Restoration and Management of Rare or Declining Habitats
Oyster Bed Restoration

United States Department of Agriculture – Natural Resources Conservation Service

Conservation Practice Job Sheet ***643***

INTRODUCTION

Oyster beds were historically prolific throughout Maryland's estuarine waters, and contributed to the productivity and diversity of marine and estuarine fish and wildlife species.

In the past three decades, however, the declining oyster habitat has led to a reduction in water quality and harvest yields. In 2008, Maryland watermen harvested only 101,000 bushels of oysters compared with 2.5 million bushels in 1980.

Healthy oyster beds provide benefits including a complex living habitat and a biodiverse ecosystem for many species of fish, crabs, mussels, barnacles, and other reef dwellers. Oysters serve as a high protein food source for migratory waterfowl and other marine organisms. The water filtering capacity of oyster beds improves water quality as well as water clarity.

Life Cycle

The eastern oyster (*Crassostrea virginica*) spawns in Maryland waters when water temperatures become greater than 68°F, usually in early summer. The oyster begins its life as a free-floating organism, and within 2 to 3 weeks, develops a foot and eye spots, at which time it is referred to as *eyed larvae*. The eyed larvae settle to the bottom, where they attach to oyster shell or another hard substrate. Once attached, the oyster metamorphoses into a tiny oyster called a *spat*. The process of oyster larvae attaching to shell is known as *spat set*.

Spat grow rapidly, and can reach harvestable size in 1 to 3 years. Oysters feed by filtering plankton and other particulate matter through their gills. Feeding is greatest when water temperatures are above 50°F. Oyster growth is most successful in areas with firm and stable bottom, salinities of 10 to 30 ppt, little sediment accumulation, and oxygen concentrations greater than 5 ppm. Oysters reach sexual maturity in as little as 4 months, and can live up to 20 years.

RESTORATION

Oyster bars can be rehabilitated or restored in areas where conditions will support their growth and reproduction. A firm or hard bottom, with or without shell, can be used for oyster bar restoration.

Restoring the Shell Bed

Creation of a suitable shell base is critical for oyster bar restoration. A shell base of 2 inches minimum thickness elevates oyster spat in the water column for feeding, and reduces the potential for smothering by sediment. For best establishment, the shell should be placed on the bottom, at a rate of about 2,200 bushels per acre-inch.

On bottoms with shell covered by sediment, the shell can be reclaimed using oyster harvest dredge gear. When dredging with a net (bagged dredging), the shell is brought on deck, culled, and returned to the bottom. This method of restoration, in contrast to dredging without a net (bagless dredging), provides a greater level of certainty of the final product.

Where buried shell is not available, shell may be purchased, usually from shucking houses or organizations that recover shell from restaurants, and placed on firm bottom. Although oyster shell is preferable, clam shell may be used to create the shell base. When using clam shell for the base, try to top the bar off with whole clam shells or oyster shell. This will provide better habitat, and may reduce losses due to predation.

Seeding the Bed

In some areas of the Chesapeake Bay and its tributaries, and varying with water conditions, naturally occurring reproduction and spat set (natural spatfall) occurs at rates adequate for oyster bed establishment. In most areas, however, natural spatfall is insufficient to fully establish oyster beds, and active seeding of the beds is required.

Oyster beds can be actively seeded with spat set on oyster shell. The spat set can be facilitated in an oyster hatchery, or in a remote setting station. In both cases,

***Landowners and leaseholders please note**: If you received cost-sharing for the oyster bed restoration, be sure to check with your funding agency/organization for specific requirements.*

the eyed larvae are released into tanks containing oyster shell in bags. The controlled environment enhances the spat set efficiency, but usually requires 3 to 4 times as many larvae to achieve the desired number of spat on shell.

The bags of spat on shell (spat on cultch) are transported to the oyster bed site, and are emptied from the bags onto the shell bed.

The minimum seeding rate is 1 million oyster spat on shell per acre.

Oyster Seed Types and Availability

In the Chesapeake and Coastal Bays, only seed of the native eastern oyster is used. Three types of the native oyster are available for seeding: Diploid wild, diploid disease-resistant, and triploid disease-resistant. The diploid types are capable of reproduction, while the triploid type is not. Because the triploids do not reproduce, they can expend all of their energy on growth, and consequently can reach harvestable size in 1 to 2 years. In contrast, diploids may take as much as 3 years to reach harvestable size.

The faster growth rate of triploids has obvious advantages for commercial growers, and the shorter time to harvest may help to avoid disease. Diploids, however, have the advantage of being able to naturally maintain the productivity of the oyster bar, which can reduce the long-term costs of maintaining the bar. The use of diploids on managed bars can also help to support natural oyster bars by providing natural spatfall to area waters.

When actively seeding beds, a minimum of 70 percent diploid oyster seed shall be used, allowing up to 30 percent triploids. This option offers flexibility in oyster bed operations, while ensuring a significant portion of the oyster beds restored will be capable of natural regeneration. The use of triploids is not required.

OPERATION AND MAINTENANCE

One of the requirements of having an oyster bottom lease in the State of Maryland is to work at least 25 percent of the lease each year. In working the lease, the leaseholder is maintaining the productivity of the oyster bar. "Working" a bar includes dredging, tonging, culling, and applying shell and spat on cultch. Dredging and tonging are used to harvest oysters, but can also be used to redistribute young oysters so they may grow faster, and to remove accumulated sediment. Culling is a process in which oysters are harvested, and the young oysters and cultch are separated and placed back on the bar.

Shell replacement is another important component of oyster bar maintenance. In some cases, additional spat on cultch may be added to the bar to enhance oyster production.

OTHER CONSIDERATIONS

Oyster bed restoration activities in Maryland require permits and compliance with a number of regulatory programs, including tidal waters and wetlands regulations, public health regulations, Maryland's Oyster Sanctuaries rules, bottom aquaculture leases and permits, and commercial fisheries licenses and permits. Cooperators and participants are responsible for obtaining all necessary permits and licenses, and ensuring compliance with regulatory programs.

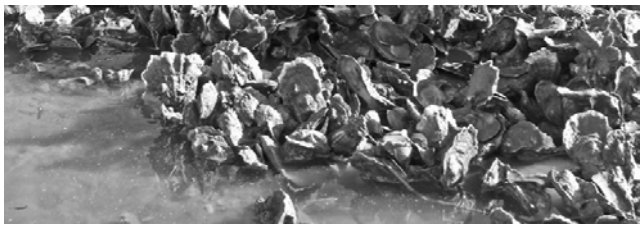
REFERENCES

Maryland Sea Grant, University of Maryland. *Oysters in the Environment*. March 31, 2011. Available at: http://www.mdsg.umd.edu/issues/chesapeake/oysters/education/oysback.htm.

Nestlerode, J.A., M.W. Luckenbach and F.X. O'Beirn. 2007. *Settlement and survival of the oyster Crassotrea virginica on created oyster reef habitats in Chesapeake Bay.* Restoration Ecology 15(2):273-283.

Puglisi, Melany P. *Crassostrea virginica*. Smithsonian Marine Station at Fort Pierce. October 1, 2008. Available at: http://www.sms.si.edu/irlspec/ Crassostrea_virginica.htm.

Wallace, Richard K. 2001. *Cultivating the Eastern Oyster, Crassostrea virginica.* Southern Regional Aquaculture Center Publication No. 42, Revised August 2001.



OYSTER BED RESTORATION

Name:		**Date**:
County:	**Farm and Tract No**:	**Assisted by**:

License Type: ☐ Unlimited Tidal Fish (TFL) ☐ Commercial Oyster Harvester (OYH) ☐ None

Site Information

Size of Lease/Bed: acres	**Name of Waterway**:
Size of Area to be Restored: acres	**Water depth at mean lower low water**: Min. ft Max ft (i.e. range over lease/bed area. Available from NOAA Navigation Charts.)

Type of Control: ☐ Lease ☐ Riparian Rights ☐ Other:

Substrate: ☐ Cultch ☐ Mud with cultch ☐ Sand with cultch ☐ Hard bottom ☐ Mud ☐ Sand

MDE Shellfish Growing Waters classification: ☐ Approved ☐ Conditionally Approved ☐ Restricted

If the area is restricted, identify relay location and plan for relay:

Waters classifications maps can be found at:
http://www.mde.state.md.us/programs/Marylander/CitizensInfoCenterHome/Pages/citizensinfocenter/fishandshellfish/pop_up/shellfishmaps.aspx

Implementation Plan

Restoration Method

☐ Option 1: Dredging, no seeding
☐ Option 2: Dredging and seeding
☐ Option 3: Dredging/purchasing shell and seeding
☐ Option 4: Purchasing shell and seeding

Types of Eastern Oyster to be Cultivated

☐ Diploid wild
☐ Diploid disease-resistant
☐ Triploid Percentage: (maximum of 30%)

Type of Shell for Base

☐ Oyster shell ☐ Clam shell

Source of Spat on Cultch

☐ Purchased ☐ Remote Setting

Source of Spat

Name:
Address:

Implementation Dates

Restore/rehabilitate oyster bed:
Seed bed:

Seeding Quantity

Number of spat per acre:
Minimum of 1 million spat/acre

Describe location of the land base that will be used to support this aquaculture project (i.e. private pier, commercial landing:

Describe your proposed activities on the lease site, including any and all methods that will be used for shellfish cultivation, maintenance, and predator control:

OYSTER BED RESTORATION

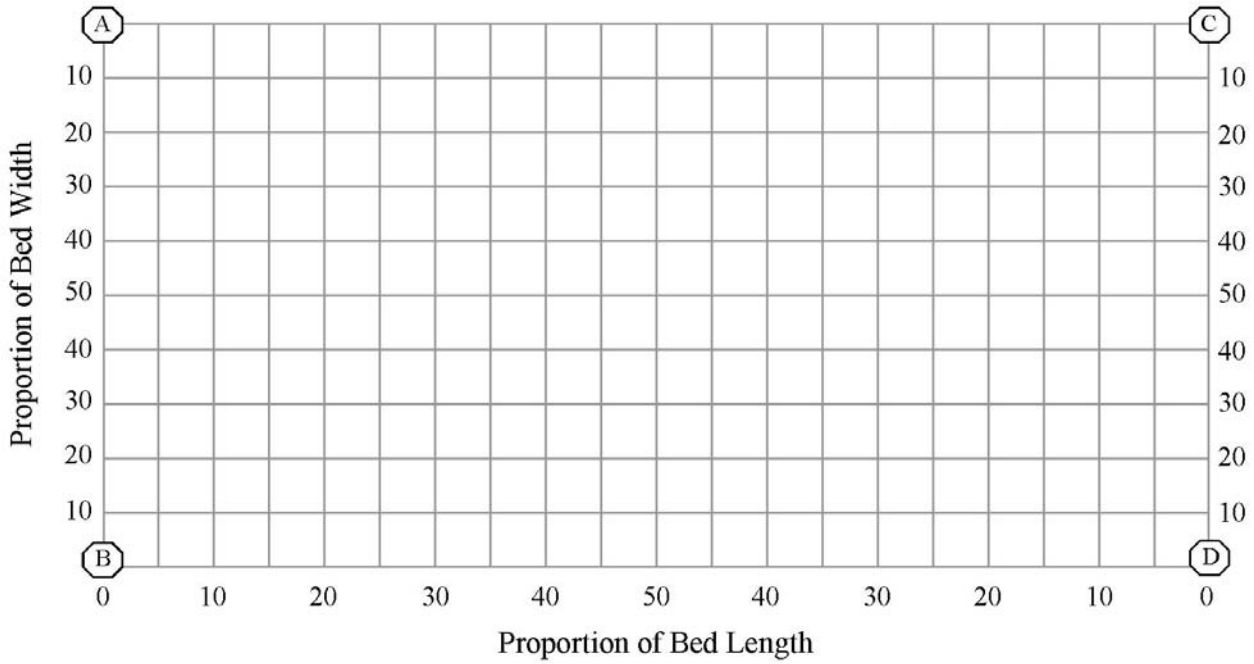
Describe the labor, harvesting methods, and harvesting equipment to be used:

Operation and Maintenance

The State of Maryland requires all bottom leaseholders to work at least 25 percent of the lease each year. In working the lease, the leaseholder is maintaining the productivity of the oyster bar. Operators shall maintain their oyster bars utilizing accepted practices and activities, including dredging, tonging, culling, and shell and spat on cultch supplementation.

PLAN VIEW OF OYSTER BED

Identify the area of the lease/bed that will be restored. Assume the bed is rectangular and has the corners A, B, C, and D. Shade or cross-hatch the portion that will be restored. (May be provided on separate map or sheet.)

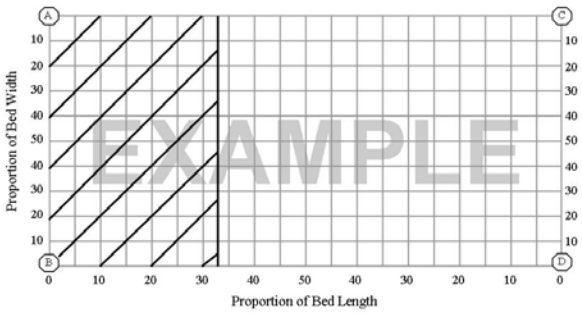


Enter the lat/long coordinates for corners of the lease or bed area:

A:	N	W	C:	N	W
B:	N	W	D:	N	W

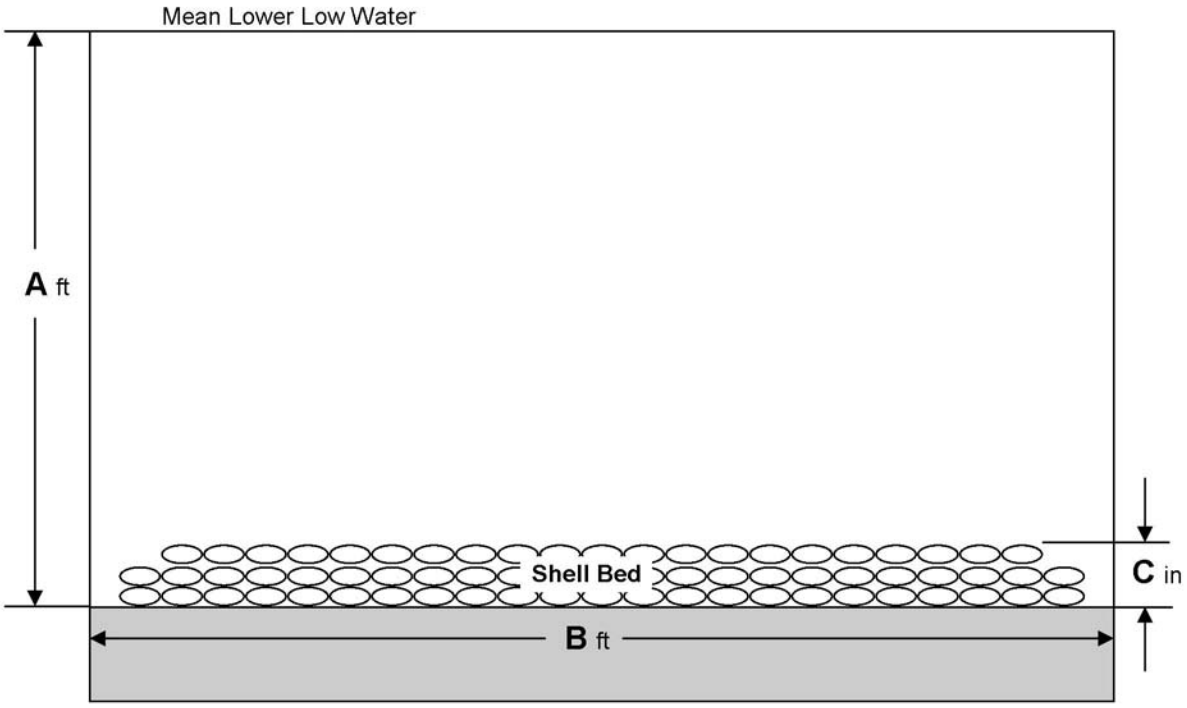
EXAMPLE

In the example on the right, the cooperator would be identifying approximately 1/3 of the lease/bed area to be restored. The restored area would consist of 1/3 of the length and the full width, and would be located on the side of the lease with corners A and B.



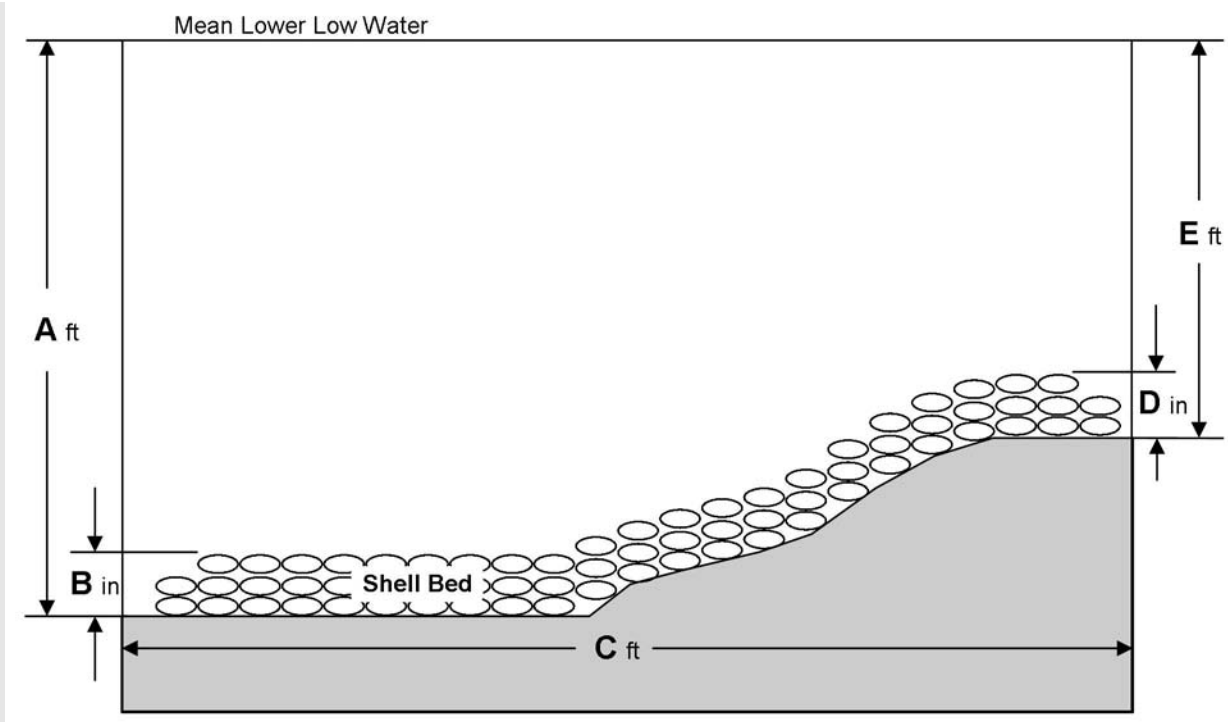
CROSS SECTION DIAGRAM OF OYSTER BED

Constant Bottom Depth



A = ft B = ft C = in

Variable Bottom Depth



Side: ☐ Offshore A = ft B = in C = ft D = in E = ft Side: ☐ Offshore
☐ Nearshore ☐ Nearshore

COOPERATOR RECORDKEEPING

Instructions: Cooperators should utilize this section of the job sheet to record the amount, methods, and timing of oyster bed restoration, as well as the quantities and sources of materials.

Name:

County: | **Farm and Tract No**:

Restored Acres:

Types of Eastern Oyster

☐ Diploid wild ☐ Diploid disease-resistant ☐ Triploid: Percentage: (maximum of 30%)

Restoration Method

☐ Dredged, not seeded
☐ Dredged and seeded
☐ Dredged, placed purchased shell, and seeded
☐ Placed purchase shell and seeded

Type of Shell for Base

☐ Oyster shell ☐ Clam shell

Source of Spat on Cultch

☐ Purchased ☐ Remote Setting

Activity Implementation Dates

Check the box next to the activity when it is completed, and record the quantity and date of implementation. Not all activities are required for every restoration method.

Completed	Activity	Quantity	Units	Date Implemented
☐	Dredged shell		bushels (estimated)	
☐	Purchased shell		bushels	
☐	Placed shell		acre-inch	
☐	Purchased larvae		number	
☐	Purchased/acquired spat on cultch		bushels	
☐	Seeded bar		spat/acre	

Sources of Materials

Material	Source
Purchased Shell	
Larvae	
Spat on Cultch	

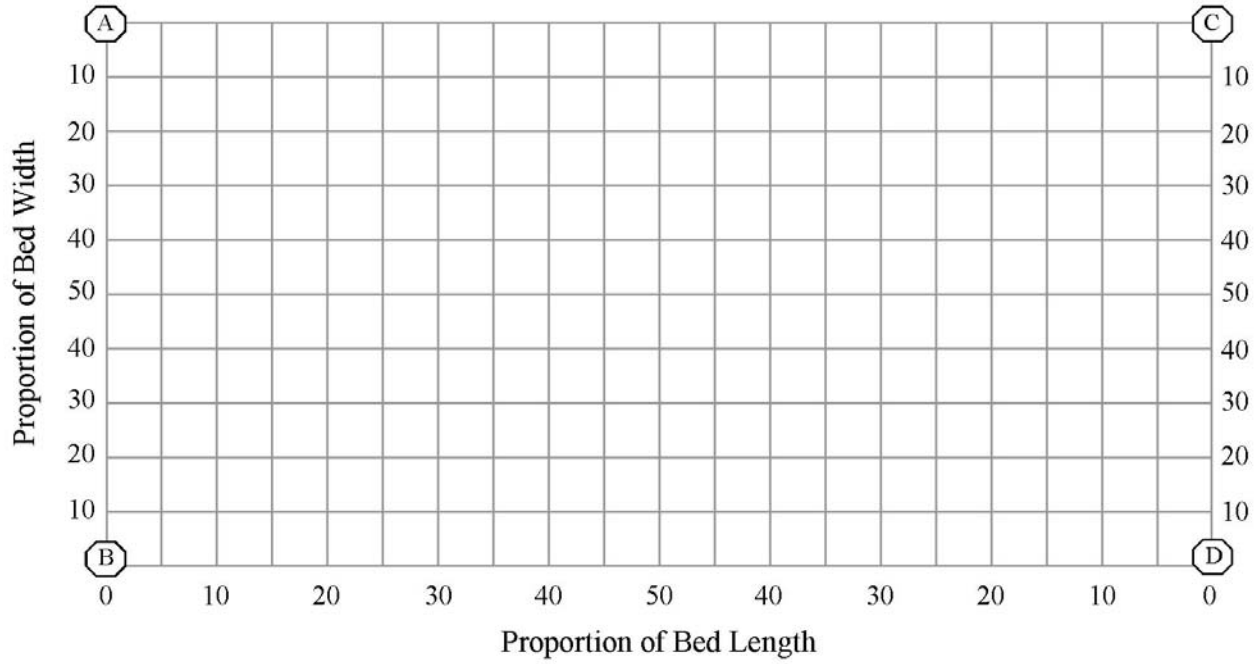
Additional Comments

Provide any additional comments about the restoration activities:

COOPERATOR RECORDKEEPING

PLAN VIEW OF RESTORED OYSTER BED

Identify the area of the lease/bed that was restored. Assume the bed is rectangular and has the corners A, B, C, and D. Shade or cross-hatch the portion that was restored. (May be provided on separate map or sheet.)



Enter the lat/long coordinates for corners of the lease or bed area:

A:	N	W	C:	N	W
B:	N	W	D:	N	W

EXAMPLE

In the example on the right, the cooperator would be identifying approximately 1/3 of the lease/bed area as restored. The restored area would consist of 1/3 of the length and the full width, and would be located on the side of the lease with corners A and B.