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Sea Grant CONNECTICUT

WRACK LINES

Volume 24, Number 1, Spring/Summer 2024

WHERE CONNECTICUT MEETS THE SOUND

NATURAL EFFECTS

Tales of our Dynamic Environment

Sea Grant
CONNECTICUT

Volume 24, No. 1 Spring/Summer 2024

Editor
Judy Benson

Graphic Design
Maxine A. Marcy

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University of Connecticut
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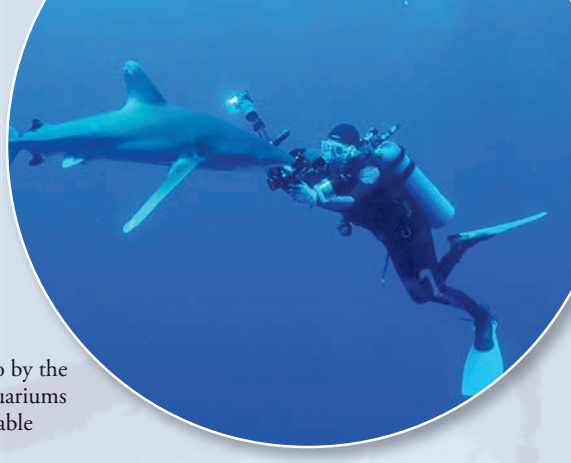
From the EDITOR

Shark Week comes around this summer July 21-28.



This semi-serious annual event that started 36 years ago by the Discovery Channel has since been adopted by bars, aquariums and other venues looking to tap into the public's insatiable fascination with this ancient species.

But, as Michaela Thompson told an audience at Avery Point in April, there is more to Shark Week than clever marketing. Looking at it through her anthropologist's lens, she sees it as a manifestation of the shifting relationship between people and sharks, and perhaps the rest of nature.

Thompson, environmental historian and sustainability scientist at the Harvard Extension School, previewed her forthcoming book in a talk titled "Shadows in the Water: What Sharks Tell Us About Ourselves," that was part of the annual Coastal Perspectives Lectures on campus. By happy coincidence, Thompson came to share her insights on the dynamics of human-shark interactions just as this issue of *Wrack Lines*, framed around a more universal version of the same theme, was going into production. She handed me a perfect nugget to represent the whole mountain, the metaphoric story of one creature that illustrates the broader concept of the ever-changing nature of nature and the human role in it.

Widespread interest in sharks, she noted, is an artifact of 20th Century technological advances and trends in human society. New equipment for exploring the sea has made scientific study of sharks possible for the first time, and the rise of beachgoing as a popular pastime put millions within proximity of the sharks' domain for the first time on a large scale. Before then, only sailors and fishermen encountered sharks, and often they described them as "cowards" because of their opportunistic eating habits.

"The rise of beach culture and marine recreation thrust sharks and humans into unprecedented contact," Thompson said.

In the 1950s and 1960s, the number of shark attacks on humans rose sharply, mainly because of the "numbers game" of more people swimming, surfing and sailing at the shore. Peter Benchley, author of the book that became the infamous 1975 movie *Jaws*, used the real-life shark attacks as the basis for his thriller.

"*Jaws* doesn't occur in a vacuum," Thompson said.

But a sea change has happened since the anti-shark frenzy whipped up by *Jaws*. Attention to sharks turned into curiosity, and more scientific study. Awareness grew about the important role sharks play in the ecosystem. In recent decades, as their survival in the marine habitat they depend on became more precarious, "the narrative shifted from saving people from sharks to saving sharks from people.

"There has been an evolving perception of sharks," Thompson said. "They've gone from being considered cowards to killers to charismatic megafauna to conservation objects."

But the core tension of our relationship with sharks remains. Sharks are predators that sometimes prey on humans.

"We are resistant to the notion that we could be prey for other animals," she said, out of a belief in "human exceptionalism."

Sharks present just one example of the dynamic environment we humans are part of and must continually adapt to. This issue looks at marsh scientists, an artist, a shoreline community, aquaculture researchers and marine biologists observing the changes in the environment and doing what they can to help all of us both adapt and build healthier relationships with nature in the process. That may require putting the notion "human exceptionalism" aside.

Judy Benson
judy.benson@uconn.edu

Above: A diver photographs an oceanic whitetip shark as part of a research project. Photo: Peter Auster. To see more shark photos, visit: https://seagrant.uconn.edu/?p=11758

Cover: Marsh grass advancing into a coastal forest at Barn Island Wildlife Management Area in Stonington is marked with a transect of orange flags as part of a research project. Photo: Shimon Anisfeld.

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About OUR CONTRIBUTORS

GRACE CAJSKI

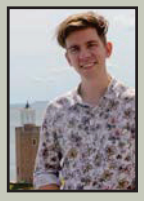
Grace Cajski is studying marine conservation and English at Yale University. As a 2022-2024 NOAA Hollings Scholar, she worked with the Milford lab GoPro team to analyze scup behavior around oyster aquaculture cages. Cajski is interested in sustainable aquatic food systems and how coastal communities are feeding themselves in a changing world. She supports bottom-up, community-based conservation efforts rooted in sustainability and longevity. Her articles have been published in *ECO* and *Oceanographic* magazines, and her work has been recognized by the Udall Foundation and the Association of the U.S. Navy.

PAUL CHOINIERE

Paul Choiniere is a lifelong journalist who spent much of his career writing about all things Connecticut for *The Day* of New London. His reporting included health, science, and the environment. He received numerous awards for investigative reporting on safety violations at the Millstone Nuclear Power Station in Waterford in the 1990s. Lessons learned from the problems at Millstone led to major reforms in nuclear power regulation. From 2007 until his retirement in 2021, he served as *The Day's* opinion editor. He now does freelance reporting, editing and opinion writing.

MAGGIE COZENS

Maggie Cozens is the Long Island Sound Study outreach coordinator with Connecticut Sea Grant and UConn Extension. She works to increase appreciation, stewardship, awareness and understanding of Long Island Sound through the development of engaging and inclusive outreach and educational programming. She holds a Master of Science in Environmental Science from the University of North Carolina at Wilmington, with a special focus on salt marsh and wetlands conservation.



OWEN PLACIDO

Owen Placido is an assistant extension educator focused on nature-based approaches to climate adaptation. He works to connect individuals and communities to resources that can help them adapt to climate impacts, implement nature-based solutions and restore critical habitats in the Long Island Sound watershed. He is interested in how science, art and the environment intersect to create a sense of place. Owen joined Connecticut Sea Grant in 2023 after earning his Master of Science in environmental science from the University of Rhode Island.

JUDY BENSON

Judy Benson has been communications coordinator at Connecticut Sea Grant and editor of *Wrack Lines* since 2017. Before that, she was a newspaper reporter and editor, concluding her journalism career at *The Day* of New London covering health and the environment. She is the author of a book created in collaboration with artist Roxanne Steed: *Earth and Sky: Nature Meditations in Word and Watercolor*, published in 2021 by New London Librarium (nllibrarium.com). She earned both a bachelor's degree in journalism and a Master of Science in natural resources from UConn.

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Oyster cage videos a powerful tool for lessons on shellfish benefits

By Grace Cajski

Over more than two decades of operating Noank Oysters near the mouth of Mystic Harbor, oysterman Steve Plant has seen a wealth of marine life around his oyster cages.

"I have pulled up a cage with 17-inch flukes sitting on top of it. I'd have pilot fish milling around the buoys," he said. During the summer months, he's seen tropical exotics such as yellow tang, juvenile snowy grouper, and butterflyfish.

Chuck Viens, who has operated Charles Island Oyster Farm in Bridgeport and Milford since 2009, has found baby lobsters in his cages.

Mike Gilman, co-owner of Indian River Shellfish and Connecticut Sea Grant assistant extension educator, has spotted blue crabs, seahorses, blackfish, black sea bass and eels when he hauls up his oyster cages.

Beth Simonds, a partner of Stonington Farms Shellfish since 2017, has noticed fish, crabs, eels and seahorses in the cages she and her husband, Kris, keep on their lease area in Groton. The marine life around oyster aquaculture is very rich and often entertaining.

"It's like working in the touch tank of the aquarium all day long and my mom never says it's time to go home," she said. "You never know what you're going to find."

Intrigued by the growers' stories, National Oceanic and Atmospheric Administration (NOAA) scientists at the Milford Laboratory started using GoPro cameras in 2017 to understand how fish interact with aquaculture gear. The small waterproof cameras are mounted to the tops and bottoms of oyster cages, recording eight-minute segments every hour, from 7 a.m. to 7 p.m.

"Our research program is quantifying some of the environmental benefits of shellfish aquaculture, expanding our understanding of how habitat benefits vary over time and space, and whether the farm practices influence habitat provisioning," said Julie Rose, research ecologist and co-leader of the project. "The knowledge gained will aid in ensuring that future aquaculture development maximizes both environmental and economic benefits to society."

As the GoPro Aquaculture Habitat Project forges into its sixth year, NOAA's scientists are analyzing the thousands of hours of video footage they've collected across Long Island Sound. Thus far, their findings confirm the growers' lived experience.

"We see fish of all sizes and life stages using cages as habitat," said Renee Mercaldo-Allen, research fisheries biologist who is leading the project with Rose. "Our findings show that oyster aquaculture cages provide habitat for temperate reef species similar to natural rock reef habitats and that clusters of cages may act like an artificial reef, adding structure to relatively flat seafloor."

Beth Simonds of Stonington Farms Shellfish uses a shell tumbler while working on her company's oyster farm as her dog Max looks on. Photo: Grace Cajski

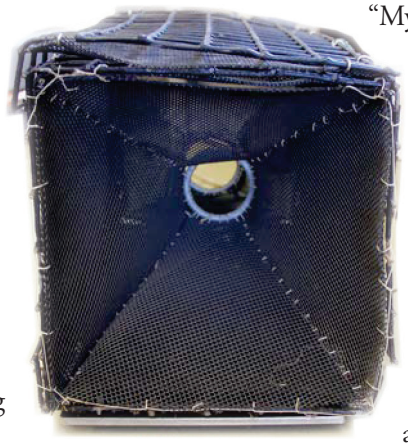
This project wouldn't have been possible without contributions from and collaborations with the state's shellfish growers, who allowed researchers to place study cages on their shellfish leases. As the team has reviewed videos and published their findings, the growers gain quantitative evidence that confirms their lived experience.

Facing page, Dylan Redman, left, fisheries biological technician at the NOAA Milford lab, and Isaiah Mayo, biological science technician at the lab, lower an oyster cage onto the deck of a NOAA vessel to download footage from the attached GoPro camera. Photo: Judy Benson


AEROQUIP

A scup is captured swimming past an oyster cage by one of the GoPro cameras. Photo courtesy of NOAA Milford Lab. Below, one of the oyster cages used in the research project. Photo: Judy Benson

"I think this is the greatest thing ever," said Gilman. "The cages are down there, but you never know exactly how they fit into the environment. The GoPro Project helps give little snippets of how the cages are acting as artificial reefs in that particular habitat…We can say that there are fish swimming around it, but having videos of spawning fish and predatory activities occurring throughout the cages is proof."



It is proof, specifically, that humans can have a positive impact on the surrounding environment.

"Yes, we're putting a piece of metal and plastic in the water," said Gilman. "But it's being productive as aquaculture, it's offering habitat and refuge for other organisms, and it is functioning in the natural environment."

Connecticut Sea Grant's Senior Extension Educator Tessa Getchis agrees with Gilman that these data can shift the dynamics of aquaculture policymaking.

"Having this science-based information is really critical because the growers are empowered," she said. "They can speak up at public meetings, and the local officials who are making decisions can use the information that there aren't any negative effects and that there are benefits to the local environment."

These findings position growers as stewards of the marine environment—a role they already self-identify with. Plant is proud that his oysters provide habitat for other species.

"My best term for oysters is bio-substrate. It's almost like living bottom," he said. "It's bottom that attracts vertebrates, invertebrates, all manner of critters."

By working in cooperation with nature, he believes, he and other oyster farmers are active environmentalists.

"These creatures are filtering the water," he said. "Reducing nitrogen, reducing algal blooms, keeping the water clean, making it more hospitable to submerged aquatic vegetation, all that good stuff. Sequestering carbon in their shell. They are unique in that they're one of the few species where the more you have, the better it is for the environment. It's reverse pressure. It's anti-pressure."

Viens sees his work as a collaboration with nature.

"Having bottom-holding cages is not an environmental problem, it's potentially a solution," he said. "My feeling is that the cages offer refuge from predators."

As such, "oyster farming is about as green as you can get," he

said. “I’m on the side of making it perpetual. I find myself wanting to work closer with the bigger picture.”

Such a sustainability mindset is something that Norm Bloom of Copps Island Oysters in Norwalk has perfected over a lifetime of oystering.

“It’s a gift, you’re given a gift,” he said, referring to each of the oysters he grows. “To be sustainable, now I become a manager. We say, ‘Work with Mother Nature.’ She gives me this, now I have to manage it.”

Like Viens, Bloom has his eye on the long game.

“When I get this resource, the better I manage it, the longer it’s going to last,” he said.

And, being the second of four generations of Bloom oystermen, his management ethos leans towards protectionism. To ensure that there will be enough oysters for his grandson Jack to steward in a couple decades’ time, Bloom considers himself not just a resource manager, but also a resource protector.

Simonds considers herself an oyster caregiver.

“Cozy is my favorite word, and I love making people feel cozy,” she said. “I feel like that with the oysters: they’re little tiny baby bivalves, and I’m giving them a bath and tucking them in.”

Of course, the environmental benefit that the oysters have is not lost upon Stonington Farms Shellfish.

Her husband added: “We’re contributing by cleaning the water.”

Indian River Shellfish’s 11 acres of oysters are also cleaning the nearby water, something that Gilman is proud of.

Sitting on his dock by the Indian River, he gestured to a pile of oyster cages.

“Having 700 of these, the marine environment went from very little shellfish substrate refuge habitat for fish to having a couple million oysters filtering water every single day,” he said.

Shellfish growers are proud of their stewardship of the marine environment, and through the GoPro Project, the public is becoming more aware of their contributions. If a picture is worth a thousand words, how many words is a video worth?

“The videos are meaningful for the public,” Getchis said. “It’s not one image or one video showing one perspective. It’s not just showing the environmental services in terms of fish production. We show the water quality perspective as well. We show reef building as a way to provide services and talk about nutrient mitigation.”

Knowing the power of video footage, the team was intentional about sharing it on its website, as well as through news outlets and social media. The project website’s video footage has already been viewed nearly 17,000 times, project leaders note.

This public reaction has surpassed the researchers’ expectations.

“Video footage of fish interacting with oyster cages has turned out to be a compelling educational and outreach tool to help the public understand shellfish aquaculture and what benefits it may confer beyond producing healthy sustainable food,” said Mercaldo-Allen.

The growers have certainly appreciated the positive press.

“NOAA is helping educate people on the benefits of oystering, through research, through videos,” Plant said. “You have juvenile black sea bass… sheltering up in an oyster cage safe from predators, so what a wonderful thing.

“The more habitat you have, the more biomass you can support,” he continued. “A year-round group of oyster cages can provide regular habitat for all manner of creatures, whether they’re vertebrate or invertebrate, and you can document that through the GoPro study. That’s a good thing.”

Cultivator, one of the vessels used by Copps Island Oysters, is used to harvest oysters in an area near where the NOAA Milford lab is conducting its research. Photo: Grace Cajski

To view the NOAA Milford Lab oyster cage videos, visit: htts://www.youtube.com/watch?v=Yjf8ZVwzrOl

Are black sea bass becoming the 'new cod' in the Sound's warming waters?

By Paul Choiniere
Photos by Hannes Baumann

Graduate students Max Zavell, left, and David Riser, right, stretch out a beach seine during sunset at Mumford Cove in Groton. Right, a male black sea bass is seen underwater.

Black sea bass (*Centropristis striata*) are the poster fish for the unpredictability brought about by a changing climate.

Not many years ago these carnivorous bottom feeders were considered largely southern dwellers, only rare visitors to the cold Atlantic waters north of Hudson Canyon, which runs from New York/New Jersey Harbor to 400 nautical miles out to sea.

A 1953 U.S. Fish and Wildlife Service publication, "Fishes of the Gulf of Maine," stated about the species that "it has never been found in any numbers north of the elbow of Cape Cod so far as we can learn. We have never seen it in the Massachusetts Bay region."

Given their suitability for warmer ocean waters, there was no expectation of a move north.

The authors can be forgiven for not knowing the climate was already warming, a product of the industrial age spewing carbon into earth's atmosphere, trapping heat like a greenhouse. And who could have predicted then that the waters off the northeastern United States would warm more rapidly than most?

In 2021, the Connecticut Department of Energy and Environmental Protection, in issuing its annual Long Island Sound Trawl Survey, noted a shocking discovery. In a single decade the black sea bass population had increased by an estimated 1,084%.

"The outburst of black sea bass has really happened after 2010. The Long Island Sound Survey has caught more sea bass in the last five years than in all the years before combined," said Assistant Professor Hannes Baumann.

Baumann is the founder of the Evolutionary Fish Ecology Lab at the University of Connecticut Department of Marine Sciences, located at the Avery Point Campus. He is leading research into the multiple implications that sea bass expansion has for the ecosystem of the Sound. Baumann has obtained Connecticut Sea Grant funding to undertake the first comprehensive evaluation of black sea bass diets in the Sound, the most recent of several of his projects focusing on this fish.

While warming ocean temperature is more favorable to the opportunistic sea bass, it is making the waters less hospitable to cod, summer flounder and, particularly, winter flounder. Overfishing had already depleted these stocks, all of which are now fished following strict regulations.

"The sea bass found an empty seat at the table," Baumann said.

Working with Baumann is Max Zavell, whose doctoral research at UConn marine sciences has focused on what water temperature conditions could allow the sea bass to transition from just being summer visitors to our local coastal waters, to permanent dwellers that survive our winters, capable of spawning in winter and spring.

Such research will help sort out the implications of black sea bass expanding their turf and determining how big of a foothold they may get. Just how dominant will they become among fellow bottom feeders?

Black sea bass from Long Island Sound are swimming in large tanks at UConn's Rankin seawater laboratory in 2020

The Maine lobster industry is also taking a wary view of the invader, which has been found with increasing frequency in lobster traps there. If juvenile lobsters become a significant part of the diet of an expanding black sea bass population, that would have troubling implications for the lobster trade.

On the positive side, black sea bass could grow into a staple for the commercial and recreational fisheries, which have seen other stocks diminish.

"It could become the new cod," Baumann said of the fish that was once abundant in the Sound and adjacent coastal waters.

MOVING

Like the fish he is now studying, Zavell is a transplant to these environs. He didn't take a typical route, geographically speaking, to his love of the sea. Zavell grew up in the great midwestern city of Chicago. Though nearby Lake Michigan primed his curiosity, it was the family summer trips to coastal Maine that set him on his career course.

"I found I had an innate connection to the sea, even way back then," he said.

To friends he was known as a fish nerd.

"Ask anybody who has known me — forever — and they will say, from day one, they knew this is what I was going to do. In high school, they'd say, 'Max is going to be a fish doctor,'" recalls Zavell.

He came east to attend the University of Rhode Island, in 2020 graduating with a Bachelor of Science degree in Marine Biology. He arrived at UConn that same year to pursue his Ph.D. Zavell is expected to be recognized this spring as a Doctor of Oceanography. In other words, a fish doctor.

Zavell's research focused on the Mid-Atlantic black sea bass, also known as the northern stock. There is also a South Atlantic stock. These sea bass are protogynous hermaphrodites, with most starting life as females, but many transitioning to males as they mature and grow.

The fish migrate to inshore coastal areas and bays in the spring and summer, feeding on shrimp, worms, clams, crabs and small fish. Warming water temperatures account for the big increase seen in black sea bass summer migration to the Sound and other northern coastal areas. They head back offshore to warmer waters in the fall and spawning begins in winter.

Zavell wanted to observe the water temperature tolerance of these Mid-Atlantic black sea bass. If the waters warm enough, and the black sea bass adapt to those temperatures, more of them can be expected to spawn in local waters and skip the offshore trek. That could lead to further dramatic increases in population.

Graduate students David Riser, left, and Max Zavell pull the beach seine on shore in Mumford Cove.

"It's just a matter of time, potentially, as water temperatures continue to increase, that it might be favorable for them to stay," he said.

Utilizing facilities at the UConn marine sciences laboratories, Zavell and his assistants filled a dozen blue buckets with 700 liters of seawater pumped directly from the Sound. They populated each with eight black sea bass. Studied were fish subjected to 19 degrees Celsius (66.2 degrees Fahrenheit), considered the ideal growth temperature; 12 Celsius (53.6 Fahrenheit), the temperature typical of their northern offshore fall migration; and 6 Celsius (42.8 Fahrenheit), considered the bottom level of their tolerance.

In some tanks, Zavell also manipulated temperatures to mimic changes during migration.

As expected, the fish grew vigorously in the warmest temperatures and thrived in the 12 degrees Celsius conditions as well. More surprising was the tolerance and growth seen at 6 Celsius. Those colder conditions still left the fish depleted, making migration to warmer water still the better survival and reproduction option, he said. But not by a lot.

"These fish might have a much lower temperature threshold than we previously thought," Zavell said.

Curious, Zavell subjected some black sea bass to winter temperatures now typical to the eastern Sound — between 3 to 4 degrees Celsius (about 37.4 degrees Fahrenheit). It was not part of the research and so not carefully analyzed or included in his doctoral dissertation. But it proved interesting.

"We did see mortality, but survival was much higher than expected," Zavell said.

It may be that we are witnessing the development of a subunit of the Mid-Atlantic stock, said Zavell. This hardier stock would be ready for rapid population growth.

Left, a juvenile black sea bass swims in one of the experimental tanks.

Above, Max Zavell measures a live, anesthetized black sea bass juvenile to subsequently measure its growth during winter. Additional photos from the research project can be found at: https://seagrant.uconn.edu/?p=11758

DIET

Earlier research by Baumann and fellow scientists found that the sea bass in the Sound tend to be smaller, younger and grow faster than the traditional stock. The largest of about a thousand specimens measured 57 centimeters, or about 22 inches. But the average size was 35 centimeters, about 14 inches.

South Atlantic black sea bass grow to two feet.

Baumann's next research will examine what these predators are feeding on and the implications it has for the ecosystem and for fisheries. Project researchers will analyze hundreds of sea bass through the traditional method of cutting them open and looking inside their digestive tracts, but also by using DNA technology to determine which critters have already been digested.

"As scientists there are many, many things we still don't know," Baumann said. "But we will know more when we determine what these fish are eating."

The sea bass diet could be contributing to the decline in river herring, for example, which come in from the Sound to spawn in Connecticut streams, Baumann said. And does their diet for crustaceans include many juvenile lobsters? If so, that would be bad news for the lobster industry, which has already collapsed in the Sound, but remains thriving off coastal Maine, for now.

Baumann's path to UConn traces back to East Germany. "I was 14 when the (Berlin) Wall came down," he said.

Under the communist government of East Germany, he would never have had the chance to pursue a marine biology career, Baumann said. Having scientists in that field was a low priority for a socially engineered society.

It was a hobby he took up as a teen and still enjoys, scuba diving, that led to his interest in the field. "I wanted to identify and understand the fish I was looking at."

Baumann earned his doctorate from the University of Hamburg and came to do his post-doctoral work in the United States in 2008. He joined the UConn faculty in 2014.

For recreational and commercial fishing, the explosion in sea bass is an opportunity, Baumann said. Research on their growing abundance could lead to larger catch limits for the commercial fishery, he said, and smaller size limits for recreational fishermen and women, given the smaller size of mature fish in local waters.

"There are winners and losers when it comes to climate change," he said. "These sea bass are winners. We need to understand the implications of that and react accordingly."

'the explosion in sea bass is an opportunity'

SPARROWS, MARSH MOVEMENT AND GRASS GENETICS

The latest salt marsh research from Connecticut scientists

by Owen Placido

The team of researchers from The Maritime Aquarium at Norwalk hold the mallets used to secure the miniature greenhouses into place as part of Sarah Crosby's research project. Photo: Sarah Crosby

Salt marshes are in-between places.

Tucked behind a beach front, along a tidal creek, between dry land and open water, they are Connecticut's liminal ecosystems.

When conditions are just right, marsh grasses can establish themselves in sheltered coves and embayments, and these transitional ecosystems are formed. Once common along the Connecticut coast, the remaining marshes have become a research passion for three scientists and their partners who are trying to do what they can to help preserve these essential waterscapes.

"The marshes are spectacular, in terms of their beauty and complexity," said one of the researchers, Shimon Anisfeld of the Yale School of the Environment.

In addition to being some of the most productive ecosystems in the world, salt marshes perform critical ecosystem services. They remove excess nutrients from water, sequester carbon in layers of peat and are critical habitat for hundreds of key species. Salt marshes can protect our communities from flooding by soaking up storm surges like a sponge, and they lessen storm damage by softening the blows from waves to the coast.

Despite the value we now recognize, the salt marshes in Connecticut have a long history of mismanagement and degradation. A brief comparison of aerial photos from the 1930's to present shows acres of this invaluable habitat drained, filled, or eroded away.

These practices weren't merely tolerated. State laws promoted marsh draining in a misguided effort to drive down the mosquito nuisance. Even today the effects of this practice can be seen in many marshes: linear ditches dug throughout the 20th century that crisscross the marsh surface.

While the drainage ditches left many marshes a disturbed habitat, draining and filling destroyed other marshes altogether. These historical land management decisions, in concert with the impacts of climate change, have led to the current conditions in which the remaining salt marshes in Connecticut are threatened.

The salt marsh ecosystem is finely balanced on a range of elevations and saline gradients—an equilibrium that is being disrupted by rising seas. Marshes in Connecticut have been

able to shift with the changing sea levels during the past few thousand years, but the acceleration of sea level rise this century may be too quick for them to keep up. On the landward edge, many marshes have nowhere to go, hemmed in by development that has crept up against marsh systems.

In this context, salt marshes have become a priority for coastal ecosystem restoration. Millions of dollars have been devoted to protecting these critical habitats. Wanting to restore a marsh is one thing—figuring out the best practices another. When every day counts, using methods backed by science is critical. Researchers Chris Elphick, Sarah Crosby and Anisfeld are working hard with their colleagues to understand how to effectively protect and restore salt marshes in the state.

THE SPARROW IN THE SALT MARSH

Restoration and research, while they might seem synergistic, are not always integrated in the same project. Elphick, a scientist with the University of Connecticut Department of Ecology and Evolutionary Biology, led a team of research partners who took advantage of a unique opportunity to change that at Great Meadows marsh in Stratford. Audubon Connecticut, the Connecticut Department of Energy and Environmental Protection and the town of Stratford received more than $4.5 million to restore the marsh habitat. With Elphick and other scientists involved in the design of the restoration plan, the project had an experimental design from the start. Additional funding from the EPA's Long Island Sound Study ensured that not only would the habitat concerns be addressed in the short term, but long term, systematic monitoring could be conducted to understand which restoration techniques yielded the best results.

The strategies employed at Great Meadows revolved around the Saltmarsh Sparrow, a species of keen concern in the region. Squeezed by habitat loss and rising sea levels, this bird has experienced precipitous decline in the past decades. The critical thing for the sparrows, Elphick said, is elevation. At Great Meadows, a novel technique was employed to raise the surface of the marsh. "Hummocks" (mounds of fill material) were placed throughout the marsh to provide elevated patches of ground where Saltmarsh Sparrows can nest safe from sea level rise. Some projects to elevate marshes to cope with sea level rise take a blanket approach, in which sediment or dredged material is deposited on the marsh surface in a thin layer (on a much more limited scale than previous marsh-destroying fill projects) and then replanted grasses are allowed to revegetate on their own. This might work well for elevating the marsh surface, but for the sparrows, Elphick said, the bare sandy material post-restoration

Top: Elevated hummocks were created at Great Meadows in Stratford to provide nesting areas for these and other Saltmarsh Sparrows. Photo: Chris Elphick

Center: Two 'ghost trees' in the Barn Island marsh are visible evidence about how the habitat is changing. Photo: Shimon Anisfeld.

Bottom: An aerial view of the south end of Great Island at the mouth of the Connecticut River shows the grid of ditches dug for drainage and mosquito control. Photo: Long Island Sound Resource Center

is a "wasteland." In contrast, these smaller hummocks elevate the marsh in small patches, which can revegetate more quickly to allow for sparrows to use them immediately. This is less impactful to the habitat and more cost-effective than large scale sediment additions.

Great Meadows was an ideal site to pilot this technique. The population of Saltmarsh Sparrows there is at a level that will ensure the scientists get relevant data, but there are not so many birds that disturbing the site would be dangerous for the species overall. The early results Elphick and his team have discovered have been promising. Birds have been found nesting on the hummocks, especially willets and killdeer, a type of plover, but many nests have failed due to predation. The plants are doing well too: Elphick says that on the mounds the team found "some of the lushest growth of *Spartina patens* I've ever seen." While this is not unexpected given the nutrient-rich fill used to create the hummocks, it is still an encouraging start. Unfortunately, some invasive *Phragmites* (common reed) have returned to the disturbed areas, but that is unsurprising given nearby populations of the plant.

SEEN AND UNSEEN

The marshes that line the Connecticut coast have always been on the move, a phenomenon called salt marsh migration. The question now, as sea level rise rapidly accelerates due to climate change, is whether the marshes will keep up, or be drowned in place. Two Yale School of the Environment researchers, Anisfeld and Craig Brodersen, combined their expertise in marsh ecology and forestry to study how marshes migrate into coastal forests, funded by a Connecticut Sea Grant research initiative. Their research took place at Barn Island in Stonington, Connecticut.

The "migration" of salt marshes can be understood as a process in which physical conditions over time influence the plant communities that can grow in a specific spot. If a portion of land that isn't currently marsh gets flooded by tides over and over, the non-salt-tolerant plants will slowly die off, and marsh grasses can move in to fill the space. As Anisfeld describes, it is a fluid progression from one stage to another—it takes occasional inundation over a period of decades for the edge of a salt marsh to push into the upland.

Gradual sea level rise and tidal flooding aren't the only forces that can make a marsh move. Coastal storms like hurricanes play a key role in causing marsh migration. Storm events leave marks on the ecosystem that can't always be seen with the eye. The damage is ingrained in the growth rings of trees for the rest of their life, because of the salt water doused over the forest from surging seas in a hurricane. This type of "invisible migration" (a term Anisfeld came up with) is there if you know where to look. It can clue us into exactly how quickly some of these habitats are changing, which isn't visible from aerial imagery. Storm events open gaps for the marsh to move in a couple ways. Sudden tree death from wind will immediately clear a space, but saltwater inundation can also hamper a tree's growth for an entire growing season. What did he find most surprising about the project?

Researchers erect miniature greenhouses on a salt marsh to measure how marsh grass responds to elevated temperatures. Photo: Sarah Crosby

"The importance of historic events to driving change on the landscape," Anisfeld said. "I expected this to be a story of the last few decades."

But, as he and his collaborators found, marshes have been migrating due to sea level rise and storms for the past century. Storms as far back as the '38 Hurricane left a noticeable mark. In fact, Hurricane Sandy, which the team would have expected to jumpstart migration in some areas, had less of an impact on tree growth because it hit outside of the growing season, they found.

WHICH PLANTS TO USE

Restoration can be thought of as two main stages: physical alterations to a marsh, and revegetation afterwards. Crosby, the director of conservation and policy for The Maritime Aquarium at Norwalk, is focused on getting that second step right.

Crosby has been researching different aspects of salt marshes for many years, but recently her projects are centered on figuring out how different sources of cordgrass influence the success of a restoration project. This is critical—even if a marsh is elevated to account for sea level rise, it is the ecological community that springs from the plants that will

ultimately decide how effectively a marsh functions as an ecosystem.

After the system is modified in a restoration project, there is often a concentrated replanting effort, which, in Crosby's words, leads to important questions.

"Where are those plants coming from, and does it matter where we're sourcing these plantings from?" she asked.

Plants sourced from southern nurseries, she noted, might be genetically different than plants of the same species found in a natural Connecticut marsh.

Results of the first project, funded by Connecticut Sea Grant, a study of marsh grasses of different genotypes, is in review for publication right now. It also yielded a wealth of valuable data, she said. The surplus of information, while daunting, potentially provided insight on how plant resources impact marsh restorations. The six natural marshes sampled for the project generally had more peat buildup and marsh resident species than the six restored sites which displayed more genetic diversity but equaled the natural sites in transient species and live below-ground biomass.

In a follow-up to that work, funded by the EPA's Long Island Sound Study, Crosby and her team moved to studying the ways differently sourced plants might respond to stressors from climate change. Under rising summer temperatures, it is reasonable to think that *Spartina alterniflora* southern genotypes might be better adapted. To figure this out, they constructed 144 miniature greenhouse cubes out of PVC pipe and greenhouse plastic, which raise the ambient temperature 2 to 3 °C during hot summer days. These are being placed in marshes throughout the state, four that have been restored in the past and four that remain unaltered by restoration. Marshes bordering communities with exposure to coastal flooding and environmental justice concerns such as Bridgeport, Stratford, Milford, and New Haven were selected.

"It's fascinating what is happening in the cubes," said Crosby, who is eager to share the findings once the study concludes this year.

A UNITED FRONT

It's no secret that the future holds challenges for Connecticut's marshes. Historic land use practices, sea level rise and development all threaten to continue the decline of this vital habitat in the state. There is good news, though. Passionate scientists like Elphick, Anisfeld, and Crosby are learning all they can about these issues. Their projects are led by investigators of different expertise linked by a shared passion for marshes.

Elphick's interest in the Saltmarsh Sparrow is born of his childhood exploring the marshes of northern England, where he grew up.

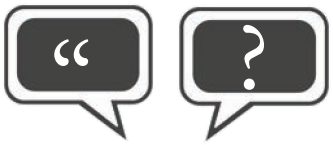
"It's a chance to learn something cool about how the world works and apply it to a specific problem," he said of connecting the welfare of one species to the entire ecosystem.

Crosby has cultivated a love of salt marshes since she was introduced to tidal ecosystems at a young age, and now she wants to contribute "anything I can do to help us restore these sites more efficiently and effectively for the future" with her research.

Anisfeld expresses an inspiration that will resonate with everyone captivated by Connecticut's marshes.

"There is a complex interplay of physical, chemical, and biological forces that is kind of magical," he said.

UConn Avery Point students learn about local birds and mammals from a Denison Pequotsepos Nature Center staff member at the campus EcoHusky Club's Earth Day celebration on April 22. Photo: Judy Benson



TALK TO US

Send comments and questions about this issue to: judy.benson@uconn.edu

We'll share as many as possible, along with our responses, at: seagrant.uconn.edu

SHARING OUR STORIES
Connecticut Sea Grant

10 Questions with Bonnie Rose Sullivan

With playful illustrations, engaging characters, she shares her love of sugar kelp.

By Maggie Cozens

Author's note: In 2022, Bonnie Rose Sullivan, a teaching artist at the New Britain Museum of American Art and The Wadsworth Atheneum of Art, was one of three artists chosen for the Connecticut Sea Grant Arts Support Award.

The Connecticut Sea Grant Arts Support Award, which began in 2010, awards up to $1,000 to an artist or group of artists whose work features the Connecticut coastal and marine environment. Awardees are selected based on aesthetic quality, relevance to Connecticut Sea Grant themes, and the potential for their work to reach non-traditional audiences.

For her project, Sullivan wrote and illustrated a children's picture book titled, Rory and Mo Are Ocean Farmers! *The book follows the titular characters as they go about their jobs farming for sugar kelp while experiencing the joys and intricacies of the marine and coastal environment.*

Sullivan, originally from Connecticut, has been painting and drawing since childhood.

Connecticut Sea Grant recently sat down with Bonnie to discuss her work, her sources of inspiration, and the importance of encouraging joy in today's world.

Bonnie Rose Sullivan works with some of the paints and other art supplies she used to illustrate *Rory and Mo are Ocean Farmers!*
Photo: Maggie Cozens

1. Can you tell us a little bit about your background?

I'm originally from Connecticut and I went to three state schools. I attended UConn for my BFA (Bachelor of Fine Arts). Then I went to Central to become a certified K-12 teacher. After that, I went to Western Connecticut University for my MFA (Master of Fine Arts).

I've always loved drawing. I was shy as a kid, so I was kind of always drawing from the beginning as a way of making sense of any situation I was in, and to have fun. It's still the same now really. I love the process of drawing and painting and creating characters and mini worlds.

2. What was the process for developing your book? What drew you to this story and why sugar kelp?

I learned about ocean farms and sugar kelp about 10 years ago and I have been on a low boil about it ever since. I love the fact that it can be grown and harvested right here in Connecticut on Long Island Sound, and that it and other algae were among the first forms of life on Earth: it has an ancient, almost mythic quality much like the old bedrocks here in Connecticut, and our prehistoric-looking horseshoe crabs. What drew me the most though is that sugar kelp doesn't need any fresh water, soil or fertilizer to grow, which is a very exciting and hopeful solution to many challenges we face both right now and in the future with climate change.

When it came to the book, I wanted it to be "ficto-informational,' a.k.a., something imaginative and character-driven, but also usable in a classroom with students.

3. Can you describe the timeline of your work and how you got involved with the Sea Grant project?

Before applying for the program, I had already created some sketches of the characters. I knew I wanted the main characters to be a tiger and a turtle. I think the turtle also kind of looks like Jake from The Blues Brothers. Like Jake, he's always wearing sunglasses. So, I had sketched the characters first, and then I saw the Sea Grant opportunity. It was perfect timing. I thought 'I'm just going to do it. I'm going to just try to do this.'

I ran this opportunity by the two museums that I work at, and they were very receptive and supportive. So, I got to work! Essentially, the timeline was a little bit here, a little bit there, then all at once.

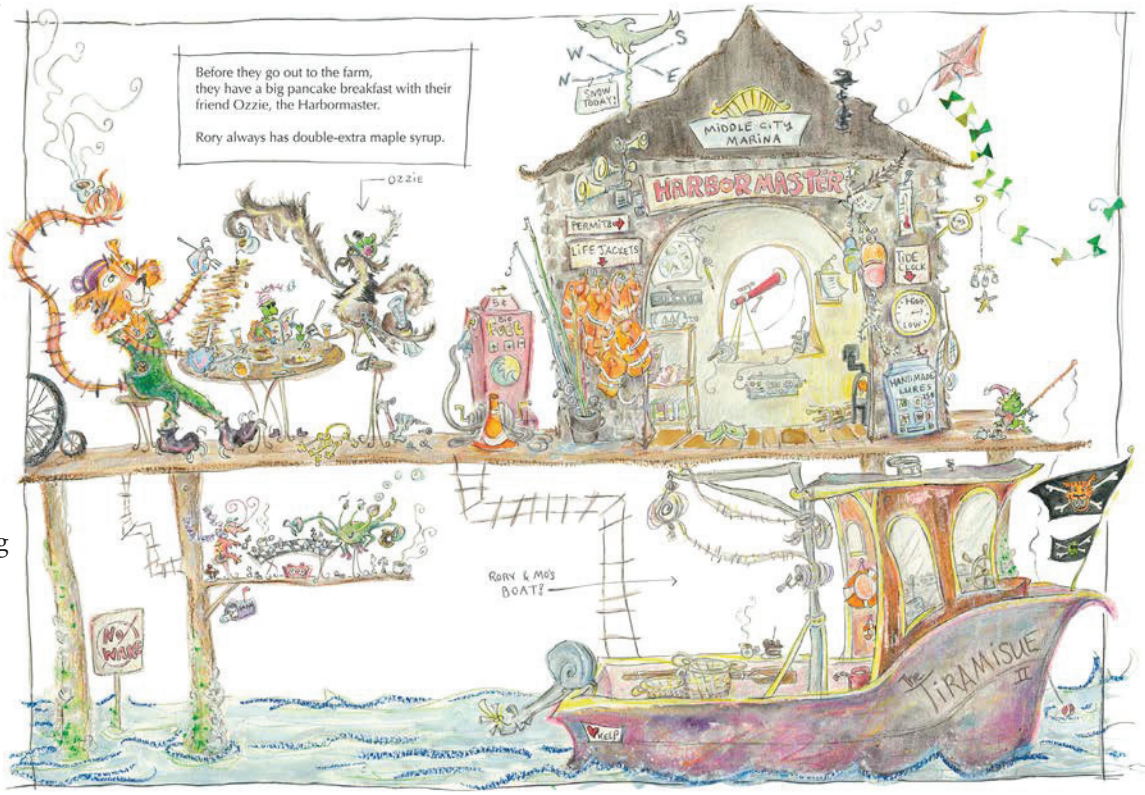
4. When it comes to science and education, art is a powerful way to connect the two. How does science motivate you in your work?

My best friend is a geologist, and she was the STEM teacher at the Savannah Children's Museum in Georgia. She'd always say: art and science, they're not that different.

And I agree: they're really not that different! There's a real opportunity for science to be as accessible as possible, but it's almost like you need a translator to do so. I think visual translation —art—can resonate with so many people. When it comes to real world problems, there's a lot of opportunity for everybody, but especially for illustrators, writers and educators, to help people understand not only the negatives but to also appreciate the positive; especially when it comes to demonstrating the possibilities for positive change.

5. How did you find the process of translating sugar kelp farming to an artistic medium?

I loved the process. Sugar kelp's colors and shape are unusual, beautiful, and full of movement—I can't look away! It's like dancing stained glass just



One of the pages from *Rory and Mo are Ocean Farmers!* Image courtesy of Bonnie Rose Sullivan

growing in the ocean, ready to solve lots of problems all at once by being a relatively low-maintenance supernova of nutrients and versatility. *Rory and Mo are Ocean Farmers!* was created with ink, watercolor, crayon, colored pencil, and cut-paper collage.

6. What surprised you the most about sugar kelp?

Historically and in other cultures, sugar kelp and other seaweeds have served a greater purpose and have been recognized for their incredible benefits for a long time. I feel lucky to have been able to learn about sugar kelp over the past 10 years, and luckier still to live in a place like Connecticut where it is grown and harvested. I love that sugar kelp can multitask and make everything better: it can be used to create everything from a delicious dinner to a powerhouse organic fertilizer. Plus, the fact that sugar kelp can simultaneously capture carbon and help Mama otters take care of their kids by effectively hugging them until she comes back adds a... moon-landing level of awe for me.

7. Can you talk a little bit about how you draw inspiration from Connecticut and Long Island Sound?

The Sound is an integral part of Connecticut, and it shapes our lives more than we know. Even if you live, say, in New Britain, or in Hartford: Long Island Sound and the watershed affect you. Even if you don't live right next to it, or even if you didn't go to Rocky Neck State Park every day.

I'm proud to be from Connecticut. And to me, Long Island Sound feels like home. I think there's a sense of freedom being close to the ocean and it is something that is tied to Connecticut's identity. I draw a lot of inspiration from that.

Also, I think especially after we're seeing some of the effects of climate change it is clearer than ever that we're all connected. The watershed—rivers, streams, etc.—are a connecting thread between all of us to the Sound and the ocean. At the risk of sounding eye-rollingly obvious, I think the connections we have to each other at the watershed level reverberate throughout our communities and landscapes in a very beneficial way, so it's important that we celebrate and encourage those connections.

8. Looking at your art, it's clear there's a lot of vibrance and joy. Is 'joy' something you intentionally try to cultivate in your work?

I think it's very clear to kids when a book is trying to push a very serious concept on them in a heavy-handed, didactic way. They don't like it. Children are very smart. And so are the parents who are reading to them, or the librarians, or the teachers.

But at the same time, one of the reasons why I wanted to demystify ocean farming and make it accessible was, first, because you're not going to be interested in doing something unless you know the terminology and understand the opportunities. I couldn't find a book teaching children about a job like 'ocean farming.' I was wondering, if you could read a book about being a postal worker, for example, why not also be able to read about being an ocean farmer? You never know what might pique somebody's interest. And as a teacher, I am a big fan of using a colorful, imaginative example to dive deeper into a larger concept.

Now, will ocean farming look different in 20 years when that child grows up due to climate change and other issues? Of course. But I think it's less scary when it's presented in a friendly, positive, and inclusive way. If kids know the message is heavy-handed, I think it closes the door for them. I want my ideas to open the door.

If children are taught about different possibilities in a way that is joyful, I think is very powerful. Joy is sorely needed.

9. Do you have a favorite place to visit on Long Island Sound? Do you have a favorite animal in the Sound?

For my favorite place, I would say Rocky Neck or Hammonasset Beach State Park. Everywhere you look, there are birds, crabs, there are these rocks that have been tumbling in the waves for 500 years. Both places are just gorgeous.

As for an animal…it's hard to choose just one! I love ospreys. I respect their authority. I walk by their nest, and I think, 'I see you; I respect you. Thank you for letting me walk here.'

10. What do you hope people will walk away with after reading your book?

A love for sugar kelp and Long Island Sound, and maybe a bit of hope for the future!

I want children to walk away feeling empowered. That's what I'm trying to do in my very small way: empower children to not be as scared of the future and all the things happening in the world today.

At the same time, I also want them to wonder: what can we do about it?

I want people to know that there's a lot that we can do, and it's important that we do something. And it can be done in a joyful way. You can, for example, eat some pancakes and then go farm for sugar kelp.

Look for Rory and Mo are Ocean Farmers! *on bookstore shelves, Internet sites and in libraries in the near future.*

Wooden stakes and rock sills are key elements of the living shoreline created in Old Saybrook. Photo: Judy Benson

Old Saybrook community faced its climate reality with a cutting-edge project

By Judy Benson

These days, there's a lot of talk about resilience—the capacity not just to bounce back from extreme events, but to anticipate and grow stronger in spite of them.

It's something we need more of, these discussions often assert, as individuals and as a society.

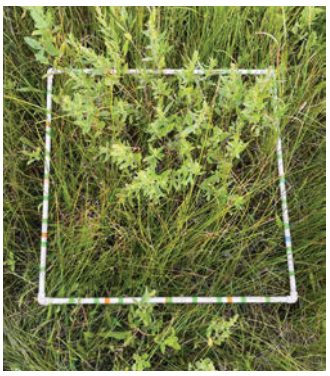
In the context of coastal communities challenged by rising seas and intensifying storms, such conversations often turn to the concept of living shorelines.

"There are a number of communities looking at them," said Andrew Fisk, who helped guide the completion of a living shoreline project in Old Saybrook.

Generally, a living shoreline is a type of landscape engineering project that attempts to recreate or enhance natural features such as dunes, boulder shelves and sediment traps to protect marshes, beaches and beach communities from flooding, erosion and loss of key habitats as sea level rises with climate change. As the name connotes, these are *living* projects intended to incorporate native plants, shifting tides and evolving marsh habitats.

"People are looking around to get inspiration to do these projects," said Madeline Kollegger, a restoration scientist and UConn doctoral student who's been monitoring the Old Saybrook site since the bulldozers and backhoes left two years ago. "But they're few and far between in Connecticut."

Living shorelines are considered more ecologically minded alternatives to traditional shore-hardening with concrete sea walls, groins, jetties and the like. Instead of creating rigid barriers between the terrestrial and aquatic environments, living shorelines allow for a more natural transition between the water-land interface. Elements can include beach grass planting, oyster reef seeding and strategic placement of logs and rocks of various sizes. At the Old Saybrook site, it also includes biodegradable netting anchored with wooden stakes at the tidal edge to support young marsh grasses, and a series of stone sills offshore to soften incoming waves.



A transect of one of the areas being monitored by Madeline Kollegger contains *Spartina* grass and marsh elder. Photo: Madeline Kollegger

This may sound simple on the surface. But as the saying goes, the devil is in the details. In the case of living shorelines, the details of a particular site are just the beginning of the challenges. There's engineering, permitting, community buy-in, funding and the dynamic nature of the shoreline, for starters.

"Every site along the Connecticut shoreline is different," said Juliana Barrett, CT Sea Grant's coastal habitat specialist. "A living shoreline needs to be built to the specifics of the site."

Barrett knows well the intricacies of creating a living shoreline, thanks to her years of involvement with a host of other land-use experts and local residents at the Old Saybrook site, which is near the mouth of the Connecticut River. Encompassing roughly four acres of salt marsh, tidal creek, dunes and beach, this living shoreline is a bellwether of sorts, serving as one of the few places along the Connecticut coast where this oft-touted approach to resilience-minded landscaping actually exists. Land-use professionals and students visit often.

"One of the things this project reinforces is that these projects are complicated and require a lot of patience bringing the community and residents and funders and regulators along," said Fisk.

Living shorelines, he said, along with dam removals and stream and streambank restoration (known as riparian buffers) are important techniques being advanced for environmental restoration that also protects homes, roads and other human infrastructure. The more people know about tangible examples like the Old Saybrook project, the better, he said.

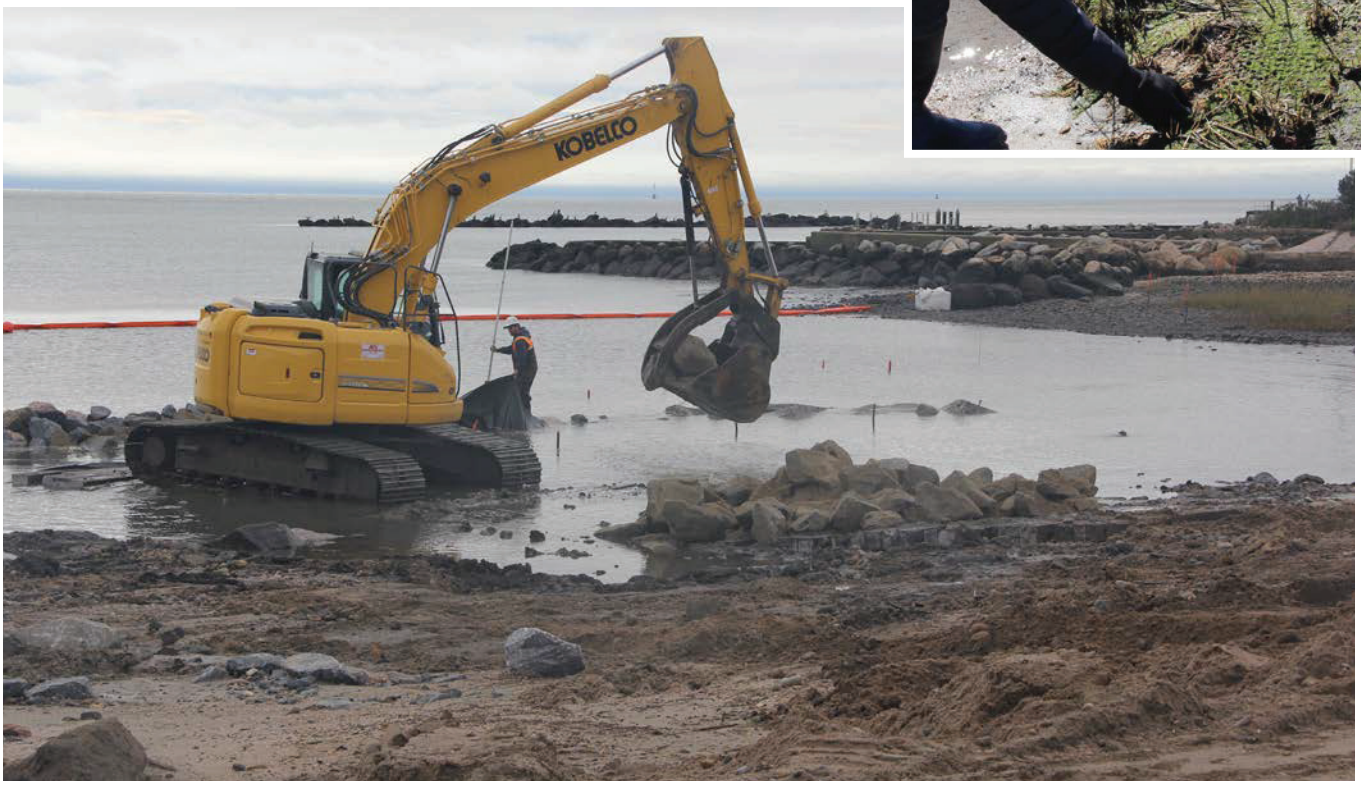
"We need to socialize these concepts," he said. "We want to do more of these projects, and do them more efficiently."

Fisk is now the northeast regional director of American Rivers, a nonprofit environmental organization. When he became involved in the Old Saybrook project, he was the executive director

Top: Marsh grasses have started to grow since the living shoreline project was completed. Photo: Madeline Kollegger

Center: Madeline Kollegger checks on the biodegradable netting placed to support marsh grass at the living shoreline site. Photo: Judy Benson

Bottom: A backhoe used during the construction phase of the project in 2020 moves rocks to create a series of sills offshore to break wave action. Photo: Judy Benson



‘...it's important...that we learn from these projects.’

of the Connecticut River Conservancy. It was the first living shoreline project for that organization, he noted, but it fit perfectly with the group's mission of partnering with local groups on restoration work that benefits the river and sets a positive example for others to follow.

Jack Matthias, right, coastal resilience associate with Audubon Connecticut, shows an area at Hammonasset Beach State Park in Madison where a living shoreline project is proposed to restore it as piping plover nesting habitat. With him are Owen Placido and Sarah Schechter of Connecticut Sea Grant. Photo: Judy Benson

“We came in to do the grant administration, found additional funding and managed bidding for the project,” he said. From the design work to permitting to paying for excavation, stone placement and dune construction, the total cost exceeded $1 million, he noted, and was far more complex than the volunteer-run land trust that first conceived of the project could have managed alone.

The idea originated at least a decade ago at the grassroots level with the Lynde Point Land Trust, which protects the area's marshes and other conservation lands. Flooding from tidal breaches during Superstorm Sandy and Hurricane Irene left residents feeling vulnerable and looking for solutions.

Ethel Davis, president of the land trust, said the living shoreline was the latest in a series of projects her group has undertaken to protect and restore the natural marsh and Crab Creek, a tidal waterway that had been moved about 100 years ago. As part of the living shoreline project, a portion of the creek was relocated closer to its original path, restoring flow to a tidal pond that would be blocked by sediment after severe storms.

Looking out from the shoreline where the rock sills, netting and stakes were placed two years ago, Davis shows obvious pride in what was accomplished: a beach, marsh and tidal creek improved for wildlife and people alike.

“There's nothing negative about looking at it,” she said. “We've heard no objections.”

Is it working to protect the homes from flooding and preserve the marsh? So far, Davis and others said, the answer is yes. But there's one important caveat—the area has not been tested by a strong hurricane since the construction was complete.

“It's wait and see,” Davis said.

Patience, said Kollegger, who is tracking the plant growth and the overall habitat of the living shoreline as part of state permit requirements, is essential for any group that wants to embark on a living shoreline project. There is a long lead time in the planning, permitting and fundraising. After the construction phase, beach grass and marsh plants take years to get fully established. Several seasons of storms and tidal peaks must pass before the watery landscape can be considered settled, she said.

“The words success and failure are often not used for restoration projects,” she said. “What we're looking for is not the status quo. It's trying to do something thoughtfully that's better than doing nothing.”

Harry Yamalis, environmental analyst with the state Department of Energy and Environmental Protection (DEEP), said that other than the Old Saybrook project, there are only two living shorelines in Connecticut. One on private property in Westport has several features in common with the Old Saybrook site. The other living shoreline, at Stratford Point, is very different. It uses reef balls—hollow concrete spheres that temper wave action while permitting oyster seed to settle and establish new colonies.

Many groups have explored the idea of creating a living shoreline, he said, only to give up or opt for less complex traditional erosion control measures instead.

“I've had a lot of ideas thrown at me that fizzle out,” he said.

Still, DEEP is encouraging living shorelines along the coast, and is hoping to build two itself. One would be at Hammonasset Beach State Park in Madison and the other at Seaside State Park in Waterford, Yamalis said. Educational signs would be installed at both to explain living shorelines to the public.

“It's very important if we want to have more of these, that people learn from these projects,” he said.

What's in our names?

What are wrack lines? The word wrack is a term for various kinds of seaweed, and wrack lines are the collections of organic matter (sea grass, shells, feathers, seaweed and other debris) that are deposited on shore by high tides. More generally, wrack lines are where the sea meets the land.

With our magazine *Wrack Lines*, we tell stories about the intersection of the land, sea and Connecticut Sea Grant. So what is Connecticut Sea Grant? One of 34 Sea Grant programs across the country, it helps residents make the most of our coastal resources and inland waterways.

It addresses the challenges that come with living by the water or within the Long Island Sound watershed, in a state with 332 miles of shoreline and three major tidal rivers. This NOAA-state partnership based at UConn's Avery Point campus works with aquaculture farmers, fishermen and seafood purveyors to help their businesses prosper.

It funds research essential to understanding and managing our changing coastal and inland environments. It provides communities and local leaders with the information they need to make better land and shoreline decisions that result in more resilient communities and healthier watersheds. It educates students as well as teachers and adults of all ages about the marine environment.

Connected to experts and residents who live, work and recreate in the Sound and its watershed, it brings diverse interests together around a common purpose of working for mutually beneficial solutions to problems.

The wrack line at Hammonasset Beach State Park is clearly defined by the contrast between the darker wet sand along the water and the dry sand on the other side. Photo: Judy Benson

Small in staff but big in impact, Connecticut Sea Grant is like a pilot boat that navigates the way for large vessels toward safe harbors. Since 1988, Connecticut Sea Grant has supported "Science Serving the Connecticut Coast."

FALL-WINTER 24-25

SPECIAL ISSUE COMING THIS FALL

FEATURING PERSONAL ESSAYS BY RECIPIENTS OF THE *WRACK LINES* VOICES OF DIVERSE YOUTH SCHOLARSHIPS

Three UConn Avery Point students and three New Haven high school students met for a writing workshop in April to launch the special issue project. Photo: Judy Benson

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***Wrack Lines* is available online at: https://seagrant.uconn.edu/publications/wrack-lines/**

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School vacation week in April brought many people to Hammonasset Beach State Park in Madison to enjoy the sand and surf. Photo: Judy Benson

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