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# Horseshoe Crab (Limulus polyphemus)

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# Horseshoe Crab (*Limulus polyphemus*)

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The horseshoe crab is known as a living fossil; one of the four known species can be found in the oceanic environment of Narragansett Bay.

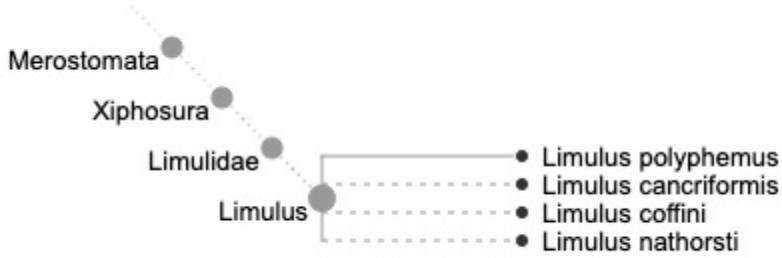
Atlantic horseshoe crab at St. Lucie County Marine Center in Fort Pierce, St. Lucie County, Florida, U.S.A. Photographed by Hans Hillewaert. Licensed under the Creative Commons Attribution-Share Alike 4.0 International.
https://commons.wikimedia.org/wiki/File:Limulus_polyphemus_(aq.).jpg

**Identification:**
Horseshoe crabs are easily identified by their horseshoe shaped, domed shell and a pointed tail. They are a living fossil, dating back to 445 million years ago (Evolution of the Horseshoe, n.d.). Their body structure very closely resembles that of their ancestors. They range in color from a dark black to an orange-brown color. They are composed of three main sections: the prosoma or cephalothorax, opisthodomos, and telson (*Mangrove Horseshoe*, n.d.). The prosoma or cephalothorax includes the carapace (shell) and the underside of this region. The shell houses their two sets of compound eyes that contain over one thousand photoreceptors. Along with this, on the underside of the shell the horseshoe crab has the mouth and five sets of legs. The first set is called the "first", the next three are called "walking", and the last set is called the "pusher" (Whitaker & Kendrick, n.d.). One set of legs is not used for walking, instead it is used to bring food to its mouth ("10 Incredible," 2022). The opisthodomos is the abdomen. This area houses

most of the horseshoe crab's gills and muscles which are protected by moveable spines that line the outside of the abdomen (*Horseshoe Crab*, n.d.). The anus is located between the abdomen and telson. The telson is the tail, which is used to help the horseshoe crab flip back over when it is flipped shell side down by the ocean current. Horseshoe crabs vary in size and weight, but they can be twelve inches in width across the prosoma, twenty-four inches long including the tail, and eleven pounds (*Atlantic Horseshoe*, n.d.). Female horseshoe crabs lay around twenty nests of eggs each year, this means that they produce about four thousand eggs per year. Their offspring look like smaller versions of the mature horseshoe crabs, the only notable difference is the fact that they are more translucent ("10 Incredible," 2022).

**Similar Species:**
There are no species which closely resemble horseshoe crabs, they are a very distinct species. There is only one species of horseshoe crab found in North America, the only other species of horseshoe crabs are found in Asia (*Atlantic Horseshoe*, n.d.).

**Classification:**
Phylum: Arthropoda
Class: Merostomata
Order: Xiphosura
Family: Limulidae
Genus: Limulus
Species: *Limulus polyphemus*




Open Tree of Life. (2023, Sep 18). *Limulus.*
https://tree.opentreeoflife.org/opentree/opentree14.9@ott1041449/Limulus

**Geographic Variation:**
There is only one species of horseshoe crab found in Narragansett Bay. Other species of horseshoe crabs aside from the Atlantic horseshoe crab are the *Carcinoscorpius rotundicauda* or mangrove horseshoe crab, *Tachypleus tridentate* or Chinese/Japanese horseshoe crab, and *Tachypleus gigas* or coastal horseshoe crabs which are found in parts of Asia. These horseshoe crabs are very similar to the Atlantic horseshoe crab. One notable difference about the species is

that the mangrove horseshoe crabs tail is rounded whereas the Atlantic horseshoe crabs have a triangular shaped tail (*Mangrove Horseshoe*, n.d.).
Within Narragansett Bay there is only the one species of horseshoe crabs, the *Limulus polyphemus* or Atlantic horseshoe crab. Horseshoe crabs do not closely resemble any other species, and therefore are usually not mistaken for any other species.

**Fossil History:**
There are many fossils of the Atlantic horseshoe crab. They are known for being "living fossils" because they are known to predate dinosaurs. There are fossils of horseshoe crabs that date as far back as 445 million years ago ("10 Incredible," 2022).

**Systematics Summary:**
Due to the lengthy historical record of horseshoe crabs and their ability to predate dinosaurs that are now extinct, we know that there is a long history of evolution. In order for this species to have lived as long as they have and be as prevalent and abundant as they are in the oceanic environments today, they must be a biologically fit species. They have been able to evolve over generations in order to adapt and change based upon environmental changes.

**Distribution in Rhode Island:**
There are four current species of horseshoe crabs. The *Limulus polyphemus* species or Atlantic horseshoe crab is the only one found in North America. It can be found along the Atlantic coast from Main to the Gulf coast in Mexico. The other three species, the *Carcinoscorpius rotundicauda* or mangrove horseshoe crab, *Tachypleus tridentatus* or Chinese/Japanese horseshoe crab, and *Tachypleus gigas* or coastal horseshoe crabs, can be found in parts of Southeast Asia (Facts About, n.d.).

**Habitat:**
Within the oceanic environment, they can typically be found in the deep waters on the floor level. Though they are also found at the shore, because they travel to shoreline each year to reproduce (11 Facts, n.d.).

**Feeding Behavior:**
Horseshoe crabs eat anything in which they can obtain in their environment. Their main diet typically consists of small clams, crustaceans, and sea worms, though they will eat other animals and algae. Due to the fact that they don't have any teeth, they use the set of legs closest to their mouth to break up their food. Similarly, to birds, they have a gizzard structure in which further breaks down their food before It reaches their stomach (*Facts About*, n.d.).

**Breeding Biology:**

Horseshoe crabs spawn primarily during the spring, summer, and fall, though they have the ability to spawn whenever they please. In areas such as Florida where the climate is much warmer year-round, they take advantage of this ability and spawn all seasons *(Facts About*, n.d.). When mating the male horseshoe crab may attach himself to the shell of the female horseshoe crab using a set of specialized legs and claws. By doing this the male is able to fertilize the female's eggs while they crawl along the shoreline together. Though some males may not attach to females and instead they may hang around an attached male and female and still have success fertilizing a female's eggs. The female will then lay these eggs in a nest, typically during a high tide at or around the time of a new or full moon. Several weeks after the eggs are laid, the successful larvae may emerge and develop into a juvenile horseshoe crab. These juvenile horseshoe crabs look exactly like adult horseshoe crabs, just significantly smaller. These juvenile horseshoe crabs will spend a significant period of time on the floor of the intertidal zone feeding on invertebrates and eventually developing into adult horseshoe crabs (*Facts About*, n.d.). Each nest can have up to four thousand fertilized eggs (*Horseshoe Crab*, n.d.), some of which will survive to be juveniles and a good majority of the juveniles will survive to adulthood.

**Behavior Summary:**
Horseshoe crabs do not maintain a very specific diet, thus allowing them to survive by eating practically anything of substance that they can harvest. This makes them very biologically fit, since the ocean is a changing environment and some resources may not always be readily available, their ability to adapt allows them to better survive. Along with this, their mechanisms of breeding have proved to be very successful. By laying a large number of eggs, it ensures the survival of at least a few to postdate the current population.

**Population Status:**
Horseshoe crab populations in Narragansett Bay and in New England as a whole have rapidly declined over the past twenty-five years. Due to this, many initiatives have been put into place to ensure the survival of the population. Over the next five years Rhode Island plans to populate their oceans with about one million horseshoe crabs in order to not only replace the diminished populations but flourish the future populations (*The Horseshoe*, n.d.).

**Impacts of Human Activity:**
Human activity has played a significant role in the rapid decline of horseshoe crab populations. Humans harvest horseshoe crabs for various reasons. In Asia both horseshoe crabs and their eggs are harvested as a food source, though this is becoming increasingly less common (Mullaney, 2023). All over the world, horseshoe crabs are harvested to be used as bait for eel and whelk bait. Though the leading cause in the depletion of this species is that humans harvest them for their blood. Horseshoe crabs have blue blood which is used in the pharmaceutical industry to help develop and test many vaccines (*The Horseshoe*, n.d.). Lastly, as is the case with many living

elements of the oceanic environment global warming and climate change caused by humans has had an impact on their environment, therefore affecting horseshoe crabs.

**Management:**
Horseshoe crabs have many restrictions when it comes to harvesting, which vary by state in the United States. In Rhode Island, you must obtain a license and permit. You can only harvest in specific areas, which have to be over one hundred feet away from Patience and Prudence Islands. If you have a recreational permit, you can only harvest five horseshoe crabs per day, with a commercial license the number varies per season ranging from zero to sixty. Different commercial licenses have different restrictions and harvest limitations ("5.4 Horseshoe," 207, pp. 1-3).

**Priorities for Future Research:**
The majority of research done that has to do with horseshoe crabs is within the pharmaceutical industry. Horseshoe crabs have blue blood, their blood is quite literally blue. Aside from its' beautiful color, it also contains important immune cells that are very sensitive to bacteria. When the blood comes into contact with toxic bacterium it clots around it, preventing the bacteria from spreading and protecting the horseshoe crab. In the pharmaceutical industry this blood is of the utmost importance. They can use the sensitivity to bacteria that this blood contains to their advantage testing all sorts of vaccines (Pavid, 2021).

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