Horseshoe Crab

Limulus polyphemus

Federal Listing	N/A
State Listing	SGCN
Global Rank	NR
State Rank	SNA
Regional Status	

Photo by Rachel Stevens

Justification (Reason for Concern in NH)

Horseshoe crabs are ecologically important for diverse reasons. Horseshoe crab eggs are an excellent source of nutrition for migrating shorebirds and finfish and are used as bait for American eel and conch fisheries. Approximately 500,000 horseshoe crabs are collected each year by the biomedical industry for Limulus amebocyte lysate (LAL), a component of their unique blue blood that can detect foreign bacteria on medical instruments and in drugs. Once they collect a portion of their blood, the horseshoe crabs are returned back to the ocean; however, some mortality occurs through this process.

Distribution

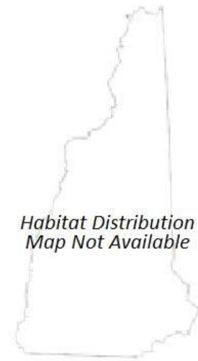
Horseshoe crabs range from northern Maine to the Yucatan peninsula, and are most abundant between New Jersey and Virginia. In New Hampshire, horseshoe crabs exhibit a seasonal pattern of movement in the Great Bay estuary (Watson et al., 2009). During the spring in the Great Bay Estuary, horseshoe crabs move into shallow waters and are highly active during the summer. In the fall, most animals move downriver into deeper water and remain throughout the colder months. Nearshore, shallow water, intertidal, and subtidal flats are considered essential habitat for the development of juvenile horseshoe crabs.

Habitat

Horseshoe crabs are benthic arthropods that prefer sandy habitat. They occupy estuaries and continental shelf habitats. Adults prefer water depths of less than 30 meters but have been observed in depths of greater than 200 meters. During spawning season, which reaches its peak in May and June, horseshoe crabs utilize sandy beaches. Horseshoe crabs typically select beach habitats within bays and coves for protection from the surf. Eggs hatch in approximately 14-30 days after fertilization, depending on temperature. For the first two years of their life, juvenile horseshoe crabs live on intertidal flats. During the first year of development, horseshoe crabs shed their exoskeleton two to three times. As they grow larger, the molting frequency decreases. It generally takes 9 to 11 years and 16-17 molts to reach sexual maturity.

NH Wildlife Action Plan Habitats

● Marine



Distribution Map

Current Species and Habitat Condition in New Hampshire

Populations of horseshoe crabs in New Hampshire (NH) exist in Great Bay Estuary. According to the most current ASMFC stock assessment (ASMFC, 2013) horseshoe crab abundance is declining in New England.

Population Management Status

Harvest of horseshoe crabs in NH is limited to 10 per day and reporting of catch is required. There is no closed season for the harvest of horseshoe crabs. The resource is managed by New Hampshire Fish and Game Department with careful consideration of horseshoe crab population biomass.

Regulatory Protection (for explanations, see Appendix I)

● Harvest permit - season/take regulations

Quality of Habitat

Horseshoe crabs in NH overwinter in the deepest parts of Great Bay estuary and move into shallow water and tributaries of Great Bay in late April and early May (Schaller et al., 2010). Horseshoe crab movement is limited when temperatures are below 8*C, generally between December and March. During the spring, when water temperatures exceed 11*C animals move out of wintering locations and travel to shallow subtidal mudflats prior to spawning. Tidal flats are important nursery areas for horseshoe crabs.

Habitat Protection Status

Currently there is no formal habitat management plan for horseshoe crabs in New Hampshire, however, as a member of the ASMFC abides by the Horseshoe Crab Interstate Fishery Management Plan.

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Threats to this Species or Habitat in NH

Threat rankings were calculated by groups of taxonomic or habitat experts using a multistep process (details in Chapter 4). Each threat was ranked for these factors: Spatial Extent, Severity, Immediacy, Certainty, and Reversibility (ability to address the threat). These combined scores produced one overall threat score. Only threats that received a "medium" or "high" score have accompanying text in this profile. Threats that have a low spatial extent, are unlikely to occur in the next ten years, or there is uncertainty in the data will be ranked lower due to these factors.

Species and habitat impacts from increasing sea surface temperatures (Threat Rank: High)

Increased water temperatures may have interactive effects with ocean pH, ultimately decreasing survivorship of larvae and reducing growth of horseshoe crabs.

Both high temperatures and salinities significantly affected the success of embryonic development in horseshoe crabs. Temperatures 35°C and above are lethal to horseshoe crab embryos and adversely affect larval growth and development (Ehlinger and Tankersley, 2004).

Species and habitat impacts from ocean acidification (Threat Rank: Medium)

Habitat impacts from increased freshwater run-off (Threat Rank: Medium)

Habitat and species impacts from harvesting (Threat Rank: Medium)

Horseshoe crabs are harvested recreationally during the spring and summer for bait in the lobster and eel fishery. There is also unintentional catch by commercial trawling that could reduce local population size.

The harvest of horseshoe crabs is managed by the ASMFC as outlined in the Horseshoe Crab Interstate Management Plan and addendums. Harvest occurs in the state of New Hampshire and is therefore managed through licenses and harvest regulations. All harvesters are required to obtain a coastal harvest permit and report all horseshoe crab effort and catch on a trip level basis.

Habitat impacts from gear effects related to commercial harvest (Threat Rank: Medium)

Habitat degradation from shoreline hardening (Threat Rank: Medium)

Shoreline hardening or armoring, often by the construction of seawalls, has proven beneficial in preserving valuable yet vulnerable waterfront properties thus reducing, if not eliminating damage caused by coastal storm surge. Shoreline barriers can interfere with the formation of beaches, dunes, and intertidal areas, and conceivably devalue the beneficial function of those areas lost (O'Connell, 2010). Collectively, the construction of shoreline barriers and accelerated rate of sea level rise pose environmental risks to coastal marine dwellers.

Research has revealed that intertidal rocky shores adjacent to seawalls had less biological diversity than areas not fragmented by anthropogenic structures (Goodsell et al., 2007). Additionally, artificial infrastructure (i.e., breakwater) can prompt a shift from consumer- to producer-dominated communities, resulting in a dynamic alteration of the ecosystem structure (Martins et al., 2009).

Habitat degradation due to siltation and turbidity from multiple sources (Threat Rank: Medium)

Habitat impacts from introduced or invasive species (Threat Rank: Medium)

Horseshoe crabs, though armored are vulnerable to various pathogens including algae, fungi, cyanobacteria, gram-negative bacteria, and a variety of parasites (Nolan et al., 2009). Green algal infection is the most common pathogen identified from the horseshoe crab (Leibovitz and Lewbart, 1987, 2003). Since horseshoe crabs cease to molt once maturity is reached, severity of green algal disease increases with age (Harrington et al., 2008). Importation of frozen Asian horseshoe crabs for use as bait are a cause for concern and could potentially expose native populations of horseshoe crabs to foreign pathogens and disease.

Green algal disease can lead to loss of tissue structure and function, including deformed shells, degeneration and loss of ocular structures, erosion of the arthrodial membrane, and cardiac hemorrhage (Braverman et al., 2013). The ASMFC recommends that states ban the importation of Asian horseshoe crabs (ASMFC, 2013).

Habitat degradation from excess nutrients (including algal blooms) (Threat Rank: Medium)

Eutrophication is an environmental response to excess nutrients, primarily nitrogen (N) and phosphorous (P) that enter an aquatic environment though industrial, domestic, and agricultural runoff. Surplus nutrients stimulate algae and phytoplankton growth, resulting in blooms. Large concentrations of algae can reduce light penetration to ecologically important species that inhabit the seafloor, ultimately reducing biological diversity if prolonged. Typically, the algae eventually die and settle to the seafloor, where biological decay of the organism results in reduced oxygen levels (anoxic) in the environment.

Large rain events can result in nutrient runoff from farmlands, which create large algae bloom, eventually leading to a dead zone, an area of low oxygen where species struggle to obtain oxygen to survive. Increased nutrient loads could increase algae growth. Green algal disease can lead to loss of tissue structure and function in horseshoe crabs, including deformed shells, degeneration and loss of ocular structures, erosion of the arthrodial membrane, and cardiac hemorrhage (Braverman et al. 2013).

Habitat degradation from excess nutrients (waste water) (Threat Rank: Medium)

Crustaceans are sensitive to excessive nutrients, toxic chemicals, and/or sediment originating from water-borne sewerage and non-point run-off from housing and urban areas.

Excessive nutrients cause eutrophication increasing the likelihood of disease.

Habitat impacts from mercury deposition (Threat Rank: Medium)

Mercury is released into the environment as a result of human activity such as coal burning, mining, and industrial processes. Mercury ultimately makes its way into the marine environment through river and watershed inputs, as well as atmospheric deposition.

Horseshoe crab eggs are vulnerable to heavy metals, with mercury, organotin, and cadmium being the most toxic (Botton, 2000). Impacts of heavy metal toxicity include mortality, lower limb regenerative abilities, segment defective embryos, and abnormal eyes (Itow et al.; 1998a, 1998b).

Habitat degradation from oil spills (Threat Rank: Medium)

Oil introduced into the marine environment can have lethal and sublethal effects on a variety of marine life across all life stages. Oil has the potential to come in contact with marine life through various industrial and shipping processes that inhabit our coastal waters. Oil spills pose the biggest threat with the potential to disperse large amounts of oil into the marine environment.

Horseshoe crabs are relatively tolerant of petroleum hydrocarbons, but their tolerance decreases with increasing temperature. Exposure to oil and chlorinated hydrocarbons results in delayed molting and elevated oxygen consumption in horseshoe crab eggs and juveniles (Laughlin and Neff, 1977).

List of Lower Ranking Threats:

Habitat impacts from marine debris

Habitat degradation from emerging or unmonitored contaminants

Habitat degradation from shore-based contamination

Habitat degradation from shoreline hardening

Habitat degradation from dredging and the dumping of spoils

Habitat impacts from recreational boating

Species impacts and habitat impacts from aquaculture

Habitat impacts from increased wave action that causes bottom disturbance

Habitat degradation from sea level rise that alters communities

Actions to benefit this Species or Habitat in NH

Find ways to limit oil spills and increased response time to oil spills

Primary Threat Addressed: Habitat degradation from oil spills

Specific Threat (IUCN Threat Levels): Pollution / Industrial & military effluents / Oil spills

Objective:
Increase response time in the event of an oil spill.

General Strategy:
Coordination of all agencies responsible for oil spill clean-up and monitoring of water bodies for signs of smaller oil spills. The impact of oil spills can vary depending on the grade of the oil and their size and location in coastal waters. A quick repose time is needed to limit the damage an oil spill can have on oyster reefs and other marine resources. Coordination between agencies and the public with strategies for quick response by agencies when an oil spill occurs will help limit the damage an oil spill can have on the environment.

Political Location:
Statewide

Watershed Location:
Coastal Watershed

References, Data Sources and Authors

Data Sources
Information on horseshoe crab habitat and population was obtained from New Hampshire Fish and Game Department harvesting regulations, scientific literature, and consultation with experts.

Data Quality
New Hampshire is one of the few New England/Mid-Atlantic states that do not participate in an annual horseshoe crab survey (ASMFC, 1998). Little is known about the dynamics of the horseshoe crabs in Great Bay estuary and the environmental parameters that influence the timing of mating. Currently, little is known about the population of horseshoe crabs that reside in the Great Bay Estuary, NH. Scientific studies have mapped the locations of where horseshoe crabs aggregate within the estuary, but populations numbers are unknown (Schaller et al. 2010). In addition, New Hampshire is the only state in New England that does not currently participate in an annual horseshoe crab survey, however did conduct an annual survey between 2001 and 2013.

2015 Authors:
Robert Eckert, NHFG

2005 Authors:
N/A

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