BAY JOURNAL

Great Wicomico site of thriving native oyster reef

Despite early gains, many scientists are reluctant to declare the project a total success until a few more years have passed

By Karl Blankenship

While the Baywide oyster population hovers near its all-time low, a group of Virginia scientists say they have turned a mostly barren portion of the Great Wicomico River into the most vibrant oyster reef around the Chesapeake.

The team said its 86.5-acre oyster reef project is home to roughly 185 million oysters, the largest single population anywhere around the Bay. Some parts of the reef hold more than 1,000 oysters per square meter-which they say also makes it the densest population in the Bay.

Before the reef project was built in 2004, the area was mostly sand and mud, and averaged fewer than two oysters per square meter.

"We have never, in the Bay, seen this kind of oyster bed in the modern era," said David Schulte, a biologist with the Norfolk District of the Army Corps of Engineers, which funded the $3 million project. "It is really a remarkable body. It exceeded our expectations. This is really something we are quite excited about."

The study, *"Unprecedented Restoration of a Native Oyster Metapopulation,"* appeared in the July 30 online edition of the journal, Science. In addition to Schulte, the project team included Russ Burke and Rom Lipcius, both researchers at the Virginia Institute of Marine Science.

The reef, Lipcius said, "is the largest restored native oyster reef anywhere in the world. The only thing we've seen come close was about half as large."

It is a glimmer of good news for oysters, whose condition in the Bay is so dismal because of overfishing, disease and poor water quality that state and federal agencies spent the last five years studying whether they would be better off using a nonnative oyster from Asia. The agencies this year rejected that option, but their report warned that restoration efforts with native oysters would likely cost hundreds of millions of dollars in the coming decades, and produce only incremental results.

Lipcius, though, said that in the Great Wicomico, "we have laid out what we think is a strategy that will work." The scientists say their technique can be used in certain other locations. Over time, it's possible that disease-resistant oysters from these areas may gradually work their way out into larger rivers, and the Bay itself.

While the project has met with initial success, a number of Bay oyster experts are more cautious about the findings. They say it's too early to draw long-term conclusions about how oysters on the reef will fare.

"People want success so bad that they are willing to jump very early and claim success," said Jim Wesson, who oversees restoration efforts with the Virginia Marine Resources Commission. He cautioned that the Bay is littered with restoration projects that showed signs of early success, only to succumb to disease and other problems. "All of us think we are oyster restoration experts during the first two years," Wesson said.

Oysters bars, once so large they rose above the surface in some parts of the Bay, historically played an important role in the Chesapeake ecosystem. Oysters filtered huge amounts of water, and their reefs

provided habitat for many other creatures.

Rebuilding reefs is a vital component of any effort to restore oyster populations. Hard surfaces, preferably oyster shells, are critical for oysters as their young, or spat, need to land on a solid surface to survive and "recruit" into the population.

With populations at an all-time low, the vast majority of historic oyster grounds have disappeared, many under a layer of sediment. By some estimates, 90 percent of the Bay's historic oyster habitat is gone. The few oysters at remaining sites struggle to keep their habitat clean enough for spat to land. Also, because most oysters die at a young age from disease, their shells are thin and can rapidly degrade, unlike the large shells of old oysters which made up many of the original reefs in the Bay.

The majority of restoration sites around the Bay over the last two decades were small, and often developed with an eye toward harvesting them in the future-the idea being that oysters should be harvested before succumbing to disease-rather than preserving them as a permanent sanctuary.

The team working on the Great Wicomico, which is located between the mouths of the Potomac and Rappahannock rivers, contend their project differs from earlier efforts in a number of ways.

One is its large size. Other restoration projects in the Bay are typically no more than a few acres, and are placed in rivers that cover thousands, or tens of thousands, of acres. "That percentage is so small it is not going to make any difference," Schulte said. The scientists estimate their project-a series of nine interconnected reefs-covers nearly a third of the 250 acres of historic oyster grounds in the river.

The large size also helps to protect the reef from poachers, which is considered a significant impediment to oyster restoration. On reefs in small sanctuaries, it is difficult from a distance to tell whether someone is tonging within the sanctuary boundary; on the Great Wicomico, there is no question.

The Great Wicomico is also a "trap estuary" which recirculates much of its water. That means oyster larvae that didn't initially land on the reef might have a second or third chance to settle.

Unlike other constructed reefs, which typically consist of a series of oyster shell mounds poured into the river, the scientists said their high reefs were constructed as elongated bars, which they said were more typical of historic reefs.

The project included a mix of high reefs, which stand 10-18 inches above the river bottom, and low reefs, which coat the bottom with 3-5 inches of shell and are typical of most oyster restoration projects. The presence of the high, three-dimensional reefs, was critical to the project's success, the scientists said.

The oysters on the higher reefs showed better growth and survival than those on low reefs. Even though the elevated reefs covered only about a third of the project area, they contained two thirds of the oysters observed in 2007.

In fact, while the low reefs were gradually being buried by sediment, the oysters on the high reefs were creating enough new shell that the reefs were actually growing as populations of larger, older oysters increased. "The high-relief reefs are actually putting more new shell down on the reef than is being lost from sedimentation and other processes," Lipcius said.

The three-dimensial reefs offer a number of advantages, they say. By getting oysters off the bottom, they are less subject to the stress of sedimentation and poor water quality. Currents that run along the higher reefs help to keep them clean and provide a steady stream of food. As a result, the oysters grow faster, and are more likely to survive.

By grouping large numbers of male and female oysters together, they can produce more fertilized larvae. The high-profile reefs also provide larger targets for oyster larvae, or spat, to land on. Crevices in the reefs provide places for spat to settle where they are protected from predators.

Schulte said that 2006, 2007 and 2008 were all strong years for the recruitment of young oysters, and that the reef population was a major contributor to recruitment success in the latter years. "This is the first time a restoration project can be demonstrated to be enhancing recruitment in the hydrodynamic region of influence," he said.

The elevated reefs are also providing habitat for other species. "What we see on the high-relief reefs that we don't see on the low relief is a functional oyster community," Burke said. "We see lots of gobies, and blennies and shrimp and crabs and things that consistently clean the reefs and feed on the things that land there."

But many scientists are cautious about the study, saying it would take several more years of monitoring to fully assess the project's impact. While a high proportion of oysters on the reefs have survived to be 3-4 inches, Wesson of the VMRC believes the area has not been severely tested by disease.

"You can't divorce yourself from the fact that disease is still the driving factor," Wesson said. He said his surveys showed oysters "are dying significantly this year."

The project team disputes that the reefs have suffered significant disease mortality.

Wesson and others also attribute part of the success to good timing. The reef was constructed in 2004, and had a huge natural spat set in 2006 that jump-started the population-the river is known for periodically having exceptionally strong recruitment years.

But state fishery managers say it's less clear that oyster survival on high reefs is significantly better than those on low reefs after several years. As a result, state agencies, whose projects are often aimed at improving harvest, have been reluctant to invest limited funds on more costly, high-relief reefs.

"All of our three-dimensional reefs have spiked high and then ended up coming back to the same densities as two-dimensional reefs over time," Wesson said.

Maryland state officials reported similar experiences with three-dimensional reefs.

Other scientists concur with the Great Wicomico team. They say the differences in opinion stems from separate points of view. Agencies are often trying to enhance stocks for harvests, rather than long-term restoration. It therefore makes little sense for them to build more costly three-dimensional reefs, which require large amounts of oyster shell, a diminishing resource in the Bay.

"But when you are building a sanctuary reef, you want longevity and you need the amount of relief that, when combined with the vertical growth of the oysters that you plant on it, will be able to overcome whatever the local siltation and shell degradation rate may be," said Bill Goldsborough, a fisheries scientist with the Chesapeake Bay Foundation.

While Goldsborough said the project was "a success to date" he cautioned that the oysters still "have an uphill battle, frankly, in dealing with low-dissolved oxygen, siltation and disease."

Roger Mann, an oyster researcher at VIMS, said long-term success depends not only on the number of oysters produced, but how long they survive. "You can often find yourself in a situation where you have lots of oysters, but the habitat is degrading faster than the oysters create it," he said.

Besides disease pressure, oyster reefs have to withstand degradation by oyster drills and other creatures that cause shells to deteriorate.

Mann said his work suggests that oyster reefs need to get a number of oysters to live at least 6 years to sustain themselves over time. The old oysters not only produce more young, but also have larger, thicker shells which are more resistant to degradation.

"In truth, we are not going to know if many of these things work until they have been sitting there for 10 years," he said. "A generation is three or four years, and you would like to see them go through

several generations."

Mark Luckenbach, another VIMS oyster scientist, agreed that it's too early to label the project a total success. If the river has several years of poor recruitment, coupled with increased disease mortality, the project could require more work.

But he said that shouldn't be considered a setback-the oysters that survive disease pressure are more likely to pass disease-resistant traits to their offspring. "It is only by going through those disease impact events that we can hopefully build up a larger and growing population of more disease-tolerant animals," Luckenbach said.

The key, he said, is not to walk away from the project nor allow it to be harvested, as has been the case in the past, but to monitor and intervene when appropriate, perhaps by adding more shell, until it is truly self-sustaining.

Success, he said, "is unlikely to occur with a single intervention. If that were the case, we would have done it a long time ago."

Report finds world has lost 85% of its oyster reefs

The loss of native oyster reefs isn't limited to the Chesapeake-a recent report concluded that 85 percent of oyster reefs have been lost globally.

A report released by The Nature Conservancy in July, *"Shellfish Reefs at Risk,"* said that oyster reefs are the most severely impacted marine habitats in the plant.

"We're seeing an unprecedented and alarming decline in the condition of oyster reefs, a critically important habitat in the world's bays and estuaries," said Mike Beck, senior marine scientist at The Nature Conservancy and lead author of the report.

Even in areas where oysters may remain, the reef communities they once supported have largely vanished.

Reefs are destroyed by destructive fishing practices, while coastal development and channel dredging also take a toll. Pollution from agriculture and urban areas impact the water quality and increase sediment deposition on reefs.

The report labeled oyster reef communities along much of the East Coast as being "functionally extinct." In the Chesapeake Bay, it said that more than 90 percent of oyster reef habitat has been lost.

That was echoed by a recent Environmental Impact Statement examining oyster restoration options in the Bay. It said "the continuing loss of hard-bottom habitat is an overarching constraint on the likelihood of increasing the oyster population in Chesapeake Bay."

The Nature Conservancy report likened the importance of oyster reefs to those of tropical coral reefs.

The reefs, it said, help to buffer shorelines from waves, filter the water and are important habitat for other species.

Yet in many areas, the report said, "we are still managing these species and their reefs in ways that almost assure that they will continue to decline."

The report recommended that remaining oyster reefs receive priority for habitat protection, that large-scale restoration efforts be undertaken, and that reefs be recognized for their ecosystem value, rather than purely for their fisheries value.

In addition, the report said that the introduction of nonnative oysters into new areas, and pollution sources in watersheds draining into oyster habitats should be controlled.

Use of nonnative oyster officially ruled out

The idea of introducing a nonnative oyster into the Chesapeake to revive wild oyster populations or to provide a boost to private aquaculture officially came to an end in August.

Col. Andrew Backus, commander of the Norfolk District, U.S. Army Corps of Engineers, signed the "record of decision" which brings to a close a five-year study of oyster management options in the Bay.

The study, known as a Programmatic Environmental Impact Statement, began when state officials-facing a native oyster population ravaged by disease, overharvesting and destruction of habitat-proposed the introduction of *Crassostrea ariakensis*, a native of China, which in tests appeared resistant to diseases that afflicted the native species.

The Corps and the states of Maryland and Virginia were lead agencies for the study, which was expanded to consider a series of oyster management alternatives. State and federal officials announced earlier this year that they would rule out the use of nonnative oysters. The record of decision cited "ecological uncertainties" about introducing a nonnative species, and "strong opposition of most stakeholders" to the use of a nonnative species.

The preferred alternative, outlined in the record of decision, incorporates three of the options that were studied:

- Expand, improve and accelerate native oyster restoration programs.
- Implement a temporary harvest moratorium on native oysters and develop a buy-out program to compensate displaced watermen, which could include work in restoration efforts.
- Expand native oyster aquaculture to support the commercial production of oysters.

While the record of decision establishes a "preferred alternative" from the study, it is not necessarily binding on the states. For instance, it does not have the authority to force states to implement a harvest moratorium and dramatically accelerate restoration efforts, which would come with a huge price tag.

But it does set a consensus direction. In August, A.C. Carpenter, executive secretary of the Potomac River Fisheries Commission, said he would recommend to the commission in September a moratorium on oyster harvests in the river, citing continued poor harvests and the recommendations from the EIS.

The final Environmental Impact Statement and Record of Decision can be found at www.nao.usace.army.mil/OysterEIS/.

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