PROJECT *LIMULUS*
Horseshoe Crab Monitoring
SLIDESHOW

LIVING RESOURCES MONITORING Project *Limulus* (Horseshoe Crab Monitoring)

WHAT SCIENTISTS HAVE LEARNED about American horseshoe crab physiology has led to significant advancements in eye research and in the testing for the safety of pharmaceutical drugs. But surprisingly, despite its importance to humans, very little is known about the abundance of the horseshoe crab (*Limulus polyphemus* in Latin) in the coastal areas where it resides. This is particularly true in Long Island Sound, but monitoring programs such as Project *Limulus* are beginning to bring us greater understanding of this important marine animal.

◀ JENNIFER MATTEI, Chair of the Biology Department at Sacred Heart University, started Project *Limulus* in 1997. Here she is applying a cinch tag on a horseshoe crab (*www.sacredheart.edu/limulus.cfm*).

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FROM MID-MAY to the end of June, during the high tides of the new and full moons, horseshoe crabs move from the deeper waters of Long Island Sound to the shoreline to find mates and to spawn.

▲ GUY ROBINSON, a research associate at Fordham University, and Racelle Deshaies, a student at Sacred Heart University, searching for horseshoe crabs at Long Wharf Harbor in New Haven. After finding a crab Robinson measures the length of the carapace, tags it, and Deshaies records the information.

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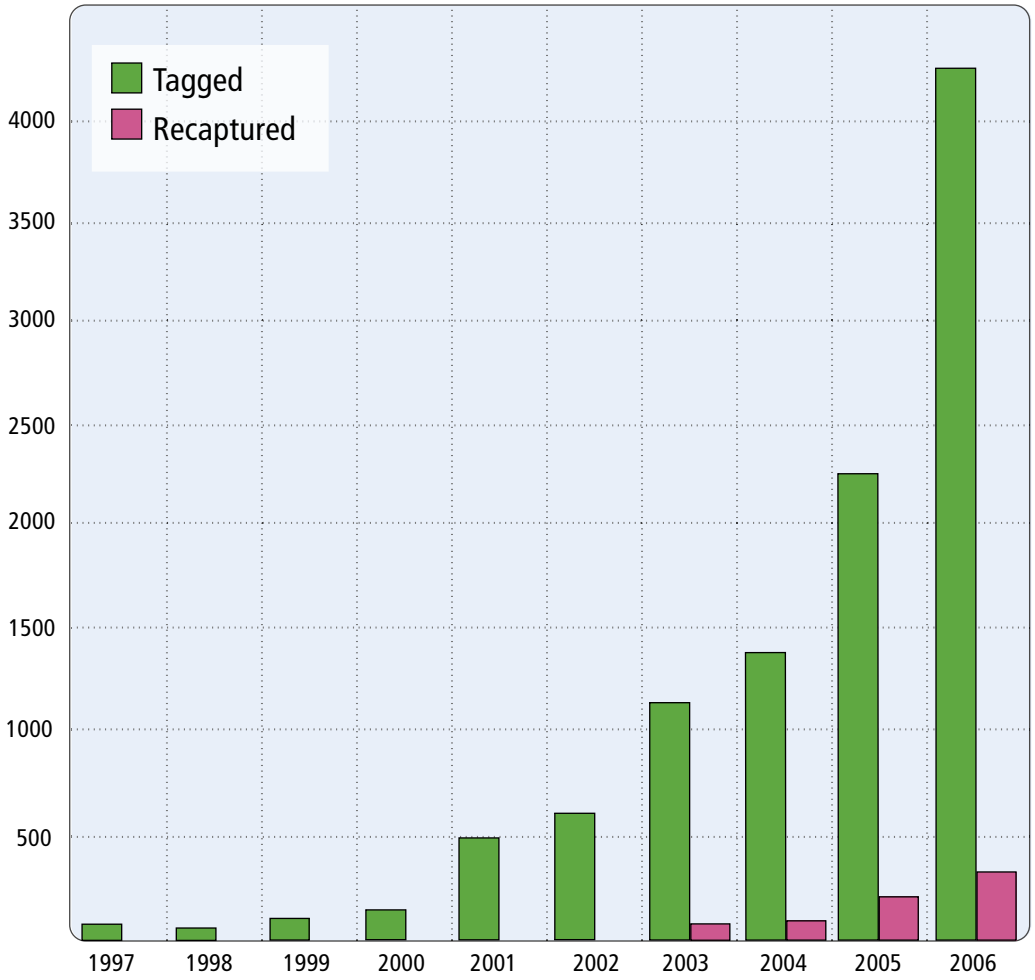
SINCE 1997, more than 10,000 horseshoe crabs have been tagged on Connecticut beaches, and more than 650 of these have been spotted again (recaptured) by monitors.



▲ EACH TAG has a unique identification number as well as contact information for beach visitors to report where they found the crab.

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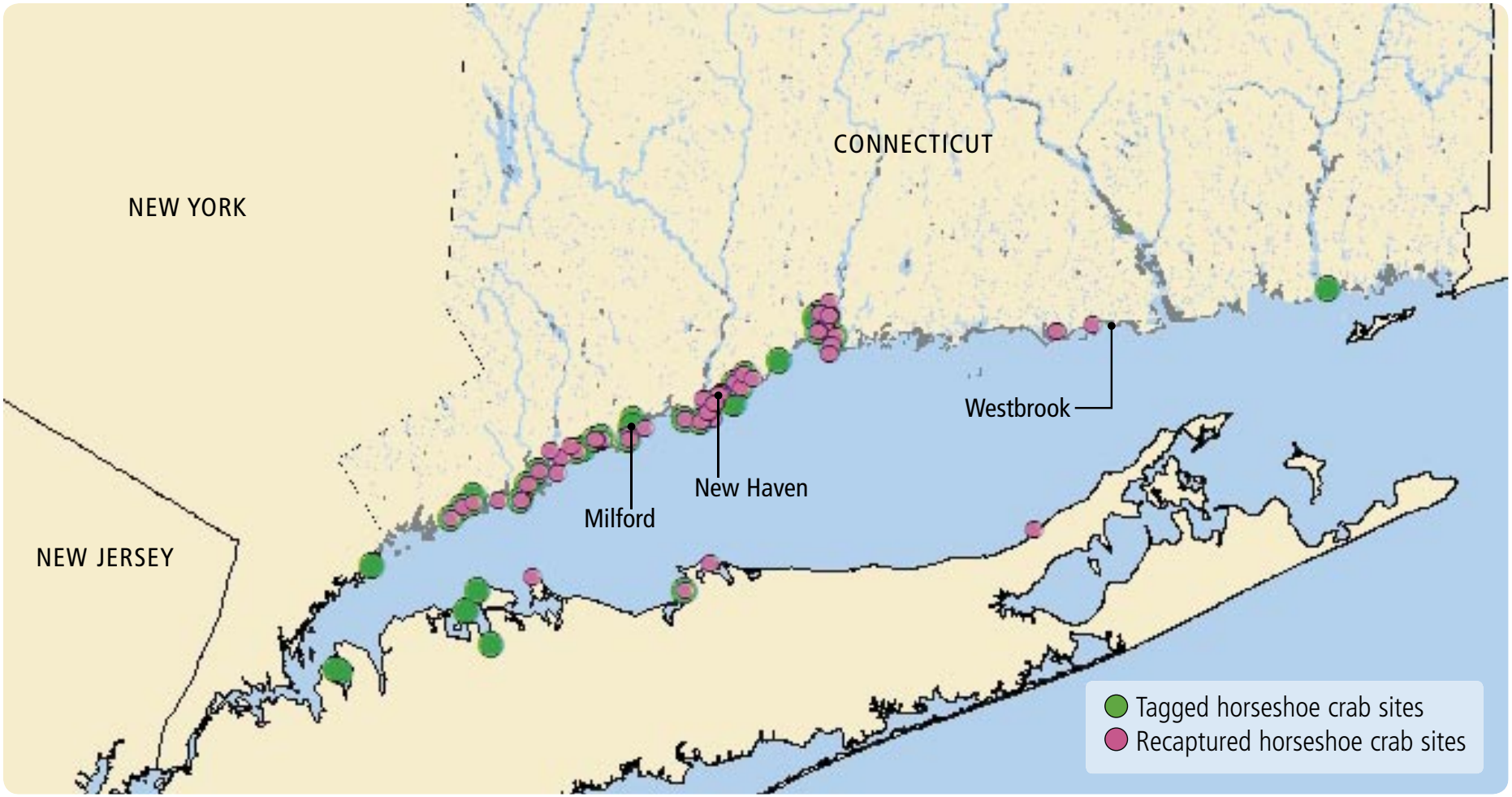

THE TAGGING takes place at beaches that include New Haven, Milford, Fairfield, Norwalk, and Westbrook in Connecticut, and Oyster Bay in New York. Horseshoe crabs tagged in the Sound have never been recaptured outside the Sound. But only 1 percent of crabs return to their tagged locations.

▲ THE MAJORITY of crabs recaptured have been spotted within 13 miles of the tagging locations.

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IN LONG ISLAND SOUND, many horseshoe crabs arrive as pairs to mate. But in Delaware Bay, which has a much larger crab population, many crabs mate in clusters of three or more males to one female. Biologists believe that the genetic diversity from mating in clusters is healthier for the survival of the species.

◀ A PAIR OF mated horseshoe crabs—the male will use two front claspers to attach onto the female's body, and the female drags the male onto the beach.

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▶ A HORSESHOE CRAB monitor is shown holding about 100 eggs at a nesting site in Long Wharf Beach.

FEMALE CRABS dig a shallow nest on the beach between the high and low tide lines. In the nest they will deposit thousands of eggs that will be fertilized by the males. Newly laid horseshoe crab eggs are opaque, pastel-green in color, and about 1/16th inch in diameter. Only a few offspring make it to adulthood from these nests.

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THE EGGS of the horseshoe crab are prized, nutritious food for resident and migratory birds. Scientists in Delaware Bay are concerned that declining horseshoe populations there may be one of the factors in declining shorebird populations.

HORSESHOE CRAB EGGS are eaten by many birds found in Long Island Sound, including the piping plover (*left*), and the dowitcher (*above*).

LIVING RESOURCES MONITORING Project *Limulus* (Horseshoe Crab Monitoring)

BESIDES CONVENTIONAL cinch tags, Project *Limulus* monitors also apply sonar tags to a sample of horseshoe crabs to track them as they move back to deeper water by the end of the summer.

◀ HIGH SCHOOL STUDENTS aboard a skiff owned by the Sound School of New Haven at Long Wharf Beach; Mattei applying a sonar tag, which contains a unique frequency that can be picked up by a receiver.

LIVING RESOURCES MONITORING Project *Limulus* (Horseshoe Crab Monitoring)

THE SONAR DATA reveal that in the summer most of the crabs stay along the coastline near their nesting grounds in the shallow waters of the Sound. After the summer they move to deeper waters or bury into the sediment of the Sound where the sonar equipment can no longer pick up their signal.

A STUDENT drops a listening device into the water, while another student listens for sonar tags on a receiver.

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IN 2006, Project *Limulus* also started using an underwater tracking device called a submersible ultrasonic receiver, which is anchored underwater, and can pick up the sonar tag frequencies within 400 meters.

▲ MATTEI, takes the SUR, in protective plastic white tubing, out of the water. Data stored on the recording device, in the clear tube, is then downloaded to a laptop computer aboard the boat.

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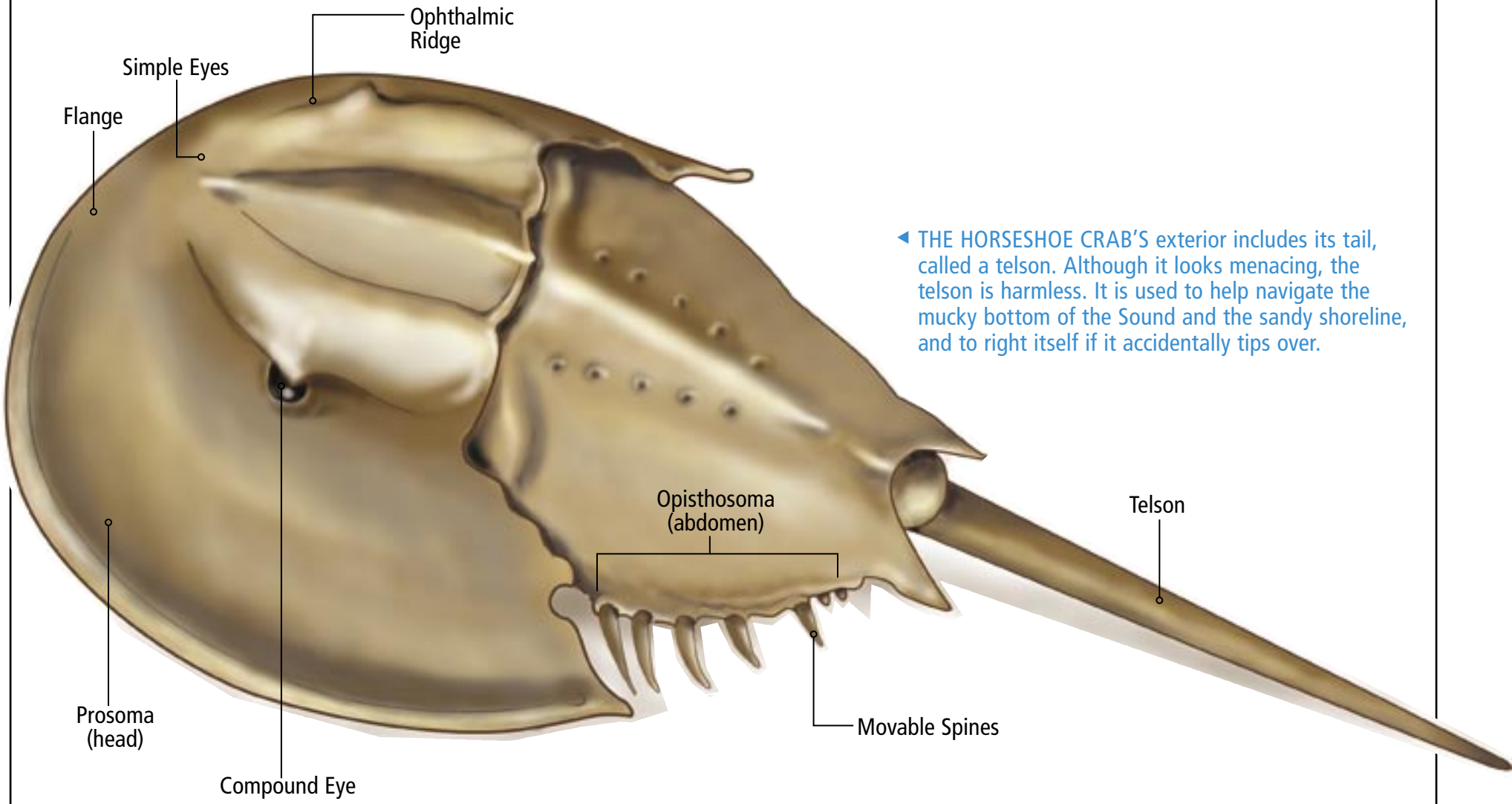
HORSESHOE CRABS are invertebrates, animals without backbones. While they resemble blue crabs and other crabs found in the Sound because of their shells and claws, they actually are more closely related to spiders and scorpions.



◀ THE HORSESHOE CRAB'S exterior includes its tail, called a telson. Although it looks menacing, the telson is harmless. It is used to help navigate the mucky bottom of the Sound and the sandy shoreline, and to right itself if it accidentally tips over.

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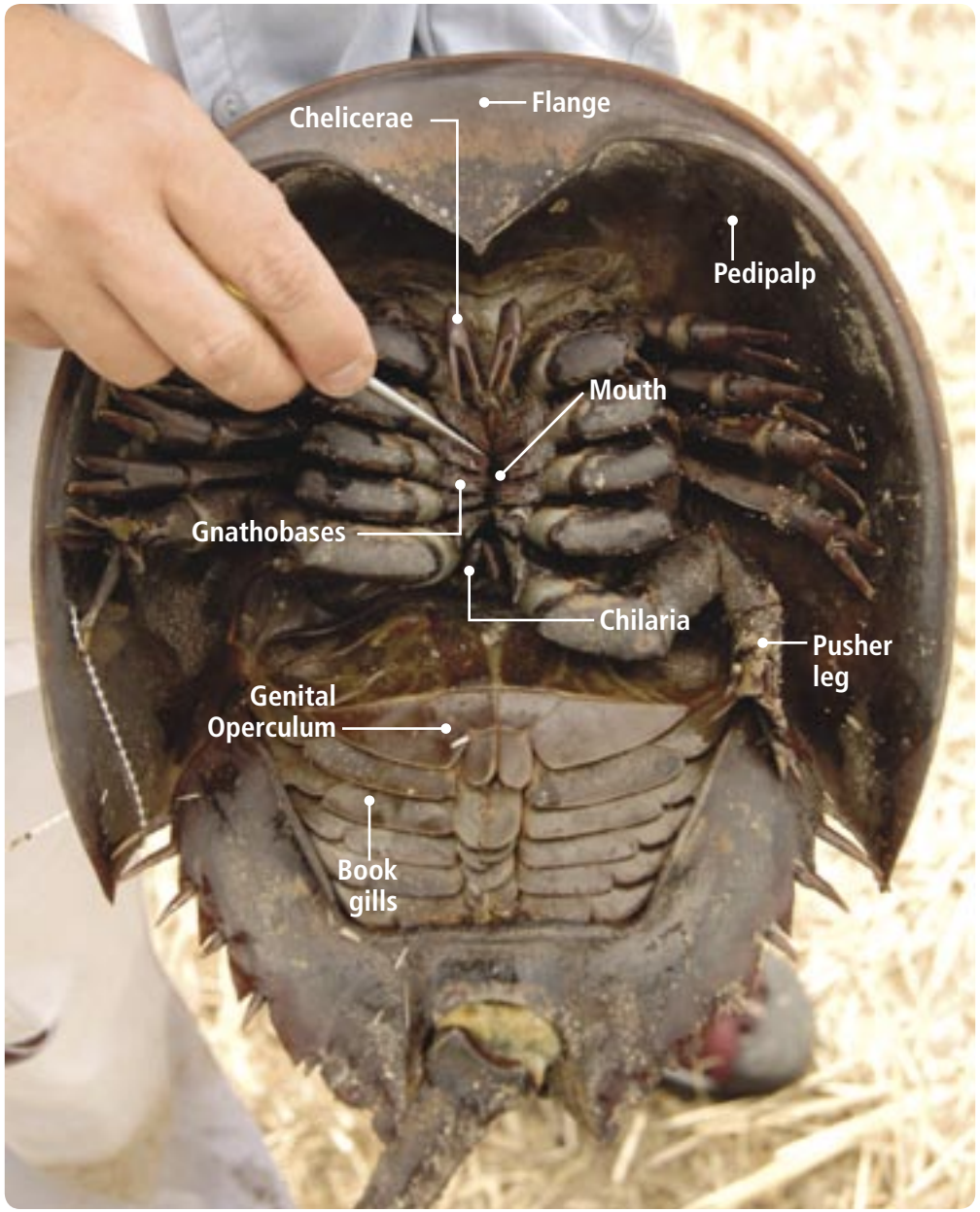

HORSESHOE CRABS breathe with leathery gills known as book gills and have 12 appendages. Their tiny front two pincher claws, called chelicera, push food into their mouths.

◄ HORSESHOE CRABS don't have jaws to chew food: when it moves bristly areas at the base of their 8 main legs called gnathobases tear and shred clams, worms, and other invertebrates.

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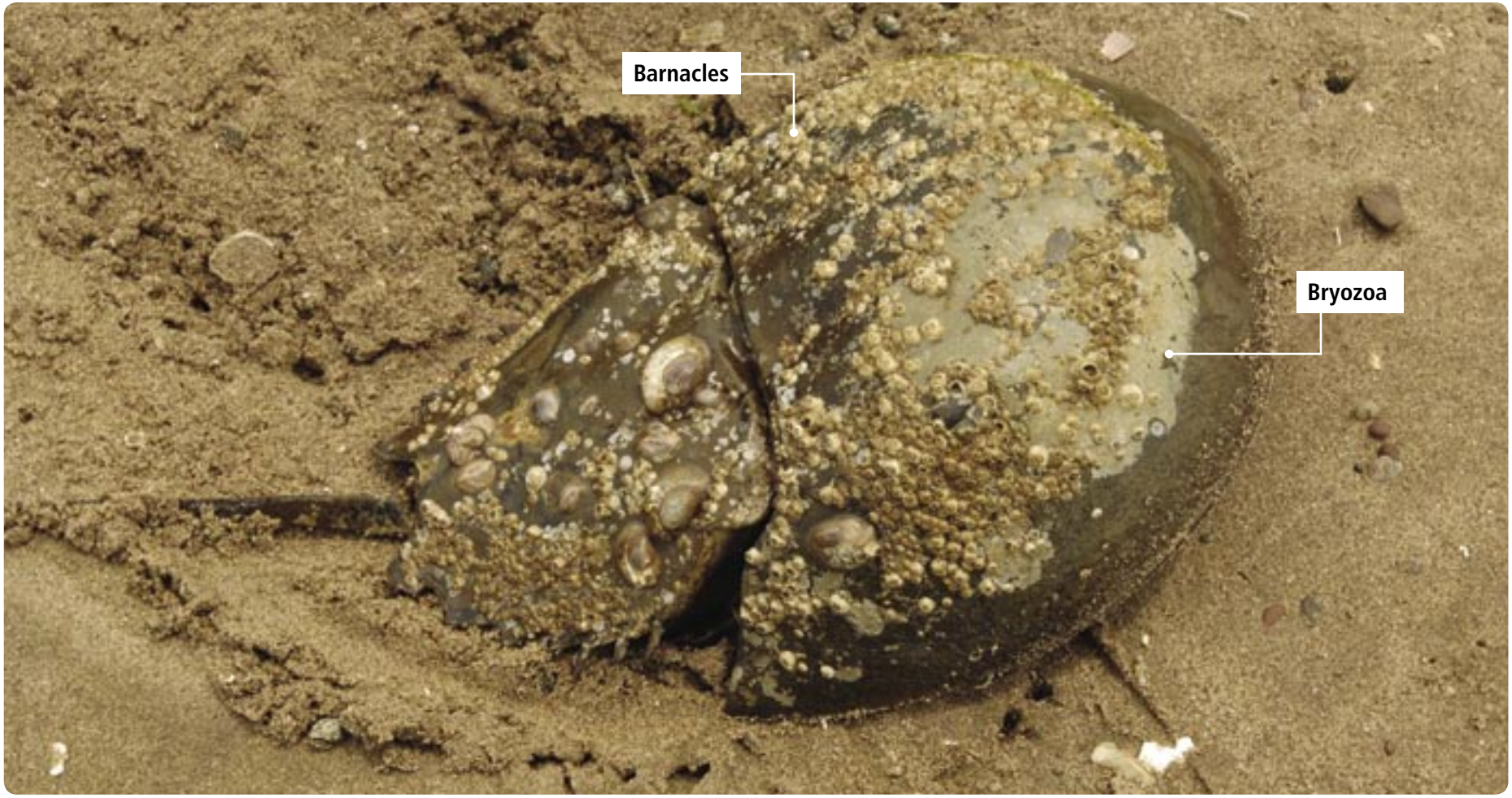
HORSESHOE CRABS have been called "walking hotels"—barnacles, blue mussels, sponges and flatworms are some of the animals that attach themselves to their shells.



▲ BARNACLES AND BRYOZOA, invertebrates, have attached themselves to this horseshoe crab.

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Mattei's monitoring teams are finding that the population trends are not good for the long-term survival of horseshoe crabs in the Sound. For example, they have consistently found that **only 40 percent** of the spawning population is female. And of the total adult population, not all are mating.

In 2005, **only 56 percent** of the 2,200 horseshoe crabs tagged at Milford Point were found as mated pairs.

It's not clear why this trend is occurring.

Project *Limulus* needs volunteers in its efforts to learn more about the horseshoe crab in Long Island Sound and help assure its survival If you want to become a tagging and monitoring volunteer, contact Professor Mattei at 203-365-7577 or e-mail her at: *matteij@sacredheart.edu*

If you want to learn more about horseshoe crabs, including the critical role it has played in biomedical and pharmaceutical research, visit Delaware Sea Grant's horseshoe crab Web page at: *www.ocean.udel.edu/horseshoecrab*