management programs for marine wetlands? A major step would be to have a greater understanding of marsh-system controls and behavior under different physical conditions. This knowledge would provide the means for municipalities to deal with future changes of valuable coastal wetlands and help develop successful strategies for wetland protection.

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Coast

WETLANDS – LOOKING BACK TO THE FUTURE

A National Park Service (NPS) biologist works on Big Egg Marsh on Jamaica Bay where goldenrod blooms and the Manhattan skyline looms to the west. This marsh was restored by the NPS in 2003 through application of a thin layer of sand with a high pressure jet spray.

Photo inset courtesy of National Park Service, Gateway National Recreation Area. Photo above by Barbara A. Branca

A core from one of the experimental sites, Hubbard County Park located on the western part of Peconic Bay on Long Island's east end. Color differences indicate chemical activity of the sediment. For example, brownish-red layers suggest oxidized sediments whereas grey to black layers suggest that reduction was taking place.

Photo by Alex Kolker

To provide a deeper understanding of Long Island's marshes, a research team at Stony Brook University led by **Dr. Steven Goodbred** (now at Vanderbilt University) took a novel approach. By looking at the history of Long Island wetlands recorded in peat cores, the research team was able to reconstruct how wetlands responded to environmental change over time. The layers within each long, cylindrical core can be read like chapters of a marsh's past—the chemistry of its sediments, the remains of the marine life, the effects of currents and waves, long term weather patterns.

Long Island's great expanse of shoreline is made of a broad range of physical coastal environments that exhibit large differences in tidal range, upland urbanization, wave energy, and sediment supply. Goodbred's team chose five sites in physically distinct settings and investigated the physical marsh structure, sedimentation rates, and paleo-environmental indicators of each in order to understand the major controls and response patterns of these different marshes.

The results of this NYSG-funded project show that Long Island marshes are very different in terms of the stresses being placed on them and in how they respond to these stresses. In general, the researchers found that marshes in areas with high tidal ranges such as Jamaica Bay on the south shore and the Nissequogue River on the north shore that empties into Long Island Sound were controlled mainly by oceanographic processes such as the North Atlantic Oscillation.

In contrast, marshes with lower tidal ranges (and thus considered lower-energy marshes) such as in Great South Bay and western Peconic Bay were more strongly influenced by climatically-driven events such as storms and weather fronts.

One important conclusion that can be drawn from this research is that management and preservation strategies for the various marshes of Long Island must consider their unique settings and their different tolerances and reactions to the natural and anthropogenic changes that are ongoing and

Watch

The Carmans River, another experimental site in Goodbred's NYSG-funded project, is considered a "low-energy" marsh. Visitors can fly fish for trout in the upper part of the river or kayak near the mouth where the river empties lazily into Great South Bay.

Photo by Susan Hamill

expected in the coming decades. Thus a one-size fits all management approach will not be appropriate.

Using lead isotope analysis as well as field cores, the team also found that accretion rates of the Long Island marshes they examined have kept pace with sea-level rise over the past century. Although marsh health has declined, these findings imply that recent losses in Jamaica Bay and other areas may not be primarily caused by sea level rise and may be related to more local factors, such as land use, urbanization, or dredging activities rather than decreases in the rates of the natural buildup of sediment.

Work by Sea Grant Scholar **Alexander Kolker** suggests that toxic effects of hydrogen sulfide could be a factor contributing to marsh loss in Jamaica Bay. He observed that nitrogen inputs into the Bay result in low oxygen conditions. These conditions produce toxic hydrogen sulfide in sediments which kills the marsh grasses that hold the sediments together. The weakened marsh structure is then more susceptible to erosion. Thus Kolker's observation suggests that reducing nitrogen inputs could be helpful to the health of Jamaica Bay.

"Kolker's research provides greater insight into the conditions contributing to marsh loss in Jamaica Bay," says **Stephen Zahn**, Natural Resources Supervisor of NYS DEC in the region. "Understanding the causative factors is critical to the development of a sustainable recovery plan."

Kolker was invited to be on an expert panel of the U.S. Climate Change Science Program looking at wetland response to potential changes in sea level rise that was assembled by the USGS. After completing his PhD, Kolker is now a postdoctoral scholar at Tulane University in New Orleans where he is working on challenges that face marshes along the Gulf coast.

The results of this research were useful to the National Park Service at Jamaica Bay National Recreation Area and the Jamaica Bay Task Force in their work to help prevent marsh loss and promote marsh restoration initiatives. The results from Goodbred's project have also been useful to the New York City Department of Environmental Protection in the development of its Jamaica Bay Watershed Protection Plan. Municipalities along Long Island have found the results of this project useful for wetland and marsh management and planning.

— Lane Smith and Barbara A. Branca

Black Bank Marsh in Jamaica Bay is an example of a deteriorating marsh that shows erosion down to the underlying mineral sediment (gray area) and marsh peat (foreground). Photo courtesy of Don Cahoon, USGS

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... for more on Jamaica Bay marshes and the North Atlantic Oscillation