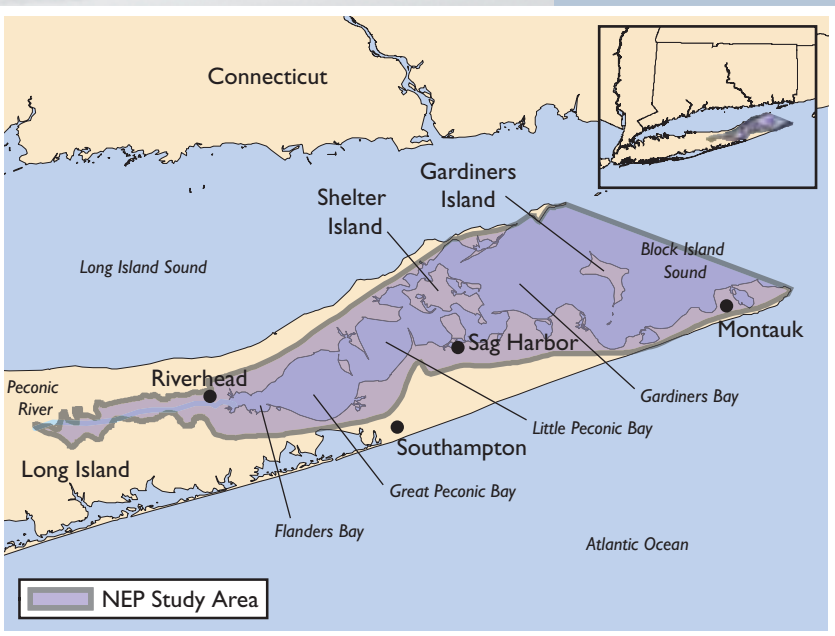
This document contains overall and specific condition of the Peconic Bay Estuary Program from the National Estuary Program Coastal Condition Report. The entire report can be downloaded from
http://www.epa.gov/owow/oceans/nepccr/index.html

National Estuary Program Coastal Condition Report

Chapter 3: Northeast National Estuary Program Coastal Condition, Peconic Bay Estuary Program

June 2007

Peconic Estuary Program



Peconic Estuary Program

www.peconicestuary.org

Background

The Peconic Estuary encompasses a series of connected bays between the north and south forks of eastern Long Island, NY. The Estuary's watershed spans more than 125,000 acres of land and 158,000 acres of surface water and features more than 100 distinct harbors, embayments, and tributaries (PEP, 2001; Balla et al., 2005). The Estuary provides important habitat and spawning and nursery grounds for a wide variety of marine organisms. The most notable species in the Estuary include shellfish, such as bay scallops and hard clams, and finfish, such as bay anchovy, Atlantic silverside, scup, summer flounder (also called fluke), winter flounder, windowpane flounder, weakfish, and blackfish. Eelgrass meadows are found in the eastern portion of the Estuary and provide food, shelter, and nursery grounds to many forms of marine life, including shrimp, bay scallops, crabs, and fish (Balla et al., 2005; SCDHS, 2006). The eelgrass beds also stabilize the Estuary bottom and are an important component of the nutrient cycle of this ecosystem.

The Peconic Estuary was declared an Estuary of National Significance in 1992, and the Peconic Estuary Program (PEP) is sponsored by EPA, the NYSDEC, and the Suffolk County Department of Health Services (SCDHS) (SCDHS, 2006). The PEP Management

Conference, established in 1993, is composed of numerous stakeholders, including citizens, businesses, non-profit groups, and local, state, and federal governmental agencies (PEP, 2006). Approved by EPA in November 2001, the *Peconic Estuary Program Comprehensive Conservation and Management Plan* (PEP, 2001) promotes a holistic approach to restoring and protecting the Estuary and its watershed.

Environmental Concerns

Land-use changes, SAV coverage, and phytoplankton and dinoflagellate blooms are some of the environmental concerns for the Peconic Estuary. The region's population growth and accompanying development pose substantial threats to the Estuary's water quality, nutrient balance, and habitat. Urbanization of the watershed continues, with approximately 600 acres per year converted from agriculture and vacant land to developed uses, mostly residential homes. The estimated 8,700 acres of eelgrass found throughout the Estuary in the 1930s (a conservative estimate) has dwindled to 1,550 acres of eelgrass today (119 beds). Blooms of the phytoplankton brown tide, *Aureococcus anophagefferens*, decimated the commercially significant fishery for Peconic Estuary scallops, particularly during the 1980s. Although brown tide blooms have not occurred since 1997, those species most affected (e.g., bay scallops and eelgrass) have not rebounded (Balla et al., 2005; PEP, 2006). In addition, blooms of the dinoflagellate *Cochlodinium polykrikoides* are of recent concern (Nuzzi, 2005). Other priority management issues are nutrient pollution, habitat and living resources, critical lands protection, pathogens, and toxic contaminants (PEP, 2001).

Population Pressures

The population of the NOAA-designated coastal county (Suffolk) coincident with the PEP study area increased by 113% during a 40-year period, from 0.67 million people in 1960 to almost 1.42 million people in 2000 (Figure 3-59) (U.S. Census Bureau, 1991; 2001). This rate of population growth for the PEP study area is almost five times the population growth rate of 24% for the collective NEP-coincident coastal counties of the Northeast Coast region. A majority of this population growth has taken place in the western portion of Suffolk

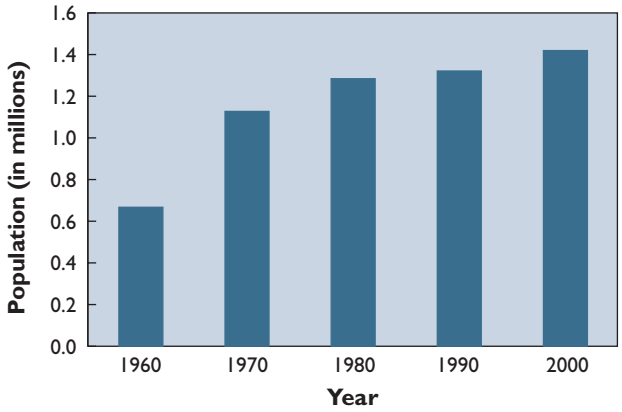


Figure 3-59. Population of NOAA-designated coastal county of the PEP study area, 1960–2000 (U.S. Census Bureau, 1991; 2001).

County, outside of the Peconic watershed. In 2000, the population density of this NEP-coincident coastal county (1,558 persons/mi^2) was the third-highest density calculated for any of the Northeast Coast NEPs and was about 50% higher than the population density of 1,055 persons/mi^2 for the collective NEP-coincident coastal counties of the Northeast Coast region (U.S. Census Bureau, 2001). Population pressures for this NEP study area are mounting, particularly for second homes and during the summer months, because the Peconic Estuary serves as a major center for recreational activities for the large urban population of New York City and Long Island.

NCA Indices of Estuarine Condition—Peconic Estuary

The overall condition of the Peconic Estuary is rated good based on three of the four NCA indices of estuarine condition (Figure 3-60). The water quality and fish tissue contaminants indices are both rated good,

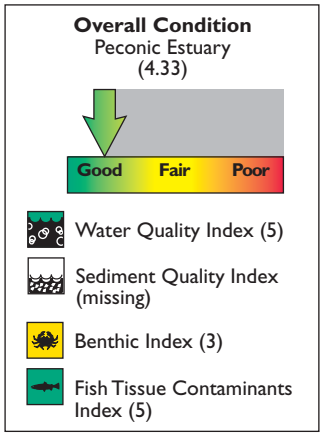


Figure 3-60. The overall condition of the PEP estuarine area is good (U.S. EPA/NCA).

and the benthic index is rated fair. No data were available to calculate a sediment quality index for the Peconic Estuary. Figure 3-61 provides a summary of the percentage of estuarine area rated good, fair, poor, or missing for each parameter considered. This assessment is based on data from 30 NCA sites sampled in the PEP estuarine area in 2000, 2001, and 2002. Please refer to Tables 1-24, 1-25, and 1-26 (Chapter 1) for a summary of the criteria used to develop the rating for each index and component indicator.

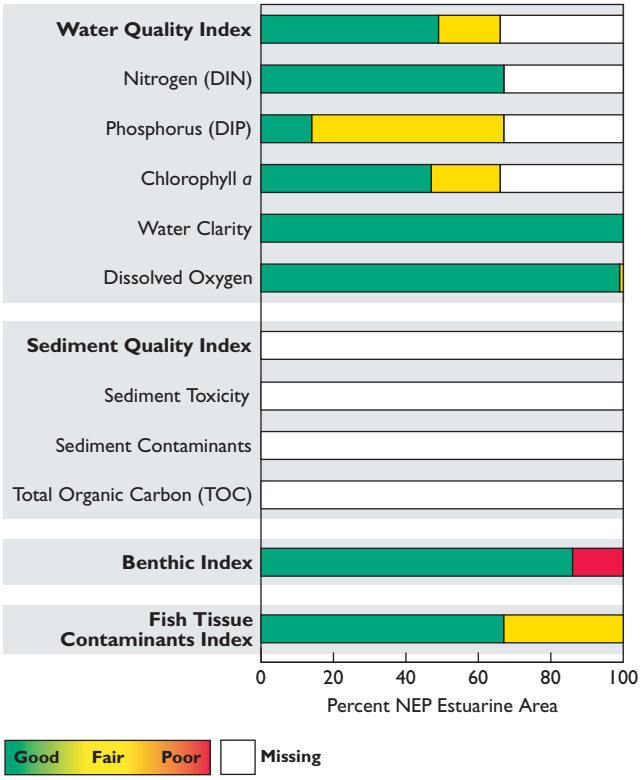


Figure 3-61. Percentage of estuarine area achieving each rating for all indices and component indicators — Peconic Estuary (U.S. EPA/NCA).

Water Quality Index

The water quality index for the Peconic Estuary is rated good; however, water quality data were unavailable for a third of the estuarine area (Figure 3-62). The water quality index was developed using NCA data on five component indicators: DIN, DIP, chlorophyll *a*, water clarity, and dissolved oxygen. DIN concentrations were uniformly low in the estuarine area, and moderate DIP concentrations were evident in most of the Estuary where data were available. Water clarity was satisfactory everywhere in the Estuary, and there was only one incidence of moderate oxygen concentrations. In all respects, water quality condition in the Peconic Estuary is similar to that observed in eastern Long Island Sound.

Dissolved Nitrogen and Phosphorus

The Peconic Estuary is rated good for DIN concentrations, with 67% of the estuarine area rated good for DIN concentrations and none of the area rated poor. NCA

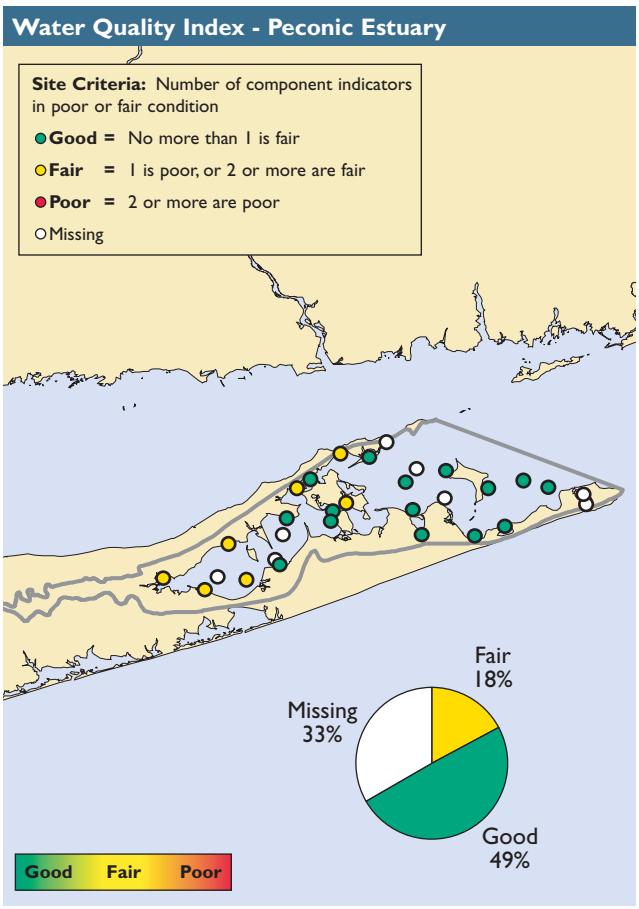


Figure 3-62. Water quality index data for the Peconic Estuary, 2000–2002 (U.S. EPA/NCA).

data on DIN concentrations were unavailable for 33% of the PEP estuarine area.

The Peconic Estuary is rated fair for DIP concentrations, with 14% of the estuarine area rated good for DIP concentrations and 53% of the area rated fair. None of the PEP estuarine area was rated poor for DIP concentrations, although NCA data on this component indicator were unavailable for 33% of the area. A more important measure for the evaluation of eutrophic condition for the Peconic Estuary may be the overall nitrogen load to the system.

Chlorophyll a | The Peconic Estuary is rated good for chlorophyll *a* concentrations. Forty-eight percent of the estuarine area was rated good, 19% was rated fair, and none of the area was rated poor for chlorophyll *a* concentrations; however, NCA data on this component indicator were unavailable for 33% of the PEP estuarine area.

Water Clarity | Water clarity in the Peconic Estuary is rated good, with 100% of the estuarine area rated good for this component indicator. Water clarity was rated poor at a sampling site if light penetration at 1 meter was less than 10% of surface illumination.

Dissolved Oxygen | The Peconic Estuary is rated good for dissolved oxygen concentrations, with 99% of the estuarine area rated good for dissolved oxygen concentrations and 1% of the area rated fair. None of the estuarine area was rated poor for this component indicator; however, the PEP has identified numerous areas of the Estuary that experience periods of low dissolved oxygen levels, particularly during the summer months.

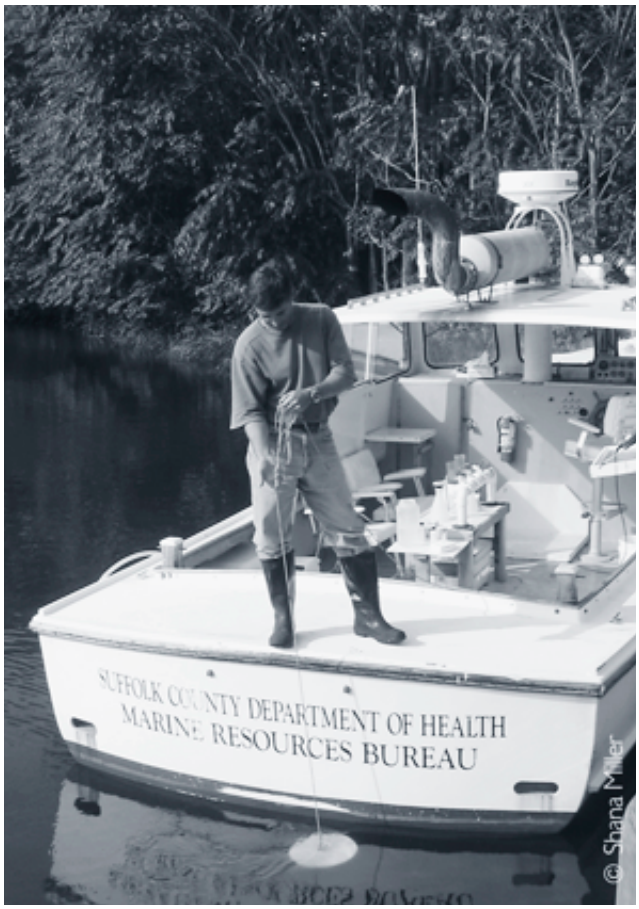
Sediment Quality Index

The NCA survey did not collect sediment quality data for the Peconic Estuary for any of the sediment component indicators in 2000–2002; therefore, a sediment quality index was not developed for this report.

Sediment Toxicity | The NCA 2000–2002 surveys did not collect sediment toxicity data for the Peconic Estuary; therefore, sediment toxicity in the Estuary has not been rated for this report.

Sediment Contaminants | The NCA 2000–2002 surveys did not collect sediment contaminants data for the Peconic Estuary; therefore, sediment contaminant concentrations in the Estuary have not been rated for this report.

Total Organic Carbon | The NCA 2000–2002 surveys did not collect sediment TOC data for the Peconic Estuary; therefore, sediment TOC has not been rated for this report.



An SCDHS sanitarian uses a Secchi disk to measure water clarity (Shana Miller).

Benthic Index

The Peconic Estuary has one of the best measures of benthic community diversity in the Northeast Coast region, with 86% of the estuarine area rated good by the Virginian Province Benthic Index (Figure 3-63); however, the benthic index for the Peconic Estuary is rated fair overall because 14% of the estuarine area was rated poor for benthic condition.

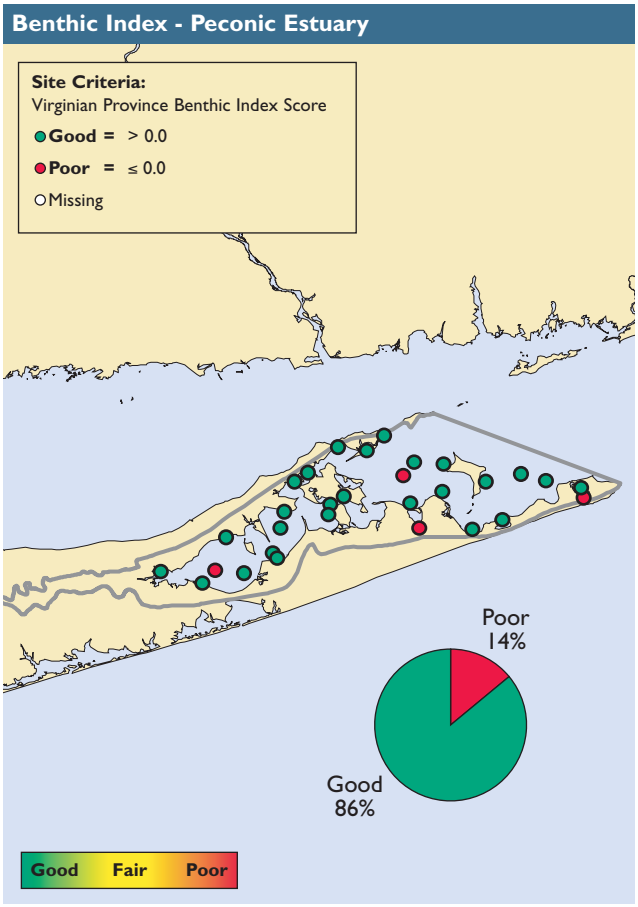


Figure 3-63. Benthic index data for the Peconic Estuary, 2000–2002 (U.S. EPA/NCA).

Fish Tissue Contaminants Index

The fish tissue contaminants index is rated good for the Peconic Estuary. Only three fish samples from the Peconic Estuary were analyzed for fish tissue contaminant concentrations, with two samples rated good and one sample rated fair (Figure 3-64). More data are needed to make an adequate assessment of fish tissue contaminant levels for the Estuary. Unfortunately, relatively few fish were analyzed in neighboring Long Island Sound waters, so it is difficult to determine an accurate assessment of fish tissue contaminant levels in this portion of the Northeast Coast region. EPA, in cooperation with the PEP, has completed a significant study of toxic contamination in shellfish and finfish tissue; however, the results of this study are not yet available.

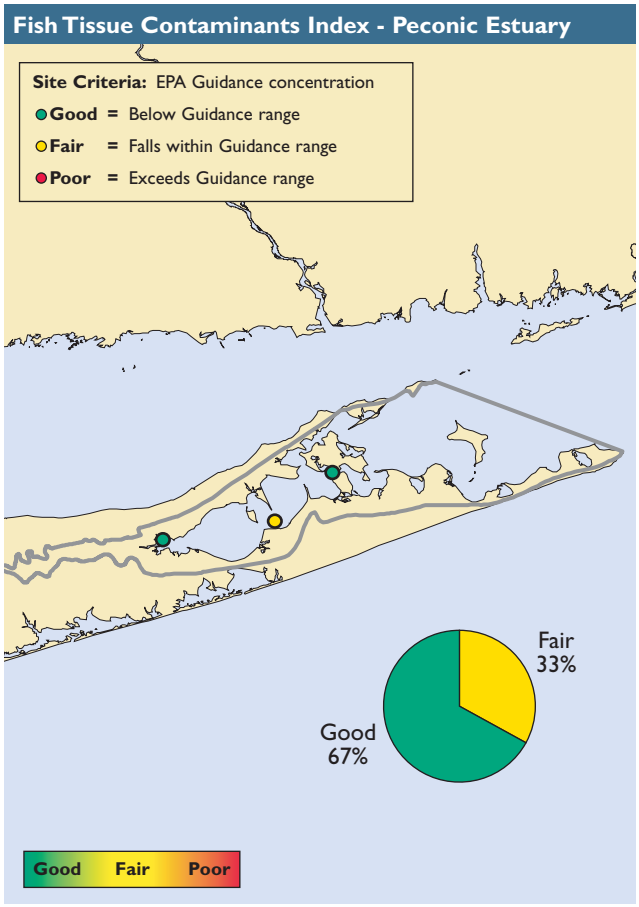


Figure 3-64. Fish tissue contaminants index data for the Peconic Estuary, 2000–2002 (U.S. EPA/NCA).

Peconic Estuary Program Indicators of Estuarine Condition

Compared to other estuaries nationwide, the Peconic Estuary is considered a relatively healthy system (PEP, 2001). For example, more than a third of the Peconic watershed is protected open space, protecting natural habitats, groundwater-recharge areas, and surface water quality. On the other hand, the Peconic Estuary shows signs of environmental stress, particularly in the more densely developed areas and tidal creeks. According to the PEP, low dissolved oxygen conditions occur in approximately 3% of the Estuary; numerous pesticides have been detected in groundwater and surface waters; and some local fisheries, most notably bay scallops and winter flounder, no longer support commercial harvests (Balla et al., 2005).

The PEP developed a list of 18 formal indicators and published a comprehensive environmental status report for the Peconic Estuary in March 2005 (Balla et al., 2005). All the PEP's environmental indicators are listed in the report, and a subset is discussed below.

Water and Sediment Quality

The following indicator measures are used to evaluate environmental changes and stressors affecting water and sediment quality in the Peconic Estuary:

- Number of bathing beach closures
- Acreage of shellfish bed closures
- Onset and duration of brown tide events
- Dissolved oxygen levels
- Total nitrogen levels
- Water clarity
- Pesticides in ground and surface waters.

The number of bathing beach and shellfish bed closures are used as indicators of excess pathogens in estuarine waters. From 1980 through 2004, there were a total of 43 beach closure days at four different bathing beaches within the Peconic Estuary; however, these were mostly precautionary closures. As of January 2004, 3,419 acres were closed and 1,803 acres were seasonally open to shellfishing (Balla et al., 2005) (Figure 3-65), although almost 96% of the Peconic Estuary was available for shellfish harvesting at some point in 2004.

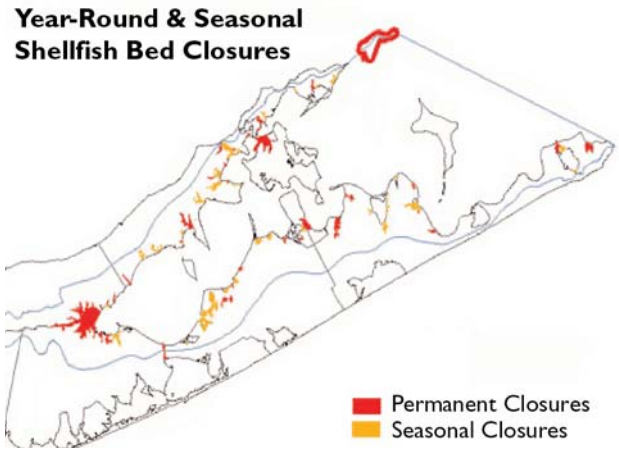


Figure 3-65. Permanent and seasonal shellfish closures in Peconic Bay on January 1, 2004 (PEP).

Some shellfish beds, such as those around Plum Island, were closed in 2004 due to administrative reasons rather than because of poor water quality (PEP, 2006). Stormwater runoff is the largest non-point source contributor of pathogens to the Peconic Estuary. Other contributions may come from wildlife, failing septic systems, improperly treated effluent from WWTPs, and illegally discharged wastes from boats (Balla et al., 2005).

Another measurable impairment of Peconic Estuary water quality is the occurrence of the harmful algal bloom (HAB) dubbed "brown tide," and it is unknown whether onset, duration, and cessation of these blooms are naturally occurring or related to human impacts on the watershed. Brown tide blooms persisted in high concentrations for extended periods in all or part of the Estuary from 1985 through 1988, 1990 through 1992, 1995, and 1997. Brown tides have not bloomed in high concentrations since 1997, but this issue continues to be an important management topic, particularly when efforts are mounted to restore shellfisheries and eelgrass meadows (Balla et al., 2005; PEP, 2006).

One of the most significant water quality concerns for the Peconic Estuary has been excess nitrogen loading, especially in the western portion of the Estuary. There seemed to be an overall decrease in total nitrogen in the Estuary's surface waters from 1994 to 2005; however, the specific cause (e.g., decreased loading, increased uptake in the food web, or a combination of other mechanisms) is not known. Nitrogen inputs to

the Estuary originate from excessive agricultural and residential fertilizer use, on-site disposal systems, atmospheric deposition, nutrient-enriched bottom sediments, STPs, and stormwater runoff. Most of the nitrogen enters the Estuary from the atmosphere (rainfall) and groundwater, although STPs are an important factor in select localized areas (Balla et al., 2005).

The relationship between excessive nitrogen loading and low dissolved oxygen levels in estuaries is well documented. The Peconic Estuary has excellent water quality with regard to dissolved oxygen levels, with less than 3% of the estuarine area periodically failing to meet New York's dissolved oxygen standard of 5 mg/L. However, the PEP strives to maintain or improve both dissolved oxygen and total nitrogen levels in the westernmost portions of the Estuary (Balla et al., 2005). Monitoring of point sources, upgrades to sewage systems, and fertilizer-reduction programs are all important actions that could be used to control nitrogen loads, particularly given the fact that development and population increases are likely.

Continuous monitoring equipment has been deployed throughout the main stem of the Peconic Estuary. These devices download information every fifteen minutes and are set one meter off the Estuary bottom. Figure 3-66 depicts the dissolved oxygen concentrations experienced on July 15, 2004 (a typical summer day). The tidal Peconic River station, the most landward monitoring site of the three locations, experienced dissolved oxygen levels that were well below the New York State dissolved oxygen standard of 5 mg/L. Of the three sites, these waters have the least amount of ocean flushing and are most affected by land use and STP effluent discharges (Balla et al., 2005). Great Peconic Bay, the most seaward of the monitoring sites, did not experience any dissolved oxygen problems on July 15, 2004, most likely due to the mixing of the Bay's waters with more oxygenated waters from the seaward boundary (Balla et al., 2005; Personal communication, Bavaro, 2006). Flanders Bay, a station located between the tidal Peconic River and Great Peconic Bay, showed diurnal depressions in dissolved oxygen levels (Balla et al., 2005).

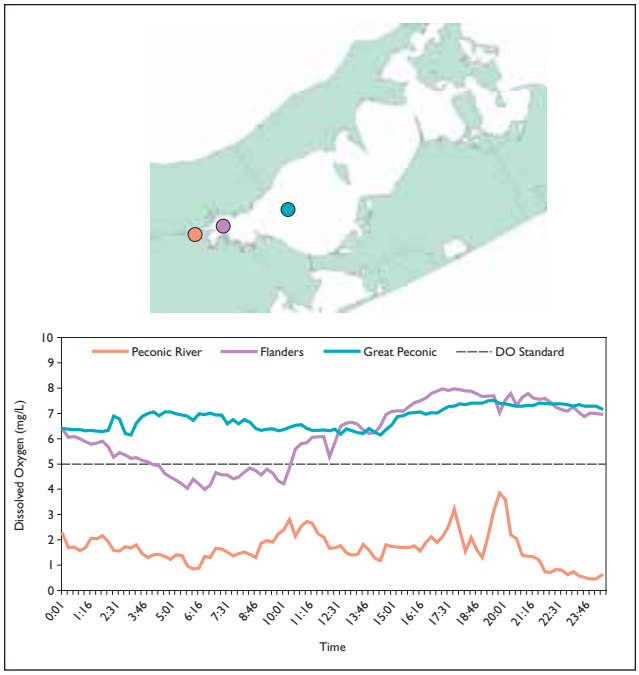


Figure 3-66. Dissolved oxygen concentrations at the three continuous monitoring locations on July 15, 2004 (Balla et al., 2005).

Habitat Quality

The indicators used by the PEP to evaluate habitat changes over time include the following:

- Extent of eelgrass beds (acres)
- Extent of tidal wetlands (acres)
- Area of habitat restoration (acres).

The extent of eelgrass beds in the Peconic Estuary continues to decline, with an areal decrease of at least 82% since the 1930s. Despite generally good water quality, eelgrass beds, measured at 1,550 acres in 2005, are not expanding. The most extensive Peconic wetlands losses occurred prior to 1972. The approximately 5,700 acres of estuarine wetlands in Peconic Estuary are constantly threatened by the degradation of surrounding buffer areas and the invasive common reed *Phragmites australis*. The wide variety of habitat-restoration efforts undertaken in the Estuary have included the replanting of eelgrass, restoration of intertidal marsh, control of common reed growth, and construction of fish passages. Most of these projects have been small, ranging in size from one-tenth of an acre to several acres, but there have been several open-marsh water management and grassland projects of about 50 acres in scope (Balla et al., 2005).

Living Resources

The PEP uses the following key indicator measures to study the overall health of the living resources in the Peconic Estuary system:

- Bay scallop commercial landings
- Winter flounder population abundance
- Piping plover nests and nesting productivity
- Osprey nests and nesting productivity
- Toxic substances in sediments, biota, and groundwater.

Peconic Estuary scallop landings are now a fraction of what was once a nationally significant fishery. In the 1970s and mid-1980s, the harvest of bay scallops ranged from 100,000 to 700,000 pounds of meat. Since 1996, commercial landings ranged from zero to just under 6,000 pounds. Although brown tides have had a large effect on the overall population of scallops, habitat loss, changes in predator-prey relationships, and overharvesting also play a role. Winter flounder are considered an overfished species and have declined throughout the northeastern United States. In the Peconic Estuary, the average catch/tow from 1987 to 1995 was 15.6 for winter flounder, whereas the mean winter flounder/tow was 0.4 and 1.4 in 2002 and 2003, respectively (Balla et al., 2005).

A variety of shorebirds are found nesting, feeding, and breeding along the shores of the Peconic Estuary and its islands. Some of these shorebirds are federally listed as threatened or endangered or are rare in New York, such as the piping plover, least tern, roseate tern, and common tern. The Peconic Estuary is also home to more than half of the ospreys on Long Island; the population of this species has burgeoned since the banning of DDT in 1972. Piping plover breeding pairs on Long Island have generally increased in numbers since the mid-1980s, when the total population was slightly more than 100 pairs. By 2002, the number of Long Island piping plover breeding pairs rose to 369, of which 57 were found in the PEP study area (Balla et al., 2005).

Environmental Stressors

The following indicators are used to assess the impact of human activities on the Peconic Estuary:

- Extent of shoreline hardening
- Extent of impervious surfaces
- Extent of land protection.

The largest threat to beaches and other shoreline habitat is shoreline hardening. Use of bulkheads, rip-rap, jetties, groins, and other hardened structures has been widely permitted to stabilize shoreline in front of waterfront property throughout the Estuary. These structures have replaced beaches with uplands, increased shoreline erosion, and altered sediment accretion patterns that may lead to loss of wetlands and beaches. More than 6% of the Peconic Estuary shoreline has hardened surfaces (Balla et al., 2005). Data on impervious surfaces has been collected, and analysis of these data is underway. Using GIS capabilities, the PEP has finalized its *Critical Lands Protection Plan* (PEP, 2004) to evaluate land available for development and to identify priorities for protection across the Estuary.

Scientists collect sediment samples in a tidal creek on the North Fork of Long Island to test for toxic contamination (Rick Balla).

HIGHLIGHT

Critical Lands Protection in the Peconic Estuary Watershed

Increasing development in the Peconic Estuary watershed continues to result in the loss and fragmentation of open space and natural habitats, degraded groundwater quality, and declines in local plant and wildlife populations. As of 2001, almost half of the nearly 114,000 acres of land in the watershed's 5 eastern towns was developed, with more than 30% protected and more than 20% still available for development. More than 2,500 parcels of the developed area, comprising 3,500 acres, were developed between 1998 and 2001 (PEP, 2004).

The PEP's *Critical Lands Protection Plan* (PEP, 2004) identified and prioritized for protection the land available for development in the Peconic watershed. Using environmental criteria and GIS, each parcel was evaluated through the lens of habitat and water quality protection. The strategy and resulting plan were not meant to be the sole reference for land protection in the region, but rather a tool for state and local agencies that make land acquisition decisions based, in part, on estuarine considerations (PEP, 2004). Almost 70% of the 25,271 acres of remaining land available for development in the Peconic watershed have been designated as "Critical Lands Protection Strategy (CLPS) high-priority parcels" (Gringalunas et al., 2004).

The towns, county, state, and private land trusts have been instrumental in acquiring open space in the Peconic Estuary watershed. As of 2005, the most widely used land protection tool is full-fee acquisition from willing sellers. Although the Community Preservation Fund (CPF; 2% real estate transfer tax) is the most successful land protection program on Long Island, raising more than $245 million through January 2005, it does not sufficiently keep up with the rate of development and loss of critical landscapes. An estimated $1.375 billion would be needed to protect all of the vacant parcels in the Peconic watershed (approximately 17,000 acres) that meet at least one of the plan's environmental criteria (see map). Future CPF revenues could purchase less than 10% of these parcels. Given these findings, it is apparent that current land acquisition funding, including the additional funding from county, state, and federal sources, is not sufficient to keep pace with the current and anticipated rates of development.

Large amounts of land can be protected without having to expend large sums of money. Alternative protection tools include clearing restrictions, clustering requirements, rezoning, overlay districts, easements, purchase of development rights, and overall better land-use practices. It is estimated that the implementation of clearing restrictions would protect an additional

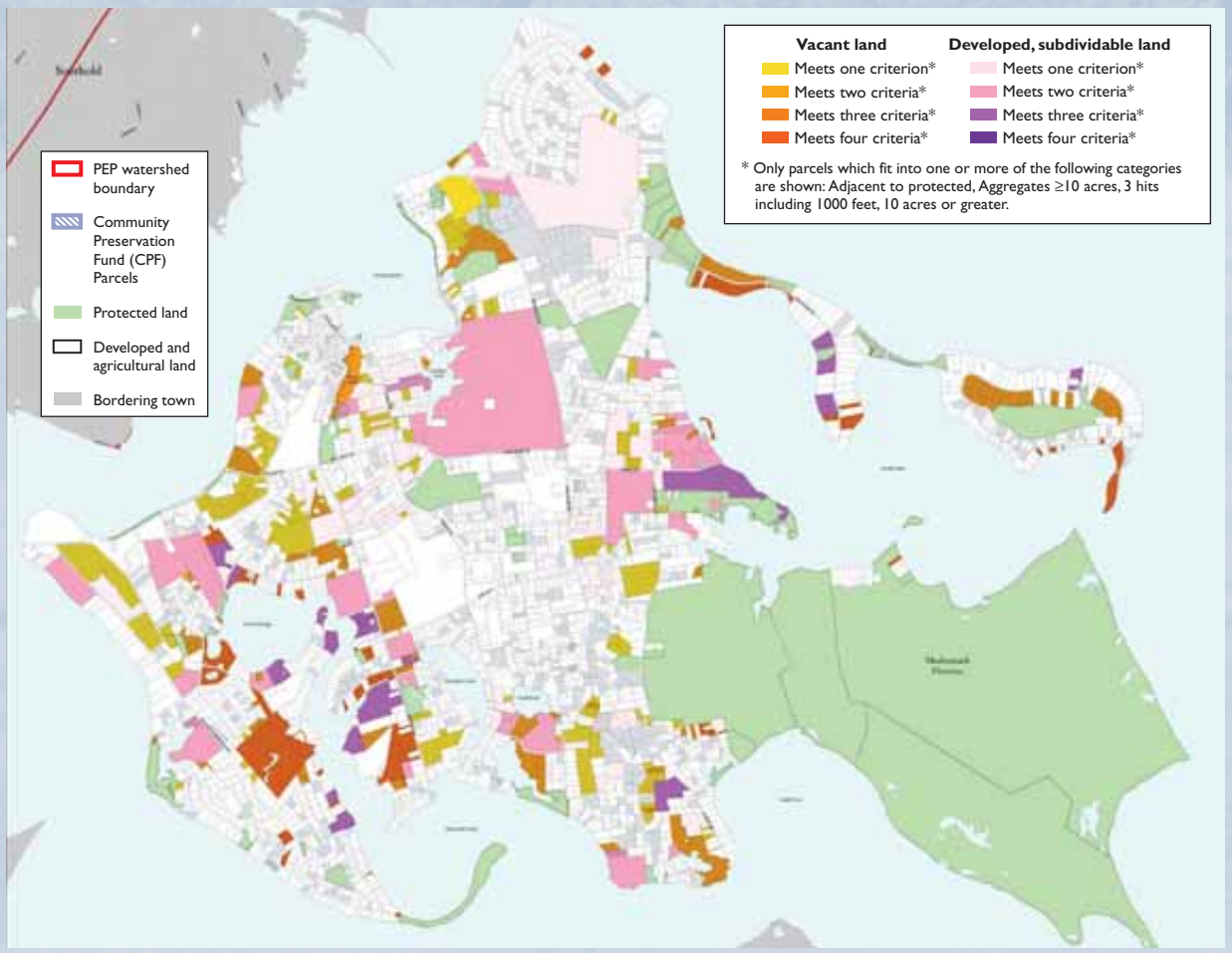
Non-market Benefits Associated with Open Space Acquisition in Riverhead, NY, Using a 3% Discount Rate (Gringalunas et al., 2004)

Non-market Benefit	Cost per Acre
On-site recreational use for bird watching and wildlife viewing	$209,362
Off-site water quality impacts on recreational swimming	$5,216
Localized amenity values to adjacent property owners	$18,300

3,183 acres in the five East End Towns and that acquiring an equivalent amount of land would cost approximately $355 million. If these same lands were developed with both clearing restrictions and clustering requirements, a total of 3,491 acres would be protected, and the estimated cost for acquiring an equivalent amount of land would be $382 million (PEP, 2004).

As part of a case study conducted in 2004, the costs and benefits of protecting 220 acres of open space in Riverhead, NY, through outright acquisition in perpetuity were examined. The cost of acquiring the open space was estimated to range from $22 million to $38 million. These costs were compared to estimated economic impact of three non-market benefits (see table). The estimated impact of these benefits ranged from $20.5 million to $51.4 million, depending on the discount rate selected. Although only three benefits were analyzed, the mid-point of the range of estimated benefit impact exceeds the mid-point of the estimated costs, thereby strengthening the argument for continued land protection (Gringalunas et al., 2004).

Much of the Peconic watershed will be built-out in the next decade. The PEP's efforts to highlight land-protection goals, funding gaps, and protection tools are critical in guiding the watershed's final landscape.



Map of prioritization of environmental criteria for Shelter Island (PEP).

Current Projects, Accomplishments, and Future Goals

Some of the major environmental accomplishments of the PEP include the following:

- **Restoration projects** – Between 1993 and 2005, more than 120 priority demonstration and implementation projects were funded using federal and state funds totaling more than $20.2 million. Projects include upgrades to STPs; restoration of wetlands, eelgrass beds, and fish passages; construction of artificial wetlands; and mitigation of stormwater runoff (Personal communication, Bavaro, 2006).
- **Nitrogen total maximum daily load (TMDL)** – A nitrogen TMDL for waters in the western Estuary will be submitted to EPA in 2006. Nitrogen loadings to these waters need to be reduced to alleviate dissolved oxygen impairments.
- **STP upgrades** – In 2001, the Riverhead and Sag Harbor STP upgraded to tertiary treatment with ultraviolet light disinfection.
- **Agricultural nitrogen reduction** – The PEP was responsible for bringing the region's agricultural community and other stakeholders together for the first time to develop a strategy to lower nutrient and pesticide inputs to the environment.
- **Promotion of best management practices (BMPs)** – The PEP promotes projects, such as the Stop Throwing Out Pollutants (STOP) Program, integrated pest management, and stormwater mitigation at marinas, golf courses, and other facilities, to reduce levels of toxics in the watershed.
- **Benthic mapping** – Underwater land maps are being created for the Peconic Estuary to document bathymetry and distribution of natural resources, identify potential sites for commercial aquaculture operations, assess biodiversity, and clarify Essential Fish Habitat designations.
- **Habitat restoration plan** – The PEP identified the need for 72 restoration projects encompassing 836 acres, with an estimated cost of more than $42 million (PEP, 2002).
- **Vessel Waste No-Discharge Zone** – In 2002, the entire Peconic Estuary was designated a Vessel Waste No-Discharge Zone, whereby the direct discharge of treated and untreated wastes from marine toilets is prohibited. In addition, the PEP aids municipalities in acquiring additional vessel waste pump-out boats.

Conclusion

Compared to other NEP estuaries, the Peconic Estuary is a relatively healthy system. For example, more than a third of the Peconic Estuary watershed is protected open space, preserving natural habitats, groundwater-recharge areas, and surface water quality. On the other hand, the Peconic Estuary shows signs of environmental stress, particularly in the more densely developed areas and in the tidal creeks. Monitoring data from Suffolk County show that water quality across the Peconic Estuary is in relatively good condition. This finding is consistent with EPA's overall condition rating of good based on three of the indices used by the NCA. The PEP feels that more scientific inquiry and monitoring of the Peconic Estuary and its watershed is needed to accurately understand the causes and effects of pollutants, and that additional funding is critical to develop indicators, monitor them over time, and report to the public about Estuary conditions.

Bay scallops were once a nationally significant fishery in Peconic Estuary (Shana Miller).