Hatchery-based Oyster Restoration in Chesapeake Bay

Guidelines for Successful Project Development

Donald Meritt[1] and Donald Webster[2]

[1]University of Maryland Center for Environmental Science

[2]University of Maryland Extension

Abstract

Chesapeake Bay oyster populations have declined precipitously during the past half century. Efforts to reverse this trend during the 1950s and 1960s were successful at some locations and in some years but were unsuccessful in others. Many decisions regarding restoration were based on opinions of commercial harvesters and were often aided by political influence. Success using traditional repletion activities have become less frequent both annually and spatially. To create cost-effective restoration programs for public reefs, sanctuaries and commercial aquaculture leases, the authors propose using knowledge gained from historic efforts with those learned from recent projects. This will lead to the development of techniques based on scientific data and verified by accurate monitoring. New techniques using hatchery-produced seed for restoration projects have shown promise and may be more effective than traditional methods at yielding larger harvests. The authors provide information discussing differences and concerns associated with new techniques and identify steps required to achieve success on restoration sites.

Background

It must be understood that a project to restore significant oyster populations is a construction project, and incorporates aspects similar to building any structure. Failure to recognize this fact will likely result in failure. The construction development process can be broken down into come basic components for proper site evaluation to be determined.

Bottom Characteristics

Oyster reefs have important requirements for supporting survival and growth and not all sites are capable of establishing healthy populations. Reef communities are heavy and require substantial support to prevent living oysters from settling into the bottom and dying. Oyster spat survive and grow best when placed where water flow is maximized around them. Placing seed oysters on a homogeneous bed of exposed shell is provides the best substrate of those that have been tested to date.

This resembles the conditions that were found on natural reefs as generations of oysters produced subsequent generations. Unfortunately, those conditions are rare in Chesapeake Bay today as many once productive reefs have been covered with sediment, settled into the bottom or both. Care must be taken

to evaluate current conditions prior to placing seed oysters to minimize loss from marginal or poor conditions. This can only be accomplished using new assessment techniques that have resulted in seed survival that is more than double that seen when bottom type was inadequately surveyed.

Site selection begins by choosing locations that once produced abundant oysters. However, one should not assume that historical performance is a valid indication of current conditions at the location. Many formerly productive sites are poor candidates for restoration today due to changes in bottom conditions, however some could be made acceptable using proper techniques. Two basic approaches exist to improve conditions at a site. First is to deploy additional material to stabilize the bottom and improve bearing strength and water flow to planted seed. On sites that have existing shell that is slightly covered with sediment it may be possible to remove overburden and expose cultch prior to planting new seed.

The process should be approached carefully and only after a thorough and accurate survey has been conducted. Then, cost estimates can be made to determine the budget required for site rehabilitation. Both the removal of existing sediment and the addition of new material is expensive, but only after it has been evaluated can a decision be made to proceed or abandon the site in favor of a better location.

Water Quality Parameters

Success also depends on water quality. There is great variation within oyster producing regions of Chesapeake Bay. Failing to consider the effects of water quality variation on oyster growth, survival, and recruitment will lead to poor success for oysters on the site. Some sites are assisted by natural recruitment while others it almost non-existent. Variation in natural recruitment is difficult to predict, however long-term surveys of spat fall that have been conducted since 1939 clearly show huge variation in Chesapeake Bay. This is both regional and annual and the long-term trend has been downward. Natural recruitment is much reduced today from the 1960's and is a principal cause of Maryland's reduced oyster population. The causes of this include: lack of sufficiently dense populations of adults able to spawn; lack of substrate for setting, and; degraded water quality.

Restoration using hatchery seed does not depend upon natural recruitment for ultimate success but sites that receive even moderate spat sets will show more productivity. Reasonable predictions about the probability of natural recruitment must be considered in metrics for restoration. Predictions must rely on recent surveys and not those from long ago when Bay conditions differed significantly from today.

Construction Plan

Once the site evaluation has been completed, a construction plan can be developed. This should include activities needed to complete bottom preparation and deploy seed. Preliminary surveys will determine what preparation is required and allow a cost estimate to be developed. Surveys should be conducted before and after the site is prepared to understand the conditions that exist at the outset and the results of your chosen preparation methods.

After site preparation and evaluations are completed, it will be ready to plant seed. The amount of seed depends on the target production of oysters after grow-out. The amount of seed can be calculated using

data from similar sites and should incorporate both deployment and grow-out mortality. There is a huge difference in these mortality calculations due to many factors. These include bottom type, disease, and a variety of local conditions but are important in estimating mortality losses. It must be noted that oyster seed is expensive and care should be taken to maximize its survival for a profitable business to result.

Estimating Cost

Oyster reef restoration is expensive and care should be taken to minimize cost while providing the components needed for success. Economic factors for site development include initial surveys, rehabilitation of existing substrate and/or addition of new substrate, seed cost, planting and monitoring. Traditionally, oyster shells leftover from processing plants were used as substrate for restoration but today that shell is in short supply and until new resources are identified, will remain scarce and expensive. This aged, whole shell is also vital to hatchery-based spat production and should be prioritized for this purpose. Alternative materials have been used in place of oyster shells and they exhibit different characteristics while being extremely expensive.

Rehabilitating or recovering buried shell deposits may also be expensive and some sites may therefore not be good candidates for this activity. Efforts using commercial oyster harvest gear to renovate sites has not been demonstrated to be effective. Other types of gear, such as those used in other regions of the nation, may prove effective and should be considered and evaluated for determining project success.

Monitoring is vitally important but many people considering site renovation feel that it is unnecessary while adding to the cost of the project. However, only through monitoring can accurate evaluations be made for project success and only by analyzing data from previously restored sites will we be able to continue to make improvement for future site development.

Seed cost varies by the supplier and care should be taken to evaluate seed purchased for restoration. Factors including seed size, time of deployment and delivery cost should be considered before entering into a contract. It is good business practice to request references of prior purchasers and commodity associations can often be a good source of information about the business practices of a seed supplier. In general, smaller seed is cheaper than larger seed and recent research indicates that mortalities are similar and more related to conditions at the deployment site than the size of seed at time of planting.

Evaluation Metrics

All sites must have proper surveys and metrics in place before starting a project. Failing to provide reasonable metrics for determining success will not allow a project to be evaluated for success. Metrics cannot be accurately determined without a well-designed monitoring plan and it should not be based solely on the amount of bottom stabilization material used, rehabilitation required, or seed planted. A plan based on production allows the best evaluation of a project. Examples of metrics could be: a) bushels of oysters produced per acre; b) number of days harvested, and; c) years the site was productive post development. These provide a meaningful way to evaluate efforts at restoring productive oyster reefs through hatchery-based restoration.