Peconic Estuary Partnership
Draft Horseshoe Crab Action Plan

Horseshoe Crab Workgroup
September 2005 (Seatuck 9/2 Draft)

I. Introduction

The Peconic Estuary Partnership Horseshoe Crab Workgroup was convened in 2024 to develop a draft action plan to advance horseshoe crab conservation in the Peconic Estuary. The workgroup was tasked with 1) identifying present and future threats to the health of the estuary's horseshoe crab population, 2) developing a framework for addressing the threats to horseshoe crabs and reversing the population's long-term decline, and 3) identifying research needs to inform and support the effort to conserve horseshoe crabs in the estuary. The workgroup, which was organized by Seatuck Environmental Association, submitted this draft plan to the Peconic Estuary Partnership's Natural Resources Subcommittee for review and approval.

II. Background

A. Ecology

The American Horseshoe Crab (*Limulus polyphemus*) is one of four horseshoe crab species occurring in the world and the only horseshoe crab species found in the western hemisphere. The species' distribution ranges from the Gulf of Maine to the Gulf of Mexico; it is found in all coastal waters surrounding Long Island, including the Peconic Estuary.

Adult horseshoe crabs spend the winter months in deeper estuarine waters or on the continental shelf. In spring, they move into shallower, warmer waters, with spawning occurring on estuarine beaches and marsh edges during May and June. Adults remain in shallow, near shore habitats through the fall, when cooling waters signal them to return to deeper waters.

Horseshoe crabs utilize the intertidal zone to spawn. They prefer to spawn on sand/gravel beaches that are well oxygenated, but will also utilize low marsh habitat. Typical spawning activity, which typically peaks with high tides occurring during the full and new moon phases, involves a female crab emerging from the water into the intertidal zone where she partially buries herself in the sediment to lay eggs. The eggs are primarily fertilized by a male crab attached to the female's abdomen; however, recent research has documented that 'satellite' males that often surround the mating pair also contribute to the external fertilization of the eggs.

Juvenile horseshoe crabs, which hatch in two to four weeks, spend the first two years of their lives in nearshore areas. As they grow, the crabs will molt more than fifteen times before reaching

sexual maturity after approximately ten years. horseshoe crabs are known to live more than twenty years.

Over the past several decades scientists have increasingly recognized the important ecological role horseshoe crabs play in estuarine environments. Perhaps most notably, their eggs sustain more than a dozen shorebird species, which depend on them as a critically important food source during spring migration. Red Knots and Ruddy turnstones, two species in significant decline, rely heavily on horseshoe crab eggs to fuel their spring migration to breeding grounds in the High Arctic. Other non-bird species, including whelk, blue crabs, silversides and American eels, also feast on the eggs during the spawning season. Additionally, as they grow, horseshoe crabs are a documented food source for everything from sea turtles to sharks to striped bass. Finally, it has been recently documented that as horseshoe crabs dig through the substrate to feed on benthic organisms, they create food-rich clouds of turbidity that support a wide range of other estuarine species.

B. Management

Overarching management of horseshoe crabs falls under the authority of the Atlantic States Marine Fisheries Commission (ASMFC), a partnership of the fifteen Atlantic coastal states, including New York. ASMFC sets overall coastwide management parameters that are implemented by relevant member states. The New York State Department of Environmental Conservation (NYSDEC) is the responsible state agency for managing horseshoe crabs in New York State and does so through a management framework that involves, most notably, harvest limits/restrictions and reporting requirements.

The NYSDEC has established an annual quota that for the past decade has allowed 150,000 crabs to be taken for use as bait, primarily in the eel and whelk fishery. In 2021, NYSDEC implemented a requirement that “bait bags” be used in whelk pots to help decrease the amount of horseshoe crabs needed for bait and lessen harvest pressure on New York's population. The agency also implemented two five-day harvest bans around the full moon in May and the new moon in June (lunar closures) to allow for more horseshoe crabs to spawn before being taken. The purpose of the closures is to allow horseshoe crabs to spawn uninterrupted during their peak spawning periods. In 2025, two additional five-day lunar closures were implemented during the spring spawning season (see Figure 1 below for NYSDEC’s full 2025 horseshoe crab harvest limits). Harvest activities of horseshoe crabs within the Peconic Estuary is governed by these state regulations.

2025 Horseshoe Crab Quota Distribution				
Periods	**Dates**	**Quota (# of crab)**	**Trip Limit (# of crabs)**	**% Distribution**
1	January 1 - April 15	6,000	30	4%
2	April 16 – August 31	138,000	200	92%
2-closed	**May 10 – May 14**	**closed**	**0**	**closed**
2-closed	**May 24 – May 28**	**closed**	**0**	**closed**
2-closed	**June 9 – June 13**	**closed**	**0**	**closed**
2-closed	**June 23 – June 27**	**closed**	**0**	**closed**
3	September 1 – November 30	6,000	250	4%
4	December 1- December 31	TBD[1]	TBD[1]	TBD[1]

Figure 1 - NYSDEC 2025 HSC Quota Distribution

C. Research & Monitoring

There are currently five Peconic Estuary sites included in the New York Horseshoe Crab Monitoring Network, an annual effort to assess the status of horseshoe crabs in the New York's Marine District. The effort, which is coordinated by Cornell Cooperative Extension's Marine Program and Stony Brook University in conjunction with the New York State Department of Environmental Conservation (NYSDEC), engages organizations and volunteers to collect horseshoe crab spawning data during May and June. The PEP sites include the following:

- South Harbor Park, Southold
- West Creek, Southold
- Squires Pond, Hampton Bays
- Northwest Harbor, East Hampton
- Napeague Bay, East Hampton

Horseshoe crab data for the estuary has also been gathered annually since 1987 as part of the NYSDEC's Peconic Bay Small Mesh Trawl Survey.

D. Population Status

Generally speaking, the decline of the American horseshoe crab over the past several decades has been well documented throughout its range. The species has undergone an overall decline in abundance throughout New York waters, including the Peconic Estuary. The 2024 Atlantic States Marine Fisheries Commission (ASMFC) horseshoe crab stock assessment found that while

the status of horseshoe crab stocks in the Northeast states was "neutral," the New York stock was in "poor" condition; it was the only state to receive such a rating.

Little detail is known about horseshoe crab abundance, distribution, patterns of movement, and habitat use within the Peconic Estuary. Additionally, as noted above, while some horseshoe crab spawning beaches are well known and are part of the New York Horseshoe Crab Monitoring Network, there is incomplete data as to the extent of shoreline habitat being used by horseshoe crabs for spawning. This lack of data also extends to juvenile horseshoe crab, especially as it relates to habitat requirements during their first two years of their lives.

In addition to data from the several spawning beaches monitored by the Monitoring Network [*data available?]*, what is known about the status of the Peconic Estuary's horseshoe crab population is largely based on NYSDEC's annual trawl survey. Data from the survey was included in a recent analysis of six datasets from monitoring programs in the Long Island Sound region. Crosby, S.C., Raviraj, R., Fajardo, M. *et al.* Regional biodiversity monitoring reveals severe population decline of the Atlantic horseshoe crab (*Limulus polyphemus*)in Long Island Sound, USA. *Sci Rep* 15, 31528 (2025). The analysis found an overall drop in horseshoe crab populations in the region, with Peconic Bay exhibited the steepest decline (see Figures 2 and 3 below).

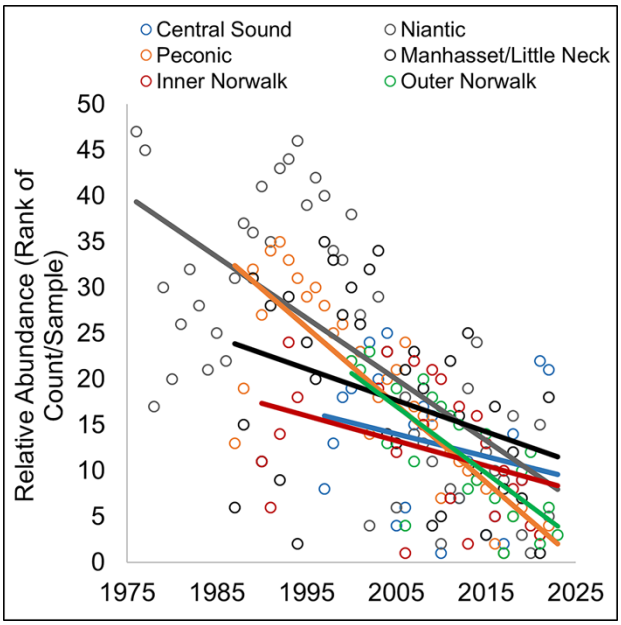

Figure 2. Relative abundance (rank-transformed count per sample, shown with linear regression line) of *L. polyphemus* across six datasets in the Long Island Sound, USA region.

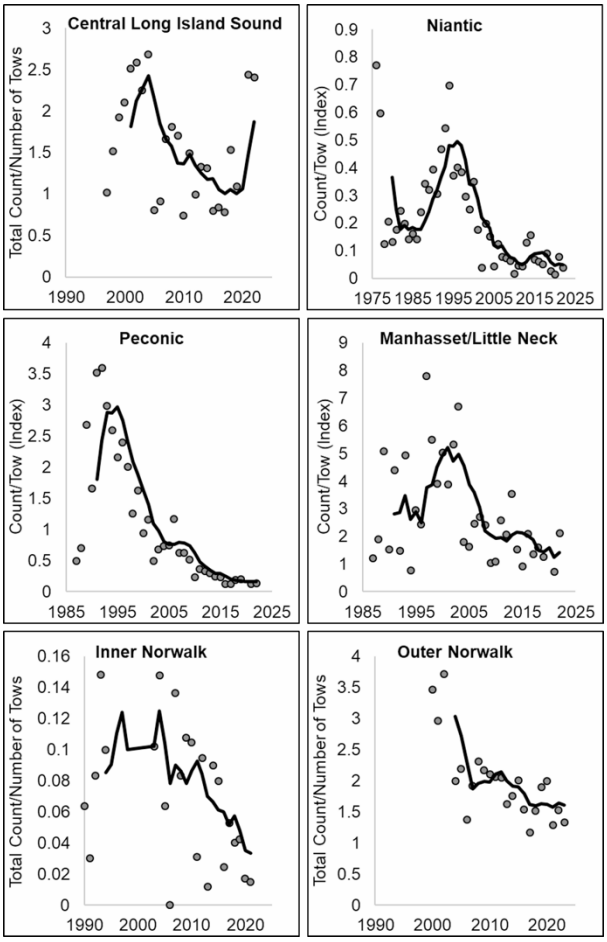

Figure 3. Observational data on counts of *L. polyphemus* at NYSDEC's Peconic East Survey and Manhasset/Little Neck West Surveys, Harbor Watch's Inner Norwalk Harbor Survey, and The Maritime Aquarium's Outer Norwalk Harbor Survey.

III. Threats

A. Harvest for Bait

As noted above, the primary harvest of horseshoe crabs in New York is for use as bait in the whelk and American eel fisheries. According to the NYSDEC website, in 2025, the total reported number of horseshoe crabs harvested was 64,879. This total represents 43% of the total NYSDEC harvest quota of 150,000 - and only 18% of the quota of the ASFMC quota of 366,272 authorized for New York (the highest quota limit of the Atlantic States). Despite the reduced quota, as well as the lunar closures and bait bag requirements that have been implemented in recent years, New York's harvest remains one of the largest among the Atlantic States.

B. Harvest for Bleeding

For over a half century, horseshoe crabs have been harvested and bled for a compound found in their blood - Limulus Amebocyte Lysate (LAL) - that, because of its high reactivity to the presence of bacteria, became standard for contaminant testing for human vaccines, implants and other sterile biomedical products. However, over the past decade researchers have developed synthetic, non-animal-derived alternatives, known as recombinant reagents, that are synthesized from horseshoe crab genes. These products have the potential to fully replace the use of LAL and the need to bleed horseshoe crabs.

While these synthetic reagents, including recombinant Factor C (rFC), have been fully approved and adopted in Europe and other parts of the world for years, the United States has lagged behind. Recently, the United States Pharmacopeia (USP) approved the use of recombinant reagents and finally paved the way to the use of alternatives to LAL testing. Still, adoption of the new reagents by the pharmaceutical industry has been slow.

While there is currently no harvest for bleeding in the Peconic Estuary, or anywhere in New York, the potential exists for the increased adoption of the practice, especially given the increased demand for vaccines in the wake of the COVID pandemic. In addition, horseshoe crabs are being harvest for bleeding in other locations in the region, which, given new research documenting the extensive ocean movement of individuals crabs, has the potential to impact of the overall health of the coastal horseshoe crab population (from 2004 to 2022, the number of horseshoe crabs bled throughout the East Coast states swelled from 101,020 to 828,181).

C. Habitat Loss & Sea Level Rise

The most significant threat to horseshoe crabs in the Peconic Estuary, especially in an era of rising seas, is from loss of shoreline spawning habitat through the placement of “hardened” or “armored” shoreline structures, such as bulkheads and rip-rap. These structures impact wildlife habitat by interfering with the upland supply and littoral drift of sediment and preventing wildlife from accessing upland habitat. In addition, instead of absorbing and attenuating wave action like natural shorelines, they deflect wave energy, which causes additional scouring an exacerbates beach loss. Finally, as sea levels rise, which will drive the conversion of intertidal habitat to subtidal habitat, hardened shorelines are especially problematic because they prevent beaches and marshes from adjusting to higher water levels by “migrating” upland. Together, these factors will combine to significantly interfere with the natural functioning of the shoreline and impact the coastal habitat continuum that is so critical for the needs of horseshoe crabs and many other estuarine species.

Over the past several decades there has been a significant increase in the amount of bayfront properties within the Peconic Estuary that have armored or hardened their shorelines, resulting

in a substantial loss of potential spawning habitat for horseshoe crabs. [*Include shoreline hardening data from PEP / CCE shoreline assessment*?]

IV. Recommendations

The Horseshoe Crab Work Group recommends the pursuit of a number of strategies to reverse the long-term decline in horseshoe crab abundance in the Peconic Estuary. It has also identified several research and assessments needs that are necessary to inform and support the conservation effort.

A. Reduce the Overall Harvest of horseshoe crabs

1) Close qualifying horseshoe crab spawning areas to harvest.

Pursuant to state regulations (6 NYCRR Part 44.3(b)), NYSDEC may, following "consultation with horseshoe crab permit holders and other interested parties," establish closed areas for commercial hand-harvest of horseshoe crabs. There are two ways the agency can close a location to harvest.

First if it determines that the site receives *significant* use by spawning horseshoe crabs during the horseshoe crab spawning season AND by transient shore bird species of greatest conservation need as defined by New York State's Comprehensive Wildlife Conservation Strategy (e.g., dunlin, semipalmated sandpiper, sanderling, ruddy turnstone, greater yellowlegs, American golden-plover, black-bellied plover, buff-breasted sandpiper, short-billed dowitcher, red knot, purple sandpiper, marbled godwit, Hudsonian godwit, and whimbrel).

Second, if the area is managed by a local, state or federal agency or governing body as a public recreation area, and such agency or governing body has requested that the department restrict horseshoe crab hand-harvesting.

There are currently only four areas in New York closed to horseshoe crab harvest pursuant to 6 NYCRR Part 44.3(b); they include Fire Island National Seashore, Gateway National Recreation Area, West Meadow Beach (Stony Brook) and Cedar Beach (Mt. Sinai Harbor). There are no closed spawning sites within the Peconic Estuary.

Municipalities within the estuary should work with local horseshoe crab and bird experts to identify potential qualifying spawning areas and submit a request to NYSDEC to close the location to harvest. Advocates can also identify and recommend other potentially qualifying spawning locations for the agency to close on its own.

2) Reduce the take of horseshoe crabs for bait.

To supplement strategies that are currently being implemented (such as the aforementioned lunar closures), NYSDEC has additional tools at its disposal to reduce the take of adult horseshoe crabs and increase their reproductive success.

The Department should consider additional strategies to increase the efficacy of the annual horseshoe crab spawn, such as limiting the harvest of certain female horseshoe crabs (based on a size slot limit) and a banning the harvest of horseshoe crabs in amplexus.

3) Advance alternatives to the use of horseshoe crabs for bait.

Recent studies have documented promising alternatives to replace the use of horseshoe crabs as bait in the whelk and eel fisheries (see, Munley, et al, *Laboratory investigations into alternative baits for the channeled whelk (Busycotypus canaliculatus) fishery*, and Munley, et al, *Alternatives to Horseshoe Crab (Limulus polyphemus) as Bait for the Channeled Whelk (Busycotypus canaliculatus) Trap Fishery*. In 2026, NYSDEC, Seatuck Environmental Association and Cornell Cooperative Extension of Suffolk County will commence a study of the potential for alternative baits for use in the whelk fishery in New York. The advancement of a successful replacement for horseshoe crabs as bait would put a permanent end to the majority of horseshoe crab harvest, not only in New York, but also in other states throughout along the Atlantic coast where it is still permitted.

The Peconic Estuary Program, municipalities, nonprofits, etc. should express support for current efforts to develop an alternative bait to horseshoe crabs for use in the eel and whelk fisheries. Such support can lead to additional funding for research and advances in the development and adoption of alternative baits.

4) Support phase out of the use of horseshoe crab blood in the biomedical industry.

While no horseshoe crabs are currently harvested in the Peconic Estuary to obtain LAL through bleeding, the potential exists for the establishment of such use in the future. In addition, horseshoe crabs are being harvest for bleeding in other locations, which has the potential to impact of the overall health of the region's horseshoe crab population.

The Peconic Estuary Program, municipalities, nonprofits, etc. should express support for the adoption of rFC. Full transition to synthetic reagents for endotoxin testing would eliminate the need to obtain LAL through the bleeding of horseshoe crabs.

B. Improve horseshoe crab Habitat

1) ***Amend municipal codes regarding shoreline hardening***.
Municipalities within the Peconic Estuary should review their municipal codes regarding shoreline management – particularly the criteria for approving shoreline hardening structures – and amend them to 1) require "softer" and "nature-like" approaches where appropriate, and 2) increase the requirements for hardened structures so such structures are approved only when necessary. Municipalities should also explore opportunities to provide incentives for the removal of hardened shoreline structures on private property.

2) ***Identify opportunities for softening publicly owned shorelines***.
Municipalities within the Peconic Estuary should review shoreline properties they own to determine if they contain shoreline hardening structures that are suitable candidates for removal.

3) ***Identify opportunities for public acquisition of horseshoe crab spawning habitat.***
Municipalities should identify and acquire through their CPF programs property with undisturbed shorelines that is conducive for horseshoe crab spawning (and that would also serve as important habitat for diamondback terrapins, shorebirds and other wildlife).

4) ***Identify opportunities for permanent protection of horseshoe crab spawning habitat.***
Municipalities should assess shoreline properties they own for potential dedication to the town's highest protective land use category of their respective town codes. These include the Town of Shelter Island Chapter 91, Town of Southampton Chapter 231, East Hampton Chapter 182 and Riverhead Chapter 221. Acquisition and protection of shoreline habitat should also be prioritized by the Peconic Land Trust and other private conservation entities.

5) ***Advance use of CPF funding for shoreline restoration.***
If permissible pursuant to the terms of the "water quality improvement project" provision of the CPF (NY Town L § 64-E), town should utilize program income to work with private property owners to remove bulkheads and other shoreline protection structures and restore natural shoreline habitats. If not currently authorized, advance and support an amendment to the CPF state enabling legislation to permit such projects, perhaps through the use of conservation easements or permanent deed restrictions.

C. Research Needs

1) ***Improve understanding of horseshoe crab habitat within and around the Peconic Estuary.***
   - Continue refinement of Peconic Estuary shoreline inventory
   - Expand tagging studies
   - Compare stable isotope values of spawning horseshoe crabs with spatially explicit isoscapes to
     retrospectively assign regions of critical offshore habitat.
   - Employ occupancy-abundance model
   - Conduct surveys to identify habitats within the Peconic Estuary important to the development of juvenile horseshoe crabs
   - Examine linkages between DEC trawl survey data and environmental variables; assess trawl survey data for spatial distribution changes over time.

2) ***Improve understanding of horseshoe crab spawning areas in the Peconic Estuary.***
   - Expand participation in the New York Horseshoe Crab Monitoring Network
   - Conduct drone surveys to map and record spawning horseshoe crab and collect physical features of spawning beaches with LiDAR.
   - Collect relevant environmental and biological information on beaches to characterize horseshoe crab spawning habitats and spatial use; use data to predict the probability of habitat use of spawning horseshoe crabs (*See Landi et al.'s (2015) model of the CT shoreline*).

3) ***Research connection between climate variation and horseshoe crabs.*** Identify how changes in North Atlantic Oscillations and Atlantic Multidecadal Oscillations are impacting horseshoe crab within the Peconic estuary

4) ***Advance research to support the development of an alternative bait to horseshoe crabs.*** Conduct research to determine horseshoe crab components that make them are a popular bait for whelk, eel, etc.

5) ***Determine whether horseshoe crabs are adversely impacted by dredging and trawling activities.***
   - Assess the extent to which dredging activities taking place within the Peconic Estuary have an adverse impact to horseshoe crabs.
   - Assess the extent to which nearshore commercial fishing trawls impact horseshoe crabs as bycatch.