

UNITED STATES
DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Region
State, Federal & Constituent Programs Office



COMPLETION REPORT

Grantee: MARYLAND DEPARTMENT OF NATURAL RESOURCES

Project No: N/A

Grant No: NA86FU0526

Project Title: MARYLAND OYSTER REEF RESTORATION - 1998

Period Covered: 08/01/98 - 09/30/99

Prepared by: CHRISTOPHER JUDY

Approved by: _____

Date: JUNE 21, 2000

Statutory Funding Authority: Anadromous Fish Conservation Act
(P.L. 89-304)

- ☒ Chesapeake Bay Studies
- ☐ Endangered Species Act
- ☐ Interjurisdictional Fisheries Act (Title III of P.L. 99-659)
- ☐ Magnuson Act
- ☐ Oyster Disease Research
- ☐ Saltonstall-Kennedy
- ☐ Unallied Industry Projects
- ☐ Unallied Science Projects

FINAL REPORT

Maryland Oyster Reef Restoration - 1998

August 1, 1998 - Sept 30, 1999

NA86FU0526

[Christopher Judy]
Eric Campbell

June 21, 2000

MARYLAND DEPARTMENT OF NATURAL RESOURCES
SHELLFISH DIVISION
580 TAYLOR AVENUE B- 2
ANNAPOLIS MD 21401

FINAL REPORT

Maryland Oyster Reef Restoration - 1998

- A. Grant Number: NA86FU0526
- B. Amount of Grant:
- | | |
|---------|------------------|
| Federal | \$ 82,039 |
| Match | <u>\$ 87,613</u> |
| Total | \$169,652 |
- C. Project Title: Maryland Oyster Reef Restoration - 1998
- D. Grantee: Maryland DNR Shellfish Division
- E. Award Period: From: Aug 1, 1998 To: Sept 30, 1999
- F. Report Period: From: Aug 1, 1998 To: Sept 30, 1999
- G. Summary of Progress and Expenditures to Date:

ABSTRACT

The Maryland Oyster Reef Restoration Project 1998 was initiated in September 1998 by the Shellfish Division of the Maryland Department of Natural Resources (DNR). The objectives of the project were to demonstrate the economic and biological effectiveness of restoring naturally existing 3-dimensional oyster bottom by planting a veneer of shell rather than creating the relief by building piles made entirely of shell; to populate the restored sites by seed oyster plantings and natural spat set, if it occurred on site; and to attract participation by other oyster restoration groups in Maryland via the planting of seed oysters.

The sites restored by this grant were located within oyster sanctuaries in order to develop long term, permanently protected oyster populations and reef communities. One sanctuary is in the Choptank River at Cambridge, Maryland and the other is in the Severn River at Annapolis, Maryland. ✓ o/c

In the Choptank River sanctuary a section of Shoal Creek oyster bar was restored by planting oyster shells in two configurations: flat and mounded. The flat planting was actually a layer of shell planted a few inches thick on top of a naturally occurring underwater hill 10 acres in size and rising about 8 feet above the surrounding bottom. The layer of shell provided new habitat over a large acreage for natural recruitment and as a base for planting young seed oysters. The use of an existing hill produced 3-dimensional habitat on a large scale. The second shell planting constructed a series of shell piles built adjacent to the natural hill, to a similar height in the water column as the natural hill. Man-made 3-dimensional habitat was compared to natural 3-dimensional habitat based on cost and acreage of bottom covered.

To develop the oyster population and reef community, DNR planted hatchery seed oysters and natural seed oysters at the site. Additional hatchery seed was planted the second year as part of the Corps of Engineers/DNR Oyster Project. By receiving the extra seed the site served a broader audience of oyster restoration partners, a design feature of the reef project. These various seed plantings accelerated oyster reef community development beyond what local spat set could do for the site.

Results of the Choptank project showed that using naturally existing 3-dimensional habitat for shell planting yields about 10 times more acreage at about 1/10 the cost per acre compared to the method of constructing man-made shell piles. The increased acreage yields increased oyster biomass for the site and the lower cost per acre results in more efficient use of funds. The natural hill cost \$2,293 per acre and the man-made piles cost \$27,080 per acre. At the completion of the Choptank project, \$31,000 remained for shells. The funds were used in the Severn River in 1999.

In the summer of 1999, two oyster bars at the mouth of the Severn River were restored by the planting of oyster shells and seed oysters. Lake Ogleton bar, a 10 acre natural underwater hill, was utilized much the same as the Shoal Creek natural hill: to maximize acreage, reduce cost per acre, provide a large area for seed planting to maximize biomass, and to attract partners in seed planting. A major seed planting on the Lake Ogleton site was made by the Oyster Recovery Partnership and the University of Maryland.

The other Severn River site, Tolly Point bar, was restored with a flat 10 acre shell planting. Natural contour was very limited at the site, therefore the shells were used to improve the existing bottom to prepare the site for a 3-dimensional man made shell pile project in the summer of 2000 (see 1999 project quarterly reports). A portion of the flat site not to be occupied by the array of piles will be available for seed planting by partners.

The Choptank River and Severn River projects conclusively demonstrated the benefits of planting on natural contour, the ability of such projects to leverage seed from other oyster restoration groups, the application of hatchery seed to restoration projects, the suitability of the chosen sanctuary sites for meeting program objectives, and the importance of restoring good natural bottom rather than creating bottom where none existed before.

This grant funded the construction of two basic types of habitat and the stocking of oysters on the sites. These tasks were completed. Oyster reef community development is underway at these sites. However, lower levels of oyster biomass were attained compared to what potentially could have been achieved due to commitment of some funds to expensive small acreage shell piles.

Signature of Principal Investigator

Date

OBJECTIVES

The Maryland Oyster Reef Restoration Project 1998 was initiated in September 1998 by the Shellfish Division of the Maryland Department of Natural Resources (DNR). The three restoration sites selected for this grant are shown in Figure 1 and are:

- (a) the Choptank River sanctuary at Cambridge,
- (b) the Severn River sanctuary at Annapolis, and
- (c) the Plum Point sanctuary in the mid-Chesapeake Bay on the Western Shore

The Choptank River and Severn River sites were the priority sites for the project as stated in the 1998 project plan since Plum Point had already received a significant restoration effort in earlier years. All of the funds in this grant were used for the Choptank and Severn sites.

The objectives of the project were to demonstrate the economic and biological effectiveness of restoring naturally existing 3-dimensional oyster bottom by planting a veneer of shell rather than creating the relief by building piles made entirely of shell; to populate the restored sites by seed oyster plantings and natural spat set, if it occurred on site; and to attract additional seed plantings by oyster restoration groups in Maryland who partner with DNR. The text from the 1998 approved plan reads:

"Within the sanctuary areas, existing three dimensional habitat which is cultch limited will be improved by the planting of dredged oyster shell on top of the natural bottom. By utilizing existing relief areas, it is not necessary to plant large piles of shells which result in limited acreage being improved. This plan for 1998 will maximize both acreage and quality of habitat. Oyster populations will be created on this new habitat by either natural spat set or the planting of seed oysters. The shells and the oysters together will produce a viable oyster reef community, protected from harvesting."

"The shelled areas will also provide planting sites for use by oyster restoration partners working with DNR (ORP, CBF, oyster gardeners, COE, UnMd, etc). Therefore, the funds used this year will launch many years of oyster restoration effort in the sanctuaries, a goal of the Oyster Division."

JUSTIFICATION

Various State and Federal agencies recognize the importance of oyster habitat and oyster populations to the health of the Chesapeake Bay, especially within protected areas that can't be harvested. Living oyster reefs provide many ecological benefits: brood oysters and production of oyster larvae, consumption of excess algae, development of diverse benthic communities, and enhancement of essential fish habitat which is a priority habitat of Federal and State agencies.

This project addressed the oyster habitat and sanctuary objectives found in the Oyster Management Plan, the Oyster Roundtable Action Plan, and the Chesapeake Bay Aquatic Reef

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Habitat Plan and supports the goals of DNR, NOAA, EPA, ORP (Oyster Recovery Partnership), and CBF (Chesapeake Bay Foundation).

This project efficiently utilizes limited and valuable shell supplies to maximize improvements to oyster habitat in areas closed to harvest.

SHELLS and SEED OYSTERS

The shells used in this project were dredged from buried, non-productive oyster bars in the upper Chesapeake Bay between Pooles Island and Fairlee Creek (Figure 1). DNR contracted shell dredging, washing, transportation and planting with C.J. Langenfelder and Son, Inc. of Love Point, Maryland. This contractor has worked for DNR since 1960, dredging and planting oyster shells for oyster restoration with equipment specifically designed and built for this work. Dredged shells are a finite and valuable resource. The shells are crucial for oyster restoration and also as fish habitat. Upper Bay fishermen value the undredged upper Bay shell hills as fish habitat therefore every use of the shells must be wisely decided.

Hatchery seed oysters were produced at DNR's Piney Point facility where oyster larvae were placed in tanks of water containing about 1,000 bags of oyster shell obtained from shucking houses. The larvae attached to the shells yielding spat. The bags were moved to the project sites by trucks, boats and barges. The bags were cut open and the shells with attached spat were shaken out and planted on the bottom.

Natural seed was produced by DNR in bay waters via dredged shell planting in areas of high natural spat set. The planted shells caught natural spat in the summer and the seed were later moved to planting sites. DNR contracted seed moving with Maryland watermen using large workboats equipped with dredges to harvest the oysters and water pumps to wash the oysters overboard.

WORK ACCOMPLISHMENTS

Scheduled tasks are organized below by Reporting Quarter and by Area. Actual accomplishments are described in the text which follows.

Work Tasks by Quarter

<u>Quarter</u>	<u>Scheduled Tasks</u>
First Quarter 8/98-10/98	Focus on Shoal Creek in the Choptank River sanctuary site at Cambridge Survey the area and select sites for shell planting Plant dredged shells on about 10 acres to a thickness of 2" to 4" Plant dredged shells in 4 man-made piles about 5' high Plant hatchery seed if available this quarter
Second Quarter 11/98-1/99	No tasks were scheduled DNR reviewed the project to determine if changes were needed
Third Quarter 2/99-4/99	Plant natural seed in April 1999 Decide how to use the \$31,000 remaining from the Choptank site
Fourth Quarter 5/99-7/99	Use the \$31,000 in the Severn River Survey the area and select sites for shell planting Plant dredged shells on two 10 acre sites Survey the piles to confirm location and size Plant hatchery seed on the sites

Work Tasks by Area

<u>Sanctuary Site</u>	<u>Scheduled Tasks</u>
Choptank River	Focus on Shoal Creek bar Survey the area and select sites for shell planting Plant dredged shells on about 10 acres to a thickness of 2" to 4" Plant dredged shells in 4 man-made piles about 5' high Plant hatchery seed if available Plant natural seed in April 1999 Decide how to use the \$31,000 remaining from the Choptank site
Severn River	Use the \$31,000 in the Severn River Survey the area and select sites for shell planting Plant dredged shells on two 10 acre sites Survey the piles to confirm location and size Plant hatchery seed on the sites

Choptank River - Completed Tasks

Site Selection and Survey

The Choptank River sanctuary spans a great distance upstream and downstream of Cambridge and contains numerous oyster bars suitable for restoration as indicated by the darkened polygons in the map in Figure 2. No harvesting is allowed throughout the entire Cambridge sanctuary area due to sewage treatment outfall from Cambridge. The area is closed to shellfish harvesting by the Maryland Department of the Environment.

To select the best site for the project DNR Shellfish Division biologists examined the Yates oyster bar charts (1906), the current oyster bar charts (1983), conducted field surveys and depended on their knowledge of the area gained over the past 20 years.

Various sites were considered along the 12' to 18' contour that runs somewhat parallel to the deeper channel waters, since oyster bars frequently occur on edges of channels. The sites were surveyed by DNR shellfish biologists aboard the vessel MISS KAY, using a video depth finder to visualize the bottom. This equipment differentiates between sand, mud and shell bottom and mixtures of these bottom types. Potential sites were identified with this gear and then a sounding pole and dredge were used to verify the video depth finder results, to test the bottom for firmness and shell, and to determine the exact boundaries. None of these sites had the firmness of bottom or the acreage needed for this project. These sites could be restored but at much greater expense.

Another site surveyed by the same methods was Shoal Creek oyster bar. It was superior to the previous sites and was selected for the project (Figure 2). It had firm shelly bottom, natural high relief, strong tidal currents and a remnant population of large oysters indicating long term survival at the site (a desired feature of the reef project). In addition, the site experiences periodic spat set, another desired feature, though the setting levels are low and irregular year to year.

DNR surveyed Shoal Creek bar to select the exact location for the project which needed two structural features: an underwater hill with natural 3-dimensional contour and adjacent bottom that was deep enough and firm enough on which to build man-made shell piles about 5' high. The site that was found was about 12' deep in the middle and about 14' deep at the edges, then it dropped sharply on its channelward sides to about 20' and deeper. The hill was about 10 acres in size. The bottom to the southeast of the hill was suitable for the man-made piles, with about 15' to 18' of water and firm bottom. These basic features can be seen on the nautical chart in Figure 3. Buoys were placed by DNR to mark the 10 acre hill and the deeper area for shell planting.

Shoal Creek History

Shoal Creek bar has been closed to harvest for decades due to high fecal coliform counts. This closure, plus the occurrence of periodic spat sets and the general suitability of the site for

oysters, built up the oyster population over time. The storehouse of large oysters were attractive to the fishery so on numerous occasions these "pollutes" were transplanted to commercial bars for depuration and harvest. Transplantation and periodic disease impacts resulted in a low density, remnant population of large brood oysters. In addition to the removal of oysters, much shell was removed (shell was harvested by the dredge boats along with the oysters).

This Federally funded reef restoration project provided the opportunity to improve the habitat via shell planting, to re-establish a significant population of brood oysters via seed planting and natural set, and to develop a rich benthic reef community. The site is being managed as a sanctuary, i.e. no more "pollutes" will be transplanted from the site.

Shell Planting

DNR staff buoyed the planting area and supervised the plantings as they occurred to keep the shell barge within the correct area and away from deep muddy bottom or shallow sandy bottom. Also, DNR staff checked the bottom during planting to assure correct coverage of the bottom. Figure 4 illustrates the shell plantings made at Shoal Creek.

Natural Hill Planting

Dredged shells were planted on September 3rd and 4th 1998 (73,285 bushels), producing a layer about 3 to 4 inches thick on the hill. The shells were washed overboard with large water canons as a tug boat towed the shell barge through the area. The site was periodically checked with a sounding pole to verify that the shells were forming a layer over the entire area. The final product was a rehabilitated 10 acre 3-dimensional structure for oyster restoration. A list of latitude/longitude coordinates for the natural hill shell planting is in Appendix 1.

The shell contractor only billed for 55,832 bushels so the cost for this grant was a skewed \$22,934.49 or \$2,293 per acre. This compares to about \$100,000 per acre for the man-made shell pile approach seen in prior projects funded by the reef program. If billed in full, the total cost would have been \$30,104.08 or \$3,010 per acre. The billing was less than the actual volume planted since more shells arrived on the barge than requested. DNR's contractor didn't want the excess returned so the shells were planted at no charge. The volume of shells expected was 3,343.22 cubic yards and the volume delivered was 4,388.35 cubic yards so the excess volume was 1,045.13 cubic yards (17,453.67 bushels at \$7,169.59). Prices for the natural hill planting were \$6.86 per cubic yard and there were 3,343.22 cubic yards billed for the natural hill planting, totaling \$22,934.49. There are 16.7 Maryland oyster bushels per cubic yard. The excess shells are a contribution but are not claimed as match since they are not needed as match.

Pile Planting

Dredged shells were planted on September 10, 1998 just east of the 10 acre site to create piles (59,900 bushels total). Five piles were made, but two of the piles were so close together they may be considered one large pile. A list of latitude/longitude coordinates for the piles is in Appendix 1. It is estimated that the piles range from 10,000 bushels up to 15,000 bushels. Pile height was about 5' to 7' at construction. The man-made piles covered about one acre total and cost \$27,080.87 or about 10 times the cost per acre as the method that used natural relief bottom (based on the billing). From these results, it is clear that utilizing naturally existing 3-dimensional oyster bottom in need of restoration is more cost effective than creating

3-dimensional bottom on a small scale with shells.

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It was difficult to control pile shape and the volume of shells used per pile due to the construction method. The shell barge was held in position with spuds and a portion of the shells were washed off. The barge was then rotated on one spud to reposition the barge and more shells were washed off. This was done until all of the shells were planted. It is unknown exactly how many bushels were used for each pile. This experience demonstrated that a crane should be used to make piles so the location and volume of shells can be precisely controlled. A crane was used successfully by DNR for 15 other shell pile projects, but the contractor's large crane couldn't fit under the Choptank River bridge to get to the site.

Prices for the pile planting were \$7.55 per cubic yard and there were a total of 3,586.87 cubic yards planted in piles (16.7 Maryland oyster bushels in a cubic yard). A total of 133,185 bushels (7,975.22 cubic yards) were planted for the project, which includes the extra shells. The total cost was \$50,015.36 to the grant, which does not include the extra shells. At the completion of the Choptank project funds remained in the grant for the Severn River and Plum Point.

Seed Planting

Soon after the shells were planted at Shoal Creek, hatchery seed oysters from Piney Point of ½ inch to 1 inch in size were planted on both the natural hill and one of the piles. A list of the latitude and longitude coordinates is found in Appendix 2. A total of 1,784,393 spat were planted in 1998 (728,000 spat on September 9 and 1,055,993 spat on November 12). The DNR match of 5 million hatchery seed was not met in 1998 due to very low salinity at the hatchery which lowered production.

Hatchery seed oysters were supposed to have been used exclusively, but to make up the seed deficit, natural seed oysters were planted in April 1999 and comprised a large portion of DNR's seed match. There were 5,136 bushels of natural seed planted on the western side of the hill. The seed counted 379 small oysters per bushel, yielding 1,946,544 oysters for the site. The natural seed were from the 1997 set, therefore they were a year older and larger than hatchery seed that might have been used. Being older, the natural seed spawned in the summer of 1999 whereas younger hatchery seed would have taken another year to spawn. The use of natural seed was a plus for the project.

In the summer of 1999, hatchery seed oysters were available again and were planted on the hill to continue stocking the large 10 acre area. There were 480 bags of shell (1/3 bushel size) planted which contained an average of 1517.5 spat per bag (9.97 spat per shell), totaling 1,055,993 spat. The average size of the spat were 20 mm. These seed were not funded by the reef grant, but were provided by DNR as part of another project it was conducting with the Corps of Engineers. Therefore, the 1999 hatchery seed were match for the DNR/COE Project and not this reef project. This shows the ability of the reef project and DNR to attract restoration partners to a site.

In total there were 2,840,386 hatchery spat and 1,946,544 natural oysters planted at the Choptank site. For all seed plantings, DNR surveyed the sites, placed buoys, supervised the harvest and planting of the seed oysters, sampled the material to count the number of oysters per bushel, and kept the paperwork to document the plantings. Figure 4 illustrates the seed plantings.

Severn River - Completed Tasks

Site Selection and Survey

In the summer of 1999, \$31,000 remaining from the Choptank project were committed to the Severn River sanctuary. The Severn River sanctuary spans the entire river and contains many historic oyster bars (Figure 5). However, only a few bars are suitable for restoration projects. No oyster harvesting is allowed in the Severn River due to sewage treatment inputs.

To select the best site for the project DNR Shellfish Division biologists focused in an area downstream of the Route 450 bridge since this portion of the river provides the best habitat and salinity regime for both long term oyster survival and possible spat set in the summer. Yates oyster bar charts (1906), the current oyster bar charts (1983), field surveys and past knowledge of the area were used for site selection.

Various sites were considered along the 12' to 18' contour that runs somewhat parallel to the deeper channel waters, since oyster bars frequently occur on edges of channels. The sites were surveyed by DNR shellfish biologists aboard the vessel MISS KAY, using a video depth finder to visualize the bottom. This equipment differentiates between sand, mud and shell bottom and mixtures of these bottom types. Potential sites were identified with this gear and then a sounding pole and dredge were used to verify the video depth finder results, to test the bottom for firmness and shell, and to determine the exact boundaries. Two locations were selected for this project: Lake Ogleton and Tolly Point (Figure 5). Other sites were suitable but they were reserved for oyster projects with DNR's other partners.

Lake Ogleton (a name given to the reef site by DNR) was selected due to its 3-dimensional natural contour over a large acreage, about 10 acres. The Choptank project clearly identified the value of using natural hills to maximize the use of a given budget and quantity of shells, and therefore reef restoration benefits. Lake Ogleton hill lies about .8 miles NE from the actual Lake Ogleton, a small embayment on the southern shore of the river. The Lake Ogleton site is about 14' deep in the middle of the hill and drops to about 20' deep on three sides. The shoreward side becomes shallower and sandier toward shore. The hill is composed of remnant oyster shell and a sparse population of oysters inhabited the site due to the marginal quality of the habitat.

The other Severn River site, Tolly Point bar, is about 14' to 17' deep. This site is not a natural 3-dimensional hill, due to its gentle slope. The Tolly Point site had marginal amounts of shell.

Shell Planting

DNR staff supervised the shell planting, placing buoys on site to keep the shell barge within the correct area and away from deep muddy bottom or shallow sandy bottom. Also, DNR staff checked the bottom during planting to assure correct coverage of the bottom. H

Lake Ogleton was planted with 43,910 bushels of shells on July 7, 1999 spread over 10 acres. Spreading this veneer of shells on a site with natural 3-dimensional contour maximized the benefit of the shells and prepared the site for a major seed planting between July 12 and August 11 by the Oyster Recovery Partnership and the University of Maryland Horn Point hatchery (two of DNR's oyster partners) under the 1999 Maryland Oyster Reef Restoration Project. See the 1999 quarterly reports for details.

Tolly Point was planted August 24, 1999 with 47,617 bushels of shells on 10 acres. Since Tolly Point does not have obvious natural 3-dimensional contour the shells were planted to prepare the site for the 1999 Maryland Oyster Reef Restoration Project of mound building at Tolly Point and to provide a base for seed planting by DNR and other partners. The mound building project will form an "upside down egg carton" structure (see 1999 reef report). Tolly Point did not receive seed under this grant, but it will receive seed under next year's reef grant.

The Lake Ogleton shells cost the grant \$17,090.71. The Tolly Point shells cost the grant \$13,909.29 and DNR contributed \$4,624.38, but DNR's contribution was not claimed as match for this grant.

The dredged shell plantings in the Severn River met three goals. The shells (a) improved habitat on which to plant seed oysters, (b) prepared the sites for future restoration projects, and (c) provided habitat for spat set, which might occasionally occur in the river during high salinity drought conditions.

DISCUSSION OF COMPLETED TASKS

Site selection was crucial to this grant in order to achieve the objectives. Natural hills of suitable size and bottom type were essential. Such hills frequently exist around the State but they are not found everywhere, therefore careful and deliberate surveys were required.

For both Shoal Creek and Lake Ogleton, natural hills were successfully located after examining oyster charts and surveying the areas. The bottom was determined to be firm enough for the shell and seed plantings by use of a video depth finder, sounding pole and oyster dredge. The sites were well suited to demonstrate the objectives of the project and to sustain sanctuary populations over time.

At Shoal Creek the cost difference between using the natural hill and making man-made shell piles demonstrated the effectiveness of using natural contour to provide 3-dimensional habitat for oyster reef restoration. The natural hill method cost about \$2,293 per acre and the man-made pile approach cost \$27,080 per acre. In terms of acreage, the natural hill method yielded about 10 times the acreage for a given budget. Higher acres restored indicate that more of the desired benefits of oyster restoration projects can be achieved: oyster biomass, reef community development, oyster larvae production, potential increases in spat set, algae consumption, and enhancement of essential fish habitat and achievement of multi-species

Natural seed oysters were not proposed in the project plan, but were used to augment a low supply of hatchery seed in 1998. This was discussed earlier in this report.

EXPENDITURES

Federal funds paid for shell plantings at the Choptank site and the two Severn River sites. Shells were used to plant natural 3-dimensional hills and to create small scale man-made mounds of shell. Federal funds also paid for a DGPS unit that was used to locate plantings and to provide a site visit for the Federal grant manager. State funds were used for additional shell at Tolly Point in the Severn River and to plant seed oysters at the Choptank River site.

The shell and seed expenditures below are considered final and differ slightly from data reported in quarterly reports.

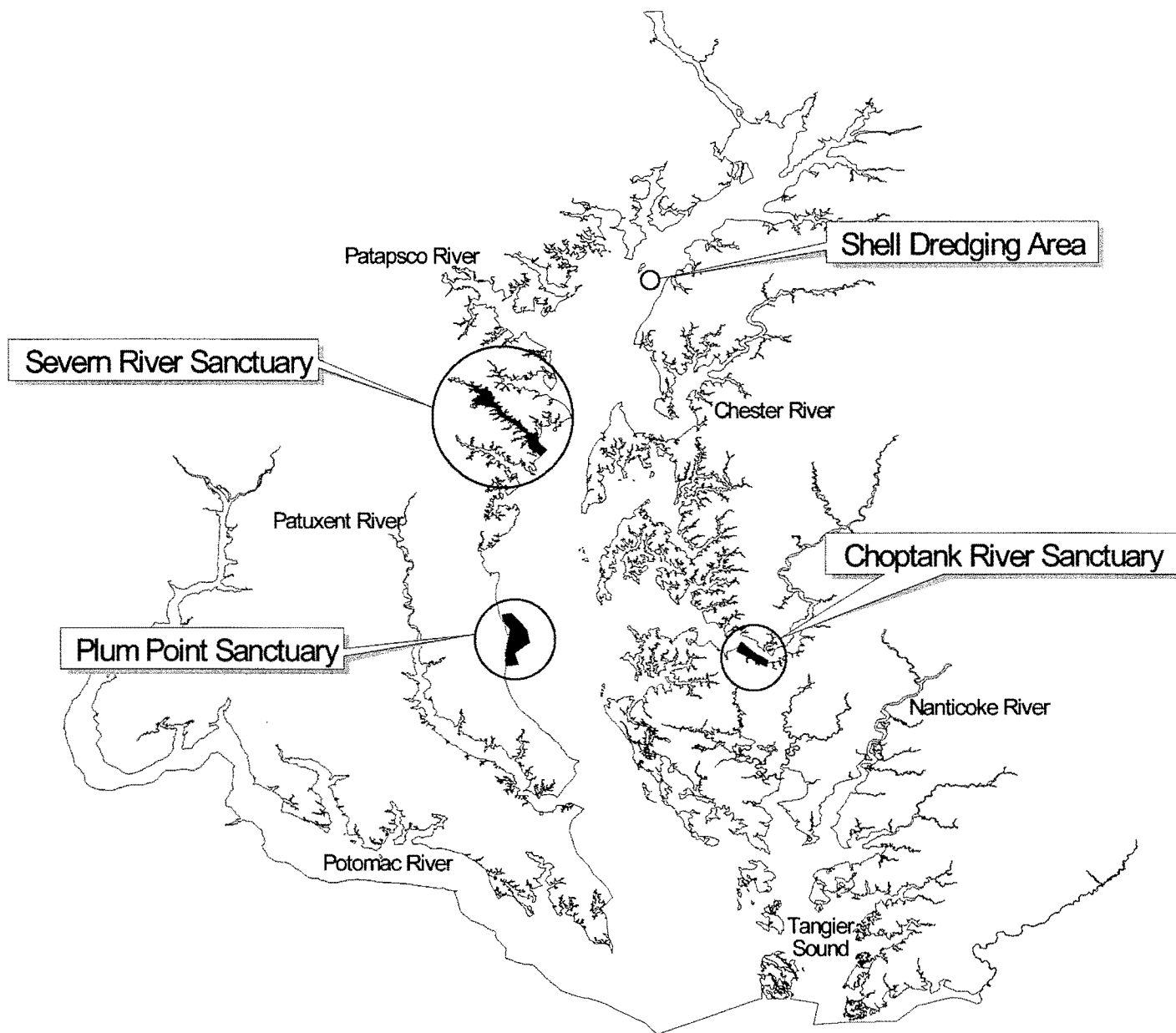
Table 1: Seed Planting Summary

<u>Bar Name</u>	<u>Hatchery Seed</u>	<u>Natural Seed</u>	<u>Total Seed</u>
Choptank River			
Shoal Creek	2,840,386	1,946,544	4,786,930 (5M was goal)
Severn River			
Lake Ogleton	Refer to 1999 Reef Program Quarterly Report for seed numbers. Seed were planted under that project.		
Tolly Point			

Table 2: Shell Planting Expenditures for Habitat Restoration

<u>Bar Name</u>	<u>Acres</u>	<u>Bushels</u>	<u>Federal Funds</u>	<u>DNR Funds</u>
Choptank River				
Shoal Creek				
Natural Hill	(10a)	73,285	\$22,934.49	\$ 7,169.59
Man-made Piles	(1a)	<u>59,900</u>	<u>\$27,080.87</u>	
		133,185	\$50,015.36	
Severn River				

Maryland's Chesapeake Bay Reef Sanctuary Areas For 1998 Reef Program



Choptank River Sanctuary Historic Oyster Bars

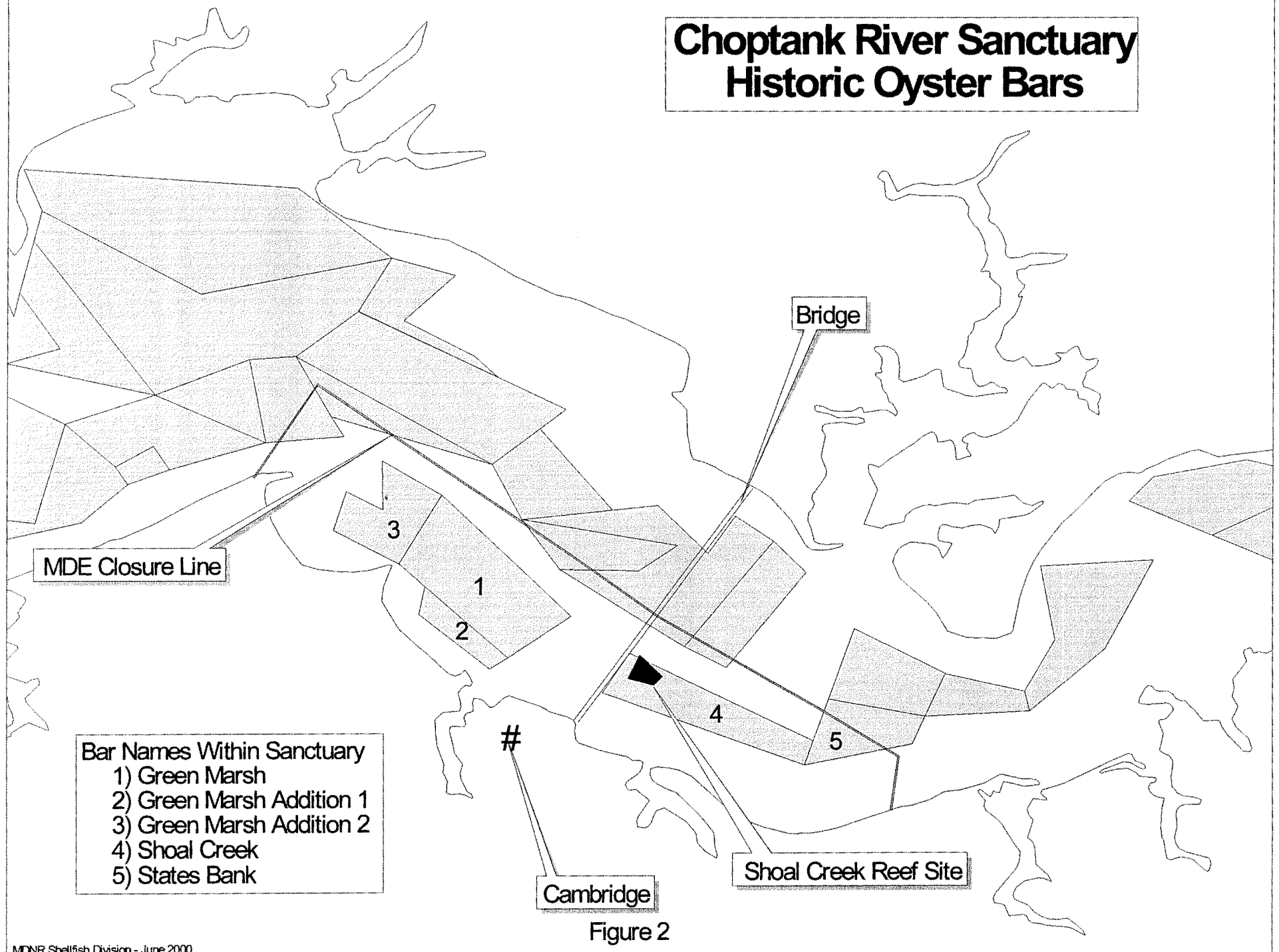


Figure 2

Choptank River Reef Site

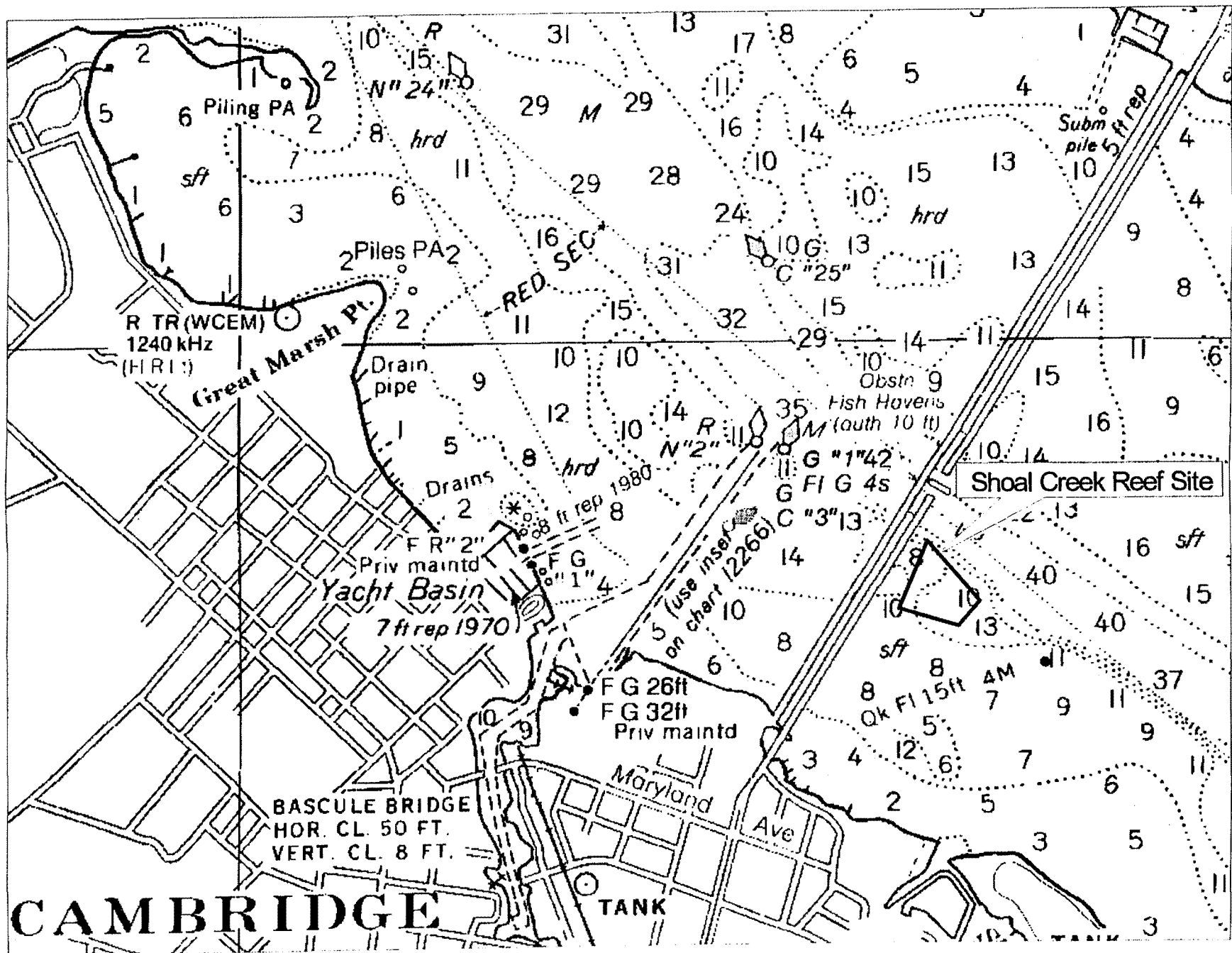


Figure 3

Shoal Creek Reef Site Choptank River 1998-1999

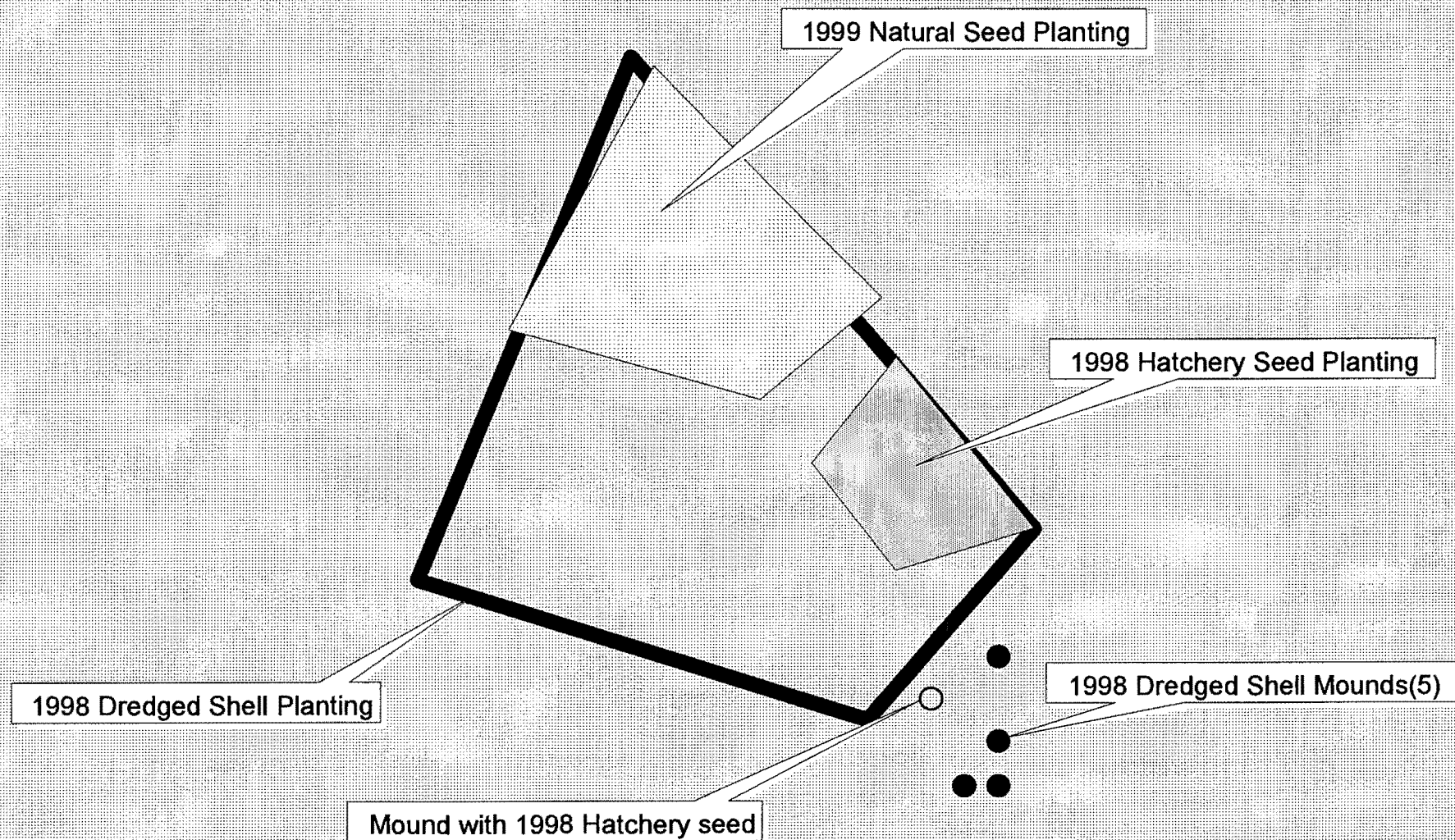


Figure 4

Severn River Sanctuary Historic Oyster Bars

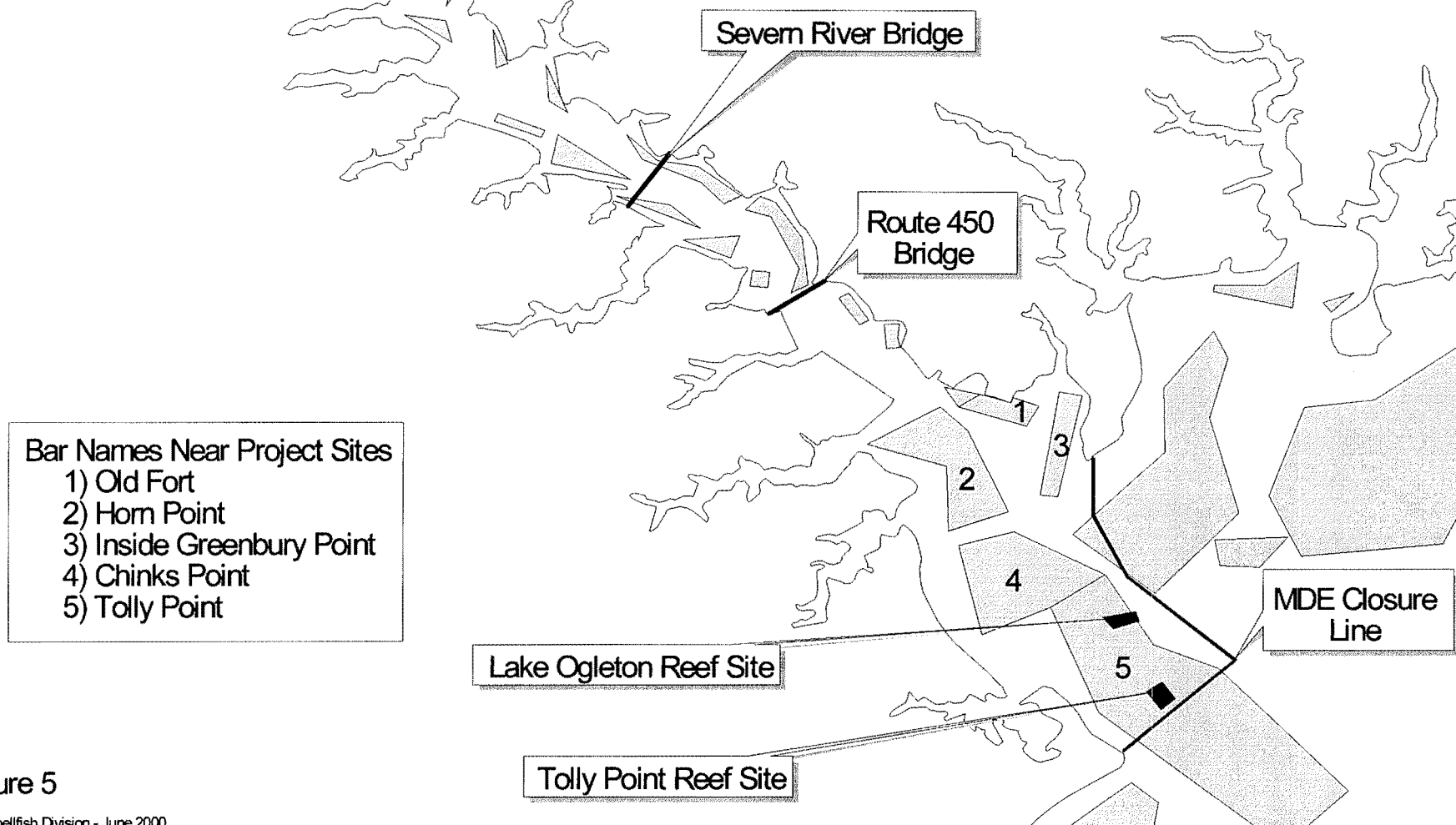


Figure 5