Peconic Estuary Partnership's Habitat and Wildlife Monitoring Strategy

2023

Peconic Estuary Partnership

PROTECTING AND RESTORING LONG ISLAND'S PECONIC BAYS

Peconic Estuary Partnership

Habitat and Wildlife Quality Monitoring Strategy

Background

The 2020 revision to the Comprehensive Conservation and Management Plan (CCMP) for the Peconic Estuary Partnership (PEP) sets goals to restore and maintain the chemical, physical, and biological integrity of the Peconic Estuary and surrounding study area (Figure 1). The Technical Advisory Committee (TAC), Citizens' Advisory Committee (CAC), Local Government Committee (LGC), Management Committee (MC) and Policy Committee (PC) for PEP worked with partners and the public to develop Goals, Objectives and Actions to guide the Partnership over the next decade.

The 2020 PEP CCMP focuses on four Goals: Strong Partnerships and Engagement; Resilient Communities Prepared for Climate Change; Clean Water; and Healthy Ecosystem with Abundant, Diverse Wildlife. As outlined in the FY 2021- 2024 Clean Water Act §320 National Estuary Program Funding Guidance, a revised CCMP should include revisions to a Monitoring Plan to track and detect changes and/or improvements within the study area and effectiveness of CCMP Actions.

The Habitat and Wildlife Monitoring Strategy (this document) is a component of the Peconic Estuary Monitoring Plan and addresses habitat and wildlife quality-related elements contained within the four CCMP Goals: Strong Partnerships and Engagement, Resilient Communities Prepared for Climate Change; Clean Waters for Ecosystem Health and Safe Recreation; and Healthy Ecosystem with Abundant, Diverse Wildlife. The Habitat and Wildlife Monitoring Strategy was developed as an addendum to the Water Quality Monitoring Strategy which was developed in 2021. The Water Quality Monitoring Strategy and the Habitat and Wildlife Monitoring Strategy together represent the complete Peconic Estuary Monitoring Plan.

Overview

It is critical to assess whether the goals of the PEP CCMP are being met and if the CCMP actions are having their desired effects. For each CCMP habitat and wildlife quality-related goal, objectives were developed to help evaluate progress towards meeting those goals and linked to one or more specific actions in the CCMP. Each element of this Habitat and Wildlife Monitoring Strategy is linked to one or more of these Goals.

Measuring the effectiveness of CCMP actions in bringing about environmental change is accomplished with the monitoring of a suite of indicators. These indicators are used to report on progress toward meeting PEP's CCMP goals and objectives, and to assess the status and trends in the habitat and wildlife quality, health and abundance of the Peconic Bays' habitats and living resources.

This Strategy provides a framework that builds on existing habitat and wildlife monitoring strategy programs within the PEP study area administered by organizations involved in the development and implementation of the CCMP.

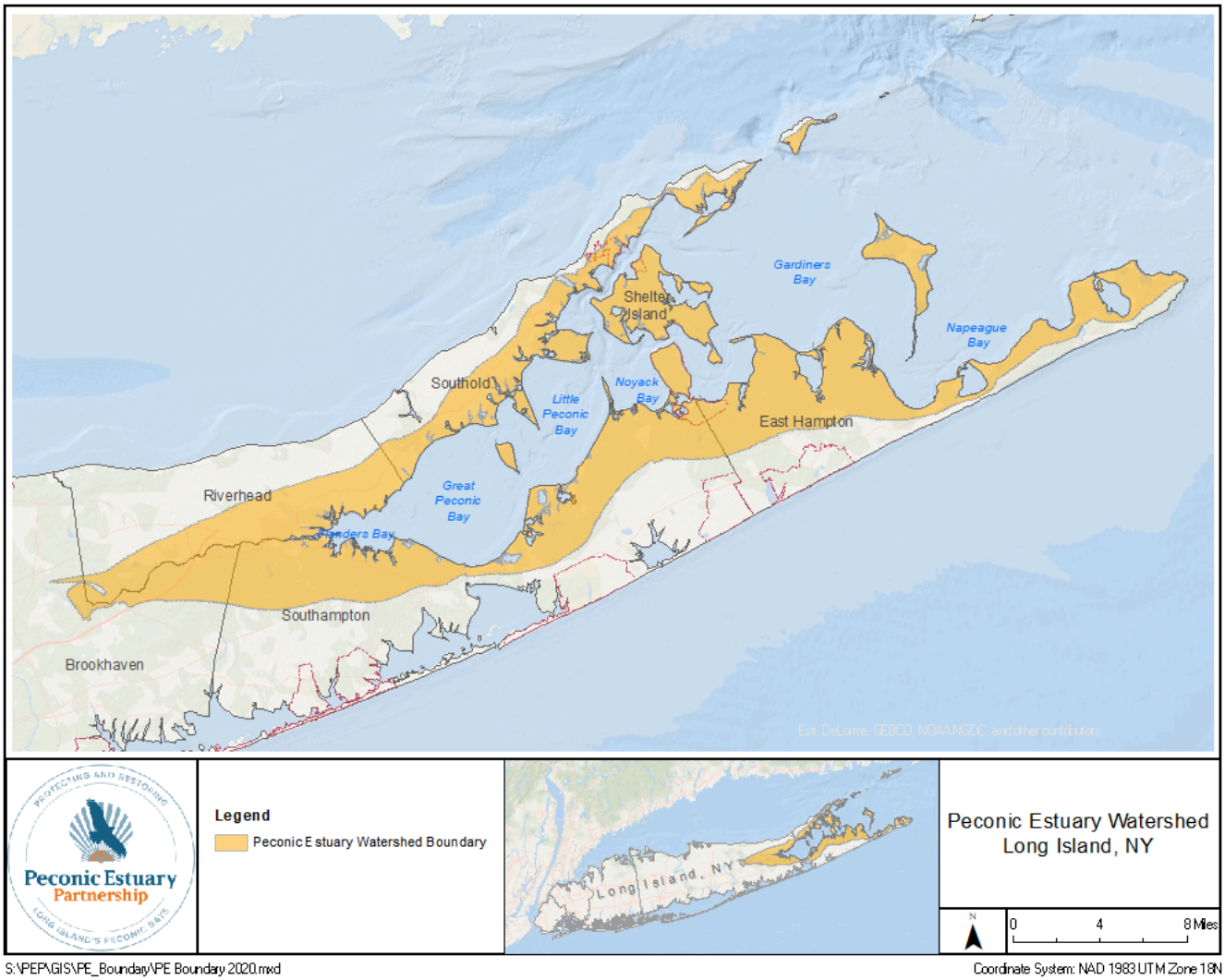

Figure 1. Peconic Estuary watershed and study area.

The purposes of the Habitat and Wildlife Monitoring Strategy are to:

1. Provide the data necessary to routinely track habitat and wildlife trends and assess the environmental health of the PEP study area.

2. Describe how the synthesis of data from ongoing habitat and wildlife monitoring programs can assist in evaluation of the effectiveness of CCMP actions.

This Habitat and Wildlife Monitoring Strategy focus on habitat and wildlife related Objectives and Actions identified in the Goals of the 2020 PEP CCMP, and includes the following:

GOAL: STRONG PARTNERSHIPS AND ENGAGEMENT

OBJECTIVE B: Empower local communities to support estuary health, including underrepresented groups

ACTION 6: Increase community members' awareness of the Peconic Estuary, key issues relating to the CCMP's Goals, and the PEP as a resource to help them address the issues

ACTION 7: Involve community members in citizen science programs to cultivate personal connections to the Peconic Estuary and inspire positive behavioral change to support estuary health

GOAL: RESILIENT COMMUNITIES PREPARED FOR CLIMATE CHANGE

OBJECTIVE C: Help local communities to take meaningful, well-informed action to prepare for and adapt to climate change impacts in the Peconic Estuary

ACTION 10: Incorporate climate change considerations into new and existing projects of PEP and partner organizations

ACTION 11: Provide tools and assistance to local government to mitigate and adapt to the impacts of climate change

ACTION 12: Mitigate climate change through coastal ecosystem management

ACTION 14: Increase public awareness of anticipated impacts of climate change on the Peconic Estuary and practical ways to mitigate and prepare for them

ACTION 15: Strengthen partnership with the Shinnecock Indian Nation and collaborate to implement the Climate Ready Assessment and Action Plan

GOAL: HEALTHY ECOSYSTEM WITH ABUNDANT, DIVERSE WILDLIFE

OBJECTIVE G: Expand scientific understanding of the Peconic Estuary ecosystem and deliver information that supports management decision-making

ACTION 23: Conduct scientific studies to expand understanding of the Peconic Estuary ecosystem and support ecosystem-based management

ACTION 24: Review and update data for rare, protected and endangered species in the Peconic Estuary to support the development of protection strategies

ACTION 26: Quantify the impacts of fishing, aquaculture, boating, navigational dredging, and hardened shoreline structures on habitats and vulnerable species, to foster sustainable recreational and commercial uses of the Peconic Estuary that are compatible with protection of biodiversity

ACTION 27: Facilitate spatial planning of the Peconic Estuary to help mitigate resource-use conflicts and ensure the protection of critical habitats

OBJECTIVE H: Restore and protect key habitats and species diversity in the Peconic Estuary and its watershed

ACTION 28: Protect critical natural resource areas and high-priority lands in the Peconic Estuary watershed

ACTION 29: Maintain, restore, and enhance viable diadromous fish spawning and maturation habitat in the Peconic Estuary Watershed

ACTION 30: Monitor and protect existing eelgrass beds; where appropriate, restore and expand eelgrass beds

ACTION 31: Use available habitat quality assessment and climate change resiliency tools to prioritize wetland restoration projects identified in the 2020 PEP Habitat Restoration Plan, and implement the top priority projects

ACTION 33: Implement living shoreline projects, monitor for ecological and financial benefits, and use model projects to educate planners and homeowners on the benefits of living shorelines over hardened shorelines

ACTION 34: Develop habitat protection and restoration strategies for key species in the Peconic Estuary and its watershed, including the river otter, diamondback terrapin, and horseshoe crab

ACTION 35: Monitor results of shellfish restoration efforts, share findings, and encourage creation of shellfish spawner sanctuaries

PEP Research Priorities

PEP identified the following priorities for research and monitoring to help achieve the Goal of a healthy ecosystem with abundant, diverse wildlife. While the CCMP 2020 Actions will help advance some of these priorities, initiatives by other entities are necessary to fully address them.

- Research on eelgrass habitat in the Peconic Estuary, including studies of eelgrass traits, population genetics, and groundwater influences on eelgrass health, including potential positive (cooling effect) and negative (pesticide/herbicide) impacts.

- Research on the distribution and value of submerged aquatic vegetation (SAV) habitats other than eelgrass, such as widgeon grass (*Ruppia*)

- Monitoring of amounts and types of natural, hardened, and living shorelines in the Peconic Estuary, repeated every three to five years, and analyzed for trends in shoreline changes.

- Monitoring to track changes in marsh extent and condition, and to evaluate the success of wetland and shoreline restoration projects, based on wetland and shoreline monitoring efforts of New York State (e.g., Unvegetated to Vegetated Marsh Ratio Analysis, Tidal Wetland Rapid Assessments, Protocol for Monitoring Nature-based Shorelines).

- Alewife monitoring for the Peconic Estuary to track population status and the success of fish passage projects

- Zooplankton surveys to monitor spatial and temporal trends in abundance of zooplankton taxa

- Development of habitat protection and restoration strategies for key wildlife species in the Peconic Estuary and its watershed, including the river otter, diamondback terrapin, and horseshoe crab

- Continue to monitor the fish communities in the Peconic Bays through the New York Department of Environmental Conservation (NYSDEC) Peconic trawl survey and expand monitoring to Gardiners Bay if feasible.

GOAL: STRONG PARTNERSHIPS AND ENGAGEMENT

The main role of PEP is to facilitate collaboration among numerous government bodies and non-government organizations (NGOs) with an interest in the Peconic Estuary and its watershed. PEP engages New York State, the Trustees from Southold, Southampton, and East Hampton, students and researchers from Stony Brook University, students and researchers from Suffolk County Community College, Cornell Cooperative Extension (CCE), Central Pine Barrens Joint Planning and policy Commision, Concerned Citizens of Montauk, Seatuck, Peconic Land Trust, New York Sea Grant, The Nature Conservancy, Peconic Baykeeper and other partners to collaborate on numerous projects. PEP successes are truly the result of the partnerships fostered by the Program.

PEP is a regional leader in providing Citizen Science and community-based volunteer opportunities to residents and visitors of Suffolk County, wider Long Island and New York State. PEP's Citizen Science activities include and are not limited to student citizen science data collection and wildlife monitoring such as river herring, eel, horseshoe crab and river otters. Engaging the public in habitat restoration and wildlife projects increases the public's understanding of the importance of Peconic Estuary Watershed and bolsters support for habitat and wildlife restoration and protection efforts. Recruiting citizens to participate in PEP's activities allows PEP to benefit from community engagement, build partnerships with other stakeholders and contribute to PEP's ability to collect basic scientific information that allows PEP to move forward with prioritizing our larger research priorities.

- **Wildlife Monitoring Network (WMNLI)**

The Wildlife Monitoring Network (WMNLI) is a 'one-stop-shop' for wildlife monitoring surveys that are conducted for species found throughout Long Island (Figure 2) and fulfills Actions 6, 7 and 24 of the 2020 PEP CCMP.

Seatuck led the development of a Wildlife Monitoring Network for Long Island. The creation of the Wildlife Monitoring Network, was assisted by the Peconic Estuary Partnership and it's sponsored and maintained by Seatuck Environmental Association. The goal of the Wildlife Monitoring Network is to create a centralized website where all citizen science LI wildlife monitoring projects are housed together with links to surveys. This makes it easy for partners to collaborate and avoid overlap, and for the public to become aware of the multiple citizen science programs they can participate in. With the creation of the WMNLI, we aimed to increase citizen participation, data collection, and partner collaboration. The public is encouraged whilst they are hiking or boating in their favorite bay around Long Island to keep an eye out for wildlife. This is a Citizen Science initiative and community scientists are instrumental in assisting with the WMNLI efforts of collecting the data needed to identify habitat usage by wildlife, and protect and restore the wildlife and their habitats.

Figure 2. Wildlife Monitoring Network schematic

- **River otter monitoring Internship and part of the "Otter Watch" Program**

Otter Watch is a community science project led by Seatuck, that engages the public to monitor the recolonization of Long Island by river otters. Participants are simply asked to report any possible river otter sightings. Any member from the public can participate at any time. The purpose of this survey is to assist scientists in accumulating data showing the range of river otters on Long Island.

PEP coordinated an internship opportunity for local undergraduate students to be a part of the Otter watch program. The interns were responsible for assisting with the collection of scientific data on Peconic Estuary and Watershed Otter Surveys in the Spring from March through May. The interns also participated in an Otter Survey Workshop Training to prepare for the monitoring duties. This PEP internship opportunity fulfills Actions 6, 7, 24 and 34 of the 2020 PEP CCMP.

Next steps: PEP will work with Seatuck to carry out the 2023-2024 Otter Watch monitoring and develop Quality Assurance Project Plan and a conservation plan for otters in the Peconic watershed. The plan will work with NYSDEC and other partners to outline a series of actions and recommendations for otter conservation.

Photo caption: PEP interns during otter survey with Mike Bottini (Seatuck). Photo credit: Valerie Virgona

- **Long Island Volunteer River Herring and Eel Survey**

The Long Island Volunteer River Herring and Eel Survey is organized by Seatuck in partnership with Long Island Sound Study (LISS), PEP, and the South Shore Estuary Reserve (SSER), was started in 2006 and is the longest running community science project on Long Island. The Long Island Volunteer River Herring and Eel Survey is part of the WMNLI and has been a major part of PEP Outreach since 2017. PEP in partnership with Long Island Diadromous Fish Restoration Strategy and through the Volunteer alewife Monitoring Survey, co-leads a citizen science initiative throughout the Peconic watershed to identify potential additional alewife habitat. During the survey period, volunteers are trained using River herring and Eel survey protocol by PEP and partners, to survey local waterways in the Peconic Estuary Watershed from mid-March through mid-May. The information from the survey is then submitted through an easy-to-use on-line application, Survey123 field app, via computer or mobile device and automatically becomes part of Long Island Volunteer River Herring and Eel Survey Database. The on-line app provides PEP and Partners geo-location resources for both survey location and photos taken at the respective sites.

The survey engages community volunteers to monitor historical runs of migratory river herring and American eels in rivers and streams across Long Island. The Volunteer Alewife Monitoring Survey provides data on “remnant” runs of river herring – the size and timing of these runs, any obstacles or impediments that affect the river herring or eel migration. This monitoring is critical and important to know before any funds are spent on fish passages for spawning habitat restoration. As the annual Long Island Volunteer River Herring Survey continues, additional remnant runs are sure to be discovered in the coming years. Restoration efforts will further add to the establishment of new runs which add to the overall River Herring population and aid in the expansion into new rivers and streams. This project fulfills Actions 6, 7, 24,26 and 27 of the 2020 PEP CCMP.

GOAL: RESILIENT COMMUNITIES PREPARED FOR CLIMATE CHANGE

Climate change is a formidable threat, but an adaptation strategy that stimulates collective engagement and ingenuity has the potential to make the Peconic Estuary and its surrounding communities more resilient. The Peconic Estuary faces numerous pressures including development, habitat loss, and nutrient loading. Climate change poses another set of challenges; among them are sea level rise (SLR), more frequent and more intense storms, and changing weather patterns. Suffolk County has already seen a 2.3°C (4.14°F) increase in annual temperature since the late 1890s, above the 1°C average increase for the United States over the same period (Mufson *et al.* 2019). All these pressures and challenges have the potential to further degrade water and habitat quality and lead to greater habitat loss and fragmentation.

- **Climate-Based Critical Lands Protection Strategy Criteria and Ranking Tool**

The influence of climate change on the Peconic Estuary and the communities around it will grow profoundly far into the future. Scientifically informed, proactive efforts can reduce the negative impacts and are critical in climate resilience planning in the Peconic Estuary Watershed. The PEP identifies parcels of land for priority acquisition based on their proximity to the shoreline, location in a nitrogen-impaired sub-watershed, presence of wetlands (as defined by the National Wetlands Inventory), size relative to other protected lands and the potential to aggregate multiple adjacent preserved parcels. Protecting land that is critical to the health of the Peconic Estuary from future development is a high priority for PEP, municipalities, and the public. One goal of the CCMP is to protect PEP designated Critical Natural Resource Areas (CNRAs) throughout the Peconic Estuary. Recognizing the need to be strategic and focused, PEP developed the Critical Lands Protection Strategy (CLPS) to help identify and prioritize developed, undeveloped, and agricultural parcels for acquisition based on factors including marsh migration, sea level rise and depth to groundwater. This project fulfills Actions 10, 11, 12 and 14 of the 2020 PEP CCMP.

- **Climate Vulnerability and Climate Ready Assessments**

In 2016, with funding from the EPA Climate Ready Estuaries program, PEP began the process of two Climate Ready Assessments (CRA): one for Peconic Estuary watershed and one in partnership with the Shinnecock Indian Nation. This allowed our communities to work together to address climate change by taking the first step of assessing our vulnerabilities. PEP completed both CRAs to provide climate change analysis for strategic planning of habitat restoration and land protection initiatives that addressed impacts of climate change and provided coastal resiliency and sustainability in our programs.

The PEP also conducted a risk-based climate change vulnerability assessment that developed into the Peconic Estuary Partnership Climate Vulnerability Assessment and Action Plan consistent with EPA's Climate Ready Estuaries Program. The Quality Assurance Project Plan (QAPP) for the Peconic Estuary Climate Ready Assessment, identified the tasks which foster resilient Peconic Estuary communities prepared for climate change. These projects fulfill Actions 10, 11, 12, 14 and 15 of the 2020 PEP CCMP.

- **Salt Marsh Elevation Monitoring**

The loss of natural shoreline, particularly marsh areas, contributes to a decline in water quality and in commercial and recreational fisheries. The Peconic Estuary watershed Salt Marsh Monitoring is a Nature Conservancy led project that PEP assists in to track whether Peconic Estuary marshes are sinking or gaining elevation relative to sea level. Monitoring is conducted twice annually, with data contributing to local and regional understanding of the status and future of salt marsh systems in a changing world. PEP monitors two of the six sites monitored in the Peconic Estuary watershed under The Nature Conservancy's Salt Marsh Elevation Monitoring Program. PEP staff measure the surface elevation of the salt marsh at Indian Island County Park, Hubbard County Park, and Cedar Beach of Southold Town, using Lynch *et al.* 2015, SET monitoring protocol.

The SET instrument is a portable mechanical device that provides high-precision measurements of relative elevation change in wetland sediments or shallow water bottoms relative to the base of the rod SET (RSET) mark to which it is attached. At each site, staff take several measurements of the height of a marsh surface with the SET instrument and use this data to track whether a marsh is sinking or gaining elevation relative to sea level. This helps us assess if the marsh is keeping pace with rising seas. Most sites within the network of 29 National Estuarine Research Reserves have been measuring SETs for several years. There are multiple elevation tables at each PEP site that measure marsh accretion or subsidence, natural processes that are influenced by sea-level rise, changes in sediment loading, increasing temperatures, and other consequences of climate change. PEP's SET monitoring assesses these sites' efficacy in providing storm resilience and coastal habitat, and the changes in elevation of the shoreline over time to identify loss/gain of sand and the growth of coastal vegetation such as smooth cordgrass (*Spartina alterniflora*) and America beachgrass (*Ammophila*). This project fulfills Actions 10, 11, 12 and 14 of the 2020 PEP CCMP.

- **Monitoring hardened shorelines in the Peconic Estuary**

Hardened shorelines are defined as man-made structures designed to stabilize the seashore as well as facilitate recreational and commercial activities. Hardened shoreline structures include docks, jetties, permanent piers, groins, revetments, and bulkheads/seawalls. Although beneficial for promoting short term shoreline stabilization and recreational activities, extensive anthropogenic shoreline structures as outlined above can promote marine environmental degradation. Destruction of vital habitats such as salt marsh and eelgrass beds often accompany construction of hardened shoreline structures. Eventual shoreline erosion, increased flooding, and degradation of nursery habitat for recreationally and commercially important fish species are only some of the negative environmental implications of shoreline development.

The increase in hardened shorelines in the Peconic estuary is a significant problem from a natural resources standpoint. In addition, as sea level rises over the coming centuries, hardened shorelines will prevent intertidal habitats from migrating landward sea level rises, resulting in substantial losses of these ecosystems. Some technologies for shoreline protection, incorporating intertidal vegetation into their design, currently exist for use in place of traditional bulkheading and other hard structures. However, many of these technologies can only be used in the presence of extremely low wave energy. Further research and testing of pilot projects is required to develop additional strategies that respond to current technological limitations.

In 2019, students at the Stony Brook Geospatial Institute completed a GIS-based survey to document the extent of hardened shoreline coverage along the Peconic Estuary using 2016 digital orthoimagery obtained from the New York State GIS Clearinghouse. PEP is funding the next step of this hardened

shoreline assessment that will confirm its accuracy by ground-truthing a subsample of the recorded structures and either validate their presence or noting their absence. This quality control measure aids in the elimination of discrepancies in digital mapping and between town records, as well as between maps created by different agencies, in different years, or using different survey methods. A Quality Assurance Project Plan is in development and will be completed prior to the commencement of ground truthing. This aligns with CCMP Actions 10, 11, 12, 23, 26 and 27. This monitoring project will also aid in the development of a protection strategy for horseshoe crabs and other wildlife in the Peconic Estuary, and data obtained from this project will inform PEP's future habitat restoration and protection initiatives. In addition, local Governments will be able to make informed decisions regarding land preservation, as well as to help form the basis of the PEP Horseshoe Crab strategy.

GOAL: HEALTHY ECOSYSTEM WITH ABUNDANT, DIVERSE WILDLIFE

- **Ecosystem Based Model of the Peconic Estuary**

NYS is funding the development of an Ecosystem Based Model of the Peconic Estuary, which will carry out an ECOSIM/ECOPATH model to establish trophic assemblages in the estuary and identify key species as indicators in our watershed. At the ecosystem level, Ecopath and its time varying companion Ecosim are quantitative modeling frameworks that represent all major ecosystem functional groups (Christensen & Pauly 1992, Pauly *et al.* 2000) and can be used to identify and assess structural changes in the ecosystem in response to environmental change. This project will use the data collected during the annual NYSDEC trawl survey of the Peconic Estuary (figure 3), and will develop risk metrics from ecological relationships for the Peconic Estuary (PE) that examine whether local and regional environmental changes have increased the vulnerability of individual finfish and mobile invertebrate species, community assemblages, and ecosystem processes.

The information gathered from the Ecosystem Based Modeling of the Peconic Estuary has direct application to decisions affecting the use, management, and conservation of the natural resources in the bay. For example, the New York State Department of Environmental Conservation and Suffolk County could incorporate this information into their decision-making evaluating proposed locations for shellfish aquaculture in the Aquaculture Lease Program. Tools and metrics developed in the study could be applied directly to other regional data (e.g., CTDEEP's trawl survey, NMFS surveys) and are not limited to marine finfish and mobile invertebrates. Abundance-occupancy relationships have been examined in such disparate groups as plants, moths, birds, and mammals (Gaston *et al.* 2000) and variogram analysis has provided insights into the spatial scaling of terrestrial plants (Wagner 2003, 2004) and freshwater and marine benthic invertebrates (Flanagan and Cerrato 2015; Flanagan *et al.* 2018). This project fulfills Actions 10, 23, 24 and 26 of the 2020 PEP CCMP.

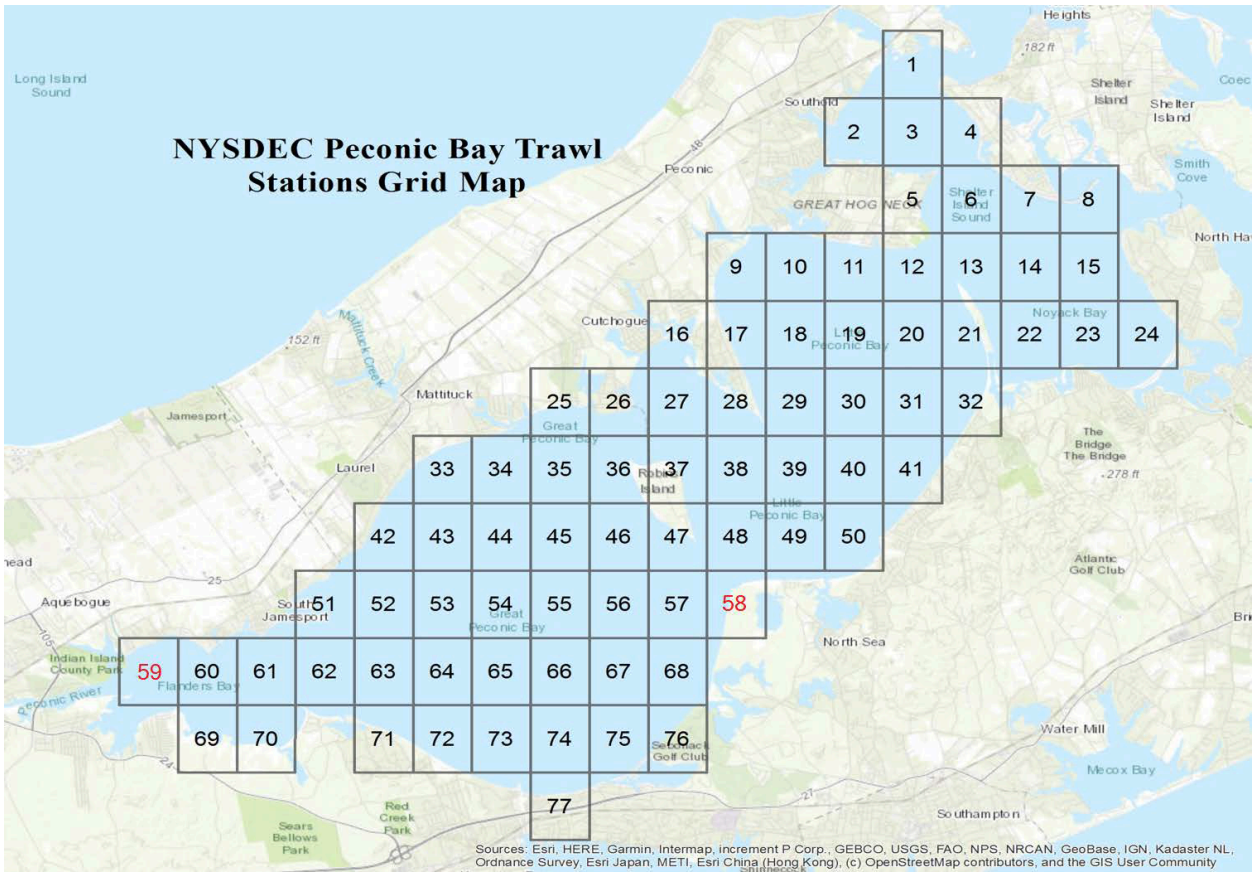

Figure 3. Peconic Estuary survey blocks used in the [NYSDEC fishery-independent trawl survey](), based on 1' latitude by 1' longitude grid cells. Trawls begin near the center of each randomly-selected block. (Source: [NYSDEC]())

- **Maintain, restore, and enhance viable diadromous fish spawning and maturation habitat in the Peconic Estuary watershed**

The installation of fish passages support the restoration of access to freshwater spawning habitat for diadromous fish populations in the Peconic River and tributaries. Restoring and strengthening ecosystem services, fish and wildlife of the Peconic Estuary will benefit from access to critical habitat, increased biodiversity and restoration of historic food webs. PEP and partners have been tracking alewife abundance in the Peconic River, evaluating the success of fish passage restoration efforts and plan on using these results to guide management of the species. Diadromous fish habitat connectivity restoration efforts within the Peconic watershed are guided by the PEP Habitat Restoration Plan, the Long Island Diadromous Fish Restoration Strategy, and the Volunteer Alewife Monitoring Survey.

Until recently, the Peconic River had six dams along its length that prevented diadromous fish species from migrating up and downstream. Currently, four out of the six dams have had fish passages built, Grangebel in 2010, Edwards Avenue in 2016, Byron Young Fish Pass (fka Woodhull dam) in 2022 and Forge Road in February of 2023, restoring 264 acres of diadromous fish habitat on the Peconic River (Figure 4). The last major barrier on the main stem of the Peconic River is the Upper Mills Dam. At this site, there are two fish impediments - the Upper Mills Dam and a weir that is part of the USGS flood stage station. PEP is working on a modification plan to the weir and securing funding for the construction of the Upper Mills Fish Passage. This passage will open up 2 miles of river and 43 acres of diadromous

spawning and maturation habitat on the main stem of the Peconic River (Figure 4). Completion of the Upper Mill Dam Fish Passage will connect the whole Peconic River System and enable the expansion of one of Long Island's premier Alewife spawning runs, foster species recovery, and contribute to ecosystem resilience. This project fulfills Actions 28 and 29 of the 2020 PEP CCMP.

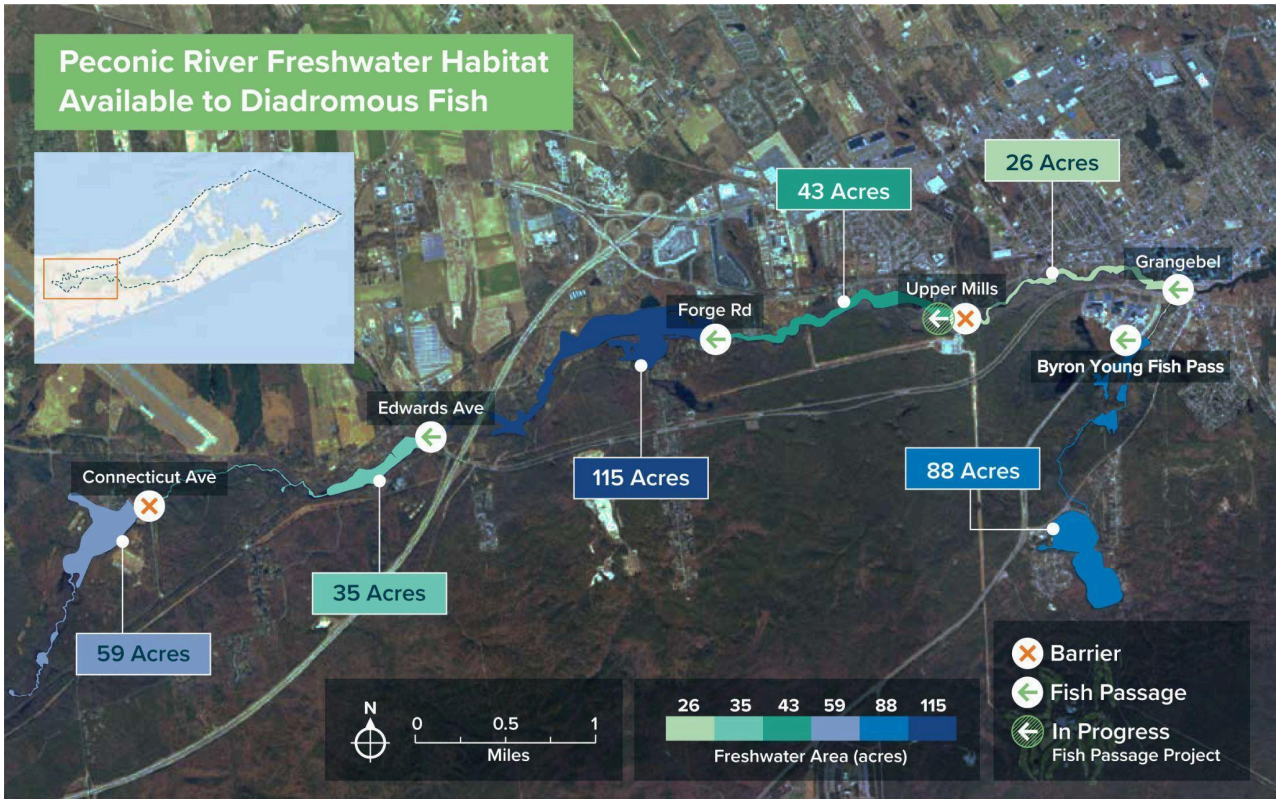

Figure 4. Map of Peconic River freshwater habitat available to diadromous fish and the fish passage status.

- **Alewife and eel monitoring**

The primary goal of these projects is to estimate alewife and eel spawning abundance in the Peconic River and in the future, other tributaries within the Peconic Estuary watershed. The results from these monitoring efforts reflect the annual strength of the alewife "run" and its migratory behavior, and can shed light on the positive impact the built fish passages and new habitat opened have on this species. The monitoring projects described below fulfill Actions 23, 24, 26 and 29 of the 2020 PEP CCMP.

- Grangebel Park: Grangebel Dam (Figure 4) was the first barrier on the main stem of the Peconic river and the first one to have a fish passage built on it. Construction of the Grangebel Nature-Like Fishway opened up 1.5 miles of river and 26 acres of diadromous spawning and maturation habitat at the start of the Peconic River. Alewife monitoring at Grangebel Park has a long history - pre and post the installation of the fishway at Grangebel Park in 2010. The Volunteer Peconic River Alewife Monitoring Program was initiated by retired NYSDEC biologist, Byron Young, in 2010. This monitoring effort included visual estimates of total fish numbers attempting to access Woodhull dam and biological sampling, including size measurements, determination of sex, and scale retrieval for age estimates (Young 2019). By 2018, the restorative efforts of the permanent Rock Ramp fish passage at Grangebel were evident with thousands of alewives using the fishway each year. With the

increased numbers of alewives returning to the Peconic Estuary watershed, PEP's partners at Suffolk County Community College (SCCC) took over the initiative from Byron Young. SCCC have been monitoring alewives at Grangebel from the Spring 2018 to present. An alewife video monitoring QAPP was developed by PEP to formalize the procedures for collecting visual fish count, biological data and a process for analyzing video footage to obtain fish abundance estimates.

- Byron Young Fish Passage: The Woodhull Fish Passage, renamed, Byron Young Fish Passage at Woodhull Dam, in honor of the dedication of retired NYS Fish Biologist Byron Young, was completed in May 2022 and opened up 2 miles of river and 88 acres of diadromous spawning and maturation habitat on Little River, a tributary to the Peconic River (Figure 4). The Byron Young Fish Passage is a combination Denil pass and step pool fish passage with an eel passage, through the dam bypassing the existing culvert. It has a permanent video monitoring system. The 2023 Alewife season was the first time fish were seen passing through the fish passage. Currently no monitoring occurs at this location. A QAPP is being developed to monitor Alewife at Byron Young Fish Passage for the 2024 Alewife spawning migration.

- **Peconic Estuary Horseshoe Crab annual survey**

Cornell Cooperative Extension of Suffolk County, Stony Brook University and PEP are working with the New York State Department of Environmental Conservation to coordinate and implement the New York Horseshoe Crab Monitoring Network. Horseshoe crabs play an important role in the marine food web, producing eggs that are an essential energy source for migrating shorebirds. Research on horseshoe crab anatomy and physiology has allowed scientists to learn more about a variety of topics impacting everything from human health to space travel. Horseshoe crabs play a vital role in the biomedical industry. The blood of the horseshoe crab contains a protein called Limulus Amebocyte Lysate (LAL) and is used by pharmaceutical and medical device manufacturers to test their products for the presence of endotoxins and bacterial substances that can cause fevers and even be fatal to humans. This is critical to maintaining the safety of many drugs and devices used in medical care. The main threats to horseshoe crab populations include loss of habitat due to shoreline hardening and sea level rise, and overharvesting by fisheries and the biomedical industry.

The intent of the New York Horseshoe Crab Monitoring Network is to collect scientific data that is used to assess the status of horseshoe crabs in New York's Marine District, and to assist with the regional management and conservation of this important species through the Atlantic States Marine Fisheries Commission. The New York Horseshoe Crab Monitoring Network monitors 26 sites on Long Island, NY Horseshoe Crab Monitoring Sites, 5 of which are in the Peconic Estuary Watershed (Figure 5a). Each site has a site Coordinator who is responsible for the collection of data, training of volunteers and overall manager of the site. Monitoring protocols for consistent and sound data collection and recording have been developed, and are site specific (Total Count Protocol, Quadrat Method Protocol). Under the supervision of the site coordinator, participants collect data on spawning abundance, size, sex and tag returns around full and new moon events in May and June. PEP's Program Office is the site coordinator for Squires Pond, Hampton Bays, NY (Figure 5b). The PEP Program Office, along with at least 2 volunteers per night, surveys Squires Pond Horseshoe crabs a total of 12 nights around full and new moon events from May to July. On each survey night the site coordinator and volunteers walk the transect twice - one direction to count the horseshoe crabs and the other for tagging, a total of 1.2 km (0.7 miles). This monitoring project fulfills Actions 7, 23, 24, 28 and 34 of the 2020 PEP CCMP.

Next steps: Thanks to a PEP sponsored grant, CCE will conduct a pilot-scale test of satellite telemetry technology to advance the monitoring of diamondback terrapins and horseshoe crabs within the Peconic Estuary. This project will commence in April to July 2024 at the New York Horseshoe Crab Monitoring Network Peconic Sites, see map below.

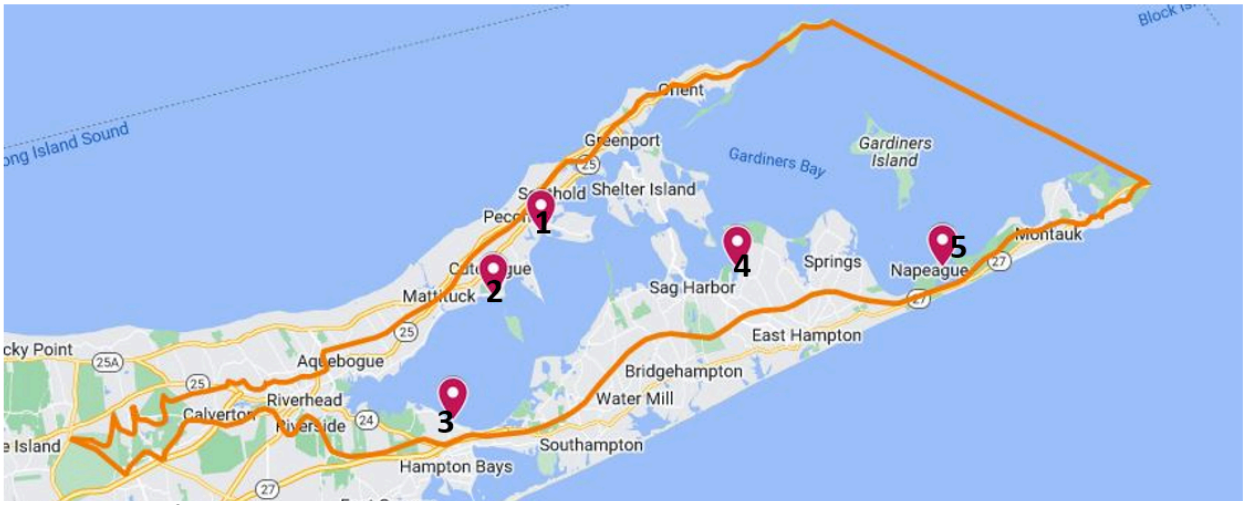

Figure 5a. Map of New York State Horseshoe Crab Monitoring Network Sites in the Peconic Estuary Watershed: 1-South Harbor Park and 2-West Creek in Southold, 3- Squires Pond in Hampton Bays, 4- Northwest Harbor and 5-Napeague Bay in East Hampton.

Figure 5b. Aerial map of Squires Pond, Hampton Bays, New York

- **Submerged Aquatic Vegetation Long Term Monitoring Plan**

The Submerged Aquatic Vegetation Long Term Monitoring Plan (SAV-LTEMP) was carried out by PEP annually with EPA §320 funds. Eelgrass monitoring has been carried out since 1997 and has been paramount in the PEP's efforts regarding eelgrass restoration. From 1997 to 2022, Cornell Cooperative Extension was contracted by PEP to carry out the SAV-LTEMP. A QAPP was developed for this monitoring

project which took place at select stations within the Peconic Estuary (Figures 6a and 6b). At each site, eelgrass shoot density, macroalgal percent cover and identification, sediment samples (lab analysis for percent organic content), eelgrass bed aerial extent, light measurement, salinity, and water temperature were collected using certified scuba divers trained as data collectors. Eelgrass bed aerial extent was conducted using the most current aerial photographs of the Peconic Estuary and were ground truthed by CCE scuba divers to ensure accuracy. All samples and records, as well as several copies of all data spreadsheets are stored in the custody of Cornell University Cooperative Extension of Suffolk County, Marine Program at the Suffolk County Marine Environmental Learning Center, Southold, New York. At the end of every monitoring year, an annual report was produced detailing the LTEMP activities and results (Figure 5c). The reports are submitted to PEP and posted on the PEP Habitat & Wildlife webpage. This monitoring project fulfills Actions 6, 23, 26, 27 and 30 of the 2020 PEP CCMP.

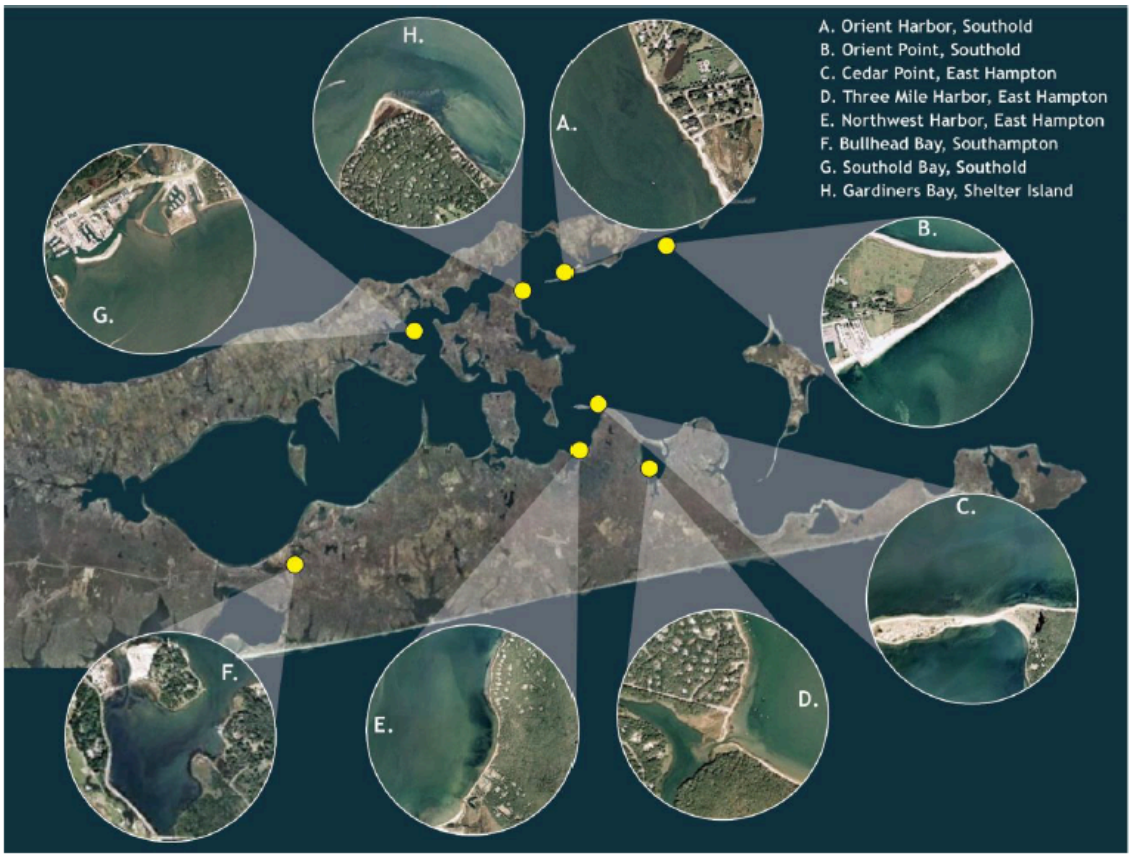

Figure 6a. Map of the Peconic Estuary showing the original eight LTEMP sites

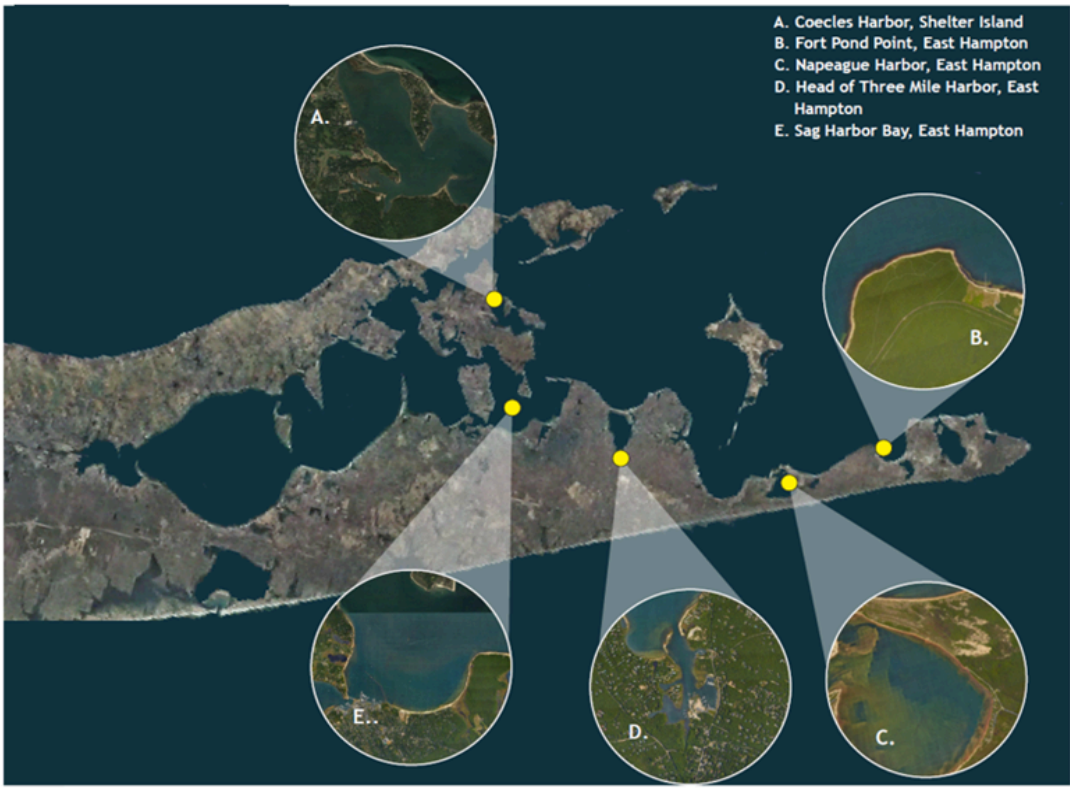

Figure 6b. Map of the Peconic Estuary indicating the locations of the five eelgrass meadows added to the monitoring program in 2017.

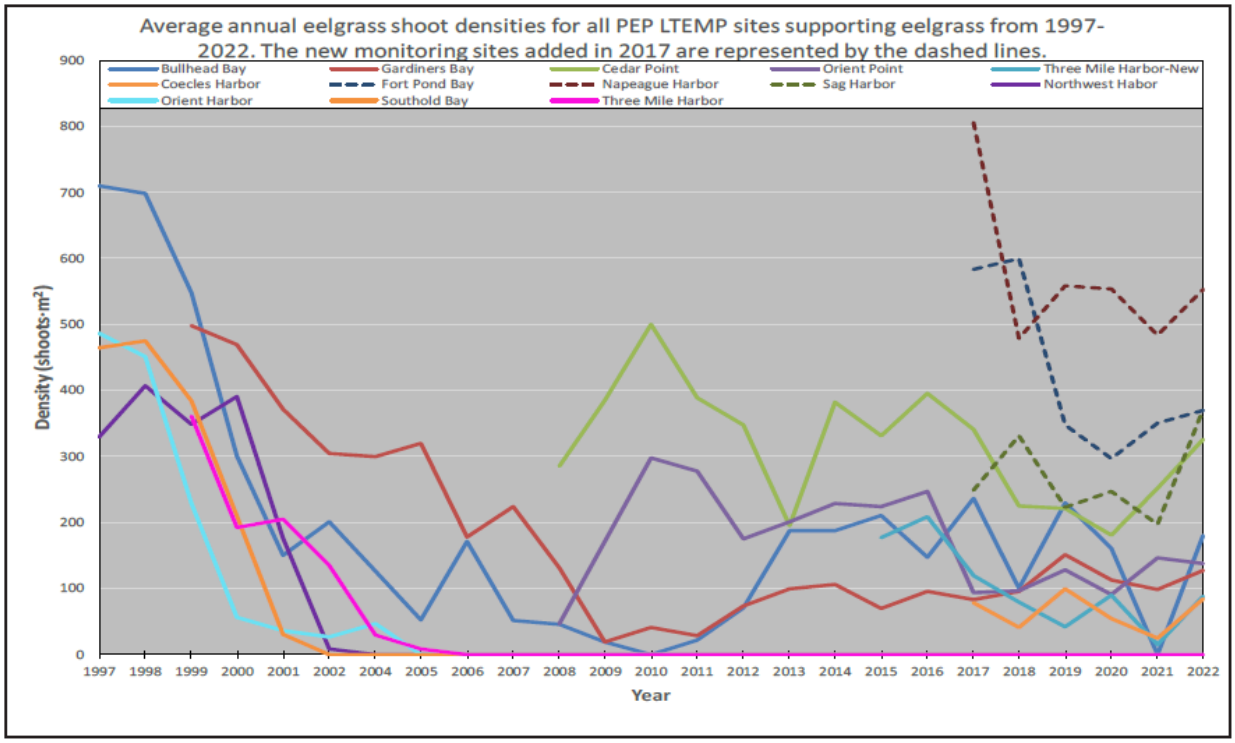

Figure 6c. Peconic Estuary Long-Term Eelgrass Monitoring Program eelgrass shoot density between 1997 and 2022

- **Aerial monitoring of eelgrass extent in the Peconic Estuary**

The decline of eelgrass (*Zostera marina L.*) in the Peconic Estuary over the last 70 years has contributed to the degradation of the estuary as a whole. This submerged, marine plant is inextricably linked to the health of the Estuary. Eelgrass provides an important habitat in near-shore waters for shellfish and finfish and is a food source for organisms ranging from bacteria to waterfowl. To better manage this valuable resource, the Peconic Estuary Program's CCMP had recommended regular aerial overflights of the estuary to map the distribution of eelgrass meadows and to allow managers to identify trends in the coverage of eelgrass meadows over time. The data collected from the aerial surveys will assist the Peconic Estuary Program, the New York State Department of Environmental Conservation (NYSDEC), and local town governments in planning for future conservation/management, permitting, and restoration activities throughout the Peconic Estuary. This monitoring project fulfills Actions 23, 26, 27 and 30 of the 2020 PEP CCMP.

2014 Peconic Estuary Aerial survey

An aerial survey was conducted by PEP through the contracting of Seawall and CCE in 2014. The SAV-LTEMP worked in tandem with this aerial survey to provide field support to ground truth the established delineations and subsequent photo-interpretation using ArcGIS-based photo-interpretation. CCE ground truthing ensured the accuracy of the eelgrass coverage maps and provided additional information regarding density of eelgrass, presence of macroalgae and defining deep edges in eelgrass meadows.

Current Peconic Estuary Aerial

After the success of the 2014 Aerial Survey the Peconic Estuary, PEP outlined a plan to conduct aerial surveys every 4-5 years. The QAPP was updated for specific aerial work (aerial imagery eelgrass monitoring plan), and PEP in partnership with the Long Island Sound Study (LISS), have joined efforts to map SAV within their watersheds (Figure 7). The new protocol will allow for the identification and delineation of eelgrass beds that have more than 5% cover and are larger than or equal to 0.25 acres in eastern LIS and the Peconic Estuary. NYS Department of Environmental Conservation and the USGS Water Services Center will be contracted to acquire the aerial imagery and the orthophotography needed for this project. The aerial imagery will be acquired during low tide between June 1st and July 31st (approximately 24 days), when sun angles and surface wind speeds are optimal to maximize water clarity. Once draft orthophotography has been delivered to the University of Rhode Island, initial eelgrass delineations and areas to be ground-truthed for LIS and PE will be identified by eye and digitized on-screen. Historical data sets (including GPS ground truth points) will also be used as supplemental sources to aid in photo interpretation. Field surveys will be conducted by boat in the same year as the aerial orthophotography was acquired (2023) in order to minimize any variability in eelgrass extent from one year to the next. Field surveys will be conducted from August to October and will utilize a tethered underwater video camera linked to an on-board GPS (Seaviewer Inc). After the fieldwork has concluded, the underwater video recordings will be converted to GIS track lines and points of eelgrass presence or absence. Other benthic data (sand, rocks, and algae) will also be recorded. After final delivery of the orthophotography product, the final delineations of eelgrass polygons along with the interpreted points from the underwater video can be added to a mosaic map.

This project has experienced some setbacks due to the COVID19 pandemic, contracting delays, unfavorable weather and until recently smoke from the Canadian Wildfires.

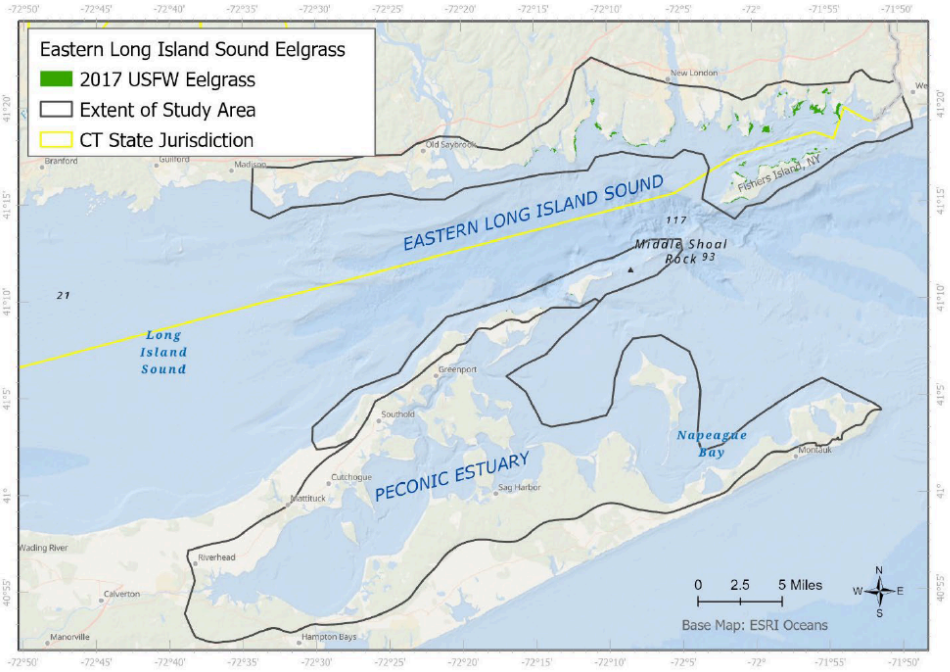

Figure 7. Map of aerial survey sites in eastern Long Island Sound and the Peconic Estuary.

- **Peconic Estuary Seagrass Bio-Optical and Habitat Suitability Model**

In 2019, Stony Brook University completed for PEP a Seagrass Bio-Optical and Habitat Suitability Model to better understand the specific light and temperature requirements for eelgrass in the Peconic Estuary. This project further shed light on the causes of the decline in eelgrass populations over the last few decades and allowed us to develop a targeted management strategy that addresses the factors causing the continued decline in eelgrass and the prevention of population rebound. PEP also funded the Stony Brook University project "Peconic Estuary Seagrass Bio-optical Model project- Living on the edge: analysis of *Z. Marina* and the potential for restoration". This project was presented at the Winter 2020 PEP Technical Advisory Committee(TAC)/Natural Resources Subcommittee (NRSC) meeting. These results will be used to inform the PEP restoration strategy plan and ultimately, increase restoration success by quantifying the relative contributions of water-column constituents to light attenuation. These projects fulfill Actions 10, 11, 26, 27 and 30 of the 2020 PEP CCMP. The QAPP is available here.

- **Peconic Bay Scallop**

In 2019 reports of adult bay scallop die-offs were recorded in Peconic Bay through field monitoring and fishermen observations. The extent of the die-off was described as "near unprecedented", where the mortality rate was estimated between 90-99% in certain areas in the Peconic Bay, resulting in a total economic loss to commercial fishermen (Tettelbach et al., 2023). PEP convened a group of scientists, managers, and other experts to assess the possible factors that may have likely contributed to the 2019 die-off. Bay scallops were actively reproducing under less than desirable environmental conditions around the time of the die-off. Water temperatures were abnormally high, approaching bay scallop's thermal limit, and localized hypoxia was present (Tomasetti et al., 2022). There was an influx of cownose rays that are known to be voracious predators of bay scallop, and this feeding frenzy was supported by anecdotal information by area baymen. Given the available evidence, this preliminary dialogue

suggested that bay scallops could have succumbed to thermal stress and it wasn't possible to determine if cownose rays contributed to the die-off.

This perspective changed drastically when a frighteningly similar die-off occurred in 2020, making it the second event in two years. As a rapid response action, NYS funds dedicated to PEP were directed to support pathology analyses at the SUNY Marine Animal Disease Laboratory (MADL). The results detected a parasite, Bay Scallop Marosporida (BSM), that is believed to proliferate under prolonged elevated water temperature. While the parasite doesn't pose any human health concerns, the presence of the organism in high density under stressful conditions (such as elevated water temperature) is sufficient to kill bay scallops (Pales-Espinosa et al., 2023). PEP managers and industry leaders have also raised their concerns about bay scallop recruitment failure in the future, and economic prosperity of commercial fishermen who depend on this fishery. These concerns were acknowledged with the 2021 fishery disaster declaration, allowing fishery managers to implement new remediatory actions. The NOAA appropriation was used to support research to study the parasite and identify bay scallop strains that can tolerate the parasite under high temperature conditions. Funds were also used to enhance monitoring and other data collection efforts and expand aquaculture hatchery efforts.

A multi-year response effort was envisioned to address the bay scallop fishery disaster, prompting PEP to appoint the Peconic Bay Scallop Technical Review Committee (TRC) to allow scientists, managers, and decision makers to jointly monitor and strategize the response coordination being administered in the Peconic Bay and its watershed. The TRC meets twice each year (Spring/Fall) to review the research progress and prepare the annual research/monitoring workplan. The current scope of the fishery disaster coordination incorporates:

- Ongoing monitoring through annual surveys being conducted by Cornell Cooperative Extension (CCE) over two decades.
- MADL research on peconic bay scallop genomics to identify resilient strains and predation studies.
- CCE bay scallop aquaculture effort to supply seeds being used in the department's restocking program.

The major findings of this preliminary response effort eliminated cownose rays and harmful algal bloom as potential causes for the fishery collapse. More importantly, the evidence that were collected refined the list of possible reasons for the die-of to the following driving forces: BSM infection and sustained elevated temperature in the estuary with associated low dissolved oxygen

These preliminary findings allowed policy makers to make informed decisions regarding funding to support future bay scallop research. In summary, the TRC presently serves as a gathering to exchange information among parties involved with the daily fishery disaster response actions. The TRC fulfills Actions 6, 10, 11, 23, 24 and 35 of the 2020 PEP CCMP.

Conclusion

The activities described within this Habitat and Wildlife Monitoring Strategy identify the projects and data necessary to assess the effectiveness of PEP in achieving CCMP actions related to habitat and wildlife. These projects will also serve as indicators used by the PEP are expected to be an effective mechanism for evaluating progress and identifying gaps regarding the achievement of significant improvements to the Peconic Estuary. Decision-makers and the public will be kept informed about the condition of the Peconic Estuary as analyzed through these monitoring programs. Stable funding and commitment from monitoring entities is necessary to ensure PEP's CCMP is effectively implemented for the continued improvement of the Peconic Estuary and its watershed.

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