Chesapeake Executive Council

Chesapeake Bay Oyster Management Plan

Chesapeake Bay Program

Agreement Commitment Report

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July 1989

Chesapeake Bay Oyster Management Plan

An Agreement Commitment Report from
the Chesapeake Executive Council

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July 1989

ADOPTION STATEMENT

We, the undersigned, adopt the **Chesapeake Bay Oyster Management Plan**, in fulfillment of Living Resources Commitment Number 4 of the 1987 Chesapeake Bay Agreement:

> *"...by July 1989, to develop, adopt, and begin to implement Bay-wide management plans for oysters, blue crabs, and American shad."*

We agree to accept the Plan as a guide to protecting, restoring, and enhancing the oyster resource for long-term ecological and economic benefits. We further agree to work together to implement, by the dates set forth in the Plan, the management actions recommended to address: (1) harvest decline and overharvesting; (2) recruitment; (3) disease mortality; (4) low production from leased ground; (5) habitat degradation; (6) shellfish sanitation problems; (7) market stability; and (8) repletion efforts.

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

Date July 31, 1989

For the Commonwealth of Virginia

For the State of Maryland

For the Commonwealth of Pennsylvania

For the United States of America

For the District of Columbia

For the Chesapeake Bay Commission

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EXECUTIVE SUMMARY

Introduction

One of the strategies for implementing the Living Resources Commitments of the 1987 Chesapeake Bay Agreement is to develop and adopt a series of Bay-wide fishery management plans (FMPs) for commercially, recreationally, and selected ecologically valuable species. The FMPs are to be implemented by the Commonwealth of Pennsylvania, State of Maryland, Commonwealth of Virginia, District of Columbia, and Potomac River Fisheries Commission as appropriate. Under this strategy, a timetable was developed for completion of fishery management plans for several important species. Oysters, blue crabs, and American shad were given highest priority, with plans due for these species in July 1989.

A comprehensive approach to managing Chesapeake Bay fisheries is needed because biological, physical, economic, and social aspects of the fisheries are shared among the Bay's jurisdictions. A Fisheries Management Plan Workgroup (FMPW), under the Chesapeake Bay Program's Living Resources Subcommittee, was formed to address the commitment in the Bay Agreement for Bay-wide management plans. The FMPW is composed of members from government agencies, the academic community, and public interest groups from Pennsylvania, Maryland, Virginia, and the District of Columbia.

Development of Fishery Management Plans

A fishery management plan is a dynamic, ongoing process to wisely use a fishery resource. Each of the fishery management plans prepared under the 1987 Chesapeake Bay Agreement is a concise summary of the fishery under consideration, problems and issues that have arisen, and recommended management actions.

The process of developing a management plan incorporates public and scientific evaluation, and appropriate governmental approvals. After an FMP is adopted by the Executive Committee, an implementation plan will be developed to provide more detail on actions that participating jurisdictions will take and the mechanisms for taking these actions. In some cases, regulatory and legislative action will have to be initiated, while in still others, additional funding will be required. An annual review of each FMP will be conducted, under the auspices of the Living Resources Subcommittee, to incorporate new information and to update management strategies.

Goal of the Chesapeake Bay Oyster Management Plan

The goal of the Chesapeake Bay Oyster Management Plan is to increase the baywide stocks of oysters by initiating short- and long-term management actions, in order to enhance the ecological value of the resource and to help maintain a viable fishery.

Problem Areas and Management Strategies

Problem 1: Harvest Decline and Overharvesting. The Chesapeake Bay oyster harvest has been generally unstable and declining, culminating in all-time low harvests and dockside value during each of the past few years. Advances in gear technology have contributed to the problem, as has mortality due to oyster diseases. Many traditionally productive areas have been lost or diminished, resulting in even more concentrated fishing effort. The average catch per man-day is lower than the permitted daily limits, signalling that the limits are no longer an effective means of conserving the oyster resource.

Strategy 1: Oyster harvest from public bars is governed by the quantity and distribution of natural spat set, and by subsequent survival to market size. To increase the number of oysters reaching market size, harvesting effort needs to be stabilized and monitored, harvest levels need to be set commensurate to the resource status, and broodstocks should be protected by closing and opening harvesting areas as needed.

Problem 2: Recruitment. The repletion progams in Maryland and Virginia are dependent largely on natural spatfall. For the past two decades, natural spat set has been erratic, generally low, and of limited geographic range compared to historic figures. Strong reproductive years have been hurt by harvest pressure, poor water quality and habitat conditions, and oyster diseases.

Strategy 2: Repletion efforts need to continue but will be evaluated to increase their efficiency. In order to augment natural reproduction, plantings of shell for cultch should continue, as should moving seed oysters to growing areas. Hatchery production for research and rehabilitation projects need to be maintained and possibly expanded, and aquaculture efforts should be supported. Research needs to be conducted on reconstruction of natural oyster bars and on the relationship between adult oyster density and recruitment.

Problem 3: Disease Mortality. Harvest declines have been compounded since 1986 due to extensive disease mortalities caused by MSX (Haplosporidium nelsoni) and Dermo (Perkinsus marinus). Little is known about how these diseases are transmitted, and they cannot be controlled or eliminated. Current management actions rely on favorable natural conditions to combat these diseases, and are primarily reactionary in nature.

Strategy 3: Actions should involve increased monitoring of the diseases so that timely decisions can be made regarding seed and shell plantings. Additional research needs to be conducted on the diseases and on disease-resistant oysters.

Problem 4: Leased ground production. Production from private leased bottoms could enhance the Bay-wide oyster harvest, but leased grounds are under-utilized. Expenses, shortage of seed and shell, and disease mortality are among the contributing factors.

Strategy 4: There will be a Bay-wide effort to increase leased ground production by increasing the amount of seed available, developing new culture methods, continuing technical extension services, and implementing "proof of use" measures.

Problem 5: Habitat Issues. Water and habitat quality impacts the distribution and abundance of oysters.

Strategy 5: The objectives of the 1987 Chesapeake Bay Agreement will be promoted.

Problem 6: Shellfish Sanitation. Many areas otherwise suitable for shellfish production are closed or lost due to contamination by pollutants and bacteria.

Strategy 6: Plans under the 1987 Chesapeake Bay Agreement to improve water quality will be promoted, and depuration and relaying methods will be investigated.

Problem 7: Market Production. Chesapeake Bay oysters are becoming less competitive in the national market because of smaller Bay harvests, standard quality and high price, and negative public perception associated with oyster diseases and pollution.

Strategy 7: Enhancement of Bay-wide oyster stocks by following this plan should improve many market considerations, and public awareness programs can used to combat misperceptions about the quality of Chesapeake Bay oysters.

Problem 8: Repletion Programs. Current repletion programs are not improving oyster stocks, and other problems are arising. Obtaining an adequate supply of dredged shell for cultch is becoming increasingly difficult, and the amount of fresh or house shell available is declining as the harvest declines. Much of the fresh shell is also being lost because of out-of-state exports and distribution to many small businesses. Seed (small) oyster production is decreasing because of oyster diseases, and transporting shell and oysters to disease-free areas (often farther up tributaries) is becoming more expensive.

Strategy 8: There needs to be a Bay-wide effort to distribute shell and seed to reflect the best biological information available. Recommended actions include reviewing statutes that dictate repletion strategies, analyzing production as it relates to seed and shell plantings, and evaluating export taxes on oysters. Expanded seed programs, establishment of oyster sanctuaries, a repletion program on the Seaside of Virginia, and increased use of alternative sources of cultch are also necessary.

INTRODUCTION

MANAGEMENT PLAN BACKGROUND

To protect and manage the natural resources of Chesapeake Bay, the jurisdictions are developing and will implement a series of fishery management plans under the Chesapeake Bay Agreement. This agreement adopted a schedule for the development of Bay-wide fishery management plans for commercially, recreationally, and selected ecologically valuable species. The strategy for implementing the Living Resources Commitments in the 1987 Agreement listed the priority of each species and a timetable for completion of fishery management plans:

- oysters, blue crabs and American shad by July 1989
- striped bass, white perch, bluefish, weakfish, and spotted trout by 1990
- croaker, spot, summer flounder and American eel by 1991
- red and black drum by 1992

A comprehensive approach to Bay problems and a means to coordinate the various state and federal groups was also necessary. Bay fisheries are managed separately by the States of Pennsylvania, Maryland, and Virginia, the District of Columbia, and the Potomac River Fisheries Commission. There is also a federal Mid-Atlantic Fishery Management Council (MAFMC) which has jurisdiction for management planning over offshore fisheries (3-200 miles), and a coast-wide organization, the Atlantic States Marine Fisheries Commission (ASMFC), which coordinates the preparation of plans for migratory species in state coastal waters from Maine to Florida. The state/federal Chesapeake Bay Stock Assessment Committee (CBSAC) is responsible for developing a Bay-wide Stock Assessment Plan which includes collection and analysis of fisheries information but does not include the development of fishery management plans. Consequently, a Bay-wide Fisheries Management group, under the Living Resources Subcommittee of the Chesapeake Bay Program, was formed to address the commitment in the Bay Agreement for management plans.

The Fisheries Management group is responsible for developing and writing the fishery management plans and includes: Maryland Department of Natural Resources, Fisheries Division; Pennsylvania Fish Commission, Office of Chief Counsel, Planning and Environmental; Potomac River Fisheries Commission; Virginia Marine Resources Commission, Fisheries Management Division; and Washington, D.C. Department of Consumer and Regulatory Affairs, Fisheries Management Division. The management workgroup also included representatives from the Chesapeake Bay Foundation,

Chesapeake Bay Commission, University of Maryland, College of William and Mary/Virginia Institute of Marine Science, Maryland Watermen's Association, Virginia Watermen's Association, Charter Boat Association, and Maryland Saltwater Sportsfishermen's Association. Plans developed by this group reflect the multijurisdictional management requirements appropriate to the species.

WHAT IS A FISHERY MANAGEMENT PLAN?

A management plan is a dynamic process of analyzing the complex biological, economic and social components of a particular finfish or shellfish fishery, defining problems, identifying solutions, and implementing decisions regarding habitat problems and human usage of the resource.

GOALS AND OBJECTIVES FOR FISHERY MANAGEMENT PLANS

The goal of fisheries management is to protect the reproductive capability of the resource and provide for optimal harvests. Fisheries management must include biological, economic and sociological considerations in order to be effective. It requires an adaptive management scheme which responds to the most current status of the stock, therefore, it is of primary importance to prepare a plan which provides a means of regular review and reevaluation of current management actions. Three simply stated objectives to protect the reproductive capabilities of the resource while allowing optimal harvest include:

- quantify biologically appropriate levels of harvest
- monitor current and future resource status to ensure harvest levels are conserving the species while maintaining an economically viable fishery, and
- adjust resource status if necessary through management efforts.

MANAGEMENT PLAN FORMAT

The background section for each management plan summarizes:

- biological profile
- habitat requirements
- historical fishery trends
- economic profile

- current stock status
- current regulations (in effect as of September 1988), and
- data needs

This information was modified from the Chesapeake Bay Fisheries: Status, Trends, Priorities and Data Needs document. Including this section as part of the management plan provides historical background and basic biological information for each of the species.

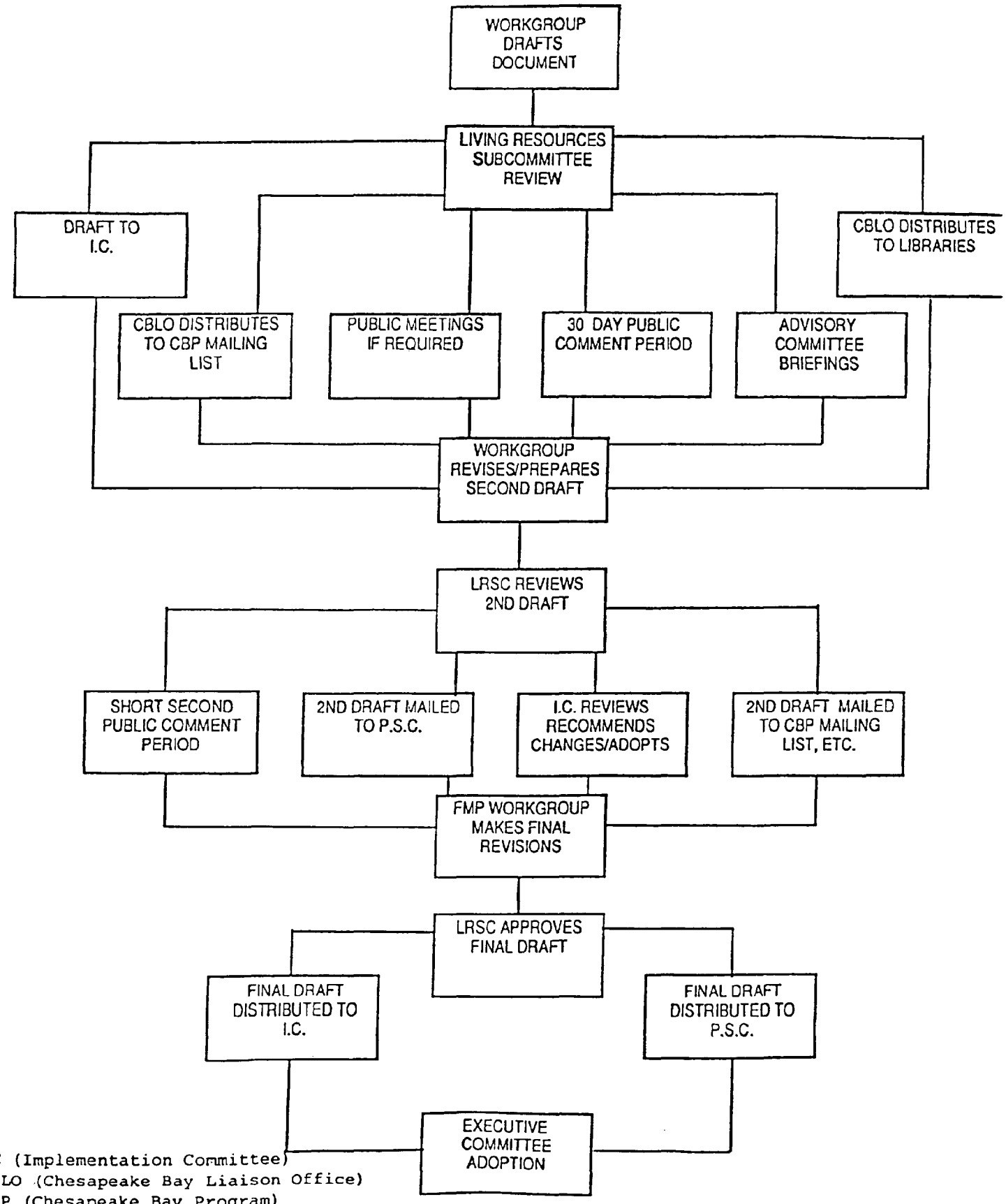
The management section of the plan defines:

- specific goals and objectives for each species
- problem areas for each species
- management strategies to address each problem area, and
- action items with a schedule of implementation.

These plans are concise summaries that consider interjurisdictional issues and recommend regulations which will be subject to public review and appropriate approvals. Management planning provides the opportunity for public and scientific evaluation, and debate of management options and regulation strategies prior to actual regulatory proposals. As the management plan review process continues, changes will be necessary. The strategies will be further defined as new information becomes available and, therefore, must reflect some flexibility.

Once the plan has been adopted by the Executive Committee appropriate regulatory and legislative action will be initiated. An annual review of the management plans will be required to continually update management strategies and actions. A workgroup will be established to annually review the plan. Completed management plans will follow the schedule set forth by the Chesapeake Bay Agreement. The process of fishery management plan review and acceptance is presented in the flow chart below.

COMMITMENT PREPARATION AND ADOPTION FLOW CHART



IC (Implementation Committee)
CBLO (Chesapeake Bay Liaison Office)
CBP (Chesapeake Bay Program)
LRSC (Living Resources Subcommittee)
PSC (Principal Staff Committee)

x

SECTION 1. BACKGROUND

American Oyster Introduction

American oysters occur along the east coast of North America from the Gulf of St. Lawrence, Canada, to Key Biscayne, Florida. In the Carribean, 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 habitat conditions.

Oysters generally spawn from May through September in Chesapeake Bay. Larvae settle to the bottom two to three weeks after hatching and attach to oyster shells or other hard substrates. The attaching phase is termed "setting" and the newly attached oysters are called "spat." Oysters grow at the rate of about one inch per year and enter the market from three to five years after spat settlement.

Oysters have a unique ecological role in the estuarine environment. As a result of their reproduction, growth and tremendous filtering capacity, the oyster bar community is radically different from surrounding sand and mud communities. Oysters can filter and remove sediments and algae from the water column.

FMP Status and Management Unit

The 1987 Chesapeake Bay Agreement contains a commitment to develop, adopt and begin to implement a Bay-wide FMP for oysters by July 1989.

The management unit is the American oyster (Crassostrea virginica) throughout its range in the Chesapeake Bay.

Fishery Parameters

Status of exploitation:	Fully exploited.
Long term potential catch:	Currently unknown, highly dependent on prevalence and intensity of diseases.
Importance of recreational fishery:	Insignificant.
Importance of commercial fishery:	Highly significant; although harvests are declining, oysters still rank as one of the top seafood species in dockside value.

Fishing mortality rates:	In the late 1970's, estimated at 0.24. Probably much higher now

Biological Parameters

Natural mortality rate:	Not quantified, but variable. Mortality may be high under conditions of disease, hypoxia or high freshwater inflow.
Fecundity:	5 - 15 million eggs at one spawning.
Longevity:	Generally 5-6 years; up to 15 years.
Age/size at maturity:	2-3 years/3 inches.

Habitat Requirements

Spawning and larval development

Spawning season:	May through September.
Spawning area:	Throughout Chesapeake Bay.
Salinity:	7-30 ppt; at 5 ppt, gametogenesis is retarded.
Temperature:	68^{o} - 75^{o} F.
pH:	6.8 - 8.8.
Dissolved oxygen:	Survival minimum 2.4 ppm.

Subadults and Adults

Location:	Semi-hard mud to hard, rocky substrate.
Salinity:	5 - 32 ppt.
Temperature:	60^{o} - 86^{o} F.
Dissolved oxygen:	Survival minimum of 2.4 ppm.

Habitat Issues

Some of the more important environmental factors affecting oyster stocks 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 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 close to the treatment outfall. 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.

The 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 tongers. Landings have declined dramatically since that time and continue to show a downward trend. During the past 27 years, oyster harvests in Maryland ranged from 3.2 million bushels (20.4 million pounds) in 1973 to 565,146 bushels (3.6 million pounds) in 1987 (Figure 1). In Virginia, the harvest of market oysters over the same time period ranged from 1.9 million bushels (12 million pounds) in 1964 to 442,000 bushels (2.8 million pounds) in 1987 (Figure 2). Prospects for the near future are for similarly low harvests.

Economic Perspective

In Maryland, oysters have always been a major part of the yearly commercial fishery landings. On the average from 1971-1986, 48% of the total dockside value and 21% of all commercial landings were from oysters. In 1986, in addition to the dockside value of $17.47 million, harvesting and processing activities generated an additional $25 million of output of all goods and services along with $14 million in employee income and $1.84 million of indirect taxes. Although the price per bushel of oysters increased in 1988 ($20/bushel), the total dockside value for the Maryland oyster

Figure 1. Maryland commercial landings for oysters from the Chesapeake Bay

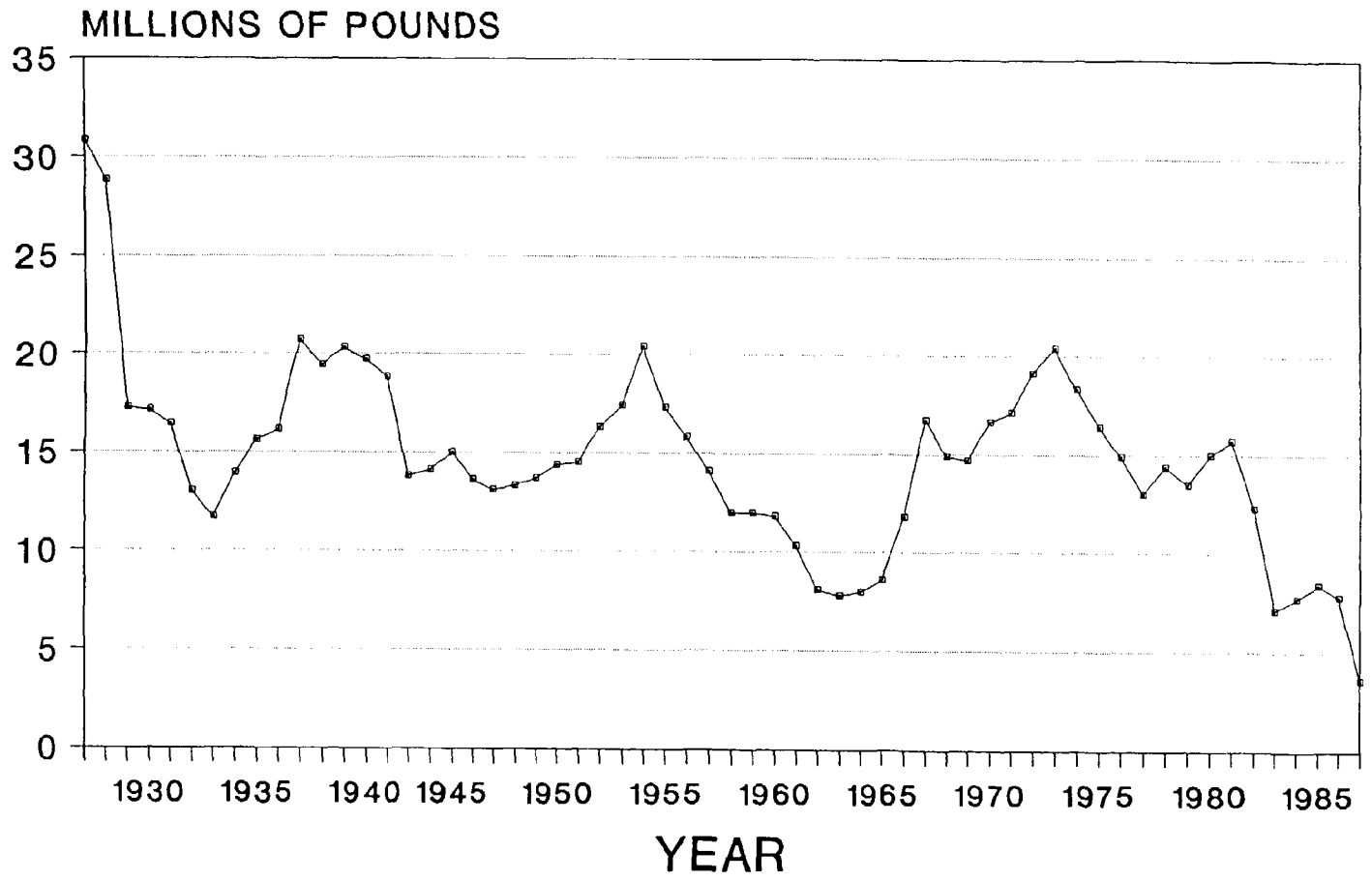
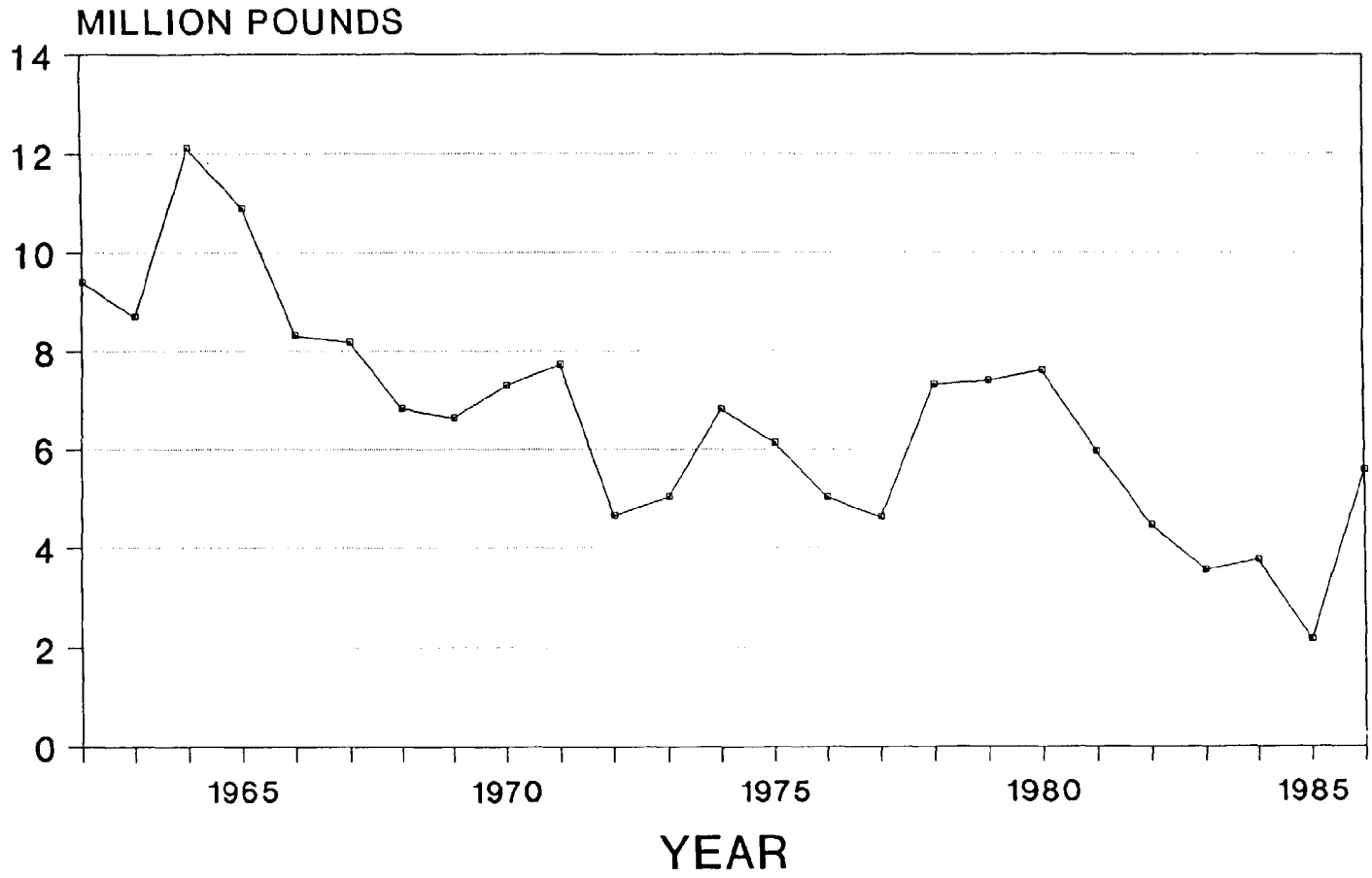


Figure 2. Virginia commercial landings for oysters from Chesapeake Bay



harvest decreased from 16.3 million dollars in 1987 to 7.3 million dollars.

Total landings and dollar value, however, are not the best indicators of the health of a fishery. Economists have developed several indices related to profits which indicate the health of a fishing industry. From an economic analysis of the Maryland fishing industry, the 1987 productivity of the oyster industry has declined to about 40% of the 1981 value. This loss has been tempered by a decline in effort and an increase in the price of oysters. As a result, watermen who continued to harvest oysters earned approximately the same profits as they earned in 1981. According to the Maryland fishing industry analysis, if oyster prices in 1987 had remained at the 1986 level, industry health and watermen profits would have fallen to their lowest value in the decade.

Resource Status

At present, the Baywide oyster stock can be characterized as severely depleted. Recent expansions of the range of oyster diseases, MSX (Haplosporidium nelsoni) and Dermo (Perkinsus marinus), low dissolved oxygen episodes and past harvesting practices are primarily responsible for the population's current decline. Average levels of spatfall have dropped in the past decade 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 have occurred during 1987 and 1988.

Since 1985, the James River has become the center of the market oyster landings in Virginia. The low number of surviving spat, 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. Bushel counts (spat, small, and market) for spring 1988 were below 100 oysters per bushel downriver from Wreck Shoal and Dry Shoal in the James. Upriver of these same bars, the bushel count has dropped from an average of 504 oysters per bushel in the spring of 1986 to 274 oysters per bushel in the spring of 1988. In the Great Wicomico River, spat per bushel averaged 887 spat on all bars, but the number of small oysters decreased 56 percent in one year.

Current management strategies for oysters in Chesapeake Bay include an annual planting of oyster shell on natural bars and the transporting of seed oysters from areas of high spat set to areas of low set.

Laws and Regulations

Limited entry:

Maryland's Delay of Application Process went into effect September 1, 1988 and requires previously unlicensed applicants to wait two years after registering with MDNR before a license to harvest oysters with commercial gear will be issued.

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

Limited or delayed entry are not in effect in Virginia.

Minimum size limit:

Maryland - 3".

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).

Virginia - James River Seed Area market oysters must equal or exceed 2.5"; all other areas, 3". No cull size for leased (private) grounds.

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 - 25 bushels per licensee, but not to exceed 75 bushels per shaft tong boat or single rig boat, or 100 bushels per double rig boat; dredge boat - 150 bushels per boat; diving - 30 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: Hand tongs 15 bushels per person per day or 45 bushels per boat per day in the Nansemond, Poquoson and Back Rivers and Chisman Creek; patent tongs and dredge-15 bushels per person per day or 45 bushels per boat per day for the Pocomoke Sound/Tangier Management Area and 45 bushels per boat per day for the Chesapeake Bay Management Area.

Harvest quotas: Not in effect in Maryland, on the Potomac River or Virginia.

Season: 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.

Virginia - Shaft tongs or hand tongs: James River Seed Area, October 1 to July 1, sunrise to sunset. All other public areas, October 1 to June 1, sunrise to sunset (except sunrise - 2 p.m. for Cod Harbor and Pocomoke Sound, and sunrise to 12 noon for Milford Haven). 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.

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 uses 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 it's 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 lifted devices may be used subject to specified conditions.

Potomac River - Patent tongs and power or sail scrapes or dredges, power or hand-operated winch, spool, winder, ets. 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.
Time Restrictions:	Potomac River - Hand tongs, lawful only Monday through Friday from sunrise to 3:00 p.m. 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.

Status of Traditional Fishery Management Approaches

Catch-Effort:	Commercial fisheries data for Chesapeake Bay are a reasonable indicator of the current status of the stock. However, catch and effort statistics for the commercial fishery are, in general, of low quality and of limited value in developing fisheries management models.
Estimates of mortality:	3-100% depending on disease prevalence.
Yield-per-Recruit:	Currently unknown.
Stock-Recruitment:	The stock-recruitment relationship for Chesapeake Bay oysters is unknown.
Maximum Sustainable Yield (MSY):	Perhaps as high as 14 million pounds in Maryland under ideal conditions.

Virtual Population Analysis (VPA): Has not been carried out.

Data and Information Needs

1. Yearly evaluation of the geographic distribution and prevalence of MSX and Perkinsus.

2. Evaluation of the ability of MSX resistant oysters to survive when placed in the Chesapeake Bay.

3. Identification of the MSX mode of transmission and the oyster's immune response to MSX.

4. Evaluation of production from seed plantings in low salinity areas.

5. Determine factors affecting abundance, survival and growth of larvae and juveniles.

6. Determine the acreage of actively cultivated leased bottom and estimates of CPUE from that acreage.

7. Determine production potential for synthetic cultch material.

8. Determine the density of spawning stock necessary to repopulate an area decimated by disease.

9. Determine natural and fishing mortality rates.

10. Define stock/recruitment relationship.

11. Identify costs associated with harvesting and processing activities.

References

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Lipton, D. 1987. The status of Maryland's fishing industry. University of Maryland, Sea Grant Extension. Publ. No. UM-SG-MAP-89-02.

Maryland Department of Natural Resources. 1987. Maryland's oyster resources: status and trends, 1987. MDNR, Tidal Fisheries Division, Annapolis, Md.

Virginia Marine Resources Commission. 1988. Oyster resources in Virginia, Part I: Description. VMRC Fisheries Management Division, Newport News, Va.

SECTION 2. OYSTER MANAGEMENT

The source documents for this plan (Haven et al., 1981; Kennedy and Breisch, 1981; MD DNR, 1987; VMRC, 1988) discuss many problems associated with the current status of the Chesapeake Bay oyster resource and its industry. Oyster management programs in Maryland and Virginia have consisted of protecting oyster bars from dredging or filling, planting shell on natural oyster bars, transporting seed oysters to augment natural oyster production, and regulating oyster harvest through seasons, catch limits, cull laws, and gear restrictions. With an increase in disease, the historical management techniques are no longer cost effective and the regulations need to be reevaluated. The Maryland and Virginia oyster resource is characterized by instability and declining harvests and warrants comprehensive management. For this plan, oyster problems have been grouped into several categories which served as the basis for identifying the goal and management objectives. The problems are followed by strategies developed to address the oyster problems. Current regulations regarding oyster harvest will continue to be enforced with specific changes as recommended by the management plan.

Fishery activity on the tidewater portion of the Potomac River is managed by the Potomac River Fisheries Commission, a six member body empowered under the Maryland-Virginia Compact of 1958. The Commission meets quarterly to establish and maintain a program of conservation and improvement of the seafood resources and to regulate and license fisheries in the Potomac River. The Commission will develop appropriate Actions and Implementations to address those Problems and Strategies identified in the Management Plan which are within the purview of the Commission by July 1990.

A. GOAL AND OBJECTIVES

The overall goal of this plan is:

> Increase the baywide stocks of oysters through the initiation of short and long-term management actions which will enhance the ecological value of the resource, ensure the growth of the resource and maintain a viable fishery in the long term. The management plan for oysters will be adaptive and involve continuous responses to new information about the current state of the resource.

In order to achieve this goal, the following objectives must be met:

1) Stabilize harvest to maintain a spawning stock at a size which eliminates low reproductive potential as a cause of poor spawning success.

2) Promote protection of the resource by maintaining a clear distinction between conservation goals and allocation issues.

3) Evaluate statewide repletion efforts.

4) Encourage the utilization of aquaculture techniques on private oyster grounds.

5) Develop quantities of low-cost, low-risk seed sources in disease-free areas to benefit the public and private industry.

6) Promote continued cooperation of various state agencies in water quality and habitat improvement measures to maximize conditions for natural production and to minimize harvest restrictions due to sanitary reasons.

7) Further our understanding of oyster diseases and the development of a disease-resistant strain of Chesapeake Bay oyster.

8) Enable baywide fisheries management agencies to provide more timely and effective responses to short term and unpredictable changes in the status or operation of the fishery.

9) Increase and stabilize the market share of Bay oysters by providing a reliable product both in quality and quantity.

B. PROBLEM AREAS AND MANAGEMENT STRATEGIES

Problem-Harvest Decline and Overharvesting: The Chesapeake Bay oyster fishery can be characterized by instability and declining harvests. During the past 27 years, oyster harvests in Maryland have ranged from 3.2 million bushels (20.4 million pounds) in 1973 to 565,146 bushels (3.6 million pounds) in 1987. In Virginia, the harvest of market oysters over the same time period ranged from 1.9 million bushels (12 million pounds) in 1964 to 442,000 bushels (2.8 million pounds) in 1987. A high mortality of market oysters during 1986 and 1987 have caused the resource to reach an all time low. Maryland's 1988 harvest of 355,473 bushels represents a 77% decline from the 1986 harvest of 1,557,091 bushels. Traditionally productive areas have been lost due to disease mortality and the effects of advances in gear technology. Presently, there is a concentrated fishing effort up the tributaries and Bay to areas of about 12 parts per thousand salinity or less. In Virginia this has resulted in the almost exclusive use of the James River as the State clean cull area. Similarly, the fishing effort in Maryland is directed on seed plantings and the remaining naturally productive oyster bars.

Strategy-Harvest Decline and Overharvesting: Oyster harvest from public bars is governed by the quantity and distribution of natural spat set. The outlook for future years is not promising and current management attempts at increasing harvest on a local scale are insufficient to halt the decline. The average catch per man day is lower than the permitted daily limit, therefore, it is no longer an effective means of conserving the oyster resource. Harvest levels need to be set commensurate to the resource status. Analysis of existing and future data on oysters will allow for necessary modifications to the FMP strategies. Comprehensive use and improvement of the FMP strategies is deemed necessary to revive the fishery.

PROBLEM 1.1
Oyster harvest and associated revenues in the Chesapeake Bay have declined to a record low. Current management practices have not been effective in maintaining historical levels of harvest.

STRATEGY 1.1
There will be a Baywide effort to stabilize oyster harvest and protect brood stocks.

ACTION 1.1.1
Maryland and Virginia will open and close harvest areas on a rotating basis to control fishing effort. Recommendations for closed areas will be based on an analysis of the oyster population structure, i.e., number of adults, juvenile oysters and spat, determined by annual surveys. As an example, when adult oyster density reaches a predetermined minimum, the bar will be closed.

IMPLEMENTATION 1.1.1
1990

ACTION 1.1.2
Maryland and Virginia will establish catch limits that reflect the status of the resource. Catch limits will be developed to stabilize harvest based on historic harvest trends for specific geographic areas. Recommendations will also consider recent spat set, mortality rates, levels of disease infection and growth rates.

IMPLEMENTATION 1.1.2
1991

ACTION 1.1.3
Maryland will continue a delayed entry program to stabilize fishing effort.

IMPLEMENTATION 1.1.3
Maryland law currently in effect.

Problem-Recruitment: For the past two decades, natural spat set has been erratic and generally low. The geographic range of good setting areas has also been reduced compared to historic trends. Though there have been strong reproductive years such as 1985, the stocks have been severely depressed by continued disease mortality, harvest pressure, and water quality. The repletion programs in Maryland and Virginia are dependent on natural spatfall.

Strategy-Recruitment: Both the magnitude of spat set and number of consecutive years in which a spat set occurs in a specific geographic area are important to future recruitment and harvest. Present management efforts are dependent on natural spatfall. Planting shell for the production of seed in seed areas provides more habitat for new oysters.

PROBLEM 2.1
There has been a significant increase in the number of specific oyster bars with low levels of spat set.

STRATEGY 2.1
There will be a Baywide effort to enhance natural spatfall and recruitment to the fishery.

ACTION 2.1.1
Maryland and Virginia will continue hatchery operations to produce eyed larvae and seed oysters for research and rehabilitation projects.

IMPLEMENTATION 2.1.1
1989

ACTION 2.1.2
Maryland and Virginia will support aquaculture efforts as a means of increasing oyster production with a subsequent increase in brood stock.

IMPLEMENTATION 2.1.2
1990

ACTION 2.1.3
Maryland and Virginia will continue the oyster repletion program of planting shell for cultch and moving seed oysters to augment natural reproduction.

IMPLEMENTATION 2.1.3
1989

ACTION 2.1.4
Maryland, as an experimental procedure, will reconstruct buried oyster bars to the physical configuration that enabled the extinct bar to be productive in the past.

IMPLEMENTATION 2.1.4
1990

ACTION 2.1.5
Maryland and Virginia are conducting research on the relationship between adult oyster density and recruitment and will use the information to regulate harvest and provide optimum stocking of seed oysters.

IMPLEMENTATION 2.1.5
1992

Problem-Disease Mortality: Recent harvest declines, especially during 1986 and 1987, are the result of extensive disease mortalities by MSX and Dermo (Perkinsus). Virginia has lost most of their growing areas due to disease. Little is known about the mode of transmission of these diseases and there is no known cure. Presently, these diseases cannot be controlled or eliminated.

Strategy-Disease Mortality: Recent expansion of the geographic occurrence of oyster diseases has been one of the primary factors contributing to the oyster decline in Maryland and Virginia. The nature of the disease problem requires careful monitoring in order to make timely decisions about management actions.

PROBLEM 3.1
The decline in the oyster resource has been compounded by high mortalities from the diseases MSX and Dermo (Perkinsus) in most of the commercially important oyster beds.

STRATEGY 3.1
There will be a Baywide effort to understand and control the spread of oyster disease.

ACTION 3.1.1
Maryland and Virginia will continue the annual disease survey to determine the best plan for planting seed and shell.

IMPLEMENTATION 3.1.1
1989

ACTION 3.1.2
Maryland will implement a program to monitor seed oysters for disease before transporting to disease-free areas. Techniques used for monitoring will include histocytology, immunological detection tests and histopathology.

IMPLEMENTATION 3.1.2
1990

ACTION 3.1.3
Maryland and Virginia will continue research on the transmission and reduction of oyster diseases and development of a disease-free strain of Crassostrea virginica.

IMPLEMENTATION 3.1.3
1989

ACTION 3.1.4
Maryland and Virginia are researching the development of a disease-resistant hybrid oyster with the potential for introduction into the Chesapeake Bay. Proper precautions will be taken to avoid the introduction of exotic organisms into the Bay ecosystem.

IMPLEMENTATION 3.1.4
1989

Problem-Leased Ground Production: Presently, private leased bottoms are under-utilized. For both Maryland and Virginia it has been estimated that less than 10% of the total leased grounds are in production. The expenses of private bed preparation and seeding are a deterrent and there is a shortage of shell and seed. Disease mortality has also stifled private production and initiative.

Strategy-Leased Ground Production: Private oyster production on leased ground could enhance oyster harvest. During their best years, Virginia increased oyster production by more than seven times from their private leased grounds. In Maryland, leased bottom production, especially in areas of low salinity, could provide increased production.

PROBLEM 4.1
Leased ground is under-utilized and could be a viable means of increasing oyster production.

STRATEGY 4.1
There will be a Baywide effort to increase leased ground production as a means of conserving and enhancing the oyster population in the Bay.

ACTION 4.1.1
Maryland has established a seed bed for sale of seed to private leaseholders.

IMPLEMENTATION 4.1.1
1989

ACTION 4.1.2
Maryland and Virginia will continue an active extension program to provide technical assistance to oyster leaseholders.

IMPLEMENTATION 4.1.2
1989

ACTION 4.1.3
Maryland and Virginia will implement "proof of use" measures in the form of minimum production or repletion criteria, to promote private production and cultivation.

IMPLEMENTATION 4.1.3
1990

ACTION 4.1.4
Virginia will promote the development of new culture methods by removing impediments in the existing permitting process required for the private sector.

IMPLEMENTATION 4.1.4
1990

ACTION 4.1.5
Virginia will research the feasibility of and methodology for new culture methods. VIMS will initiate rack culture research by establishing pilot studies. Results will be used to assess the economic and biological feasibility of implementing such a program in Virginia.

IMPLEMENTATION 4.1.5
1990

Problem-Habitat Issues: The distribution and abundance of oysters are impacted by water quality. Nitrogen and phosphorus overenrichment from sewage treatment plants and agricultural runoff have increased the extent of hypoxic and anoxic conditions thus limiting oyster distribution. Man's activities have also impacted the distribution and abundance of oysters. Sediment from channel dredging, upland construction and agricultural activities have smothered oyster beds and fouled cultch enough to prevent setting.

Strategy-Habitat Issues: Water quality standards and strict enforcement are necessary to insure adequate protection of living resources in Chesapeake Bay.

PROBLEM 5.1
Water quality impacts the distribution and abundance of oysters in Chesapeake Bay.

STRATEGY 5.1
Maryland and Virginia will promote the objectives of the Chesapeake Bay Agreement to improve water quality in all areas of the Bay.

ACTION 5.1
The following action items are commitments under the 1987 Chesapeake Bay Agreement. Maryland DNR and VMRC will not carry out the specific commitments, but are involved in setting the objectives of the programs to fulfill the commitments and reviewing the results of the action programs. The achievement of these commitments will lead to improved water quality and enhanced biological production.

A) Develop and adopt a basinwide plan that will achieve a 40% reduction of nutrients entering the Chesapeake Bay by the year 2000.
   1) Construct public and private sewage facilities.
   2) Reduce the discharge of untreated or inadequately treated sewage.
   3) Establish and enforce nutrient and conventional pollutant limitations in regulated discharges.

4) Reduce levels of nutrients and other conventional pollutants in runoff from agricultural and forested lands.
5) Reduce levels of nutrients and other conventional pollutants in urban runoff.

B) Develop and adopt a basinwide plan for the reduction and control of toxic materials entering the Chesapeake Bay system from point and nonpoint sources and from bottom sediments.
1) Reduce discharge of metals and organic compounds from sewage treatment plants receiving industrial wastewater.
2) Reduce the discharge of metals and organic compounds from industrial sources.
3) Reduce levels of metals and organic compounds in urban and agriculture runoff.
4) Reduce chlorine discharges to critical finfish areas.

C) Develop and adopt a basinwide plan for the management of conventional pollutants entering the Chesapeake Bay from point and nonpoint sources.
1) Manage sewage sludge, dredge spoil and hazardous wastes.
2) Improve dissolved oxygen concentrations in the Chesapeake Bay through the reduction of nutrients from both point and nonpoint sources.
3) Continue study of the impacts of acidic conditions on water quality.
4) Manage groundwater to protect the water quality of the Chesapeake Bay.
5) Manage marine sources of non-point pollution such as recreational and commercial boat dicharges.
6) Continue research to refine strategies to reduce point and nonpoint sources of nutrient, toxic and convential pollutants in the Chesapeake Bay.

IMPLEMENTATION 5.1
Variable, depending on the specific project.

Problem-Shellfish Sanitation: In response to FDA guidelines, Maryland's Department of the Environment established conditionally approved areas which are restricted to shellfish harvesting for 3 days after periods of rainfall, 1" or more in a 24 hour period. This was in response to a human health concern from consumption of oysters contaminated with bacterial pathogens. The FDA guidelines keep

oysters with transitory high levels of bacterial contaminants from being harvested. The areas of concern are located in almost every tributary in Maryland. For the 1987-1988 season there were approximately 18 days when some part of the Bay was closed to shellfish harvesting. Such closures interrupted harvest and market supply but more importantly, the publicity about possible contamination shifted consumer preference away from Maryland oysters. In Virginia, continuous habitat degradation has resulted in approximately 100,000 acres of productive or potentially productive shellfish grounds being classified as unsuitable by the Division of Shellfish Sanitation. Improvement or reopening of these areas will be difficult because of high fecal coliform counts which cannot be traced to point source pollution. This problem is expected to become increasingly worse as human population continues to grow. In both Maryland and Virginia, permitted discharges of treated wastewater into the Bay and tributaries from sewage treatment plants require a closed shellfish harvesting zone around the outfall. Construction or expansion of sewage treatment plants to serve the growing population or areas presently without public sewage connections, will increase the number and size of outfall closures.

Strategy-Shellfish Sanitation: The sessile nature of oysters makes them particularly vulnerable to adverse water quality conditions and bacterial contamination. The oyster resource can be protected from bacterial contamination by reducing the outflow of bacterially contaminated water into shellfish harvesting areas. A less desirable tactic is to move oysters from closed areas.

PROBLEM 6.1
Outfall from sewage is frequently the cause of bacterial contamination of oyster bars in Chesapeake Bay.

STRATEGY 6.1
As an extension of the efforts to improve water quality in the Bay through the nutrient, toxics and conventional pollutant control plans of the 1987 Chesapeake Bay Agreement, bacterial pollution will also be controlled.

ACTION 6.1.1
Maryland and Virginia will promote the objectives of the Chesapeake Bay Agreement to improve water quality in all areas of the Bay as stated in Action 5.1.

IMPLEMENTATION 6.1.1
Variable, depending on the specific project.

ACTION 6.1.2
Virginia will continue participation in the Interagency Shellfish Enhancement Task Force

(SENTAF) to encourage cleanup and opening of condemned shellfish grounds.

IMPLEMENTATION 6.1.2
Currently being implemented

ACTION 6.1.3
A) Maryland and Virginia will investigate the potential of depuration techniques. (1992)
B) Virginia will implement regulations allowing for the containerized relaying of condemned oysters. (1989)

IMPLEMENTATION 6.1.3
Variable, depending on the specific project.

ACTION 6.1.4
Maryland and Virginia will promote more effective treatment of sewage through innovative disinfection techniques and promote municipal water conservation programs which should reduce sewage volume. Specific items are defined in Action 5.1-A.

IMPLEMENTATION 6.1.4
1995

Problem-Market Production: Chesapeake Bay oysters are marginally competitive in the national market because of their size, quality and higher price. Consequently, consumer preference for Maryland oysters has decreased and processors report that some restaurants and seafood outlets have discontinued the sale of Maryland oysters. Consumer avoidance to Maryland's oysters is also due to negative media publicity about the diseases MSX and Dermo.

Strategy-Market Production: Application of optimum fishery regulations, repletion programs, disease control and habitat restoration should improve stock condition and result in larger harvests and restoration of consumer confidence.

PROBLEM 7.1
The quality of Chesapeake Bay oysters has diminished and consumer demand has been affected by the disease problem.

STRATEGY 7.1
There will be a Baywide effort to improve oyster stock condition.

ACTION 7.1.1
Maryland and Virginia will implement the strategies of this management plan to restore oyster stocks. Productive stocks should help correct the market problems.

IMPLEMENTATION 7.1.1
1989

ACTION 7.1.2
A) Maryland will promote public awareness that oysters infected with MSX and Dermo are safe to consume.
B) Virginia will use industry and state promotion of oyster quality to prevent further loss of market production due to public misconceptions.

IMPLEMENTATION 7.1.1
1990

Repletion Program:

Maryland- In 1988, Maryland planted approximately 5.8 million bushels of dredged shells; 130,000 bushels of fresh shells; and 878,000 bushels of seed. Continued funding is necessary to maintain this repletion effort. The most immediate problem in the repletion program is securing a supply of dredged shells to meet future needs. The areas now being dredged will last about two more years at best. Obtaining the necessary permits to dredge new areas is increasingly difficult with growing public pressure against any expansion of the dredging program. No viable substitutes exist for dredged shell.

As harvest declines, the amount of fresh shell declines and Maryland loses 60% of its fresh shell supply due to out-of-state export of the oyster harvest. There is no economical nor logistical method to purchase, transport and plant these shells back in Maryland waters. The fresh shells that remain in Maryland are a small contribution to the State's shell needs.

The Department of Natural Resources has no disease-free seed producing areas in Maryland. The traditional seed grow-out areas are also infected requiring expensive long distance transport of seed to less impacted areas.

Virginia- Repletion efforts have helped the oyster industry to maintain production but only at low levels compared to historical harvests. Further expansion of repletion activities is needed to counteract disease problems, water quality conditions, and climatic events. The repletion program will need more than the 1.9 million bushels of shell planted in 1987 to establish future seed growing areas. Virginia has not developed its own reef shell supply and receives only a small percentage of the "house" shells from the packing and processing industry. The number of seed areas have decreased due to disease and have not improved. Additionally, the repletion department does not have the necessary storage areas, manpower or equipment to accommodate a large volume of "house" shells. Virginia also faces a shortage of disease-free seed growing areas for planting shells. The problem is compounded because seed can no longer be transplanted in historical grow-out areas in the Potomac tributaries, lower Rappahannock River or Pocomoke Sound because of disease intensity. The repletion program must incur increased cost to incorporate other less accessible grow-out areas. The repletion program lacks adequate monitoring equipment and manpower to quantitatively analyze (stock assessment) the results of shell planting and seed transplanting activities.

Strategy-Repletion Program: Planting dredged or fresh shell and seed oysters will be the mainstay of the repletion program to supplement natural oyster reproduction.

PROBLEM 8.1
The repletion program is adversely affected by low natural spatfall, shortage of cultch, disease problems and cost of transporting seed and shell.

STRATEGY 8.1
There will be a Baywide effort to distribute oyster shell and seed to reflect the best biological information available.

ACTION 8.1.1
Maryland will review the existing statutory authority which dictates the distribution of seed and shell.

IMPLEMENTATION 8.1.1
1991

ACTION 8.1.2
Maryland will consider increasing the tax on exported oysters to compensate for the loss of shell and increase revenue for oyster propagation.

IMPLEMENTATION 8.1.2
1991

ACTION 8.1.3
Maryland and Virginia will evaluate their repletion programs by monitoring production in the planted and seeded areas.

IMPLEMENTATION 8.1.3
Currently being implemented.

ACTION 8.1.4
Maryland and Virginia will utilize alternative sources of cultch.

IMPLEMENTATION 8.1.4
1989

ACTION 8.1.5
Maryland will continue to protect and expand specific areas of oyster production by establishing oyster sanctuaries for seed and research purposes.

IMPLEMENTATION 8.1.5
1991

ACTION 8.1.6
Virginia will enhance its seed oyster program in the Great Wicomico, Piankatank, and James Rivers to contribute to the rebuilding of the oyster fishery in Virginia. Seed will be used to plant prime disease-free growing areas.

IMPLEMENTATION 8.1.6
Currently being implemented

ACTION 8.1.7
Virginia will establish a special repletion program for the Seaside of Eastern Shore.

IMPLEMENTATION 8.1.7
1989

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