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Collaborative Project Gets to the Bottom of Oyster Questions

Barring any unforeseen delays in permitting, researchers from VIMS and the University of Maryland will in late August begin a 30-month comparative field trial of native and non-native oysters in Chesapeake Bay.

The study will provide crucial information regarding the future direction of oyster restoration efforts in Bay waters by comparing the performance of the native species *Crassostrea virginica* and the Asian oyster *C. ariakensis* during on-bottom trials.

"This work will answer key questions needed for the Environmental Impact Statement [EIS]," says project leader Dr. Mark Luckenbach. The EIS is being prepared by federal and state agencies in response to the proposed introduction of diploid *C. ariakensis* to Chesapeake Bay in Virginia and Maryland. The EIS will evaluate eight alternatives to the states' proposed action (see sidebar).

Luckenbach will conduct the study with fellow VIMS faculty member Dr. Stan Allen, post-doctoral research associate Dr. Peter Kingsley-Smith, and Drs. Kennedy Paynter and Donald Meritt of the University of Maryland Center for Environmental Science. They will deploy the trial oysters in large-mesh bottom cages to exclude large predators and provide biosecurity against human disturbance.

"This is the first study to compare the growth rate, growth form, survival, and disease resistance of these two species in natural bottom habitats using triploid oysters," notes Luckenbach.

Dr. Stan Allen's lab will produce the study's triploid oysters by genetically manipulating normal diploid oysters to carry an extra set of chromosomes. His lab has produced triploid oysters for all previous *C. ariakensis* trials as well.

The triploid condition renders oysters sterile as a precaution against an unintentional introduction. It also enables oysters to transfer energy that they would otherwise use for reproduction into tissue growth. Some researchers contend that this energy transfer contributed to elevated growth rates seen in previous comparisons of triploid *C. ariakensis* and diploid *C. virginica*. The upcoming study will address this concern by using triploids of both species during the comparative trials.

"Field studies with triploid non-native oysters are not without risks," notes Luckenbach. "A small fraction of the animals are likely to be diploids and a small fraction of triploids can

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VIMS post-doctoral research associate Dr. Peter Kingsley-Smith shows one of the predator-exclusion cages that will be used in the oyster trials.

Preparation of the Environmental Impact Statement (EIS) for the proposed introduction of *C. ariakensis* into the tidal waters of Maryland and Virginia is being led by the U.S. Army Corps of Engineers, the Virginia Marine Resources Commission, and the Maryland Department of Natural Resources, in cooperation with EPA, NOAA, and the U.S. Fish and Wildlife Service.

The EIS will evaluate eight alternatives for increasing oyster populations in the Chesapeake and coastal bays:

1. Take no new action
2. Expand the current native restoration program
3. Implement a temporary harvest moratorium on native oysters
4. Establish or expand aquaculture operations using native oysters
5. Establish or expand aquaculture operations using non-native oysters
6. Introduce and propagate an alternative strain of *C. ariakensis* or an oyster species other than *C. ariakensis*
7. Introduce diploid *C. ariakensis* and discontinue restoration programs for *C. virginica*
8. Pursue a mix of alternatives

For more information, visit www.epa.gov/fedrgstr/EPA-IMPACT/2004/January/Day-05/i073.htm

Virginia Institute of Marine Science
School of Marine Science
College of William and Mary
P.O. Box 1346
Gloucester Point, Virginia 23062

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gradually develop some diploid tissues. In designing this study we took great care to estimate those risks and to develop an experimental design that reduced them to a minimum. This gives me confidence that we will be granted the necessary permits."

Current knowledge of the potential performance of *C. ariakensis* in Chesapeake Bay is based on aquaculture trials in which triploid oysters were grown in floating cages, or in laboratory tests with fertile, diploid oysters grown in quarantine. Neither approach provides all the information needed by the authors of the EIS to most accurately predict the performance of an established wild population of *C. ariakensis* in Bay waters.

"Oysters grown in surface cages are likely to have higher survival and growth rates than those grown on the bottom," says Luckenbach. "Oysters on the Bay floor are exposed to lots of silt, a greater variety of predators, potential space competition, and reduced food levels."

The aquaculture trials also fail to provide information on the potential interactions between *C. ariakensis* and *C. virginica*, or on the growth form and reef-building potential of the non-native species. Luckenbach's study of *C. ariakensis* in its native habitat in Asia suggests that this species may have a lower propensity for reef-building in comparison with *C. virginica*. Oyster reefs were once a key part of the Chesapeake Bay ecosystem, providing food and cover for many Bay species. Such reefs have dramatically declined over the last century due to over-harvesting, habitat degradation, and disease.

Ongoing studies using diploid *C. ariakensis* and *C. virginica* in quarantined systems at VIMS' Eastern Shore Laboratory and the University of Maryland's Horn Point Laboratory are addressing some of the inherent shortcomings of the aquaculture studies. But these laboratory studies have shortcomings of their own.

"The limitations of the aquaculture studies are offset to a degree by comparisons with *C. virginica* grown under comparable conditions," notes Luckenbach, "but the laboratory studies are unable to duplicate conditions in natural bottom habitats, and can only provide relative rates of growth and survival to the population models under development for the EIS."

The upcoming study is designed to measure the most naturalistic rates of growth and survival of the two oyster species. It will investigate four key research areas: growth rates and environmental tolerances, head-to-head competition, reef-building potential and habitat use; and the transmission of oyster diseases. These research topics were identified as priorities by a Chesapeake Bay Program Scientific and Technical Advisory Committee established in 2003.

Funding for the first-year of the project comes from NOAA's Chesapeake Bay Program, the Virginia Marine Resources Commission, the Maryland Department of Natural Resources, and the Keith Campbell Foundation for the Environment The team will seek support for the remaining 18 months of the study from each of these sources.