

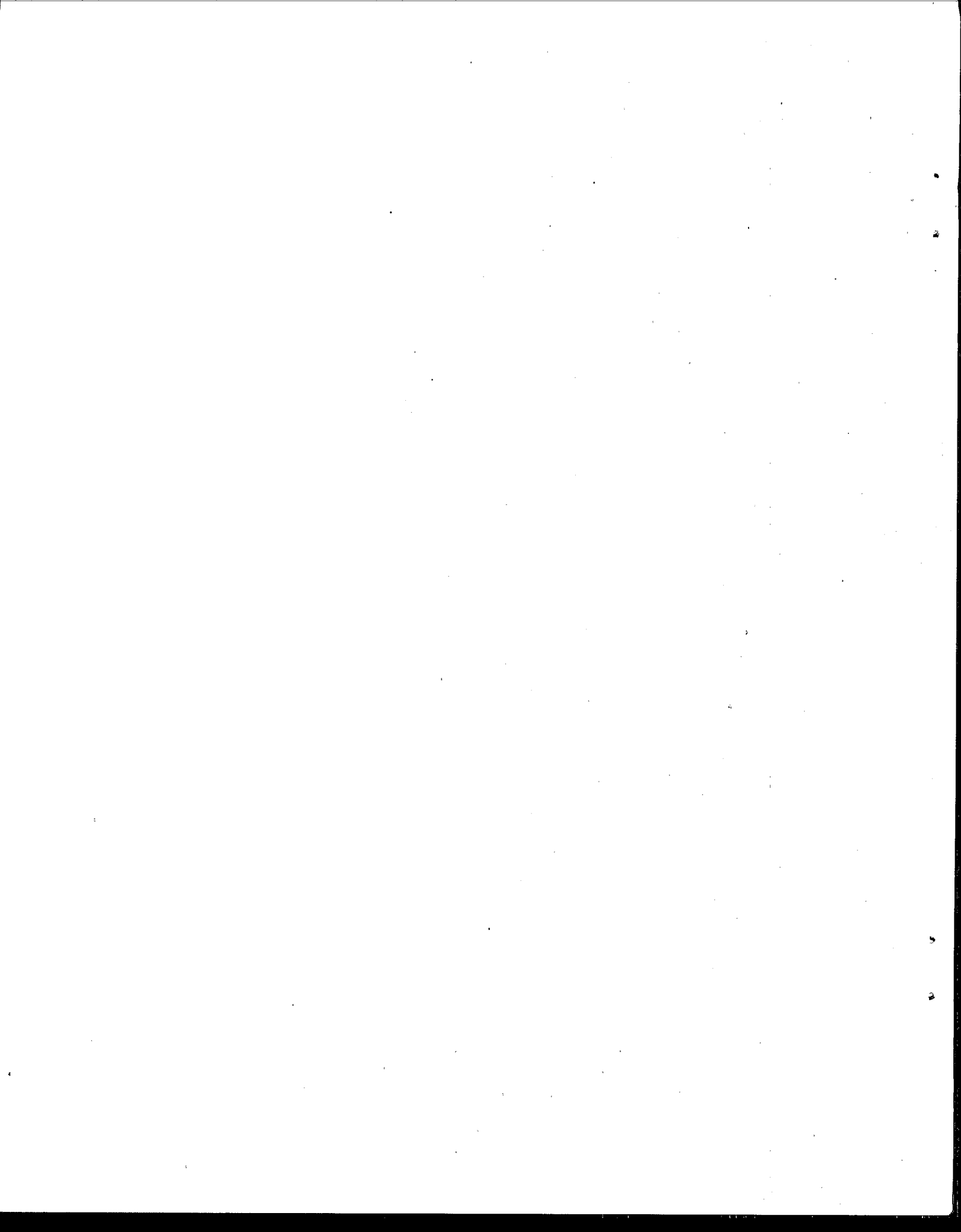
Chesapeake Executive Council

Annual Progress Report

Chesapeake Bay Alosid,
Blue Crab, and Oyster
Fishery Management Plans

Chesapeake Bay Program

December 1990



Annual Progress Report

Chesapeake Bay Alosid, Blue Crab, and Oyster Fishery Management Plans

A Commitment Progress Report from
the Living Resources Subcommittee

Annapolis, Maryland
December 1990

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for the
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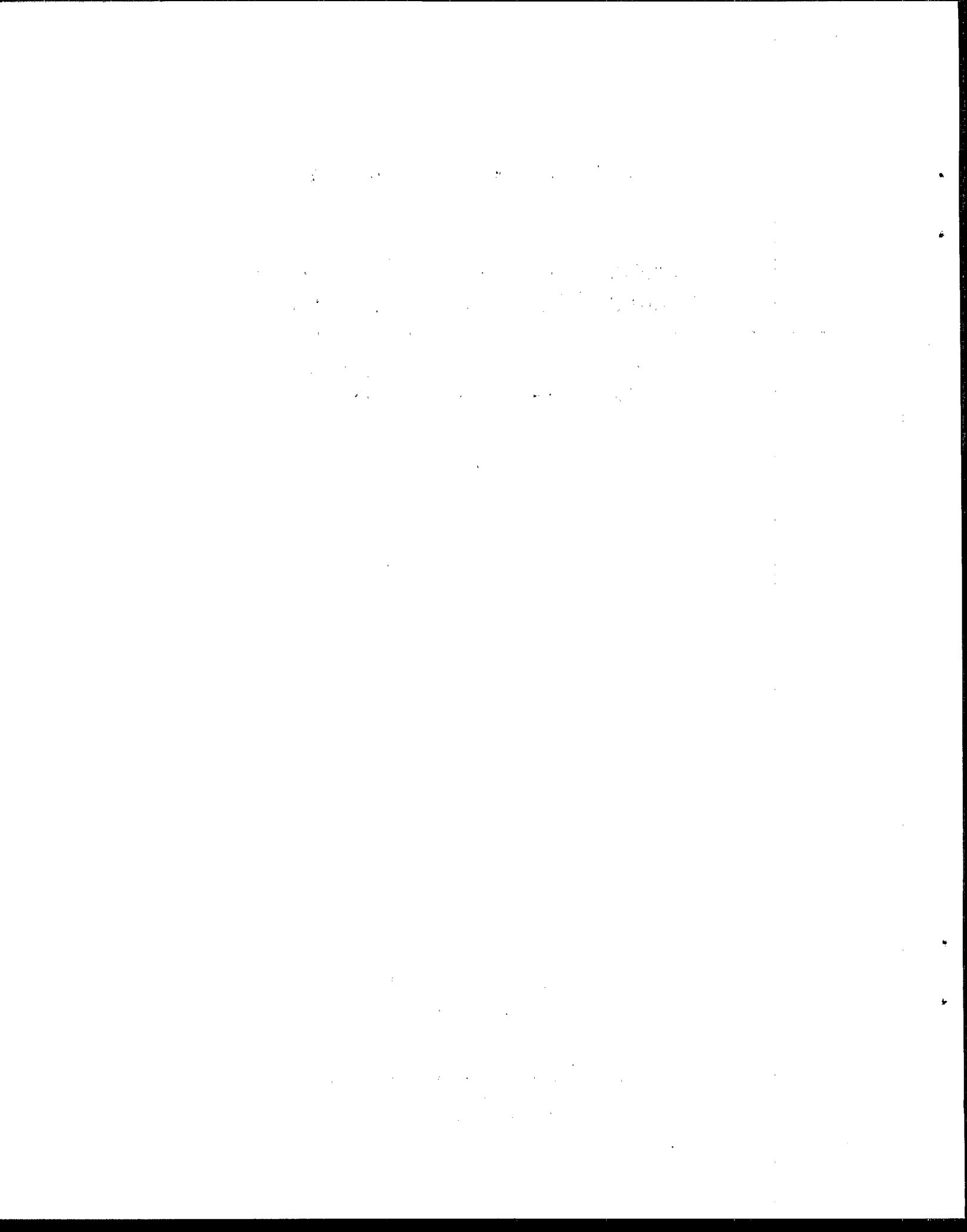


TABLE OF CONTENTS

Executive Summary.....	iii
Alosids (Shad and Herring).....	iii
Blue Crabs.....	iv
Oysters.....	v
Introduction.....	1
Chesapeake Bay Alosid Management Plan.....	3
Declining Abundance.....	3
Overfishing.....	4
Stock Assessment.....	4
Habitat Loss and Degradation.....	5
Conclusion.....	7
Alosid Implementation Matrix.....	8
Chesapeake Bay Blue Crab Management Plan.....	13
Fishing Effort is Increasing.....	13
Wasteful Harvesting Practices.....	14
Stock Assessment Deficiencies.....	16
Regulatory and Conflict Issues.....	18
Habitat Degradation.....	18
Conclusion.....	19
Blue Crab Implementation Matrix.....	20
Chesapeake Bay Oyster Management Plan.....	25
Background.....	25
Harvest Decline and Overharvesting.....	25
Recruitment.....	27
Disease Mortality.....	29
Leased Ground Production.....	30
Habitat Issues and Shellfish Sanitation.....	31
Market Production.....	31
Repletion Program.....	32
Conclusion.....	33
Oyster Implementation Matrix.....	34

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EXECUTIVE SUMMARY

Alosids (Shad and Herring)

Historically, the upper Chesapeake Bay was the most productive area for American shad harvest. Since 1988, population estimates of American shad in the upper Chesapeake Bay have increased from approximately 38,000 to 125,500 fish. The increase in abundance can be attributed to the moratorium on fishing in the Maryland portion of the Bay (enacted in 1980); restocking by the Maryland Department of Natural Resources (MDNR), the Pennsylvania Fish Commission (PFC), and the Susquehanna River Anadromous Fish Restoration Committee (SRAFR); and removing river and stream blockages to make additional habitat available for anadromous fish. Although the increase in upper Bay shad abundance is encouraging, the recovery of shad in other Chesapeake Bay river systems may not follow upper Bay trends. Funding must be assured to achieve recovery of shad populations throughout the Bay watershed and to implement any additional controls that may be needed for the fishery.

Population surveys have begun in other river systems to determine shad abundance in areas outside of the upper Bay. Juvenile surveys are currently in progress and are used in conjunction with adult stock assessment projects as another means of evaluating stock health. The juvenile data will eventually be used to develop a baywide young-of-the-year alosid index.

There is increasing concern about the growth of ocean shad fisheries during the past ten years. These fisheries are probably intercepting stocks that are not native to the states in which the fish are landed. The ocean fisheries are threatening to displace traditional inshore shad fisheries and may be hampering efforts to rebuild local stocks along the coast, including those of the Chesapeake Bay. Maryland and Virginia are evaluating potential actions to control their ocean shad fisheries and will pursue this issue with other coastal states.

Management strategies and actions for hickory shad will continue in conjunction with strategies and actions for American shad. Management measures for these two species are combined because their life histories are similar and there is little specific information on hickory shad.

The status of river herring (alewife and blueback herring) stocks is believed to vary according to river system, but more detailed information is needed. River herring stock assessment will be expanded in the upper Bay and efforts will be made to assess current fishing rates. The river herring juvenile survey has showed considerable variation among river systems and environmental conditions such as rainfall appear to contribute to the variation. River herring populations will continue to be monitored through

fishery dependent surveys. The proposed strategy to manage river herring on a system-by-system basis must be postponed until a more comprehensive data base has been established. River herring populations will be positively affected by continued restocking efforts and the removal of stream and river blockages.

Blue Crabs

Blue crabs are currently the most valuable commercial species in the Chesapeake Bay. In addition, the recreational fishery is very important and accounts for a significant catch. By nature of its life history, blue crab abundance is highly variable from year to year; therefore, there is the potential for overexploitation during any year of low relative abundance.

The commercial blue crab harvest from the Bay continues at historic high levels, yet effort needed to attain the catch generally increased during the 1980s. The crab population does not appear to be in any danger of collapse (there was a glut of blue crabs toward the end of summer 1990 and into the fall), however, the Bay jurisdictions are taking a conservative approach to keep fishing effort from increasing and to reduce waste in the fishery. Efforts include: developing a delayed or limited entry program in Virginia similar to that in Maryland; establishing tighter licensing requirements for commercial crabbers and studying licensing issues for other components of the fishery; targeting wasteful harvest practices that catch small or poor quality crabs and that cause excessive mortality, and investigating potential harvest, time, and area limits that will directly contain harvest. Methods used to control harvest must take into consideration prices and increasing competition in the market from other states and other crab products.

Several actions are being tried on a voluntary basis by the user groups involved. Cull rings allow undersized crabs to escape from pots, thereby reducing damage to or death of the crabs, as well as improving culling efficiency of the crabbers. Information provided by state agencies is assisting watermen in the design and use of cull rings for crab pots. Many watermen are now using cull rings regularly. Watermen are exploring ideas with state agencies on ways to string crab pots so that the number of floats used is reduced, while also maintaining overall crabbing efficiency. Navigation and conflicts with other fishermen will be improved in many areas by having fewer floats in the water. Many crab shedders have participated in a voluntary survey to assess the size and production of their operations, mortality, and general knowledge of shedding techniques. This information will greatly assist the states in improving production and profits from current harvest levels.

A priority for improving management of the blue crab fishery is to improve our understanding of the stock/recruitment

relationship and other aspects of crab population dynamics. The winter dredge and summer trawl surveys begun two years ago will be continued, along with other cooperative research on blue crab population dynamics, to provide information such as wintering ground mortality, migration, growth, and sex ratios. Monitoring efforts are also being improved, especially catch/effort information from both the commercial and recreational components of the fishery. Management decisions will be based on the most current information from the research and monitoring data. With an improved data base, socioeconomic issues can be better defined and incorporated into management decisions.

Oysters

The Chesapeake Bay oyster harvest declined precipitously during the mid- and late 1980s due to a combination of factors, including overharvesting, oyster diseases, pollution, and poor spatfall in many areas. It appears that harvest levels are stabilizing as the oyster disease MSX subsides and Maryland, the Potomac River Fisheries Commission, and Virginia continue their oyster repletion efforts. The repletion programs include planting shell and moving seed oysters to enhance natural production. Repletion efforts continue to be refined and improved, but are contingent on adequate funding.

Spat set was very good in many areas of the Bay in 1990. The quality of Chesapeake Bay oyster meats has also generally improved as oyster populations become healthier. There is reason to be optimistic that harvests will increase over the next few years and that prices will stabilize commensurately. Consumer confidence in the Chesapeake oyster appears to be increasing as these events occur.

Progress has been made on assessing oyster stocks and understanding oyster diseases. Scientists in Maryland and Virginia are conducting studies to improve sampling methods for oyster bars and to recreate oyster beds. Researchers are also developing strains of the Eastern oyster that appear to be less susceptible to diseases in the Chesapeake Bay and are improving our knowledge of oyster diseases and biology. These studies will help rejuvenate the oyster fishery and improve management techniques. Introduction of non-indigenous species, such as the Pacific oyster, is an important issue and is being studied as well.

An area of increasing interest and importance to the oyster fishery is aquaculture. New management measures are making seed oysters more readily available to the private lease holder and legislation requiring strict utilization of leased ground within a certain time period should lead to increased production. Many issues relating to aquaculture are being evaluated; these include the states' role, potential ability of aquaculture to stabilize production and markets, and use of the water column.

INTRODUCTION

Under the 1987 Chesapeake Bay Agreement, commercially, recreationally, and ecologically valuable finfish and shellfish species were selected for the development of baywide fishery management plans (FMPs). Because fishery management is a dynamic process, provisions were made for a periodic review of each FMP under the auspices of the Living Resources Subcommittee. A periodic review provides the format for incorporating new information, evaluating progress toward achieving objectives, and updating management strategies when necessary.

The Alosid (American shad, Alosa sapidissima; hickory shad, Alosa mediocris; blueback herring, Alosa aestivalis; and alewife herring, Alosa pseudoharengus), Blue Crab (Callinectes sapidus), and Oyster (Crassostrea virginica) Management Plans were adopted in July, 1989. An Implementation Plan for each species has also been adopted. The implementation plan is a tabular synopsis for keeping track of management progress. It includes a list of problem areas and actions, the type of implementing action required (i.e., administrative, regulatory, or legislative), and comments about the progress of each action.

The following report is the first review of the Alosid, Blue Crab, and Oyster FMPs. Each major problem addressed in the FMP's has been highlighted and is followed by a discussion on the status of pertinent action items. For details on each problem, management strategy, and action, refer to the appropriate management plan. An updated implementation table has also been included at the end of each management plan review.

CHESAPEAKE BAY ALOSID MANAGEMENT PLAN

Declining Abundance

Maryland will continue the moratorium on American shad in the Chesapeake Bay. The criteria for reestablishing a fishery in Maryland is an increase in annual population estimates for three consecutive years and a stock size of 500,000 fish in the upper Bay. The 1990 population estimate for American shad in the upper Bay was 125,574, an increase from the 1989 estimate of 75,329, but it does not meet the criterion for opening a fishery. Population surveys for adult American shad in other parts of the Bay (Nanticoke and Potomac Rivers) have begun but population estimates are not yet available. The general increases in population estimates of American shad in the upper Bay during the past 11 years is a strong indication that efforts by the Maryland Department of Natural Resources (MDNR), the Pennsylvania Fish Commission (PFC), and the Susquehanna River Anadromous Fish Restoration Committee (SRAFRFC) are producing positive effects. Virginia has also participated as an ex officio member on SRAFRFC and the Fish Passage Workgroup.

In Virginia, shad landings for 1989 were 502,184 pounds, 35% below the ten-year average of 777,000 pounds. Growth in the coastal (Territorial Sea) gill net fishery has increased and presently constitutes about 80% of the landings. Anchored and drift gill nets continue to take the majority of shad, combining for 85% of the landings in 1989. In 1990, harvest restrictions were proposed by the Virginia Marine Resources Commission (VMRC) to reduce the shad exploitation rate from 38% to 25%. However, due to the importance of the coastal fishery, its mixed stock characteristics, and the timing (shad season was already underway), the proposal was rejected by the Commission. The Commission has requested a status report on the shad fishery for November 1990.

Maryland has begun to monitor adult river herring stocks on the Nanticoke River to evaluate current exploitation rates. Nanticoke river herring populations show relatively low total annual mortality rates compared to other exploited populations in other states. It appears that river herring populations on the Nanticoke River are relatively stable and can sustain moderate exploitation. The recommendation of controlling river herring harvest on a system by system basis does not appear feasible at this time because of limited information for each river system. A larger data base is required before adult commercial landings or population estimates from each system can be related to juvenile indices from the same systems. Alosid research, particularly adult river herring, will be expanded in the upper Bay in order to obtain a more comprehensive data base. In Virginia, river herring landings in 1989 were 652,618 pounds, about 40% below the ten-year average.

Haul seines accounted for over 85% of the landings in 1989. Virginia is currently assessing exploitation rates for river herring.

The hickory shad catch at the Conowingo Fish Lift during 1989 continued to be low. The Maryland moratorium on hickory shad will continue.

Overfishing

The jurisdictions have continued to participate in Atlantic States Marine Fisheries Commission (ASMFC) coastal stock identification and ocean landing studies of alosids. An ASMFC-funded project on evaluating shad ocean landings by state has just been completed. The use of the term "intercept" fisheries has caused some confusion and will be better defined. The term "intercept" has been used in reference to alosids harvested from coastal areas and from the Chesapeake Bay while the fish are migrating either toward or away from the spawning areas.

Virginia submitted a proposal to limit the coastal shad fisheries. As a result of this proposal, VMRC began a one year study to evaluate the inequities of regulating the coastal fishery. Results from this study should be available in 1991. Although there is a moratorium on American shad in the Maryland portion of the Bay, there was a total of 488,000 lbs (1989) reported as ocean landings. The Maryland ocean catch will be evaluated followed by appropriate steps to limit fishing effort if warranted. The jurisdictions have acknowledged a need to include and contact North Carolina for cooperation in tagging studies, especially for the ocean shad fisheries.

Stock Assessment

It is generally accepted that juvenile year class fluctuations greatly influence the amplitude and variation in commercial fish landings. The data for developing a reliable juvenile alosid index is being collected. The Virginia Institute of Marine Science (VIMS) will reinstitute an alosid juvenile survey with Chesapeake Bay Stock Assessment Committee (CBSAC) funding. This juvenile survey had been discontinued because of lack of funding. With new funding, the survey will complement past juvenile data and ongoing alosid stock assessment. A long term data base is required before the relationship between juvenile indices and adult commercial landings or population estimates can be evaluated. The 1989 juvenile CPUE for American shad in the upper Bay was the highest recorded since the survey began in 1980.

Juvenile river herring in the upper Bay showed considerable variation among river systems from 1985 to 1989. The apparent decrease in juvenile river herring CPUE in most of the systems

sampled during 1989 was primarily the result of record rainfall in the late spring and summer. The influx of freshwater reduced salinities and, most likely, extended the juvenile distribution. In order to develop a baywide juvenile index, environmental factors may need to be incorporated.

Substantial increases in the adult river herring commercial catch were seen in the Patuxent River and upper Bay during 1989. Adult river herring populations will continue to be monitored through fishery dependent surveys. Virginia began an alosid stock assessment project in 1989 and will continue to collect biological data for shad and river herring. This information will improve the ability to calculate exploitation rates for these species.

The proposed shad tagging project for the coastal fisheries was not implemented due to lack of funds. This project is currently being reviewed by CBSAC for funding during the next year. Tagging studies would provide information on the origins of coastal migrating alosids and would help define management options for regulating the coastal fishery.

The Fisheries Management of the District of Columbia (FMDC) has begun to obtain detailed information on anadromous fish stocks in the upper Potomac and Anacostia Rivers. A biological survey of anadromous fishes, in general, is being conducted to determine the onset and duration of spawning migration, age composition, and other factors which affect reproductive ability. In addition, physical and hydrographic parameters are also being collected and will be coordinated with the fish-stock information. Collection and analysis of data relating to American shad, hickory shad, and river herring will be done during this process. The CPUE and juvenile index calculations will be used to assess the future strength of adult alosid populations. The gear and sampling methods for assessing CPUE and juvenile production are consistent with Maryland and Virginia.

Habitat Loss and Degradation

Removing impediments to migratory fishes has been a primary strategy for improving alosid habitat. Progress has been made at several priority sites. For a detailed account, refer to the document, "Removing Impediments to Migratory Fishes in the Chesapeake Bay Watershed." Construction of fish passageways will be underway at Winter's Run, Ft. Meade, and Conowingo Dam following the 1990 anadromous fish spawning period. Several other contracts are in the final stages for sites on Big Elk Creek, Little Patuxent River and Tuckahoe Creek. Four dams on the Patapsco River have been given highest priority and will open 21 miles of river habitat to alosid species. The Maryland Legislature has authorized \$2.25 million in funds for the Fish Passage Program on the Patapsco River. Fish passage improvements were made at four sites on the James River system in 1989 (Manchester, Brown's Island, Herring

Creek and Walkers Dam). Also slated for fish passageways are William's Island and Boher's Dam. Work has been initiated on designing passage at Embrey Dam in Fredericksburg.

Weekly biological monitoring for the assessment of anadromous fish populations is being conducted on streams under fish passage development. A monitoring study was initiated in March 1989 to assess the effectiveness of the passageways on the Richmond dams and to determine where the fish are approaching the next impediment, 5 miles upstream, at William's Island Dam. Trap/transport and restoration of river herring to areas in the Patapsco, Patuxent, Big Elk and Tuckahoe have occurred. To date, approximately 10,500 fish have been relocated. Suitable trap and release sites were selected based on easy access and areas considered good habitat for reproductive success. Release sites have been monitored for alosid eggs and larvae. The Havre de Grace and Elkton Shad restoration (grow-out and release ponds) facilities were opened in July, 1990. In cooperation with the Pennsylvania Fish Commission (PFC), the culture facilities were stocked with approximately 650,000 shad fry from the Van Dyke Hatchery. These fish will be released into the lower Susquehanna and upper Elk Rivers this fall. The new facilities have an added advantage over traditional stocking methods in that they hold the fry until they grow to juveniles and they are released without being transported. In addition to these two grow-out facilities, the Mattaponi Indian Tribe completed a new shad hatchery on the Mattaponi River. This complements the facility built on the Pamunkey River in 1989.

The restoration of American shad to the Susquehanna River consists of trapping pre-spawn adults and transporting them above dams, restocking fry and fingerlings, improving water quality, and providing passage over dams. For specific details on the restoration program, refer to the 1989 Annual Progress Report, "Restoration of American Shad to the Susquehanna River." During the 1989 season, 6,697 adults were transported to upstream spawning areas and PFC released a record 21.1 million shad fry (15-37 days old) and 70,000 fingerlings (107-204 days old) in the Susquehanna watershed. Successful outmigration appeared higher in 1989 than in any past year. High abundance was probably related to record stocking of hatchery fry at Lapidum and upstream, and high river flow conditions. Ongoing SRAFRRC projects to evaluate methods for successful outmigration of American shad juveniles and adults included a biological evaluation of strobe lights to guide downstream migrants at York Haven hydroelectric dam, radio tagging studies, and a study to determine the migratory routes, timing and relative abundance of juveniles as they reach the forebay of Holtwood hydroelectric project. Restoration efforts have also included monitoring the relative contribution of hatchery produced fish to the wild population.

Dam operators on the Susquehanna River upstream of Conowingo Dam have agreed to share the cost of additions to the new fish lift

at Conowingo Dam. This was potentially a serious gap in the Shad Restoration Program for the Susquehanna River. These operators include Baltimore Gas & Electric (BG&E) and Pennsylvania Power & Light (PP&L) at Safe Harbor Dam, PP&L at Holtwood Dam, and General Public Utilities (GPU) at York Haven Dam.

Support of water quality commitments in the 1987 Chesapeake Bay Agreement has continued. Although FMDC, MDNR, PFC, the Potomac River Fisheries Commission (PRFC), and VMRC do not carry out the specific commitments, each agency has been actively involved in defining water quality goals. Specific strategies for nutrient reduction, reduction and control of toxic substances, and control of pollutants can be found in the 1989 Annual Progress Reports for each. Specific habitat requirements including water quality parameters have been developed for alosids and will be available in the document, "Habitat Requirements for Chesapeake Bay Living Resources." Maryland DNR and the Department of the Environment (MDE) have initiated a joint project to estimate direct atmospheric deposition of selected trace elements and organic compounds into the Bay. Sampling will be coordinated with an EPA sponsored study at a site in Virginia.

Conclusion

The 1989 Chesapeake Bay Alosid Management Plan was adopted with a view to improve the abundance of alosid stocks in the Bay. During the first year, the alosid FMP directed efforts toward restoration and habitat improvement. The restoration program in the Susquehanna River has resulted in the largest population estimate and largest production of hatchery-raised American shad to date. Significant progress has been made in the removal of impediments to migratory fish and restocking of adult shad and herring has begun. Current exploitation rates for alosid stocks are being examined, especially the coastal shad fisheries, in order to improve and develop regulatory measures. Data deficiencies have been identified and current research projects have been expanded.

There are two general areas that need to be emphasized during 1990-1991 in order to continue rebuilding Chesapeake Bay shad and herring stocks. Briefly, these are:

- 1) Continue to remove impediments to migratory fishes in each Bay jurisdiction.
- 2) Identify the composition of coastal shad and herring stocks to gauge what effects the coastal (intercept) fisheries have on Chesapeake Bay stocks.

1990 ANNUAL PROGRESS REPORT
CHESAPEAKE BAY ALSOSID FISHERY MANAGEMENT PLAN

PROBLEM AREA	ACTION	IMPLEMENT DATE	RESPONSIBLE AGENCY & METHOD	COMMENTS/NOTES
1. Declining alosid abundance	1.1.1.1 Continue shad moratorium in MD, other restrictions.	Continue	MDNR - A, R	The 1990 shad population estimate was approximately 125,600 fish, up from 38,000 in 1988. Both natural production and restocking efforts are responsible.
		1991	DCFM - R	DC will consider a moratorium on shad after estimating fishing pressure and adult shad abundance.
		Variable	PFC - R	A recreational fishery will be opened in PA when shad population reaches a predetermined level; will be coordinated with SRAFRFC.
		Continue	PRFC - R	Will continue present creel limit of 2 fish/person/day.
	1.1.2 VA will follow ASMFC recommendation to limit exploitation rate on shad and herring to 25%.	1989	VMRC - A, R	VA is assessing exploitation rates and will take appropriate steps as needed. The ocean intercept fishery is being looked at closely.
	1.2 Control river herring catch, including: by system, regulate areas slated for restoration, other.	1990	MDNR - A, R DCFM - A, R PFC - R VMRC - A, R	Managing river herring harvest on a system-by-system basis is delayed until a larger data base is collected. Will be coordinated with the Fish Passage Workgroup and SRAFRFC. DC will control river herring catch in Rock Cr. & Potomac.
	1.3 Hickory shad fishery will follow the same management actions as in shad fishery (see Action 1.1.1)	Variable	MDNR - A, R DCFM - R PFC - R VMRC - A, R PRFC - R	PRFC & DCFM will place new restrictions on hickory shad to coincide with Am. shad fishery.

1990 ANNUAL PROGRESS REPORT
CHESAPEAKE BAY ALSOSID FISHERY MANAGEMENT PLAN

PROBLEM AREA	ACTION	IMPLEMENT DATE	RESPONSIBLE AGENCY & METHOD	COMMENTS/NOTES
	1.4 Protection will be given to alosids in the Susquehanna as restoration progresses.	1991	MDNR - A,R PFC - A,R	Continued coordination with Fish Passage Workgroup & SRAFR. Fish Passage projects are underway. Weekly biological monitoring is currently in progress.
2. Overfishing	2.1 Jurisdictions will participate in the ongoing ASMFC management program.	Continue	MDNR - A,R DCFM - A PFC - A VMRC - A,R PRFC - A VMRC - A,R	Are participating in ASMFC deliberations. Are discussing potential cooperative coastal stock identification and ocean landing studies.
	2.2 VA. will reduce shad exploitation to 25%.	1990		States, CBSAC, USFWS are discussing tagging project. MD & VA are assessing need for controls on their ocean shad fisheries.
	2.3.1 VA. will reduce river herring exploitation to 25%.	1991	VMRC - A,R	VA is assessing exploitation rates and will take steps as needed.
	2.3.2 Will ensure river herring by-catch is minimized in the mackerel fishery.	Continue	MDNR - A VMRC - A	Are participating in ASMFC and MAFMC meetings.
3. Stock assessment deficiencies	3.1 Continue to collect alosid data.	Variable by item		
	A) Collect alosid juvenile data.	Continue	MDNR - A PFC - A DCFM - A VMRC - A	Are collecting data to develop baywide juvenile index of abundance.
	B) MD will continue projects in upper Bay and Nanticoke to estimate adult shad abundance.	Continue	MDNR - A	Underway.

1990 ANNUAL PROGRESS REPORT
CHESAPEAKE BAY ALIQUID FISHERY MANAGEMENT PLAN

PROBLEM AREA	ACTION	IMPLEMENT DATE	RESPONSIBLE AGENCY & METHOD	COMMENTS/NOTES
	C) Improve assessment of catch/effort on shad stocks.	Open 1990 1990	PFC - A DCFM - A VMRC - A	Underway.
	D) VA will collect additional fishery-dependent data on shad	Continue	VMRC - A	Underway.
	E) VA will begin ocean intercept tagging program to determine shad stock composition.	1990	VMRC - A	Proposed tagging study is delayed until 1991; are discussing possible coop. study with MD, CBSAC, USFWS.
	F) MD & DC will examine and improve herring data.	1990	MDNR - A DCFM - A	Includes characterization of adult river herring and creel census.
	G) VA & DC will conduct surveys of alioisid spawning grounds and compile info.	Continue	DCFM - A VMRC - A	Underway; DC will monitor Potomac River and Rock Creek.
	H) A joint effort will be made to investigate flm. shad in the Potomac.	1991	MDNR - A DCFM - A PRFC - A VMRC - A	Planning underway.
4. Habitat loss and degradation	4.1 Implement the Chesapeake Bay Fish Passage Plan			Refer to Fish Passage Plan.
	A) - I) Implement various Fish Passage projects.	Variable	MDNR - A PFC - R DCFM - A VMRC - A	Many projects completed, others at different stages of implementation. More detail is provided in status reports for Fish Passage Plan.
	J) Coordinate to obtain sources of adult fish for restocking areas.	1990 Variable	MDNR - A PFC - R	Discussions underway with SRAFRG.
	K) Establish measures to protect reintroduced stocks.	Variable	MDNR - R PFC - R VMRC - R	Must be coordinated with restoration efforts. Weekly biological monitoring in effect in Maryland.

1990 ANNUAL PROGRESS REPORT
CHESAPEAKE BAY ALLOSID FISHERY MANAGEMENT PLAN

PROBLEM AREA	ACTION	IMPLEMENT DATE	RESPONSIBLE AGENCY & METHOD	COMMENTS/NOTES
	L) Monitor impact of fish passage projects.	Variable	MDNR - A PFC - A VMRC - A	Is being coordinated with restoration efforts. Weekly biological monitoring in effect.
	4.2.1 MD & PA will work with SRAFRFC for successful downstream passage of allosids in the Susquehanna River.	Variable	MDNR - A PFC - A	Continue to develop and use SRAFRFC annual work plans.
	4.2.2 Hatchery production A) Promote use of Susquehanna brood stock for PA restocking.	Variable	MDNR - A PFC - A	Will develop and use SRAFRFC annual work plans.
	B) Increase funding for Pamunkey/Mattaponi hatcheries.	Variable	VMRC - A	Have new facility at Mattaponi
	4.3 Technical issues regarding water quality at Conowingo Dam have been accepted. A) Adoption of minimum oxygen standards below the dam B) Installation of vent/intake systems. C) Turbine operation to meet D.O. standard. D) Monitor spills as needed. E) Flow schedules.	1989 1991 1989 1989 1989	MDNR - A PFC - A	Standards must be monitored and enforced. A special committee within SRAFRFC has been established.
	4.4 Establish new water classification system based on living resources, habitat, and water quality.	1990	MDNR - A DCFM - A PFC - R	MD is developing a computerized data base & mapping system. PA process underway.

1990 ANNUAL PROGRESS REPORT
CHESAPEAKE BAY ALIQUOT FISHERY MANAGEMENT PLAN

PROBLEM AREA	ACTION	IMPLEMENT DATE	RESPONSIBLE AGENCY & METHOD	COMMENTS/NOTES
	4.5 Promote Bay Agreement water quality commitments.	Variable	MDNR - A PFC - A DCFM - A PRFC - A VMRC - A	Are coordinating with various local, state, and federal agencies.

LEGEND: ASMFC = Atlantic States Marine Fisheries Commission
 CBSAC = Chesapeake Bay Stock Assessment Committee
 DCFM = District of Columbia, Fisheries Management
 MDNR = Maryland Department of Natural Resources
 MAFMC = Mid-Atlantic Fisheries Management Council
 PFC = Pennsylvania Fish Commission
 PRFC = Potomac River Fisheries Commission
 SRAFRFC = Susquehanna River Anadromous Fish Restoration Comm.
 USFWS = U.S. Fish & Wildlife Service
 VMRC = Virginia Marine Resources Commission

A = Administrative action
 R = Regulation
 L = Legislation

CHESAPEAKE BAY BLUE CRAB MANAGEMENT PLAN

Fishing Effort is Increasing

Containing the harvest of blue crabs can be accomplished by several changes in the commercial and recreational fisheries. The Delayed Entry Program, passed during the 1988 Maryland legislative session and implemented during 1989, has limited the number of new people entering the commercial fishery. With the two-year delay, the first new licensees will enter the fishery during the 1992 season (Sept.1, 1991- Aug.31, 1992). Since the tidal fish license (TFL) was established, there has been an increasing number of TFLs, with a dramatic increase between 1988 and 1989 in anticipation of the delayed entry deadline. In addition to the TFL, there are three other commercial crab license categories in which the number of licensees have generally decreased. One of these crab licenses, the limited crab catcher (LCC), was exempt from the delayed entry until 1990. After one year of the Delayed Entry Program, the number of TFLs appears to be holding steady but the positive effects of the Delayed Entry Program will not be fully realized for several years. Although conclusive data documenting the effectiveness of the Delayed Entry Program is not available at this time, the program will be effective at controlling short-term effort that could result from changes in fishery regulations. A bill which would have given VMRC authority to delay entry into the fisheries was tabled at the last session of the Virginia General Assembly. The bill was sent to a House subcommittee for study. No action will be taken until the 1991 session of the General Assembly.

There will be a proposal to eliminate the non-commercial crab catcher (resident and non-resident) license in Maryland. During the 1989 crabbing season, there was a total of 13,027 licensed non-commercial crabbers that landed approximately 6 million pounds. This catch appears high for personal consumption and it is likely that some of the catch is being sold. Currently, non-commercial crabbers are allowed 2 bushels of crabs per licensee per day. Elimination of the non-commercial category would force crabbers to purchase a commercial license or limit themselves to the sport crabbing limit of 1 bushel per person per day.

Maryland and Virginia continue to conduct summer trawl and winter dredge surveys to collect information on blue crab population dynamics. Ultimately, Maryland's goal is to develop a forecasting model based on the information from the winter dredge and the summer trawl surveys. This model would be used for predicting yearly harvest and possibly establishing yearly quotas. Preliminary work on a model has begun but is not expected to yield predictive information for another three to five years.

Mechanisms being considered for containing blue crab harvest are gear restrictions and daily harvest limits. The Maryland commercial crabbing survey will provide information on the average

number of pots, yards of trotline, number of scrapes, number of collapsible traps, number of crab pounds and number of dip nets used by commercial crabbers per day each month plus the maximum and minimum number of each gear type. Gear restrictions may be effective at limiting effort but enforcement problems may outweigh the advantages. Daily time limits are based on the premise that a licensee can fish only a certain number of pots or other gear per hour. Maryland will consider establishing daily time limits which will require investigating the average number of hours spent crabbing to determine if limiting commercial crabbing between sunrise and 3:00 p.m. and/or prohibiting crabbing on Sunday will effectively limit effort. Virginia currently prohibits commercial hard crabbing on Sunday. Currently, there is no data to support taking action on hard crab size limits.

Evaluating the economic and social impacts of containing blue crab harvest were too broadly stated in the FMP and need to be more specifically defined. Suggestions for improving the social and economic questions about crabbing include such topics as the effects of limiting the number of pots, traps, trotline, etc. on the economics of both commercial and recreational crabbers; and, the economic effects of eliminating the non-commercial crabbing license. Economic and social aspects of crabbing will become clearer as information on total catch becomes available.

Another economic concern is the perception of business investors in relationship to management actions. Rumors about blue crab stock collapse in the Chesapeake Bay can prompt investors to import crabs from other states, thus impacting fishery economics in the Bay. It should be emphasized that the blue crab harvest from the Bay has been relatively high since the early 1980s and the stock is not in danger of collapse. Since blue crab abundance is highly variable from year to year and because it is an important fishery, conservative management actions have been proposed to protect the stock and should not signal economic concerns to business investors.

Wasteful Harvesting Practices

The release of buckram crabs, which weigh less than "fat" hard crabs, is in the initial stages of being promoted through educational pamphlets and other informational material. Size, weight, and volume designations from crab dealers and buyers were evaluated as a means of reducing the harvest of poor quality crabs. However, the actual size of a crab in a given size category can vary during any given season depending on availability, seasonality, demand, and dealer interpretation of the market. Establishing standard weight limits per bushel does not seem feasible at this time.

The reduction and elimination of waste in the blue crab dredge fishery has been a topic of concern. In June 1989, VMRC approved

a proposal to limit crab dredging from sunrise to sunset. In other action, a committee comprised of industry members and VMRC Fishery Management Division staff, was established to discuss and develop viable management options for Virginia's blue crab fishery. This Blue Crab Subcommittee [of the Fishery Management Advisory Committee (FMAC)] has met several times to discuss topics such as daily catch limits, cull rings, crab and pot theft, peeler pot and shedder licenses, delayed entry, and modification of crab dredges.

Cull rings can effectively reduce the number of sublegal crabs found in crab pots and, therefore, reduce the amount of time a crabber spends culling out small crabs. Virginia produced and distributed a brochure about the use and benefits of cull rings to all licensed crab potters. In addition, research on testing cull ring size and effectiveness in Virginia tributaries of the Bay will continue. Results from a recent survey of Virginia crab potters indicate that nearly 60% of the full-time crabbers are using cull rings voluntarily. Maryland is in the process of designing and printing a similar brochure for cull ring use and has also printed an article about cull ring use in the Watermen's Gazette. Depending on the success of the voluntary use of cull rings, Maryland may propose future regulations requiring all new crab pots to have cull rings. Definitions and dimensions of cull rings and peeler pots will need to be defined.

As of September, 1989, it is illegal in Maryland to possess, transport, or pack a female crab from which the egg pouch has been removed or an egg-bearing crab, known as a sponge crab, which has been taken from state waters (COMAR 08.02.03.02). Sponge crabs also cannot be taken from the Potomac River. In addition, the use of mature female crabs as bait in the eel fishery will be surveyed in Maryland using a list generated by the new requirement for eel pot licenses.

Abandoned crab pots continue to fish for crabs and contribute to mortality. The current Maryland regulation states that all crab pots shall be removed from State waters by December 31 of each year. Proposed changes to the wording of this regulation would state that pots found in the waters of the Chesapeake Bay after Dec. 31st of each year will be considered the property of the finder. The Department could fine (an amount to be determined) the licensee of any crab pot found by the Department after Dec. 31st. Maryland will also assess the feasibility of using different types of biodegradable panel configurations and implement their use on an experimental basis with the cooperation of selected watermen.

The Maryland Natural Resource Police conducted a survey of shedding operations during the summer 1990. This survey will provide information on the extent of shedding operations, peeler mortality, and whether it would be beneficial to license shedding operations. Virginia is also considering a license for shedding operations. Maryland is discussing the feasibility of preparing a

shedding demonstration using low cost technology to improve yield and reduce peeler mortality.

The above actions will begin to reduce the waste problem in the blue crab fishery and also contribute to the containment of the blue crab harvest.

Stock Assessment Deficiencies

The Summer Trawl survey has been modified to collect more detailed data on size class distribution and availability, environmental parameters, and specific crabbing areas in order to obtain the biological data necessary for determining blue crab abundance and distribution.

The second year of the Winter Dredge Survey was completed in March 1990. The first year was a pilot study and it may take 3 to 5 years before a sufficient data base is collected and management recommendations can be made. There are expectations that the Winter Dredge Survey will provide the basis for developing a forecast model for blue crab harvest in Chesapeake Bay. Preliminary results from the dredge survey are found in the last paragraph in this section.

The Maryland Commercial Crab Catch Reporting Form has been modified as a means to more accurately measure blue crab effort and harvest. For instance, crabbers must now include a separate total for dozens of soft crabs and numbers of peeler crabs. How much gear used per day for trotlines has been clarified by indicating either feet or yards and effort information has been clarified by rewording the question on the number of "runs of trotlines" or "pulls" of the specific gear type. The wording for fishing area has been changed from "area code" to "water code" to avoid confusion. Virginia collects hard crab landings from several sources including wholesalers and picking houses. Virginia is currently working on obtaining an accurate account of crabs landed.

Maryland has expanded the national Marine Recreational Fishery Statistics Survey (MRFSS) by contracting for an additional regional recreational crabbing survey. The data from this survey will be compatible with previous MRFSS surveys conducted in 1983 and 1988. Instead of the usual 5-year period between surveys, the additional regional survey will be conducted more regularly. The specific time interval between surveys will be determined once the data is analyzed and data needs are better defined. Virginia plans to add questions to the MRFSS telephone survey to help estimate catch rate and fishing effort in the recreational blue crab fishery. Maryland's Natural Resources Police (NRP) conducted a recreational crab survey during the summer, 1989. Preliminary results indicate the recreational crabber spends an average of 4.8 hrs crabbing and catches 41 crabs per trip (<1 bushel). This survey has the potential of providing important information on catch and effort

trends in the recreational fishery and efforts will be made to conduct the survey again in 1991. Any controls placed on the commercial harvest of crabs will be considered for the recreational fishery as well.

Virginia conducted an effort survey in 1989/1990 to assess commercial and recreational fishing effort in the crab pot fishery. The response level was excellent from the 2425 crabbers surveyed. Data are being processed and a report will be released this year. Additionally, Virginia's Stock Assessment Program initiated a survey of CPUE trends in the winter dredge fishery. The CPUE data generated from this ongoing project will serve as an index for abundance. Virginia is developing a program to collect biological data from the commercial dredge fishery and summer fishery to determine the effect of both male and female crab harvest on population dynamics.

Cooperative research on blue crab population dynamics is in progress. There are three subprojects that comprise the population dynamics field study: a survey of the Maryland pot fishery, a fishery independent winter dredge survey, and a tagging study. A survey of the pot fishery provides information on size-frequency and will be used to express CPUE by sex and size class. This data will allow an examination of the age and sex structure of the blue crab population on a seasonal basis. Preliminary conclusions from the fishery independent winter dredge survey are as follows: more crabs are found in river systems and tributaries than in the open Bay; crabs in the river systems are on average much smaller and include many young-of-the-year crabs; and, sex ratios vary widely between the upper and lower Bay, and among rivers. The estimated standing stock of >5 mm crabs in the Bay during the 1989 winter was between 60 and 90 million crabs. The winter dredge survey is viewed as a pilot study to develop a long-term, baywide survey and to predict the availability of blue crabs in following seasons. The tagging study will provide data for estimating exploitation rates for the commercial and recreational fisheries.

Although the action on regulating the use of eels for crab bait was delayed, the first step towards investigating the problem has begun. Maryland Senate Bill 158 was passed during the 1990 session of the General Assembly. This bill will require a person to obtain a tidal fish license to catch eels with a pot or other device in the tidal waters of the State. Limited crab catchers (up to 50 pots) are exempt from the license provided the harvested eels are not sold and are for personal use only. A person can apply for an eel license until September 1, 1991 without the required waiting period. Reports must be submitted to the MDNR if eels are offered for sale. The new license will provide data on eels used as bait in the blue crab fishery.

Regulatory and Conflict Issues

Conflict issues in the blue crab fishery have begun to be resolved. An amendment to COMAR 08.02.03., which prohibits the setting of buoyed crab pots in marked channel entrances of certain access and navigational areas within Maryland, will add 19 new buoy-free areas. With the proposed elimination of the non-commercial crabbing license (Action 1.3.1) in Maryland, the use of crab pots would be retained for commercial harvesters and waterfront property owners. This action would also facilitate enforcement of harvesting regulations.

Enforcement policies and practices regarding the blue crab fishery have been strengthened throughout the Bay by a commitment to consistent and uniform practices. Enforcement effort has been placed on the practice of culling small crabs from the commercial and recreational catch. More stringent penalties have been enforced for repeat violations of crabbing regulations.

Habitat Degradation

Support of the habitat and water quality commitments in the 1987 Chesapeake Bay Agreement has continued. Although MDNR, PRFC, and VMRC do not carry out the specific commitments, each agency has been actively involved in defining water quality goals and reviewing the results of the action programs. Specific strategies for nutrient reduction, reduction and control of toxic substances, and control of conventional pollutants can be found in the 1989 Annual Progress Reports for each. In addition to these areas of habitat and water quality concern, specific items have been addressed for blue crabs. Data collected from the summer trawl survey in Maryland indicate that the areas of highest crab abundance, well-suited for crab sanctuaries, are also the best commercial crabbing areas. At this time, it does not seem feasible to prohibit crabbing in these areas. As environmental parameters are better defined, areas with moderate abundance may be targeted for protection. It is recommended that those areas of highest crab abundance be protected against environmental modifications such as channel dredging.

Additional research on crab habitat preference has shown that vegetated habitats support more juvenile crabs by an order of magnitude than adjacent unvegetated marsh creeks. The need to protect and restore submerged aquatic vegetation (SAV) and support tidal and non-tidal wetlands strategies remains important. The development of the document, "Habitat Requirements for Chesapeake Bay Living Resources," is in the process of being completed and will include specific information on critical and sensitive areas for blue crabs.

Conclusion

The 1989 Chesapeake Bay Blue Crab Management Plan was adopted with a view to prudently manage a highly valuable resource. Increasing fishing pressure on the blue crab stock, incomplete knowledge about blue crab population dynamics and environmental factors that affect larval stages, and socioeconomic issues present a complex management agenda. During the first year, actions were begun to contain blue crab harvest by decreasing the waste of small or poor quality crabs. Other methods of controlling blue crab harvest are being investigated. The blue crab data base has been improved, especially for the recreational fishery, and should yield some important and valuable information in the near future. With an improved data base for both the commercial and recreational fisheries, socioeconomic issues can be better defined and incorporated into management decisions.

Two general areas need to be emphasized during 1990-1991 in order to improve the management of the blue crab fishery. Briefly, these are:

- 1) Continue to collect and analyze data from the winter dredge and summer trawl surveys. This research will improve the understanding of stock/recruitment relationships and contribute to developing a forecasting model for the fishery.
- 2) Improve the data base and methodologies needed to decrease waste in the fishery. Waste arises from harvesting small or poor quality crabs and operations that cause excessive mortality. The winter dredge fishery, consistent size limits for peeler and soft crabs, and shedding operations are among the issues to be addressed.

1990 ANNUAL PROGRESS REPORT
CHESAPEAKE BAY BLUE CRAB FISHERY MANAGEMENT PLAN

PROBLEM AREA	ACTION	IMPLEMENT DATE	RESPONSIBLE AGENCY & METHOD	COMMENTS/NOTES
1. Fishing effort is increasing	1.1.1 Contain commercial harvest at present levels; assess potential regulatory measures.	1991	MDNR - A,R VMRC - R,L PRFC - A,R	Are assessing available information and collecting additional data. Are consulting with advisory groups. VA conducted survey of crabbers. Will hold workshop in 1991.
	1.1.2 Delayed entry program for commercial watermen	MD-contin VA-1991 PRFC-open	MDNR - A VMRC - R,L PRFC - R	MD is monitoring its program; controls short-term changes in fishery. Bill likely to be introduced to VA legislature in 1991. PRFC implementation will depend on evaluation of MD program.
	1.2 Establish compatible regulations to ease inter-jurisdictional issues, based on yield/recruit data	1991	MDNR - A,R VMRC - A PRFC - A	Are continuing to collect and assess data; have discussed size limits, gear & time restrictions, and licensing; will follow through.
	1.3.1 MD will distinguish clearly between commercial, non-commercial, and recreational crabbers.	1991	MDNR - A,R,L	Have introduced bill to eliminate non-commercial license (2 bu/day, not for sale), limiting choices to commercial or recreational.
	1.3.2 MD will evaluate socioeconomics of crabbing to resolve user group conflicts.	1990	MDNR - A	Additional biological and other data needed to really address socio-economics; data being collected.
2. Wasteful harvesting practices	2.1(A) MD and PRFC will promote the release of buckram (papershell) crabs.	1990	MDNR - A PRFC - A	Are evaluating definitions of buckrams & peelers, enforcement difficulties.
	2(B) VA will consider limits on dredges, establish mgmt areas.	1990	VMRC - A,R	Being evaluated, are discussing with advisory groups.

1990 ANNUAL PROGRESS REPORT
CHESAPEAKE BAY BLUE CRAB FISHERY MANAGEMENT PLAN

PROBLEM AREA	ACTION	IMPLEMENT DATE	RESPONSIBLE AGENCY & METHOD	COMMENTS/NOTES
	2.2 Evaluate and promote the use of cull rings to allow sublegal crabs to escape.	1989	MDNR - A,R VMRC - A,R PRFC - A,R	VA developed & distributed brochure; MD has printed articles and is modifying brochure for use by MD & PRFC.
	2.3(A) MD will prohibit harvest of sponge crabs, evaluate need to protect other females.	1990	MDNR - R	MD promulgated regulation in 1989. MD & VA are collecting additional data on female crabs.
	(B) VA will monitor fem. crab harvest for potential regs.	1993	VMRC - A	Underway.
	(C) Investigate female crab mortality in eel fishery.	1990	MDNR - A	Data will be collected via reporting forms or surveys; have new law requiring license for catching eels.
	(D) PRFC will continue to prohibit the possession of egg-bearing females.	Continue	PRFC - A	Continuing.
	2.4(A) VA prohibition of abandoned crab pots;	In place	VMRC - A	Continuing.
	(B) MD will evaluate the need for regulation on abandoned crab pots;	1990	MDNR - A,R	Regulation prohibits crab pots from being in water from Jan 1 - Mar 31; are evaluating stronger enforcement.
	(C) MD will assess biodegradable sections in crab pots;	1990	MDNR - A,R	Evaluating data from other fisheries & conducting field study.
	(D) Improve enforcement.	1990	MDNR - A VMRC - A	Underway, including undersized crabs.
	(E) PRFC will consider regs on abandoned crab pots.	1991	PRFC - A,R	Evaluating MD & VA regs.

1990 ANNUAL PROGRESS REPORT
CHESAPEAKE BAY BLUE CRAB FISHERY MANAGEMENT PLAN

PROBLEM AREA	ACTION	IMPLEMENT DATE	RESPONSIBLE AGENCY & METHOD	COMMENTS/NOTES
	2.5 Promote reduction of peeler mortalities in floats and shedding operations.	1991	MDNR - A VMRC - A PRFC - A	MD conducted survey of shedding operations in 1990; are assessing data. MD & VA are studying license requirements. MD & VA have shedding manuals & extension services.
3. Stock assessment deficiencies	3.1(A), (B) Continue summer and winter surveys.	Continue	MDNR - A VMRC - A	Continuing.
	(C) MD will implement a modified reporting system.	1990	MDNR - A	Modified its commercial reporting form & expanded the recreational survey.
	(D) VA will design a reporting system.	1990	VMRC - A	Are gathering CPUE data & working to gather accurate landing data.
	(E) Make reporting systems compatible.	1991	MDNR - A VMRC - A	Still working on reporting needs in individual states.
	(F) PRFC reporting system will be modified.	1991	PRFC - A	Will be modified to provide better catch by life stage data.
	3.2 Utilize Baywide and federal surveys on recreational crabbing to evaluate effect on fishery, economics, and need for new regulatory measures.	1991	MDNR - A VMRC - A PRFC - A	Management strategies for the recreational fishery will be similar to those for Action 1.1.1.
	3.3 Support crab population research.	1990	MDNR - A VMRC - A PRFC - A	Research underway by universities and agencies; CBSAC is supporting research. Need continued funding.
	3.4 Conduct studies on use of eels as bait for trotlines.	Delayed	PRFC - A	PRFC will continue minimum mesh size limits on eel pots. MD will collect data from reports/surveys.

1990 ANNUAL PROGRESS REPORT
CHESAPEAKE BAY BLUE CRAB FISHERY MANAGEMENT PLAN

PROBLEM AREA	ACTION	IMPLEMENT DATE	RESPONSIBLE AGENCY & METHOD	COMMENTS/NOTES
4. Regulatory, conflict issues	4.1 MD will investigate ways to decrease the number of crab pot floats and increase the number of float-free areas.	1990	MDNR - A, R	MD established 19 new buoy-free areas in 1990; are discussing issue with advisory groups and watermen.
	4.2 Determine need for coordinated soft and peeler crab size limits.	1991	MDNR - A VMRC - A PRFC - A	Are evaluating/discussing issue among agencies and with advisory groups; have preliminary proposal. MD is increasing enforcement on size limits of imported soft crabs.
	4.3 MD will consider crab pots for commercial use only.	1990	MDNR - A, R	MD is evaluating options; no action will be taken in 1990.
	4.4(A) MD will continue point assignment system;	Continue	MDNR - A	Continuing.
	(B) VA will consider similar system;	-	VMRC - A, R	
	(C) Make enforcement consistent among jurisdictions;	-	MDNR - A VMRC - A	Continuing.
5. Habitat degradation	(D) PRFC will continue "second offender" program.	Continue	PRFC - A	Provides increased penalties for the repeat offender.
	5.1 Support Bay Agreement	Variable	MDNR - A VMRC - A PRFC - A	MD & VA are conducting research; are coordinating with local, state, & federal agencies & private groups.
	5.2 Establish crab sanctuaries to restrict environmental modifications and harvest.	1991	MDNR - A, R VMRC - R	VA has lower Bay sanctuary; MD is evaluating alternatives; will assess data for other potential areas.

1990 ANNUAL PROGRESS REPORT
CHESAPEAKE BAY BLUE CRAB FISHERY MANAGEMENT PLAN

PROBLEM AREA	ACTION	IMPLEMENT DATE	RESPONSIBLE AGENCY & METHOD	COMMENTS/NOTES
	5.3 Support SAV and wetland research and management, development of habitat requirements documents.	Variable	MDNR - A VMRC - R	Continuing.

LEGEND: MDNR = Maryland Department of Natural Resources
 PRFC = Potomac River Fisheries Commission
 VMRC = Virginia Marine Resources Commission
 CBSAC = Chesapeake Bay Stock Assessment Committee

A = Administrative action
 L = Legislation
 R = Regulation

CHESAPEAKE BAY OYSTER MANAGEMENT PLAN

Background

Governor Schaefer's Committee to Review State Policy for Funding Maryland's Chesapeake Fisheries is concluding its assessment of the State's role in managing the oyster fishery. The committee's final report should be released towards the end of 1990. The various topics under review by the Committee are discussed under the appropriate headings of this report.

The University of Maryland, Chesapeake Biological Laboratory (CBL) in Solomons, is conducting research to improve oyster bar sampling methodologies and to increase our understanding of oyster population dynamics. This information will improve management of the fishery and has implications for shell and seed stocking strategies in the micromanagement of specific oyster bars. Results of the first phase of research are briefly discussed in the appropriate sections of this report.

In December 1989, the Virginia Marine Resources Commission, Fishery Management Division (FMD) identified several management options designed to reduce harvest and prevent excessive reduction of James River oyster broodstock. Strong opposition by industry representatives resulted in a Commission decision to deny the public hearing process for consideration of the staff proposal. The Commission, instead, approved the establishment of a committee comprised of industry members and FMD staff to further discuss and develop viable management options for Virginia's oyster industry. This group, known as the Shellfish Subcommittee (of VMRC's Fishery Management Advisory Committee), conducted several meetings in early 1990. Agenda items included discussions on the 1990 repletion proposal, status of the James River oyster fishery, and status of disease research at the Virginia Institute of Marine Science (VIMS). A second FMD proposal to restrict James River harvest for the 1990-1991 season was presented in August 1990. Final Commission action is expected following the FMD's review of October, 1990, landings.

Harvest Decline and Overharvesting

The preliminary count for Maryland's 1989-1990 oyster harvest is 395,000 bushels, the third season in a row that the harvest has been under 400,000 bushels. The Choptank and Tred Avon Rivers alone accounted for approximately 61 percent of the harvest. The Maryland harvest has stabilized at these low numbers, in part, due to the subsidence of MSX, the seed and shell repletion program, and the continuing delayed entry program for commercial fishing licenses in Maryland. Virginia's total market and seed production for calendar year 1989 was 355,000 bushels, a 39 percent reduction from the 1988 harvest and 66 percent below the ten year average

annual harvest from 1979-1989. Preliminary estimates for 1990 harvest levels through April are within 1 percent of 1989 levels.

The daily harvest for each gear type in Maryland was generally less than the limit allowed under current regulations, however, the Department shortened the beginning of the season by two weeks in an attempt to decrease total effort and to maximize economic return from the available resource. Watermen will be consulted on season length and catch limits for the 1990-1991 oyster season. Fishing effort in Virginia's James River in October-November 1989 was 40 percent below that for the same period in 1988. Average catch per vessel in October 1989 was down over 50 percent from 1988.

The VMRC, as part of its normal seasonal closure of the State's public oyster grounds, approved the May 1, 1990 closure of all public oyster rocks on the Seaside of the Eastern Shore and on the clean cull areas of the State, with the exception of the James River. The James River was closed on June 1, 1990 by a separate order. Such closures reduce effort and allow for spawning and spat set in areas traditionally harvested. In an attempt to promote broodstock conservation in the James River, the VMRC approved the closure of Deep Water Shoals to public harvest in 1990. This upriver productive rock has escaped MSX and Perkinsus (Dermo) because of its location in low salinity waters.

The procedure for opening and closing specific harvest areas on a rotating basis is not yet fully developed, however, CBL has concluded the first phase of a study that will lead toward that and other management goals. Among the important findings of CBL is that patent tongs are more efficient than an oyster dredge for sampling oyster bars. The CBL has also developed a preliminary, cost-effective, baywide sampling scheme for oyster bars. In order to verify some assumptions in the preliminary sampling scheme, intensive systematic surveys were conducted in the Choptank River. Nine oyster bars were surveyed and data from British Harbor, Chancellor Point, and France bars were analyzed. Results indicate the importance of tightly defining the acreage of an oyster bar when estimating oyster population densities, and the need to refine on-bar sampling techniques. In addition to the bars sampled in 1989, intensive stock assessments have been completed on Stonerock, Man-O-War, Simmons and Little Cove Point bars. Information on population distribution, oyster density, abundance, and size-class composition were collected. Using this information, these oyster bars can be described according to average oyster density; estimated total abundance; percentage of spat, smalls and markets; average size; and estimated total number of markets.

The Maryland Delayed Entry Program passed during the 1988 legislative session and established in 1989 to control the number of people entering the commercial fisheries, requires commercial fishing license applicants to wait a minimum of two years before receiving their license. With the two-year delay, the first new

licensees will enter the fishery during the 1992 season (Sept. 1, 1991 -Aug. 31, 1992). As previously mentioned in the review of the Blue Crab Management Plan, the number of tidal fish licenses (TFLs) has been increasing with a dramatic increase between 1988 and 1989 in anticipation of the delayed entry deadline. The number of oyster harvesting licenses (OYHs) have fluctuated for the pass several years. After one year of the Delayed Entry Program, the number of TFLs appears to be holding steady but the positive effects of the Delayed Entry Program will not be fully realized for several years. Although conclusive data documenting the effectiveness of the Delayed Entry Program is not available at this time, the program will be effective at controlling short-term effort that could result from changes in fishery regulations.

Proposed legislation authorizing the VMRC to limit or delay entry for fisheries (House Bill 286) was introduced to the 1990 Virginia General Assembly. The bill was tabled and assigned to a legislative subcommittee for further study. No action will be taken until the 1991 legislative session.

Recruitment

The 1990 Maryland, Virginia, and Potomac River oyster repletion programs were conducted at approximately the same level as last year. Maryland planted approximately 5.5 million bushels of dredged (fossil) shell and 86,000 bushels of fresh shell as cultch. In order to improve the usefulness of cultch, the bagless dredging program was upgraded. Previously, bagless dredging was used only for fouled or silted oyster bars. Beginning in 1988, bagless dredging was used in seed areas to increase spat set and, thereby, increase recruitment. During 1990, three State seed areas were cleaned for the upcoming oyster set and 49 oyster beds were improved by bagless dredging. Approximately 160,000 bushels of surf clam shells, a viable alternative cultch, were also planted and represents a considerable increase from previous years. In addition, approximately 340,000 bushels of seed oysters were moved.

Virginia planted approximately 1.2 million bushels of shell and transplanted 175,000 bushels of seed. The repletion program began shifting its emphasis to seed transplants in 1987 to reduce the time it takes to produce market-size oysters, thereby, decreasing exposure to disease and environmental pressures. Areas receiving seed included the Coan River, Currioman Bay, and the Rappahannock River. No repletion activities were proposed below the Piankatank River because of low spat strikes in the James River and Mobjack Bay over the past few years. Plantings in the Great Wicomico and Piankatank Rivers will foster future seed transplanting activities.

Approximately 50 acres of old shell beds were proposed for cleaning by bagless dredging on Virginia's Eastern Shore Seaside. The Seaside, which typically receives moderate to heavy spat sets,

will continue to be planted with reef shells from VMRC's 1988 stockpile in Harborton, VA. In addition, some Eastern Shore buyers indicated the availability of fresh shells for the Seaside Program.

The 1989 Maryland oyster spat set was poor. Most areas received no set and a few scattered areas had a very light set. The lower Eastern Shore was the most productive, with 30-50 spat per bushel. Even the seed areas, which are heavily planted with cultch in historically good spat setting areas, had a poor set in 1989. However, if these oysters survive, together with small oysters from the past two years, and there is similar recruitment this season, there is the potential for increased harvests in future years.

Maryland's hatcheries at Deal Island and Piney Point are actively engaged in oyster production and research. Experiments are being conducted with Delaware and Chesapeake oyster stocks and with the pacific oyster, Crassostrea gigas, under quarantine. More details are provided under the Disease Mortality section of this report. Maryland DNR and the University of Maryland have begun a cooperative project to assess a new technique for remote setting. The Piney Point aquaculture facility will produce approximately 70-80 million eyed larvae for the project. Researchers will "plant" these larvae from a sled pulled behind a vessel onto 6 or 7 plots, each 1/2 acre in size. The plots will be monitored before, during, and after planting, and will be compared to hatchery-set spat. If successful, this technique could be used to revitalize existing oyster bars, establish new bars, and make the large-scale culture of oysters with specific characteristics, such as disease resistance or fast growth, feasible. Cooperative research between MDNR, Baltimore Gas & Electric, Langenfelder Company, and SCM Chemicals, Inc. is also underway for the development of artificial cultch composed of gypsum and fly ash.

The Virginia Institute of Marine Science (VIMS) will continue hatchery operations to produce eyed larvae and seed oysters for research and rehabilitation projects (also see Disease Mortality). The VIMS Oyster Outreach Program currently provides hatchery-reared cultchless seed oysters to industry for off-bottom rack culture (grow out). This cooperative venture is designed to evaluate the feasibility of rearing the oysters to market size before heavy mortality from MSX and Perkinsis (Dermo) is realized.

In February, 1990, VMRC approved a project for an applicant to install a series of floating trays, 3 feet long by 2 feet wide and 6 inches deep, for raising oysters to market size. A total of 400 trays is anticipated, requiring encroachment over approximately one acre of State-owned subaqueous bottom. The project is situated in the upper reaches of Butcher Creek, a tidal tributary to the Chesapeake Bay, in Accomack County. Questions concerning riparian property owner rights and the potential for impacts were addressed at length. This project represents Virginia's first aquaculture

permit for oysters authorizing the use of the water column in tidal waters.

Disease Mortality

Maryland and Virginia are continuing their annual oyster disease surveys in order to develop strategies for optimal seed and shell planting. Plantings have been focused in areas of low salinity to take advantage of the 12 ppt minimum salinity tolerance of MSX.

The incidence of MSX decreased in Maryland waters during 1989; much of this can be attributed to high rainfall, resulting in low salinities. However, Perkinsis (Dermo) does not appear to be limited by salinity, and incidences of this disease were found in areas previously thought to be uninfected.

Maryland is currently planting spat produced from Delaware Bay disease-resistant oysters on Maryland oyster bars to gauge their effectiveness here. Native stocks are also being bred and tested for their resistance to MSX and Perkinsis (Dermo). To date, it appears that either the Maryland or Delaware Bay stocks may be superior in any given area of the Chesapeake. In addition, the Pacific oyster (Crassostrea gigas) is being experimented with, under quarantine, for disease resistance. Initial results suggest that they are resistant to MSX, but are susceptible to Perkinsis (Dermo), at least at sublethal levels.

The Virginia Institute of Marine Science is actively pursuing funds to continue its oyster disease research program. The overall goal of the research is to develop or identify strains of oysters that are less susceptible to Chesapeake Bay oyster diseases and that can be used in programs to rejuvenate the oyster industry. Specific objectives are: 1) develop, through selective breeding or genetic manipulation, a strain of C. virginica that survives well enough in disease endemic areas of the Chesapeake to make its use economically feasible, and; 2) determine growth and susceptibility to MSX and Perkinsus (Dermo) of diploid and triploid C. gigas and of C. virginica x C. gigas hybrids, if hybrids can be produced. The VMRC held a public hearing in May 1990, on the subject of introducing C. gigas into natural waters for experimentation, and ruled that an environmental impact statement would have to be conducted before such action could be taken.

A series of workshops concentrating on rehabilitation of the Chesapeake and Delaware Bay oyster industry was held during the past year. Workshop participants included both scientists and managers, and topics ranged from oyster genetics and disease to the introduction of exotic oyster species. The workshops produced recommendations for research and a consensus that additional efforts should be made to rebuild populations of the eastern

oyster, C. virginica, before attempting major rehabilitation efforts with the Pacific oyster or other non-native species.

Leased Ground Production

Maryland made seed oysters available to private planters in May 1990, from one of two seed beds established in 1989 for this purpose. It was estimated that the area in St. Jerome Creek, St. Mary's County, would yield approximately 50,000 bushels of seed at an average count of 113 spat per bushel. The seed area was found to be disease-free during the winter of 1989-1990, however, because Perkinsis (Dermo) was found in adjacent sites, MDNR recommended that the seed not be replanted on oyster leases in areas not impacted by oyster diseases. The 1989 spat set was too low on the private seed bed in Calvert County to make seed available this year. Additional cultch plantings and a second year of set may improve conditions for 1991.

The Maryland State Legislature passed HB 214 in 1990 which raises the fee for leased bottom applications. A leased ground applicant must now pay DNR a non-refundable fee of \$300 to cover the costs of recording, surveying, and advertising potential tracts. In addition, the time period during which a leaseholder must "utilize" his/her lease by planting cultch, planting shellfish, or harvesting shellfish was reduced. Previously, a leaseholder need only use/improve the leased ground once during a five-year period. Now a leaseholder must utilize his/her leased ground at least once during a three-year period.

Virginia proof-of-use measures to promote private production and cultivation were implemented July 1, 1990. Section 28.1-109 of the Code of Virginia specifies that, unless there is good cause, VMRC may not renew or extend oyster ground leases if there has been neither significant production of shellfish nor reasonable plantings of shellfish or cultch during the 10-year period of the lease prior to its renewal. The first leases to be evaluated for usage prior to renewal were reviewed by the Commission in June, 1990, resulting in over half of the 26 lease renewals under consideration to be denied.

One of the subjects being studied by the Committee to Review State Policy for Funding Maryland's Chesapeake Fisheries is whether private oyster culture can play a more important role in the state production of oysters. The committee is looking at production potential, whether the state should help develop the industry, appropriate areas and conditions for private culture, cost and tax issues, enforcement, and related matters. Once the committee's recommendations are presented to Governor Schaefer, the Department will take actions as needed.

The VMRC staff are working within current legal requirements to minimize impediments in the existing permitting process for

applicants seeking new culture methods. The first permit was issued in February, 1990 (see the discussion of tray culture under Recruitment). The Virginia Institute of Marine Science is shifting the emphasis of its outreach program and internal research program to new culture techniques for the Virginia oyster fishery.

Habitat Issues and Shellfish Sanitation

The signatories to the Chesapeake Bay Agreement continue to press forward with research, monitoring, and management for habitat and water quality improvement. Reports for the Baywide Nutrient Strategy, Living Resources Monitoring Plan, State of the Chesapeake Bay, Habitat Requirements, Wetlands Policy, Submerged Aquatic Vegetation (SAV) Policy, and other plans should be consulted for details.

The VMRC, in cooperation with VIMS and the Department of Health, conducted a feasibility study in 1987 which investigated the potential for containerized relaying (depuration) of condemned oysters. This technique was found to be acceptable for depurating both the American oyster and the hard clam (*Mercenaria mercenaria*). The VMRC instituted a containerized clam relay program in March 1987 and has recently (July 1990) approved the same procedure for oysters. The Food and Drug Administration found this relay practice to be beneficial to both industry and the Commonwealth; industry could maximize yield due to reduced transplant mortality, and Virginia would benefit from an improved system of controls which would reduce the likelihood of contaminated shell stock reaching the consumer.

In Maryland, the Department of Natural Resources, the Department of the Environment, and the Department of Health and Mental Hygiene continue to share responsibility for the sanitary control of the shellfish industry. The VMRC and the Virginia Department of Health (Division of Shellfish Sanitation) jointly regulate the sanitary control of Virginia's shellfish industry.

Market Production

Successful implementation of the various strategies listed in the management plan should help restore natural oyster stocks and increase private production, thus providing a more reliable quantity and quality oyster product to the market. As noted in earlier sections of this report, production remains at low levels but progress is being made in several important areas.

In the meantime, efforts are being made to improve consumer interest in the Chesapeake oyster. The Maryland Department of Agriculture, Seafood Marketing Division, has created a consumer's guide and a fact sheet that include information on the quality of Chesapeake oysters. The department also regularly publishes the

Maryland Seafood Buyer's Bulletin. Both DNR and the Department of Agriculture have also given numerous media interviews and distributed press releases on oyster quality issues.

The Virginia Marine Products Board (VMPB) continues active promotion of the Chesapeake Bay oyster. Three pamphlets, targeting consumers, have been produced to encourage consumption of oysters. Fact sheets were distributed to promote oyster purchases by wholesale distributors. Another brochure was designed to advertise oysters on an international level. In addition, the VMPB featured Virginia oysters at four major trade shows. Trade leads from 200 buyers interested in purchasing Virginia oysters were generated from these shows. In response to negative publicity about oysters, the VMPB began a quality assurance campaign, producing a video tape on safe inspection of Virginia shellfish, promotional advertisements, and a direct mail program.

Repletion Program

A major topic under consideration by the Committee to Review State Policy for Funding Maryland's Chesapeake Fisheries is the oyster repletion program. This subject area includes how and at what level the program should be conducted, the extent to which the state and participants in the fishery should share repletion costs, severance taxes on the sale of oysters, and other related matters. The state will not take specific action on any of these issues until the committee's report is completed.

The Chesapeake Biological Laboratory conducted studies in 1989 to help determine optimal time and location for shell plantings. Preliminary data from field experiments indicate that shells placed in polyethylene cages were more effective in attracting spat than were mesh bags 1 meter off the bottom or shells on oyster bars. At least for 1989, when salinities were unusually low due to high levels of rainfall, spat settlement was most pronounced in July and August. Data from these and other experiments is still being analyzed and will be available this year. In addition, a project to experimentally reconstruct oyster bars into productive configurations will begin.

In 1989, VIMS reported on three studies comparing alternative substrates for oyster cultch - oyster shell, tire chips, and expanded shale. The studies entailed laboratory and field evaluations of the three substrates for oyster settlement and an assessment of mobility and hydraulic roughness of the substrate materials. The laboratory evaluation of oyster settlement indicated that oyster shell was significantly superior to the other two substrates, and in two of three tests, there were no statistically significant differences between the tire chips and expanded shale. The field studies of oyster settlement indicated that oyster shell was the preferred substrate based on the proportion of spat present. Laboratory and field analyses found

that tire chips were more readily dispersed or transported along the bottom than the other substrates. Expanded shale fragments were somewhat more mobile than oyster shell. The VMRC and VIMS agreed that tire chips did not serve as suitable substrate, but that expanded shale may warrant further study if it can be obtained in cost-effective quantities.

An oyster industry restoration program is in the development stages and includes Maryland and Virginia harvesters and processors, officials from other states, and the federal government. Currently, MDNR and the University of Maryland Sea Grant Program are planning to hold a national conference in August, 1991. Oyster scientists from the United States and other countries and oyster industry people will be invited to gather information and discuss a program for rebuilding the Chesapeake Bay oyster stocks and industry. One of the major issues will be whether to utilize non-native species.

Conclusion

Progress has been made on methodologies for improving the assessment of oyster stocks and on understanding oyster ecology and diseases. Important policies regarding oyster management are also being developed. However, refinement of techniques and additional information is needed before some management actions can be put into place. With continued progress, management agencies will, in the next few years, be able to manage oyster bars at the "micro" level. This should lead to increased and stable production of quality oysters.

Concurrently, Chesapeake fishery managers are discussing reasonable target goals for recovery of the oyster fishery. Both biological and economic concerns are being addressed in these discussions. Target goals will provide managers with direction for their actions and will provide a yardstick with which to measure their success. Target goals should be fully developed by the end of 1990.

Two general areas need to be focused on during 1990-1991 in order to rebuild oyster stocks and improve management of the fishery. Briefly, these are:

1. Identify new areas of fossil oyster shell that can be dredged and planted for cultch, and increase the availability of alternative sources of cultch.
2. Continue to conduct research on growth, disease resistance, and production capabilities of the eastern oyster, and continue developing an official baywide policy on the introduction of non-indigenous species of oysters.

1990 ANNUAL PROGRESS REPORT
CHESAPEAKE BAY OYSTER FISHERY MANAGEMENT PLAN

PROBLEM AREA	ACTION	IMPLEMENT DATE	RESPONSIBLE AGENCY & METHOD	COMMENTS/NOTES
1. Harvest decline and overharvest	1.1.1 Open and close areas on a rotating basis to control fishing effort.	1990	MDNR - A VMRC - A PRFC - A	Are conducting studies & evaluating techniques to enable specific NOB management, but not ready to implement yet.
	1.1.2 Establish catch limits that reflect the status of the resource.	1991	MDNR - R VMRC - A PRFC - A	Are evaluating fishery and conferring with advisory groups.
	1.1.3 Delayed entry program to stabilize fishing effort.	Continue	MDNR - A	In effect.
		Open	PRFC - A	Are assessing MD program.
2. Recruitment	2.1.1 Continue hatchery operations to produce eyed larvae and seed oysters.	1989	VMRC - L MDNR - A PRFC - A	VA groups are interested, likely to propose to legislature in 1991.
	2.1.2 Support aquaculture efforts.	1990	MDNR - A, L VMRC - A	Are continuing experimental hatchery production for disease resistance, alternative cultch, and growout methodologies.
	2.1.3 Continue oyster repletion program.	1989	MDNR - A PRFC - A VMRC - A	MDNR, MDAGR, UM, VIMS are conducting aquaculture projects with natural and hatchery seed; have various outreach/extension programs.
	2.1.4 Reconstruct buried oyster bars on an experimental basis.	1990	MDNR - A	1990 repletion programs were at same levels as in 1989; are refining programs; funding may limit in 1991. Research project underway.

1990 ANNUAL PROGRESS REPORT
CHESAPEAKE BAY OYSTER FISHERY MANAGEMENT PLAN

PROBLEM AREA	ACTION	IMPLEMENT DATE	RESPONSIBLE AGENCY & METHOD	COMMENTS/NOTES
	2.1.5 Use research findings on adult density/recruitment relationship to regulate harvest and stocking of seed.	1992	MDNR - A PRFC - A VMRC - A	Research and analyses are underway.
3. Disease mortality	3.1.1 Continue the annual disease survey to determine the best plan for planting seed and shell.	1989	MDNR - A PRFC - A VMRC - A	Are maximizing seed & shell plantings in areas free from disease pressure.
	3.1.2 Implement a program to monitor seed for disease before transplanting them.	1990 Continue	MDNR - A PRFC - A	Are continuing efforts with an emphasis on disease strategies. PRFC is not transplanting seed from infected areas to disease-free areas.
	3.1.3 Continue research on disease transmission & development of a disease-resistant strain of C. virginica.	1989	MDNR - A VMRC - A	Research in field & laboratory underway at several institutions. An international oyster conference is planned for 1991.
	3.1.4 Continue research on the development of a disease-resistant hybrid oyster.	1989	MDNR - A PRFC - A VMRC - A	Limited research is being conducted under quarantine; an environmental impact analysis is being done prior to any potential field studies.
4. Leased ground production	4.1.1 Establish a seed bed for sale of seed to private leaseholders.	1989	MDNR - A	Planted 302,000 bu shells on 2 areas in 1989: 10 ac in Calvert Co. & 15 ac in St. Mary's; 114,000 bu shell in Kedges Straits in 1990. No seed is available yet, but may be in 1991.
	4.1.2 Continue active extension program for leaseholders.	1989	MDNR - A VMRC - A	Extension programs are underway; are working with numerous agencies.

1990 ANNUAL PROGRESS REPORT
CHESAPEAKE BAY OYSTER FISHERY MANAGEMENT PLAN

PROBLEM AREA	ACTION	IMPLEMENT DATE	RESPONSIBLE AGENCY & METHOD	COMMENTS/NOTES
5. Habitat issues	4.1.3 Implement "proof of use" measures to promote private production and cultivation.	1990	MDNR - A, R, L VMRC - A	MD law tightened to require use within a 3-yr period. VA began implementing measures in July 1990.
	4.1.4 Promote the development of new culture methods by removing impediments in the existing permitting process.	1990	VMRC - A	VMRC is working within legal requirements to minimize problems encountered by applicants; first such permit issued in Feb. 1990.
	4.1.5 Research the feasibility of and methodology for new culture techniques.	1990	VMRC - A	VIMS outreach program and internal research are shifting emphasis to new culture techniques.
6. Shellfish sanitation	5.1a-c Promote the objectives of the Chesapeake Bay Agreement to improve water quality.	Variable	MDNR - A VMRC - A	Underway; are working with various local, state, and federal agencies and private groups.
	6.1.1 Promote the improvement of water quality (see 5.1).	Variable	MDNR - A PRFC - A VMRC - A	Underway.
	6.1.2 Participate in the Interagency Shellfish Enhancement Task Force.	Continue	VMRC - A	Underway.
	6.1.3 a) Investigate the potential of depuration techniques.	Variable	MDNR, MDE - A VMRC - A	MD moves some polluted oysters to clean growing areas; will assess VA relaying program (Action 6.1.3.b)
	b) Implement regulations for containerized relaying (depuration) of condemned oysters.	1989	VMRC - R	Passed regulations for containerized relaying of oysters in July 1990.

1990 ANNUAL PROGRESS REPORT
CHESAPEAKE BAY OYSTER FISHERY MANAGEMENT PLAN

PROBLEM AREA	ACTION	IMPLEMENT DATE	RESPONSIBLE AGENCY & METHOD	COMMENTS/NOTES
	6.1.4 Promote more effective treatment of sewage and water conservation (see 5.1).	1995	MDNR - A	Underway.
	6.1.5 (new) PRFC will continue participation in the ISSC.	Continue	PRFC - A	Continuing.
7. Market Production	7.1.1 Implement the strategies of the management plan to restore oyster stocks.	1989	MDNR - A PRFC - A VMRC - A	Underway; special commission is reviewing MD oyster industry, recommendations are due in 1990.
	7.1.2 a) Promote public awareness that oysters with MSX and Dermo are safe to consume.	1990	MDNR - A MDAGR - A	Had press releases & media interviews; developed consumer guide & fact sheet. Consumer confidence appears to be returning.
	b) Use industry and state promotion of oyster quality to stem market losses.	1990	VMRC - A VMPB - A	Va Marine Products Board actively promotes Chesapeake oysters. Consumer confidence appears to be returning.
8. Repletion program	8.1.1 Review the existing statutory authority which dictates the distribution of seed and shell.	1991	MDNR - A	A commission has reviewed the MD program and will release findings in 1990. PRFC will suspend shell plantings on "set and grow" areas.
	8.1.2 Consider increasing the tax on exported oysters.	1991	PRFC - A	
	8.1.3 Evaluate repletion programs for production and cost efficiencies.	1991	MDNR - L MDNR - A PRFC - A VMRC - A	Under review by special commission; Will wait for commission findings. Under evaluation.

1990 ANNUAL PROGRESS REPORT
CHESAPEAKE BAY OYSTER FISHERY MANAGEMENT PLAN

PROBLEM AREA	ACTION	IMPLEMENT DATE	RESPONSIBLE AGENCY & METHOD	COMMENTS/NOTES
	8.1.4 Utilize alternative sources of cultch.	1989 1990	MDNR - A VMRC - A PRFC - A	Are using surf clam shell; investigating other means, such as fly ash/gypsum and expanded shale.
	8.1.5 Continue to protect and expand areas for seed and research purposes.	1991 Continue	MDNR - A PRFC - A	MD currently has 10 sanctuaries; are evaluating potential new ones. PRFC will maintain oyster sanctuary on Jones Shore.
	8.1.6 Enhance the seed program in the Great Wicomico, Piankatank, and James Rivers.	Continue	VMRC - A	Carried out repletion program in the Great Wicomico & Piankatank, as well as other systems; no repletion effort below the Piankatank due to low spatfall in the James R.
	8.1.7 Establish a special repletion program for VA Eastern Shore Seaside.	1989	VMRC - A	Planted reef shells & cleaned some old shell beds by bagless dredging. Fresh shells may become available.
	8.1.8 (new) Continue to utilize the input of the Oyster Repletion Committee	Continue	PRFC - A	Will develop an Annual Oyster Repletion Program for the Potomac.

LEGEND: MDE = Maryland Department of the Environment
MDAGR = Maryland Department of Agriculture
MDNR = Maryland Department of Natural Resources
PRFC = Potomac River Fisheries Commission
VMRC = Virginia Marine Resources Commission
VMPB = Virginia Marine Products Board

A = Administrative action
L = Legislation
R = Regulation

