

Species Status Assessment

Common Name: Horseshoe crab

Date Updated: 01/05/2024

Scientific Name: *Limulus polyphemus*

Updated by: Jennifer Lander

Class: Merostomata

Family: Limulidae

Species Synopsis (a short paragraph which describes species taxonomy, distribution, recent trends, and habitat in New York):

Horseshoe crabs are found from Northern Maine to the Yucatan Peninsula. Temperature appears to be the limiting factor on the northern range of this species (Shuster, 1982). Horseshoe crabs are not true crabs but are in fact more closely related to spiders and scorpions (Roscoe, 2011). Many migrating shorebirds from South America to the Arctic rely on horseshoe crab eggs as a food source. Although humans do not consume horseshoe crabs, both recreational and commercial bait fisheries exist. Additionally, the horseshoe crab's unique blood is used by the biomedical industry to produce Limulus Amoebocyte Lysate (LAL). Crabs harvested for this purpose can (and should) be returned to the water alive, however, there is a 15% mortality rate associated with the bleeding of live crabs (see fig 4; ASMFC, 2023).

In New York, American horseshoe crabs are found year-round on coastal waters along both the north and south shores of Long Island as well as the Peconic estuary (Sclafani et al., 2014). The 2019 Atlantic States Marine Fisheries Commission (ASMFC) horseshoe crab stock assessment found that while on a coastwide basis, the status of horseshoe crab stocks was neutral, the New York stock was in poor condition (ASMFC, 2019a). Primary threats to horseshoe crab populations in New York are commercial harvesting, sea-level rise, and shoreline hardening. Horseshoe crabs are currently still prevalent in New York waters but have shown an overall decline in abundance. Annual survival rates for adult horseshoe crabs in New York are lower compared to other regions, falling below 60% in some areas (Bopp et al., 2019). In addition, female spawning indices in the New York region are lower compared to other regions (Mattei et al., 2010; Sclafani et al., 2014; Bopp et al., 2019). The 2019 ASMFC horseshoe crab stock assessment found the status of New York horseshoe crab stock was poor; stocks are defined as poor if 33% of the surveys included were below the 1998 reference point (ASMFC, 2019a). Based on the fitted model results from the ASMFC abundance indices, I calculated the percent decrease in abundance for the CT trawl survey (64.77%), the NEMAP Fall survey (49.43%), the Peconic trawl survey (94.35%), the Little Neck/Manhasset bay seine survey (69.59%), and the Jamaica bay seine survey (61.35%).

I. Status

a. Current legal protected Status

i. **Federal:** Not Listed _____ **Candidate:** No

ii. **New York:** Not Listed _____

b. Natural Heritage Program

i. **Global:** G5 _____

ii. **New York:** S3 _____ **Tracked by NYNHP?:** Yes

Other Ranks:

-New York 2025 SGCN status: High Priority Species of Greatest Conservation Need

-IUCN Red List: Vulnerable

-Northeast Regional SGCN: RSGCN

Status Discussion:

According to the 2022 Horseshoe Crab Fishery Management Plan review, no definitions for overfishing or overfished have been established by the Management Board. However, a stock assessment characterized the status of each regional and coastwide population based on the percentage of surveys within a region (ASMFC, 2023). The stock status of the Delaware Bay and Southeast Regions have remained consistently neutral and good, respectively, through time. The status of the Northeast region has changed from poor to neutral. The status of the New York region has trended downward from good, to neutral, and now to poor. These trends should be viewed with caution because the number of surveys in each region has changed in the current assessment and the index values have changed due to a change in methods for developing indices (ASMFC, 2019b).

II. Abundance and Distribution Trends

| Region | Present? | Abundance | Distribution | Time Frame | Listing status | SGCN? |
|-----------------|----------|------------|--------------|-----------------------|----------------|-----------------|
| North America | Yes | Unknown | Stable | 1988-2008 | | Choose an item. |
| Northeastern US | Yes | Declining | Stable | 1988-2008 New England | | Choose an item. |
| New York | Yes | Declining | Stable | 1987-2008 | Not Listed | Yes |
| Connecticut | Yes | Declining | Stable | 1978-2008 | Most Important | Yes |
| Massachusetts | Yes | Declining | Stable | 1978-2008 | Not Listed | No |
| New Jersey | Yes | Increasing | Stable | 1988-2008 | | No |
| Pennsylvania | No | - | - | | | - |
| Vermont | No | - | - | | | - |
| Ontario | No | - | - | | | - |
| Quebec | No | - | - | | | - |

Column options

Present?: Yes; No; Unknown; No data; (blank) or Choose an Item

Abundance and Distribution: Declining; Increasing; Stable; Unknown; Extirpated; N/A; (blank) or Choose an item

SGCN?: Yes; No; Unknown; (blank) or Choose an item

Monitoring in New York *(specify any monitoring activities or regular surveys that are conducted in New York):*

The NYSDEC and Cornell Cooperative Extension work together on the Horseshoe Crab Monitoring Network, a State Wildlife Grant (SWG) funded project. This is primarily a spawning survey and is used to gather information on important spawning habitats for horseshoe crabs. Data on prosomal width, number of crabs (separated by sex), distance of crabs from shoreline, and environmental conditions are collected as part of this survey. This surveys also includes a tagging/recapture component to monitor trends for individual crabs and to learn more about their life history traits and migration patterns. Tags come from the U.S. Fish and Wildlife Service (USFWS) and are also used on NY's Striped Bass Trawl Survey and their Atlantic Sturgeon Ocean Trawl Survey. More recently, NY is looking to develop a program to monitor the interactions of shorebirds and horseshoe crabs as part of the SWG project. Additional information on the abundance of horseshoe crabs in New York comes from the NYSDEC's Peconic Trawl Survey, Western Long Island Beach Seine Survey, and Ocean Surf clam Dredge Survey (NYSDEC, 2013). The CT DEEP also conducts a trawl survey that collects abundance data on horseshoe crabs in the Long Island Sound.

A commercial fishery sea sampling program run by the NYSDEC is also currently underway. This program entails accompanying commercial fishermen while they harvest for crabs and monitoring their catch to collect data on size, sex, and catch-per-unit-effort (CPUE).

Trends Discussion *(insert map of North American/regional distribution and status):*

The decline of the red knot has resulted in much attention to horseshoe crab populations since horseshoe crab eggs play a vital role as a food source for these migrating birds. NY indices show year to year fluctuations, yet an overall stable abundance in the western Long Island Sound, from 1987 through 1996, with a sharp increase seen from 1996 to 1997. After 1997 the abundance decreased, although it remained higher on average than previous years. In 2003, another peak was reached, followed by a sharp decline in 2004. From there on, abundance remained relatively stable until 2011 (besides a small peak in 2007). Although abundance in the eastern Long Island Sound followed a similar pattern to the western portion from 1987 to 1996, it has since shown a gradual overall decline, reaching some of the lowest values in the time series in 2010 and 2011 (LISS, 2013).

Based on model outputs from ASMFC compiled from multiple surveys, NY Horseshoe crabs continue to show fluctuations as time progresses. From 2000 to 2015, there is an overall decline in horseshoe crab abundance in the New York region (see Fig. 3).

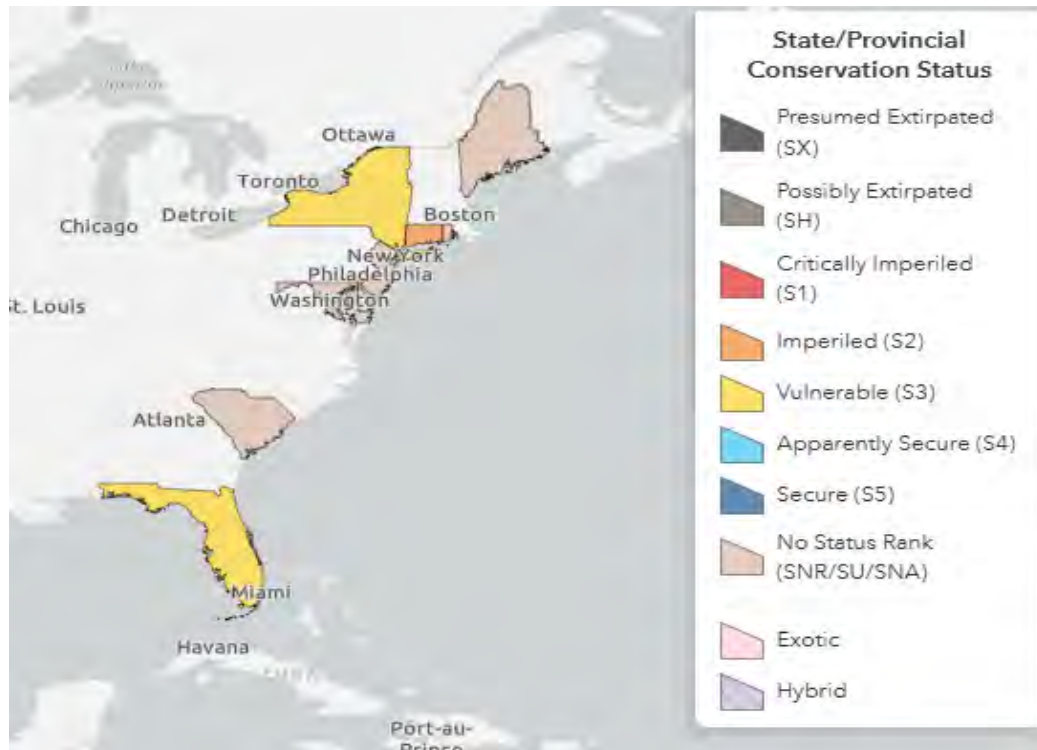


Figure 1. Conservation status of horseshoe crab in North America (NatureServe 2024).

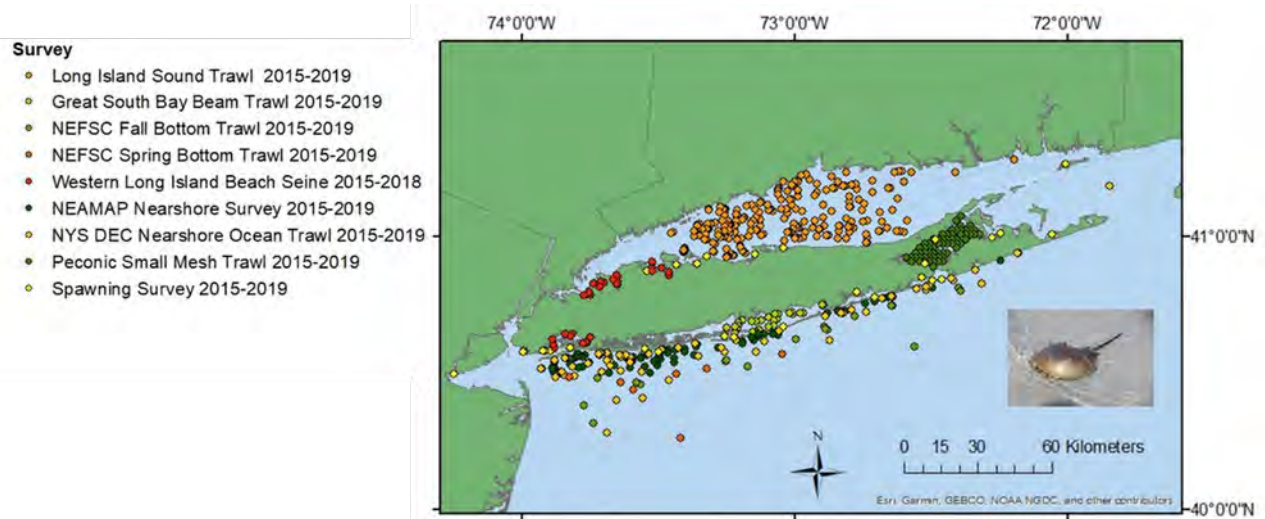


Figure 2. Horseshoe crab records between 2015-2019 within the geographic scope of the NY Ocean Action Plan

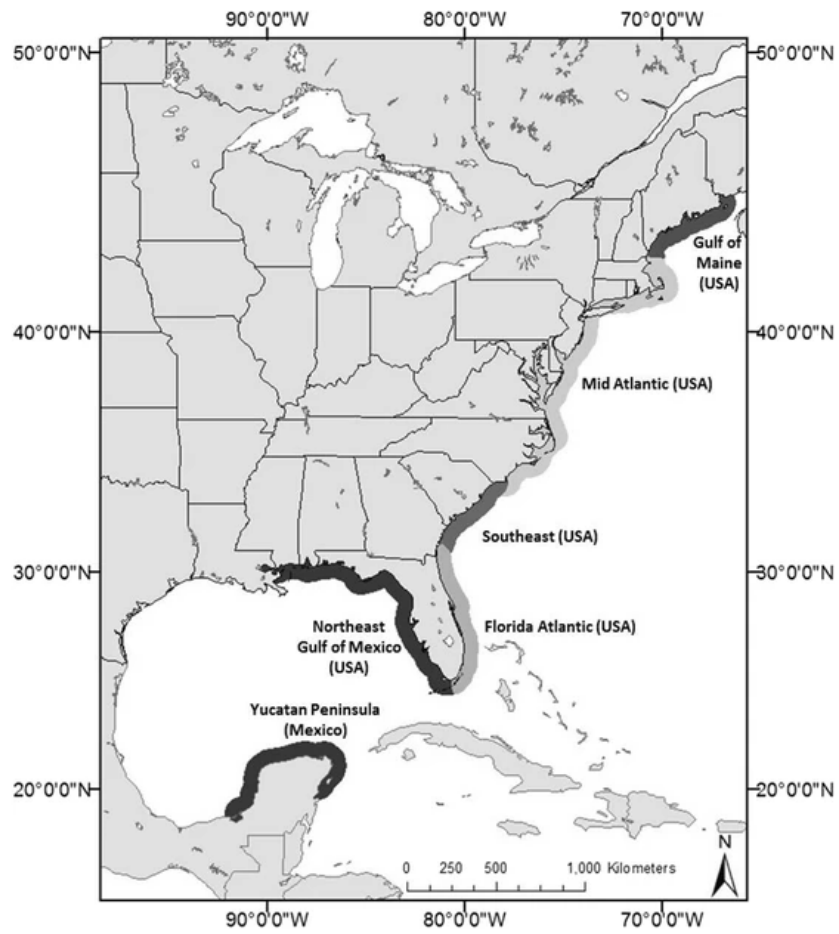


Figure 3. Distribution map for the American Horseshoe Crab (*Limulus polyphemus*), including genetically-defined regions used in the IUCN Red List assessment. Shading is included to contrast each region and indicate geographic extent (Smith et al., 2017).

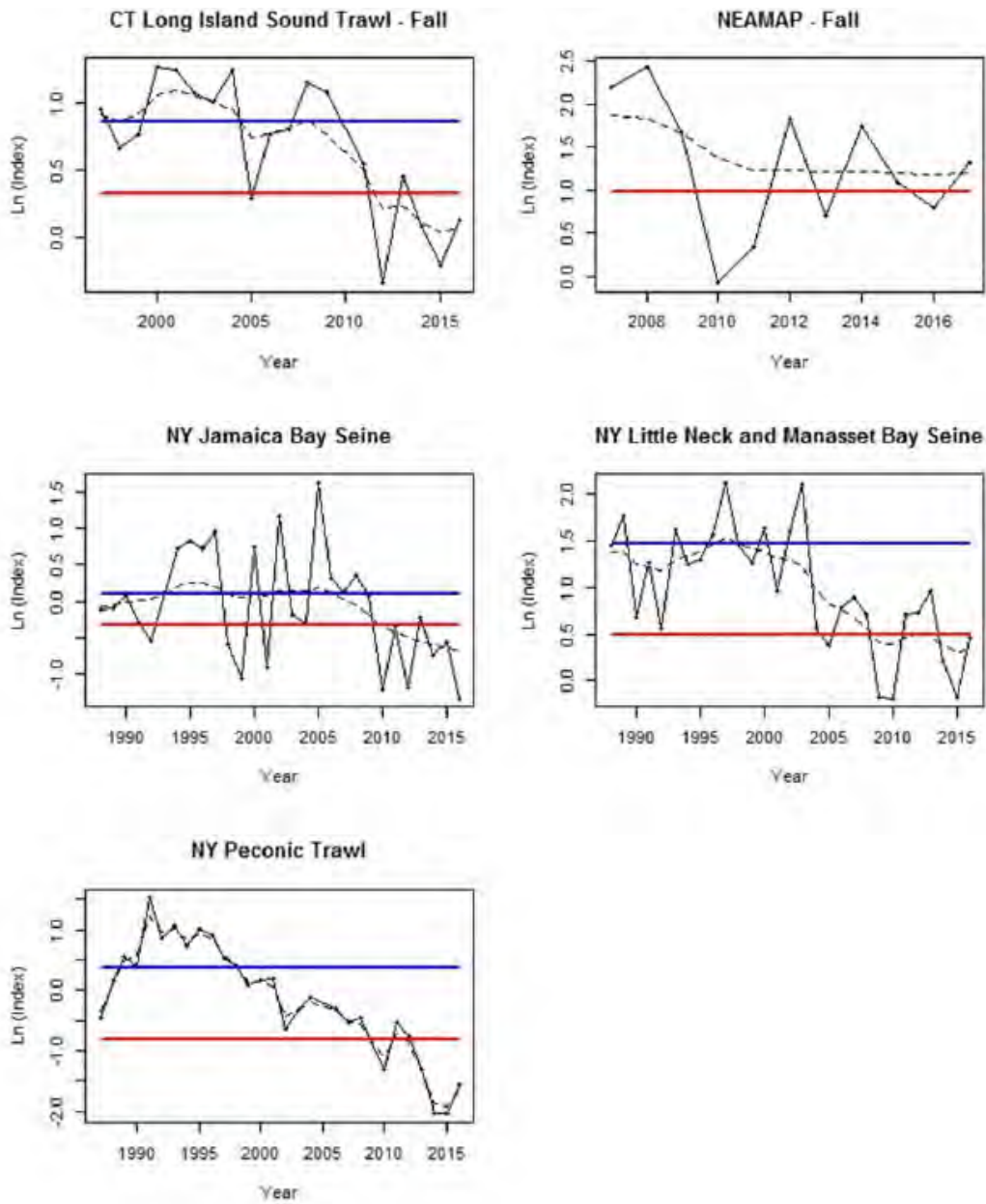
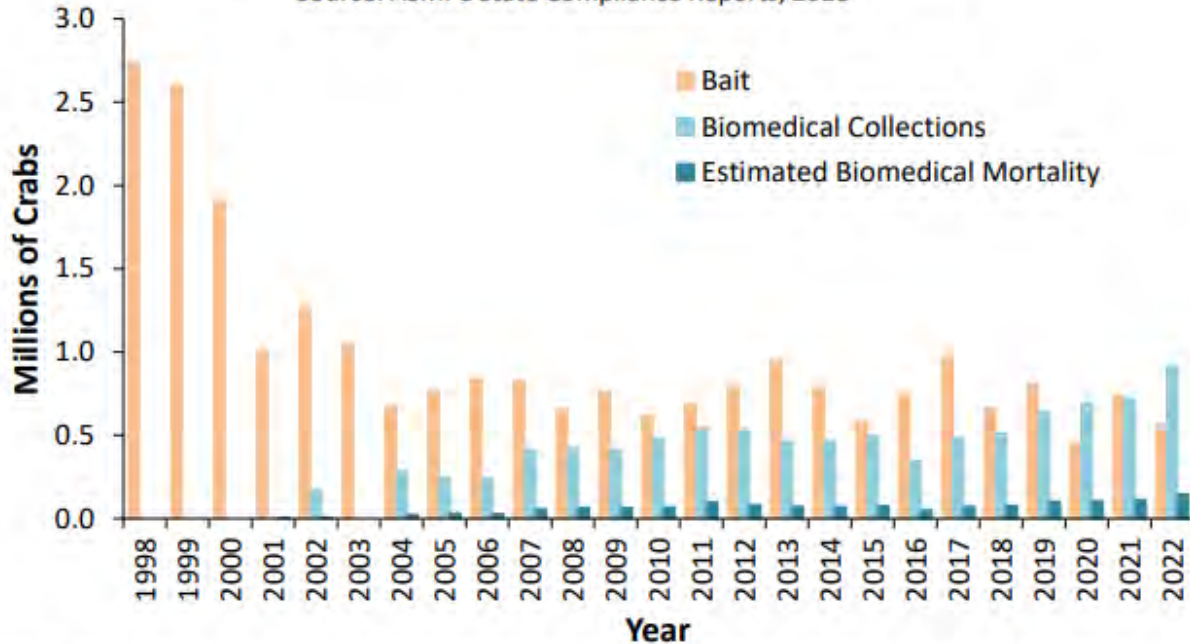


Figure 84. New York Region horseshoe crab survey ARIMA model fits. The solid line represents the observed Ln transformed indices and the dashed line represents the fitted indices. The red horizontal line represents the Q₂₅ reference point and the blue horizontal line represents the 1998 reference point.

Figure 4. Model outputs from the Atlantic States Marine Fisheries Commission for New York Horseshoe crabs (ASMFC, 2019a)

Coastwide Horseshoe Crab Bait Landings & Biomedical Collections

Source: ASMFC State Compliance Reports, 2023



*Biomedical collections are annually reported to the Commission and include all horseshoe crabs brought to bleeding facilities except those that were harvested as bait, "rented" by biomedical facilities and counted against state bait quotas.

*Crabs collected solely for biomedical crabs are returned to the water after bleeding; a 15% mortality rate is assumed for all bled crabs that are released. This number plus observed mortality reported annually by bleeding facilities via state compliance reports equals the 'Estimated Biomedical Mortality.'

Figure 5. Number of horseshoe crabs harvested for bait and collected for biomedical purposes, 1998-2022. (ASMFC, 2023).

III. New York Rarity (provide map, numbers, and percent of state occupied)

Horseshoe crabs are not considered rare in New York.

Details of historic and current occurrence:

From the 1850s to the 1920s, between 1.5 and two million horseshoe crabs were harvested annually for fertilizer and livestock feed. Harvest dropped throughout the 1950s and ceased in the 1960s. Between 1970 and 1990, reported commercial harvest ranged from less than 20,000 pounds to greater than two million pounds annually (ASMFC, 2010).

Horseshoe crabs are currently still prevalent in New York waters but have shown an overall decline in the Long Island Sound, Jamaica Bay, Peconic Bay, and Western Long Island. (see fig. 3). The ASMFC Technical Committee suspects that decreased quotas in Delaware Bay, in order to protect horseshoe crab eggs as a food source, have subsequently increased harvest pressure in New York and other nearby regions (ASMFC, 2012).

New York’s Contribution to Species North American Range:

| Percent of North American Range in NY | Classification of NY Range | Distance to core population, if not in NY |
|---------------------------------------|----------------------------|---|
| 1-25% | Core | |

Column options

Percent of North American Range in NY: 100% (endemic); 76-99%; 51-75%; 26-50%; 1-25%; 0%; Choose an item

Classification of NY Range: Core; Peripheral; Disjunct; (blank) or Choose an item

IV. Primary Habitat or Community Type (from NY crosswalk of NE Aquatic, Marine, or Terrestrial Habitat Classification Systems):

1. Marine, Shallow Subtidal
2. Marine, Deep Subtidal
3. Maritime Intertidal Gravel/Sand Beach
4. Marine, Intertidal, Tidal Flat
5. Benthic

Habitat or Community Type Trend in New York

| Habitat Specialist? | Indicator Species? | Habitat/Community Trend | Time frame of Decline/Increase |
|---------------------|--------------------|-------------------------|--------------------------------|
| No | No | Stable | |

Column options

Habitat Specialist and Indicator Species: Yes; No; Unknown; (blank) or Choose an item

Habitat/Community Trend: Declining; Stable; Increasing; Unknown; (blank) or Choose an item

Habitat Discussion:

Horseshoe crabs are benthic organisms and non-breeding adults are exclusively subtidal. They have been caught at depths of greater than 200 meters but are thought to prefer depths of less than 30 meters. Overwintering adults may remain in bays or migrate to the continental shelf (ASMFC, 2015).

During spawning season, which typically reaches its peak in May and June, sandy beaches are utilized by the crabs. Beaches or coves that are protected from strong wave action are the preferred habitat for spawning events. Shallow inshore water or shoals are ideal nursery grounds for horseshoe crabs. For the first two years of their life, horseshoe crabs live on intertidal sand flats. Older juveniles eventually migrate out of these nursery habitats and into waters a few miles offshore (ASMFC, 2015).

V. Species Demographics and Life History

| Breeder in NY? | Non-breeder in NY? | Migratory Only? | Summer Resident? | Winter Resident? | Anadromous/Catadromous? |
|----------------|--------------------|-----------------|------------------|------------------|-------------------------|
| Yes | - | - | Yes | Yes | - |

Column options

First 5 fields: Yes; No; Unknown; (blank) or Choose an item

Anadromous/Catadromous: Anadromous; Catadromous; (blank) or Choose an item

Species Demographics and Life History Discussion (include information about species life span, reproductive longevity, reproductive capacity, age to maturity, and ability to disperse and colonize):

Adult females reach sexual maturity at the age of ten years old, one year later than males. Although spawning events may be affected by water temperature, generally, they occur from May to June. The females lay clusters of eggs in nests near the high tide mark during new and full moons and the males then fertilize the eggs. During spawning events it is common to find the generally smaller-sized males attached to the larger females by means of specialized grasping appendages on their legs. When the eggs hatch the larvae are free-swimming for about six days.

They then settle to the bottom and undergo their first molt (Shuster, 1982). During their first and second summer, juveniles are abundant on intertidal flats (Shuster, 1955, 1979). The remainder of the crabs' 14 to 19 year life span (Ropes 1961) is spent subtidally, except during annual spawning events (Botton, 1987).

VI.Threats (from NY 2015 SWAP or newly described)

| Threat Level 1 | Threat Level 2 | Threat Level 3 | Spatial Extent | Severity | Immediacy | Trend | Certainty |
|---------------------------------------|--|----------------------------------|-----------------------|-----------------|------------------|-----------------|------------------|
| 1. Residential and Commercial | 1.1 Housing & Urban Areas | - | Choose an item. | Choose an item. | Choose an item. | Choose an item. | Choose an item. |
| 2. Agriculture & Aquaculture | 2.1 Annual & Perennial Non-Timber Crops | - | Choose an item. | Choose an item. | Choose an item. | Choose an item. | Choose an item. |
| 3. Energy Production & Mining | 3.3 Renewable Energy | - | Choose an item. | Choose an item. | Choose an item. | Choose an item. | Choose an item. |
| 4. Transportation & Service Corridors | 4.3 Shipping Lanes | 4.3.2 Dredging of shipping lanes | Choose an item. | Choose an item. | Choose an item. | Choose an item. | Choose an item. |
| 5. Biological Resource Use | 5.4 Fishing & Harvesting Aquatic Resources | - | Choose an item. | Choose an item. | Choose an item. | Choose an item. | Choose an item. |
| 5. Biological Resource Use | 5.4 Fishing & Harvesting Aquatic Resources | 5.4.2 Commercial fishing | Choose an item. | Choose an item. | Choose an item. | Choose an item. | Choose an item. |
| 7. Natural System Modifications | 7.3 Other Ecosystem Modifications | 7.3.4 Beach development | Choose an item. | Choose an item. | Choose an item. | Choose an item. | Choose an item. |
| 9. Pollution | 9.1 Domestic & Urban Wastewater | - | Choose an item. | Choose an item. | Choose an item. | Choose an item. | Choose an item. |
| 11. Climate Change | 11.1 Habitat Shifting & Alteration | - | Choose an item. | Choose an item. | Choose an item. | Choose an item. | Choose an item. |

Table 3: Threats to Horseshoe crab.

The amount of horseshoe crabs being harvested for their blood by the biomedical industry to produce Limulus Amoebocyte Lysate (LAL) has been increasing since 2004 with a 15% mortality rate on crabs that are returned to the water after being bled (ASMFC, 2023). While there currently are no biomedical licenses in NY to harvest horseshoe crabs, this should be considered as a potential threat in the future. Estimated mortality from the biomedical industry has been estimated to be between 10-30%. However, post-release mortality has not been estimated.

Some areas are closed to harvesting throughout the year (e.g., Fire Island National Seashore, Gateway National Park in Jamaica Bay and Staten Island, West Meadow, and Cedar Beach) (NYSDEC, 2023a). Declines in horseshoe crab abundance in New England, including the New York region, have been presumed to be a result of overharvesting (Smith et al., 2017). Despite reductions in quotas, NY horseshoe crab populations remain in poor condition.

The importation of frozen Asian Horseshoe crabs for use as bait has been a cause of relatively low concern in recent years. With the introduction of a nonnative species into local waters, our native populations can potentially be exposed to foreign pathogens and disease. The ASMFC recommends that member states ban the importation of Asian horseshoe crabs (ASMFC, 2013).

Beach development and coastal erosion pose a direct threat to horseshoe crabs' spawning habitat. During peak spawning periods human activity could potentially disrupt the spawning event or disturb individual crabs.

Are there regulatory mechanisms that protect the species or its habitat in New York?

Yes: ✓

No:

Unknown:

If yes, describe mechanism and whether adequate to protect species/habitat:

Currently, New York manages the commercial fishery by setting a strict limit (number of crabs) per calendar year as required by the Atlantic States Marine Fisheries Commission. Since 2004, NY has voluntarily reduced their allotted quota in order to help both horseshoe crab and shorebird populations (NYSDEC, 2013). This quota distribution plan is divided amongst several periods which are comprised of predetermined dates. Depending on the month, weekly or monthly reporting of commercial harvest by fishermen is mandatory in order to manage this quota. Gear restrictions are in place for commercial harvest. Also, the NYSDEC maintains the right to close areas to harvest for several reasons, for example if the area is documented as being important to spawning. If horseshoe crabs are harvested for bio-medical purposes the crab must be returned immediately to the location of harvest after bleeding, or sold as bait and reported as bait harvest which will in turn be used as part of the allotted bait quota. The appropriate permits are required depending on the purpose of harvest (i.e. bait or bio-medical) (NYSDEC, 2023a). The recreational harvesting of horseshoe crabs in New York is subject to daily limits and is open all year. The sale of recreationally harvested horseshoe crabs is prohibited (NYSDEC, 2023b).

In 2022, New York was allotted a quota of 366,272 horseshoe crabs by ASMFC. NY voluntarily reduced the state harvest limit to 150,000 horseshoe crabs for the year, which was not exceeded. A total of 111,481 landings were reported in 2022. Starting in 2021, NY implemented two 5-day lunar closures around the full moon in May and the new moon in June to help protect spawning horseshoe crabs (ASMFC, 2023).

Describe knowledge of management/conservation actions that are needed for recovery/conservation, or to eliminate, minimize, or compensate for the identified threats:

Closures and heavily restricted harvest in other states in this region are suspected to result in increased harvest pressure in New York and other surrounding regions. This needs to be carefully monitored as it is possible that in New York and New England waters, horseshoe crabs are being harvested at an unsustainable rate (ASMFC 2012). Management is recommended to continue at the regional level. An assessment update is expected for completion in 2024 (ASMFC, 2023).

Trials testing the effectiveness of alternative baits to horseshoe crab for the American eel and whelk fisheries have been conducted (ASMFC, 2023). In addition, there is a synthetic LAL alternative that is currently not FDA approved. This alternative can help lessen horseshoe crab harvesting for the biomedical industry and, as a result, there is a big push for this alternative to be approved.

| Action Category | Action | Description |
|---|--|---|
| C.7 Legislative and Regulatory Framework or Tools | C.7.1.3.0 Create, amend, or influence regulation | Regulate horseshoe crab harvest |
| C.10 Institutional Development | C.10.3.0.0 Alliance and Partnership Development | Encourage alternate baits to horseshoe crab |

Table 2: Recommended conservation actions for horseshoe crab.

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