In hard-hit fishing communities, scientists help improve output — and save sea turtles

Goal is to reduce wasteful 'bycatch' while maintaining productive fisheries and helping threatened species

By Joe Rojas-Burke, ASU News
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Eddie Willis was 7 years old when he began working on fishing boats catching flounder, mullet, crab, shrimp and bay scallops.

By age 13, he was making a living at it.

From his father, Willis learned how to set and fish pound nets, bottom-anchored systems that funnel fish through a one-way tunnel into a corral of netting. Each year, he cuts down saplings to make poles to erect underwater fences of netting that will lead fish into the pound, the trap portion of the setup.

He works an expanse of clear, shallow water protected from the rough Atlantic by a miles-long ribbon of barrier islands. Several rivers flow into the sound to mix with twice-daily tides. Scallops dot the sandy bottom between patches of seagrass. It is a productive nursery for marine life. In its heyday, the flounder fishing was bountiful.

“There was days we'd catch 10,000 pound out of all the nets, you know,” says Willis, a fourth-generation commercial fisherman who was born and raised on Harkers Island, North Carolina, and who owns a seafood store in the area. “We used to could fish 22 nets in three hours. You go in one, out the other, you know, zip, zip, zip, hard as you could go.”

Many forces have threatened the fishing way of life. An influx of seafood imports and consolidation among processors cut into fishers’ revenues. Regulators imposed stricter catch quotas on fisheries deemed to be declining. Rising fuel prices made each fishing trip more expensive.

And then there's conservation efforts.

Sea turtles around the world are threatened with extinction. Despite signs of recovery, current population numbers remain a small fraction of the total that once existed. Fishing gear that unintentionally entangles turtles remains a primary threat, along with climate change, pollution, habitat loss and emerging diseases.

Recovery plans under the Endangered Species Act have imposed severe limits on commercial fishing in coastal North Carolina and other areas that are havens for green sea turtles, loggerheads and Kemp's ridley sea turtles.

"It shut down the gillnetting here, and there was a lot of people dependent on that," Willis says. "It put a lot of people out of work. A lot of people."

That has stirred anger and distrust of conservationists and scientists among people in fishing communities.

Finding a win-win solution

That's where Arizona State University's Senko Lab comes in.

Jesse Senko, an assistant professor in the School of Ocean Futures, and his team are studying ways to make fishing gear less harmful to sea turtles, sharks and other threatened species and thereby help sustain people who fish for a living.

"All they've heard is they are bad because they are killing sea turtles," Senko says, who has made it a priority to work in collaboration with fishers as partners in his research.

The overarching goal is to develop practical solutions that can be widely deployed to reduce wasteful "bycatch" while maintaining productive fisheries.

"From the very beginning, we ask how can we actually improve the way their fishing goes," he says. "It's not just about saving sea turtles. It's about how we can improve their fishing operations and preserve their livelihoods."

In one series of controlled experiments in Mexico's Sea of Cortez, Senko and colleagues showed that illuminating gillnets with green LED lights could reduce the capture of turtles and other off-target species by 63% while helping fishers save time retrieving and disentangling nets — all without interfering with the harvest and value of targeted fish.

Bright ideas

On a calm morning in July, Willis is out on the water with the Senko Lab team replacing pound net poles knocked over in a storm.

Willis wades in chest-deep water beside the boat. He has a hose in hand, spraying a stream of water to loosen the sand and let a fresh pole sink into upright position.

His work with the researchers goes beyond setting nets and ferrying team members in his boat. They rely on his on-the-water expertise and his ideas for testing fishing gear modifications.

One afternoon, after completing the day's research tasks, Willis casually mentioned to Senko several ideas, including a crab pot design that wouldn't trap and drown diamondback terrapins, the only brackish-water turtle species in the world and listed as a species of special concern in North Carolina.

Willis offered to make a beta test version. Then he described a design for a turtle-safe net for deepwater fishing. Senko began making plans for new studies.

"My head is just racing right now," Senko said later. "How do we prioritize these projects?"

Back on the water, Larisa Avens, a biologist with NOAA Fisheries' Southeast Fisheries Science Center who partners with the Senko Lab team, steers her boat over a submerged fence of netting so that the team can retrieve any turtles caught in the pound.

"Do me a favor," Willis says. "When you go in the next one, go in from the other side; the wind'll be on your bow. The tide'll be on your bow. Make it easier for you. East wind ain't no good for nothing."

Kayla Burgher, a PhD candidate in the Senko Lab, stands at the front of Avens' boat, pushing down on the top line of the net with a makeshift wooden stick.

"OK, yeah, so kneeling up on the bow, push down off the side just a little bit right in front of the bow," she tells Emily Bowen, an ASU student in the Senko Lab majoring in conservation biology.

"Oh, is that a little shark? We have a little shark!" Bowen announces.

Multipronged research

For several weeks, Burgher has been testing the newest version of the flashing green LED lights placed on fishing nets to deter sea turtles. The first version Senko deployed was powered by batteries that ran down quickly and had to be swapped out repeatedly. The new design is solar powered to reduce waste and work more reliably with less labor.

Senko is trying to optimize the design to make the gear inexpensive to manufacture and affordable for small-boat fleets that account for the majority of the world's ocean fisheries.

Senko plans to work with a manufacturer to mass-produce LED lights for fishing nets. He thinks it's possible to make them available for purchase within two to three years. Research on their effectiveness could encourage conservation organizations and government agencies to provide grants or subsidies to help fishers buy them. Senko has received funding for the research from Schmidt Marine Technology Partners, the Disney Conservation Fund and the National Philanthropic Trust.

To measure effectiveness, the ASU researchers are comparing the numbers of turtles, sharks and other species caught in nets on days with or without illumination. Every day, Burgher pulls a kayak along the toplines of each net, attaching solar-powered lights one day and removing them the next. Fair weather or foul, she can't miss a day because the nets must be cleared of any captured marine life.

The researchers are also capturing observations of sea turtle behavior never seen before using a set of custom-designed underwater video cameras and data recorders that Burgher assembled with Bowen, graduate student Jasmine Abe and Senko Lab doctoral student Teagan Keating, whose research focus is sea turtle behavior, especially in relation to fishing gear.

The cameras are active around the clock, recording sea turtle interactions with pound net fishing gear. Detailed observations could help researchers refine the design and function of lighted nets to more selectively reduce bycatch. Senko says it’s still unclear why turtles avoid lighted nets.

“We have no clue what is going on,” Senko says. “Is the light simply illuminating the hazard? Is the light making the net less attractive? Video recordings will provide all sorts of new information on behaviors.”

Missing pieces

Much about sea turtles remains a mystery. They travel unobserved over long distances in the vastness of the ocean.

“It's really hard to study them,” Burgher says. “We know a lot about what happens on nesting beaches, but in-water work is so hard to do. There's so much more that we need to find out to even understand them at a basic level.”

Thousands of hours of underwater video of sea turtle behavior could help fill in gaps, Keating says.

“Because we're seeing examples of them gathering close together, it changes our understanding of their distribution and their functioning,” she says. “From a conservation perspective, if you have a bunch of them close together, it makes it easier for a whole group to be hit by a boat or entangled in fishing gear.”

Researchers aren’t all that sure of their estimates of the recovery of sea turtle populations. Avens said estimates rely on counts of nests on beaches, not numbers of nesting females, whose demographic characteristics could be changing.

“They could be laying more nests per individual or less; we have no idea,” she says. “There is some good news out there. But we have a limited window on to what’s happening in the rest of the population.”

That makes every bit of data on sea turtles valuable. Senko’s team painstakingly records all they can about every turtle they retrieve from their experimental pound nets.

In his years of fishing, Willis has a developed a keen sense for sea turtles and their habits.

“This net here is a really, really good spot for the Kemps and the greens,” he says. “This whole banks, all in there, it's about 2 feet of water. That is just covered with ’em, I mean everywhere in there. And of a night, they come off the shoal.”

Burgher liberates a green sea turtle from the net and holds it in her lap with her forearms on the edges of its shell. After swabbing antiseptic and a numbing agent on each turtle’s skin, she uses a syringe to place a PIT tag that can be scanned, like a barcode, to identify individuals over a

lifetime. The researchers also take blood and skin biopsy samples that provide clues to identify which nesting population the turtles came from, where they have traveled and what foods have sustained them.

The samples can also help researchers detect whether the warming climate is altering the proportion of male and female sea turtles. Egg incubation temperature determines whether a turtle embryo becomes female or male. The sex of juveniles can't be determined visually; it requires a blood test.

When Burgher finishes measuring and taking samples, she lowers the scrambling sea turtle into the water. It swims away with astonishing speed through the sunlit water.

"He got away quick, didn't he? Like a rocket, jet-propelled," Willis says.

"They are so alive."

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This story originally appeared on ASU News.

Main image

Retired fisherman Eddie Willis, owner of Mr. Big Seafood, looks out his boat off the coast of Harkers Island in North Carolina on July 30, 2025. Photo by Samantha Chow/Arizona State University

Text image(s)

No caption

Mr. Big Seafood Shack in Harkers Island, North Carolina, is owned by retired fisherman Eddie Willis. Photos by Samantha Chow/Arizona State University

Gallery

ASU environmental life sciences PhD candidate Kayla Burgher examines a Kemp’s ridley sea turtle after rescuing it from a pound net off the coast of Harkers Island, North Carolina, on Aug. 1, 2025.

Jesse Senko (left) and ASU student Emily Bowen measure a green sea turtle before tagging and releasing it.

ASU Assistant Professor Jesse Senko releases a Kemp’s ridley sea turtle that was caught off the coast of Harkers Island, North Carolina.

Gallery

NOAA research fishery biologist Larisa Avens (bottom left), ASU Assistant Professor Jesse Senko (bottom center), retired fisherman Eddie Willis (back) and fourth-year conservation biology and ecology, and earth and environmental sciences student Emily Bowen (bottom right) work to get a lemon shark out of a pound net off the coast of Harkers Island, North Carolina, on Aug. 1, 2025.

Eddie Willis (right) discusses ideas for turtle-safe fishing gear with researchers from the ASU Senko Lab.

Gallery

Environmental life sciences PhD candidate Kayla Burgher lays out solar panel lights to charge in front of the home she is staying at in Beaufort, North Carolina, on July 31, 2025. The lights are being tested on pounds nets in North Carolina to deter turtle bycatch.

Pound nets are bottom-anchored systems that funnel fish through a one-way tunnel into a corral of netting. In the orange kayak, Kayla Burgher attends to solar-powered lights. Colleagues in the larger boat service an underwater video system for recording sea turtle behavior.

Environmental life sciences PhD candidate Kayla Burgher adds solar panel lights to a pound net from a kayak off the coast of Harkers Island in North Carolina on July 30, 2025.

ASU graduate student Jasmine Abe removes the battery of an underwater camera off the coast of Harkers Island, North Carolina. The camera, which was fully developed by students in the Senko Lab, records 24-hour underwater footage.

Solar panel lights, used by the Senko Lab, illuminate pound nets to deter the bycatch of turtles and sharks off Harkers Island, North Carolina.