

Horseshoe Crab Spawning

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Springtime in the Mid-Atlantic means it is time for one of the great marvels of nature to display itself. In this case it is the spawning of the horseshoe crabs. Near the full and new moons of May and early June, predominantly at night, hundreds of thousands of horseshoe crabs will make their way on to sandy beaches to spawn. This spawn will not only ensure the perpetuation of the horseshoe crabs, but will also serve as fuel for the migration of shorebirds from Tierra de Fugo at the southern tip of South America to the Northern Arctic circle where these birds will nest. Much of the following information has been taken from the stock assessment recently completed as part of the Atlantic States

Marine Fisheries Commission horseshoe crab management plan. If you want more information on horseshoe crab management, it can be found on our website at [Horseshoe Crabs](#). Additional information can also be obtained at www.ASMFC.org, and information about the biology of the horseshoe crab can be found at www.horseshoecrab.com.

The status of the horseshoe crab, *Limulus polyphemus*, population along the Atlantic coast is of great concern for a number of different interests. Horseshoe crabs play an important role in marine and estuarine ecosystems. In addition, the species serves as a primary bait source for several important commercial fisheries and is the backbone of a major biomedical process. Despite its importance, little is known about horseshoe crab abundance and stock dynamics. However, with each new year of data comes better understanding.

Horseshoe crabs are characterized by high fecundity, high egg and larval mortality, and low adult mortality (Botton and Loveland, 1989; Loveland et al., 1996). They breed in late spring on low-energy coastal beaches along the Atlantic coast, laying eggs in nests buried in the sand. Planktonic larvae hatch from the eggs within 2-4 weeks, although some larvae may overwinter within nests and hatch out the following spring (Botton, et al. 1992). Larvae settle within a week of hatching and begin molting. Juvenile crabs remain in the intertidal flats, usually near breeding beaches. Older individuals move out of intertidal areas to deeper waters (Botton and Ropes 1987). Crabs are thought to mature around 10 years of age, and may live up to 20 years.

Adult horseshoe crabs migrate from deep bay waters and the Atlantic continental shelf to spawn on intertidal sandy beaches. Beaches within estuaries, such as the Delaware and Chesapeake Bays, are preferred because they are low energy environments and are protected from the surf, thus reducing the risks of stranding during spawning events. Spawning generally occurs from March through July, with the peak spawning activity occurring around the evening new and full moon high tides in May and June (Shuster and Botton, 1985). In the Delaware Bay and the coastal bays of Maryland, spawning activity gradually increases prior to the full and new moon, peaks on the day of the full and new moon, and then gradually decreases (Maio et al. 1998; Maryland Department of Natural Resources 1998). However, in the Chesapeake Bay, peak horseshoe crab spawning does not occur consistently on any one day around the full and new moons (Maryland Department of Natural Resources 1998).

Horseshoe crabs spawn multiple times per season and per tide (Schuster 1950), laying approximately 3,650 to 4,000 eggs in a cluster (Shuster and Botton 1985). Adult females lay an estimated 88,000 eggs annually (Shuster 1982). Males often precede females to a beach, awaiting the arrival of females (Shuster 1996). During spawning, a male typically attaches to the female's abdomen using its pedipalps prior to coming ashore to spawn. Satellite males follow the conjoined pair onto the beach. Numerous satellite males may be in a spawning group with a single female (Loveland and Botton 1992). Females excavate a depression and deposit the clusters of eggs in the upper portion of the intertidal zone at depths from 5 to 30 centimeters (mean 11.5 centimeters) (Rudloe 1979; Brockman 1990; Williams 1987). External fertilization occurs and allows for sperm competition from the satellite males (Brockman 1990; Brockman et al. 1994).

Horseshoe crab eggs hatch between 14 and 30 days after fertilization (Sekiguchi, et al., 1982; Jegla and Costlow 1982; Botton 1995). Newly emerged larvae swim for approximately six days (Shuster 1982) before they settle in shallow water areas to molt into their first juvenile instar in approximately 20 days (Jegla and Costlow 1982). The crabs molt several times during their first two to three years. As the crabs grow larger, there are longer periods between molts. Carmichael et al. (2003) reported that juveniles grew faster than adults. Horseshoe crabs molt at least 16 to 17 times over the 9 to 11 years it takes to reach sexual maturity (Shuster 1950). Based on growth of epifaunal slipper shells (*Crepidula fornicata*) on their prosoma, horseshoe crabs live at least 17 to 19 years in the northern part of their range (Botton and Ropes 1988). Similarly, Carmichael et al. (2003) found that estimated growth rates suggest that males may live up to 16 years and females up to 18 years. Once sexual maturity is reached, crabs may cease to molt and grow (Shuster, pers. comm.). However, Carmichael et al. (2003) suggest that adult crabs may molt as frequently as once per year rather than have a terminal molt. Females typically attain larger sizes than males, probably the result of females undergoing an additional molt than males (Shuster 1982).

Factors contributing to natural mortality include age and excessive energy expenditure during spawning, which can result in stranding, desiccation, and predation. Loveland et al. (1996) believe that the natural mortality rate in adults is probably low. Carmichael et al. (2003) found in Pleasant Bay, Massachusetts, adults had a lower estimated mortality rate than juveniles, and there was no significant difference in estimated mortality rate between adult males and females. Horseshoe crab mortality due to predation from sea turtles and other marine animals remains unknown. Shorebirds feed on horseshoe crab eggs in areas of high spawning densities such as the Delaware Bay. Horseshoe crab eggs are considered essential food for several shorebird species in the Delaware Bay, which is the second largest migratory staging area for shorebirds in North America. Despite significant shorebird predation on horseshoe crab eggs, such activity probably has little impact on the horseshoe crab population (Botton et al. 1994). Horseshoe crabs place egg clusters at depths greater than 10 centimeters, which is deeper than most short-billed shorebirds can penetrate. Many eggs are brought to the surface by wave action and burrowing activity by spawning horseshoe crabs. These surface eggs consumed by birds would not survive, due to desiccation (Botton et al. 1994).

If you are interested in observing horseshoe crab spawning the best places to go are Delaware Beaches along the Delaware Bay. There is some spawning activity on Maryland inland sandy beaches both in the Chesapeake Bay and along the coast. So these areas are definitely worth a try if you don't want to travel so far. Also if you intend to observe the horseshoe crab spawning on the Delaware Beaches make sure you stick around until day time to observe the shorebirds which feed on the horseshoe crab eggs, this is another of nature's marvels.