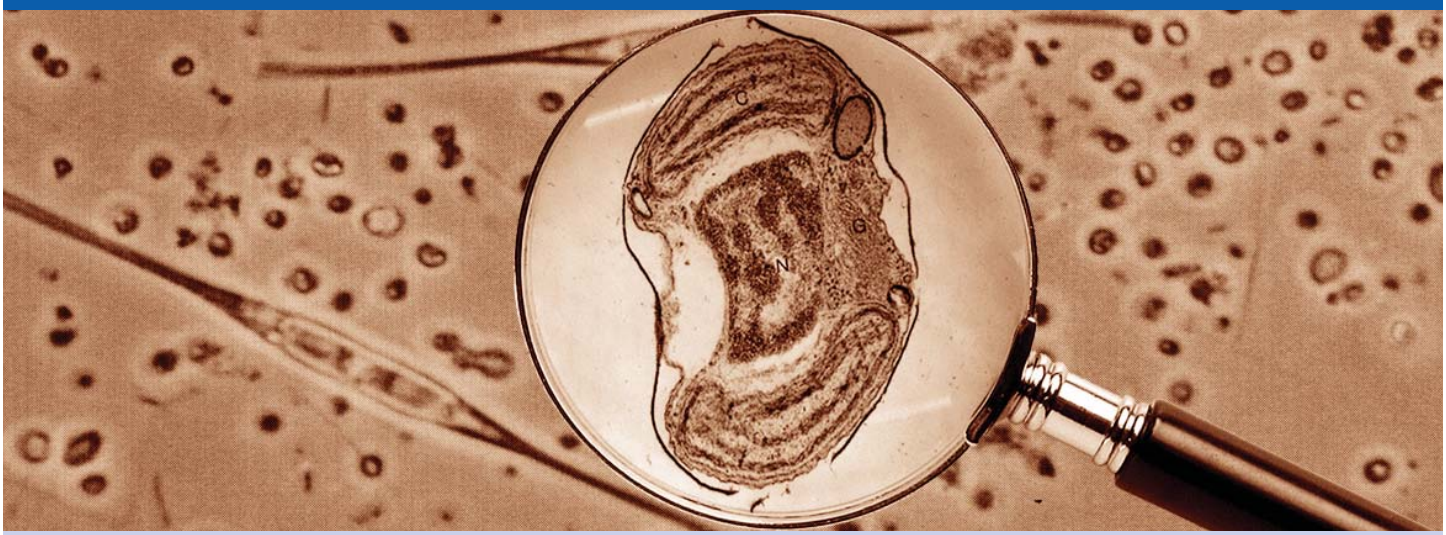
OUTCOME 6: IMPROVED KNOWLEDGE FOR ECOSYSTEM MANAGEMENT



Development of the Reserve CMP resulted in the identification of gaps in current knowledge of the Reserve. Filling these information gaps is critical to improved management of the estuary. As CMP recommendations have been implemented, key partnerships have been established to learn more about the Reserve through scientific research and monitoring.

Monitoring Water Quality

Water quality monitoring is necessary to establish baseline data, assess water quality trends, and analyze current water quality or ecological issues. Expansion of government, non-profit organization, and volunteer monitoring programs is a vital step in addressing water quality impairments. Reserve partners have implemented programs to monitor water quality in the bays and tributaries of the Reserve as follows:

- As part of its Vital Signs program, Fire Island National Seashore (FINS) is implementing two programs to monitor long-term trends in estuarine eutrophication and nutrient loading.
- The United States Geological Survey (USGS) conducted water quality monitoring in the Reserve through the NY Climate Response Network and NY WaterWatch. Ongoing efforts include monitoring chemical parameters at Reynolds Channel in Point Lookout in cooperation with NYS Department of Environmental Conservation (DEC) and the Town of Hempstead.
- The NYS DEC conducted routine water quality monitoring for fecal coliform at shellfishing sites. NYS DEC also conducted a routine intensive basin study on Long Island, which included biological screening (2003) and water chemistry sampling (2004) of freshwater streams on the south shore.
- As a component of its stormwater management plan, Nassau County initiated a surface water sampling program that is being implemented along select south shore streams and ponds. The sampling program will screen for illicit discharges, prioritize areas for further study, create a baseline to document the performance of various best management practices, and collect data for use in the County's annual stormwater management plan progress report.
- Suffolk County has monitored water quality in the Reserve since 1976 and has developed a comprehensive water quality database. In addition to routine monitoring, special studies were performed in response to problems, complaints, or requests for information.

- Suffolk County identified eutrophic conditions in the Forge River in 2005 and initiated a comprehensive water quality monitoring program to determine the causes of algal blooms and fish kills.

- The Town of Hempstead maintains a water quality testing laboratory where it tested water samples from over 30 sites in the estuary for bacteria and various chemical parameters for its shellfish certification and production programs. The Town also tested for bacteria at swimming beaches to determine closures.

- Peconic Baykeeper organized and trained a group of volunteers to monitor water quality in the Forge River. Information generated will serve as important baseline data for watershed planning.

- The Nature Conservancy (TNC) monitored water parameters in Great South Bay in association with shellfish research. It has also formed a subgroup of the Bluepoints Bottomlands Council to research funding opportunities for preparation of a report on historical and current nutrient loading in Great South Bay.

- The Art Flick Chapter of Trout Unlimited has partnered with Syracuse University, the NYS Department of State (DOS), and USGS to monitor water quality in the Carmans River watershed. The information will be used to help manage future development in the watershed.

- Dowling College Department of Earth and Marine Sciences conducted a water quality monitoring program at Fire Island National Seashore to monitor water quality of Great South Bay within the boundaries of FINS.

BROWN TIDE RESEARCH INITIATIVE

Algal blooms known as brown tides are formed by the phytoplankton *Aureococcus anophagefferens*. These blooms cause a marked decline in the feeding response of shellfish and reduce light penetration through the water column, limiting the growth of submerged aquatic vegetation (SAV). Since 1985, Long Island's south shore bays and other Atlantic coast estuaries have experienced intermittent brown tides.

The Brown Tide Research Initiative (BTRI) began in 1996 as a partnership between New York Sea Grant (NYSG) and the National Oceanic and Atmospheric Administration (NOAA) Coastal Ocean Program (now the Center for Sponsored Coastal Ocean Research). Since that time, the BTRI has coordinated and advanced research about the causes of brown tide blooms in the South Shore Estuary and other Long Island estuaries, and investigated strategies for more effective management of shellfish, finfish, and SAV impacted by brown tide. A steering committee comprised of representatives of NYSG, NOAA, NYS agencies, Suffolk County, the Peconic Estuary Program, the Reserve Council, and citizens has guided this research. BTRI results have advanced new research directions and influenced state and local policy.

Researchers prepare to collect brown tide data

From 2001 to 2005, BTRI efforts focused on synthesizing research results and presenting findings to inform estuary managers and the public. BTRI research and findings have greatly expanded scientific knowledge of the estuary's ecosystem and established a foundation for future scientific research projects consistent with implementation actions called for in the Reserve CMP.

- Students of Dr. Lori Zaikowski, Chair of the Dowling College Chemistry Department, participated in the Chemistry in Action program, in which they monitored dissolved oxygen, various nutrients, and benthic invertebrate organisms in Reserve tributaries.

Additional Water Quality Research

- USGS is analyzing the shallow groundwater flow at FINS. USGS and the National Park Service have begun a comprehensive data collection and modeling program.

Additional water quality research is needed to determine the causes of impairments in Reserve tributaries and bays.

- NYS DOS and SUNY School of Environmental Science and Forestry have partnered on a pilot project to develop a dynamic nonpoint source pollution model for the Carmans River watershed.

- Cornell Cooperative Extension has developed a method for using DNA technology to identify species-specific sources of coliform bacteria found in water samples, which will be used to test for human-source bacteria in Suffolk County stormwater discharge pipes as part of an illicit discharge detection and elimination monitoring program.

- New York Sea Grant (NYSG) is nearing completion of a study that used molecular methodologies to identify sources of fecal coliform bacteria based on genetic differences between animal species or groups. The study may be used to establish and validate clonal bacterial libraries to aid in targeting best management practices based on actual sources of water quality contamination.

- Suffolk County completed an environmental assessment of Grand Canal in Oakdale. The study concluded that the canal is impacted by nutrient enrichment and poor flushing. Development of a comprehensive managment plan to restore the canal and adjacent marsh was recomended. Suffolk County also investigated the causes of high levels of hydrogen sulfide odors at Frederick Canal.

- Peconic Baykeeper inventoried and monitored all SPDES discharges in the Reserve to ensure compliance with permits.

Determination of Sediment Composition in Bays and Tributaries

Areas with contaminated sediments that have the potential to impair water bodies in the Reserve should be tested to determine required actions and, if necessary, should be remediated on a priority basis. Reserve partners have taken the following steps to characterize sediments:

- TNC completed a sediment survey of its underwater lands in Great South Bay. TNC and the National Park Service have partnered to secure funding to research sediment history and dynamics in Great South Bay.

- A NYSG funded project that examined Great South Bay's sub-bottom structure and geologic development is nearly complete. The information from this study could be used to increase understanding of the bay's evolution and possible future response to environmental changes such as sea-level rise and breaches of barrier islands.

Monitoring the Ecosystem

It is essential that the current abundance and distribution of critical Reserve species, endangered and threatened species, and important habitat needs be documented in order to increase knowledge and understanding of the Reserve's ecosystem.

- Electrofishing surveys were conducted by NYS DEC on Carlls River to assess summer survival of spring stocked trout and overwinter survival of stocked brown trout.

- NYS DEC and Cornell Cooperative Extension monitored horseshoe crabs at two sites in the Reserve. Data collected through this pilot program are being analyzed to develop a suitable spawning index that will reflect changes in horseshoe crab abundance over time.

- Suffolk County is working with the US Army Corps of Engineers (ACE) to identify restoration priorities for habitats degraded by historic duck farms in the County. This project will include collection of historical materials pertaining to the location and scope of past duck farm activities, field inspection and tests to determine the extend of environmental degradation, and prioritization of sites and recommended actions. The regional study will provide justification for habitat restoration at sites along Bellport and Moriches Bays.

- The Town of Hempstead conducted annual waterfowl and Canada goose surveys. Bird banding is also carried out annually.

- In partnership with US Fish and Wildlife Service (FWS), Ducks Unlimited completed a three-year monitoring study of Open Marsh Water Management on selected reference projects in the Reserve.

- The Dowling College Department of Earth and Marine Sciences operated an annual Long Island Horseshoe Crab Network program at more than 50 sites to assess horseshoe crab populations.

- Ducks Unlimited completed the first year of a two-year study of wintering food resource and habitat use by American Black Ducks at Wertheim National Wildlife Refuge in Shirley and JFK Sanctuary in Oyster Bay.

Researchers survey hard clam populations in Great South Bay as part of a broader effort to increase understanding of the bay's ecosystem.

- Great South Bay Audubon Society sponsors the Captree Christmas Bird Count. Members also participate in a winter bird feeder survey covering over a dozen locations in the Reserve, the Fire Island Hawk Watch, and bird banding research. South Shore Audubon Society members collect statistics on waterfowl populations throughout the Reserve and participate in a backyard bird survey.

- The Art Flick Chapter of Trout Unlimited took aquatic insect samples as part of a cooperative effort with NYS DEC to characterize impairments to surface water.

- The Peconic Baykeeper is developing a Reserve-wide inventory of all available data and information pertaining to key environmental indicators including fisheries, watershed health and pollutants.

Study of Hard Clam Biology

Although overharvesting has played a contributing role in reducing hard clam stocks, a general decline in both recruitment and growth rates is also involved. Shellfish managers are hindered in their efforts to rebuild stocks by critical information gaps regarding both of these factors.

- NYSG's Hard Clam Research Initiative includes a suite of projects examining the biological and ecological factors that limit hard clam production in the south shore bays. A core project involves creation of a model to simulate hard clam growth and development under various conditions. Other hard clam-related projects are studying the parasite QPX, seasonal survival of hard clam seed planting, the effects of brown tide, plankton quality and ctenophore predation on hard clam larval growth and survivorship.

Tidal Wetland Research

Improved understanding of tidal wetlands and identification of potential restoration sites and methods is needed to facilitate protection and restoration of these important habitats. Reserve partners have completed the following studies:

- US FWS conducted preliminary identification of additional sites for restoration in a planning document prepared for the US ACE Fire Island to Montauk Point Reformulation Study.

- NYS DOS furthered its remote sensing-based investigations of wetland change by focusing on potential internal loss or fragmentation of marshes due to forces other than erosion, such as sea level rise or sediment budget disruption. GIS files of marsh surface were analyzed to measures changes in various wetland attributes such as overall wetland area change, shoreline change, internal ponding and changes in stream and ditch characteristics. Marsh surface area analysis was completed in 2004.

- The Town of Hempstead conducted a trend analysis of salt marshes which indicated those habitats are receding. The Town conducted studies of marsh banks and pond management for Pearsall's Hassock, Black Banks, Smith Island, and Pine Island, which also showed that the marshes are receding and that the ponds are silting in. A reconnaissance study of Reynolds Channel to assess possible dredged material island restoration opportunities was conducted by the Town in partnership with NYS DOS, NYS DEC, and US ACE.

A scientist collects data about eelgrass in the estuary. Eelgrass beds provide habitat for many important Reserve species.

Completion of a Baseline Inventory of Eelgrass Distribution

- The National Oceanic and Atmospheric Administration (NOAA) completed mapping of the estuary's eelgrass beds. This data has established a baseline of eelgrass distribution and abundance. Periodic monitoring will provide the basis for evaluation of eelgrass loss or impairment trends in relation to restoration efforts.

Monitoring Coastal Processes: Flooding, Erosion, and Barrier Island Breaches

Research is needed to better understand the natural causes of bay flooding and erosion, the impacts of development in erosion prone areas, the effects of shoreline hardening, and potential impacts of barrier island breaches. Reserve partners are conducting research as follows:

- US ACE is preparing a Fire Island to Montauk Point Reformulation Study to identify, evaluate, and recommend long-term solutions for hurricane and storm damage reduction for homes and businesses within the coastal floodplain of this area. TNC, in partnership with US ACE and other federal, and state agencies, developed a vision, restoration framework, and fact sheets about key coastal processes to guide for development of the study. TNC has also worked closely with US ACE to promote consideration of ecological needs and nonstructural alternatives in its recommendations for storm damage reduction.

- USGS is partnering with NYS DEC, the Town of Hempstead, and the Village of Freeport to operate a network of real-time tide elevation and meterological stations to provide information on coastal flooding.

- NYS DOS and the Reserve Office prepared a report on bay flooding and erosion in the Reserve. The report is based on surveys of local government officials about the location and extent of flooding and erosion in their communities and existing programs to manage these hazards.

- NYSG is currently conducting a suite of research projects on the impacts of breaches on the circulation and water properties of Great South Bay and the influence of ocean exchange on nutrients, plankton, SAV, and shellfish in Long Island estuaries. Modeling efforts are underway to examine the transport of contaminants in metropolitan New York and nearshore wave characteristics. These models will help assess water quality, breach and erosion mitigation, and with rip current safety.

- The Town of Southampton began an inventory of hardened shoreline in the Town.

- TNC worked with local governments to develop and implement ordinances to decrease shoreline hardening and is evaluating alternatives to conventional bulkheading techniques that would both protect property and ecological processes.

Expansion of Brown Tide Research

In addition to the Brown Tide Research Initiative (see Spotlight), Reserve partners have helped expand brown tide research as follows:

- Suffolk County continues to undertake brown tide research. Studies were conducted of additional algal blooms in Reserve tributaries, and the blooms were not found to be harmful in the Reserve.

- TNC has funded a three-year brown tide research project in the Reserve.

NEXT STEPS FOR IMPROVED ECOSYSTEM KNOWLEDGE

Reserve Council partners will work cooperatively to design and implement comprehensive and coordinated ecosystem-based monitoring programs for Reserve living resources and water quality.

The Department of State Division of Coastal Resources and the NOAA Coastal Services Center will monitor habitat trends through continued Reserve benthic mapping efforts.