

## A Knotty Problem

*The number of red knot shorebirds stopping over along the Delaware Bay has plummeted.*



Windrows of horseshoe crab eggs line the surface of the Delaware Bay Beachfront. Photo credit: Shorebird Project.

By Larry Niles, Wildlife Restoration Partnerships

One of NJ's most important ecological features, the Delaware Bay stopover for Arctic nesting shorebirds, currently hangs in the balance. This year the passage red knot population fell to less than 80% of what it was just two years ago, and that was only a third of the original number before the overharvest of horseshoe crabs in the 1980s.

As a young biologist with the NJ Endangered Species Program, I worked on this original population. With Pete McClain, the Deputy Director of NJ Fish and Wildlife, we helped conduct the early surveys. Back then, we estimated that over 1.5 million shorebirds of 6 different species used the beaches and the intertidal mudflats and creek edges of the Delaware Bay. Back then the crab population seemed boundless. Crabs cobbled every beach, and eggs piled in windrows on some shorelines.

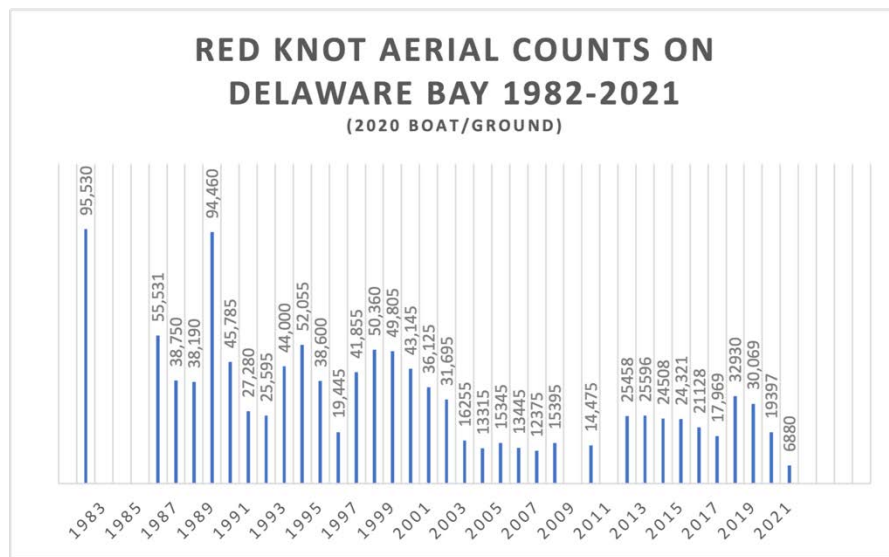
Birds and fish gorged themselves, creating a cornucopia of abundant marine life and providing animals and people with a well-tuned ecosystem.



Horseshoe crabs look like cobblestones on the beachfront when spawning is at its height. Photo credit: Shorebird Project.

The overharvest of horseshoe crabs changed all that. During the 1990s, crab harvests went from about 100,000 to a whopping 2.5 million by 1998. Egg densities nose-dived from 50,000 eggs per square meter to 6,000. Red knot numbers plummeted from 90,000 to 50,000, then to 30,000, bottoming out at 17,000 in the mid-2000s.

In response, beach restoration was conducted by American Littoral Society after Hurricane Sandy in 2012 and it continues to the present, reviving egg densities, and red knot numbers improved to over 30,000. However, this year we saw only 6,880 birds. The problem is there are too few crabs and eggs to support the stopover under all circumstances. We are still managing horseshoe crabs for the best of conditions, when we should be focusing on the worst.



Red knot preens feathers after feeding on horseshoe crab eggs. Photo credit: Jan van de Kam.

Currently an estimated three-quarters of a million crabs still die every year. Numbers must be estimated because surveillance is weak and regulations are only loosely applied.

The horseshoe crab harvest for bait is regulated using a male-only take in the mid-Atlantic, although the reporting of sex is no longer required of states. Regardless, Delaware Bay females still die legally. Eric Hallerman of Virginia Tech reported to one Atlantic States Marine Fish Commission (ASMFC) Adaptive Resource Management (ARM) committee that 44% of the harvest landed in NY was from the Delaware Bay. NY is nearly 150 miles from the mouth of Delaware Bay, so profits must be substantial to justify the transport costs. It's legal to take Delaware Bay crabs out of federal waters, so anyone can catch them, land them, and apply them to one's own state's quota. Which is exactly what NY currently does. The ASMFC has little idea of by-catch mortality and illegal harvests. Still, the agency continues to insist, against all indications to the contrary, that females are protected by only harvesting males.

In another drain on the population, horseshoe crab blood is used by the pharmaceutical industry to detect bio-contaminants for medical devices or for drugs put into human bodies. Today there are alternatives available, and the use of their blood should be phased out. As prospective partners in conservation, the pharmaceutical companies that bleed crabs leave little room for trust. Chiara Eisner in South Carolina has written several in-depth articles in *The State*, a South Carolina newspaper, about Charles River Associates' (a bleeding company) payments to the state agencies

regulating the fishery. This company is also under a court order to end taking horseshoe crabs from a USFWS refuge, potentially illegally.

Regardless of their integrity or lack thereof, the bleeding companies, with the full knowledge of big pharma, take no part in conservation activities to replace what they kill or to restore what has been lost in the past. Instead, they use regulatory loopholes that allow them to evade public scrutiny, and all of their data is self-reported and monitored without any third-party field verification. Bleeding companies claim a kill of around of 100,000; it could be much higher and focused on Delaware Bay females.

The ASMFC management board argued that the harvest could not harm a population the size of Delaware Bay's horseshoe crabs, but the data tells another story. When the horseshoe crab population crashed 20 years ago, the ASMFC initiated the Delaware Bay Horseshoe Crab Trawl, a dedicated at-sea survey. Numbers fluctuated, at times showing improvements, but currently the survey numbers are no different than when the crash occurred.

The success of this survey is its longevity. During its 20-year life, Virginia Tech used the data to estimate the size of the population each year. Over time they have shown that, on average, 1.4 million new adult females per year mature into the adult population. After nine years of maturation these new females should be driving population growth, yet the number of adult females stays the same.

Why do numbers of mature female horseshoe crabs fail to increase? Because someone or

something is killing females as fast as they mature. The regulatory and federal agencies are happy to make bold assumptions in estimating the quotas to kill crabs, but no one explains or offers data to explain this fundamental data conflict. Instead, the agency's management board ignores it. Usually, they resort to the usual litany of causes and provide no data or reasonable justification. The ASMFC management board often cites habitat loss, ignoring the decades-long beach restoration projects conducted in NJ. The habitat loss argument also fails basic wildlife science. If crabs were being limited by habitat loss, the crabs would be over-abundant in the remaining suitable habitat. But the egg densities tell another story. Currently there are only 8,000 eggs per square meter versus a capability of 50,000 eggs. Egg densities will grow only if the killing of female horseshoe crabs ends.

Climate change will also be blamed. And it is indeed an existential threat to all life. Still, horseshoe crabs breed from Florida to New Hampshire, so ocean warming changes nothing for crabs except distribution, and the Delaware Bay will always remain the crab's preferred habitat. The bay is relatively shallow, allowing quick warming to optimal water temperature. Mostly unpopulated beaches surround the bay, providing a near-perfect blend of naturally coarse sand, good tidal range, and mostly gentle wave action. It's no accident the Delaware Bay still has the largest population of horseshoe crabs in the world.

The Delaware Bay is dominated by one of the country's most prosperous ports which treats all levels of the bay's food chain as marketable

commodities with little regard for maintaining that ecosystem. Everything is sold off, mostly to foreign markets - eels, menhaden, conch, herring, nearly all the basic building blocks of a productive biome. It's like farmers selling earthworms or mining organic matter from the soil while growing a crop. Imagine a farmer who does nothing to nurture a crop and then wonders why it fails.

So how can this be fixed?

As part of the ASMFC ARM committee, I have worked for over 20 years with regulatory and federal agencies to recover horseshoe crabs by limiting harvest quotas. Unfortunately it hasn't worked, because the agency has little idea of who is killing 1.4 million adult female crabs every year. This is because all the agencies, state and federal, fail a basic lesson in ecology, one all farmers would understand. To harvest, you must sow. The only way to grow the crab population is to stop the killing altogether.

Just like any living system, an ecosystem must be nurtured. We cannot sell off the herring, shad, eels, squid, menhaden, and yes, horseshoe crabs without regard to the impact on the marine ecosystem and still expect the bay to magically produce abundant weakfish, stripers, flounder, and shorebirds. The overharvest of horseshoe crabs is especially destructive.

Recovery of the bay's productive base is crucial to all people living on the bay. In 1969 Carl Shuster, an academic at the University of Delaware who spent his career studying crabs, conducted a gut content study of all fish in

the Delaware Bay. Nearly all fish and shellfish ate horseshoe crab eggs and young. However, small fish like killifish, the so-called forage fish, ate the lion's share of horseshoe crab eggs. Killifish serve as forage for all the fish we love to eat, so if we lose the horseshoe crabs, it impacts not only the crabs and their ecosystem but also many fisheries and communities up the food chain. For example, until the 1990s, just before the horseshoe crab overharvest, recreational and commercial fishers took over 3 million pounds of weakfish each year. Now they take 40,000 pounds a year. As the weakfish fishery collapsed, so did many marinas, tackle stores, and restaurants. These businesses fell because a few horseshoe crab harvesters used the crabs to make extraordinary profits. Most of these profits went to investors and politicians (Republican and Democrat), not to the fishermen who risked all or to the communities who once depended upon them. No one considers the impact of marine overharvests on local communities.



The health of the red knot population is reliant upon an abundant horseshoe crab population and its spawn. Photo credit: Jan van de Kam.



# Fish Depend on Horseshoe Crab Eggs to Survive

Several sportfish include horseshoe crab eggs and larvae as part of their diet. Smaller fish like the Striped Killifish and Atlantic Silverside provision larger species of fish such as the Striped Bass and Summer Flounder.



Thousands of Loggerhead sea turtles migrate to the Delaware Bay in the summer to feed on horseshoe crabs. As crab populations have dropped, the turtles have shifted their diet toward fish and have turned to raiding fish nets and crab traps for food.



\* Many larger fish species depend on the killifish to survive, as they are a heavily consumed food source for other marine life. Less eggs available for killifish to eat means fewer killifish for bigger fish to eat, further damaging the health of our fisheries.

## SOURCES

Summer Flounder: NOAA / Public Domain: [https://cdn2.webdamdb.com/1280\\_mOukEXtDQuMF.png?1501272587](https://cdn2.webdamdb.com/1280_mOukEXtDQuMF.png?1501272587)  
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Loggerhead Sea Turtle: PIXNIO / Public Domain: <https://pixnio.com/free-images/2017/03/06/2017-03-06-19-32-49-900x600.jpg>

Graphic by Theo Diehl.

There are many ways to help the red knot and the Delaware Bay stopover, but there is only one that will create results: stop killing female crabs in all the states, from Virginia to Massachusetts, as soon as possible.