THE REEF MAKERS

An Alabama experiment aims to restore oysters—and transform how we conserve our coasts.

By SCOTT McMILLION

Photographs by Penny De Los Santos

OYSTERS DON'T SING. But they do make music. Drag a set of long-handled oyster tongs across the muddy bottom of Alabama's Fowl River Bay, and you might hear the melody. It's something the old-time oystermen call chirping.

It's an odd sound, this clinking of oyster shells on rusty steel rakes: Imagine a wind chime doing its job under a couple feet of water. While this is sweet music to an oysterman's ears—it sounds like money, food, another day of keeping the wolf from the door—the tune rings hollow around here these days. In 2009, state officials closed Alabama's shores to oyster harvest.

The oysters of Fowl River Bay, Heron Bay and Portersville Bay, all part of the vast Mississippi Sound/Mobile Bay ecosystem along the coast of Alabama, have been hammered over the past few years and many have died, leaving empty shells that make a flat song. They've suffered what the locals call a perfect storm of perils: major hurricanes, extensive drought and a proliferation of killer snails.

Even so, the oyster habitat here is among the healthiest anywhere.

WILLING HANDS: With a NOAA grant of $2.9 million —part of the federal economic stimulus program enacted in 2009— the Conservancy has hired local contractors in Alabama to help build 1.5 miles of oyster reefs.

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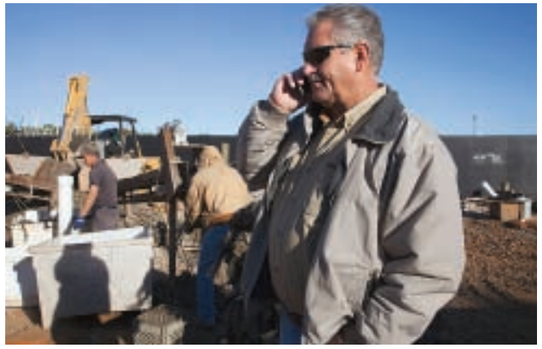
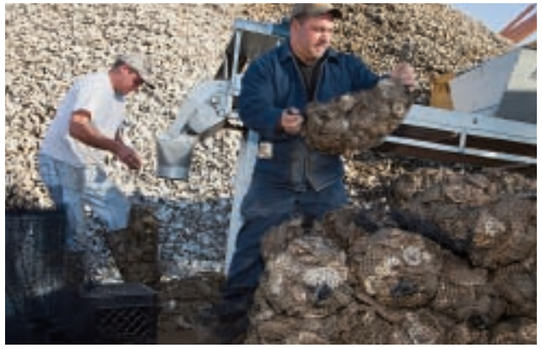
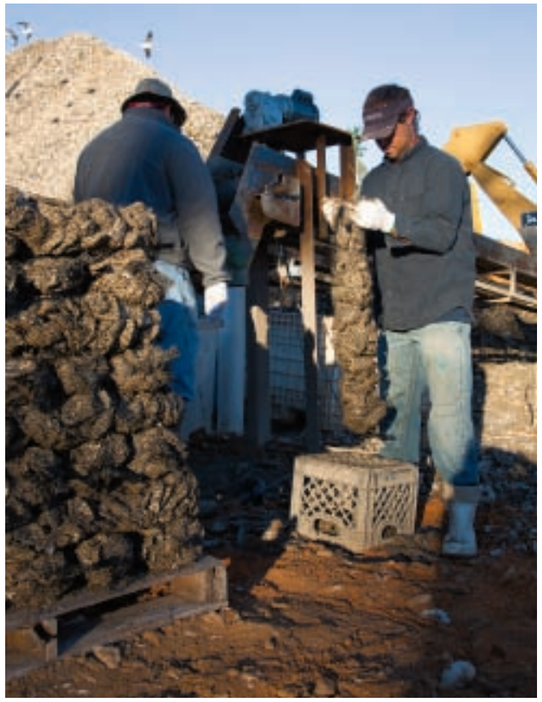






MOVING MOUNTAINS: Local businessman Wayne Eldridge (top left) designed a machine to efficiently fill bags with the oyster shells piled high at his job site in Bayou La Batre, Alabama. Shell bags are just one material being tested for its ability to act as a breakwater and give young oysters a place to attach themselves. Shell-filled iron rebar cages—or ReefBLKs—and concrete reef balls (bottom left) will also be used to build one of the longest man-made reefs in the Gulf of Mexico.

More than half of the native oyster reefs are gone from Mobile Bay and the rest of the Gulf of Mexico, but even so, the region still contains the largest chunk of healthy oyster habitat left in the world. A productive, sustainable fishery—and not just for oysters—remains a possibility here.

But to get to sustainability, where nature replaces what humankind removes, Alabama's oysters could stand a little help. So could Bayou La Batre, the hub of Alabama's seafood industry and a town that's been knocked around by bad weather, foreign competition and a soured economy.

Now, The Nature Conservancy has received a sizable chunk of federal stimulus money from the National Oceanic and Atmospheric Administration (NOAA) to help the oysters, plus offer a hand up to the humans and other species that depend on a healthy sea. Working with the University of South Alabama, the Dauphin Island Sea Lab and others, the Conservancy secured a $2.9 million grant under the American Recovery and Reinvestment Act, the federal stimulus program enacted last year to help reboot the economy. The money is being used to build some of the longest man-made oyster reefs in the Gulf of Mexico.

The work at Bayou La Batre is one of eight Conservancy restoration projects funded by NOAA with stimulus money (see "Green Jobs, Blue Waters," page 64, and "Freeing the River," page 32). This particular effort calls for thousands of tons of bagged oyster shells, iron-rebar cages and perforated concrete domes to be laid on the bay floor in sections that total about a mile and a half in length. The project has three goals: Create jobs in a place that sorely needs them, protect Alabama's eroding shoreline and boost the myriad aquatic species linked to oysters.

There's a lot at stake, especially for the hard-hit community of Bayou La Batre. Most of the building and all of the assembly of the reef will be done in town. When finished, the new reefs should help revive the Bayou's local oyster population.

"I'm all about creating habitat," says Wayne Eldridge, a Bayou native who owns an oyster company and a marine construction company, a man who wants nothing more than to see his long-suffering community succeed.

Eldridge also has become a key player in the reef-restoration project. He is helping to provide the practical skills and line up the willing hands that will build and install the reef sections.

But the Bayou isn't the only player with a lot at stake here. This project will be one of the largest-ever experiments using man-made oyster reefs to protect shorelines, says Rob Brumbaugh, who directs coastal restoration projects across the country for the Conservancy. "We're taking restoration up more than a notch," he says.

If the reefs work, the project could change the way scientists think about marine restoration around the world.

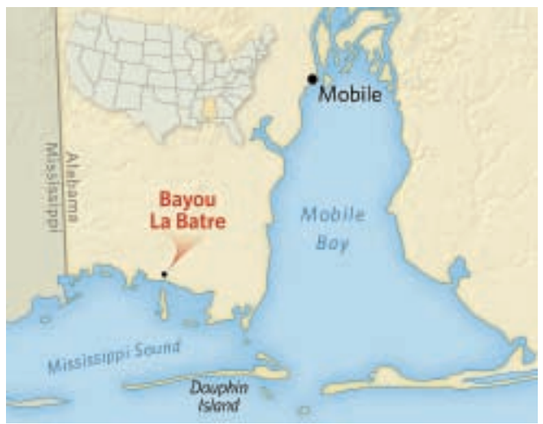
Consider the Oyster

The oyster is an incredibly fecund creature, one hard-wired to reproduce, which you wouldn't expect from a hermaphrodite.

In the first stage of its life, an oyster usually is male and produces sperm. Then, as it grows and strengthens, it becomes female and starts to produce eggs. The result is that late in the spring, a colony of oysters will release clouds of eggs and sperm into the water. When they find each other, they create billions and billions of fertilized larvae, each about the size a pepper flake. The larvae drift in the tides, looking for a solid place to attach themselves.

The ocean is a harsh incubator, however. Not many of them get the job done.

And that's OK. The eggs (as many as 170 million from a single female) and larvae provide food for all sorts of fish and crustaceans. And since there are so many larvae, survival of just a tiny fraction can lead to enormous oyster populations when conditions are right. The young survivors, called spat, are the ones that find something hard and durable—say a rock, a piece of wood or, most commonly, the shell of another oyster—where they can glue a foot down and begin to grow. That's when they set about the work of fostering an ecosystem, gluing and stacking themselves on top of each other and, in the process, succoring as many as 300 species of plants and creatures around them.



MAP: © XNR PRODUCTIONS

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Over time, the bivalves will cluster together to form huge reefs—tangled mounds of shells and oysters capable of feeding armies of people, legions of starfish, a sky full of birds. The countless crevices in the reefs harbor infant shrimp and crabs, and give tiny fish a place to hide from bigger fish. Oyster reefs also help break up waves and boat wakes, dissipating the wave energy so that water laps at the shoreline instead of crashing into it. This reduces erosion, which makes it easier for sea grass to grow, which provides nurseries for even more small creatures.

An average oyster will suck about 20 gallons of water through its innards every day as it works to filter out plankton and other tiny bits of food. This process ends up cleaning and clarifying the water. Clearer water means more sunlight reaches the bottom, which helps the sea grass that shelters the small creatures that feed the big creatures that feed people.

Areas with sea grass have between 10 and 1,000 times the biological productivity of similar places without vegetation, says Ken Heck, a biologist at Dauphin Island Sea Lab. The comparisons, he says, "will blow you away."

Oyster reefs have perpetuated themselves for thousands of years. They have survived predation by almost everything that lives along the coast—whether it has feathers or gills, whether it's wrapped in fur or clad in a rain slicker. But now Alabama's oyster reefs face a host of problems, mostly because of human-caused changes: urban and agricultural runoff; the mining of reefs for building materials; attempts to farm oysters by bringing in non-native species and their diseases; other marine invaders and diseases that arrive in the ballast water of ships. These things add up.

Alabama isn't alone. According to the Conservancy's 2009 report *Shellfish Reefs at Risk*, nearly 85 percent of the world's oyster reefs are gone. They have been victim to overharvest, pollution, disease, the filling of wetlands, the dredging of shipping canals. Oyster reefs are the most imperiled type of marine ecosystem on Earth. Nothing else—not even coral reefs—has been hit as hard.

In the Chesapeake Bay, early explorers found oyster reefs so dense that they threatened the safety of ship traffic. The reefs are gone now.

As recently as 1911, oystermen in New York City were harvesting 25 million pounds of oysters annually at the mouth of the Hudson River. Those reefs are gone, too.

When a region loses its oyster reefs, things can unravel across an entire estuary. The water becomes less clear, the fish less plentiful. Shorelines erode into the sea. These days, landowners who want to protect shorefront property don't have a lot of options beyond bulkheads, groins or other vertical structures of steel, wood and cement. But those remedies only compound the problems: When waves hit traditional bulkheads, the wave energy is reflected back out into the bay, increasing turbulence and erosion elsewhere—and in some cases harming nearby sea-grass beds and the creatures within them.

Nobody wants to see that spiral of loss along the Gulf Coast. And while more than half of the Gulf's oyster reefs are gone, that means a fair number of them are still there.

"It's not too late for Mobile Bay," says Brumbaugh. "This is a chance to work in a thoughtful way instead of a desperate one."

Restoration on a major scale remains a possibility in the Gulf in part because the warm waters let oysters mature quickly. The oysters can build reefs in relatively short order, as long as the spat can find a solid place to attach—somewhere above the muddy sea bottom, where they suffocate. In this part of the Gulf, that place is usually an oyster shell.

Wayne Eldridge has oyster shells, a small mountain of them alongside his dock in Bayou La Batre. That pile is one of the tallest things in the sleepy town. Now, working with the Conservancy, he's putting those shells back in the water, but not just willy-nilly. They'll be precisely placed where scientists say they can do the most good.

But first, Eldridge has some problems to solve.

He has to find at least 1,000 empty pallets. He has to hire a crew to put the shells in mesh bags, stack the bags on the pallets, load the pallets on a barge and then set the bags down underwater where they're needed.

Those shells won't turn into a reef on their own.

Wedded to the Sea

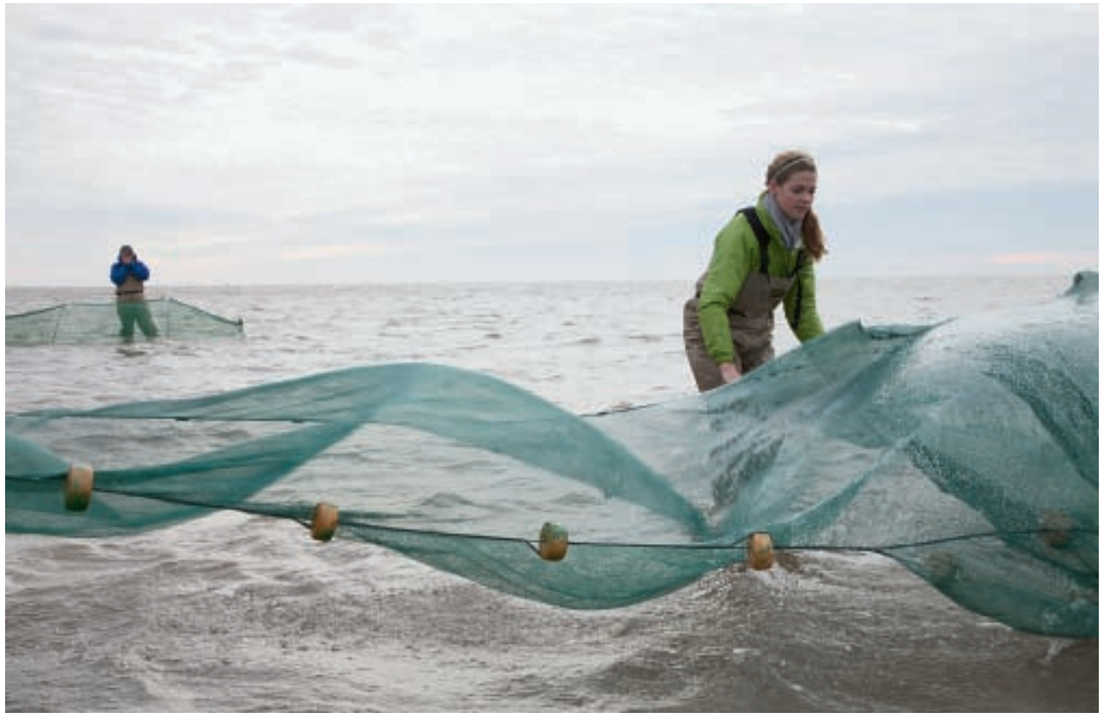
Like most people of his generation in Bayou La Batre, Eldridge, 53, has worked the sea and knows its ways. He started out as an oysterman.

"Everybody in this town, they fished," says Eldridge. "Their parents fished. Their grandparents fished."

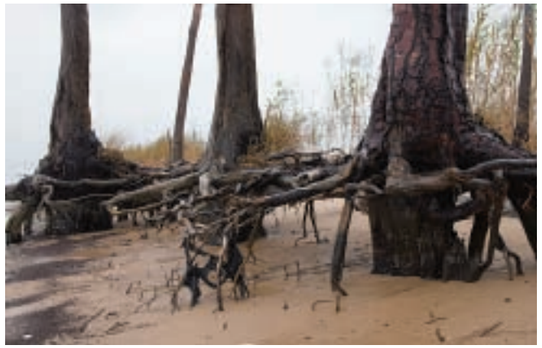
As a young man, Eldridge put in long days scratching his tongs across the bottom of estuaries from Florida to Texas. He remembers harvesting so many oysters in the 1970s that he almost swamped his boat.

"When do you quit?" he asks, grinning. "Right before your boat sinks."

He fed his family that way, filling burlap sack after burlap sack with oysters.



MEASURING CHANGE: Dauphin Island Sea Lab's Kellen Watson (at right, in the green jacket) and Jared McKee take measurements at Coffee Island, where some of the new oyster reefs will be installed. In addition to collecting biological data, the team is recording changes in sediments and the slope of the sea floor to determine how well oyster reefs reduce shoreline erosion.



Eventually, he got into other businesses, and he prospered. Today, he owns Bayside Oysters, a facility that employs some 20 people who shuck oysters—that is, when Eldridge can scrounge some up. Sometimes he has to search as far as Texas to buy them.

He also owns a marine construction company, and he buys and sells oyster shells, which have become a commodity with a variety of uses. Many of them wind up back in the water to provide a place for spat to roost. But this time, the work of placing shells—and measuring the results—is growing sophisticated.

The project is using three different methods to build two oyster reefs in sections totaling about a mile and a half. One method consists of stacking approximately 150,000 shell-filled mesh bags about 100 feet offshore in rows measuring 13 feet wide, four bags high and more than 400 feet long. Another section will consist of side-by-side triangular boxes, each 2 feet high with 5-foot-long sides, made of iron rebar filled with shells. A third section will be made of rows of reef balls—concrete domes riddled with grapefruit-sized holes. Though hollow, they are structures of substance: Imagine a 250-pound beach ball.

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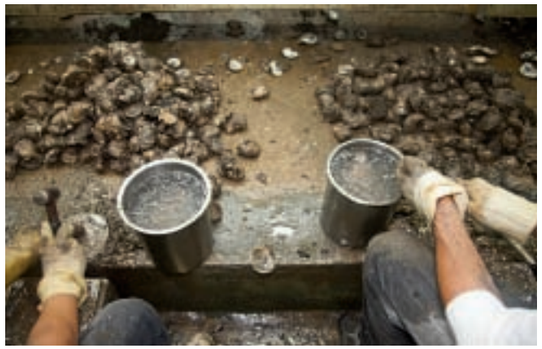

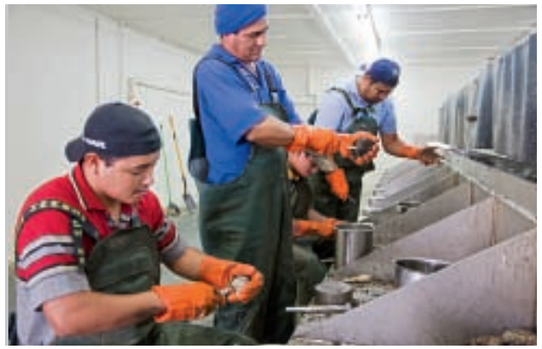

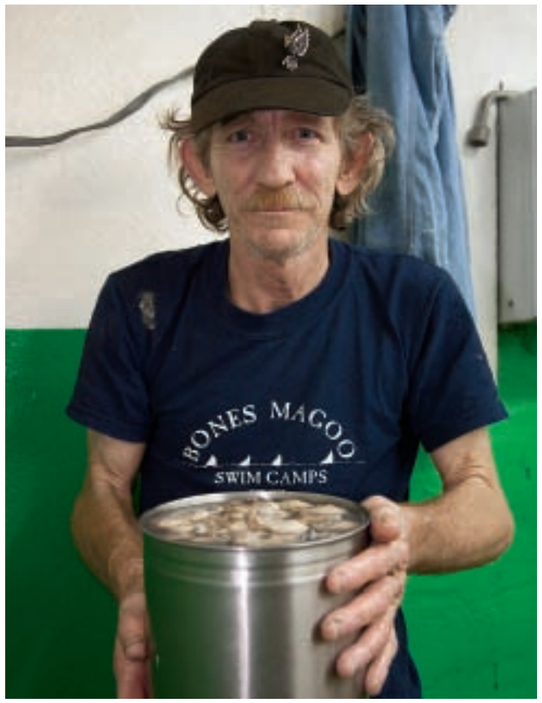

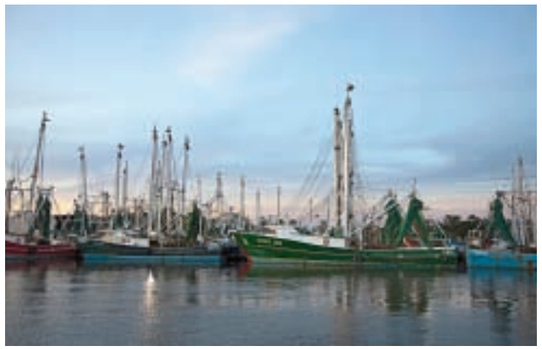

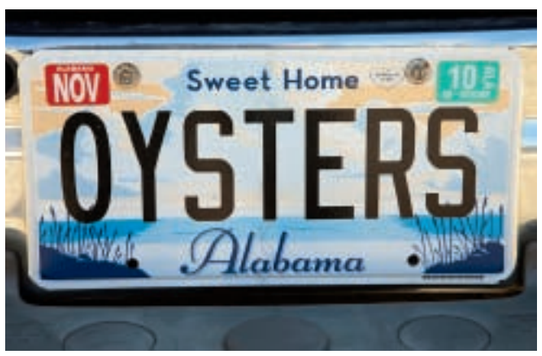

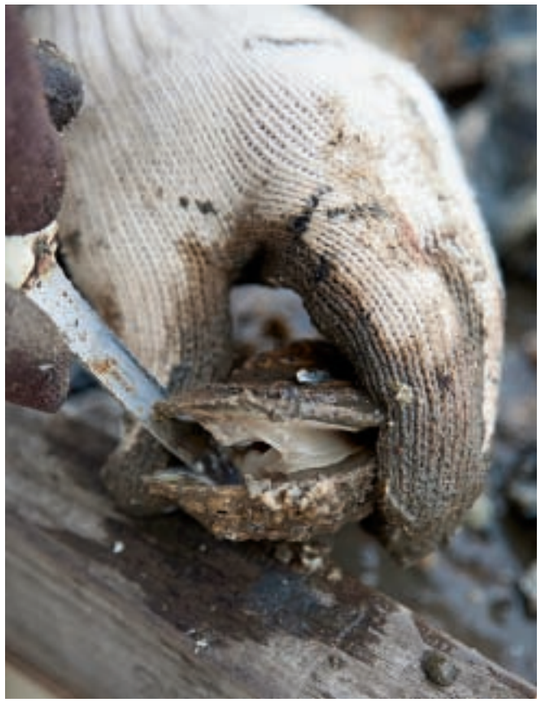

OYSTER TOWN, USA: **Workers at Alabama's Best Oysters (top and middle left) and Wright Brand Seafood (top right) shuck oysters—from Louisiana. Waters near Bayou La Batre, Alabama's seafood capital, are closed to oyster harvest to help the bivalves recover. In the meantime, there is less work—or sometimes none—for shuckers. Once established, the new reefs will produce billions of oyster larvae and nurture myriad other creatures, to the benefit of the ecosystem and the economy.**

While a mile and a half of new reefs might not sound like a big deal compared with the vastness of the Gulf, it's a big step up from past projects, according to Meg Goecker, who monitors the project for NOAA. "These are some of the longest reefs to be restored in the region," she says.

The oyster-shell business is what put Eldridge in touch with the Conservancy, where officials knew that filling 150,000 bags was a tall order.

Normally, the messy, smelly job of filling mesh bags is done by volunteers with shovels and gloves, says Jeff DeQuattro, who manages the Conservancy's projects on the Alabama coast. "It's grueling work," he says, "and it often limits the size of the projects we can undertake."

Eldridge revamped the entire process. Working with his welders and machinists, he designed and built a simple but efficient conveyor-belt system that can fill several thousand bags a day.

"Several thousand bags a day is unprecedented," says DeQuattro. "But nobody's ever needed 150,000 shell bags before."

Even at that remarkable pace, it will take months for about 15 people to bag up all those shells, load them onto barges and put them where they belong.

Eldridge pays the workers a minimum of $15 an hour. In a relatively poor community like this one, where the average household income is about $25,000, he doesn't have to reach far for workers. But he wants to treat them well.

"You've got to give people a reason to come to work in the morning," he says. Some of his employees are out-of-work oystermen and shrimpers, people Eldridge has known for 30 years. Others are from the shipyards, where work comes in cycles.

"Tell him to come see me Wednesday," Eldridge tells a welder in a nearby shipyard, a man whose son, also a welder, has just been laid off. Word of the shell-bagging project has spread: There are new jobs in town.

Eldridge says he'll find something for the son.

"How could I tell him no, when his boy's out of work?" Eldridge explains later. It bothers him, he says, to see willing hands go idle.

And on Wednesday morning, the young man arrives, in scuffed boots and jeans. Eldridge puts him right to work patching up a steel barge. The vessel will be needed later to haul materials to the new reef.

Within earshot of Eldridge's shell-bagging operation, Freddie Johnson is spending the winter on the oyster project, building cement reef balls under the shade of ancient live oak trees. He says he's glad to have the work and has enjoyed acquiring some new skills working with concrete.

"Keeping busy, that's what we want," Johnson says of his job. "And thank God for what we get."

Nowadays, a relatively small percentage of the local population fishes for a living. Still, Bayou La Batre remains Alabama's seafood capital, and about 50 processing plants dot the landscape. You see them everywhere, big ones looming above the docks or small ones tucked into residential neighborhoods. Most of them are mom-and-pop operations, but cumulatively they employ thousands of people to shuck oysters, pick crabmeat and sort and freeze shrimp. The workforce is a mixture of Bayou natives, Southeast Asian immigrants and Mexicans on temporary-work visas. Mass at Saint Margaret Catholic Church is delivered in English, Vietnamese and Spanish.

Bayou La Batre is very much a working town. Its smells are of seawater, diesel fuel, fish in the smoker. Its sounds are the hiss of a welder, the cries of the gulls, the banter of workers calling out in a chorus of accents and languages. Coastal living can be harsh, and catastrophe rarely comes as a surprise to people here. Hurricane Katrina, which forced most of Bayou La Batre's 2,300 people to higher ground and deposited many of its boats in the woods, was just one of the beatings this town has taken.

"People went through a hard time with Katrina," says Father Bieu Nguyen, a priest at Saint Margaret's. "But they recovered, I think because of hard work. They're very hard-working people."

The storm that swamped the town also smothered a lot of oysters, and after that came withering drought affecting most of the seven rivers that flow into Mobile Bay. With less fresh water flowing in, the bay's waters became more and more salty. The boost in salt content led to an explosion of oyster drills, a predatory snail that, given enough time and salinity, can wipe out an oyster reef.

"They can tell an oyster smell from a long way away," says Ken Heck, the biologist at Dauphin Island Sea Lab. "They sniff them out."

Once the drills start breeding on the reefs, they feed until the reef dies or the salinity decreases.

Alabama's oysters have suffered declines before, and people here expect that rains and time will take care of the drills. But until then, oystermen are out of work, and the processing plants must import oysters from other states, cutting into their profits. Often, oysters are not available at any price, which means frequently there's no work for the shuckers.

Building new reefs may help set things right, or at least help the oysters recover faster from these troubles and any

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future problems. Although the new reefs likely will be off-limits to direct harvesting, their ecological benefits will increase and billions of larvae will spread.

"I'm glad somebody's trying to help us," says Sandra Kinney, owner of Alabama Best Oysters and a woman who has been shucking oysters since she was 3 years old. "I figure Mother Nature will take care of her own. She usually does. But it's OK to give a little help every now and then."

Engineering an Answer

Artificial reefs are nothing new in the Gulf of Mexico. People have been dumping scuttled ships, junked cars (that didn't work so well) and even military tanks in the water for decades. But most of that work focused on deep-water habitat, where the goal was to attract more fish.

The reefs work, says Eldridge. When he wants to catch a mess of snapper, he motors out to one of the artificial reefs.

Similarly, the new man-made reefs should increase the numbers of oysters, crabs and fish, says Brumbaugh. They also should provide one additional key benefit: They ought to protect the shoreline from erosion, ship wakes and storm surges.

Historically, oyster reefs provided a natural buffer from battering waves, says Brumbaugh. He believes that man-made oyster reefs do the same. In fact, they could stem erosion just as well as bulkheads and do it without scouring the sea bottom or requiring repairs and upkeep. But the engineers and government agencies that grant permits for shoreline work want to see some proof of the reefs' effectiveness: They want graphs, statistics and specific measurements of success.

The Alabama oyster restoration project, Brumbaugh says, could deliver the proof.

"This will give us the data to responsibly put reefs in the playbook," he says. "I'd love to pick up a marine engineering handbook someday and see a chapter on reefs as an alternative to bulkheads."

Getting the data is no simple task. Jared McKee, an engineer at Dauphin Island Sea Lab, is leading a field crew that spends much of its time wading through thigh-deep muck, riding choppy seas and feeding blood to swarms of sand fleas and mosquitoes. They have measured the sea bottom and the shore down to the centimeter. They have gathered and tallied tiny fish and crabs and shrimp, assessing the abundance of life. And they have measured the size of the sediments and counted individual plants.

They did all this in the fall and winter, before workers began placing the new reef in the water. Since the spring, contractors have been placing shell bags, rebar cages and reef balls strategically in two areas where erosion has been a problem. The crews are racing to have the reef ready for the warm waters that trigger adult oysters to spawn.

The hope is that the spat will quickly cement themselves to the reef, gluing it together and making it bigger. Throughout the summer, McKee and his team will do their measurements several more times. By the end of 2010, the before-and-after numbers will show how much erosion was avoided, how much biodiversity was increased and which method of reef building worked the best.

Over the two-year life of the project, about 50 people—scientists, reef-ball makers, shell baggers and others—will be employed. The jobs won't fix all of the Bayou's problems, but it's a helpful nudge to the local economy, a few months' worth of work. Eventually, the new reefs ought to provide a bigger boost in the form of additional fish and oysters. Meanwhile, the Conservancy, NOAA and others are watching closely, hoping the lessons learned here will give coasts worldwide a boost of their own. ▪

Green Jobs, Blue Waters

In June 2009, the National Oceanic and Atmospheric Administration (NOAA) granted $167 million in stimulus funds to restoration projects across the nation. The Nature Conservancy is leading eight such projects, which together will restore hundreds of acres, improve miles of river and generate some 400 jobs. (See also "Freeing the River," page 32.)

Mobile Bay, Alabama
ACTION: Build 1.5 miles of oyster-reef breakwater; create 30 acres of sea-grass habitat
BENEFITS: Improve fisheries; reduce erosion

Southeast Alaska
ACTION: Restore 460 acres of eelgrass; restore fish access to Klawock River watershed
BENEFITS: Improve critical salmon habitat; restore sustainable fisheries

Shasta River, California
ACTION: Restore and protect 11 miles of salmon-stream habitat; develop fish-friendly irrigation methods BENEFITS: Sustain salmon; help farmers

Florida & U.S. Virgin Islands
ACTION: Grow staghorn corals and transplant them to 34 coral reefs BENEFITS: Boost tourism; improve fisheries

Maunalua Bay, Hawaii
ACTION: Remove invasive algae from 24 acres near shore BENEFITS: Restore native species; create jobs

Grand Isle & St. Bernard Marsh, Louisiana
ACTION: Build 3.4 miles of oyster-reef breakwater BENEFITS: Improve fisheries; protect 2,000 acres of marsh

Eastern Shore, Virginia
ACTION: Build 24 acres of oyster reef; replant 100 acres of sea grass; reintroduce bay scallops BENEFITS: Restore fisheries; improve water quality

Fisher Slough, Washington
ACTION: Restore 60 acres of marsh; open passage to 15 river miles BENEFITS: Improve salmon habitat; reduce flooding

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