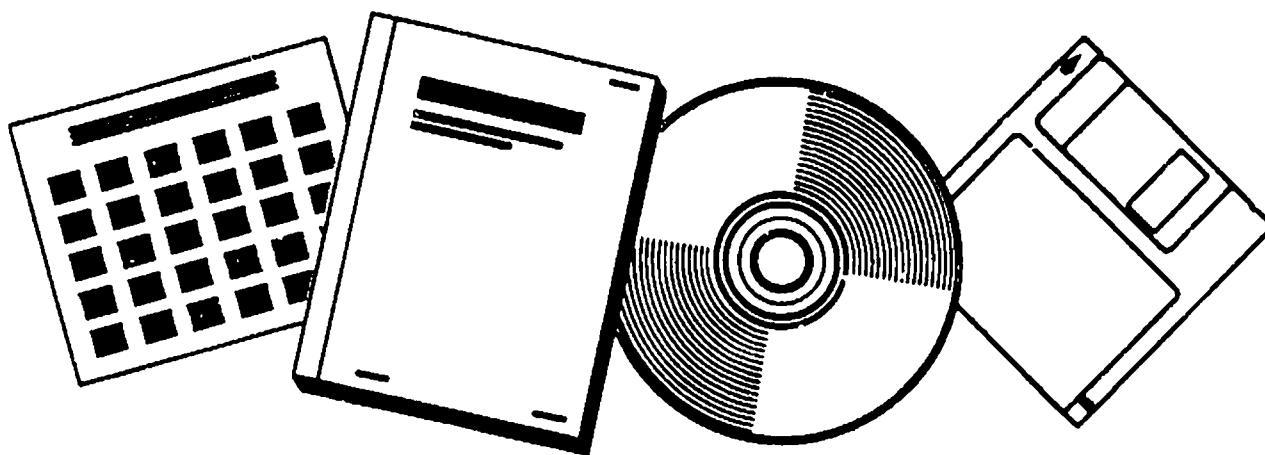


**CHESAPEAKE BAY 1994 OYSTER FISHERY
MANAGEMENT PLAN. AGREEMENT COMMITMENT
REPORT REVISION**

(U.S.) ENVIRONMENTAL PROTECTION AGENCY, ANNAPOLIS, MD

DEC 94



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Abstract: The 1994 Chesapeake Bay Oyster Management Plan is a continuing effort to fulfill the Living Resources Commitment of the 1987 Chesapeake Bay Agreement. The 1994 Plan is a revision of the original Chesapeake Bay Oyster Management Plan that was developed and adopted in 1989. The participants agree to work together to implement, by the dates set forth in the Plan, the management actions recommended to address: (1) disease mortality; (2) repletion efforts; (3) habitat restoration and water quality improvement; (4) increased oyster production; and (5) collection of management quality data. The State of Maryland further commits to special management efforts for oyster recovery areas.

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Pennsylvania, US E'A, District of Columbia, Production, Water quality,
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#25 Identifiers: *Crassostrea virginica*.

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fulfill the Living Resources Commitment of the 1967 Chesapeake Bay Agreement.
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(3) habitat restoration and water quality improvement; (4) increased oyster
production; and (5) collection of management quality data. The State of
Maryland further commits to special management efforts for oyster recovery
areas.

#30 0

Chesapeake Bay Oyster Fishery Management Plan

Agreement Commitment Report Revision



October 1994

Edited By Nancy H. Butowski

Printed by the U.S. Environmental Protection Agency for the Chesapeake Bay Program

Chesapeake Bay Oyster Fishery Management Plan

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Adoption Statement

We, the undersigned, adopt the 1994 *Chesapeake Bay Oyster Management Plan*, as a continuing effort to fulfill the Living Resources Commitment of the 1987 Chesapeake Bay Agreement. The 1994 Plan is a revision of the original Chesapeake Bay Oyster Management Plan that was developed and adopted in 1989.

We agree to accept the revised Oyster Management Plan as a guide to enhancing the production of oysters in the Chesapeake Bay ecosystem. We further agree to work together to implement, by the dates set forth in the Plan, the management actions recommended to address: (1) disease mortality; (2) repletion efforts; (3) habitat restoration and water quality improvement; (4) increased oyster production; and (5) collection of management quality data. The State of Maryland further commits to special management efforts for oyster recovery areas.

We recognize the need for long-term, stable financial support and human resources for the task of enhancing the oyster resource. In addition, we direct the Living Resources Subcommittee to review and update the 1994 Plan yearly and to prepare an annual report addressing the progress made in achieving the Plan's management recommendations.

Signatures

Date October 14, 1994

For the Commonwealth of Virginia

George F. Allan

For the State of Maryland

William J. Schaefer

For the Commonwealth of Pennsylvania

Robert Plasey

For the United States of America

Carl M. Brown

For the District of Columbia

John A. ...

For the Chesapeake Bay Commission

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EXECUTIVE SUMMARY

Introduction

A Chesapeake Bay Oyster Fishery Management Plan was developed in 1989 as one of the strategies for implementing the Living Resources Commitments of the 1987 Chesapeake Bay Agreement. The ecological value of oysters to water quality was recognized and disease became more limiting, an improved framework was needed for managing the oyster resource. Through committee recommendations from the Maryland Oyster Roundtable and the Virginia Oyster Roundtable, the 1994 Chesapeake Bay Oyster Fishery Management Plan (FMP) was developed. The revised 1994 Oyster FMP was drafted by the Maryland Department of Natural Resources (MDNR), the Virginia Marine Resources Commission (VMRC), and the Potomac River Fisheries Commission (PRFC). A FMP workgroup consisting of members from government agencies, the academic community, the fishing industry, and public interest groups reviewed and commented on the revised plan. The oyster plan revision is part of the fishery management process to update the status of the resource, include new biological information, control fishing mortality and address habitat issues.

Goal and Objectives

The goal of the 1994 Oyster Fishery Management Plan is:

Enhance the production of oysters in the Chesapeake Bay ecosystem by restoring habitat, controlling fishing mortality, promoting aquaculture and continuing the repletion programs.

In order to meet this goal, a number of objectives must be met. These objectives are incorporated into the areas of concern and management strategies summarized below.

Areas of Concern and Management Strategies

Section 1. Baywide Management Strategies

Disease: The oyster parasite diseases, MSX and Dermo, have impeded the restoration of oyster stocks in the Bay. Currently, there are no known disease-resistant oysters but disease-tolerant oysters do exist. The Bay jurisdictions will monitor the prevalence and intensity of parasite diseases and attempt to minimize their spread. A coordinated, multi-year, goal-oriented disease research program will be implemented and evaluated after five years. Research will continue on developing disease-resistant oysters.

State Repletion Programs: State repletion programs have focused on moving shell and transplanting seed oysters to enhance oyster harvest. The programs are limited by natural reproduction (spat set), disease infection, the amount of available shell, and

funding. The state repletion programs will be adapted to promote natural oyster production, meet the changing needs of the oyster resource, and respond to the initiatives recommended in the 1994 plan. Repletion efforts will be monitored then evaluated after a three-year period (1997).

Habitat/Water Quality: Overfishing has contributed to the reduction of oyster habitat by removing shell. With reef flattening, oysters are particularly vulnerable to siltation and increased mortality. The reduction in reef surface area also reduces the amount of substrate for spat settlement. Oysters are an important part of the Bay ecosystem especially in their role as filter-feeders. Adequate water quality is essential for oysters to reproduce, grow and maintain health. The Bay jurisdictions will conduct a phased program to evaluate and implement projects to restore the physical habitat for oysters. In addition, the jurisdictions will ensure that water quality is maintained at levels necessary to support healthy oyster populations.

Management to Increase Oyster Production: The disease problem, the lack of oyster habitat, variability in recruitment, and harvest pressures have placed constraints on oyster production. New technology is needed for the restoration, culture, and production of oysters. The Bay jurisdictions will work to improve and increase oyster production in the private and public oyster fisheries. Increased oyster production will be accomplished by focusing effort and finances into aquaculture projects. Guidelines will be established for controlling fishing mortality.

Collection of Management Quality Data: Improvements in the collection and analysis of oyster data are necessary. In addition to research on disease, research should be encouraged on natural and fishing mortality rates, the stock/recruitment relationship, spawning stock densities needed to repopulate an area, and factors affecting abundance, survival and growth of larvae and juveniles. The Bay jurisdictions will continue to collect quantitative data on oyster stocks, habitat and diseases.

Section 2. Management for Maryland Oyster Recovery Areas (ORAs)

Oyster Recovery Areas: Geographic areas termed "oyster recovery areas" (ORAs) will be designated in low salinity reaches of the Bay and tributaries where MSX and Dermo are less viable. These areas will be managed to limit transplantation activities that have the potential to introduce disease and new rehabilitation techniques for restoring oyster populations will be evaluated.

Strategy 1: The implementation of activities within the ORAs will be guided by an independent advisory committee.

Strategy 2: Each ORA will be comprised of from one to three zones and specific activities will be defined for each area.

Strategy 3: Criteria will be defined for determining the boundaries of each ORA and then adopted into Maryland regulation.

THE FISHERY MANAGEMENT PLAN PROCESS

What is a fishery management plan?

A Chesapeake Bay fishery management plan provides a framework for the Bay jurisdictions to take compatible, coordinated management measures to conserve and utilize a fishery resource. A management plan includes pertinent background information, management strategies, recommended actions, and implementation dates.

A fishery management plan is not an endpoint in the management of a fishery but part of a dynamic, changing process consisting of several steps. The first step consists of analyzing the complex biological, economic and social aspects of a particular finfish or shellfish fishery. The second step includes defining the concerns of a fishery, identifying potential solutions, and choosing appropriate management strategies. Once specific goals have been defined, it is important to measure progress towards meeting the goals, establish accountability and engage the general public. Plans must be adaptive and flexible to meet the changing needs of a particular resource. They are annually reviewed and updated in order to respond to the most current information on the fishery.

Management Plan Background

As part of the 1987 Chesapeake Bay Agreement's commitment to protect and manage the natural resources of the Chesapeake Bay, the Bay jurisdictions developed a series of fishery management plans for commercially, recreationally, and selected ecologically valuable species. A comprehensive and coordinated approach by the various local, state and federal groups in the Chesapeake Bay watershed is necessary for successful fishery management. Bay fisheries are traditionally managed separately by Pennsylvania, Maryland, Virginia, the District of Columbia, and the Potomac River Fisheries Commission. There is also a federal Mid-Atlantic Fishery Management Council (MAFMC) which has management jurisdiction for offshore fisheries (3-200 miles), and a coastwide organization, the Atlantic States Marine Fisheries Commission (ASMFC), which coordinates the management of migratory species in state waters (internal waters to 3 miles offshore) from Maine to Florida.

A Fisheries Management Workgroup, under the auspices of the Chesapeake Bay Program's Living Resources Subcommittee, was formed to develop baywide fishery management plans. The workgroup's members represent fishery management agencies from the District of Columbia, Maryland, Pennsylvania, the Potomac River Fisheries Commission, Virginia, and the federal government; the Bay area academic community; the fishing industry; conservation groups; and interested citizens. Establishing Chesapeake Bay FMPs, in addition to coastal FMPs, creates a forum to specifically address problems

that are unique to the Chesapeake Bay. They also serve as the basis for implementing regulations in the Bay jurisdictions.

The Chesapeake Bay Program's Fishery Management Planning Process

The planning process starts with input by the Fisheries Management Workgroup and development of a draft plan. This is followed by a review of the management proposals by Bay Program committees, other scientists and resource managers, and the public. Comments are incorporated into a final draft of the management plan. It is endorsed by the Chesapeake Bay Program's Living Resources Subcommittee (LRSC), the Implementation Committee (IC), and the Principal Staff Committee (PSC). The plan is sent to the Executive Committee (EC) for adoption.

Upon adoption by the EC, the appropriate management agencies implement the plan. In 1990, the Maryland legislature approved Section 4-215 of the Natural Resource Article giving the Maryland Department of Natural Resources authority to regulate a fishery once a FMP has been adopted by regulation. In Virginia, FMP recommendations are pursued either by legislative changes or through a public regulatory process conducted by the Commission. A periodic review of each FMP is conducted by the Fisheries Management Workgroup to incorporate new information and to update management strategies as needed.

The first group of fishery management plans, including oysters, was completed in 1989. Additional plans have been completed each year encompassing 16 finfish and shellfish species. With time and changes, it became apparent that a substantive review of each FMP at regular intervals would be necessary. The FMP workgroup developed a review schedule to upgrade each plan (Table 1). The revised FMP must be sent through the regular Chesapeake Bay Program's fishery management planning and adoption processes. Since the major review schedule extends over a 5-year period, important minor changes are addressed through an amendment procedure. This entails developing a description of the proposed changes and sending it through the FMP workgroup for endorsement. The amendment must be published for public comment and reviewed by the LRSC and the IC for their comment and approval. The PSC has been given authority by the EC to approve amendment changes.

Table 1. Schedule for reviewing fishery management plans

SPECIES	ADOPTION DATE	REVIEW DATE
Shad/Herring	1989	June 1995
Blue Crab	1989	1994
Oysters	1989	1994
Striped Bass	1989	August 1995
Weakfish/Seatrout	1990	March 1996
Bluefish	1990	June 1995
Croaker/Spot	1991	1996
American Eel	1991	1996
Summer Flounder	1991	March 1996
Black Drum	1993	1997
Red Drum	1993	
Catfish	July 1995	2000
Mackerel	1994	1998
Black Sea Bass	July 1995	2000
Tautog	December 1995	2000
Horseshoe Crabs	1994	1999

INTRODUCTION

The oyst (Crassostrea virginica) resource in the Chesapeake Bay has been significantly impacted by the oyster parasites MSX and Dermo, habitat losses, water quality, and harvesting. In 1989, a Chesapeake Bay Oyster Fishery Management Plan (FMP) was completed for oysters and included strategies to address the problems of harvest decline, recruitment, disease mortality, leased ground production, habitat issues, shellfish sanitation, market production and the repletion program. The oyster commercial harvest continued to decline and special committees were organized to review the situation. In Maryland, the role of the State in oyster management was analyzed and evaluated by a special committee appointed by the governor. As a result of the committee recommendations, the Maryland Department of Natural Resources (MDNR) increased oyster taxes and license fees, developed a seed supply for private aquaculture, continued the repletion program, developed stock assessment efforts and increased disease research and monitoring (Refer to Appendix I for a summary of major recommendations from the Governor's Report, also known as the Wolman Report).

In Virginia, a 33-member "Blue Ribbon" Panel met to discuss oyster issues and develop recommendations for restoring Virginia's oyster industry. Four potential oyster sources were considered: traditional state and private culture of C. virginica; off-bottom culture in approved waters; on-bottom culture of a non-native species, C. gigas; and on-shore depuration of moderately polluted oysters. The recommendations of the Virginia Blue Ribbon Panel were prepared and reported in the Virginia Holton Plan (Refer to Appendix II for a summary).

As the ecological value of the oyster resource to water quality was recognized and disease became more limiting, an improved framework was needed for managing the oyster resource. The Chesapeake Bay Program's Scientific and Technical Advisory Committee (STAC) initially played a dominant role in coordinating efforts to draft a baywide oyster restoration action agenda. After several workshops, eight problem areas were defined to maintain the oyster fishery and restore the oyster reef community. These problem areas were: restoration of habitat; recognition of ecological function; control of fishing mortality; improvement of the repletion program; management around disease; support of research; promotion of aquaculture and the establishment of oyster sanctuaries. The STAC work provided the framework for revising the 1989 Oyster FMP. Specific actions and details for each of the problem areas were taken from recommendations made by the Maryland Oyster Roundtable (MOR) and the Virginia Holton Plan (VHP). Although these efforts were independent, the Chesapeake Bay management plan attempts to coordinate and direct baywide efforts in regards to oysters. The Virginia and Maryland committee reports served as the source documents for the 1994 Oyster FMP.

One of the major innovations resulting from the MOR was defining oyster recovery areas (ORA's). Restoration areas will be established in the Chester, Choptank, Magothy, Nanticoke, Patuxent, and Severn Rivers. These areas will be targeted for restoring oyster populations then scientifically monitored to see how well the new techniques are working. A non-profit corporation will be formed by aquaculturists, environmentalists and watermen to play a major role in developing and applying innovative oyster restoration techniques. The delineation of ORA's has resulted in two management sections in the revised 1994 Oyster FMP, the first section addresses baywide strategies and actions, and the second section addresses Maryland strategies and actions for the ORA's. The biological background section from the original 1989 Oyster FMP has been updated and included after the management sections. In addition to establishing ORA's, Maryland DNR will also establish a pilot permitting program for oyster aquaculture demonstration projects.

Ecological Role

The ecological value of oyster reefs to the Chesapeake Bay ecosystem includes the effects of oyster filtration on water quality and the biological diversity associated with reef communities. Oysters filter phytoplankton and other organic particulate matter from the water column, thus clarifying the water and reducing organic loads contributing to anoxia (STAC 1992). Results from oyster modelling (Ulanowicz and Tuttle 1992) suggest that increasing oyster stocks either by aquaculture or enhancing natural oyster bars would augment the attainment of water quality goals. Although the ecological role of oysters in the Chesapeake Bay ecosystem is recognized, its benefit is indirect and hard to measure. Few data are available to quantify oyster reef community structure and function. Myatt and Myatt (1990) conducted an ecological study of hard-substrate communities within the Chesapeake Bay. They concluded that an artificial reef program would be an asset to the Bay environment. Since ecological functions overlap with other problem areas, specific actions addressing these issues have not been developed. Strategies and actions that restore oyster habitat and enhance/increase oyster production will benefit the ecosystem.

Current Status of the Oyster Fishery

Currently, oyster harvest from the Chesapeake Bay is at an all time low. The fishery is restricted to a few areas where legal-sized oysters can be harvested. These are low salinity areas, where natural recruitment (spat set) is low and unpredictable, where the State's repletion programs expend the greatest effort, and where oysters are at greatest risk from the influx of freshwater (also known as freshets). During the 1992/1993 oyster season, 124,000 bushels were harvested from Maryland, 64,500 bushels from Virginia and 105,000 bushels from the Potomac River. Preliminary 1993/1994

commercial oyster landings from Maryland are 76,000 bushels. This is the seventh consecutive year of harvests below 500,000 bushels (Figure 1 and 2). Preliminary 1993/1994 oyster harvests from Virginia and the Potomac River were 30,000 and 223 bushels, respectively. Oyster surveys in Maryland indicate that oyster diseases have expanded their range. Oyster spat set has been variable (Figure 3). The 1991 spat fall index, the average number of young oysters found on a given amount of oyster shell, was the highest recorded in 27 years at over 200 spat per bushel. The 1993 oyster spat set was 16.2 spat per bushel. For more details on the biology and life history of oysters and an historic perspective on the oyster fishery, refer to the biological background section (p. 26).

Biologists from the Virginia Marine Resources Commission (VMRC) recommended a moratorium on the harvest of market oysters from public grounds during 1993. After public hearings, the VMRC decided to shorten the oyster season and set a 6,000 bushel limit from October 15th through December 31st, restrict the length of tongs to 18 feet, and prohibit harvest after 12 noon. The VMRC's actions did not affect the harvest of oysters from private grounds. The restrictions were similar to those approved by the Potomac River Fisheries Commission (PRFC) in response to high oyster mortalities. Mortalities as high as 90% were reported in parts of the Potomac River due to a high freshwater influx from spring rainfall and snowmelt.

FMP Status and Management Unit

A Chesapeake Bay Oyster Management Plan was completed in 1989. The 1994 Oyster FMP supersedes the 1989 FMP. The management unit is the American or eastern oyster (Crassostrea virginica) throughout its range in the Chesapeake Bay. The Virginia oyster industry has two different environments, the Bay and Seaside. Management considerations for the Virginia resource are for the Bay oyster bars and do not include the intertidal Seaside bars.

Figure 1. Maryland Commercial Oyster Landings by Season

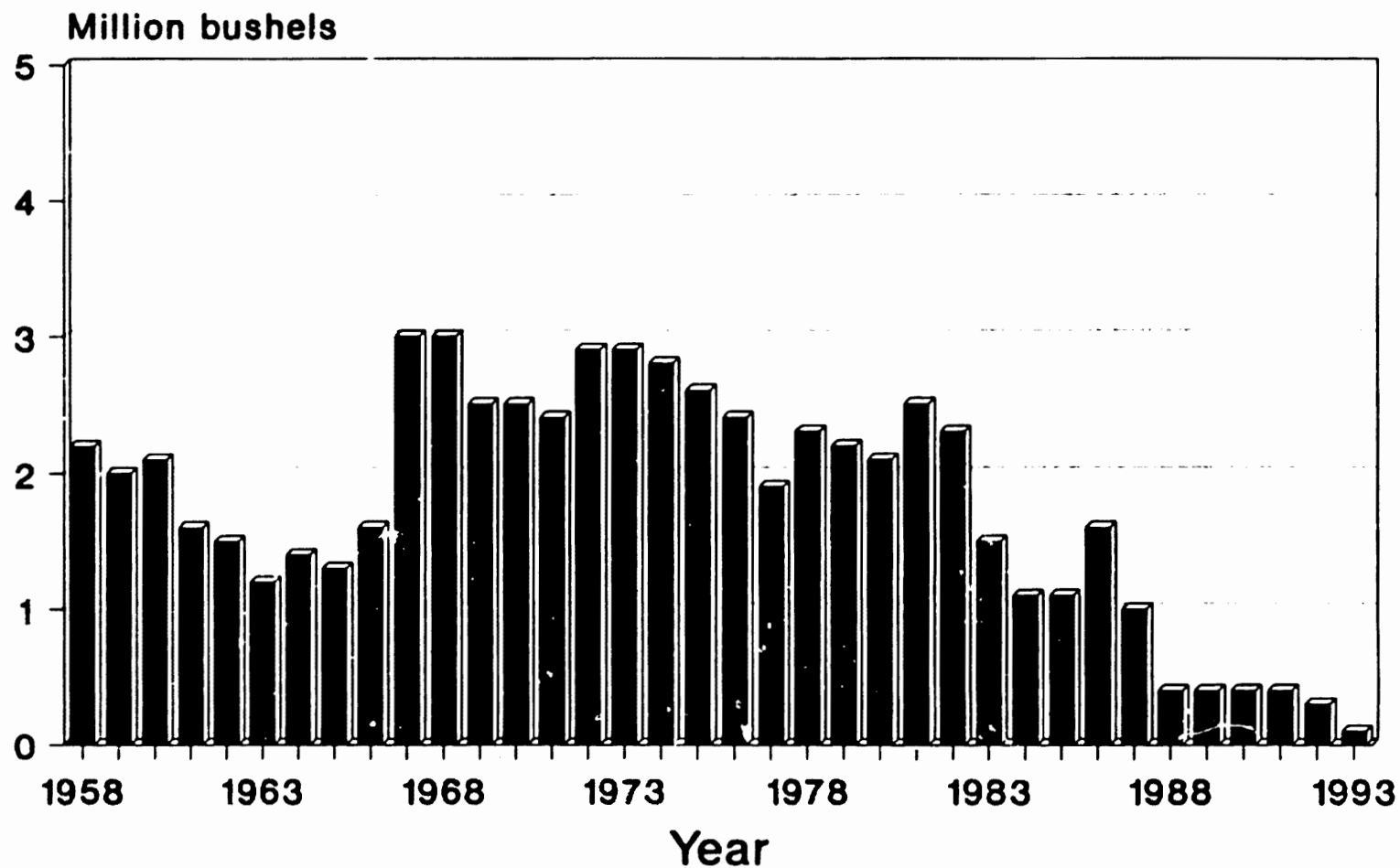


Figure 2. Virginia Oyster Ground Production by season

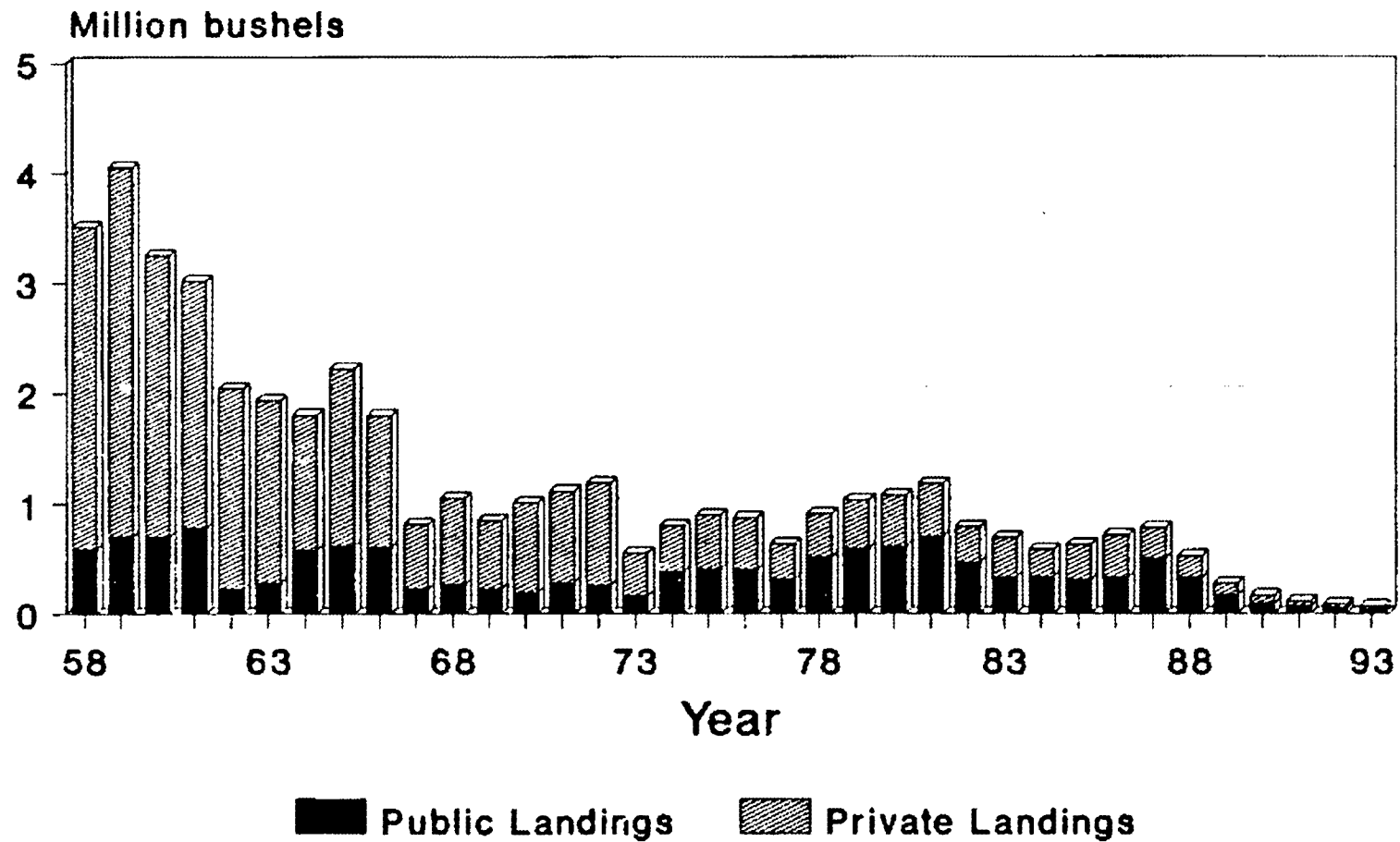
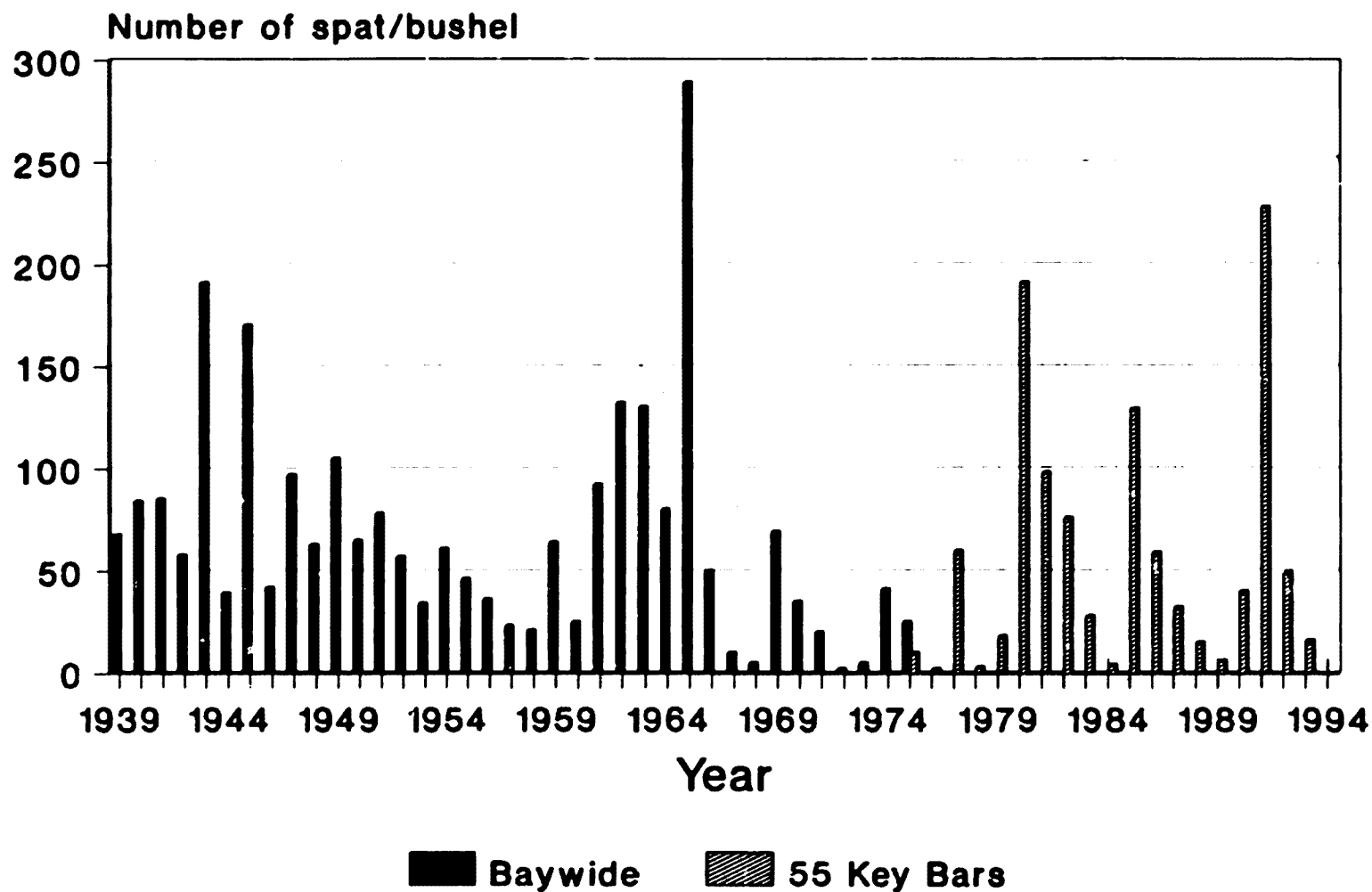


Figure 3. Maryland spat set, 1939-1993



Goals and Objectives

The overall goal of the 1994 Oyster FMP is as follows:

The Bay jurisdictions will enhance the production of oysters in the Chesapeake Bay ecosystem by restoring habitat, controlling fishing mortality, promoting aquaculture and continuing the repelation programs.

The objectives defined by the Maryland Oyster Roundtable are:

- 1) Maximize and enhance the ecological benefits of oysters;
- 2) Maximize and enhance the economic benefits derived from harvesting in the public and private oyster fisheries; and
- 3) Maximize the ability of government to respond effectively to the magnitude of the problem.

The objectives defined by the Virginia Holton Plan are:

- 1) Determine fair and justifiable harvest quotas through a data collection and analysis system.
- 2) Rejuvenate the public oyster fishery by redesigning the repelation program and evaluate the effectiveness of a redesigned oyster repelation program.
- 3) Implement a limited entry program for fisheries in order to protect both full-time fishermen and the resource.
- 4) Implement regulatory reforms and technical advisory service to strengthen off-bottom culture.
- 5) Explore the feasibility and ultimate construction of a depuration facility for oysters from both the private and public bottom.
- 6) Test in the laboratory and, conditionally, in the York River, the suitability of the non-native oyster, C. gigas, as a factor in the rejuvenation of Virginia oyster industry.

SECTION 1.

BAYWIDE PROBLEM AREAS AND MANAGEMENT STRATEGIES

Disease

Haplosporidium nelsoni (MSX) and Perkinsus marinus (Dermo) are the major impediments to restoring oyster stocks to the level of abundance of recent decades in the Chesapeake Bay. Approximately 100% of Maryland and Virginia oyster beds are infected with disease. MSX and Dermo are single-celled parasites that grow within oyster tissue. They cause significant mortalities within the first two years of life and have altered the size and age structure of the oyster population. There is substantial variation in population structure and relative oyster abundance from area to area (Smith and Jordan 1992). Maryland stock survey data from limited areas, indicate moderate numbers of juvenile and premarket oysters but greatly reduced numbers of market-sized oysters. Although oysters exhibit highly variable growth rates, they can reach market size in about 3 years. This is enough time for diseases to eliminate all market-size oysters on a bar. Younger, less than 3" oysters, can still reproduce and maintain moderate recruitment success or spat set. However, fecundity (the number of eggs produced) increases exponentially with size (see biological background section, Figure 4). Oysters larger than 3" contribute considerably more to the reproductive capacity of the population. It is speculated that continued removal of large oysters due to disease and/or harvest, may confer a competitive advantage on early reproduction and ultimately result in a population of small oysters. Climate and subsequent changes in salinity affect disease distribution and infection. Salinities below 10-15 ppt and above 30-32 ppt are associated with decreased MSX activity. MSX can inhibit oyster growth and gametogenesis in spring. Dermo can tolerate lower salinities and is more persistent and damaging to oyster populations than MSX.

Currently, there are no known disease-resistant oysters available but there are several species that are disease-tolerant. Rutgers has developed an MSX tolerant strain which can become infected with MSX but will survive to market size. This strain, however, is more susceptible to Dermo than regular oysters. The native North Carolina seaside oyster can reach market size in 12 to 18 months with about 25-30% cumulative mortality (Brown et al. 1994). A major breakthrough in 1993 was the culture of Dermo in the laboratory and the ability to detect Dermo in the water column. These breakthroughs will make it easier to study the organism and, hopefully, facilitate some advances in disease research. In order to provide a successful research program, stable and carefully targeted funding must be provided over several years. After a pre-determined time frame, the research and management program should be critically evaluated to determine its effectiveness in reversing the decreasing trend in oyster stocks and progress towards controlling MSX and Dermo.

Strategy 1.1

The Bay jurisdictions will monitor the prevalence and intensity of MSX and Dermo in the Bay and attempt to minimize the spread of disease.

Actions:

- 1.1.1 The Bay jurisdictions will continue the annual disease survey, increase sample size and develop new disease detection techniques at the Oxford Laboratory and the Virginia Institute of Marine Science (VIMS).

Implementation 1.1.1

Continue existing sampling schedule during October/November and March.

- 1.1.2 The Bay jurisdictions will establish a protocol for certifying oysters, including seed oysters, for the prevalence and intensity of MSX, Dermo, or other pathogens.

Implementation 1.1.2

1995

- 1.1.3 Maryland and Virginia will continue their repletion programs using natural seed with low levels of MSX and Dermo contamination until hatchery produced, disease-free seed is produced. At that time in Maryland, movement of seed which cannot be certified (Action 1.1.2) will cease. Techniques for disease monitoring will include histocytology (thioglycolate assays and histological analysis), immunological detection tests and histopathology.

Implementation 1.1.3

Continue. Implement movement of disease-free seed from hatcheries as it becomes available.

- 1.1.4 The jurisdictions will continue to rotate seed areas to avoid transport of older year classes that have a higher probability of disease infestation.

Implementation 1.1.4

Continue

- 1.1.5 The jurisdictions will conduct a pilot study to test the difference in survival between seed moved in the fall compared to seed moved in the spring and investigate other approaches for seed planting to reduce the possibility of disease infestation before transport (part of improved repletion program).

Implementation 1.1.5
September 1994- April 1995

Strategy 1.2

The Bay jurisdictions will implement a National Oceanic and Atmospheric Administration (NOAA) coordinated, multi-year, goal-oriented research program to identify, understand, prevent and control MSX, Dermo, and other potential pathogens. Funding for this research should be stable, carefully targeted for specific research issues and followed by an evaluation after five years to assess progress and determine continuation.

Actions:

- 1.2.1** The Bay jurisdictions will delegate responsibility for coordinating the research program to a specific person/agency.

Implementation 1.2.1
1994

- 1.2.2** Maryland will initiate the first five-year phase of a multi-year research program aimed at early detection, prevention, and control of MSX and Dermo which will include the following:

- 1) Improve the methodology for early detection of disease during all life stages of oysters;
- 2) Obtain a better understanding of the life cycle of MSX and Dermo, including environmental requirements and identification of alternate hosts;
- 3) Identify existing information and intensify research on the physiological aspects of MSX and Dermo, including immune system function;
- 4) Determine why some oyster species are not susceptible to MSX or Dermo;
- 5) Utilize cell culture to learn Dermo's requirements for survival and the best methods of eradicating it;
- 6) Understand the effects of cold temperature and low salinity on parasites and relate them to various management scenarios;
- 7) Examine the response of C. virginica from other regions (outside the Chesapeake Bay) to MSX and/or Dermo when transplanted in the Bay.

Implementation 1.2.2
1995-2000

Strategy 1.3

Research will continue on disease-resistant oysters, hybridization, and the possible effects of introducing a hybrid or exotic species into the Bay.

Actions:

- 1.3.1** The Bay jurisdictions will follow the guidelines set forth in the Exotic Species Policy developed by the Chesapeake Bay Program's Living Resources Subcommittee.

Implementation 1.3.1

1994

- 1.3.2** Maryland will initiate a pilot field program to plant strains of C. virginica from North Carolina to the Chesapeake Bay in higher salinity areas of the Bay and its tributaries. Adequate precautions will be taken to prevent the introduction of new disease strains and undesirable genetic stock (see Action 1.3.1).

Implementation 1.3.2

1995

- 1.3.3** A) Virginia, through the Virginia Institute of Marine Science (VIMS), is conducting an environmental impact assessment on the introduction of a non-native oyster, C. gigas. Specific guidelines on the research of triploid individuals are being developed.

B) Maryland will conduct an environmental impact assessment of the potential introduction of a non-native oyster species as a contingency plan if the action items in this plan are not enough to increase oyster stocks in the Bay. Maryland will utilize the results of the Virginia assessment (Action 1.3.3.A) to avoid duplicating efforts.

Implementation 1.3.3

a) Continue b) Open

Repletion Programs

State repletion programs have focused on increasing the size of the oyster harvest by moving shell and transplanting seed oysters. Currently, state agencies move seed oysters to grow-out regions so watermen who pay a license fee can harvest them for market. Since there is little to no production from natural bars, the repletion program supports a put-and-take fishery.

The State repletion program is the major source for harvestable oysters in Maryland at this time. It is limited by natural reproduction (spat set), disease infection, the amount of available shell or cultch, and funding. Because of high disease pressure in most lower-Bay locations, seed repletion programs move oyster seed from high salinity, high spat set areas, to low salinity, low spat set areas which have slow growth and low disease. Maryland and Virginia currently have no disease-free,

seed-producing areas and transplanting seed may facilitate the spread of disease throughout the Bay. The repletion program in each state should be adapted, as appropriate, to the initiatives recommended in this plan. Monitoring efforts should continue and adjustments made to the timing and location of shell and seed plantings in order to enhance oyster production without encouraging the spread of disease. (Refer to Appendix III and IV for a summary of each state's repletion program during 1993).

Strategy 2.1

The Maryland and Virginia repletion programs will minimize the possibility of spreading MSX and Dermo.

Actions:

- 2.1.1 The Bay jurisdictions will implement NOAA recommended disease strategies and actions defined in the Disease Section of this management plan to minimize the spread of disease.

Implementation 2.1.1

Variable, depending on actions defined in the previous management section.

Strategy 2.2

The Bay jurisdictions will maintain and adapt their current state repletion programs to promote natural oyster production and meet the changing needs of the oyster resource. This includes adjusting plantings based on salinity patterns and disease information. The programs will be modified as new initiatives from the MOR and VHP are implemented. Repletion efforts will be monitored then evaluated after a three year period (1997).

Actions:

- 2.2.1 Maryland will maintain the state repletion program as funds are available at a level of at least 2 million bushels of shell and 500,000 bushels of seed if spat set levels permit. The amount of shell and seed may be variable depending on availability. As new initiatives by the MOR are implemented, the repletion program may be modified.

Implementation 3.2.1

Continue. Seed plantings begin in April 1994 and shell plantings in June and early July 1994.

- 2.2.2 Maryland will continue the fall dredge survey which provides data on oyster mortality, recruitment (spat set), and disease patterns, to direct the oyster repletion efforts.

Implementation 2.2.2

Continue

- 2.2.3 Maryland will provide fresh shell to the state hatchery and to community groups for habitat enhancement and develop a policy on the minimum desiccation period to prevent the spread of MSX and Dermo with fresh shell.

Implementation 2.2.3
1995

- 2.2.4 Maryland DNR will support the ORA efforts by providing the program with a percentage of available shell. The amount of shell will be determined annually. For 1994/1995, 200,000 bushels of shell will be available.

Implementation 2.2.4
Beginning in 1994 and continuing annually.

- 2.2.5 Virginia will restore two major areas where setting is good, the James and the Rappahannock Rivers, forming sanctuaries for maintaining the biological stock. Restoration efforts will include: 1) locating the best substrate; 2) prohibiting harvest in these areas; 3) adding shell or other material to build reef structure; 4) adding seed; and, 5) monitoring the growth of oysters.

Implementation 2.2.5
Begin in 1994

- 2.2.6 Virginia will turn and clean or add cultch on a rotating basis on oyster beds near sanctuary reefs in the James and Rappahannock Rivers to prepare them to receive spat set from the sanctuary areas. The cleaning and shelling procedure will include: 1) identifying the best areas; 2) delineating the best time to turn or shell the beds; 3) monitoring the growth of new oysters; 4) opening the beds to harvest and setting a quota; and, 5) closing the beds once the quota is met and starting the process again.

Implementation 2.2.6
1995

- 2.2.7 A) The Bay jurisdictions will continue to monitor their repletion efforts and adjust the timing and location of shell and seed planting based on the best available data. B) Virginia will establish a computer data-base system to monitor the progress of the repletion program on a bar by bar basis.

Implementation 2..
a) Continue b) 1995

- 2.2.8 When the hatchery production of seed is adequate to meet planting needs, the repletion programs will be modified to eliminate the spread of disease with seed plantings.

Implementation 2.2.8

Open. Dependent on seed production.

Habitat/Water Quality

Historically, overfishing has contributed to the reduction in available oyster habitat in the Chesapeake Bay by breaking up reefs and removing shell. Oyster bars have become small mounds with relatively thin layers of shell scattered over the bottom. Reef flattening has taken oysters out of the higher water column where currents bring fresh food supplies and oxygen, making them particularly vulnerable to siltation. Heavy sediment loads from agricultural and urban run-off, construction activities, natural erosion, channel dredging, forestry activities, and seafood harvesting practices can impact oyster bars. The reduction in reef surface area has also reduced the amount of substrate for oyster larvae to settle. Oyster shell is the most suitable substrate for spat settlement and should be considered an important natural resource. Loss of shell due to the export of oysters out of the Bay is detrimental to restoring oyster beds. Shell conservation should be practiced. Oyster beds can be re-established by building up the base with additional firm substrate. Rebuilding efforts should be focused in shallow areas (less than 10m) where low oxygen is not a problem.

Adequate water quality is essential for oysters to reproduce, grow and maintain health. Habitat requirements for temperature, salinity, sediment, pH, and dissolved oxygen have been summarized in Table 1 in the Background Section (p.32). Oyster eggs and larvae can be killed by suspended sediments. Adult oysters can withstand periods of increased turbidity and sedimentation but extended exposure can result in damage to their filtering apparatus. Of greatest concern, baywide, are the effects of excess nutrients and the impacts of toxic materials.

Oysters are an important part of the Bay ecosystem especially in their role as filter-feeders. They remove inorganic particles from the water column and deposit them as pseudofeces. They also consume large quantities of suspended organic particles, recycle nutrients, and transfer energy throughout the food web.

Strategy 3.1

The Bay jurisdictions will conduct a phased program to evaluate and implement projects to restore the physical habitat for oysters.

Actions:

3.1.1 The Bay jurisdictions will restore physical oyster habitat through the Maryland and Virginia Aquatic Reef Program (refer to the Aquatic Reef Habitat Plan 1994 for details).

- 1) Approximately 5000 acres each of new oyster reef habitat will be created in Maryland and Virginia and 1000 acres in the Potomac River, over the next 5 years.
- 2) Oyster harvest will be prohibited within permitted reef sites.
- 3) A research plan will be prepared to obtain hydrodynamics, unit design, and deployment configuration recommendations.
- 4) The reefs will be monitored to determine compliance and evaluate ecological performance.
- 5) The Reef Program will expand into additional areas and sites as guided by the findings of research and monitoring.

Implementation 3.1.1

See specifics in the 1994 Aquatic Reef Habitat Plan

3.1.2 The Bay jurisdictions will redefine sanctuaries with adequate geographic extent and distinctiveness.

- 1) Virginia will expand the 25 acre broodstock sanctuary in the James River (Lower Jail Island/Wreck Shoal) currently used by the Oyster Repletion Program to an area not less than 2000 acres, north of the channel and chosen by the VMRC.
- 2) Virginia will establish a broodstock sanctuary in a geographically distinct area of approximately 50 acres in the Rappahannock River.
- 3) Virginia will establish a broodstock sanctuary of less than 50 acres in Mobjack Bay and manage it according to the repletion plan.
- 4) Virginia will continue to use specific areas within the Piankatank and Great Wicomico Rivers as seed areas for the repletion program.

Implementation 3.1.2

Variable, but beginning in 1994.

3.1.3 The Bay jurisdictions will evaluate innovative techniques for restoring physical oyster habitat, conduct projects such as cleaning bottom areas, and evaluate optimal physical structures and alternative materials for rebuilding oyster bars.

Implementation 3.1.3

1995

Strategy 3.2

The Bay jurisdictions will work to ensure that water quality is maintained at levels necessary to support healthy oyster populations.

Actions:

- 3.2.1 Current programs established under the Chesapeake Bay Program to reduce pollutant sources that adversely affect oyster stocks will be maintained. The Tributary Strategies will identify specific measures to protect and restore water quality in the Bay and its tributaries for the benefit of living resources, including Bay oyster stocks.

Implementation 3.2.1
Continue

- 3.2.2 Local, state, and federal agencies will utilize their permitting and environmental review programs to ensure that oyster habitat is not adversely affected by the discharge of pollutants, dredging, and other human activities.

Implementation 3.2.2
Continue

- 3.2.3 The ORA advisory committees will assess the potential impact of activities which may adversely affect oysters in ORA's and provide recommendations to the appropriate agencies for prevention and restoration of adequate water quality.

Implementation 3.2.3
1995

Management to Increase Oyster Production

The disease problem, the lack of oyster habitat, variability in recruitment, and harvest pressures have placed considerable constraints on oyster production. Current production levels of certified oyster larvae and seed oysters will not meet the needs of stocking the ORA's or providing for private aquaculture and community association projects. Past and current oyster culture techniques should be analyzed and coordinated with management approaches to enhance production. New technology is needed for the restoration, culture, and production of oysters. In the past, institutional barriers made it difficult to obtain aquaculture permits. To allow progress toward opportunities for private aquaculture ventures, efforts should be made to assist and encourage the private industry. There will be difficulty enforcing

property rights relevant to private oyster aquaculture in the Bay without significant social change. Presently, MDNR has oyster hatcheries at Deal Island and Piney Point, and the University of Maryland has a hatchery at Horn Point. Production at these hatchery facilities in Maryland should be increased to provide spat and larvae.

The advantages and disadvantages of a 'slot limit' should be evaluated as a means of increasing oyster production. Lowering the minimum size to 2.5" in disease impacted areas would allow oysters to be harvested before they succumb to disease. A 4" maximum size would protect larger oysters that have survived MSX and Dermo infestation and allow the possible development of disease-resistant/tolerant individuals and eventually, the build-up of a disease resistant stock.

Strategy 4.1

The Bay jurisdictions will work to improve and increase oyster production in the private and public oyster fisheries.

Actions:

- 4.1.1 Maryland and Virginia will prepare a comprehensive analysis of past and current oyster culture techniques in the Chesapeake Bay and other relevant areas to help focus effort and finances into projects with the best chances of success. In preparing the document, existing expertise and experience in the National Marine Fisheries Service will be utilized.

Implementation 4.1.1
1995

- 4.1.2 Maryland will increase the hatchery production of oyster larvae and seed oysters by maximizing production at Horn Point and using fresh shells supplied by MDNR. In addition, field surveys are currently underway to evaluate plantings of hatchery reared seed which will guide utilization of larvae and seed from state facilities.

Implementation 4.1.2
Field study of hatchery reared seed is in its second year. Shells were delivered to Horn Point in February 1994.

- 4.1.3 Maryland will establish remote setting sites for eyed-larvae purchased from public or private hatcheries, in appropriate locations with low levels of MSX and Dermo.

Implementation 4.1.3
1995

- 4.1.4 Maryland and Virginia will encourage private companies to develop oyster hatcheries. Encouragement will include competitive bidding for contracts to provide oyster larvae and seed for ORA's and other areas.

Implementation 4.1.4
1995

- 4.1.5 Maryland and Virginia will initiate a grant program with matching funds provided by private industry, to stimulate the development of innovative techniques for oyster restoration, culture and production.

Implementation 4.1.5
Dependent and limited by availability of funding.

- 4.1.6 Maryland DNR will establish a pilot permitting program for oyster aquaculture demonstration projects. The pilot program will include the following aspects:
- 1) an initial 5 year permit;
 - 2) a limit of 20 permits;
 - 3) permits will be limited to 5 acres per individual;
 - 4) total area under a single permit may include more than one location;
 - 5) permittees will be required to prepare and submit a report summarizing the activities on the permitted area to MDNR. The report should include information on what restoration activities were undertaken, the production techniques utilized, and amount of oysters planted and harvested;
 - 6) if a permittee fails to report or does not undertake any production activities, MDNR may revoke the permit;

Implementation 4.1.6
As of February 1994, a draft document entitled, Oyster Aquaculture Permit Guidelines 1994 has been developed (see Appendix V for details).

- 4.1.7 MDNR will establish an aquaculture permit clearinghouse service for applicants which will include:
- 1) designating a single point of contact for questions related to the regulatory requirements for aquaculture, tracking permit applications, and coordinating state agency permitting activities related to aquaculture permits;
 - 2) coordinating the preparation of a permitting handbook for potential applicants for aquaculture permits.

Implementation 4.1.7
1994

4.1.8 The Bay jurisdictions will define the acreage available for leasing oyster bottom.

1) MDNR will identify areas to be characterized as Aquaculture Zones through recommendation by the MOR.

2) VMRC will implement the following for off bottom culture:

a) VIMS will establish criteria for identifying potentially productive areas, classifying waters as appropriate (I), marginal (II), and not appropriate (III) for aquaculture;

b) establish regulations for aquaculture in regulation title 28.1, Fish, Oysters, Shellfish and Other Marine Life (includes a permitting process for aquacultural off-bottom projects that accommodates structures of changeable configuration and permit time-spans of appropriate length);

c) establish Department of Health regulations specifically for aquaculture through discussions among the Department of Health, industry representatives, and advisors;

d) draft a model legislative package by VIMS that establishes tax incentives for the start-up of private hatcheries to provide a steady supply of seed to farmers;

e) designate a technical advisory agent with the VIMS Advisory Service who will specialize in hatchery advice, grow-out advice, permitting assistance and site selection assistance.

3) PRFC will not permit any leasing except by authorization from both Maryland and Virginia

Implementation 4.1.8

Variable beginning in 1994

4.1.9 The enforcement of property rights relevant to private oyster aquaculture will be added to the public education program.

Implementation 4.1.9

1995

4.1.10 The VMRC will develop and operate a depuration facility to utilize oysters in less than optimum water quality situations. The development of a depuration facility will not lessen the need to continue to improve water quality.

Implementation 4.1.10

1995. Dependent and limited by the availability of funds.

Strategy 4.2

The Bay jurisdictions will reduce and control fishing mortality.

Actions:

4.2.1 Maryland will utilize the following guidelines for controlling fishing mortality:

a) The population structure of oysters on a bar will be established before the harvest season, the areas will be monitored during the season, and harvesting rates will be determined. If harvest rates from the previous year exceed the guidelines (see 4.2.1 b), adjustments will be made concerning the opening and closing of specific areas for harvest.

b) Maryland will regulate harvest on open bars at fishing mortality rates dependent on gear type. The following annual fishing mortality rates will be established in repleted areas:

1) Tributaries -

a. Hand Tong	50%
b. Patent Tong	40%
c. Dredge	40%
d. Diver	40%

2) Mainstem -

a. Lower Bay (MD/VA line to Cove Pt)	- 50%
b. Mid Bay (Cove Pt. to Holland Pt.)	- 40%
c. Upper Bay (Holland Pt north)	- 40%

The following annual fishing mortality rates will be established in unrepleted areas and apply to all gears:

1) Tributaries - 30% once every 3 years

2) Mainstem -

a. Lower Bay	- 50% once every 2 years;
b. Mid Bay	- 50% once every 2 years
c. Upper Bay	- 0%; area will be closed

Implementation 4.2.1

1995

4.2.2 The Bay jurisdictions will evaluate the potential advantages and disadvantages of a 'slot limit' with a minimum size for harvesting of 2.5" and a maximum size of 4" for areas impacted by disease.

1) Slot limit already in effect for PRFC below the hand scrape line.

2) Maryland will collect oysters over 4" from diseased areas and test their resistance to disease and the resistance of their progeny. The patent tong survey data will be reviewed to provide estimates of the impact of harvesting small oysters from the population.

Implementation 4.2.2

1) Continue. 2) Began collecting in March 1994 and reviewing patent tong data in April 1994.

4.2.3 VMRC will manage the public oyster grounds in specific areas by establishing the following:

James River

- 1) establish an 18' length limit on shaft tongs to protect oysters in deeper water;
- 2) establish a market oyster harvest quota that is updated yearly and based on estimates of standing stock;
- 3) increase the minimum size in clean cull areas to 3";
- 4) as part of the culling practices, reduce the tolerance for blank shells in seed oysters from 10 quarts per bushel to 6 quarts per bushel;
- 5) open Deep Water Shoal to public fishery on a limited basis;
- 6) establish beds for intensive repletion near the sanctuary and manage them according to the repletion plan.

Rappahannock River

- 7) expand the prohibited area for patent tonging to include the area on the southside of the river to the channel above a line connecting Bailey Point (Urbanna/Southside) and the mouth of Beach Creek (Northside) in order to reduce harvest pressure on productive stocks;
- 8) establish beds for intensive repletion near the sanctuary and manage them according to the repletion plan.

Pocomoke/Tangier Sounds

- 9) Prohibit patent tonging and dredging for a 3 year period and re-evaluate the health of the rocks at the end of that period.

Seaside Eastern Shore

- 10) establish a 3" minimum size limit on market oysters.

Implementation 4.2.3

Variable

Collection of Management Quality Data

Oyster population data and harvest information is currently being collected but improvements in bar-specific data should be made. A summary of the Maryland and Virginia 1993 Oyster Programs can be found in Appendix III and IV. The summaries include descriptions of various sampling surveys and management programs already conducted by the states. In addition to the research data on disease (Strategies 1.2 and 1.3), the following research topics and data needs should be encouraged:

- 1) Determine the density of spawning stock necessary to repopulate an area decimated by disease;

- 2) Determine natural and fishing mortality rates;
- 3) Define stock/recruitment relationship;
- 4) Determine factors affecting abundance, survival and growth of larvae and juveniles;
- 5) Evaluate the effects of reducing the minimum harvest size from 3" to 2.5" on oyster stocks including effects on the reproductive capacity of the population and long term effects on the gene pool.

Strategy 5.1

The Bay jurisdictions will improve the collection of management quality data.

Actions:

- 5.1.1 The Bay jurisdictions will continue to collect quantitative data on oyster stocks, habitat and diseases and make the information available in an annual report.

Implementation 5.1.1
Annually.

- 5.1.2 VMRC will establish a computer data-base system for the collection, storage and analysis on a bar-by-bar basis, updated weekly, of information to estimate standing stock and establish yearly catch quotas. Data will include daily entries for total landings, boat numbers, landings per boat, where harvested, and number of harvesters per boat.

Implementation 5.1.2
1995

- 5.1.3 The fisheries agencies will make oyster data available to the research community as needed to investigate suggested research topics or in connection with other research.

Implementation 5.1.3
1994

**CHESAPEAKE BAY 1994 OYSTER FISHERY MANAGEMENT PLAN
IMPLEMENTATION MATRIX**

PROBLEM AREAS & STRATEGIES	ACTIONS	DATE	COMMENTS
1. Disease 1.1 Monitor the prevalence and intensity of MSX and Dermo and attempt to minimize the spread of disease	1.1.1. Continue the annual disease survey, increase sample size and develop new disease detection techniques.	Continue	New techniques will be developed at the Oxford Lab and VIMS.
	1.1.2. Establish a protocol for certifying oysters, including seed oysters, for the prevalence and intensity of MSX, Dermo, or other pathogens.	1995	
	1.1.3. Continue the repelion programs using natural seed with low levels of MSX and Dermo contamination until hatchery produced, disease-free seed is produced. At that time in MD, movement of seed which cannot be certified will cease.	Continue	Techniques for disease monitoring will include histocytology (thioglycolate assays and histological analysis), immunological detection tests and histopathology. Implement movement of disease-free seed from hatcheries as it becomes available.
	1.1.4. Continue to rotate seed areas to avoid transport of older year classes that have a higher probability of disease infection.	Continue	
	1.1.5. Conduct a pilot study to test the difference in survival between seed moved in the fall compared to seed moved in the spring. Investigate other approaches to reduce disease infestation before transport.	1994-1995	Part of the improved repelion program.
1.2 Implement a coordinated research program.	1.2.1. Delegate responsibility for coordinating the research program to a specific person/agency.	1994	
	1.2.2. MD will initiate the first 5-year phase of a multi-year research program aimed at early detection, prevention and control of MSX and Dermo.	1995-2000	
1.3 Continue research on disease-resistant oysters, hybridization, and possible effects of introducing a hybrid or exotic species.	1.3.1. Follow the guidelines set forth in the Exotic Species Policy.	1994	
	1.3.2. MD will initiate a pilot field program to plant strains of <i>C. virginica</i> from North Carolina to the Chesapeake Bay in higher salinity areas of the Bay and tributaries.	1995	Adequate precautions will be taken to prevent the introduction of new disease strains and undesirable genetic stock.
	1.3.3. a) VA is conducting an environmental impact assessment on the introduction of a non-native oyster, <i>C. gigas</i> . b) MD will conduct an environmental impact assessment on the introduction of a non-native oyster as a contingency plan if the action items in this plan are not enough to increase oyster stocks in the Bay.	Continue Open	Specific guidelines on the research of triploid individuals are being developed. Maryland will utilize the results of the VA assessment to avoid duplicating efforts.

1994 OYSTER IMPLEMENTATION (cont'd)

PROBLEM AREAS & STRATEGIES	ACTIONS	DATE	COMMENTS
2. Repletion Programs 2.1 Minimize the possibility of spreading MSX and Dermo.	2.1.1. Implement the disease strategies and actions defined in the Disease Section of this management plan to minimize the spread of disease.	Variable	Implementation depends on actions defined in the previous management section.
2.2 Maintain and adapt current repletion programs to promote natural oyster production and meet the changing needs of the resource.	2.2.1. MD will maintain the state repletion program as funds are available at current levels (2 million bushels of shell & 500,000 bushels of seed if spat set permits). As new initiatives by the MOR are implemented, the repletion program may be modified.	Continue	The amount of shell and seed may be variable from year to year depending on availability. Repletion efforts will be monitored then evaluated after 3 years (1997).
	2.2.2. MD will continue the fall dredge survey.	Continue	The survey provides data on oyster mortality, recruitment (spat set), and disease patterns that help direct the repletion efforts.
	2.2.3. MD will provide fresh shell to the state hatchery and community groups for habitat enhancement and develop a policy on the minimum desiccation period to prevent the spread of MSX and Dermo with fresh shell.	1995	
	2.2.4. MDNR will support the ORA efforts by providing the program with a percentage of available shell. The amount of shell will be determined annually.	1995	For 1994/1995, 200,000 bushels of shell will be available.
	2.2.5. VA will restore two major areas where setting is good, the James and Rappahannock Rivers, forming sanctuaries for maintaining the stock.	Begin in 1994	Restoration efforts will include: locating the best substrate; prohibiting harvest; adding shell or other material to build reef structure; adding seed; and, monitoring growth.
	2.2.6. VA will turn and clean or add cultch to oyster beds near sanctuary reefs in the James and Rappahannock Rivers to prepare them to receive spat set from sanctuary areas.	1995	The cleaning and shelling procedure will include: identifying the best areas; delineating the best time; monitoring growth; setting a harvest quota; and, implementing the quota.
	2.2.7. a) Continue to monitor the repletion efforts and adjust the timing and location of shell and seed planting based on the best available data. b) VA will establish a computer data-base system to monitor the progress of the repletion program on a bar by bar basis.	a) Continue b) 1995	Maryland has been compiling a computer-based oyster data system as an on-going effort.
	2.2.8. When the hatchery production of seed is adequate to meet planting needs, the repletion programs will be modified to eliminate the spread of disease with seed plantings.	Open	Implementation is dependent on seed production.

1994 OYSTER IMPLEMENTATION (cont'd)

PROBLEM, AREAS & STRATEGIES	ACTIONS	DATE	COMMENTS
3. Habitat/Water Quality 3.1 Conduct a phased program to evaluate and implement projects to restore the physical habitat for oyster.	3.1.1. Restore physical oyster habitat through the Maryland and Virginia Aquatic Reef Program.	Variable	See specifics in the 1994 Aquatic Reef Habitat Plan.
	3.1.2. Redefine sanctuaries with adequate geographic extent and distinctiveness.	Variable, beginning in 1994	
	3.1.3. Evaluate innovative techniques for restoring physical oyster habitat, conduct projects such as cleaning bottom areas, and evaluate optimal physical structures and alternative materials for rebuilding oyster bars.	1995	
3.2 Will work to ensure that water quality is maintained at levels necessary to support healthy oyster populations.	3.2.1. Current programs established under the CBP to reduce pollutant sources that adversely affect oyster stocks will be maintained.	Continue	The Tributary Strategy will work to identify specific measures to protect and restore water quality for the benefit of living resources including Bay oysters.
	3.2.2. Local, state, and federal agencies will utilize their permitting and environmental review programs to ensure that oyster habitat is not adversely affected by the discharge of pollutants, dredging, and other human activities.	Continue	
	3.2.4. The ORA advisory committees will assess the potential impact of activities which may adversely affect oyster on ORA's and provide recommendations to the appropriate agencies for prevention and restoration of adequate water quality.	1995	
4. Management to Increase Oyster Production 4.1 Work to improve and increase oyster production in the private and public oyster fisheries.	4.1.1. Prepare a comprehensive analysis of past and current oyster culture techniques and other relevant areas to help focus effort and finances into projects with the best chances of success.	1995	Existing expertise and experience in the National Marine Fisheries Service will be utilized.
	4.1.2. MD will increase the hatchery production of oyster larvae and seed oysters by maximizing production at Horn Pt. and using fresh shells supplied by MDNR.	Continue	Field surveys are currently underway to evaluate plantings of hatchery reared seed which will guide utilization of larvae and seed from state facilities.

1994 OYSTER IMPLEMENTATION (cont'd)

PROBLEM AREAS & STRATEGIES	ACTIONS	DATE	COMMENTS
4. Management to Increase Oyster Production (cont'd)	4.1.3. MD will establish remote setting sites for eyed-larvae purchased from public or private hatcheries, in appropriate locations with low levels of MSX and Dermo	1995	
	4.1.4. Encourage private companies to develop oyster hatcheries.	1995	Encouragement will include competitive bidding for contracts to provide oyster larvae and seed for ORA's and other areas.
	4.1.5. Initiate a grant program with matching funds provided by private industry, to stimulate the development of innovative techniques for oyster restoration, culture and production.	Dependent on funding	
	4.1.6. MDNR will establish a pilot permitting program for oyster aquaculture demonstration projects.	1994	As of February 1994, a draft document entitled, "Oyster Aquaculture Permit Guidelines 1994" has been developed (see Appendix V in this plan for details).
	4.1.7. MDNR will establish an aquaculture permit clearinghouse service for applicants.	1994	Includes: designating a single point of contact, tracking permit applications, coordinating state agencies and preparing a permit handbook.
	4.1.8. Will define the acreage available for leasing oyster bottom.	Variable beginning in 1994	
	4.1.9. The enforcement of property rights relevant to private oyster aquaculture will be added to the public education program.	1995	
	4.1.10. VMRC will develop and operate a depuration facility to utilize oysters in less than optimum water quality situations.	1995	The development of a depuration facility will not lessen the need to continue to improve water quality.
4.2 Reduce and control fishing mortality.	4.2.1. Maryland will utilize specific guidelines to control fishing mortality.	1995	Harvest rates will be determined and adjustments made on annual fishing mortality rates.
	4.2.2. Evaluate the potential advantages and disadvantages of a "slot limit" with a minimum size for harvesting of 2.5" and a maximum size of 4" for areas impacted by disease.	Begin in 1994	Slot limit already in effect for PRFC. MD will collect oysters over 4" from diseased areas and test their resistance to disease. The patent long survey will provide estimates of the impact of harvesting small oysters from the population.

1994 OYSTER IMPLEMENTATION (cont'd)

PROBLEM AREAS & STRATEGIES	ACTIONS	DATE	COMMENTS
4.2 Reduce and control fishing mortality (cont'd).	4.2.3. VMRC will manage the public oyster grounds in the James River, Rappahannock River, Pocomoke/Tangier Sounds and Seaside Eastern Shore.	Variable	
5. Collection of Management Quality Data	5.1.1. Continue to collect quantitative data on oyster stocks, habitat and diseases and make the information available in an annual report.	Annually	
	5.1.2. VMRC will establish a computer data-base system for the collection, storage and analysis on a bar-by-bar basis, updated weekly, of information to estimate standing stock and establish yearly catch quotas.	1995	Data will include daily entries for total landings, boat numbers, landings per boat, area harvested, and number of harvesters per boat.
	5.1.3. The fisheries agencies will make oyster data available to the research community as needed to investigate suggested research topics or in connection with other research.	1994	

LEGEND:

CBP - Chesapeake Bay Program

MDNR - Maryland Department of Natural Resources

MOR - Maryland Oyster Roundtable

ORA - Oyster Recovery Area

PRFC - Potomac River Fisheries Commission

VIMS - Virginia Institute of Marine Science

VMRC - Virginia Marine Fisheries Commission

Section 2.

Management for Maryland Oyster Recovery Areas (ORAs)

Due to the dominating impact of MSX and Dermo on Chesapeake oyster stocks, geographic areas termed Oyster Recovery Areas (ORAs), will be designated in low salinity reaches of the Bay and its tributaries where MSX and Dermo are less viable. Restoration projects are not limited to these areas and might in the future also include areas along the entire salinity gradient and in diseased waters. The objectives for managing these areas are 1) limit transplantation activities which would serve to perpetuate MSX and Dermo in a region and 2) evaluate different methods to rehabilitate, rebuild, plant and otherwise restore oyster populations in these areas. The following section describes the specific, intensive management effort that will be implemented in the ORAs.

Strategy 1

The implementation of activities within the ORAs by the MDNR will be guided by an advisory committee.

Actions:

- 1.1 Each ORA advisory committee will be constituted by MDNR and include representatives of the following organizations and interests: watermen; aquaculture; environmentalists; scientists; Departments of Natural Resources, Agriculture, and Environment.
- 1.2 A technical committee of scientists will be established to determine the experimental design and oversee the monitoring and evaluation of the ORAs.

Strategy 2

Each ORA will be comprised of from one to three zones and must include a Zone A and/or a Zone B. Specific activities will be defined for each area.

Actions:

- 2.1 A) Zone A will be in the lowest salinity area of the ORA. The following activities will apply:
 - 1) Clam and oyster harvesting will be suspended for five years, to reopen consistent with management objectives.
 - 2) Sections will be managed as ecological, brood stock sanctuaries.
 - 3) Natural bars will be rehabilitated to facilitate natural set.
 - 4) Intensive monitoring for MSX and Dermo will occur.
 - 5) Only certified seed will be planted on cultch placed on prepared bottom. Plots may be used for

experimental off-bottom culture techniques and other pilot programs. Other plots will be left undisturbed for monitoring purposes.

6) A portion of the plantings will become a permanent sanctuary for broodstock.

7) Sections will be transferred to higher salinity growout areas after 1, 2, and 3 years. Aquaculture permits may be obtained for parallel grow-out experiments using water column and floating raft culture.

B) Zone B will be immediately downstream of Zone A, or in a river without zone A. The following activities will apply:

- 1) Shellfish harvesting will be allowed.
- 2) Only certified seed will be planted.
- 3) Natural bars will be rehabilitated.
- 4) There will be intensive monitoring for MSX and Dermo.

C) Zone C will be a large zone downstream from Zone B. The following activities will apply:

- 1) Shellfish harvesting will be allowed.
- 2) Natural seed will be imported until it can be replaced with certified seed.
- 3) Experimental seeding will be allowed in selected areas.
- 4) Natural bars will be rehabilitated in selected areas.
- 5) Intensive monitoring for MSX and Dermo will occur.
- 6) One or more sanctuaries will be established to test techniques for rebuilding and rehabilitating oyster populations.

Strategy 3

A subcommittee of the Oyster Roundtable will define the criteria determining where the boundaries of ORAs are and submit them to MDNR for their adoption by regulation.

Actions:

3.1 The Chester, Choptank, Magothy, Nanticoke, Patuxent, and Severn Rivers will be designated as initial sites for ORAs.

3.2 The Oyster Roundtable will review the progress of activities in the initial ORAs and recommend the designation of additional ORAs if warranted, with a long-range objective of restoring and rebuilding all natural bars.

Section 3.

Biological Background

American or eastern oysters occur along the east coast of North America from the Gulf of St. Lawrence, Canada, to Key Biscayne, Florida. In the Caribbean, the range of American oysters extends to the Yucatan Peninsula of Mexico and the West Indies of Venezuela. Chesapeake Bay, which provides optimal environmental conditions for the species, is close to the center of its geographical distribution. However, oyster production varies within the Bay system depending on environmental and habitat conditions.

Oysters generally spawn from May through September in the Chesapeake Bay. Increases in water temperature to 18-20°C stimulates spawning activity. Eggs hatch into free-swimming larvae that settle to the bottom, two to three weeks after hatching. They attach to oyster shells or other hard substrates and the attaching phase is termed "setting." The newly attached oysters are called "spat." Oysters grow at the rate of about one inch per year. Growth rates can be affected by temperature, food quantity, salinity and parasitic infection. Shell growth usually occurs in the spring and soft body tissue growth occurs after spawning. Oysters usually enter the market three to five years after spat settlement.

Oysters are filter feeders and depend on phytoplankton for their energy requirements. Oysters play an important role in filtering the water. It has been hypothesized (Newell 1988) that the decrease in oyster abundance in the Bay has contributed to an apparent shift to microbial food webs and an increase in zooplankton and their predators (ctenophores and jellyfish).

Biological Parameters

Natural mortality rate: Currently, very high due to disease and freshwater inflow.

Fecundity: 5 - 15 million eggs at one spawning. Smaller oysters produce less eggs (See Figure 4).

Longevity: Up to 15 years.

Age at maturity: 2 years

Habitat Requirements (refer to Table 1)

Spawning season: May through September.

Spawning area: Throughout Chesapeake Bay.

Figure 3. Oyster fecundity vs. size

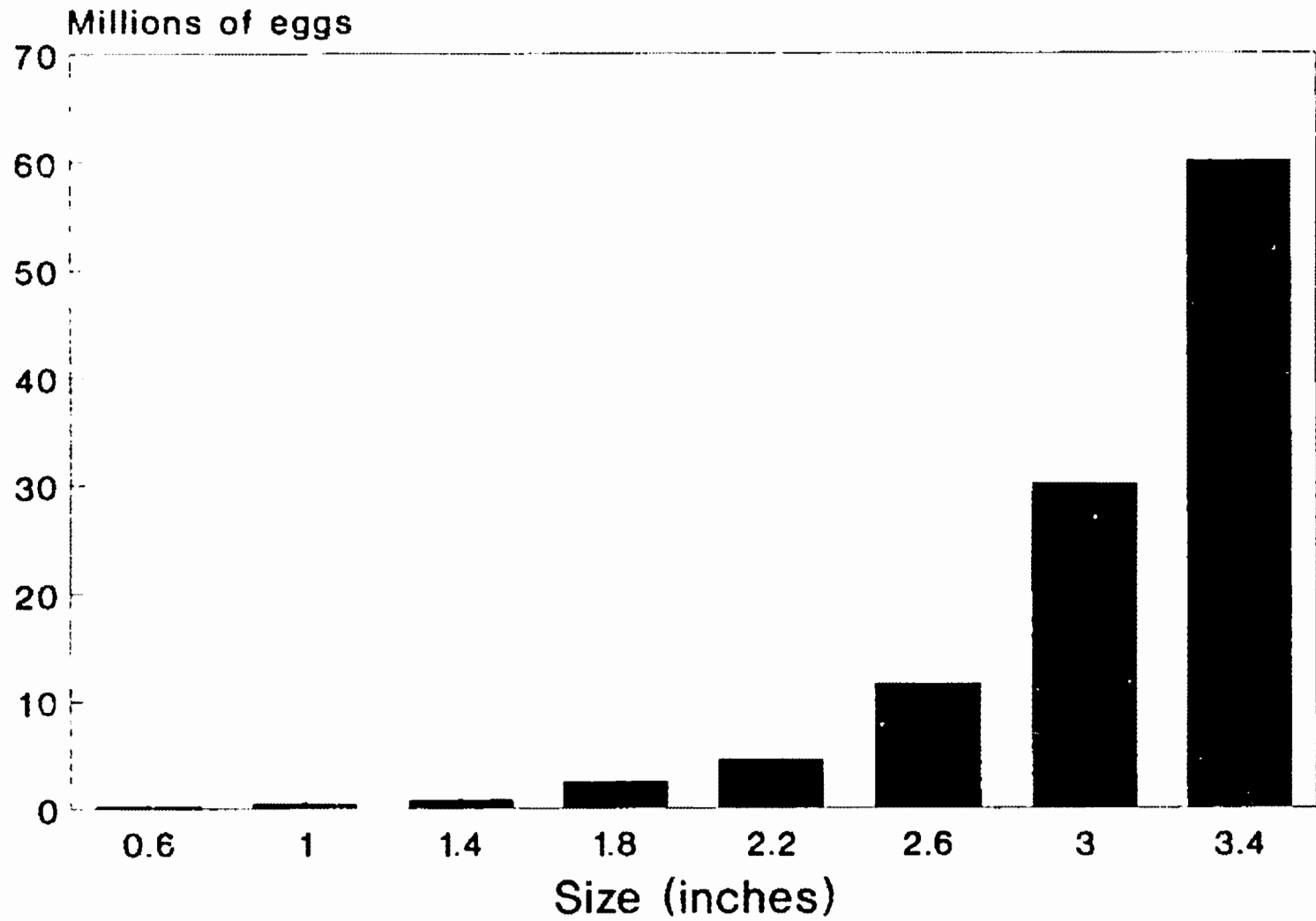


Table 1. Habitat requirements for oyster eggs, larvae, spat, and adults. Ranges are based on broad estimates and may vary with geographic location (from Habitat Requirements for Chesapeake Bay Living Resources, 1991).

LIFE STAGE	LIFE ZONE	TEMP. ^a °C	SALINITY ^a ppt	SEDIMENT ^a g/L ⁻¹	pH	DISSOLVED O ₂ mg/L ⁻¹
Eggs	water column	19-32	12.5-35 ^a 7.5-22.5 ^a	<0.25	6.75-8.75	?
Larvae	water column	19-32	12.5-27.0 ^a	<0.5	6.75-8.75	e
Spat	hard substrate	0-32+	15.0-22.5 ^a	?	?	g
Young (30-50mm)	beachoe					<0 at 10°C ^b 0.8-1.49 at 20°C ^b 2.75-4.98 at 30°C ^b
Adults	beachoe					
survival		0-32+	0-36+	?	?	~1(5 days)
feeding		6-32; (15-25 "optimum")	5+	<0.4	?	?
growth		6-32; (15-25 "optimum")	12+	?	?	?
gametogenesis		7.5-30+	10+	?	?	?
spawning		20±	10+	?	6-10	?

^a Salinity can affect temperature tolerances, and vice versa. Tolerance to temperature is roughly adult = spat > veliger larvae > zygotes.

^b Effect of temperature upon type and size of particle; experimental values have been higher than values normally encountered in nature except during intense storms.

^c Adults acclimated to 26.0-27.9 ppt; optimal egg development at 22.5 ppt and optimal larval growth at 17.5 ppt.

^d Adults acclimated to 9 ppt; optimal egg development at 10-15 ppt.

^e Median mortality times in anoxia: 11 hours for 82µm larvae; larval swimming rates unaffected at 0.5mg/L⁻¹ for up to 12 hours.

^f Spat had been set at near marine salinities.

^g Median mortality times in anoxia: 150 hours for 16mm spat.

^h LC₅₀-PO₂ (mg/L⁻¹) causing 50% mortality after 78 days of exposure at 10, 20, and 30°C, with oysters held at 10 ppt, 20 ppt, and 30 ppt at each temperature.

Habitat Issues

Some of the more important environmental factors affecting oyster distribution include substrate type, depth, salinity, and disease prevalence. Oysters need a clean, stable substrate on which to set and grow. Soft mud, shifting sand or silted bottom are unsuitable. Oysters are generally limited to waters less than 25' deep due to hypoxic/anoxic conditions that develop in many deeper waters of the Bay. Salinities above about 10-12 ppt increase oyster mortality from predation and disease. Man's activities have impacted the distribution and abundance of oysters. Sediment from channel dredging, upland construction and agricultural activities can smother oyster beds and foul cultch to prevent setting.

Nitrogen and phosphorus enrichment from sewage treatment plants and agricultural runoff have increased the extent of hypoxic and anoxic conditions. Sewage input results in high coliform bacterial counts which force the closure of shellfish harvesting areas. In 1986 only 45,500 out of 158,900 acres in the James River were classified by the National Shellfish Sanitation Program as approved shellfish growing waters. Maryland oyster samples collected and analyzed from 1980-1986 revealed that heavy metal or PCB concentrations were below action levels in all oyster growing areas sampled in the state. However, these oysters did have levels higher than would be found in a pristine environment.

Disease

Oyster diseases have been monitored and studied in the Chesapeake Bay since the late 1950's. Increased natural mortality has been linked to the spread and intensification of two parasites, Perkinsus marinus (Dermo) and Haplosporidian nelsoni (MSX). These parasites are single-celled organisms (protozoans) that infect oysters but have no effects on humans, whether the oysters are eaten raw or cooked. The exact mechanisms by which the parasites kill the oysters are not understood. There are no known cures for the diseases. The only strategy currently available is to move seed oysters, less than 1 year old, to areas where diseases are less prevalent to protect them while they are growing. These areas are usually less saline and do not provide the best growth environment. Low salinity areas rarely produce a good natural spat set. Without seed plantings, these areas cannot produce continuing harvests. Seed areas are currently monitored for disease during the fall and spring disease surveys, and seed oysters being transplanted to the upper Bay and tributary grow-out areas.

There is no evidence that low levels of pollution have any relationship either to susceptibility to the diseases or to their virulence. There is also very little information that any habitat factors except salinity and temperature, have any significant effects on disease.

Fishery Parameters

Status of exploitation:	Fully exploited.
Long term potential catch:	Highly dependent on prevalence and intensity of diseases, harvesting and freshets.
Importance of recreational fishery:	Insignificant.
Importance of commercial fishery:	Historically, highly significant; harvests have declined in the Chesapeake region, oysters still rank nationwide as one of the top seafood species in dockside value.
Fishing mortality rates:	Highly variable.

The Historic Fisheries

Before the turn of the century, over 10 million bushels of oysters (which yielded approximately 64 million pounds of meat) were harvested annually in Maryland by a large dredge fleet. Virginia harvests at this time were approximately 6-7 million bushels (38-45 million pounds of meat), and were harvested primarily by hand tongs. Landings have declined dramatically since that time and continue to show a downward trend. During the past 30 years, oyster harvests in Maryland ranged from 3.2 million bushels in 1973 to 124,000 bushels in 1993. In Virginia, the harvest of market oysters ranged from 1.9 million bushels in 1964 to 64,500 bushels in 1993. Although commercial landings are used as an indicator of stock levels, they do not necessarily reflect stock abundance. Changing market demands can affect commercial landings without any change in stock abundance.

The Oyster Resource

The Baywide oyster stock can be characterized as severely depleted. Recent expansions of the range of oyster diseases, MSX and Dermo, and past harvesting practices are primarily responsible for the population's current status. Low dissolved oxygen episodes have also contributed to the problem. Average levels of spatfall have dropped in the past decade (refer to Figure 3) and the number of natural beds receiving spatfall adequate for replenishment has been reduced from historic levels. In Maryland, the 1983 and 1984 spat sets were virtually non-existent. Although the 1985 spatfall was exceptionally high and well distributed, the year class has been effectively wiped out in those areas infected by disease. Maryland's 1986 spatfall was considered average and of limited distribution. Many of the 1986 year class have been infected by MSX

and Dermo and may be killed if high salinities continue in the Maryland portion of the Bay. Continued low levels and poor geographic distribution of spatfall levels occurred during 1987 and 1988. The 1991 spat set was a record high but disease has prevented any widespread population recovery from the set.

Since 1985, the James River has become the center of the market oyster landings in Virginia. The low number of surviving spat and decreasing bushel counts of spat, small, and market oysters, as determined from the VIMS oyster shoal surveys since the spring of 1986, indicates that the James River is failing to match the losses in number of oysters with an equal recruitment of spat. Since 1992, spat set in the Piankatank, Great Wicomico and Rappahannock Rivers has been at historically low levels.

Laws and Regulations

Limited entry:

Maryland adopted a limited entry to the commercial fishery, April 1994, which repeals the Delay of Application Process of September 1, 1988, and allows MDNR to limit the number of tidal fish licenses which may be issued.

Virginia's delayed entry went into effect December 1, 1992. It requires previously unlicensed applicants to wait two years after registering before a license to harvest oysters with commercial gear will be issued.

On the Potomac River, only Maryland and Virginia residents may commercially oyster.

Minimum size limit:

Maryland - 3" with 5% tolerance, market oysters with small oysters or spat attached may be kept if separating the small oysters or spat would kill them.

Potomac River- 3" with 5% tolerance, however, market oysters with small oysters attached must be returned if separating them kills the small oyster (including spat). High salinity areas 2 1/2" minimum and a 4" maximum.

Virginia - Clean cull areas - 3". No cull size for seed areas and leased ground.

Daily catch limit:

Recreational -- Maryland, Potomac River and Virginia: no license required for the taking of one bushel per day from public grounds. **Commercial** -- Maryland: shaft and patent tongs, diving - 15 bushels per licensee, but not to exceed 30 bushels per boat; dredge boat -

150 bushels per boat; power dredging (in designated waters of Somerset county) - 12 bushels per licensee but not to exceed 24 bushels per boat.

Commercial--Potomac River: None.

Commercial -- Virginia: None.

Harvest quotas:

Virginia: variable by season and area.

Season (actual restrictions determined prior to season) and time restrictions:

Maryland - Shaft tongs, patent tongs and diving: September 15 to March 31, Monday through Saturday, sunrise to sunset, except Worcester County where the season is January 1 to December 31, Monday through Saturday, sunrise to sunset. Dredging: Sail dredging in designated waters state-wide, November 1 to March 15, Monday through Saturday, sunrise to sunset. Power dredging: in designated waters of Somerset County, November 1 to March 15, Monday through Saturday, sunrise to 3 pm. Private grounds: no seasonal restrictions, but harvesting between sunset and sunrise or on Sunday is prohibited.

Potomac River - Hand shaft tongs: October 1 through March 31. Hand Scrape: Months of November, December and March. Hand tongs, lawful only Monday through Friday from sunrise to 12:00 noon EST. Hand scrapes, lawful only Monday through Thursday during March and Monday, Wednesdays and Fridays during November and December from 8:00 a.m. to 12 noon each day

Virginia - Shaft tongs or hand tongs: James River Seed Area, October 1 to July 1, sunrise to 12:00 noon. All other public areas, October 1 to June 1, sunrise to 12:00 noon. Private grounds, no seasonal restrictions; but harvesting on Sunday or between sunset and sunrise is prohibited. Patent tongs: October 1 to March 1, sunrise to sunset, for all public areas not prohibited by Section 28.1-82 of the Code of Virginia or VMRC Regulations and Orders. October 1 to the last day of February, sunrise to 2 p.m., in the Piankatank River, Pocomoke Sound/Tangier and Chesapeake Bay Management Areas. Private grounds, Sunday and sunset to sunrise harvesting is prohibited. Dredge: Pocomoke/Tangier Management Area, 15 November-last day of February (sunrise-2 P.M.). Chesapeake Bay Management Area, 1 November-last day of February (sunrise-2 P.M.). Private grounds, generally no restrictions, except Sunday and sunset to sunrise harvesting is prohibited. Bay and tributaries sunrise to 12:00 noon; Seaside - sunrise to sunset.

Gear Restrictions:

Maryland - The legal gear types for harvesting oysters in Maryland include hand tongs, patent tongs, diving gear, handscrapes and dredges. The use of each gear type is restricted to certain designated areas as set forth in Maryland's laws and regulations. Dredges or handscrapes cannot exceed 200 lbs. in weight or have a tooth bar greater than 42 inches in length (as measured from the outside teeth) on dredges used on rock bottom, or 44 inches in length for dredges used on mud bottom. No "devil catch", "devil diver", or similar device is to be attached to the dredge to steer it to the bottom. No power boat may have on board or in tow any gear used for dredging unless it is permitted by the Department to harvest oysters from leased bottom, from State seed areas, or unless it is a sail dredge boat using its yawl boat on push days. On Monday and Tuesday during the oyster dredging season a dredge boat may be propelled by an auxiliary yawl boat in certain areas. Diving -each person engaged in the diving operation must be licensed. Not more than two divers can work from a boat at one time. Each diver shall have one attendant on the boat. An International Code Flag "A" of the proper specifications must be displayed. Power assisted lifting devices may be used subject to specified conditions. Hand tong winders are allowed.

Potomac River - Patent tongs and power or sail scrapes or dredges, power or hand-operated winch, spool, winder, are prohibited. Hand scrapes limited to 22" catching bar. Diving for oysters limited to recreational harvest of 1 bushel per person per day. Legal gear types include hand shaft tongs, power assisted hand shaft tongs and hand scrape.

Virginia - Only one type of gear, either hand tongs, patent tongs (limit of 2) or a single dredge, is allowed on a vessel at one time in the Pocomoke/Tangier and Chesapeake Bay Management areas. Only one type of gear, either hand tongs or patent tongs (limit of 2), is allowed on a vessel at one time in the Piankatank River Management Area. Patent tongs -the teeth of patent tongs shall not exceed four inches in length, and patent tongs exceeding 100 pounds in gross weight, including any attachments (excluding rope for the taking or catching of oysters), are prohibited. Dredge - a dredge and attachment cannot exceed 100 pounds total weight.

Area Restrictions:

Maryland - Hand tongs are allowed Statewide, with portions of most tributaries reserved for hand tongs only. Downstream of these areas, diving is allowed. Patent tongs are permitted in the mainstem Chesapeake Bay, the lower Patuxent River and all of Somerset County. Power dredging is restricted to designated waters of Somerset County. Sail dredging is restricted to the Mainstem Bay, Tangier Sound, and portions of the Choptank River.

Potomac River - No harvest allowed in 25 acre oyster sanctuary on Jones Shore. Hand tongs, none except sanctuary. Hand scrapes, not allowed on Jones Shore or above a line from Herring Creek, MD to Bonum Creek, VA.

Virginia - Only hand tongs are permitted in most areas, with patent tongs restricted to those areas specified by the Code of Virginia or VMRC Regulations and Orders (Piankatank River, Chesapeake Bay and Pocomoke/Tangier Management Areas). Dredging is restricted to the Pocomoke/Tangier and Chesapeake Bay Management Areas.

Status of Traditional Fishery Management Approaches

Catch-Effort: Commercial fisheries data for Chesapeake Bay are a reasonable indicator of the current status of the marketable stock. In Maryland and Virginia, catch and effort statistics for the commercial fishery are, in general, of low quality and of limited value in developing fisheries management models. The PRFC catch and effort data are highly reliable.

Estimates of mortality: Depends on disease prevalence, freshets, and harvesting.

**Yield-per-Recruit
(spat survival to
markets):**

Traditionally, very low.

Stock-Recruitment:

The stock-recruitment relationship for Chesapeake Bay oysters is unknown.

References

- Brown, Butt, A., and K. Paynter. 1994. Performance variation among native and selectively-bred Eastern oyster strains in North Carolina. National Shellfisheries Association.
- Chesapeake Bay Program. 1989. Chesapeake Bay Oyster Management Plan.
- Kennedy, V.S. 1991. Eastern oyster. In: S.L. Funderburk, S.J. Jordan, J.A. Mihursky, D. Riley (eds). Habitat requirements for Chesapeake Bay living resources, Chesapeake Research Consortium, Inc., Solomons, Maryland.
- Newell, R.I. 1988. Ecological changes in Chesapeake Bay: Are they the result of overharvesting the American oyster, *Crassostrea virginica*? In: M. Lynch (ed.) Understanding the estuary: Advances in Chesapeake Bay research. Chesapeake Research Consortium Publication 129:536-546.
- Myatt, E.N. and D.O. Myatt, III. 1990. A study to determine the feasibility of building artificial reefs in Maryland's Chesapeake Bay. MDNR, Tidewater Admin., Fish. Div. International Weighmaster, Inc. contract #F167-89-008.
- Scientific and Technical Advisory Committee (STAC). 1992. Oyster restoration action agenda. Living Resources Subcommittee, Maryland Department of Natural Resources, Virginia Marine Resources Commission.
- Smith G.F. and S.J. Jordan. 1992. Monitoring Maryland's Chesapeake Bay oysters. A comprehensive characterization of modified fall survey results, 1990-1991. MDNR Chesapeake Bay Research and Monitoring, Habitat Impacts Program. Oxford, Maryland
- Ulanowicz R.E. and J.H. Tuttle. 1992. The trophic consequences of oyster stock rehabilitation in Chesapeake Bay. *Estuaries* 15(3)257-265.

APPENDIX I

MARYLAND'S GOVERNOR'S COMMITTEE RECOMMENDATIONS

**COMMITTEE TO REVIEW STATE POLICY FOR FUNDING
MARYLAND'S CHESAPEAKE FISHERIES**

To recommend future management strategies and whether the State should subsidize the programs.

14

MAJOR RECOMMENDATIONS

The situation in Maryland's oyster industry is dire and the State must make some crucial changes if the industry is to rebound. Recent outbreaks of oyster disease, past mismanagement and an ever-competitive marketplace have reduced the Maryland oyster industry and resource to near obscurity. To restore it to economic, social and ecological significance, major shifts in policy must be made. We recommend that the State of Maryland:

1. Encourage both the enhancement of the public oyster fishery and the development of a private fishery. Public access to natural oyster beds, a part of Maryland's heritage, should be sustained by continuing the oyster repletion program. The promise of the private fishery must be encouraged by the State through research, permitting processes and law enforcement.
2. Continue to enhance the public fishery through the repletion program but insist that an increasing share of its costs be borne by the public fishery. The repletion program is needed for production from public beds and the industry alone is currently unable to bear the entire cost of the program. Current policy should be directed towards generating more tax revenue from the public fishery to offset the existing subsidy in the repletion program. Thus, gradual increases in

taxes should be instituted with a long-run goal of program self-sufficiency. To implement this recommendation, we suggest that:

- a. The existing severance tax be revised to be a fixed percentage of dockside price and increased to reflect the resources scarcity. When established at its present level in 1982, the current tax of \$.45/bushel represented about 5% of the dockside price. The present tax rate is 1.8% of the dockside value. Existing circumstances warrant a tax increase to at least the 1982 percentage rate.
- b. The export tax be raised from its current level to an amount not less than the replacement costs of exported shell. When oysters are exported from Maryland, all legal remedies to guarantee the return of shell are lost. The replacement cost of the lost shell thus should be charged on exports.
- c. The license fees for public harvesters should be raised from the current \$50 per licensee to \$350 per licensee. Some of the costs of the repletion program are essentially overhead, with benefits accruing to all (for example, policing sanctuaries). Raising license fees will assure coverage of fixed costs.

3. Review the industry's legal and regulatory framework with the goal of promoting scientific management and enhancing the efficiency of public harvesters. The regulatory framework which has accumulated over the last century is unresponsive to current circumstances.
4. Remove certain legal impediments constraining the production of oysters through private aquaculture. Although there appears to be great promise for production from oyster aquaculture, it must be encouraged by:
 - a. expanding the bottom available for private leasing;
 - b. establishing a process to permit use of the water column;
 - c. increasing the leasehold fee (from \$3.50 annual per acre) to provide funds for enforcing leasehold rights and to discourage unproductive use of leases.
5. Intensify the enforcement of regulations related to Maryland oyster production. The protection of oyster sanctuaries, enforcement of leasehold rights and the collection of taxes must be guaranteed to assure equity among industry participants and public trust in the programs of the State.

6. Increase its knowledge of oyster pathology, ecology and markets. Oyster diseases have recently plagued the industry. A greater understanding of oysters, their diseases and alternatives to avoid them is critical in developing plans for the future of the industry. This should be done in cooperation with adjacent states, the Potomac River Fisheries Commission and the Federal Government. Likewise, reaching aquaculture's potential may only be possible through developing new seed technologies, new product forms and new markets.

7. Develop and enforce standard weights, measures and minimum quality both to protect consumers and to enhance demand. While efforts cannot be completely independent of Federal standards, the State, in conjunction with adjacent states, must develop and enforce internally consistent, replicable standards essential to a modern commercial enterprise. Quality control of the oyster product must be guaranteed so that consumer perceptions of Maryland's oyster quality are maintained or improved.

8. Strengthen its role in assessing oyster stocks, monitoring production and evaluating the quality of oyster beds. In order to determine policy, appraise programs and assure consumer safety, effort is required to collect, assimilate and analyze data. Both the public and private fisheries will

require careful scientific management on the part of the State. Use of less political influence and more scientific information in the allocation of resources within and between the public and private fishery is essential.

APPENDIX II

VIRGINIA'S HOLTON PLAN (BLUE RIBBON) REPORT

REPORT OF THE "BLUE RIBBON" PANEL

Prepared in late 1991 by a 33-member advisory panel of scientists, environmentalists, watermen, planters, economists, and others, this report (also, "The Holton Plan") sets forth issues and recommendations for restoring Virginia's oyster industry. Four potential oyster sources are considered:

- Traditional state and private culture of *C. virginica*;
- Off-bottom culture in approved waters;
- On-bottom culture of a non-native species (*C. gigas*);
- On-shore depuration of moderately polluted oysters.

The eight recommendations in the Holton Plan are summarized below:

- o **Data Collection and Monitoring** -- The State should establish computerized data base systems for detailed collection, storage, and analysis of stock assessment data and landings data, as well as for detailed monitoring of the Virginia repletion program.
- o **Legislation** -- The Virginia Marine Resources Commission should be empowered to control or limit entry to the commercial fishery, enabling the VMRC to protect the full-time fishermen and the resource.
- o **Repletion** -- The State should establish a repletion program for the public fishery, based upon oyster biology and river dynamics, and assure systematic monitoring of the program. The strategy should include programs to:
 - Restore two sanctuary reefs in the James and Rappahannock rivers, and cover them with seed oysters to maintain biological stock close to harvest areas (adjacent beds);
 - Prepare nearby beds to receive spawn from the sanctuaries, and monitor growth, harvest to quotas, close beds, and repeat;
 - Plant seed in low-set areas but with good growth potential, in the Mobjack River and the Pocomoke-Tangier areas; monitor, harvest, close, and repeat.

Initially, this should be a three-year program, with thorough data collection and monitoring, followed by an evaluation of the repletion strategy.

- o **Market Evaluation and Development** -- Commission a joint effort with the Virginia Institute of Marine Science (VIMS) and Virginia Tech to examine the marketing

potential of current oyster products, and possible new product lines, including depurated oysters. In addition, there should be a joint industry-academic study to evaluate current State-funded marketing programs and recommend new or expanded marketing strategies for Virginia seafood products. Finally, a marketing and economics advisory agent should be appointed through VIMS to develop economic markets for off-bottom cultured oysters, and to work closely with aquaculturists and others in the industry.

- o **Off-Bottom Culture** -- The State should identify areas as appropriate, marginal, or non-appropriate for aquaculture (VIMS), and establish regulations and a permitting process for off-bottom oyster culture (VMRC). To encourage start-up of private hatcheries, VIMS should draft model tax incentive legislation. A technical advisory agent should be appointed through VIMS, who will specialize in hatchery matters.
- o **Depuration** -- The VMRC should estimate oyster stocks and potential daily supplies of clean and depurable oysters from public and private sources, both on- and off-bottom, supplies that will support year-round depuration plant operations. After a complete economic analysis of such a facility (VIMS), cooperating State agencies should design a pilot plant. If economic analyses warrant, the State should establish a public-private partnership to construct an experimental depuration facility, and design a fee system to make it self-supporting.
- o **Management of Public Grounds** -- This recommendation addresses specific management steps for the James and Rappahannock rivers, Pocomoke/Tangier sounds, Seaside Eastern Shore, Mobjack Bay, and the Piankatank and Great Wicomico rivers. Included in these specific steps are limits on shaft length of tongs, quotas, changes in cull length, increases in sanctuary size, new repletion strategies, and harvest prohibitions in some areas.
- o **Introduction of Non-Native Species** -- The State (VIMS) should conduct full laboratory tests of *Crassostrea gigas*, investigating temperature and salinity tolerances, as well as ecological relationships. If preliminary tests warrant, a pilot study in the York River should be established to evaluate *C. gigas*' ability to grow and reproduce in a natural Bay environment. These studies should include evaluations of disease resistance. Based on success of preliminary studies, *C. gigas* sanctuary reefs should be expanded.

APPENDIX III

SUMMARY OF MDNR 1993 OYSTER PROGRAM

An index of survey and program sites, available data and reports, and source contacts

Prepared by Maryland Department of Natural Resources

Tidewater Administration

Fisheries Division, Shellfish Program

April 1994

This report includes, by location, the 1993 effort associated with various surveys and management programs conducted by Maryland's Department of Natural Resources Shellfish Group. These are indexed by program and by the location of data files. A substantial amount of this information is stored on computer files and these are noted in this report. Data source contacts and a brief description of each program are included. Computer stored data are kept on the following software packages:

Spreadsheet: Quattro Pro 5.0 for Dos and for Window and Axum 3.0.

Database: dBase III* and IV, mBase, and Paradox 1.5.

GIS: Mapinfo for Windows.

<u>REGION</u>	<u>OYSTER BAR</u>	<u>PROGRAM</u>	<u>DATA CONTACT</u>
UPPER BAY EAST	DEEP SHOAL	FS	MA
	TOLCHESTER	FS	MA
	HODGES	FS,SA	MA,PP
	SWAN POINT	MFSD,SA,FT,SSRP3	OXL,PP,PP,TA
CHESTER RIVER: UPPER CHESTER	SHEEP	FS,SA	MA,PP
	EMORY HOLLOW	FS,SA	MA,PP
	SPANIARD POINT	FS,FT,SSRP1	MA,PP,TA
	CLIFF	FS,SSRP1	MA,TA
	EBB POINT	FS,SSRP1	MA,TA
	DRUM POINT	FS	MA
	BOATHOUSE	FS,SSRP1	MA,TA
	OLDFIELD	MFSD,SA,SSRP1	OXL,PP,TA
	CHESTER RIVER MIDDLEGROUND	FS,SSRP1	MA,TA
	BLUFF POINT	FS,SSRP1	MA,TA
	HELL'S DELIGHT	FS,SSRP1	MA,TA
	BAY BUSH POINT	FS	MA
	PINEY POINT	FS,FT,SSRP1	MA,PP,TA
	DURDIN	FS,SSRP1	MA,TA
	HORSE RACE	FS,SA,SSRP1	MA,PP,TA
	CARPENTER ISLAND	FS,SA	MA,PP
LOWER CHESTER	BUOY ROCK	MFSD,SA,FT	OXL,PP,PP
	WICKES BEACH	FS,SSRP1	MA,TA
	LOVE POINT	FS,FT,SSRP1	MA,PP,TA
KENT SHORE	BROAD CREEK	FS	MA
	BRICK HOUSE	FS,SA	MA,PP
	GRAVEYARD (KENT POINT)	FS	MA
MILES RIVER	LONG POINT	MFSD	OXL
	SECOND POINT	FS	MA
	ASH CRAFT	MFS	OXL
	HERRING ISLAND	FS	MA
	COFFEE	FS	MA
	TURTLEBACK	MFSD	OXL
WYE RIVER	WHETSTONE	FS	MA
	MILLS	FS	MA
	BRUFFS ISLAND	MFSD	OXL
EASTERN BAY: NORTH	BUGBY	MFSD	OXL
	MILL HILL	FS	MA
	BALD EAGLE ADDITION #3	FS,SSRP3	MA,TA
	SAW MILL CREEK	FS	MA
	HOOD	FS,SSRP3	MA,TA
	WELL COVE	FS	MA
	WALTER WHITE	FS	MA
	DOMINION	FS	MA
	PARSON'S ISLAND NARROWS ADDITION	FS,SA	MA,PP

REGION	OYSTER BAR	PROGRAM	DATA CONTACT
EASTERN BAY NORTH (cont)	PARSON'S ISLAND	MFSD;SA	OXL;PP
	CEDAR ISLAND	FS	MA
	TURKEY POINT	FS	MA
	JONES HOLE	FS	MA
	RINGOLD MIDDLEGROUND	FS	MA
	WILD GROUND	MFS	OXL
	HOLLICUTTS NOOSE	MFSD;SA	OXL;PP
SOUTH	TILGHMANS POINT	FS	MA
	COOPER'S HOLLOW	FS;SA	MA;PP
WYE RIVER	WHETSTONE	FS	MA
	MILLS	FS	MA
	BRUFFS ISLAND	MFSD	OXL
MILES RIVER	LONG POINT	MFSD	OXL
	SECOND POINT	FS	MA
	ASH CRAFT	MFS	OXL
	HERRING ISLAND	FS	MA
	TURTLEBACK	MFSD	OXL
	COFFEE	FS	MA
FALBOT SHORE	POPLAR ISLAND	FS	MA
	STONEROCK	MFSD;SA*	OXL;PP
POPLAR ISLAND NARROWS	SHELL HILL	MFS	OXL
CHOPTANK RIVER: UPPER CHOPTANK	DRUM POINT	FS;SA*;SSRP4	MA;PP;TA
	ABIN CREEK ENTRANCE	SA*;SSRP4	PP;TA
	CABIN CREEK	FS;SA;FT;SSRP4	MA;PP;PP;TA
	SPAR BUOY	SA	PP
	TANNERS PATCH	FS;SA;SSRP4	MA;PP;TA
	JAMAICA POINT	SA*	PP
	DIXON	FS;SA;SSRP5	MA;PP;TA
	MILL DAM	FS;SA;FT;SSRP3;SSRP5	MA;PP;PP;TA;TA
	GOOSE POINT	SA*	PP
	BRITISH HARBOUR	SA	PP
	OYSTER SHELL POINT	MFSD;SA;FT	OXL;PP;PP
	CHANCELLORS POINT	SA*	PP
	BLACK BUOY	FS;FT	MA;PP
	STATES BANK	SA*	PP
	SUGAR LOAF	SA*	PP
	SHOAL CREEK	FS;SA*	MA;PP
	BOLINBROKE SANDS	FS;SA*	MA;PP
MIDDLE CHOPTANK	GREEN MARSH	FS;SA*	MA;PP
	KIRBY	FS;SA*	MA;PP
	HAMBROOKS	SA*	PP
	DICKINSON	FS	MA
	SANDY HILL	MFSD;SA;FT	OXL;PP;PP
	SANDY HILL ADDITION	SA	PP

<u>REGION</u>	<u>OYSTER BAR</u>	<u>PROGRAM</u>	<u>DATA CONTACT</u>
MIDDLE CHOPTANK (cont)	HOWELLS POINT	FS,SA*	MA,PP
	HORNS POINT ADDITION	FS	MA
	BEACONS	FS,SA*	MA,PP
	CHLORA POINT	FS,SA*	MA,PP
LOWER CHOPTANK	LIGHT HOUSE	MFSD,SA*	OXL,PP
	CHOPTANK LUMPS	SA*	PP
	TODD POINT	FS	MA
	DAWSON	FS,SA	MA,PP
	FRANCE	FS,SA*	MA,PP
	COOK'S POINT	MFSD,SA	OXL,PP
TRED AVON RIVER	DOUBLE MILLS	MFSD	OXL
	PECK'S POINT	FS	MA
	TOWN POINT	FS,SA*	MA,PP
	STONE CHURCH	FS	MA
	FOX HOLE	FS,SA	MA,PP
	BACHELOR POINT	FS,SA*	MA,PP
BROAD CREEK	MULBERRY PONT	SAS	MA/OXL
	DEEP NECK	MFSD	OXL
	BROWN	FS	MA
	GREAT BAR	FS	MA
	ROYSTON	MFSD	OXL
	IRISH CREEK	FS,SA*	MA,PP
HARRIS CREEK	LITTLE NECK	FS	MA
	MILL POINT	SA*,SAS	PP,MA/OXL
	EAGLE POINT (LOMA)	MFSD	OXL
	CHANGE	SA*	PP
	TILGHMAN WHARF	MFSD	OXL
	GREAT MARSH	FS,SAS,PP	MA,TA
TRIPPES BAY	BRANNOCK	SA	PP
	BRANNOCK ADDITION	SA	PP
	DIAMOND	FS	MA
	HILLS POINT NORTH	FS	MA
LITTLE CHOPTANK RIVER	TOWN POINT	FS,SAS	MA,MA/OXL
	GRAPEVINE	FS	MA
	BUTTERPOT	FS	MA
	CASON	MFSD	OXL
	SUSQUEHANNA	FS	MA
	SLAUGHTER CREEK	FS	MA
	CATORS	FS	MA
	RAGGED POINT	MFSD,SAS	OXL,MA,OXL
	PEANUT HILL	SAS	MA
	CEDAR COVE	SAS	MA
	LITTLE CHOPTANK	SAS	MA
DORCHESTER SHORE	PUNCH ISLAND CREEK	FS	MA

<u>REGION</u>	<u>OYSTER BAR</u>	<u>PROGRAM</u>	<u>DATA CONTACT</u>
HONGA RIVER	TUBMAN'S DRAIN	FS	MA
	SNOKE POINT	FS	MA
	LAKES COVE	FS,SA*	MA,PP
	WINDMILL	MFS,SA*	OXL,PP
	LONG POINT	FS	MA
	NORMAN ADDITION#1	MTSD;MS	OXL;MA
HOOPER STRAITS	LIGHTHOUSE	FS	MA
	HOOPER STRAITS ADDITION#1	FS	MA
HOLLAND STRAITS	HOLLAND STRAITS WEST	FS	MA
	HOLLAND STRAITS	MFS	OXL
KEDGES STRAITS	OYSTER CREEK	FS	MA
	WESTERN ISLANDS	SAS,SSP2	MA,TA
	KEDGES STRAIT	SAS	MA
TANGIER SOUND: UPPER	SHARKFIN SHOAL	MFS;SA;MS	OXL;PP;MA
	HAINES	FS	MA
	MUD ROCK	FS	MA
	HOLLAND STRAITS	FS	MA
MIDDLE	TURTLE EGG ISLAND	MS	OXL
	CHAIN SHOAL	FS,SA*	MA,PP
	MUSSEL HOLE	FS	MA
	GRAVEYARD	SA*	PP
	PINEY ISLAND WEST	FS	MA
	PINEY ISLAND EAST	MFS;SA*;MS	OXL;PP;MA
	HARRIS ADDITION	FS	MA
	FLACK COVE (BACK COVE)	MFS;SA*;SSRP2	OXL;PP;TA
	TERRAPIN SANDS INNER ADDITION	FS	MA
	TERRAPIN SANDS INNER	FS,SA*	MA,PP
LOWER	OLD WOMAN'S LEG	MFS;SSRP3	OXL;TA
	GREAT ROCK	MFS	OXL
FISHING BAY	JF-WAY MARK	FS	MA
	HILL	FS	MA
	OLD HOUSE	FS	MA
	GOOSE CREEK	MFS	OXL
	WARE SANDS	SA	PP
	TEDIOUS CREEK	FS	MA
	CLAY ISLAND	MFS	OXL
	EVANS	FS	MA
NANTICOKE AND WICOMICO RIVERS	UPPER STAKE	MS	MA
	WETIPQUIN	MFS;MS	OXL;MA
	HICKORY NUT	FS,SSRP1	MA,TA
	CEDAR SHOAL	FS,SA	MA,PP
	LONG SHOAL	FS	MA
	CHERRY TREE	FS	MA
	OUTER HOLE	SA	PP

<u>REGION</u>	<u>OYSTER BAR</u>	<u>PROGRAM</u>	<u>DATA CONTACT</u>
NANTICOKE AND WICOMICO RIVERS (cont)	BEAN SHOAL	FS	MA
	WILSON SHOALS	MFS,SA,MS	OXL,PP,MA
	ROARING POINT EAST	FS	MA
	MIDDLEGROUND	MFS	OXL
	MOUNT VERNON	MFS	OXL
	GREAT SHOALS	FS	MA
	EVANS	MFS,SA	OXL,PP
	HALLS POINT	FS,SA	MA,PP
	WHITE SHOALS	FS,SSRP3	MA,TA
MANOKIN RIVER	GEORGES	MFSD	OXL
	MARSHY ISLAND	FS	MA
	DRUM POINT	MFS	OXL
	PINEY ISLAND SWASH	FS	MA
	NINE CREEK	FS	MA
BIG ANNEMESSEX RIVER	BIG ANNEMESSEX	FS	MA
LITTLE ANNEMESSEX RIVER	OLD HOUSE COVE	FS	MA
POCOMOKE SOUND	MARUMSCO	MFSD	OXL
	GUNBY	MFS	OXL
	FLAT ROCK	FS	MA
	WARE ROCK	FS	MA
	TERRAPIN LEAD	FS	MA
	OLD ROCKS	FS	MA
LOWER BAY EAST	CHURCH CREEK FOG POINT	FS SAS,SSRP2	MA MA/OXL,TA
UPPER BAY WEST	COAL LUMP	FS	MA
	GALES LUMPS	FS,SA	MA,PP
	MAN-O-WAR SHOALS	FS,SA,FT	MA,PP,PP
UPPER ANNE ARUNDEL SHORE	BODKIN POINT NORTH	HS	PP
	SEVEN FOOT KNOLL	FS,SA*	MA,PP
	SIX FOOT KNOLL	FS,FT	MA,PP
	CRAIGHILL LUMPS	FS,SSRP1	MA,TA
	MOUNTAIN POINT	MFS,FT	OXL,PP
	OUTER MAGOTIY	FS	MA,PP
VER, ARUNDEL	SANDY POINT SOUTH	FS,FT	MA,PP
	HACETT POINT	MFSD,SA,FT,SSRP1	OXL,PP,PP,TA
	TOLLY POINT	FS,SSRP1	MA,TA
	THOMAS POINT NORTH	FS,SSRP1	MA,TA
	THREE SISTERS	MFS,SSRP1	OXL,TA
	WILD GROUND	FS	MA
	HOLLAND POINT	MFSD	OXL
SEVERN RIVER	FERRY POINT	HS	TA

<u>REGION</u>	<u>OYSTER BAR</u>	<u>PROGRAM</u>	<u>DATA CONTACT</u>
SOUTH RIVER	THUNDER AND LIGHTNING	SAS	TA
	SWAN REEF	FS	MA
	MARSHY POINT	FS	MA
UPPER CALVERT SHORE	HOG POINT ADDITION	FS	MA
	FLAG POND	MFSD	OXL
LOWER CALVERT SHORE	LITTLE COVE POINT	FS,SA*	MA,PP
	SIMMONS	FS,SA*	MA,PP
	HOG ISLAND	MFSD,SA	OXL,PP
PATUXENT RIVER:			
UPPER	HOLLAND POINT	FS	MA
	BUZZARD ISLAND	FS	MA
	BROAD NECK	FS	MA
	THOMAS	FS	MA
	PRISON POINT	FS	MA
	JACKS MARSH	FS	MA
MIDDLE	BROOME ISLAND	MFSD	OXL
	GATTON	FS	MA
LOWER	HELLEN	FS	MA
	HAWKS NEST	FS	MA
	BARN GATES	SA*	PP
	HUNGERFORD HOLLOW	FS	MA
	BACK OF THE ISLAND	MFSD	OXL
	TOWN CREEK	FS	MA
	SANDY POINT LUMPS	SA*,HS	PP,PP
	SWASH	FS	MA
	SOUTHEAST MIDDLEGROUND	FS,SSRP3	MA,TA
ST. MARY'S SHORE	CEDAR POINT HOLLOW	FS	MA
	ROCKY BEACH	FS	MA
	SHAVING PILE ADDITION	FS	MA
	BUTLER	MFSD,SA	OXL
	POINT LOOK-OUT	SAS,SSRP2	PP,TA
POTOMAC RIVER:			
UPPER	BEACON	FS, FT	MA,PP
	POPES CREEK	FS,FT	MA,PP
	PASCAHANNA	FS,SA*,FT	MA,PP,PP
	LOWER CEDAR POINT	MFSD,SA*,FT,SAS	OXL,PP,PP,MA,OXL
	SWAN POINT	FS,SA*,FT	MA,PP,PP
	STONY POINT	FS	MA
	WATSONS	FS	MA
	COLONIAL BEACH	FS	MA
	GUM	FS	MA
	OLD FARMS	FS	MA
MIDDLE	COBB ISLAND	FS,SA*	MA,PP
	SHEEPSHEAD BAY	FS,SAS	MA,MA,OXL
	HERON ISLAND	FS	MA

<u>REGION</u>	<u>OYSTER BAR</u>	<u>PROGRAM</u>	<u>DATA CONTACT</u>
POTOMAC RIVER MIDDLE (cont)	KINGSCOPSICO	FS	MA
	HUGGINS POINT	FS	MA
	POSEYS BLUFF	FS	MA
	COLES POINT	FS	MA
	RAGGED POINT	MFSD;SA	OXL;PP
	BLAKE CREEK	FS	MA
LOWER	PINEY POINT HOLLOW (PINEY POINT)	FS	MA
	ST. GEORGES ISLAND	FS	MA
	KITTS	FS;SAS	MA;MA/OXL
	JONES SHORE	SA*;SAS	PP;MA/OXL
	CORNFIELD HARBOR	MFSD;SA;HS	OXL;PP;PP
	BONUMS	FS	MA
	LYNCH POINT	FS	MA
	THICKET POINT	FS	MA
	HOG ISLAND	FS	MA
	GREAT NECK	FS	MA
WICOMICO RIVER	KEY	FT;SA*	PP;PP
	STODDARD	FS;SA*;FT	MA;PP;PP
	COHOUCK	SA*;FT	PP;PP
	CHAPTICO LUMPS	FS	MA
	MILLS WEST	MFSD;SA*	OXL;PP
	WINDMILL	FS;SA*;SSRP3	MA;PP;TA
	BRANLEIGH CREEK	FS;SA*	MA;PP
	WHITE POINT	FS;SA*	MA;PP
	LANCASTER	MFSD;SA*;FT	OXL;PP;PP
	ROCK POINT	FS;SSRP1	MA;TA
	MOUTH OF RIVER	FS;SA*	MA;PP
	ST. CATHERINE	FS;FT;SSRP1	MA;PP;TA
	SILVER SPRING	FS	MA
ST CLEMENTS AND BRETON BAYS	GUEST MARSHES	FS	MA
	ABELL	FS	MA
	BLACK WALNUT	MFS	OXL
	BLUE SOW	MFS	OXL
	DUKEHART CHANNEL	MFS	OXL
ST MARY'S RIVER: UPPER	HORSESHOE	FS	MA
	PAGAN	MFSD	OXL
	SEMINARY	SAS;HS	MA/OXL;MA
	GRAVELLY RUN	SAS	MA/OXL
LOWER	COPPAGE	FS	MA
	THOMPSON CREEK	FS	MA
	CHERRY	FS	MA
	CHICKEN COCK	MFSD;SA	OXL;PP
ST. GEORGES CREEK	HURDLE	FS	MA
	PINEY POINT AQUACULTURE LEASE	SAS	PP

<u>REGION</u>	<u>OYSTER BAR</u>	<u>PROGRAM</u>	<u>DATA CONTACT</u>
SMITH CREEK	GRAVES	FS	NA
	BARNES POINT	FS	NA
	CALVERT BAY	SAS	NA
CHINCOTEAGUE BAY:			
UPPER	SOUTH POND		
	SOUTH POND ADDITION	COS	PP
	HANDY'S HAMMOCK	COS	PP
	LAMBERSTON LANDING	COS	PP
	ENNIS	COS	PP
	TURPIN	COS	PP
	ROBINS MARSH	COS	PP
	ROBINS MARSH ADDITION	COS	PP
	SCARBORO CREEK ADDITION	COS	PP
	NEWPORT	COS	PP
LOWER	DIAMOND	COS	PP
	MARTON POINT	COS	PP
	KENNEL	COS	PP
	TOBY	COS	PP
	WHITE ROCK	COS	PP
	STRIKING MARSH	COS	PP

Key to Program Abbreviations.

Abbreviation	Program Name	Site	Sampling Period	Sampling Gear
FS	Annual Fall Survey.	Baywide, 300 to 400 oyster bars.	Oct.- Nov.	Oyster dredge.
MPS (MPSD)	Modified Fall Survey (Disease Survey).	Baywide, 64 "key" bars, 43 disease bars.	Oct.- Nov.	Oyster dredge.
SA (SA*)	Oyster Stock Assessment Program.	Baywide, 20,000 to 30,000 acres annually.	March- Nov.; SA* lists surveys prior to 1993.	Patent tongs.
FT	Freehet Watch Survey	Baywide, 18 bars.	May- July	Oyster dredge.
MS	Oyster Mortality Survey	Lower Bay, 10-12 oyster bars.	June- Aug.	Oyster dredge.
HS	Oyster Habitat Survey	Baywide, site number highly variable.	March- Dec.	Dredge, patent tongs, acoustics.
SAS	Seed Area Survey	Baywide, variable number of sites.	Spring and Fall	Oyster dredge.
COS	Chincoteague Bay Shellfish Inventory	Coastal Bays, 2,300 acres of oyster bars.	April- Nov.	Hydraulic clam escalator, handcrape
SSRP: 1- Seed Planting: 2- Dredged Shell Planting: 3- Fresh Shell Planting: 4- Polihole Planting. Sources 5- Polihole Planting. Locations.	Seed and Shell Repletion Program.	Baywide, highly variable number of sites.	April- Aug.	Plantings made by various vessels.

Key to Data Contact Abbreviations.

ABBREVIATION	DATA CONTACT	
	LOCATION	PERSON/PHONE NUMBER
MA	Matapeake Terminal, Fisheries Division.	Roy Scott/ 410-643-6785.
PP	Piney Point Aquaculture Center, Fisheries Division.	Mark Homer/ 301-994-0214.
TA	Tawes Building, Fisheries Division.	William Outten, Chris Judy/ 410-974-3733.
OXL	Cooperative Oxford Laboratory, Chesapeake Bay Research and Monitoring Division.	Steve Jordan, Gary Smith, George Krantz/ 410-226-0078.

SYNOPSIS OF OYSTER PROGRAMS

Fall Survey

Initiated in 1939, this survey was designed to provide geographically extensive information on the quality of oyster populations and habitat and to assess spatset. During most years, between 300 and 400 oyster bars are sampled as are numerous seed and shell planting sites. Since 1960, the Oyster Disease Survey has been concurrent with the Fall Survey and in 1990 the Modified fall Survey (see below) was implemented. Samples are collected from oyster dredge tows with data recorded from 0.5 bushel (26 liter) subsamples. Records include the number of live spat, smalls, and markets, the number and stage of dead oysters (boxes), conditional oyster data, and the extent and type of fouling on bottom material. In addition, live oyster size ranges and averages are noted, as are water quality data, the type of sample site, ie. natural, planted with seed, etc., and the geographical position of the sample. A summary of spatfall and oyster parasite data are included in an annual Fall Survey report. Data records are kept on file at the Matapeake Terminal.

Modified Fall Survey/Disease Survey

The Modified Fall Survey focuses on a subset of 64 oyster bars that are annually surveyed. Sampling on these sites involves the collection of 5 independent 0.2 bushel replicate samples. From each of the 5 samples data are recorded on the number of spat, shell height measurements of each live and dead oyster (grouped into 5mm interval categories), and the stage of each oyster box. Additional information as described for the Fall Survey are taken from a pooled sample. At the Disease Survey locations, a subset of 43 of the "key" bars, 30+ oysters > 50mm are randomly selected and shipped to the Cooperative Oxford Laboratory for disease analysis. Data from the Modified Fall Survey and from the Disease Survey are stored in database files linked to a GIS at the Oxford facility. Data from these surveys are included in an annual report.

Oyster Stock Assessment Program

Using a 1m² patent tong-based, randomly initiated systematic sampling scheme, this program obtains unbiased estimates of oyster abundance and shell quantity. Since its implementation in 1990, this monitoring program has surveyed over 50,000 acres of charted oyster bottom in Maryland's Chesapeake Bay. Field records include the stations (corrected) latitude and longitude estimates of the number and volume of live and spat, smalls, and markets per unit area, the size class distribution of live and dead oysters, volumetric estimates, per unit area, of surface and subsurface (gray) oyster shell, softclam shell, recurved mussel shell, and live tunicates, and bottom type and depth. Between 30 and 40 different oyster bars are surveyed each year, with a subset of 15 oyster bars monitored on an annual basis. Between 5,000 and 10,000 acres of oyster grounds previously surveyed in 1975 using similar sampling techniques are resurveyed. Data are stored at the Piney Point facility on spreadsheet and database files linked to a GIS. Annual reports are prepared for the Oyster Stock Assessment Program.

Winter 1993 Freshet Survey

Following the unusually wet winter of 1993, a survey was initiated during May, 1993 to track freshet related oyster mortality. Sampling was conducted using a handscape on oyster bars in the Potomac, Wicomico, Chester, and Choptank Rivers and in the Upper Bay. The Eastern Shore tributary and Upper Bay oyster populations were sampled once, as the freshet was relatively shortlived in these areas. The Potomac and Wicomico Rivers were surveyed intensively, every ten days, over a two month period as freshet effects in these systems persisted. Data recorded included the number of live spat, smalls, and markets and the number and stage of spat, smalls, and market boxes. Conditional oyster information was kept along with water quality data and size range information. Interval and cumulative oyster mortality was calculated. All data were entered and stored in spreadsheet and database files at the Piney Point facility and two reports were prepared.

Oyster Mortality Survey

Previously referred to as the "bay Peak", this effort generally takes place during the summer months. It's purpose is to provide an early check on the status of oyster parasite infection and related oyster mortality rates. The biological data are kept on file at the Matapeake Terminal with oyster disease information entered and stored at the Oxford Laboratory.

Habitat Surveys

These are special surveys made when issues arise over the use or proposed use of oyster bottom. Generally dredge-based, these surveys have also used patent tongs, hand tongs, and acoustic gear to assess oyster populations and habitat. Survey results are generally included in reports or memos with some data stored on computer files. Field data are kept at the Tawes Building, while computer file records are stored at the Piney Point facility.

Seed Area Surveys

During the Annual Fall Survey, seed oyster, dredged shell, and fresh shell planting sites are surveyed to provide information on the biological status of seed oysters from shell and hatchery plantings. These data are on file at the Matapeake Terminal with disease data stored in the oyster database located at the Oxford facility. Seed tracking information is included in the annual Fall Survey report.

Chincoteague Bay Shellfish Inventory

In 1993, a program was initiated to survey shellfish resources in Maryland's coastal bays. During the first year, surveys were conducted on hardclam beds using a commercial hydraulic escalator dredge. Numerous sampling locations were on previously charted oyster bottom allowing for the accumulation of data on the current structural status of these areas. In 1994, a more focused effort on the old oyster bars is scheduled with handscrape samples to be collected from most of these sites. In addition, surveys of the intertidal zones are planned. All data are stored at the Piney Point facility in spreadsheet and database files linked to a Gis. Quarterly and annual reports are prepared.

Seed and Shell Repletion Program

Since 1961, Maryland has conducted a program to rehabilitate oyster bars through the planting of dredged and fresh oyster shell, the planting of seed oysters set on dredged shell, and the translocation of "pollute", oysters from areas of elevated fecal coliform counts. Records are kept of all Repletion Program activities including dredged and fresh shell planting quantities and sites, the source, destination, and quantity of seed and "pollute" oysters, and associated costs. These records are kept on file at the Tawes Building and are included in an annual Seed and Shell Program report.

APPENDIX IV

SUMMARY OF VMRC 1993 OYSTER PROGRAM

Appendix IV

A Summary of the Virginia Marine Resources Commission 1993 Oyster Repletion Program.

Fall Dredge and Patent Tong Survey

A fall dredge survey has been used by the Repletion Program for many years to provide a qualitative assessment of oyster populations. Usually 150 to 200 oyster bars are sampled throughout Virginia's Bay and tributaries and the seaside of the Eastern Shore. Sampling efforts provide information on bottom condition and water quality, qualitative oyster population data, spatset, mortality rates, and meat condition.

In 1993, a patent tong-based oyster stock assessment program was initiated in Virginia. This assessment provides quantitative estimates of oyster abundance and shell quantity that will provide a statistically evaluated database for future oyster management decisions. Most of the actively harvested oyster rocks in the James and Rappahannock Rivers were sampled in 1993. Future sampling efforts will include all oyster production areas of the state.

Seed and Shell Repletion Program

Virginia has had a repletion fund for the replenishment of oyster beds since 1928. During the past 15 years expenditures have varied from \$660,000 to \$1,590,000 for oyster replenishment activities. In 1993 (Table 1) Virginia planted approximately 500,000 bushels of shell and 12,000 bushels of seed. Several new programs were also initiated in 1993, which included the construction of two oyster reef areas, experiments in methods to produce disease-free seed oysters in a natural situation and the evaluation of a hydraulic excavating machine to recover buried cultch material from old oyster bars. The total 1993 expenditures were over \$686,000 with \$426,000 contributed from the General Fund and \$250,000 from Special Funds derived from oyster taxes and permit and dredging fees.

1993 Oyster Reproduction Program Completion Report 12/07/93:

PAGE 1 OF 3

Body of Water	Area	Shells			Seed		Hydraulic Cultivating		Bagless Dredging	COST (\$)					Total Cost (\$)
		Bushels	Type	Acres	Bushels	Acres	Acres	Hours	Acres	Per Bu.	Per Hr.	Per Day	Per LF (1)	Per Acre	
Seaside, Eastern Shore															
Wills Wharf															
Hog Island Bay	Short Prong Out	1,800	(sea)	0.11						0.7				11433	1,260
	Lower Draft	8,200	(sea)	1.03						0.7				5467	5,740
	Lower Draft								0.79			200		1013	800
	Upper Draft						1.92	0.3			100			443	850
	Crab Hook								0.73			200		1096	800
Outlet Bay	Poles Channel						1.50	15.3			100			981	1550
Oyster															
	Narrow Channel	3,200	(sea)	0.37						43.7				3789	2,160
	Narrow Channel						2.49	10			100			723	1800
	Ramshorn	7,200	(sea)	0.9						43.7				3400	4,860
	Ramshorn						3.59	13.73			100			283	1375
	Point of Rock	3,600	(sea)	0.99						43.7				3810	3,780
	Point of Rock						1.79	7.13			10			448	775
	E. Brokenberry	19,200	(sea)	2.00						43.7				11305	23,430
Quincy															
Upshurs Bay	Middle Gap	31,200	(reef)	2.67						1.00				11683	31,200
	Middle Gap						1.46	13.73			100			941	1373
	Major Hole Bay						1.01	12.23			100			1213	1223
Roxel Bay	Barge Point	7,200	(reef)	0.4						1.00				18000	7,200
	Barge Point						0.56	11.73			100			2098	1175
Wachapreague															
Bertons Bay	Hummock	14,800	(reef)	1.16						1.00				14483	16,800
	Hummock						4.33	24			100			552	2400
Bradford Bay	Old Channel	7,200	(reef)	0.4						1.00				12000	7,200
	East/West						1.73	17.3			100			1012	1750
	South Bradford	4000	(reef)	1.41						1.00				2837	4,000
Swash Bay	Green Channel						3.55	9			100			251	900
Chincogan															
Wa	PO 10/20						4.05	39			100			943	3,900
SUBTOTAL		111,600		12	0	0	26	191	2						\$120,503

PAGE 3 OF 3

Body of Water	Area	Shells			Seed		Hydraulic Dredging		Bagless Dredging	Cost (\$)					TOTAL COST (\$)
		Bushels	Type	Acres	Bushels	Acres	Acres	Hours	Acres	Per Hr.	Per Hr.	Per Day	Per LP (1)	Per Acre	
Northern Neck Great Wicomico River	Haynie Bar Cleaning	29,960	(see)	5						0.65		400			19,474 4,800
SUBTOTALS		29,960		5	0	0			0						\$24,274
PROGRAM TOTALS		596,343		88	12,398	31			2						\$673,228

NOTES: 1) LP = Linear Feet

2) Mulberry Pt., James River project cancelled because of conditions of oysters and water temperatures in James River

3) Bowen's Light, Rappahannock River project cancelled because of conditions of oysters and water temperatures in James River

4) Oyster seed moved from Palmetto Bar 1992 cleaned area

APPENDIX V

DRAFT

MARYLAND OYSTER AQUACULTURE PERMIT GUIDELINES

1994

costs incurred for issuing the notice will be paid by applicant.

Administration of Tidal Aquaculture Permits
The Maryland Fisheries Division will:

- Provide permit applications.
- Provide technical advice for growing and disease avoidance.
- Collect production information.
- Monitor environmental data collected by grower.
- Supervise permits for compliance with rules and regulations.

Laws and Regulations which may Pertain to Shellfish Aquaculture

Section	Laws	Page
4-102a	State laws apply regardless of origin of shellstock	2
4-226	Department's authority over packers & dealers Audits, Forms and Reporting	2
4-514	Interference with another person's fishing equipment	3
4-741	Domestic animals prohibited	11
4-742	Restrictions on taking shellfish from polluted waters	11
4-743	Quarantine for shellfish	12
4-1004	License required to catch oysters and clams commercially	15
4-1006	Catching in polluted areas is prohibited	16
4-1007	Boying stations	17
4-1015	Oyster culling - small oysters from (c,d) leased bottom, in state and out of state, offsite or ashore	26

4-1017	Dealers license required	27
4-1019	Report of buyers or sellers of shells required	29
4-1020	Oyster taxes	30
4-1103(f)	Sale of used oysters to lease holders and aquaculture permit holders	44
4-11A-12	Species of shellfish	57
4-1203	Search warrants (suspicion of illegal species for example)	62
4-1204	Search warrants	62
4-1205	Seizure and disposition of illegal fish	63
4-1206	Seizure and disposition of equipment	63
4-11A-18	Taking oysters less than 3" for replanting	60

08.02	Regulations	
.04.04	Oyster Containers	75
.04.06	Daily Catch Limit	76
.08.01	Importation of shellfish - permit required	84
.09.04	Recording the catch and disposal of oysters	85
.14.02	Aquaculture - entire chapter 14	103

National Shellfish Sanitation Program - 1993

Section C	Growing Area Survey and Classification
Section G	Aquaculture

Copies of Laws and Regulations concerning shellfish may be obtained from the Maryland Fisheries Division, Phone: (410) 974-3733 or by FAX (410) 974-2600.

Oyster Aquaculture Permit Guidelines 1994

A Pilot Permitting Program
for Oyster Aquaculture
Demonstration Projects



This guide was prepared for the Oyster Action Plan which was developed by the Oyster Round Table and is one of many oyster restoration activities being implemented.

The Maryland Fisheries Division has assembled this guide to assist in the development of private experimental oyster aquaculture in Maryland tidal waters (e.g., both bottom and off-bottom culture).

The attached permit guidelines establish a pilot permitting program for oyster aquaculture demonstration projects.

- Five-year duration for permit - subject to review and renewal for additional five year terms
- Initial limit of number of permits issued not to exceed 20
- Area permitted not to exceed 5 acres per individual. Two or more persons may jointly obtain a permit for up to 10 acres
- A single permit may include more than one location
- An annual report is required for each permit summarizing activities on the permit area including information on restoration activities undertaken, production techniques utilized and amount of oysters planted and harvested
- Failure to submit an annual report or to conduct the activities as planned may result in DNR revoking the permit
- The purpose of the permitted projects is to demonstrate the feasibility of various oyster production techniques

The Fisheries Division Aquaculture Project, located in the Towes State Office Building, Annapolis, Maryland (410) 974 3733 will act as a permit clearing house service for applicants. Prior to applying for the necessary permits, the applicant should see that the project satisfies the

following conditions:

- Cannot take place in the Chester and Choptank rivers, but may take place in other designated Oyster Rearing Areas
- Cannot preclude oyster harvesting activities
- Must be reviewed and approved by Oyster Rearing Table representatives

Permitting Process

Two permits are required for all aquaculture activities in Maryland tidal waters:

- (1) Tidal Wetland Permit and
- (2) Tidal Aquaculture Permit

An additional permit is also required for importation of shellfish from out of state.

A completed Tidal Wetland Permit (Joint Federal/State Application for the alteration of any floodplain, waterway, tidal or nontidal wetland in Maryland) with completed Aquaculture Permit Application attached is submitted to:

Maryland Department of Natural Resources
Water Resources Administration
Central Processing Service
Towes State Office Building D-2
Annapolis, MD 21401
ATTN: Andi Cumbough
Phone (410) 974-3871
FAX (410) 974-2807

This joint permit application receives a tracking number and is distributed by the Water Resources Permit Service

Center to all appropriate agencies. These agencies may include:

Army Corps of Engineers
Maryland Department of the Environment -
State Shellfish Control Agency permit
Chesapeake Bay Critical Area Commission

Upon receipt of a Wetlands/aquaculture permit all agencies involved will initiate procedures for issuing any other necessary permits. These permits may include water use permit, waste discharge permit and 401 certification.

Progress through the permit process can be monitored by the applicant by contacting the Fisheries Division, Aquaculture Project, Phone (410) 974-3733 Fax (410) 974-2600.

It is the responsibility of the applicant to insure that oyster aquaculture will only take place in approved shellfish growing waters. To determine the status of the water at proposed site, contact:

Maryland Department of the Environment
Standards and Certification Division
Natural Resources Biologist Kathy Brohawn
Phone (410) 631-3609

It is the responsibility of the applicant to obtain appropriate county permits. Zoning variance and building permits may be required.

Prior to issuing a Tidal Aquaculture Permit, the Maryland

*Required for all operations involving interstate commerce or sale.