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Horseshoe Crabs Have Survived All of History—and Remind Us How We Could Too



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This creature is a survivor. As long as it survives, our notion of the wild, of conditions indifferent to humanity in which other species thrive, survives too.

This is Sidewalk Naturalist, a monthly column by Lenora Todaro which sees New York City through its wildlife citizens, whose lives tell us something about the way we live in the fragile ecosystem that is the city today.

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When the full moon pulls the tides high onto the shores of Plumb Beach in Brooklyn, it summons a crowd of time travelers from the ocean. Spikey and helmeted, they shimmy onto the sand to spawn.



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This happens every May and June, up and down the Atlantic Coast, from Maine to the Yucatan, including New York City. On the full and new moons, *Limulus polyphemus*, the Atlantic horseshoe crab, glides up from the ocean floor. It floats and skims along the water's edge, using one set of legs to push aside mud, silt, and sand. Of its ten eyes, the largest two on the sides of its shell are used to look for mates.



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As a female horseshoe crab moves toward the shoreline, a male will clasp onto her back with his hook-like mating claws. He rides *amplexed* to her, while she tows him along, searching for a suitable nesting site. Once found, she digs into the sand, lays some 4,000 greenish peppercorn-size eggs, then pulls the male along to fertilize them with his sperm as he passes over them. She'll do this at least four times, laying some 20,000 eggs in one day and upwards of 80,000 per season. Often, "satellite" males will tag along, fertilizing the eggs as well, perhaps giving them a greater chance for survival. Only 3 in 100,000 eggs will survive their first year perpetuating their 450 million-year-old lineage, survivors of ice ages and asteroids.

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Among the strange things about horseshoe crabs is its name. Neither a crab, nor a crustacean, it is an aquatic arachnid, a cousin in the spider, scorpion, and tick families. When you hold both sides of its brownish, hard shell you see its spidery legs feeling the air, and clacking, almost drum-like against itself. . . A mouth at the center of its body opens and closes, seeming to look at you, although it is just hungry for worms or clams. Under its abdomen, flapping like pages, are its “book gills,” which help it breathe underwater. It’s not soft or cuddly, but more like a shield protecting a wet, fleshy creature that somehow has survived five mass extinctions over the course of time as we know it. Truly, this creature is a survivor—and as long as it survives, our notion of the wild, of conditions indifferent to humanity in which other species thrive—survives with it.

In *Catch and Release: The Enduring Yet Vulnerable Horseshoe Crab*, an eco-feminist political memoir, Lisa Jean Moore writes: “I have come to see the horseshoe crab as signifying larger ecological and sociological trends—rising seas, biological interdependence, geologic time . . . In geologic time, the extent of human’s history is like a blade of grass on the far end line of a soccer field, and horseshoe crabs would be at about the top of the goal box.”



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When I spoke with her, she described holding a horseshoe crab: “The way it latches onto you is deeply affecting. Another species clasp^ging onto you. I don’t know another feeling like that.”

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This mating season, I went to help count horseshoe crabs during their full and new moon spawning sessions. I joined a group of twenty-five volunteers organized by the New York City Parks Department, ranging from seniors and singles to families with babies, and others whose school-age children were ticking off their community service. We met in the parking lot of Calvert Vaux Park near Gravesend, Brooklyn.

A bin full of rubber boots and green arm-length rubber gloves awaited us. We had brought our own headlamps; one teen wore waders, casually rejecting the gloves as unnecessary. My friend and I had anticipated an existential thrill, a magic carpet transport through time

once we entered the horseshoe crabs' world.

So here is New York city water, not at its best: a swirling mass of plastic bottles, glass shards of airplane size liquor bottles, coffee cups, candy wrappers, plastic straws, abandoned IHOP sugar packets. To find horseshoe crabs, we had to peel aside the sewage to see if any creatures were stirring beneath, oblivious and perhaps impervious to the garbage. A shrug from a creature who's seen bigger disasters than a bit of trash.

Muck pulled aside, the creatures emerged, dozens of them, swirling and aiming for the sand.

"They're doing it!" called one volunteer gleefully, as if horseshoe crab porn were a thing.

But they weren't doing it. Fertilization is external. That's it. No orgy, no lurid horseshoe hook-up scene, but maybe some frenzy as males jostle one another trying to latch on to a female, who will drag him across their spawn-to-be.

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Once mature, the horseshoe crab acquires hitchhikers—barnacles, mollusks, and the like that attach to its shell, forming a traveling ecosystem. We saw many bejeweled creatures, but while photographing them, my friend and I got distracted, and separated from our group. We were there with them, in that moment, and totally present. Time stretching out before us.

Although the horseshoe crabs appeared tough, like army tanks storming the shores of Brooklyn, Coney Island's Parachute Jump rising above the horizon, they won't try to hurt us. Despite its spiky tail and creepy visage, the horseshoe crab is one of the most harmless

creatures on earth. The tail, or *telson*, is not deadly or poisonous. Think of it as the horseshoe crab's rudder for steering in the ocean. On land, if it gets flipped onto its back, the telson will help to right it. If you see a horseshoe crab struggling on its back, a kind thing to do is turn it over so it can carry on with its journey.

New York can be like this, magical and gritty all at once. It's not always pretty or pristine. It's not free of human presence. Somehow, though, it is still wild. Here, amid the primordial gunk, we can appreciate the necessity of marginal places like these, where an ecosystem thrives despite our attempts to kill it.



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This ancient mariner brings gifts: medically valuable blue blood for humans and protein-rich eggs for shorebirds. If you have had surgery or been vaccinated, you can thank the horseshoe crabs and their blood—which contains the chemical *limulus amoebocyte lysate* (LAL). The FDA requires that all medical equipment and drugs be tested with LAL, a chemical that will clump upon contact with bacteria or endotoxins. If an endotoxin enters

your blood, you could get a fever or go into septic shock. You could say that their blood is hardly a gift, but something stolen for the survival of another species—us. The very wildness of the horseshoe crab enables contemporary human civilization to perpetuate itself.

During the brief period that horseshoe crabs leave their home on the ocean floor to spawn on land, another annual ritual unfolds: Some 400,000 of them are harvested alive, caught and sold to pharmaceutical companies for three dollars to twenty-five dollars per crab. When they reach the lab, still alive, in huge batches, barnacles are scraped off their shells. They're bathed, chilled, strapped to a metal trough. A needle is inserted into each crab's heart.

From there, the blood is extracted, filling a sterilized glass bottle. While our blood runs red from iron, horseshoe crab blood turns a beautiful, robin's egg blue from the copper that moves oxygen through its arteries. A quart of this elixir reportedly costs \$15,000. Thirty percent of each crab's blood is drained before they are returned en masse to the ocean. Scientists estimate that up to 13% or more may not survive the trauma. (A synthetic alternative to the blue blood has been developed, but has yet to gain the full attention of the medical establishment.)

Lisa Jean Moore writes in *Catch and Release*: “Humans have literally harvested the life out of horseshoe crabs for multiple purposes; we interpret them for biomedical applications, we collect them for agricultural fertilizer, we eat them as delicacies, we capture them as bait.” For their part, she argues, the crabs make us humans aware of our vulnerabilities “to toxins, the climate, the ocean, and time.”

Birders first suspected horseshoe crabs might be dying off when, after they were harvested aggressively in the 1990s for use as commercial bait and fertilizer, the birders noticed fewer red knot birds stopping along the mid-Atlantic coast to refuel. Each year, the red knot migrates 9,300 miles from the tip of Chile, where it winters, to the Arctic, where it breeds. Horseshoe crab eggs nourish them on their journey north. Without this food, they will not survive their migration. It's a beautiful act of synchronicity, to arrive in time with the horseshoe crabs' mating season.

Until birders sounded the alarm, not much thought had been given to the survival of the horseshoe crab. New York now has a 150,000 quota per year for commercial harvesting, but their decline remains worrisome. Local scientists and citizens' annual counts are crucial to help bolster plans for their conservation.

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Plumb Beach is ground zero for horseshoe conservation in New York City. Part of the Gateway National Recreation Area, along Jamaica Bay, this inlet, shoehorned between sand dunes and the highway, is near the mouth of an estuary. The beach has a rough-and-tumble history of squatter colonies, illegal gambling and boxing events, most of which disappeared by 1940 when New York City Parks Commissioner, Robert Moses, ordered the Belt Parkway built. Since then, Plumb Beach has been a haven for lovers, murderers, vagrants, windsurfers, fishermen, nude sunbathers, birders, and horseshoe crabs.

In May, I joined a citizen monitoring group at Plumb Beach organized by Cornell Cooperative Extension. Alas, beneath a gorgeous full moon, the mission was abandoned because erosion rendered the spit of beach we'd planned to walk unpassable. Later, in June, on the new moon, I joined a walk led by Keith Michaels of New York City Wild, two dozen strong, including a group of law firm interns that were doing team-building by learning about horseshoe crabs. As helicopters chopped the air overhead, we appreciated these creatures as they rolled in on the warm surf, spinning around our legs, overturning, then righting themselves, latching on to one another, dragging seaweed from their tails, skating along the tip of the tide.

Biology professor Christina Colon began to study the horseshoe crab population in this part of Brooklyn in 2010. From where we stood on the beach, she could point to Kingsborough Community College, where she teaches. We could see Breezy Point and the Marine Park Bridge.

“I’ve noticed something of a decline in the number of crabs, but there is a lot of variation from one year to the next,” she told me as we walked the beach. It was June 17, a day that would turn into a strawberry full moon. Every year, Colon and her students visit the same

six locations plotted with precise GPS latitude and longitude to survey the numbers of eggs and juvenile survivors.

“I’ll be barking orders,” she told the group. “We’ll walk down the beach, lay out a grid at the mid-tide zone and we’ll use a tape measure to go fifteen meters parallel to the beach, so we’ll be surveying a three meter wide strip. We’re going to collect ten samples from each grid.” The grid was marked with orange flags. To do this in an unbiased manner, a student tossed a piece of PVC pipe over her shoulder at random.

Wherever it landed, they sampled. Another student pounded the PVC core into the sand with a rubber mallet, pulled it up, emptied the contents into a Ziploc bag, and repeated the procedure. Later, the students would take the samples to their laboratory to sift for horseshoe crab eggs, which would be counted, recorded, and then returned to the beach, or given to Professor John Tanacredi at the Center for Environmental Research and Coastal Oceans Monitoring (CERCOM) for further study.

In 2012, Hurricane Sandy left the western side of the beach so severely eroded that the Belt Parkway was at risk of collapse. Taking no thought for the horseshoe crabs—who’d been coming there to mate for decades—the US Army Corps of Engineers dumped an enormous amount of new sand on the beach’s west side. The eastern side of the beach remained untouched.

Inadvertently, the Corps had created a site for a before-and-after study, with the new sand on the west as “after” and the old sand on the east as “before.” Scientists asked: Have the horseshoe crabs come back to the western side in numbers that are comparable to the undisturbed area on the eastern side? After five years, they concluded that horseshoe crabs still prefer to mate on the natural, undisturbed eastern beach without a clear idea why.

“I think it has to do with the type and the texture of the sand grains that were used,” Colon told me, walking and talking behind a group of students. “Maybe that sand is harder and more difficult to dig in. There’s some indication that they like the smell of the sand where they were born and without that ecological indicator they don’t go to that beach.”

She blew a whistle to hurry up some of the students who were lagging behind. All the while she had been picking up garbage and putting it into a net bag. “I do this because I want to help clean up, but also I think it encourages students to observe the ground more carefully. You never know what you’ll see.”

The horseshoe crab can't be bred in captivity—it takes too long to mature and will not survive. Plumb Beach doesn't seem special if you drive past—but this forlorn, trash strewn beach in outer-borough New York City has a mix of conditions that can't be replicated in a laboratory, an ecosystem, which, as Colon noted, “is increasingly less common as development and shoreline alteration reduces the number of spawning beaches available,” which is what makes these creatures truly wild, despite precarious circumstances.

But, as Colon pointed out, “the fact that they made it through 450 million years means they should get a Nobel Prize.” Or, as Professor Tanacredi has proposed, “they should be designated a World Heritage species,” which isn't even a thing yet, but it's a great idea. If any creature has the bona fides to be a World Heritage species, it's the ancient horseshoe crab.



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