

# Wildlife Populations: Horseshoe Crab

## Background

Horseshoe crabs, *Limulus polyphemus*, are important to a diverse set of users. They lay their eggs on sandy beaches in spring and summer, and migrating shorebirds rely heavily on their eggs to supply energy required to complete their migration. Biomedical companies catch horseshoe crabs for their blood, from which they produce Limulus Amebocyte Lysate (LAL). LAL is used to detect contamination of injectable drugs and implantable devices; it is the most sensitive means available for detecting endotoxins, which are part of the outer membrane of the cell wall of certain bacteria, such as *E. coli* and *Salmonella*. Finally, horseshoe crabs are harvested commercially for bait to catch American eels, catfish, and whelk. Horseshoe crabs are a particularly important issue here in New Jersey because the Delaware Bay is the center of horseshoe crab abundance on the Atlantic coast.<sup>1</sup>

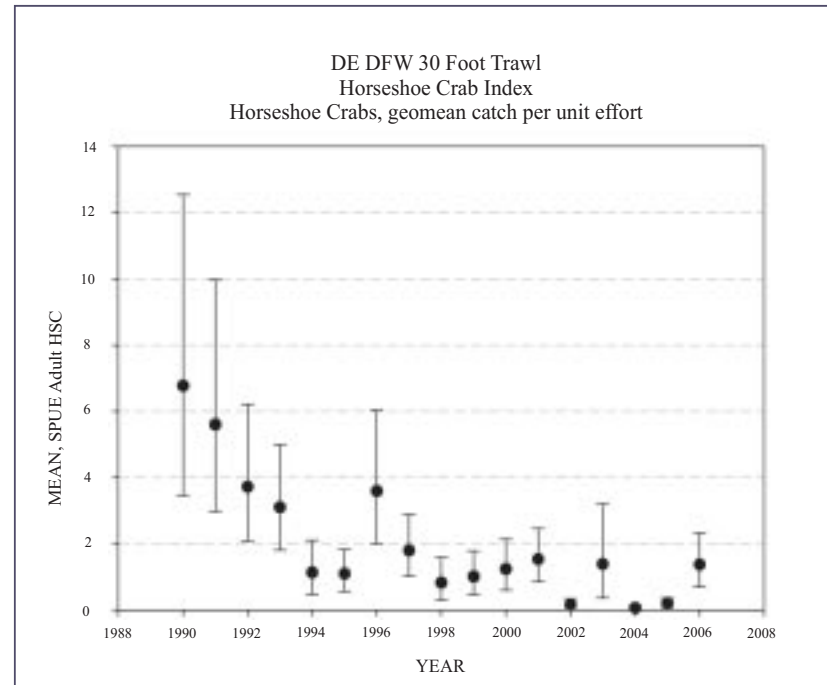
Adult horseshoe crabs winter in water 20 to 60 feet deep on the continental shelf. Increased water temperature and amount of daylight stimulate adult migration toward sandy beaches for spawning. The peak migration in the Delaware Bay generally occurs during the evening and full moon tides in May and June. Females dig a shallow hole, ranging from 5 to 30 centimeters, below their bodies and deposit their eggs in clumps within the intertidal zone. Weather can negatively affect spawning by disrupting spawning sites, driving animals off the beach, diminishing the number of pairs able to spawn, or preventing them from coming to the beach at all.<sup>2</sup>

Horseshoe crabs molt numerous times as they grow from larval stage, shedding their exoskeleton at least 16 or 17 times before reaching sexual maturity. Horseshoe crabs require nine to 10 years to reach maturity, when they cease to molt, and may reach a maximum age of 20 years.<sup>3</sup>

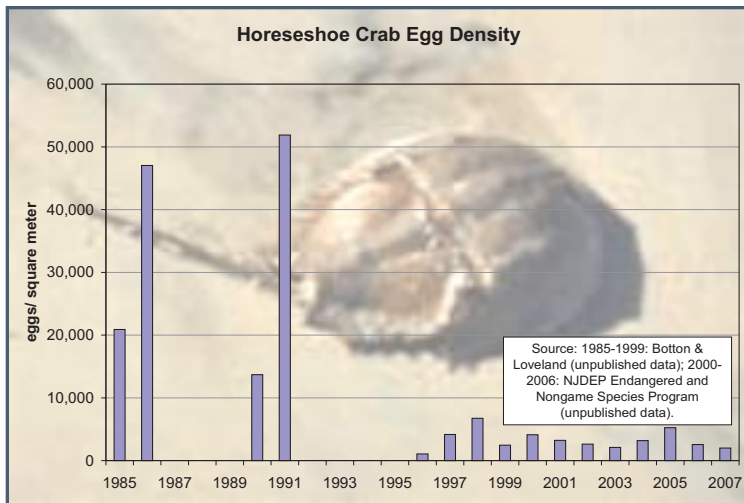
## Trend

There are a number of different surveys monitoring the horseshoe crab populations in Delaware Bay. The Delaware Division of Fish and Wildlife monitors juvenile and adult horseshoe crab populations through ongoing trawl surveys. These surveys, though not designed specifically to monitor

horseshoe crabs, are useful for monitoring long-term trends in the population.<sup>4</sup> Since the beginning of the survey, the catch/unit effort of horseshoe crab adults has declined (see *DE DFW 30-Foot Trawl Horseshoe Crab Index figure*).



In addition, studies of horseshoe crab egg density have been performed since 1985. The survey is conducted around the new and full moons in May and June, when spawning activity peaks. Results from the survey provide managers with a measure of relative abundance of eggs available to shorebirds, and are useful for monitoring trends in spawning activity. The data shows a dramatic decline in horseshoe crab egg density from peak numbers in 1991 (see *Horseshoe Crab Egg Density figure*).



Efforts also are under way to look for alternatives to horseshoe crabs as bait. In order to decrease the number of crabs used, mid-Atlantic state fishery agencies now require that fishermen encase the crabs in bait bags, which prolongs the life of the bait by lifting it off the seafloor and preventing predators from consuming it; in addition, this practice requires approximately  $\frac{3}{4}$  less bait. A variety of alternate baits have been tested, including surf clams, green crabs, and the addition of haemolymph, which is the horseshoe crab's circulatory fluid, to an alternate bait. It is readily available because it is byproduct from the horseshoe crab blood-extraction process. Finally, researchers have been experimenting with synthesizing artificial bait from a chemical compound found in horseshoe crab eggs that might be what attracts eel and whelk to the horseshoe crab.<sup>6</sup>

Furthermore, horseshoe crab harvest restrictions have been implemented beginning in 1993 under N.J.A.C. 7:25.<sup>7</sup> In 2006-2007 the fishery was closed temporarily to maximize spawning crab numbers and immediately improve feeding conditions for the imperiled Red Knot. Harvest restrictions are expected to continue until there is substantial improvement in spawning horseshoe crabs to meet the needs of migrating shorebirds on Delaware Bay.

## Outlook and Implications

Horseshoe crab eggs are an important food of the Red Knot, a migratory shorebird whose population has plummeted along with declining horseshoe crab egg abundance. This bird was identified as a candidate for federal endangered status in 2007. (See chapter on the Red Knot in the Trends Report series.) With concern rising as to the status of the horseshoe crab population, alternatives are being explored to reduce the number of horseshoe crabs needed for medical and commercial fishing uses. Each of the five biomedical companies currently bleeding horseshoe crabs have experimented with developing a synthetic compound that mimics the behavior of LAL. However, a compound that is as successful at detecting endotoxin has yet to be found. The culturing of cells to produce LAL also has been tried, and while there have been several reports of limited success, commercial production is not viable at this time.<sup>5</sup>

## More Information

For more information, visit [www.lsc.usgs.gov/aeb/2065](http://www.lsc.usgs.gov/aeb/2065).

## References

- <sup>1</sup> Hata, D and J. Berkson. 2003. Abundance of horseshoe crabs (*Limulus polyphemus*) in the Delaware Bay area. Fishery Bulletin 101:933-938.
- <sup>2</sup> Walls, E. A., J. Berkson, and S. A. Smith. 2002. The Horseshoe Crab, *Limulus polyphemus*: 200 Million Years of Existence, 100 Years of Study.
- <sup>3</sup> Walls, et al., 2002
- <sup>4</sup> <http://www.fw.delaware.gov/NR/rdonlyres/9DB7A4FC-3C03-4561-A7F3-75B751575C3E/0/hscwebdoc.pdf>
- <sup>5</sup> Walls, et al., 2002
- <sup>6</sup> Walls, et al., 2002
- <sup>7</sup> <http://www.nj.gov/dep/fgw/pdf/2004/comregs04.pdf>