

Dye Helps Predict Potential Dispersal of Non-native Oyster Larvae

Swimmers and boaters may have seen what appeared to be a “red tide” in several areas of Chesapeake Bay this summer and fall. But instead of a potential menace to the waterway, the red patches were part of a study designed to further enhance biosecurity of non-native oyster trials.

“Each of the red patches resulted from the release of about 30 gallons of

rhodamine dye into the water,” says project leader Dr. Roger Mann.

Mann, Dr. Kenneth Moore, and other VIMS researchers tracked the dye patches to help predict where tidal currents would carry larval oysters in the unlikely event that any of the non-native oysters now deployed in seafood industry trials successfully reproduce.

The first release took place in July near Crossroads Aquafarms & Chessie Seafood and Aquafarms on the York River at Yorktown. Additional dye studies took place at three other sites selected to provide a broad range of tidal conditions and salinity: Seafarms Inc., at Milford Haven in Mathews County in September, Shores & Ruark Seafood Inc., on the Rappahannock River near Urbanna in October, and near Kinsale on the Yeocomico River in mid-November.



Karen Hudson and Missy Southworth transfer rhodamine dye onto a VIMS research vessel in preparation for a dye release experiment on the York River. The dye will help show how tidal currents might disperse oyster larvae.

The dye study is one requirement of a July decision by the Army Corps of Engineers to extend the Virginia Seafood Council’s on-going trial of the non-native oyster *Crassostrea ariakensis*. NOAA, EPA, and the US Fish and Wildlife Service also contributed to the decision.

The Virginia Seafood Council (VSC) trials began in September 2003 when commercial growers deployed 100,000 sterile oysters at each of 8 sites in the Virginia waters of Chesapeake Bay. The Virginia Marine Resources Commission granted a state permit for the trial through May 2005. The Army Corps of Engineers granted a federal permit through June 2004. Both dates were based on a planned starting date of August 2003. But a two-month delay in the initial deployment of the oysters led the growers to request an extension of the federal permit until April 2005 so that their animals can grow to market size.

The main concern with the VSC request was that the extension would allow the non-native oysters to remain in the water during their summer

spawning season. The deployed oysters are the offspring of adult oysters that were genetically manipulated to produce progeny with three sets of chromosomes, rather than the pair of chromosomes carried by normal “diploid” oysters. These “triploid” offspring are effectively sterile. However, this process is not foolproof, and the original VSC permit allowed a maximum of 1 diploid oyster per 1,000 non-native oysters deployed.

The federal agreement to extend the VSC permit contained two key provisions to minimize the risk that any of the deployed diploid oysters might successfully spawn and produce larvae that could establish a feral population.

First, the extension permit required that the growers further thin out their oysters, either by distributing them amongst a larger number of containment bags, or selling those of market size. The growers also had to move the structures that contain the bags farther apart. Oysters are “broadcast spawners” that release eggs and sperm freely into the water. Increasing the distance

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Researchers Release Juvenile Blue Crabs

Hatchery-reared animals may help restore the Chesapeake’s ailing crab fishery

VIMS researchers continue to release hatchery-reared blue crabs into the York River in a collaborative effort to determine whether such efforts could be used to enhance Chesapeake Bay’s historically low blue crab stocks.

The population of female blue crabs in Chesapeake Bay has declined more than 80% during the last ten years.

The VIMS research team, led by Drs. Rom Lipcius and Rochelle Seitz and Mr. Jacques van Montfrans, released 11,540 juvenile crabs into shallow York River coves in June. Maryland scientists released a similar number of juvenile crabs into the Rhode River, which empties into Chesapeake Bay near Annapolis. Together, the 23,000 crabs represent the largest single experimental release of juvenile blue crabs ever attempted to test the feasibility of stock enhancement for the species.

The release program is a collaborative effort between VIMS, the University of Maryland’s Center of Marine Biotechnology (COMB) in Baltimore, and the Smithsonian Environmental Research Center (SERC) in Edgewater, Maryland. It complements

efforts to reduce the harvest of adult crabs through the establishment of blue crab sanctuaries.

The ongoing trials are designed to determine the optimal time and place for releasing juvenile crabs. Because the ultimate success of the trials depends on factors such as crab size, food availability, predation, cannibalism, water temperature, and salinity, the researchers spent the summer months studying crab survival in relation to these parameters. They also studied whether hatchery crabs would survive as well as those collected from the wild.

The VIMS team released another 4,017 hatchery-reared crabs into York River coves in October and November. The fall release was designed to test whether high rates of predation and cannibalism observed during the summer might decrease in autumn as adult crabs and finfish such as Atlantic croaker leave the coves to migrate downstream.

Analysis of the recent experimental data indicates that fall releases are indeed more successful. “During the summer, tethered crabs survived only about a day on average,” says Seitz.

“Many of the crabs we released in November are surviving for as long as 10 days.” In addition, hatchery crabs are surviving at rates equal to those of wild crabs of the same size.

Early results also suggest that crabs of the size used in the release studies (15-20 mm across the carapace) can and do survive in significant numbers when set loose in unvegetated sand and mud flats.

“That’s somewhat unexpected given the traditional view of seagrass beds as the main crab nursery grounds,” says Seitz. Data from ongoing studies suggest that grass beds are important for the youngest crabs, but that the slightly older and larger juvenile crabs used in the release studies may prefer the open flats because of their large populations of burrowing clams—animals the young crabs like to eat.

“Our recent field experiments also suggest that releasing slightly larger juvenile crabs of 20-25 mm carapace width produces higher survivorship,” says Lipcius.



Kristie Erickson inserts a microwire tag into a juvenile blue crab during the summertime translocation experiments.

The hatchery crabs were reared at COMB by Drs. Yoni Zohar and Odi Smora, who have spent the last several years overcoming previous obstacles to raising blue crabs in captivity, including cannibalism. Drs. Anson Hines and Eric Johnson of SERC have directed the Maryland enhancement efforts and provided support for the VIMS component.

Before each release, Lipcius, Seitz, and their staff collect the crabs from SERC, where resident and VIMS scientists have already completed the laborious task of tagging each of the

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Crab Release

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juvenile crabs. The tags, which consist of a tiny wire inserted into leg muscle, allow researchers to track the crabs despite repeated molting of the external skeleton. Researchers can easily identify a tagged and recaptured crab by passing it across a metal detector. Each of the crabs was also tagged with a dye visible through the transparent exoskeleton of the swimming legs.

After transporting the crabs to VIMS in iced coolers, the researchers released the animals into a shallow, muddy cove in the Catlett Islands (a pristine salt marsh habitat owned and managed by the Chesapeake Bay National Estuarine Research Reserve at VIMS), and another cove in Indian Field Creek, a pristine habitat under the protection of the Naval Weapons Station.

“Linking our scientific enhancement efforts with the federal protection and relatively pristine nature of many military installations may produce a favorable set of conditions for growth and survival of juvenile blue crabs,” notes Lipcius.

The current research builds on experiments during 2003 in which

Lipcius, Seitz, and van Montfrans moved young crabs from York River and Tangier Island grass beds into the same Catlett Island coves. High survival rates among these transplanted crabs showed that the coves contain far fewer crabs than they are capable of supporting.

“Last year’s experiments suggest that the ecosystem is below its carrying capacity, and that the blue crab is limited by recruitment, not resources,” says Lipcius. In other words, low crab numbers aren’t due to a lack of food, but to a shortage of young crabs.

“That’s why enhancement using hatchery-reared crabs seems like a viable method for restoring the Chesapeake’s blue crab population,” says Seitz.

In addition to Lipcius, Seitz, and van Montfrans, the release efforts were aided by VIMS graduate students Russ Burke, Dave Hewitt, Deb Lambert, Chris Long, and Bryce Brylawski; and staff members Mike Seebo, Katie Knick, and Kristie Erickson. REU college interns Francisco Soto Santiago and Nicole Rohr and Governor’s school students Ian Keene-Babcock and Jenny Geldermann also assisted with the June release.