Putting the "GREAT" Back into the Bay

JEFF BARNUM

A cooperative effort to restore oysters offers hope for the Great Bay estuary.

By Marianne Potje

ON A WARM DAY in New Hampshire, few pleasures compare with a boat ride through Great Bay and the Piscataqua River towards the mouth of the Atlantic. Viewed from the water, the lush forest surrounding Great Bay is dotted with picturesque houses and boat docks. The air is fresh with just a hint of salt. Anglers seek striped bass and bluefish. With a combination of saltwater, freshwater and land, Great Bay is home to hundreds of species of animals, birds and fish.

It seems idyllic. But all is not well in the Great Bay estuary.

Nitrogen loads in the water have increased by 42 percent over the last five years, leading to algae blooms which can potentially kill off fish and other important species. Eelgrass, which provides habitat and food for fish and numerous other species, is in decline and has disappeared entirely from some parts of the estuary. Oysters which were once plentiful in the early '90s have declined to about one-tenth of their numbers. In its 2009 State of the Estuaries Report, the Piscataqua Region Estuaries Partnership (PREP) showed 11 out of 12 environmental indicators with negative or cautionary trends.

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"The best thing we can do for the health of the estuary right now is to support oyster restoration," says Ray Konisky, Director of Marine Science for the New Hampshire chapter of The


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Nature Conservancy (TNC).

Konisky explains that the aim of oyster restoration has traditionally been to produce food for humans, but now the focus is on ecological concerns. The more the land in the watershed is protected from further development, the more the water in the estuary is protected from the stresses of deforestation, fertilizers, septic systems, wastewater treatment facilities and runoff from impervious surfaces.

DIRT AND DISEASE

Eastern or American oyster (*Crassostrea virginica*) is considered a keystone species in estuarine ecosystems. Oysters are nature's own efficient water filter, and a healthy adult oyster can filter about 20 gallons of water per day. Oyster reefs not only provide habitat and food for numerous species of invertebrates and fish, they also provide a living shoreline which cuts down on erosion and movement of the estuary floor.

When left to nature, oyster larvae settle and grow to maturity on top of old oyster shells, forming vertical reefs. When humans harvest oysters year after year and do not return the shells to their natural place, we create a gap in the ecosystem — without a hard substrate on which to settle, oysters cannot grow to maturity.

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Siltation is a natural process, but in excess it further compounds the problem. When the proportion of developed, impervious surface in a watershed approaches 10 percent, one of the main results is an increase in sediments in stormwater runoff. Silt accumulates on the estuary floor, interfering with the settling of oyster spawn on shell substrate. Some silt also remains suspended in the water. Although oysters can filter out excess silt, it is not nutritious, and so it requires the oysters to expend energy which they do not gain back. Suspended silt also irritates oysters' gills during feeding, causing them to close, which then deprives the oysters of oxygen and prevents them from feeding.

In addition to poor water quality and excess siltation, disease is another major cause of the decline in oyster populations in Great Bay and the Piscataqua region. Two pathogens in particular have devastated populations in the recent past: *Haplosporidium nelsoni* (MSX) and *Perkinsus marinus* (Dermo). Background levels of these parasites have existed in the Great Bay estuary since at least the 1980s, if not earlier. When the region experienced a drought in 1994-95, the increased salin-

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ity of the water allowed the parasites to flourish. The oyster population plummeted to about 10 percent of what it was in the early 1990s. The remaining oysters may have been resistant to the pathogens, giving scientists some hope for restoring the population from the remaining, possibly stronger stock.

OYSTER FARMING

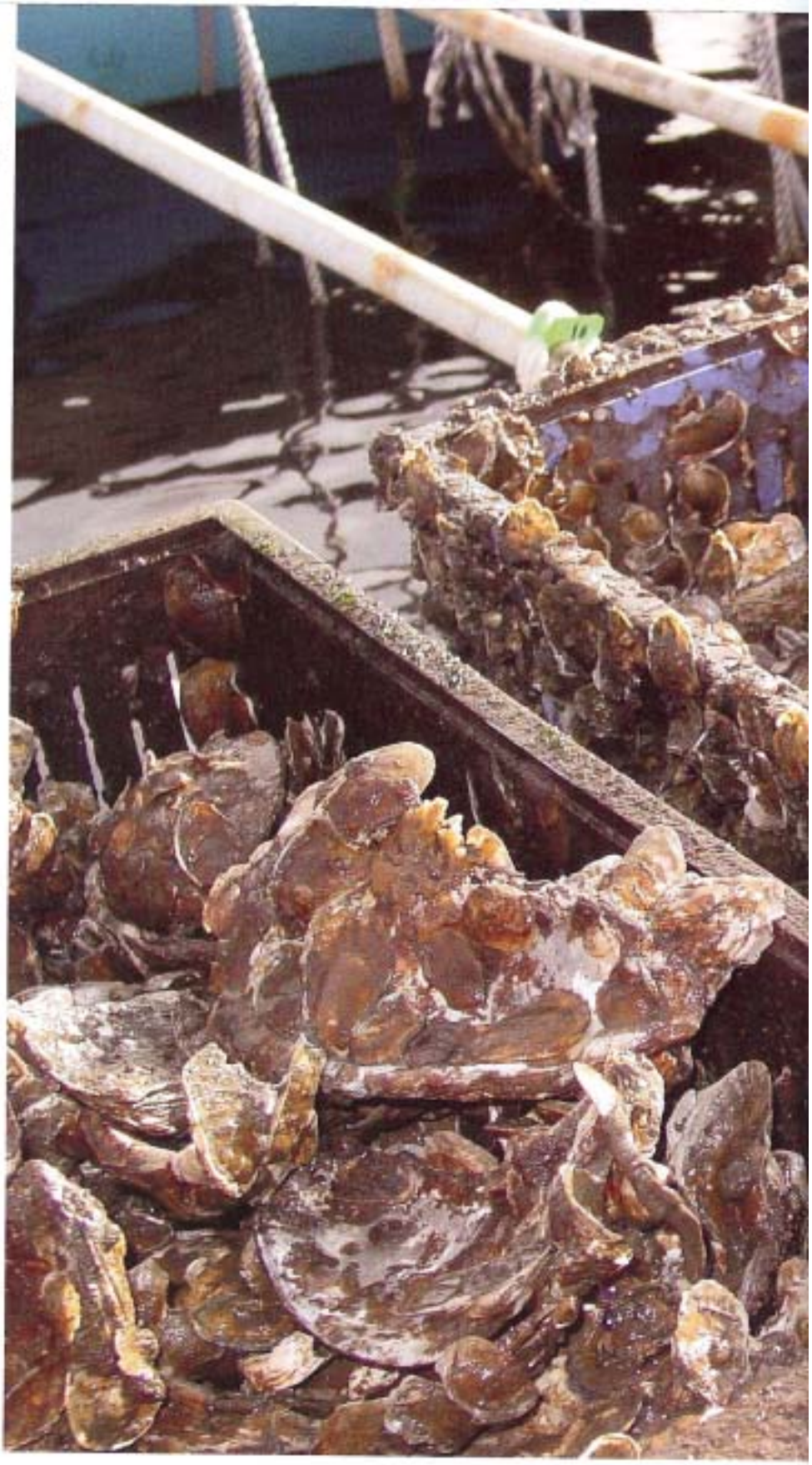
Oyster restoration efforts have two main components: shell planting and spat seeding. Shell planting replaces some of the missing shell substrate, and spat seeding introduces healthy young oysters into existing or newly constructed reefs.

Ray Grizzle heads the oyster restoration program at Jackson Estuarine Laboratory (JEL) of the University of New Hampshire. JEL hosts a shell recycling program on site, where locals bring in empty seafood shells to be used in reef restoration. Oyster larvae are sourced from the Damariscotta River in Maine and are grown on shells in tanks at JEL.

Over the past 10 years, Grizzle has initiated several shell planting and spat seeding projects, experimenting with different methods and monitoring the results. In 2008, Grizzle and Konisky surveyed the bottom of the Oyster River with underwater video equipment. The Oyster River, true to its name, was home to about 75 acres of healthy oyster beds as recently as 1970, but since then the population has declined to only one or two acres of live beds. Grizzle and Konisky located a section of riverbed downstream from the remaining live beds, and then acquired the necessary dredge and fill permit required to add substrate to the river bottom.

"Crushed concrete is really the gold standard," Grizzle says, speaking of materials that best promote oyster spat settlement and growth.

However, concrete is a foreign substance in the estuary and cannot pass the dredge and fill permit process. Oyster shell seems to have the ideal hardness over time, but is not as easily sourced as other shells. Most of the material used for the substrate consists of surf clam and ocean quahog shells acquired from Blount Seafood in Warren, Rhode Island. The shell is delivered by the dump truck load to the Kingman Farm at the University of New Hampshire, where it is allowed to dry out for at least three months to kill pathogens.



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program focuses on growing oyster larvae in customized protective cages substrate.

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The shell is then loaded into one-ton bags and trucked out to a pier for barge loading. The one-ton bags are transported on a hired barge to the chosen locations in the estuary. Each bag of shell is suspended over the water from a crane on the barge. As the barge crew gradually releases the shell from the bag, they move the bag with a rope and poles, distributing the shell as evenly as possible in a circular pattern.

TNC's oyster conservation program focuses on growing oyster larvae in customized protective cages until they are viable enough to settle onto the prepared substrate. Konisky secured the help of 22 families with docks around the estuary, and obtained the spat as single oysters from Muscongus Bay Aquaculture in Bremen, Maine. Each of the 22 families hosted a specially modified lobster trap, provided by B&B Trap and Little Bay Lobster Co. Each trap was loaded with clean recycled oyster shells and oyster larvae. The volunteer families monitored the growth of the larvae weekly and reported on their progress at two week intervals.

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SHELL RECYCLING

The efforts of CCA New Hampshire members are another useful piece of the oyster restoration puzzle. Jeff Barnum and Mitch Kalter of CCA NH were aware of the programs at JEL and wanted to help expand on these efforts by collecting oyster shells from area restaurants and oyster festivals to augment the efforts already underway. Without recycling programs, these shells would go into the waste stream and end up in landfills.

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"By participating in the program, restaurateurs are thrilled to get the shells out of their waste stream," says Barnum.

CCA NH is picking up about five bushels of shell per week. Home Depot of Portsmouth and Eldredge Lumber of York, Maine, contributed the necessary buckets and covers, and Scamman's Home and Garden Showplace in Stratham has helped with logistics. The CCA NH Oyster Shell Recycling Committee is developing a logo and asking restaurants to mention the effort on their menus as public education and awareness are key components of the project.

New England's numerous oyster festivals are a source of shells still waiting to be tapped, but transportation costs are a challenge. Last year, Barnum and Kalter approached Orvis, the well-known hunting and fishing outfitter, and applied for funding to expand on existing programs. In a huge boost to the program, Orvis subsequently contributed $10,000 to commence the shell recycling effort. Grizzle notes that the Natural Resources Conservation Service has also stepped up to the plate with much-needed funding.

Grizzle is currently working out a cost comparison for methods of treating wastewater, although oyster farming, which naturally filters water and encourages re-growth of eelgrass, has benefits far beyond economic impacts. As Grizzle says, "You just have to put them in the right spots" for the growth to be sustainable.

With luck and the continued commitment of the groups involved, Great Bay will prove to be as durable as the scrappy oysters that form the very foundation of the beautiful estuary.

"There is a natural resiliency to these animals," says Konisky. "They are a symbol of hope."

For more information on oyster restoration and volunteer opportunities: see www.oyster.unh.edu/ ,www.nature.org/, and www.ccanh.org.

Mariane Potje is a freelance writer who has contributed stories to CCA New Hampshire's Granite Tides newsletter.