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Patchogue, New York

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Abstracts of Presentations and Posters

April 21- 22, 2010

Great South Bay beyond Sailors Haven Marina, Fire Island National Seashore

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Abstracts of Presentations

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Welcome/Orientation

Fire Island National Seashore became a unit of the National Park System in 1964. Since the park was created 46 years ago, many changes in management philosophy, status of resources, availability of funding and staffing, and visitation patterns have ensued. Larger issues associated with climate change have also risen to prominence. A general management plan (GMP) was approved in 1978 and is currently being revised, and will address a variety of those changing philosophies, issues, etc.

Fire Island National Seashore encompasses 19,580 acres of marine and terrestrial property, with almost 15,000 acres of open water, 26 bay islands, approximately 101 miles of coastline (including 72 of Fire Island's 84 miles of Atlantic Ocean and bay shorelines), and 1,380 acres of federally designated wilderness. Within the boundaries of the Seashore there are also 17 preexisting communities, town and village recreational facilities, and an entire county park. Managing the park to create a balance between development and preservation is a perpetual challenge. Conducting and utilizing sound science makes the job of park managers more grounded.

Some of the research discussed during this year's science conference is being conducted in support of the park's new GMP. Research associated with shoreline change and sea level rise will have value in understanding the issues being addressed by the Fire Island Inlet to Montauk Point (FIMP) Storm Damage Reduction Plan, a larger scale project under development by the U. S. Army Corps of Engineers, in conjunction with New York State and the Department of the Interior. The results of the research associated with other inventory and monitoring programs assist park management in ongoing operations.

These biennial science conferences are an avenue to relate the status of research to the general public and to other scientists and resource managers. We appreciate your attendance at our biennial science conference to stay abreast of the state of our science and research, and planning.

Christopher J. Gobler
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Beyond Brown Tide: Dynamics of Phytoplankton Communities Across Great South Bay and Implications for Marine Resources

The occurrence of harmful brown tides caused by the alga *Aureococcus anophagefferens* have plagued Great South Bay since 1985 and have been responsible for the loss of eelgrass and the inability of hard clam populations to recover from initial overharvesting pressure. However, brown tide blooms occur only sporadically in Great South Bay, but eelgrass and clam populations continue to exist at record low levels. A robust analysis of Suffolk County's 35- year water quality record coupled with seasonal sampling of Great South Bay during the past 15- years provides evidence that even non- brown tide phytoplankton may be harmful to the resources of this estuary. There exist strong latitudinal gradients in Great South Bay with locations near inlets being cooler, higher in salinity, lower in inorganic and organic nutrients and phytoplankton biomass, and generally dominated by larger phytoplankton, in general, and centric diatoms, in particular. Locales within Great South Bay proper contain greater phytoplankton biomass as well as a higher diversity of major algal classes (diatoms, dinoflagellates, cryptophytes, chlorophytes, and cyanobacteria). Even during non- brown tide years, a clade of dense picoplankton comprised of picoeukaryotes, picocyanobacteria (*Synechococcus* sp.), and small chlorophytes dominated estuarine stations during summer and has been strongly associated with high temperatures and high levels of dissolved organic nitrogen. A second grouping of estuarine phytoplankton was comprised of nanophytoplankton and pennate diatoms, which sporadically bloomed from spring through fall. A final group of phytoplankton in Great South Bay has been harmful dinoflagellates which form blooms seasonally in the eastern extreme of this system. These results evidence the large differences between algal communities found across Great South Bay, but also demonstrate that many of these communities are not beneficial for estuarine resources including hard clams and eelgrass.

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What does the Great South Bay's Designation "Impaired Waters" Mean?

The Federal Clean Water Act requires states to periodically assess and report on the quality of waters in their state. Section 303(d) of the Act also requires states to identify *Impaired Waters*, where specific designated uses are not fully supported. For these Impaired Waters, states must consider the development of a *Total Maximum Daily Load (TMDL)* or other strategy to reduce the input of the specific pollutant(s) that restrict waterbody uses, in order to restore and protect such uses. The Section 303(d) List is comprised of waterbodies and specific pollutants that do not meet water quality standards AND for which the development of a TMDL should be considered.

Prior to the development of the Draft 2010 List, NYS solicited public input regarding available water quality information and possible changes to the list. During this solicitation process, NYS received comments from a number of groups (TNC, Suffolk County Health, SUNY Marine Sciences, NYS DOS) advocating for the listing of Great South Bay and other South Shore Estuary waters due to the impact of brown tides.

As a result, 7 new listings were included in the Draft List for waters of Great South Bay, Moriches, Shinnecock and Quantuck Bays due to the occurrence and impact of algal growth (brown tide). The impact of brown tide in these waters is not new, but such listing had not been included in previous Section 303(d) Lists due to uncertainty whether TMDLs would be an effective approach to the problem. After all TMDLs are pollutant loading reduction strategies, and developing a loading reduction strategy for "Brown Tide" would be of limited value. A more effective TMDL would need to focus on the pollutant(s) causing the brown tide. However the causes of brown tide are thought to be related to multiple factors, and further study is necessary to determine the relative contribution of these multiple factors, including the role of nitrogen loading in the bays, and whether a TMDL is the most appropriate management approach.

So, due to the significant and continuing impact of algal growth in these waters, NYS decided it was appropriate to include these waters on the 2010 Section 303(d) List. These waters are listed for nitrogen as the pollutant. However recognizing that the algal growth is a result of multiple causes, these listings appear in Part 3b of the List with the qualifier that additional study is necessary to identify the complex causes and pollutants causing the impairment and to determine if a TMDL is, in fact, the most appropriate strategy to restore the waters.

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Effect of a Prolonged Brown Tide (*Aureococcus anophagefferens*) on Interannual Eelgrass (*Zostera marina)* Densities within Great South Bay, NY

The sensitivity of seagrasses to light attenuation has been well established in the literature and many now contend that alterations in the coastal light environment are contributing significantly to worldwide declines in seagrass depth distribution, density and aerial coverage. Although a host of stressors have been shown capable of affecting such change, phytoplankton- mediated light attenuation generally receives the bulk of critical attention, as several large- scale seagrass meadow contractions have been temporally linked to inshore algal blooms. These include a 40% loss of *Z. marina* coverage within the South Shore Estuary (SSE) of Long Island (NY) following a series of *A. anophagefferens* blooms or 'brown tide' events during the mid- 1980s. A similar event occurred again during a 7- month period beginning in the spring of 2008. Using data from the National Park Service 'Vital Signs Monitoring Program' for water quality and rapid seagrass assessments conducted in 2007 and 2009, we were able to examine the putative effects of brown tide on *Z. marina* within the SSE system. Preliminary results suggest that no significant losses were sustained and modest gains in density were observed throughout the bay. A number of explanatory variables are now being examined for spatial concordance with observed changes in seagrass density.

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5-year Trend Analysis, 2004-2009 of the Water Quality Monitoring Program for the Great South Bay and Adjacent Waters, Fire Island National Seashore (FINS) Patchogue, New York

The National Park Service (NPS), Fire Island National Seashore (FINS), has a need to determine the potential impacts on water quality within the Parks' boundaries in Great South Bay, from recreational water use of boat slips and temporary berthing sites within the Park. Commencing in 2004 with a preliminary reconnaissance investigation, and continuing into 2009 under a Cooperative Agreement, Dowling College's Department of Earth and Marine Sciences, initiated a long- term water quality monitoring program for FINS. The results presented here are analysis of a 5-year trend in water quality (WQ) monitoring effort. Fourteen sampling sites were identified by the NPS within the park's boundary. Samples of estuarine waters are collected on a weekly basis between Memorial Day and Labor Day weekends. Samples are tested in our Water Quality Laboratory, Kramer Science Center, Dowling College. Nine parameters (Top and Bottom DO (dissolved oxygen); pH; chlorophyll- a; Total Nitrates; Total Phosphates; turbidity/water clarity; temperature; Total/Fecal Coliform; and salinity) are provided by the NPS Director's Order #83. Processing of samples follows Standard Methods for the Examination of Water and Wastewater (2000 Edition). Criteria for determining water quality conditions in marine/estuarine ecosystems are based on the type of contact (use) people have with these systems. Standard parameters for WQ Monitoring exhibited 5- year trend values that are "not unusual." Slightly higher Total/Fecal Coliform values observed at "boat basin areas," yet not above TL. Ecosystem health values (T/B DO; Chl- a) are within threshold values for "healthy" estuarine waters.

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Submarine Groundwater Discharge to Great South Bay

An investigation of aquifers beneath Great South Bay adjacent to Fire Island National Seashore and Long Island is being conducted to assess the importance of groundwater discharge as a potential source of excess nitrogen delivery to the bay. Over 125 miles (200 kilometers) of geophysical survey data were collected in Great South Bay in 2008. The survey system, which was sensitive to electrical properties of the water- saturated sediments beneath the bay, was used to image the fresh- saline groundwater interface below the bay's bottom. In addition, intensive groundwater sampling was performed at sites along the shore of Patchogue Bay that were representative of the developed Long Island shoreline. A shore- perpendicular transect of samples from temporary, small- diameter wells was collected here. Sample sites extended 100 feet (30 meters) out from the beach, and down to 30 feet (9 meters) below the sediment surface. The samples revealed a zone of groundwater in glacial material that was fresher than bay water up to 26 feet (8 meters) thick that extended >100 feet (>30 meters) offshore, sealed off from bay water above by buried salt marsh deposits (peat) in the shallow subsurface. Seepage meters deployed at the Patchogue site revealed discharge of up to 6.4 inches (16.2 centimeters) per day at low tide, at a distance of 15 feet (4.5 meters) from shore. Submarine groundwater within 100 feet (30 meters) of the shore, both fresh and salty, was high in ammonium and methane, and generally low in nitrate, nitrite, and dissolved oxygen. Dissolved gas data from submarine groundwater samples indicate loss of up to 40 percent of the land- derived nitrate load in groundwater prior to discharge. Two sites on Fire Island were sampled in April and May of 2009. At one site (Kismet) groundwater that was fresher than surface water was only present within about 23 feet (7 meters) of the shoreline, indicating different geological conditions than at Patchogue. The second site (Watch Hill) showed similar conditions to Patchogue, with reduced-salinity groundwater approximately 20 feet (6 meters) thick extending up to 230 feet (70 meters) into the bay beneath buried marsh deposits. The low- salinity offshore groundwater at Watch Hill is present beneath the marsh deposits in sand layers that originated from overwash of Fire Island during storms or as deposits associated with old inlets, rather than in glacial sands such as those at Patchogue. Dissolved oxygen was generally low at both Fire Island sites; chemical analysis of the Fire Island samples is ongoing. Based on these results, the onshore and offshore shallow geology of the Great South Bay shorelines appears to control the width and chemistry of the groundwater flow and discharge zones beneath the bay.

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Organic and Inorganic Nitrogen in Coastal Groundwater: A Potential Link to Great South Bay Brown Tides?

Coastal groundwater discharge (including submarine groundwater discharge) is often an important and even dominant pathway for nitrogen transport from land to sea. Sources for increasing nitrogen inputs to landscapes and estuaries of Long Island include 1) wastewater disposal; 2) fertilizer application to crops, lawns, and other turf; and 3) atmospheric deposition of nitrogen, due in part to combustion of fuels for electricity, transportation, home heating, and industry. Nitrogen typically controls the growth of algae in coastal waters, and thus increasing the rate of nitrogen supply to estuaries and bays, including Great South Bay, stimulates algal blooms. The resulting increase in production of algal organic matter, referred to as "eutrophication," leads to a host of changes in the ecosystem, including low dissolved oxygen conditions and changes in the assemblage of living organisms. Of particular concern in Great South Bay are harmful blooms, referred to as brown tides, of the algae *Aureococcus anophagefferens*. In past studies it has been shown that brown tide blooms are stimulated by inputs of only particular chemical forms of nitrogen (Taylor and others, 2006). Results suggest that nitrogen in the forms of ammonium and organic nitrogen stimulates brown tide blooms, while nitrogen occurring as nitrate stimulates other types of algal blooms. Thus, to manage nitrogen inputs and the ecology of Great South Bay, improved understanding is required of not only the sources and magnitudes of nitrogen inputs, but also of the controls on the chemical forms of nitrogen.

In Great South Bay, it has been estimated that about 65% of the freshwater discharge from Long Island occurs as coastal groundwater discharge, with the remainder occurring through river discharge (Monti and Scorca, 2003). In addition to fresh groundwater, coastal groundwater discharge commonly includes substantial quantities of saline and brackish groundwater, carrying nitrogen from marine sediment sources. To better understand the role of groundwater in eutrophication of the bay, we intensively sampled and analyzed groundwater along the bay shore of Patchogue. Results showed that nitrogen concentrations in fresh groundwater at the shoreline were closely related to human population density on the adjacent landscape, and were on average very high relative to concentrations we have measured at a range of sites along the U.S. east coast. Comparison to groundwater nitrogen concentrations in locations where wastewater inputs have been reduced by sewering suggests that sewering of the Great South Bay watershed would dramatically reduce groundwater nitrogen loading. Even in sewered watersheds, however, nitrogen loads carried by groundwater from densely populated landscapes are still quite high, due to continued inputs from fertilizer applications and atmospheric deposition. The nitrogen in both fresh and saline groundwater along the Patchogue shore was primarily in the form of ammonium and organic nitrogen, and was nearly devoid of nitrate. If the Patchogue site is representative of substantial portions of the Long Island Great South Bay coast, it may be that coastal groundwater discharge plays an important role in stimulating brown tides.

Groundwater: Questions and Answers

See also USGS fact sheet: Nitrogen Loads in Groundwater entering Back Bays and Ocean from Fire Island National Seashore, Long Island, NY

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Is it Possible to Restore Hard Clams (*Mercenaria mercenaria*) to Great South Bay, NY after 30 Years of Decline?

The once robust hard clam (*Mercenaria mercenaria*) population in Great South Bay has declined by over 90% since the mid 1970s. In addition to losing the social and economic value of this fishery resource, losing this once dominant foundation species has had consequences to the Great South Bay ecosystem, including making it less resistant to harmful algal blooms. Since 2004, The Nature Conservancy, in collaboration with town, county, state, and federal agencies has expanded efforts to restore a self- sustaining hard clam population in Great South Bay for the purposes of improving ecosystem health and reviving a sustainable fishery. The Nature Conservancy's recent acquisition of 13,400 acres of submerged lands in central Great South Bay provides a unique set of restoration opportunities. Clams in Great South Bay face several threats to recovery including sub- optimal food quality (phytoplankton species assemblages), predation, and very low spawning populations. Food quality and predation fluctuate annually, but prior to the start of this project surveys had shown that in the past 15 years, even at times when conditions appeared favorable, there were not any strong sets of clams. Documentation of recruitment limiting conditions in vast portions of the bay lead us to emphasize rebuilding of the clam's reproductive potential by stocking a network of spawner sanctuaries with adult clams relocated from nearby estuaries as a short- term strategy. Long- term efforts are focused on mitigating causes of chronic harmful algal blooms, habitat degradation, and assuring that as the clam population is rebuilt, the clam fisheries operate sustainably. Monitoring has shown that reoccurrence of brown tide and dominance of small form phytoplankton makes Great South Bay a more challenging environment for clams compared to Long Island Sound and Peconic Estuary. However, restoration results to date are encouraging. We have shown that in years when environmental conditions are favorable for spawning (such as 2007), recruitment rates can be significantly increased through large - scale targeted stock enhancement. Our work has shown that despite challenging conditions, Great South Bay is still capable of producing a strong year class of clams. However, restoration of the hard clam resource and the hard clam fisheries will take time. The dedication and cooperation shown by of town, county, state and federal agencies over the last 5 years will need to continue to occur so that all of the threats impacting the recovery of this important foundation species can be addressed effectively and simultaneously.

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Recreational Clamming Survey of Great South Bay, Long Island, New York, 2008

This report presents the findings of a study of recreational clamming in Great South Bay, New York in 2008 performed for The Nature Conservancy. The study included field observations and field intercept interviews of recreational clammers to obtain information of clamming locations, catch rates, harvesting methods, demographics of clammers, and other information needed to characterize recreational clamming activities in the bay. The study included data collection on approximately 85 different days, and a total of 1,120 clammers were interviewed or observed. The amount of field observation completed, the number of individuals interviewed, and the geographic and seasonal coverage have enabled the study to provide a comprehensive and accurate characterization of recreational clamming in the bay for 2008. The main findings of the study are summarized below.

- Three general areas of the bay accounted for 80 percent of all clamming activity — the Fire Island shoreline from Watch Hill to Talisman, Babylon waters along the State Channel and bay islands, and the East Island area in the Town of Islip.
- With the exception of Babylon waters, most of the clamming activity occurred within the Fire Island National Seashore boundary, in shallow sand and seagrass beds.
- The period between June 15th and September 15th accounted for 80 percent of clamming activity, and fewer than one percent of clammers reported that they clam year- round.
- The primary methods of harvesting are treading and scratch rakes, in waters less than four feet deep.
- The average individual catch rate was 20.6 clams per person per hour; lower rates were recorded for Islip and southwest Brookhaven, and higher rates in Babylon.
- Most of the clams harvested in Babylon were large size (cherrystone and chowders), while littlenecks was the main size category in the rest of the study area.
- The estimated 2008 recreational harvest was 487,751 clams or 1,573 bushels. The recreational catch is 27 percent of the commercial catch, and it exceeds the commercial catch in Islip waters.
- The estimated total fishing effort for recreational clamming in 2008 is 23,900 hours, and approximately 1,700 individuals participated in the activity.
- Over 98 percent responded that they clam for both recreation and food. Seventy- five percent rated clamming as a very important recreational activity.
- Compared to the results of a 1977 recreational clamming survey, the recreational catch has declined by 67 percent; however, the relative importance of the recreational catch has increased substantially, from less than one percent of the commercial catch in 1977 to 27 percent in 2008.

The overall finding of the study is that recreational clamming is an important activity on the Great South Bay, and it should be included in resource management plans and seeding programs.

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The Ecological Role of Salt Marsh Mosquito Ditches and Implications for Restoration

Mosquito ditches are human- made features designed to control breeding of salt marsh mosquitoes and are a ubiquitous feature in northeastern United States salt marshes. A ten- kilometer stretch on Fire Island was given a Federal Wilderness Area designation in 1980 (The Otis Pike Fire Island High Dune Wilderness). As a result, the National Park Service seeks to remove evidence of human influence throughout the wilderness area. Because the mosquito ditches are an obvious imprint of human influence, there has been interest in a restoration effort to remove the ditches. The National Park Service thus sought to understand the role of ditches as habitat for fish and decapod crustaceans and determine the rate of natural ditch filling. With one exception, the study showed that all of the ditch species are also represented in the creek habitat. While the Analysis of Similarity (ANOSIM) did not show a statistically significant difference in the overall community, there were differences in the species richness of the two habitats, with creeks supporting more species. However, ditches also support many resident nekton species. Physically, ditch removal would likely decrease drainage in the Wilderness marshes, causing the marsh surface to get wetter. With predictions of accelerated rates of sea level rise and the potential for submergence of salt marshes, it seems counterintuitive to conduct a restoration effort which would likely exacerbate marsh drowning. If anything, it is likely that the ditches are prolonging the current state of the marsh, and that their removal would make the impact of rising sea level increasingly apparent, yet this hypothesis remains to be tested. Additionally, because all natural creeks present in the pre- ditch marsh remain in the marsh today (based on analysis of historic and recent aerial images) there is no reasonable justification within a wilderness setting to create new creeks that could serve the role that ditches now play in marsh drainage. Given the nekton habitat function of ditches and concerns that accelerated sea level rise could result in submergence of Fire Island marshes, it is suggested that a passive restoration alternative be pursued.

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Remote Sensing of Terrestrial and Submerged Aquatic Vegetation in Fire Island National Seashore

This presentation reports the results from related projects in exploration of different types of satellite based remote sensing data and image processing approaches to map both terrestrial and submerged aquatic vegetations (SAV) in the Fire Island National Seashore (FIIS).

For terrestrial vegetation mapping, we employed QuickBird- 2 satellite data that possess 0.61- meter spatial resolution for the panchromatic band and 2.5- meter spatial resolution for the multispectral bands ranging from visible to near infrared spectrums. We took the existing data developed from the NPS Vegetation Mapping project as the Phase I map. We then employed the Phase I map as the guiding information for a stratified classification on QuickBird- 2 satellite imagery data. We followed the classification scheme and the field guide developed by the Phase I mapping project so that the results from the two projects could be consistent and comparable. In order to focus on vegetation mapping, we grouped urban related categories defined by the Phase I map as one single category of impervious surface area and kept all the vegetation categories unchanged. Our final map included a total of 30 classes. The mapping results demonstrated that high spatial resolution satellite remote sensing image, in combination with existing vegetation map and support from field survey, can meet the goals of updating vegetation map and for change analysis. We recommend a same type of practice to be continued to make a time series vegetation maps in order to facilitate the practice in long term monitoring.

For SAV classification, besides using QuickBird- 2 high spatial resolution satellite imagery data, we also tested the data from Advance Land Imager (ALI) sensor on board the EO- 1 satellite. ALI is a sensor system that provides short wave spectral coverage in the blue band (0.433- 0.453 μm). With a better penetration capacity of short blue wavelength in water, we hoped that the new type of data could help stream- line the methods for SAV mapping. In both efforts we employed bathymetry and underwater videography survey data as the references. We employed different types of classification techniques and principal component analysis. The classification included presence and absence of submerged aquatic vegetation with subcategories of >25% seagrass cover as the High Density Seagrass, < 25% Seagrass cover as the Low Density Seagrass, and < 5% Seagrass cover as the unvegetated bottom or the Sand. The unsupervised classification of QuickBird- 2 data for SAV mapping identified 2,246 hectares of seagrass habitat within the FIIS park boundary. Among those 69% (1,544 hectares) was classified as high density seagrass and 31% was classified as low density seagrass. The overall accuracy was about 82% with an overall Kappa statistics of 0.81.

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A Dredged Material Management Plan for the South Shore Estuary Reserve

In 2001, the Long Island South Shore Estuary Reserve Council, representing state and local governments and key stakeholder groups such as water dependent businesses, conservation organizations and academic institutions, reached consensus on a Comprehensive Management Plan (CMP) for the estuarine bays, tidal marshes and tributaries and watersheds along the south shore of Nassau and Suffolk County, New York. The CMP identified 11 priority Outcomes to be addressed by management actions to restore and enhance natural and cultural resources in the region and sustain the water related economy. Outcome 8 focuses on sustaining water dependent businesses, including specific actions to develop an estuary- wide plan for dredging and dredged materials management. Dredged material management has become a significant obstacle to maintenance of navigation. As a result of regulatory changes, opportunities for offshore disposal of dredged material from New York harbors and navigation channels have virtually disappeared (Marine Protection, Research and Sanctuaries Act of 1972 and amendments, EPA Final Rule Closure of New York Bight Dredged Material Disposal Site, 40 CFR Part 228, 1997).

To advance the implementation of CMP Outcome 8, the New York State Department of State entered into an agreement on behalf of the Council for private consulting services to prepare a report identifying the planning components needed for development of a dredged materials management plan. The consultant worked with a group of estuary stakeholders representing municipal, regulatory, boating and environmental interests. The completed report will identify locations where public channel dredging is needed, options for dredged material placement, dredged sediment qualities based on existing records and options for beneficial reuse of dredged material. Targeted for completion in spring 2010, the report will be submitted to the Council for further action. The report will provide recommendations for a comprehensive approach to regional dredged material management to help resolve sediment processing issues much more efficiently than the current process of single projects seeking approvals on an individual basis.

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Bayside Shoreline Changes

The ultimate source of sediment for bay shores of barrier islands, such as Fire Island, is ocean beaches. Under natural conditions, this sediment is delivered through inlets, overwash channels and dunes. The deposits evolve into new bay beaches, marshes and tidal flats, thereby allowing barrier islands to maintain their general characteristics as they migrate landward under the influence of sea level rise. The sediment inputs occur during infrequent storms, and can result in profound short-term changes to bayside landforms and habitats that are usually interpreted as losses. Recovery after these events is slow, and decades may be required to achieve pre-storm conditions. Prevention of sediment inputs from the oceanside by using human actions to stabilize inlets and dunes allows bayside landforms and habitats to evolve without the storm perturbations, but the only source of sediment delivered to the bay beaches then becomes the landforms themselves during erosion by bay waves. Thus existing landforms and habitats are threatened by either natural conditions (during large- scale additions to the sediment budget) or human- induced changes (due to restrictions in the sediment budget). The key to retaining coastal resources is finding ways to retain or enhance the bay sediment budget in the face of limited inputs from the oceanside. Artificial beach nourishment is a common method used to provide an erosional buffer between the beach and eroding upland. Past attention has focused on protecting human infrastructure on ocean beaches, but there is increasing attention on protecting eroding natural resources on bay beaches as well. Nourishing bay beaches requires a different approach from nourishing ocean beaches. Ocean beaches should be wide to allow space for the foreshore, backshore and dune environments to form, whereas nourished bay beaches should be narrow to prevent excess sedimentation on the bay bottom and allow for the faunal interaction between the foreshore and upland that occurs naturally on these small beaches. Examples are provided of the opportunities and constraints to using beach nourishment on the bay side of Fire Island with reference to a forthcoming project at Sailors Haven. The project looks small- scale and routine on the surface, but it has major implications for environmental management and policy.

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Sediment Accumulation Rates and Short-Lived Radionuclide Inventories (^{234}Th and ^{7}Be) in Great South Bay

Naturally occurring particle- reactive radionuclides (^{234}Th, ^{7}Be and ^{210}Pb)* are useful tracers in coastal systems. Their well- characterized sources permit construction of mass balances and their strong association with particles permits them to be used to evaluate fluxes of sediment transport and redistribution. The short- lived radionuclides, ^{234}Th (half- life = 24.1 d) and ^{7}Be (half- life = 53.3) are particularly useful in studying processes that operate over seasonal time scales. ^{234}Th is produced from its parent isotope, ^{238}U**, which is a function of salinity, while ^{7}Be is added directly from the atmosphere through precipitation. 40- 70 sediment grabs were collected in the fine- sediment dominated areas in the northern part of Great South Bay in June- 2005, August- 2006 and October- 2008. The surficial subtidal sediments were analyzed for excess ^{234}Th and ^{7}Be. The mean inventories of excess ^{234}Th did not vary laterally across the Bay and were similar between cruises, ranging from 0.6 to 0.7 dpm cm^{-2}. This is consistent with the expected production of ^{234}Th in the water column, subsequent deposition, concentrated in fine- sediment dominated area of the Bay. Mean inventories of ^{7}Be in the subtidal sediments ranged from 1.2 to 3.0 dpm cm^{-2} which was 88 – 97% of the direct atmospheric flux of ^{7}Be. 9 sediment cores were taken in the Bay and the long- term accumulation rates in these cores was determined using ^{210}Pb$_{xs}$. The accumulation rates in the fine sediments ranged from 0.5 to 1.4 mm y^{-1} (mean ~ 1.1 mm y^{-1}) and the mass accumulation rates ranged from 0.04 to 0.2 g cm^{-2} y^{-1} (mean ~ 0.1 g cm^{-2} y^{-1}). The highest accumulation rates were found near the Carmans (1.4 mm y^{-1}) and Patchogue Rivers (1.9 mm y^{-1}), suggesting that these rivers may be an important source of fine sediment to the Bay.

*thorium, beryllium, lead
**uranium

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Fire Island National Seashore Biotic Resource Synthesis Report Development

The purpose of this project was to create a collective description of the park's biotic resources (plants, animals, natural communities), and associated management issues, for use in the GMP planning process at Fire Island National Seashore (FIIS). Information on the biotic resources of FIIS has been gathered from a variety of sources and summarized in a manner that is relevant, accessible, easily understandable, and transferable. For each biotic resource identified, information on the current status and significance has been provided, along with a description of any known threats to the resource, recognized gaps in information, and a list of suggested management recommendations for future consideration.

Shawn Norton
Branch Chief
Sustainable Operations and Climate Change

Energy and Climate Leadership in the National Park Service

Many national parks, due to their location and unique, protected resources, are particularly vulnerable to the impacts of climate change. When the National Park Service was established in 1916, it was given responsibility to preserve and protect the significant resources within the parks for the enjoyment of future generations. If projections of future climate change and its impacts are accurate, climate change will directly interfere with the National Park Service mission. The Park Service thus has a vested interest in helping the parks adapt to a changing climate as well as educating visitors about climate change and what they can do to help slow it.

The Climate Friendly Parks (CFP) program is collaboration between the National Park Service and the U.S. Environmental Protection Agency that provides national parks with management tools and resources to address climate change. Parks that participate in CFP inventory and mitigate their greenhouse gas emissions, educate park staff and the public about climate change, and plan ways to adapt to a changing climate.

During the past six years, the program has grown to include almost 60 member parks. Together, these parks are on the leading edge of efforts to mitigate and adapt to the impacts of climate change on federal lands. CFP focuses on three major activities: 1) developing greenhouse gas inventories and mitigation strategies; 2) educating staff, visitors, and community members; and 3) developing and implementing adaptation strategies.

Sarah Newkirk
The Nature Conservancy

Coastal Resilience: Interactive Tools for Adaptation to Sea Level Rise and Storm Hazards on Long Island, New York

Coastlines have always been dynamic, now more so than ever because of storms and sea level rise, and human and natural communities are at greater risk. The costs of these hazards to human and natural communities are also increasing with the greater investments in coastal development and the loss of natural buffers, coastal wetlands and dunes.

Despite a growing awareness of the reality of global climate change and these hazards, communities and local decision makers still have little access to the information on likely changes or tools to visualize their impacts and explore alternative scenarios. As a consequence, we are unable to integrate sea level rise and coastal hazard risk into decision- making regarding natural resource protection and land use management. The Coastal Resilience project addresses these issues and provides tools and information to better inform decision- making.

We present an interactive web mapping tool at www.coastalresilience.org that explores flooding scenarios from sea level rise and storm surge for the south shore of Long Island, New York and options for addressing these issues. The shores of Long Island are highly developed and much of this private property is only inches above sea level, placing millions of dollars in public and private funds at risk. The future scenarios are mapped with information on ecological, biological, socioeconomic and management considerations. The scenarios are all developed from widely accepted climate and hazard models, and the information is presented in an easy to use framework. The project incorporates a suite of alternative future scenarios to help decision makers keep the environment and public safety in mind as sea levels rise and coastal hazards increase. The aim of the project is to provide tools to communities for their planning, zoning, acquisition and permitting decisions so that they can meet multiple management objectives while minimizing adverse impacts to human and natural communities.

The project also addresses the need for examples to inform the development of ecosystem- based management. A core aim of ecosystem- based management is to better address multiple management objectives jointly. Single sector management in which agencies address individual objectives separately (e.g., conservation or hazard mitigation) has led to management that is not efficient or effective. Through multi-objective approaches, particularly with coastal hazards and conservation, we can realize new win- win solutions. There will be trade- offs as well, but through better decision support we can maximize opportunities to meet each objective while minimizing adverse impacts across multiple objectives. This works extends and applies the tools illustrated in a toolkit recently launched by partners at *www.marineebm.org*.

The Coastal Resilience project is a collaboration between agencies, academics and non-profits and each partner has provided components that are illustrated on the interactive tool. The Nature Conservancy is working locally and globally to inform adaptation to climate change and to develop approaches to meet multiple management objectives jointly. The Center for Climate Systems Research at Columbia University and NASA Goddard Institute for Space Studies has developed sea level rise projections from state of the art global climate models to help communities visualize the impacts of rising waters on coastal resources. The existing legal and regulatory tools are sometimes adequate to protect natural resources from these forces, but they are neither elegant nor efficient.

The Pace Land Use Law Center has reviewed and evaluated the existing land use and legal tools to protect wetland, beach, bluff and dune habitats, and recommended approaches. The National Oceanic and Atmospheric Administration's Coastal Services Center has provided data and expertise in hazards and decision support tool development. The Association of State Floodplain Managers is a non- profit organization that represents the flood hazard specialists of local, state and federal government. Their mission is to promote education, policies, and activities that mitigate current and future losses, costs, and human suffering caused by flooding, and to protect the natural and beneficial functions of floodplains - all without causing adverse impacts.

Norbert Psuty
Tanya M. Sliveira
Rutgers University – The State University of New Jersey

Human Interaction with the Coastal Geomorphology of Fire Island

The scale and variety of natural processes and cultural modifications have created the existing features present on Fire Island. Human activities and their interaction with the ambient coastal geomorphology is a complex issue occurring at a variety of spatial and temporal scales that require a broad perspective to be appreciated and managed. As part of the preparation for a new General Management Plan to guide the Fire Island National Seashore, a report (available at: http://www.nps.gov/nero/science/FINAL/finalreps.htm) was produced focusing on the human activities affecting the coastal foredune. The foredune is a primary locus of human interface with the natural system and it is the site of the greatest opportunity to influence the degree of intervention of processes and to maintain the integrity of the barrier island system.

Under the present scenario of an increasing rate of worldwide sea- level rise, a continuation of the human modification of the evolving coastal system may likewise follow as a means to adapt to aspects of global climate change. As the barrier island responds via an inland displacement of the shoreline and the foredune migrates, static features such as houses and other elements of infrastructure will be increasingly exposed to the ambient winds, waves, and currents. It is likely that human actions to enhance the foredune as it shifts position will have the greatest positive impact in retaining the geomorphological characteristics of the island that function as a barrier to storm surge penetration and to keeping sand in the seaward portion of the island. Human actions that support the retention of the foredune mass and dimensions, such as the restoration of dune- forming processes and the rhizome rule, provide the greatest opportunity to combine maintenance of the natural system dynamics with protection of the development inland of the foredune.

Meredith Kratzmann
Department of Geosciences, University of Rhode Island, Kingston, RI

Cheryl Hapke
U.S. Geological Survey, Woods Hole Science Center, Woods Hole, MA

Impacts of Beach Scraping and Human Modifications to the Coastal System, Fire Island National Seashore

Anthropogenic influences including beach scraping, nourishment, and the presence of developed communities have altered the morphology of the dune/beach system at Fire Island National Seashore, New York. Understanding human- induced impacts is essential to effective management and preservation of natural resources in the park. In order to assess the extent of anthropogenic influence, volume change, shoreline change, and changes to beach profile characteristics were analyzed at two study sites. The study sites contain both developed and undeveloped areas, and scraped and non-scraped areas. Lidar, RTK GPS, and existing beach profile datasets were utilized to assess morphological change at the individual community scale (<1 km) and at a larger scales (1- 4 km) that include natural areas. In the eastern of the two study sites, the majority of the area backed by development was experiencing shoreline erosion and volumetric loss on a decadal time scale. The community- scale beach profile analysis shows distinct morphological differences in scraped areas relative to non- scraped areas of the beach. In general, scraped areas where shoreline erosion rates are highest also have lower dune elevations, resulting in higher risk of overwash during storm events. In more volumetrically stable areas, rapid mobilization of material from the artificial dunes results in increased beach accretion downcoast. Because natural park lands are immediately adjacent to modified areas, even small human- induced changes can impact park resources and beach/dune response to storms. Understanding the extent of anthropogenic influence is essential to effective management and preservation of coastal resources within Fire Island National Seashore.

Ellen Carlson
Community Planner/ Project Manager, NPS/ Northeast Region

Fire Island National Seashore's General Management Plan

In 2006, Fire Island National Seashore began a multi- year effort to develop an up- to-date general management plan. The project team has worked with a wide range of park stakeholders to explore a number of important planning questions and to consider a wide range of ideas and possible solutions in order to develop a range of feasible alternatives for Fire Island National Seashore. This presentation will provide an update on the planning process, describe the preliminary alternatives proposed for the park, and talk about the next steps in the planning process.

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Inner Shelf Morphologic Controls on Patterns of Shoreline Change: Fire Island, New York

The inner shelf off Fire Island, New York has a well- defined ridge- and- trough topography. The ridges are comprised of Holocene sand overlying a ravinement surface. Variable geomorphology of the barrier island and imbalances in the regional sediment budget suggest that some material from the sand ridges supplies the beaches along western Fire Island. The mechanism of exchange is unknown and understanding has been limited by a lack of: 1) nearshore bathymetry to establish that the ridges connect to the shoreface, 2) an understanding of the nearshore bar dynamics, and 3) a detailed analyses of shoreline change patterns and how they relate to the inner shelf morphology.

Single- beam bathymetric data were collected in the nearshore off Fire Island in 2007 and 2009. These surveys provide the first continuous bathymetric data for the 2- 12 m water depth range at Fire Island. Multibeam data extending from 12 to 24 m water depth were also collected in 2009, overlapping with the single- beam data. The resulting bathymetric surface indicates that the inner- shelf ridges and troughs are continuous into the nearshore and appear to be connected to the bar system. Comparisons of the repeated single- beam surveys show that the locations of the ridge and trough axes do not appear to change in the short- term (2007 to 2009). The fixed nature of the nearshore morphology is further supported by time series camera data collected in the winters of 2007 and 2008 that indicate persistent bars with breaks that re- form in the same locations. Additionally, long- term (~70- yr) shoreline change analyses suggest that the inner shelf morphology is exerting control on the behavior of the beach. Distinct zones of erosion and accretion are pervasive over time scales greater than a half- century, and their length- scales are similar to the spacing of the offshore ridge- trough system.

We propose that the evidence from the nearshore bathymetry that the ridges and troughs connect to the shoreface, coupled with the complex but consistent bar morphology and persistent shoreline change patterns demonstrate that there is a feedback occurring between the regional geologic framework and modern processes. The first- order framework is responsible for the existence and locations of the ridges and troughs, which then influence the morphodynamics of the beach and bar system.

Norbert P. Psuty
Tanya M. Silveira
Rutgers University – The State University of New Jersey

Trend in Foredune Crestline Displacement, Fire Island National Seashore, 1976-2005

The foredune crestline is a geomorphological feature that shifts in response to sediment budget. Its position in the beach- dune profile is much more conservative than the variation in shoreline position or any other element in the response signature. A comparison of foredune crestline position covering a span of 29 years reveals spatial variation in response, tied to the alongshore transport mechanisms as well as evolutionary development of foredune features. The mean response of the entire Fire Island foredune is an inland displacement of 13.1 m. However, discounting the area affected by the large jetties at Moriches Inlet, the mean inland displacement is 17.2 m. The 17 developed communities on the island had inland displacements ranging from 9.3 m to 21.7 m, whereas the natural areas had a mean inland displacement of 18.8 m. The spatial distribution of the displacements is related to the alongshore sediment supply and the effects of human alterations of the topography. Major deviations from the mean occur near Moriches Inlet (+49 m), at Cherry Grove, (+26 m), and a few other places. In both the natural and developed portions of the island, dune- forming processes are maintaining the foredune characteristics and dimensions while shifting inland.

Patricia Bowie
NOAA, intern with NYS-DOS Community Resilience

Post-storm Redevelopment Planning and Community Resilience

Fire Island is part of a chain of long, narrow, and partially developed barrier islands located off the south shore of Nassau and Suffolk Counties in New York. Barrier islands are valuable natural land forms that provide recreational areas, critical habitats for certain species, and protection to the mainland and estuarine ecosystems from direct exposure to the open ocean. Socially and economically valuable investments are located on barrier islands, including homes, businesses, transportation, utilities and public recreation facilities. Much of the ecological value of the barriers and their ability to persist depends on natural sediment processes and morphological changes that are destructive to static structures. Post- storm redevelopment plans offer an opportunity to adapt structural development on barrier islands over the course of time to help reduce damages to social, economic, and environmental assets from subsequent coastal storms and sea level rise.

Post- storm redevelopment planning aims to enhance community resilience by redirecting development in sustainable pathways. A resilient community is one in which social, economic and environmental systems function compatibly in the environment, with minimal external assistance necessary to resume functioning after predictable natural disturbances.

Coastal communities at risk of storm and erosion damage must evaluate their vulnerability using accurate, detailed land use data and realistic impact assessments to determine the need for adaptive measures to reduce losses to life and property and restore natural resources which humans depend upon. In addition, by documenting the full extent of damages experienced and the cost of damage prevention or response over time, including the loss or disruption of normal services as well as physical damage to development and infrastructure, communities can gauge the effectiveness of coastal hazard management in terms of improved resilience as a result of implementing a post- storm redevelopment plan.

H. Brian Underwood
SUNY College of Environmental Science & Forestry and USGS, Patuxent

Status of PZP Treated Deer Populations in Western Fire Island Communities

For over 30 years, Fire Island has been witness to a full- blown white- tailed deer eruption, including all attendant issues and concerns with having a highly abundant and visible deer population. Early experience with aerial counts of deer let biologists to recognize the need for reliable counts of deer from within the Communities of western and middle Fire Island. In 1995, a method to estimate the abundance and herd composition of deer within island Communities was deployed. At first, counts were focused on areas where porcine zona pellucida (PZP) fertility control was being applied to deer. Later, counts were expanded to include other areas important to the management of the National Seashore. Now, after 15 years of ground counts of deer, some trends are apparent. In areas with very good access to deer and the longest PZP-treatment histories, deer abundance had declined to about 50% of its initial level. In other areas, the affect of fertility control has been less dramatic or inconclusive. These analyses and others will be used in a comprehensive fertility control program review. Implications of these counts to a broader understanding deer issues island- wide will be discussed.

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Herpetofauna of Fire Island and William Floyd Estate – 20th Century Changes and Future Prospects

We inventoried amphibians and reptiles on Fire Island in 2002- 2003 and the William Floyd Estate (WFE) in 2002 using 7 sampling methods; anuran calling survey, visual encounters, coverboards, turtle traps, minnow traps, drift fencing, and incidental encounters. We recorded 12 species on Fire Island: 2 migrant and 10 resident. The 10 residents represent 90% (9/10) of the species historically present, plus a recent introduction, American bullfrog. These 12 species include 2 anurans (frogs and toads), 7 turtles, and 3 snakes. Fowler's toad, snapping turtle, and black racer were the most abundant and widespread species in each group. At WFE, 11 species, 46% (11/24) of the historic species, were recorded. These included 1 anuran, 2 salamanders, 4 turtles, and 4 snakes. Spring peeper, red-backed salamander, eastern box turtle, and eastern gartersnake were the most abundant and widespread species in each group.

Both sites have experienced decline and extirpation of species. On Fire Island, 5 of 10 species have declined, including the once abundant Southern leopard frog (extirpated), and hog- nosed snake, (extremely rare). At WFE, changes have been more dramatic, with 15 of 24 species declining. Of the 15 declining species, 11 appear extirpated: 7 of 8 anurans; 3 snake species that feed on anurans; and the eastern mud turtle. The remaining four are: status uncertain (eastern spadefoot toad, spotted turtle); rare (painted turtle); or uncommon (black racer). Exact causes for the decline and extirpation of many species are not certain, but WFE has been subjected to DDT application and dumping, salt water intrusion following the natural creation but artificial maintenance of Moriches Inlet, and urbanization of the adjacent landscape. These, plus less well documented stressors, such as acid precipitation, mercury deposition, and diseases have all likely contributed. The relatively small patch size of WFE (613 acres) may also be an important factor. The nearby Carmans River system, with over 4000 acres of similar habitat preserved

along 6.6 miles of river has not experienced a similar loss of species. Fire Island has been subjected to similar stressors as WFE, although the extent and intensity has generally not been as severe.

In spite of this past, Fire Island is important for preserving regional herpetofaunal diversity, particularly reptiles, with four of the resident species state *Endangered* or *Special Concern*. Because many of the stressors negatively impacting them regionally (e.g. road kill and habitat fragmentation) are comparatively minor on Fire Island, populations are relatively well protected. Fire Island is one of only six sites in New York where the NY *Endangered* mud turtle occurs. WFE is an isolated, moderate- sized habitat island in an urbanized landscape. It is capable of supporting species with modest area requirements, but its ability to support species with large area and complex habitat needs is uncertain. Data collected in this survey suggest that recruitment into the historic box turtle population is declining and estimated population size and density was relatively low. Further study of WFE's box turtle population is needed to better estimate population size and structure and take advantage of long term historic data to estimate survival trends. Recovery of local marine biota suggests that regional DDT levels are abating. As this continues, restoring some of the extirpated species at these two sites should be evaluated and undertaken as feasible, to restore the original community structure, function, and species richness.

Jordan Raphael & Lindsay Ries
National Park Service, Fire Island National Seashore, Division of Natural Resources Management

Resource Management at Fire Island National Seashore: Current Monitoring Programs

Fire Island National Seashore (FIIS) staff is currently involved in several long- term monitoring programs and research projects. The major programs/projects include the Threatened and Endangered (T&E) Species Program, White- tailed Deer Fertility Control Research Project, Mosquito Disease Surveillance and Monitoring Program, Invasive Plant Inventory and Control Program and a new Rapid Assessment Vegetation Monitoring Program. The Division of Natural Resource Management (NRM) at FIIS currently has 3 permanent full- time positions on staff and several full-time temporary seasonal employees and interns throughout the spring and summer season. In addition, NRM staff works with all park divisions, National Park Service (NPS) Regional offices, cooperative partners, academic institutions and NPS volunteers to accomplish monitoring and management of natural resources throughout FIIS.

Peg Hart
Seabird Ecological
Assessment Network

What is SEANET and Why Fire Island?

Seabirds are unique indicators of ecosystem health and change in the coastal marine environment. Scientific and volunteer- based seabird surveys have been ongoing for many years in the Pacific United States, Canada and Europe. In the Fall of 2002, to address the significant need for increased monitoring on the east coast, the Seabird Ecological Assessment Network (SEANET) was initiated by the Tufts Center for Conservation Medicine in collaboration with the Lloyd Center for Environmental Studies in Massachusetts.

The Seabird Ecological Assessment Network (SEANET) brings together scientists and concerned citizens in a long- term collaborative effort to identify and mitigate threats to marine birds on the Northeast Atlantic seaboard. SEANET scientists train volunteers to monitor and document seabird mortality on local area beaches and collaborate with local agencies to develop baseline data to detect patterns in disease outbreaks, oil spills, contaminants and algal toxins. Local SEANET coordinators work closely with project staff at Tufts Cummings School of Veterinary Medicine in North Grafton, Massachusetts. Through this synergistic relationship between we greatly increase the resolution, quality and quantity of data gathered while engaging the public in marine wildlife research and conservation.

Fire Island National Seashore (FINS) is an important geographic location providing essential marine habitat for resident, migrating and overwintering populations of marine birds and fish. The introduction of the SEANET program at FINS will help further develop the growing network of conservation partners between local, state, federal agencies and concerned citizens throughout Long Island, and will generate key data on seabird science, mortality and ocean health in our region.

Drew Panko
Fire Island Raptor
Enumerators (FIRE)

Trends in Raptor Migrations based on Hawk Watch Data from Fire Island?

The Fire Island Raptor Enumerators have been documenting the fall passage of raptors along the barrier beach since 1983. The inferred population trends from these counts will be presented and compared to trends observed at other North American watch sites. Additional information will be given about the passage of raptors most unique to the barrier beach, particularly the falcons.

Fire Island Raptor Enumerators (FIRE) web site at www.battaly.com/fire/ includes extensive data.

Abstracts of Posters

Daniel Gilrein
Extension Entomologist, Cornell Cooperative Extension of Suffolk County

Susan Walker
Dept. of Natural Resources, Cornell University

The New York 4-Poster Deer and Tick Study

The 4- Poster, a deer- feeding station designed to control ticks that utilize deer as a key host, is being evaluated since late 2007 on Shelter Island and Fire Island to help inform a registration determination in New York State for the technology, which includes permethrin- based Tickicide. As the deer feed on corn bait at the station, treated rollers apply Tickicide to the neck, head, and ears. In studies done elsewhere, when deployed over several years the device has provided good control of lone star and blacklegged (deer) ticks; both species are common around eastern Long Island and on Fire Island. The New York study is being conducted to answer several questions:

- Human and wildlife- associated risks due to change in deer movement and behavior, including:
  - potential impact on vegetation
  - possible increase in deer road crossings/vehicle collisions
  - increased contact and potential disease transmission between deer
  - changes in deer mortality due to feeding or reduced tick pressure
  - use of feeding stations by non- target wildlife

- Possible increased human exposure to permethrin via handling and consuming treated deer.

- Efficacy of the 4- Poster system in controlling tick densities

Karl F. Nordstrom
Institute of Marine and Coastal Sciences, Rutgers University

Nancy L. Jackson
Dipanjali Chavan
Department of Chemistry and Environmental Science, New Jersey Institute of Technology

Nicole A. Raineault
Department of Geological Sciences, University of Delaware

Patricia Rafferty
National Park Service, Northeast Region

Effects of Bulkheads on the Bay Shore of Fire Island National Seashore

Bayside bulkheads on Great South Bay, New York at Fire Island National Seashore were evaluated to determine their impact on unprotected areas adjacent to them and to identify alternatives for future protection from coastal erosion. Bulkheads extend along about 18% of the 67.3 km- long shoreline. A 13- day instrumented field study of the effects of a bulkhead on beach change conducted east of Cherry Grove revealed that although changes in beach volume were minimal (<1 m^3 m^{-1} per day alongshore), relatively high rates of horizontal beach displacement (>1.0 m per day) occurred due to limited amounts of sediment in the beach matrix. Annual topographic surveys conducted 2004- 2008 at four bulkheads and two control sites reveal that annual retreat can be as great as 3.3 m yr^{-1} in the upland and 6 m yr^{-1} on the foreshore. Local bulkhead- influenced sand starvation appears to extend up to 68 m alongshore. Sand starvation due to bulkheads is only one aspect of the erosion problem. Lack of fresh inputs of sediment to the bayshore by inlets, overwash and dune migration all contribute to shoreline transgression. The inherent dynamism of natural systems and the adaptation of species to this dynamism prevent restoration of landforms or habitats to stable target states. The closest approximation of a "permanent" solution would be to restore the sediment budget by creating feeder uplands by placing fill sediment at about the height of local natural formations and close to bulkhead ends.

Kirsten M. Leong,
Daniel J. Decker,
and William F.
Siemer

Deer, People, and Parks
Perspectives of Residents in Communities Near Fire Island National Seashore

White- tailed deer *(Odocoileus virginianus)* have been a major concern in units of the National Park Service (NPS) in the northeastern U.S. for over two decades. In 2007, a mail survey was conducted to describe and understand the views of residents living near Fire Island National Seashore (FINS) with respect to deer issues. In addition, NPS staff were asked to respond to a subset of survey questions. While a majority of residents believed NPS should be managing deer impacts, substantial differences between manager and community responses to survey questions indicate a need for dialogue to assist parties in better understanding each other's perspectives. This type of audience research can assist managers in identifying areas in need of further clarification or input, which may vary for different segments of the public.

Brian McDonnell

The Northeast Exotic Plant Management Team Control Efforts at Fire Island National Seashore

The National Park Service's Northeast Exotic Plant Management Team (NE EPMT) was formed in 2003, and serves 23 parks in the Northeast Region. The team provides direct service, advice and consultation, and training needs to its partner parks, other agencies and the public. The NE EPMT has been assisting Fire Island NS with exotic plant management since 2007. The team has provided training, performed inventory, and continues to manage infestations of several exotic plants at the Otis Pike Wilderness Area and the William Floyd Estate areas of the seashore. Species of particular interest include Japanese black pine, black locust, autumn olive, sericea lespedeza, Japanese barberry and multiflora rose. Japanese sand sedge is a potential threat, and monitoring for it should be an early detection priority.

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Genetic Diversity and Gene Flow in *Zostera marina* Populations in Great South Bay, New York

The dominant species of seagrass in NY, *Zostera marina*, has experienced several historical bottlenecks and is currently under heavy stress due to water quality and other anthropogenic problems. The consequences of these events on the genetic structure of the remaining populations are unknown. This project addressed questions regarding the genetic diversity of extant populations, and whether understanding the population genetics would aid current conservation and restoration efforts. Plant morphometrics and genetic samples of *Zostera marina* were collected at sites across Great South Bay. Each individual was genotyped at 8 different microsatellite loci. Analysis of microsatellite alleles was used to examine the population structure and gene flow between meadows within the bay. Comparisons of genetic characteristics between populations to plant morphometrics, sediment parameters and water quality data were conducted. The importance of understanding the genetic diversity of extant eelgrass populations in NY will be discussed.

Patti Rafferty
National Park Service, Northeast Region

Mary-Jane James-Pirri
Graduate School of Oceanography, University of Rhode Island

Understanding Horseshoe Crab Population Dynamics in New York and New Jersey National Parks With the Assistance of Citizen Scientists

The American Horseshoe crab (*Limulus polyphemus*) is an important component of the marine ecosystem. They are predators within the marine benthic community, are preyed upon by loggerhead sea turtles and sharks, and their eggs provide a critical nutritional resource for migrating shorebirds. The horseshoe crab is also a valuable socio- economic species. It is harvested by commercial fisherman for use as bait in the eel and conch (whelk) fishery and the biomedical industry uses it to produce a critical pharmaceutical product. Coastal National Parks in the New York and New Jersey area all have beaches where horseshoe crabs spawn; however, little is known about the spawning population dynamics in terms of spawning densities, spawning sex ratios, or egg densities at these beaches. Furthermore, it is not known if horseshoe crabs that spawn within these Parks move to other locations (e.g., across Great South Bay or across Long Island Sound) or if they remain relatively localized. In 2011, horseshoe crab monitoring and tagging will begin at Fire Island National Seashore, Sagamore Hill National Historic Site and Gateway National Recreation Area to provide information on the regional horseshoe crab population that is essential for the conservation and management of this species. The goal of this project is to develop a long- term citizen- based horseshoe crab monitoring program within each Park.

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Weathering Climate Change and Managing Invasive Species in Urban Forests of Long Island, NY

Climate change effects will inevitably alter the composition and functioning of our terrestrial landscapes. Conservation strategies to help these ecosystems best transition are still being developed and debated. Creating refugia is one adaptation approach to manage for biodiversity, theoretically resulting in greater ecosystem resilience to recover from anticipated climate disturbances. Developing and implementing Invasive Species Prevention Zones (ISPZs) puts the concept of refugia into practice. An ISPZ is a formal designation for a natural area that is dominated by native species and is known to support exceptional biodiversity concentrations. By delineating ISPZs, land managers can maximize limited staff, equipment and funding resources by focusing on sites that are relatively free of invasive species, have high ecological value, and thus are most likely to yield results. For a site to be formally designated as an ISPZ, invasive species are mapped, management efforts are prioritized, and a site- specific, integrated invasive species management plan is written. Prevention, 'early detection' of new invaders and a 'rapid response' to their discovery are the main focuses of the management plan and subsequent eradication efforts. Prevention activities are commonly accepted to be the most effective and efficient (for both cost and effort) for invasive species management. As of 2010, over 11,000 acres of ISPZs have been designated on Long Island and an additional 22,000 acres are planned. Although each ISPZ may be relatively small in size, because ISPZs are widely distributed and use standardized methods cooperative, coordinated management of on a much larger scale becomes possible.

Ashley Norton &
Michael Slattery
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Rip Current Characteristics at the Fire Island Seashore

More than 1000 hours of video images were analyzed to characterize rip- current occurrence along a stretch of coast 280m long was monitored at the Fire Island Lighthouse on Fire Island, New York. Rip currents appeared about 0.2% of the time corresponding to frequency 3.4 rip currents per day per kilometer of shoreline. Most were seen at a preferred location near the west end of the viewing area. These were classified as flash rip currents. The average duration was less than a minute. The most persistent rip current did not last more than four minutes. These events do not last long enough to substantially alter the near shore morphology although they still pose a risk to swimmers unfortunate enough to encounter them.

Dr. John Tanacredi
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5-Year Inventory Trend of Limulus Populations On Long Island: From Anecdote to Annual Survey, 2004-2009

Considerable concern regarding the abundance of American Horseshoe Crab (HSC) *Limulus polyphemus* along the coasts of New Jersey and Delaware prompted past moratoriums on collecting HSC for bait in New Jersey. The parallel population decline in migratory shorebirds such as Red Knots (*Calidris canutus*), Ruddy Turnstones (*Arenaria interpres*) and others that seasonally feed on the copious quantities of HSC eggs laid along this shoreline resulted in reduced HSC collection permits to numbers considered sustainable. In New York State's Marine District, which is mostly comprised of the Long Island coastline, there is no reliable or routine inventory network existing for determining HSC populations. Shorebird data, which has been collected by Audubon Chapters, the National Park Service and the U.S. Fish and Wildlife Service, as well as academia, have hinted at declining HSC population. However, due to the lack of formal and extensive or reliable inventory network, assessing changing trends in HSC population levels is unattainable or mostly inaccurate. Anecdotal information from these same sources, as well as coastal enthusiasts and recreationalists providing support for a declining population of HSC in the metropolitan New York City area, however were unreliable and inaccurate. Dowling College's Long Island HSC Network provides a hot- line telephone number, survey forms and website to (1) collect data on Long Island sites which support HSC [all GPS'ed for repeated sampling]; (2) count HSC for as reliable an estimate of the HSC population as practical; (3) sex and age of individual HSC at each site; and, most importantly (4) to establish a network that can be repeated annually to detect precipitous changes in HSC population numbers and distributions. Data collection for HSC will aid in protecting the HSC population as well as bird species which require HSC eggs as food during significant migratory periods.

Results of the last five years for 61 sites monitored annually, reveal (1) considerable reduced number of HSC than "remembered in the past"; (2) sites along the Long Island coastline now believed to support HSC have been found to have few to modest numbers of HSC; and, (3) a very preliminary number projection of Limulus on Long Island at approximately 15,000 adult breeding individuals on the beaches surveyed, and (4) of the 61 beaches monitored since 2002, an increase of 22.5% has been observed for the number of beaches exhibiting "no breeding activity."

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Restoring Bayside Sediment Transport Processes at Fire Island National Seashore

Fire Island National Seashore will construct a feeder beach along a segment of Great South Bay adjacent to the Sailors Haven marina to restore bayside sediment transport processes that are affected by dredging and shoreline armoring. With no paved roads or public driving, the marina provides visitor access via concessionaire ferry service and private boats; however, erosion adjacent to the marina is threatening the Sunken Forest, an old- growth maritime holly forest. The feeder beach will be constructed as a demonstration project to evaluate its feasibility in reducing erosion caused by shoreline armoring and dredging while ensuring that it does not (1) create an intervening environment between the active beach and upland (2) result in excessive sedimentation offshore; or (3) result in sediment being re- deposited back in the navigation channel. Semi- annual topographic surveys will be gathered before, during and after placement of the fill to reveal how the shore evolves through time. A process explanation will be provided in a 28- day instrumented time series study, using sand traps and dyed sand tracer to determine rates and pathways of sediment transport. Ecological effects will be evaluated by monitoring nekton, invertebrates and water quality. Project results will identify how much fill is needed, whether the volume and frequency of emplacement is related to dredging needs, and whether feeder beaches can be used in other locations along the bay shore.

Robert Grover
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Smith Point County Park Beach Nourishment

Moriches Inlet is an artificially stabilized tidal inlet that serves as a partial littoral barrier to the eastward transport of sediment. There is an efficient shoal bypass system to transport sand across the mouth of the inlet, but the enormous ebb tidal delta alters the local wave climate to trap the bypassed sediment at the eastern end of Fire Island. This process causes a chronic sediment deficit on the portion of the barrier island occupied by Smith Point County Park. In 2008- 2009 Suffolk County retained Greenman- Pedersen, Inc. to design a project to dredge Moriches Inlet and place the resulting sand on the beaches further west, beyond the significant influence of Moriches Inlet, thus facilitating an effective sediment bypassing event.

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Summary of Environmental Monitoring Following Beach Nourishment within Fire Island Communities

Eleven Fire Island communities conducted beach nourishment in the winter and spring of 2009. Four nourishment reaches were constructed: (1) Western Fire Island, including Saltaire, Fair Harbor, Dunewood, and Lonelyville; (2) Central Fire Island, including Fire Island Summer Club, Corneille Estates, Ocean Beach, Seaview, and Ocean Bay Park; (3) Fire Island Pines; and (4) Davis Park.

Post construction environmental monitoring is now being conducted to catalog the flora and fauna inhabiting the beaches following nourishment. Data collected in 2009 was compared with pre- construction monitoring data taken in 2008, to assess the impacts of beach nourishment on shorebirds, vegetation, and beach invertebrates.

Prior to beach nourishment, there were no piping plover or least tern nests within the communities. Following nourishment in 2009, there were a total of five piping plover nests recorded within three nourished communities. A total of 19 eggs were laid, 15 chicks hatched, and 2 chicks fledged. There were also 19 least tern nests observed in two communities. A total of 31 eggs were laid, 25 chicks were observed, and 21 chicks fledged.

Vegetation data was compared across nourishment and control sites to determine if there was a noticeable difference due to nourishment or some other factor. There was no apparent difference in species diversity among the nourishment and control sites, with anywhere from one to five species observed at each transect. Areas that had an established beach and dune system prior to nourishment exhibited a decrease in American beach grass counts in 2009 when compared to 2008 pre- construction counts. Areas that had severe erosion with no vegetation prior to nourishment showed a recovery of vegetation following nourishment.

Invertebrate samples were compared graphically to determine if there were any apparent differences between sample dates of October 2008 (pre- construction), June 2009, and October 2009; and to determine if there were differences between sample locations. As expected, the number of organisms was low for nourished sites in June 2009, but high for control sites. Core samples showed the start of recovery of nourished sites in October 2009, with an abundance of amphipods in Fire Island Pines. Pitfall data revealed the lack of a time of year or nourishment trend. Organism counts in pitfall samples were lower in June 2009 for the nourishment communities where dunes were created. Where dunes were already established, organism counts in pitfall samples were actually higher in June; this trend was not observed in control sites, which had lower organism counts in June. There is no apparent seasonal trend in species composition; Diptera and Homptera peaked at various seasons for various sites, including controls.

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Fire Island Lighthouse Preservation Society

Friends of Watch Hill

Friends of Fire Island National Seashore

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