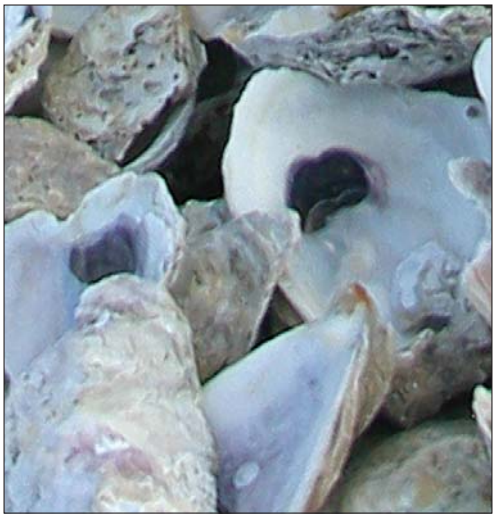
Native Oyster (*Crassostrea virginica*) Restoration in Maryland and Virginia

An Evaluation of Lessons Learned 1990-2007

For decades, natural resource managers, conservation groups, watermen, marine scientists, and others have explored ways to restore native oysters to the Chesapeake Bay. These efforts have taken many forms, seeking to restore oysters both for harvest and for the ecological functions that reefs perform. In the face of deadly oyster parasites, overharvesting, and degraded habitat, these efforts have become increasingly urgent.



Have these efforts succeeded? Everyone from political leaders to resource specialists to watermen and interested citizens want to know the answer. Groups engaged in oyster restoration activities want to know what techniques have worked best and where. And as we continue ambitious and costly efforts to restore the oyster, taxpayers and decision-makers want to know how to invest our limited resources most effectively.

To answer such questions requires documenting, in a rigorous and objective way, exactly what efforts have taken place in both Maryland and Virginia waters. An expert team of scientists and statisticians has come together to gather these data and to examine information about recent restoration and monitoring activities throughout the Bay.

Organized and facilitated by Maryland Sea Grant, this review of oyster restoration practices was funded by the Keith Campbell Foundation for the Environment, the Chesapeake Bay Office of the National Oceanic and Atmospheric Administration (NOAA), and the U.S. Fish and Wildlife Service. The team is comprised of scientists from the University of Maryland Center for Environmental Science, the Virginia Institute of Marine Science, the Smithsonian Environmental Research Center, the University of Maryland College Park, and the University of Florida. Experts at Versar, Inc. and at the University of Florida Department of Statistics assisted with data compilation and database analysis.

The team targeted their investigation to restoration efforts conducted from 1990-2007. That gave them a specific time period where they could hope to attain the data they needed to carry out a rigorous and meaningful analysis.

A Difficult Task

The task proved even more challenging than they expected.

In order to make judgments about what techniques worked best, and where, scientists needed good data on what methods were used, how often, and on what precise scales. Researchers often use particular methods for gathering data on oyster abundance, such as a particular-sized oyster dredge, pulled at a known angle for an exact depth and distance. Or they use hand-held quadrats measured by divers. Data should be collected in a predetermined and broadly consistent way for monitoring results to be comparable from one oyster bar to another.

In addition to collection methods, scientists also needed to know the precise purpose of a reef. Was it restored for ecological purposes, or was it intended for harvest? And even if it was intended for restoration, did some harvesting occur anyway?

As data began to come in, the group realized that collection methods differed among reefs, and that the purpose and status of reefs were often unclear. Sparse and inconsistent data collection among reefs made it very difficult to compare successes and failures. In addition, some involved with restoration activities in Maryland and Virginia were not forthcoming in sharing their data.

Despite these challenges, by the end of their study, the team had collected 78,000 records of activities to enhance or to monitor oyster populations in the Chesapeake Bay. Most of these data came from the natural resource agencies responsible for oyster restoration in the two states. The team identified activities on some 1035 oyster sites Baywide. Of these sites, 81 percent saw some form of restoration activity, and 86 percent saw some form of monitoring. About two thirds — approximately 67 percent — saw both restoration and monitoring at the same site.

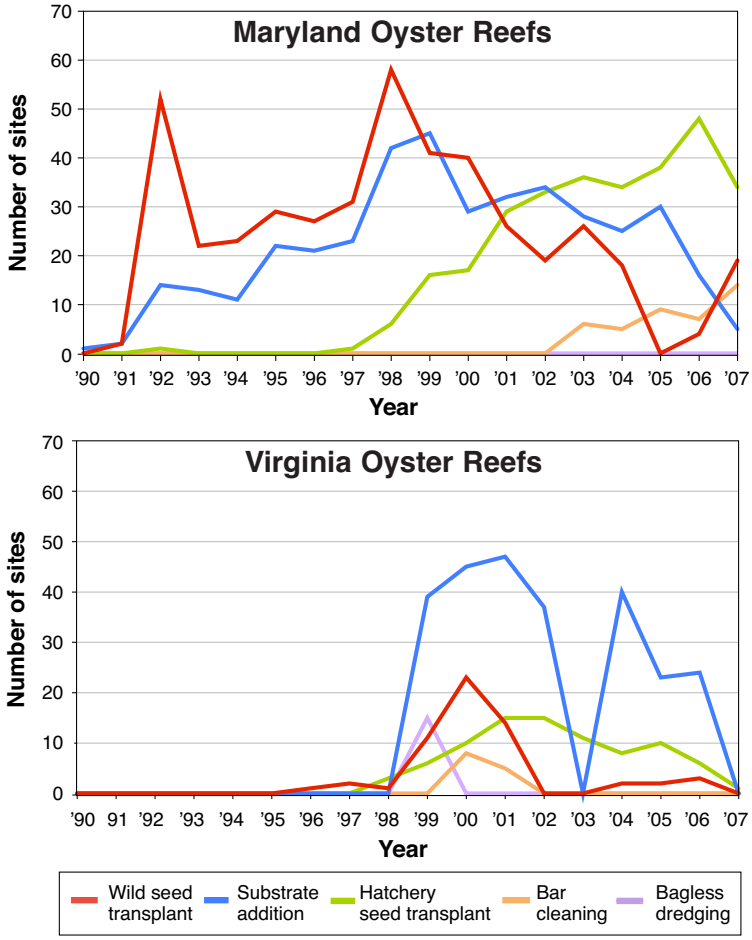
Key Findings

According to the data collected (which, as noted above, was not 100 percent forthcoming from every group), more reefs saw restoration activities in Maryland than in Virginia (378 versus 216) and slightly more reefs in Maryland saw monitoring activities (453 versus 437). In both states, more reefs saw monitoring efforts, such as measuring mortality from disease, than restoration efforts, such as the planting of oyster seed or the build-up of shell.

Restoration and monitoring activities were often carried out on the same bar more than once, so the total number of "sites" for activities (about 1,484) is greater than the number of reefs counted (about 1,037).

The team found that there was no direct correspondence between harvest regulations and actual harvest of oysters from reefs included in the database. There is little data to quantify the extent of illegal harvest on restoration reefs and its effect on restoration success. They also found that just because a bar was open to harvest did not mean that it saw harvest activity in any particular year.

A key finding was the lack of clarity in specifying whether restoration efforts were intended for harvest or for ecological function. In Maryland most restora-



Restoration strategies vary by state. In Maryland, the most frequently used method was planting wild oyster seed, which entails moving shell with baby oysters (spat) from one region to another — often from a high-disease to low-disease area. The next most common method was substrate addition, the build-up of oyster shell or other material on which oysters can set and live.

Increased use of disease-free hatchery seed after the late 1990s in Maryland began to replace the planting of wild oyster seed and reached a peak in 2006. The build-up of oyster substrate began to decline toward the end of the study period.

Maryland also saw the use of bar cleaning, where dredges remove diseased oysters by scraping bars clear down into the sediment. This practice increased from 2002 to 2007.

In Virginia during this time period, the primary method for enhancing oyster reefs by far was the addition of substrate. The planting of wild seed followed next, reaching its maximum around the year 2000. Then the transplanting of hatchery seed increased, reaching its peak around 2002.

As in Maryland, Virginia has used bar cleaning to remove diseased oysters. This practice peaked in 2000 and then continued at a low level. Bagless dredging was also used in Virginia, especially during the late 1990s, to stir shells out of the sediment so spat can settle on the available surface.

tion efforts were associated with "open" reefs, indicating that they were targeted to support the fishery. Most of these activities were carried out by the Maryland Department of Natural Resources (DNR).

In terms of monitoring techniques, the two states differed. For example, Virginia experts collected a greater proportion of monitoring data by spatially explicit sampling methods than did their counterparts in Maryland. In Maryland a significant proportion of monitoring data (taken by "untimed dredge," for example) was essentially "qualitative," according to the researchers. Even in Virginia, different sampling protocols turned up quite different density estimates, and numbers of samples taken for the Virginia monitoring data have not been provided. The absence of this information may well preclude use of this monitoring data in subsequent analyses.

Recommendations

The Oyster Restoration Evaluation Team put forward a number of recommendations, among them:

- **Clarify Goals.** A primary recommendation based on the team's findings is to more clearly define whether oyster enhancement efforts are in support of fishery harvest or ecological reef restoration. At present the confusion of these two purposes confounds attempts to judge their efficacy. There must be a focus on the quantification of progress toward a defined endpoint. In particular, reefs intended for ecological restoration must be maintained without fishing pressure.

- **Improve Coordination.** There has often been limited or no coordination between those who restore reefs and those who monitor them. Careful coordination between these groups and scientifically sound protocols will go a long way toward improving our understanding of the success or failures of restoration efforts.

- **Track Oyster Stocks.** A sound stock assessment program — similar to efforts for other important species — will help track changes in oyster populations and indicate more clearly where restoration efforts have made a difference.

- **Share Data.** Those who collect data on restoration efforts and associated monitoring should post their findings to a central collaborative database. Development of this database should build on the work of this project and should explicitly identify the potential limitation of contributed data. The database should be governed by clear guidelines and should be based on clear agreements regarding data availability, sharing, and use. As efforts to restore the native oyster continue in the Chesapeake Bay, tracking results in a rigorous and standardized way will be essential — so that everyone engaged in the effort, including citizens, will know to what degree various techniques are succeeding or not.

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To order a paper copy of the full 44-page report, *Native Oyster (Crassostrea virginica) Restoration in Maryland and Virginia: An Evaluation of Lessons Learned 1990-2007*, go to http://www.mdsg.umd.edu/store/reports/oyster_report/ or call 301.405.6376. You can also download a pdf of the report or this summary of the report at the same web site.

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