

UNDERWATER  
NATURALIST

The Oyster:  
Culinary Delight and  
Ecosystem Engineer



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On the Cover: An oyster from the reefs built by the American Littoral Society and volunteers as part of our restoration of Reeds Beach in Middle Township, NJ.





# JOIN US FOR MEMBERS DAY

**SATURDAY, JUNE 25**  
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A Day of Family Fun and Celebration for Members of the Littoral Society. Reservations/Questions: [info@littoralsociety.org](mailto:info@littoralsociety.org)



# From the Executive Director

The oyster — culinary delight and ecosystem engineer. Also, unfortunately long gone in many of its traditional habitats and with it all the services and goods *Crassostrea* supplies, both ecological and culinary.

The Littoral Society has long been involved with oysters and other shellfish. Much of our work has involved protecting the waters they live in from pollution. However, more recently we have been working to restore their actual presence in coastal waters.

We believe that “re-oystering” our bays and coastal waters will provide enormous benefits such as habitat creation, water quality improvements, and providing an important resource for the blue economy. In that work, we have learned and benefitted from the other practitioners and restoration advocates highlighted in this issue of the UN.

Not least of these is our new, exciting partnership with the Barnegat Oyster Collective — itself a partnership among oyster aquaculture farmers — to connect local oyster growers with regional restaurants and the public. Our goal is to connect a local, growing, sustainable industry with estuarine restoration and conservation — a double win for local businesses and oysters!

We will be working together to raise awareness among area residents and local restaurants on the importance of eating locally grown oysters — supporting their neighborhood businesses — AND recycling the shells back into the waterways they came from rather than dumping them into a landfill.

Oysters (and other shellfish) can be an answer to several pressing challenges along the coast. Besides playing a significant role in restoring the water quality and habitats of our bays and estuaries, they can also provide jobs and sustainable economic value to local communities.



We hope you will be engaged by the potential revealed in this issue of the Underwater Naturalist and also encouraged to join in the Society’s efforts to care for the coast.

**Tim Dillingham**

The background of the entire page is a photograph of a coastal area. In the distance, a city skyline with several tall buildings is visible under a clear blue sky. The middle ground shows a body of water with gentle waves. In the foreground, there are several large, grey, porous oyster reefs protruding from the water.

# **Oyster Restoration: A Nature-Based Solution to Unnatural Threats**

**By Rob Shane, Restore America's  
Estuaries**

***Research assistance by Cassidy McGurk,  
Restore America's Estuaries***





Over the past 20 years, oyster restoration has become one of the most popular nature-based solutions for water quality improvement, shoreline stabilization, and aquatic habitat enhancement. Love them or hate them as table fare, oysters play a critical role in the protection of estuaries and bays up and down America's coasts.

Now more of a treat to celebrate special occasions, oysters were once abundant, inexpensive, and enjoyed by everyone. In the late 1800's, New Yorkers consumed an average of 600 oysters per person per year – now down to roughly three a year. So what happened to this “every-man's food” in the past 200 years? The answer is both simple and complicated at the same time.

At the turn of the 20th century, America had already begun its westward expansion and the hunger for oysters went with it. With technological advancements in fishing, transportation and food storage, oysters quickly became available to people living in the country's interior. By the early 1900's, oyster harvest had already begun its decline. In 1850, Mid-Atlantic and Chesapeake Bay states recorded catches of 145 million pounds alone. However, by 1930 that number was a mere 45 million pounds and only 26 million in 1970.

Previous Page: Part of Tampa Bay Watch's Community Oyster Reef Enhancement program, the oyster reef ball program (formerly called “oyster domes”) uses reef balls to stabilize shorelines and prevent erosion while creating habitat similar to natural oyster communities found along shoreline areas throughout Tampa Bay.

In addition to over-harvest and lax regulations, the industrial revolution also took its toll on bivalve populations. Marshes and swamps were drained and developed in favor of factories, refineries, and other contemporary advancements. Water entering the estuaries and bays ran thick with industrial pollutants and a growing human population resulted in increased wastewater discharge, often untreated. On top of these human stressors, new diseases, Dermo and MSX, quickly spread through oyster populations and massive die offs ensued.

Oysters, and the habitat they rely on, were sacrificed, in the name of progress – both as a means to feed a growing nation and to fuel a burgeoning economy. Like many of our keystone species, once believed to be so abundant they would last forever, wild populations eventually dwindled to unsustainable levels, and regulations had to be put in place to preserve what few remained. The eastern oyster almost found itself listed under the Endangered Species Act in the early 2000's.

In modern times, most oysters served in restaurants or on the shelves at your local supermarket come from aquaculture operations. National Oceanic and Atmospheric Administration (NOAA), Environmental Protection Agency (EPA), and other environmental regulatory agencies oversee sustainable farming and harvest requirements. The oyster restoration revolution has taken on a life beyond food, though. Aside from being delicious (this author's opinion), oysters are key contributors to coastal ecosystems. They filter





water at an alarmingly high rate, up to 50 gallons per day as adults, removing nitrogen, sediment, and other toxins from the water. Oysters also provide rearing habitat for young fish and attract microfauna that fish, crabs, and avian predators rely on. Finally, they act as a buffer protecting coastal communities, critical infrastructure, and local economies from the potentially devastating effects of violent storms and rising seas.

Raising oysters for restoration is no simple task, though. Many national and state wildlife agencies, corporations, and non-profit organizations build hatcheries capable of raising hundreds of millions of juvenile oysters per year. In addition to the hatchery facility, there are two primary components

needed for successful rearing: clean, fresh, salty water (roughly 15-30 ppt salinity) and empty oyster shells.

Recycled oyster shells are becoming scarce, though, and many organizations have arranged partnerships with local restaurants to solve this problem. In Houston, TX, the Galveston Bay Foundation has partnered with numerous local restaurants for their annual Oyster Month ([www.houstonoyster-month.com](http://www.houstonoyster-month.com)), with proceeds from over a dozen restaurants going directly to their oyster shell recycling program. In the past decade, this event has collected

Photo above: Littoral Society staff load bags of recycled oyster shell on a boat for placement at monitoring locations. Photo by David Hawkins/American Littoral Society



more than 2 million pounds of recycled shells, all of which were reused for volunteer-led oyster restoration efforts in the Bay. Similar efforts have been underway in the Chesapeake Bay and other estuaries around the country.

Once oyster larvae attach to their shell, it takes roughly three years to reach adulthood, with growth rates being faster in waters with higher salinity. At this point, there are two general approaches to applying the new oysters to a specific project.

The first involves placing oysters in mesh bags and stacking clusters of these bags in rows parallel to the

shoreline. The second involves the construction of “reef balls,” typically made of marine-friendly concrete, in which the oyster larvae (spat) naturally attach. Reef balls are preferred in areas with high wave activity given their roughly 200 lb weight. Oftentimes, the two are used in tandem with the shell bags being strategically placed between the reefballs and the shoreline.

In association with the previously mentioned oyster shell recycling program in Houston, the Galveston Bay Foundation recently reclaimed more than 40 acres in partnership with The Nature Conservancy and Texas Parks and Wildlife. The project, located in Upper Galveston Bay and Trinity Bay, attempts to create both a living shoreline via oyster restoration and provide a

Photo above: Before and After Reefballs.  
Photo courtesy of Tampa Bay Watch





commercial harvest – a first of its kind approach in the area.

Completed in early 2021, the new reef required more than 20,000 tons of limestone to be placed on the bay bottom in order to create the necessary substrate for juvenile oysters to latch on to. Per Bob Stokes, CEO of the Galveston Bay Foundation, “Oysters are a vital component of a healthy estuary and we are particularly excited that this innovative reef will provide ecosystem service benefits to Galveston Bay and also sustainably support our commercial fishing industry.”

There will be a two-year closure before any harvest can take place on the site, at which time 25 acres will become commercially available and the other 15 will act as a broodstock

sanctuary reef for the harvestable site. Through responsible management and continued monitoring, the organizations hope that this reef will become self-sustaining while also providing essential ecosystem services to the Bay and the larger Gulf of Mexico. This project was paid for by funding from the National Fish and Wildlife Foundation (NFWF) and the Texas Water Development Board.

Just to the east, Tampa Bay Watch, another Gulf based non-profit organization, has been busy restoring oysters

Photo above: Oysters make reefs, which offer shoreline protection and a protected place for other marine creatures, by growing on top of each other. Photo courtesy of NOAA.



in their estuary, as well. In particular, the group has partnered with the US Fish and Wildlife Service (USFWS) and MacDill Air Force Base to construct oyster reefs in the interest of shoreline stabilization to prevent coastal erosion and protect national security interests. Dating back to 2003, this effort is part of the groups larger Community Oyster Reef Enhancement (CORE) program.

The base sits at the southern tip of the City of Tampa, just across the bay from St. Petersburg. Per the Air Force, Tampa Bay was home to more than 2,000 acres of oyster reef in the early 1900's. Now there are just 171. Wake activity from heavy boat traffic and increased intensity in storms have significantly damaged the shoreline and led, at least in part, to this decline. Thankfully partnerships like this with federal agencies and local non-governmental organizations are changing the narrative. Entering its sixth phase this Summer, the MacDill project has added more than 7,500 linear feet of oyster reef to the peninsula, and the results are promising. Vulnerable species have taken shelter there and critical defense infrastructure remains intact.

In addition to protecting the shorelines from erosion, the reefs also trap large amounts of sediment between them and the shoreline. This sediment allows for the reclamation of marshes and coastal grasslands – and ultimately mangroves – adding even more protections to the Base. Between 2006-2008 (phase III), the MacDill AFB oyster restoration project resulted in almost five inches of sediment

accumulation on average.

“Tampa Bay Watch greatly values our partnership with MacDill AFB which has given us the capacity to collaborate on some very successful living shoreline projects over the last 18 years” says Serra Hendon, Director of Habitat Restoration at Tampa Bay Watch. “These types of partnerships provide lasting benefits not only to the estuary and the coastal communities but also in allowing for the opportunity to plan and design beneficial and comprehensive ecosystem restoration efforts.”

Funding for this project came from a variety of federal agencies, including the Department of Defense, USFWS, NOAA, the Tampa Bay Estuary Program, and the Hillsborough County Environmental Protection Commission. Per the report, roughly 75% of the roughly \$1 million budget (through phase V) went to purchasing supplies with the other 25% going to permitting, design, and planning.

Restoring oyster reefs is only one half of the battle though – protecting them is equally as important. Recognizing the value of oysters in Stump Sound, and with funding from the North Carolina Land and Water Fund, the North Carolina Coastal Federation has launched a collaborative project to protect what is one of the premier oyster fisheries in the state. Stump Sound is designated as Outstanding Resource Waters, open shellfish waters, and a primary nursery area by the N.C. Department of Environmental Quality. Due to increased stormwater runoff, though, their population, and the jobs

the Sound supports, are threatened.

“Community involvement and the participation of federal, state and local agencies, scientists as well as the people who make a living from the Sound will be key to the success of this plan,” said Tracy Skrabal, the federation’s coastal scientist and project manager. “Once complete, the plan will be the foundation of work that must continue to ensure that Stump Sound remains clean and productive for all of us that live, work and play in its waters.”

Too frequently, these hallowed shellfishing grounds have been closed to harvest due to water quality problems in the Sound. The Federation plans to address this issue by bringing diverse stakeholder groups – fishermen/women, scientists, community members, and government agencies – to the table to identify key opportunities for improvement, land protection, and restoration. With efforts being launched in early 2021, this project will bring a wholistic approach to maintaining the valuable oyster populations not just for a healthy Sound but also a thriving economy.

In addition to localized efforts, federal agencies and elected officials have also recognized the value living shorelines provide to estuarine ecosystems. In 2019, Rep. Frank Pallone (NJ-6) introduced the Living Shorelines Act (HR 3115) to provide \$50 million in grant funding to coastal restoration efforts, including oyster restoration, to protect communities from flooding, sea level rise, and climate change. Special consideration in funding would

be given to communities that have previously received federal disaster declarations in the past decade.

Additionally, in 2020, the Federal Emergency Management Association (FEMA) released a new policy that allowed for the calculation of ecosystem services in the cost-benefit analysis of hazard mitigation projects. In short, this meant that nature-based solutions, such as oyster reefs and other living shoreline projects, which provide services for the entire coastal ecosystem, gained leverage in value compared to hard infrastructure, such as sea walls, that provide very little ecosystem benefits beyond flood protection.

Although we may never return to pre-industrial oyster populations, the future for oysters is looking up. Public policy and funding remain a hurdle, but organizations like those mentioned here, and the other Restore America’s Estuaries member groups, have been pushing forward with critical habitat improvements and advocacy efforts that repeatedly show positive results. However, as storm intensity and regularity continue to increase, and seas rise at alarming rates, the fate of oysters and estuaries may be less certain now than ever before.

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*About the author: Rob Shane is the Communications Manager for Restore America’s Estuaries (RAE). RAE is a DC based non-profit comprised of 10 alliance members working in 16 states and 11 estuaries, including the American Littoral Society. RAE is dedicated to the protection and restoration of bays and estuaries as essential resources for our nation. Learn more at [www.estuaries.org](http://www.estuaries.org).*



# Littoral Society Restoration Team Employs Natural Solution to Protect the Coast

**By Julie Schumacher and the Littoral  
Society Restoration Team**





In late 2012, Hurricane Sandy slammed into New Jersey's Delaware Bay beaches, covering them with tons of debris while simultaneously stripping many of the sand horseshoe crabs need for laying eggs.

The Littoral Society moved quickly to clear the storm wrack and replace the sand, in order to make sure that the crabs would find hospitable spawning grounds, which would in turn provide critical feeding grounds for migrating shorebirds – such as Red Knots – that stop on those beaches to fatten up before the last leg of their annual journey from

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*From bay to plate and back, Operation Oyster has a state-wide action plan to assist the oyster and local communities.*

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South America to the Arctic circle.

However, our work to restore the beaches didn't stop the forces that continued to erode them in many places – such as storms, which climate change has increased in frequency and ferocity.

Rather than simply surrender, our Restoration Team turned to something that had protected those shorelines for thousands of years before Europeans set foot in the new world. That something was oysters.

Since then, nature's solution for protecting the coast has become a big

part of the Littoral Society's work in New Jersey – from projects in the Two Rivers area at the northern terminus of the Jersey Shore, to work in Barnegat Bay, and our ongoing efforts to restore and protect the Delaware Bayshore.

### **Operation Oyster**

Shellfish are vital parts of the local economy as well as the ecosystem, as they serve to clean water, create habitat, and protect shorelines. Unfortunately, as the human populations grew along the coast, many shellfish species faced over-harvesting, disease, habitat loss, and ultimately mortality. In Barnegat Bay alone, oyster populations are less than 1% of their size 100 years ago.

In an effort to reverse that decline, while also cleaning water and making the coast more resistant to storms, the American Littoral Society works to implement projects that involve living shorelines, oyster reefs, and shell recycling. Unlike beach replenishment, these projects address shoreline protection, habitat creation, water quality improvement, and oyster population growth.

The umbrella for much of this work is Operation Oyster, our state-wide program encompassing all things oyster. From bay to plate and back, this program has a state-wide action plan to assist the oyster and local communities, by taking discarded shell from restaurants and turning them into projects that protect and restore the coast.

### **Shuck It, Don't Chuck It**

Thanks to a grant from the National Oceanic and Atmospheric Administration (NOAA), the Littoral Society has big plans in 2022 for the **Shuck It, Don't Chuck It!** program, which focuses on shell recycling.

Previous Page: Littoral Society staff and volunteers work to build a double-row reef in Dyers Cove near the Fortescue Wildlife Management Area. It is one of eight reefs engineered by the Littoral Society to protect restored beaches along the Delaware Bay.





Besides looking to expand our shell collection to more restaurants, we have started a new, exciting partnership with the Barnegat Oyster Collective – itself a partnership among oyster aquaculture farmers – to connect local oyster growers with regional restaurants and the public.

Our goal is to connect a local, growing, sustainable industry with estuarine restoration and conservation – a double win for local businesses and oysters. We will be working together to raise awareness among area residents and local restaurants on the importance of eating locally grown oysters – supporting their neighborhood businesses – AND recycling the shells back into the waterways they came from rather than dumping them into a landfill.

As part of that, the Society has already hired Serena Celestino as the program’s coordinator. The next step is to purchase a vehicle to transport all of the recycled shell to our curing site on Sandy Hook. Serena will also work on community outreach efforts.

The “Shuck It, Don’t Chuck It!”

program is generously supported by grants from the Marta Heflin Foundation, NOAA, Seachoice Products, The Grove West at Shrewsbury, and Brook 35 & West.

### **The Two Rivers**

The Navesink and Shrewsbury rivers, while teeming with life, both have a long history of water quality issues.

Tidal estuaries, they are also home to vulnerable river islands that have been effected by strong winds, relentless currents, and year-round boat wakes that have eroded critical habitat for migratory bird species.

The Society has been working for the past five years to find avenues for addressing both the water quality and erosion concerns

In 2017 the Society began recruiting area restaurants to give us the shells from

Photo above: The Littoral Society’s “Shuck It, Don’t Chuck It!” program focuses on recycling oyster, clam and mussel shells from New Jersey restaurants.





oysters, clams and mussels rather than sending them to landfills. The shell is recycled and cured (removing bacteria and pathogens through sun-bleaching), which makes it safe for use in restoration projects.

In 2022, the Society intends to ramp up recycling efforts by adding more Two Rivers area restaurants.

Staff are also seeking approval for a living shoreline restoration project that would use recycled shell on Gunning

Photo above: In 2011 the Littoral Society began a second reef project in Barnegat Bay. It is designed to protect a heavily eroded section of Forked River Beach in Lacey Township, NJ

Island, which is located at the confluence of the Navesink and Shrewsbury rivers. The goal is to stabilize the island's shoreline from the threat of erosion and create habitat for marine creatures.

Conversations continue with the New Jersey Department of Environmental Protection over criteria for building reefs in the rivers that would be seeded with live oyster larvae. While large-scale oyster restoration might help reduce pollution in those waters, state officials have raised concerns about potential problems if people eat shellfish taken from there.

### **Barnegat Bay**

Barnegat Bay was once home to one

of the state's healthiest oyster populations.

When Henry Hudson arrived there in 1609, he estimated there were 89,000 hectares of oyster reefs in the bay, which were mapped to help future visitors avoid running aground. From 1870 to 1930, millions of oysters were harvested from the bay each year.

However, pollution, development, overharvesting and disease virtually extinguished those oyster populations until the recent resurgence of oyster farming (aka aquaculture).

The Littoral Society has two oyster projects going on in the bay. The first, near Ocean Gate Township, is a 1/2-acre sub-tidal oyster reef off Good Luck Point. For the past 5 years, the Society has raised baby oysters in Ocean Gate, then carried them to the reef site in an annual Parade of Boats.

In Summer 2022, the Society will continue the work by seeding 500,000 oyster larvae to recycled whelk shell. Once the oysters adhere to the whelk shell substrate, they will join their cousins on the reef site.

Just a short distance away is Forked River Beach, where the Society recently began a reef project designed to reduce turbidity (the measure of relative clarity of a body of water) caused by erosion.

More than 100 feet of land have been lost on the beach front since 1995. Many homeowners along this stretch are unfortunately frequently greeted by the Bay, not only in their backyards, but on their back porches.

A series of seven double-rowed reefs were installed in late 2021. Wire baskets (also known as HESCO units), were filled with stone to anchor them in place. These will help reduce wave energy and

create habitat for marine creatures.

In the Spring and Summer 2022, 70 million oyster larvae will be seeded onto recycled shell that will be added to the reefs. This is currently the largest oyster reef operation in the state.

## **Delaware Bay**

Littoral Society reef work has also been underway in Delaware Bay for several years. At present, the Society has engineered eight oyster reefs off restored beaches on New Jersey's Delaware Baysore. Those will continue to be monitored throughout 2022.

The reefs are designed to prevent sand loss from wind-driven waves, create calmer water for spawning horseshoe crabs, and re-establish a natural habitat for numerous other aquatic creatures. Among the sites for these oyster reef living shorelines are South Reeds Beach, Moores Beach, Thompsons Beach and Dyers Cove.

The reef projects have been funded by National Fish and Wildlife Foundation (NFWF) through their Hurricane Sandy Coastal Resiliency Grants Program, and were developed in partnership with U.S. Fish and Wildlife Service (USFWS) and New Jersey Division of Fish and Wildlife.

The Society is also in the process of in the process of launching projects projects in or around Lavallette, Parker's Cove, and mouth of the Maurice River. These projects will incorporate recycled shell, hybrid breakwater systems, and seeded oyster shell with the aim of restoring natural habitat and making the coast more resilient in the face of climate change driven storms and rising sea levels.

# Farming Oysters on the Jersey Shore

By Rob Shane







MINNOWS  
GAS & ICE  
SPOT & EELS



Coastal New Jersey is known to most as a booming vacation destination with pristine beaches and destination resorts. In the past decade, though, a movement to turn New Jersey's largest body of water, Barnegat Bay, into an oyster farming destination has taken off.

The man at the forefront of this effort was Matt Gregg, founder of Forty North Oyster Farms and the Barnegat Oyster Collective. A native son of the Garden State, Matt got his first taste of work as a teenager in the fish markets along the Shark River and then as a mate on local fishing boats. This initial interest led him to pursue a degree in aquaculture, fisheries, and marine policy at the University of Rhode Island. Like most successful entrepreneurs, through his collective experience Matt recognized an opportunity and seized it.

Barnegat Bay lies entirely within Ocean County, NJ and supports a robust coastal economy flush with tourism, commercial and recreational fishing, and of course oyster farming. Most of these industries boom from May to September with the influx of vacationers and shut their doors as the colder months take hold.

Matt's business doesn't get a break, though, and as he likes to say, "we don't lose our customers in the Fall, Winter and Spring, they just go to different places." By selling direct to restaurants from New York to Philadelphia, operating a farm in Central Jersey puts him in

Previous Page: Matt Gregg's oyster farm is a 12- acre plot of estuary just a few hundred yards from the iconic Barnegat Lighthouse and the colorful Van's Bait & Tackle.

a prime location to reach tens of millions of people in just a two-hour drive.

On a Monday afternoon in late October, I was fortunate enough to get a firsthand tour of Matt's farm – a 12- acre plot of estuary just a few hundred yards from the iconic Barnegat Lighthouse. As we motored out of a small marina and came around the bend, the first thing I noticed were hundreds of pelicans perched atop a maze of ropes and cages holding the operation together. This may not seem too out of the ordinary, except that on a 360-degree observation not another pelican was to be seen anywhere in the entire bay. Sea urchins, seals, and striped bass also call his farm home.

A circulatory economy makes operations like this so important to our estuaries. Matt's oysters don't just put food on his plate, figuratively and literally, they support secondary and tertiary business that have grown to depend on him as well. Recreational anglers have identified his farm as a hot spot to enjoy catching fish. Bird watchers pay for the opportunity to see these pelicans, which Matt tells me is not a common sight in New Jersey. Many of them rent boats and buy gas, ice, bait, and snacks at the same small marina we departed from.

At the end of the day, they all rely on one thing – a healthy Barnegat Bay that can support the industries consumer's demand.

New Jersey is the most densely populated state in the U.S. It ranks 11th in population but 47th in total area, ahead of only Connecticut, Delaware, and Rhode Island. Home to more than 8 million people, that equates to about 1,200 people/sq. mile. This tracks with



estuaries across America, which account for only 4 percent of U.S. land mass but are home to 40 percent of the country's population.

If you're in the business of selling oysters, that many people at your backdoor is a huge market opportunity. That level of density, though, is a constant strain on the state's water. This puts Matt and his business at the confluence of environmental consciousness and economic productivity.

This density has come at a cost to the state's natural infrastructure. Matt's farm is lucky to be positioned just behind Island Beach State Park on one side; a largely untouched barrier island that maintains predevelopment ruggedness and no permanent settlement. New shopping centers, homes, and roads dot the landscape on the opposite side of Barnegat Inlet and have stripped most of the region of its natural defense, instead relying on stormwater management systems that may not be equipped to handle our current climate predicament.

Since Forty North Oysters produces a food product, they must also meet standards set forth by the Food and Drug Administration and state agencies. To farm shellfish in New Jersey's estuaries, not only do you have to meet water quality standards, but there cannot be any existing populations of submerged aquatic vegetation (SAV), such as eelgrass, or any endangered species. Since passage of the Clean Water Act, and subsequent legislative protections, the New Jersey Department of Environmental Protection (NJDEP), who issues permits for shellfish farms, has been documenting water approved for shellfish harvesting along the coast and it has consistently increased due to improved water quality.

Matt and his oysters are now facing another threat in the form of global

Photo above: Forty North Oyster Farms and the Barnegat Oyster Collective have been at the forefront of oyster aquaculture in Barnegat Bay.





warming, though. Seas are rising and storms are becoming more regular and more intense. His ability to produce and sell locally-grown oysters depends on his ability to access the farm – which traditionally has sat in only a few feet of water. Even while on the phone with him during what he called a small nor'easter the entirety of his farm was flooded and kept him, and his crew, from working all day – an occurrence that's becoming more and more frequent.

A horrifically ironic sign of the times are No-Wake signs that line the main street through the town of Surf City on Long Beach Island. Instructions meant

for sea-faring vessels now beg cars and trucks to slow down during the regular flood events to avoid sending waves into people's front yards or places of business! Stark evidence of climate change happening in real time.

Matt is hopeful that as more people flock to the coasts we will reconsider our approach to protecting our estuaries from the effects of climate change. In the updated Economic Value of America's Estuaries report, Restore America's Estuaries was able to estimate the value of natural infrastructure in Great Egg Harbor, just a few miles south of Matt's farm, at between \$34 and \$153 million. Of course, each estuary is different, and each natural ecosystem offers different benefits, but one can draw the correlation that the value is still significant.

Matt is also hopeful that his young son, should he choose to do so, will be

Photo above: A native son of the Garden State, Matt got his first taste of work as a teenager in the fish markets along the Shark River and then as a mate on local fishing boats.



able to take on the family business when he comes of age. Just about ten years into this voyage, he has seen the benefits of his farm translating to benefits in his local estuary. Wild oysters, a product of spawning oysters from local farms are playing a role in repopulating the bay, providing habitat for fish and wildlife, filtering water, and protecting the shores from erosion.

Seagrasses have started growing near his farm. Although he won't take the credit outright, it's hard to deny that the million plus oysters under his watch, and their ability to clean and filter water, have played some part in this.

At the end of our tour, Matt reached down into the unusually-warm-for-October water and pulled out a dozen fresh oysters for me to take home. As I enjoyed them a few days later around a

campfire on Assateague Seashore with friends, I couldn't help but wonder what life without oyster farms in Barnegat Bay looks like. How close are we to that day? What does it mean for the restaurant owner? The fishing guide? The cashier at the marina? The estuary?

*Check out the Barnegat Bay Collective to find Forty North Oysters in a restaurant near you. Special thanks to Matt Gregg for showing me around and the American Littoral Society for introducing us. Read the full Economic Value of America's Estuaries report .*

Photo above: Matt Gregg and the Barnegat Oyster Collective can often be found promoting their shellfish at events in New York and New Jersey. Photo by David Hawkins/American Littoral Society

An aerial photograph of a white boat with a cabin and a mast, floating on a vast, calm body of water. The water is a deep blue-grey color. In the far distance, a shoreline with trees and some buildings is visible under a clear sky. The text is overlaid on the upper half of the image.

# How Oysters Grow Their Way to Your Plate

From their natural or man-made homes, these bivalves benefit people and the environment

By Holly Binns & Joseph Gordon







Consuming an oyster on the half shell is about as quick and easy as eating gets—a stark contrast to what it often takes to get that mollusk to the dining table.

Oyster reefs are declining worldwide and face threats ranging from polluted and warming water to dredging, erosion, and diseases. So oyster growers,

Previous Page: Researchers inspect oyster, clam, and seagrass restoration projects near the Southampton Marine Sciences Center operated by Stony Brook University, on Shinnecock Bay in New York. Katie Orlinsky The Pew Charitable Trusts

Photo above: Oysters grow on structures at a University of North Carolina-Institute of Marine Sciences facility in Morehead City where scientists test different approaches to building reefs. The Pew Charitable Trusts

scientists, conservationists, and others are finding ways to build new reefs and help oysters reproduce. Healthy reefs not only deliver more oysters but also convey environmental benefits. Oysters filter water as they eat primarily algae. Reefs stabilize shorelines and provide habitat for many marine animals, including commercially and recreationally valuable fish species.

Here are eight things to know about oysters and how they grow:

- 1. Let's talk spat.** To reproduce, oysters produce larvae, which then drift for two to three weeks. Many are eaten by small predators or otherwise die; others settle on a surface—ideally an existing oyster reef—where they'll spend the rest of their



lives. Once attached to any surface, the larvae are called spat.

- 2. The housing shortage.** In many places, larvae have nowhere to attach. Globally, including along the U.S. coasts, about 85 percent of reefs have been lost, and in some places they have become locally extinct. In response, in some areas, governments,

Photo above: Marine experts with Cornell Cooperative Extension, a research and education partnership affiliated with Cornell University, monitor baby oysters in a floating upweller system at the extension's Suffolk County, New York, facility. When the oysters become large enough, workers transplant them into nearby estuaries, where they can grow to adulthood. Katie Orlinsky The Pew Charitable Trusts

## A Few More Facts About Oysters

Oysters play a big role in marine and coastal environments but face many threats, from pollution to changing ocean conditions to dredging. That's why it's critical to restore reefs and safeguard oyster habitat.







Photo above: Oysters grow on a man-made reef in North Carolina. Living shorelines such as this one help fortify coastlines, protecting communities and improving wildlife habitat and water quality while also potentially contributing to the overall health of the surrounding oyster population. Aaron Kornbluth The Pew Charitable Trusts

researchers, conservation groups, and others have started making reefs using cultch—material such as oyster shells or crushed limestone and concrete. Restoration efforts may also include adding spat to reefs when

Here are a few things you might be surprised to learn about Eastern oysters:

- A healthy adult oyster can filter the amount of water it takes to fill a small bathtub every day. Oysters feed by pumping water through their gills and in the process capture algae and other particles, sort of like a strainer. By cleaning the water, oysters help maintain the balance of their ecosystems.
- Oysters change gender. Most start out male, but some change to female after they spawn once or twice.
- Wild oysters can live 25 to 30 years, but typically most don't survive past six years.



building them. This technique has been widely used along the Atlantic and Gulf coasts to help the species and reefs recover, primarily to meet consumer demand for oysters.

### 3. **Oysters are OK with manufactured housing.**

Sometimes people use rocks or precast concrete structures to build large, tall, and durable condolike reefs for oysters. These structures, which may incorporate recycled shell from restaurants and shucking houses or leftover concrete from construction or demolished dams, also provide homes for other marine life, such as crabs and fish. Reef builders, who include government agencies, commercial growers, academics, and conservation groups, tend to build these reefs well below the low tide line (that is, in subtidal areas) so they are less likely to be buried by sediment or degraded by waves. Oyster larvae are attracted naturally to these structures, and reef builders can also use hoses to spray oyster seeds or spat on them to get a colony going.

### 4. **Sometimes youngsters need boarding school.** An emerging

- Today, oyster populations are at historic lows. Erosion from development, along with wetland loss, pollution, overharvesting, changing ocean conditions, freshwater discharges, disease, and damaging fishing gear, have wiped out some populations and caused others to plummet.
- From 1880 to 1910, the US produced up to 160 million pounds of oysters annually — more than all other countries combined — and some biologists think New York harbor may have once contained more than half of the world's oyster population.

technique is to grow spat on cultch in a secure environment, such as a laboratory or hatchery, before bringing that cultch to a reef. This can help build reefs in areas where there isn't sufficient existing shell material or hard substrate to provide settlement habitat for larvae or where there isn't enough wild larvae in the water to colonize the reef. Controlled spat-growing gives young oysters the best chance of survival.

- 5. Oysters aren't fussy.** Many attach to and grow on any hard substrate, such as oyster reefs, limestone outcroppings, seawalls, and various debris. Oyster farmers even grow them in

Photo on opposite page: Seafood restaurants and bars donate their used oyster shells to this recycling pile at the New York Harbor School on Governors Island in New York. The school is dedicated to helping achieve the main goal of the Billion Oyster Project: a billion oysters planted in New York Harbor by 2035. Katie Orlinsky The Pew Charitable Trusts



- Oysters live in brackish and saltwater bays, estuaries, tidal creeks, shallow ocean areas, and intertidal zones.
- What creates oyster flavor? The *merroir* (like a wine's *terroir*) is the result of climate, geology, water quality, and water temperature the oyster grows up in. These factors vary depending on where it was raised and the time of year it was harvested.
- Oyster reefs help reduce the energy from storms, waves and tides, which helps safeguard coastlines by preventing erosion and protecting estuary waters that serve as breeding grounds for marine life.





- Many marine animals hide from predators in oyster reefs and eat tiny organisms that are drawn there. Reefs host animals ranging from crabs, mussels, and snails to herring, anchovies, and menhaden. These environments provide food for turtles, shorebirds, and recreationally and commercially valuable fish such as red drum, flounder, striped bass, and spotted sea trout.
- Oysters have three-chambered hearts that pump colorless blood throughout their bodies. They breathe with gills, just like fish.

racks, bags, and cages suspended above the seafloor. Growers then retrieve mature oysters from these locations at low tide. Oysters can also grow in tanks from broodstock—a group of mature individuals that supply larvae.

**6. Oysters may need “me” time.**

Sometimes an oyster reef needs to be left alone to recover from overharvesting, disease, pollution, dredging, trawling, changing ocean conditions, or other threats. Some states designate areas in which harvest is prohibited all or part of the time to give oysters a better opportunity to breed—and even spread beyond the conservation area.

**7. Healthy reefs help people.**

Placing reefs in shallower waters or adjacent to marsh areas helps create or enhance “living shorelines” that limit erosion by stabilizing sediment and diffusing the destructive power of waves before they reach shore. Oysters grown in these projects and those that grow on seawalls naturally and on docks can contribute, sometimes significantly, to reproduction at natural reefs. Also, oysters are filter feeders, so they clean the water as they eat, improving habitat conditions for all marine life. The ability to clean water is so valuable that in certain locations, fishery managers and local governments

have set aside areas in which oysters are left alone in large part just to help improve and restore water quality, among other ecosystem services.

- 8. A shell’s second life.** Don’t throw away oyster shells—they can be reused in reefs. In some areas of the country, restaurants and other businesses have recycling programs to ensure the shells are reused in restoration projects rather than heading to landfills.

Increased use of sound practices to boost, restore, conserve, and grow oysters will provide bountiful supplies for people and leave enough in the water to offer environmental benefits, from improved wildlife habitat to water filtration. Oysters have many roles to play other than a menu item, but they need a little help to get their jobs done.

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*Joseph Gordon directs Pew campaigns to protect marine life on the U.S. East Coast. He focuses on conserving fisheries and protecting and restoring seagrass, oyster beds, and other important habitats.*

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