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ANNUAL PROGRESS REPORT

FISHERY MANAGEMENT PLANS 1994

Alosid
Blue Crab
Oyster
Bluefish
Weakfish/Spotted Seatrout
Summer Flounder
Atlantic Croaker/Spot
American Eel
Black Drum
Red Drum

October 1995

Chesapeake Bay Program

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prepared by
Maryland Department of Natural Resources
Virginia Marine Fisheries Commission

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Chapter 1
Introduction

The development of fishery management plans (FMPs) began in 1987 with the signing of the Chesapeake Bay Agreement. Since then, 13 FMPs encompassing 19 species have been completed and adopted through the Chesapeake Bay Program (Table 1.1). The adoption of a FMP is not an endpoint in the management of a fishery but part of a dynamic, changing process. Plans must be adaptive and flexible to meet the changing needs of a particular resource. Once the concerns and management strategies of a fishery have been defined and implemented, progress towards meeting the goals and objectives must be evaluated. As part of the process of establishing accountability and tracking the implementation of management actions, each FMP is annually reviewed and updated. This report reviews the progress of management plans during 1994 and includes the following species: American shad, hickory shad, blueback herring, alewife herring, blue crab, oyster, bluefish, weakfish, spotted seatrout, summer flounder, spot, croaker, American eel, black drum and red drum. The status of the striped bass resource is considered in a separate report, the 1994 Annual Progress Report for Striped Bass. The FMPs for horseshoe crabs and Spanish/king mackerel were adopted in October 1994, and will not be reviewed until next year.

After the narrative for each FMP, a table provides a synopsis of the actions, dates, and relative comments regarding the action's implementation. Since habitat issues relate to a number of species, a general overview is provided in the introduction. Specific habitat issues relating to a particular species are covered in the review for that species. For previous updates, refer to the FMP Annual Progress Reports beginning in 1990 to the present.

Atlantic Coast Cooperative Statistics Program

A recurrent issue for Chesapeake Bay finfish and shellfish species is better data on commercial and recreational landings and the coordination and exchange of data between state and federal agencies and research institutions. The increased complexity of fishery management issues and the limited budgets of state and federal agencies have caused problems with fishery data collection. During 1994, the ASMFC formed a Statistics Policy Committee (SPC) to address the problem of data collection for commercial and recreational fisheries from the Atlantic coast. The overall goal is to implement a cooperative statistics program among state and federal agencies to plan, coordinate, and evaluate marine fisheries data collection and data management activities. The ASMFC has identified the following attributes to characterize this program: 1) the development of a cost-effective, dependable and accurate data base; 2) a cooperative coastwide effort among state and federal agencies involved in the collection, compilation, and management of marine fisheries statistics; 3) the collection of both commercial and recreational statistics to provide the general public, fishermen, fishery managers and stock assessment biologists with the best available scientific technical data; 4) a means to ensure timely communication of statistics among interested parties; 5) the avoidance of duplicate sampling efforts between state and federal data; 6) a means to pursue long-term funding for the continuation and expansion of a coastwide data collection system; and 7) a means to ensure compatibility and continuity of data between all state and federal collection programs. In order to implement the statistics program, ASMFC has scheduled a series of workshops during 1995. These workshops will be the first steps in implementing an Atlantic coast cooperative statistics program which will improve the management of all marine finfish species. In addition, catch and effort statistics calculated from the Marine Recreational Fishery Statistics Survey (MRFSS) are being revised to improve their accuracy. The improvements in coastwide data collection will benefit the management efforts in the Bay and improve state fishery statistics.

Table 1.1. Schedule for reviewing fishery management plans

SPECIES	COMPLETION DATE	REVIEW DATE
Shad/Herring	1989	6/95 - 10/95
Blue Crab	1989	1995 - 1996
Oysters	1989	10/94
Striped Bass	1989	8/95 - 12/95
Weakfish/Seatrout	1990	3/96
Bluefish	1990	6/95 - 10/95
Croaker/Spot	1991	1996
American Eel	1991	1996
Summer Flounder	1991	3/96
Black Drum Red Drum	1993 1993	1997
Mackerel	1994	1998
Horseshoe Crabs	1994	1999
Black Sea Bass	Oct 1995	2000
Catfish	Dec 1995	2000
Tautog	1996	2001
Menhaden	1996	2001

The Chesapeake Bay Program (CBP) is also working to improve fisheries data. The CBP will establish a workgroup to assess and evaluate existing ecological resource inventories used by Federal agencies and make recommendations to improve coordination, compatibility, standardization and interagency transfer of information. To date, a data center director has been hired to assess data resources and needs, and draft an integration plan. A CBP conference on data coordination is planned for 1995.

Habitat Overview

The ASMFC has formed a Habitat Committee to discuss and work on habitat issues as they relate to fishery management. Currently, the habitat program is focusing on an education program, fact sheets on the habitat requirements for recreationally important finfish species, an educational display for trade shows, and the development of a habitat section for a weakfish amendment. Workshops are being planned for 1995 to increase understanding of the relative functions and value of shallow water habitats and the development of research priorities associated with shallow water, and a workshop to develop standards that define essential habitat for finfish species. The Standards and Procedures Working Group has begun work on the interstate

management plans that includes a habitat standard for all ASMFC FMPs. Each ASMFC FMP will be required to contain fish habitat information important to the stocks and ecosystem operation. The Chesapeake Bay Program FMPs will utilize the habitat outline developed by ASMFC as a guideline for improving the habitat sections in each of the new Bay FMPs being developed and revise the habitat sections of the adopted plans as they are reviewed (see Table 1.1 for review dates).

The Bay FMPs have continued to reflect the work of the Chesapeake Bay Program's (CBP) habitat and living resource restoration programs. The CBP was established in 1983 and is a voluntary partnership among Pennsylvania, Maryland, Virginia, the District of Columbia, the Chesapeake Bay Commission, and the Environmental Protection Agency. The Program addresses the prevention and abatement of pollution; the conservation and restoration of fish, wildlife, and habitat; the enhancement of public access to the Bay and its tributaries; public education; and the overall health of the Bay. The following information highlights CBP accomplishments during 1994 that relate to fisheries issues.

The Chesapeake Bay Agreement was amended in 1992 to include tributary-specific plans to reduce nutrient pollution into the Bay. Since the tributary strategies focus on watersheds instead of county or state boundaries, they provide a comprehensive management approach which integrates nutrient reduction efforts, habitat restoration, growth management and planning, preservation of agricultural lands, protection of drinking water reservoirs and aquifers, and other initiatives to promote a healthy environment. Part of the Maryland Tributary Strategy goal is to implement nutrient management plans on 60% or 1.2 million acres of agricultural cropland by the year 2000. As of mid-1994, 507,000 acres are being protected under state-approved plans which are designed to reduce nutrient runoff from farm fields. Maryland's Nutrient Management Program helps manage nutrients from animal wastes, commercial fertilizers, and urban sludge. To date, significant progress has been made to reduce nutrients entering the Bay. Maryland has reduced nitrogen entering tidal waters by 17% and phosphorus by 27%. Strategies for the lower Bay tributaries of the Rappahannock, York, James, and the western and eastern shore of Virginia will be developed by 1995. Studies indicate that these areas impact the Bay's nutrient problems to a lesser degree and require strategies specific to the areas. Refer to the document, "Achieving the Chesapeake Bay Nutrient Goals: A Synthesis of Tributary Strategies for the Bays's Ten Watersheds, October 1994, for more details.

Efforts to restore habitats for living resources were strengthened with the adoption of "Chesapeake Bay Habitat Restoration: A Framework for Action" document. It provides a foundation for integrating restoration activities in four areas: freshwater tributaries and streams for anadromous fish; shallow water for juvenile fish, crabs, diving ducks and herons; open water for adult fish, shellfish and waterfowl; and inlands and islands for waterfowl and migratory song birds. Habitat restoration projects currently include: removal of barriers to migratory fish, protection of eroding Bay islands and wetlands, the creation of aquatic reefs, restoration of riparian (stream) buffers, and the restoration of water quality conditions to support SAV.

A strong link between water quality and submerged aquatic vegetation (SAV) has been made in the Chesapeake Bay. SAVs provide critical habitat for fish and blue crabs. From 1978 to 1993, the abundance of SAV has increased by 75%, from 41,700 acres to 73,000 acres. SAV distribution and abundance is now used as a health barometer of the Bay. An SAV restoration goal of 114,000 acres baywide was defined in 1993. At current recovery rates, this goal should be achieved by 2005. Targets have also been proposed for SAV density and species diversity.

Chapter 2
Alosid (Shad & Herring) Management Plan

Introduction

In 1989, a Chesapeake Bay (CB) Alosid FMP was developed for American shad (*Alosa sapidissima*), hickory shad (*A. mediocris*), blueback herring (*A. aestivalis*), and alewife herring (*A. pseudoharengus*). The plan defined problems associated with declining abundance, the potential for overfishing, research and monitoring efforts, and habitat loss and degradation. The 1989 plan has been reviewed each year since 1990. In order to improve the effectiveness of the fishery management process, the FMP workgroup developed a revision schedule for each FMP. The CB Alosid FMP is scheduled for a substantive review in June 1995. The FMP workgroup will evaluate each strategy and action item in the 1989 plan for its effectiveness in reaching the plan's objectives and make a decision to either revise or amend the plan, based on the current stock status and monitoring and research assessments. The workgroup will also consider the proposed stock restoration targets for American shad recommended in the Fisheries Target Setting Task Force Report to the Living Resources Subcommittee (in preparation). An Atlantic States Marine Fisheries Commission (ASMFC) Shad and River Herring plan was developed in 1985 and was used as a source document for the development of the CB Alosid FMP. There is concern that the plan does not adequately address the current status of the resource. Consequently, the ASMFC FMP is under review and the preparation of Amendment 1 to the FMP has been initiated. The amendment is expected to be completed in spring of 1996. The current mandatory requirements of the ASMFC Shad and River Herring FMP and implementation schedule are as follows:

1) Each state will monitor and document existing and new EEZ (3-200 miles) and territorial sea fisheries for anadromous alosids, and report this information to ASMFC.

2) Each state shall evaluate the potential for anadromous alosid restoration within their internal waters, and provide it to ASMFC along with a summary description of ongoing restoration efforts, and a statement of anticipated restoration activities for the next five years.

An additional compliance statement was also discussed. It stated that: "all east coast states will recognize the priority rights of traditional fisheries in internal waters that target resident stocks, while not encouraging new intercept fisheries in the territorial seas waters. Such fisheries should not be encouraged and, if evidence suggests they pose a threat to any single stock of shad, steps should be taken to prohibit them" (ASMFC 1994). The ASMFC Management & Science Committee decided that this recommendation did not constitute a compliance measure and was omitted from the list of state compliance requirements.

Currently, there is a moratorium on the harvest of American shad from the Chesapeake Bay and tributaries. The prohibition on the harvest of American shad has been in effect since 1980 in Maryland's portion of the Bay and since January 1, 1994, in Virginia's waters. Maryland also placed a mortatorium on hickory shad harvest in 1981. The Potomac River allows 2 fish/person/day or 2% tolerance on the harvest of American and hickory shad in their pound net fishery. In Pennsylvania, no harvest of alosids is permitted within the Susquehanna River basin. Harvest of shad is permitted along the Maryland and Virginia coasts. Maryland has a coastal shad season from February 4 through April 30.

Stock Status

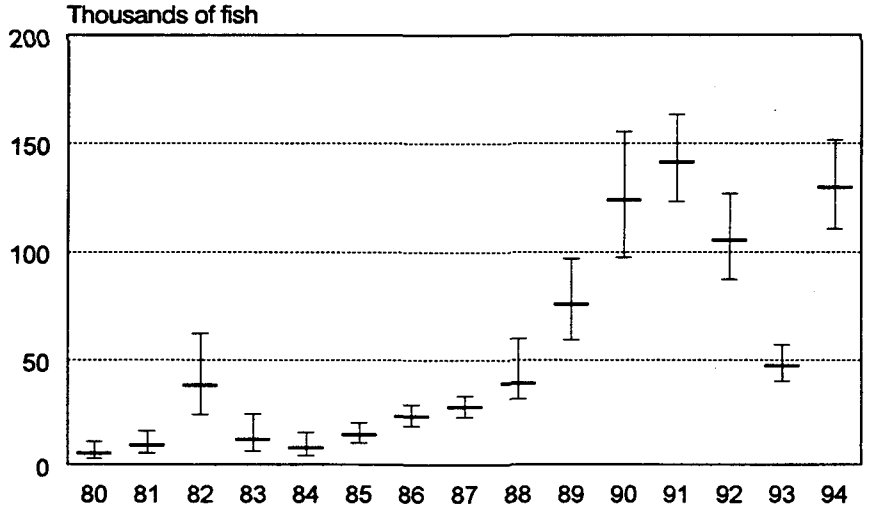
The Atlantic coast stock of American shad appears to be in a very depressed condition (Hattala, Shad Technical Committee). There has been a decreasing trend in the number of shad caught along the Atlantic coast for the past few years. Several hypotheses have been suggested to account for the decline. They are: 1) overharvest by riverine commercial and ocean intercept fisheries; 2) stock displacement or enhanced mortality due to colder than normal ocean water temperatures; and 3) increased predation on either adult and/or juvenile fish (Savoy and Crecco 1994). Data from the Connecticut River was used to test the predation hypothesis and preliminary results suggest that alosid mortality rates are positively correlated with the relative abundance of striped bass and bluefish. Currently, there is insufficient data to determine the actual cause or causes for the decline along the coast (Winslow 1994). An unresolved problem for the stock is the occurrence of both ocean and river fisheries. Riverine fisheries are not a problem in the Chesapeake Bay because of the current moratorium. A coastwide stock assessment of American shad has been hindered because there is no standard reporting.

Declining Abundance

American Shad

The upper Bay alosid population has been monitored annually since 1979. Estimates of shad abundance have been calculated based on tag-recapture results. The 1994 population estimate of American shad in the upper Chesapeake Bay was 129,482 fish with 95% confidence intervals between 110,576 and 151,597. This was an increase from the 1993 value of 47,563 but not as high as the 1991 value (Figure 2.1). Average annual mortality for adult American shad in the upper Bay has been 72% for males and 86% for females (1985-1993). A significant decrease in mean length for nearly all age groups in the upper Bay has been observed from 1980-1993 (Markham et al. 1994). Maryland and Virginia will continue their moratorium on the harvest of American shad from the Chesapeake Bay. Maryland will also continue the moratorium on hickory shad. In Maryland, removing the moratorium will be considered when the annual population estimate from the upper Bay increases for three consecutive years and stock size reaches at least 50% of historical levels (approximately 500,000 fish) during one of those three years (1989 Chesapeake Bay Alosid

Figure 2.1. American shad population estimates for the upper Bay



FMP). The target for lifting the moratorium will be evaluated when the CB Alosid plan is reviewed in 1995 and new restoration targets proposed by the Fisheries Task Force will be considered. In Virginia, 1994 was the first year that the harvest of American shad was prohibited in the Bay. In 1993, Virginia allowed a brief, 30 day harvest season.

Alewife and Blueback Herring

In the last 10 years, Atlantic coast river herring harvest have ranged between 4.6 and 14.5 million pounds (ASMFC 1994). During 1994, river herring harvest was 96,112 pounds and 120,500 pounds from Maryland and Virginia, respectively. River herring commercial landings from the Chesapeake Bay decreased considerably in the mid-1970's and have been harvested at relatively low levels since then. Traditionally, the majority of the river herring harvest from the mid-Atlantic region was harvested by Maryland and Virginia. Landings from both the New England and South Atlantic regions have shown a downward trend in river herring harvest.

Hickory Shad

There is a lack of commercial and recreational harvest data for hickory shad which makes it difficult to make any stock assessment. Historically, they have occurred as far north as New England and south to Florida, and have a similar life history to American shad. To date, management strategies in the Chesapeake Bay have not been specific to hickory shad. There has been a moratorium on the harvest of hickory shad from the Maryland portion of the Bay since 1981. Atlantic coast commercial harvest of hickory shad has been as high as 350,000 pounds (1961), but most recently has been less than 10,000 pounds.

Susquehanna River Restoration

During 1994, the shad restoration program continued stock rebuilding activities similar to previous years. Since 1976, anadromous fish restoration activities have been guided by the Susquehanna River Anadromous Fish Restoration Committee (SRAFRC). As a result of a new fish passage settlement agreement in 1993, the utility companies will no longer participate in SRAFRC activities after 1994. The 1993 agreement provides for design, construction, and operation of permanent fish passage facilities at all projects; establishes Fish Passage Technical Advisory Committees for each project; continues trap and transfer of shad from Conowingo until facilities are operational at Holtwood and Safe Harbor (1997); and, provides limited funding for shad hatchery operations and related activites until York Haven completes its fish passage project (2000). Although the committee will be reorganized, it still recognizes the need for a unified approach to planning, management, and stock enhancement. The Committee will continue to provide a forum for information exchange; plan and implement anadromous stock rebuilding programs; coordinate research activities to assess the restoration program; establish and maintain a comprehensive database; and, coordinate the construction, operation, and evaluation of fish passage facilities on the Susquehanna River (Draft Charter, 9/94).

A total of 32,330 adult American shad were collected at the Conowingo fish lifts during 1994 and approximately 29,000 were transported upstream. Observed transport and delayed mortality was 1.8%. The West lift operating procedures were hindered during 1994 by inadequate attraction flows due to the season-long outage of one of the house units which supplies water to the facility. The West lift usually accounts for 44% of the total shad catch at Conowingo and during 1994, only amounted to about 17% of the total. The American shad catch was the highest on record, but the other *Alosa* species were near record low number. There were 2,851 blueback herring, 75 alewife herring, and 2 hickory shad. Lack of herring was directly attributable to flow and attraction problems at the West lift.

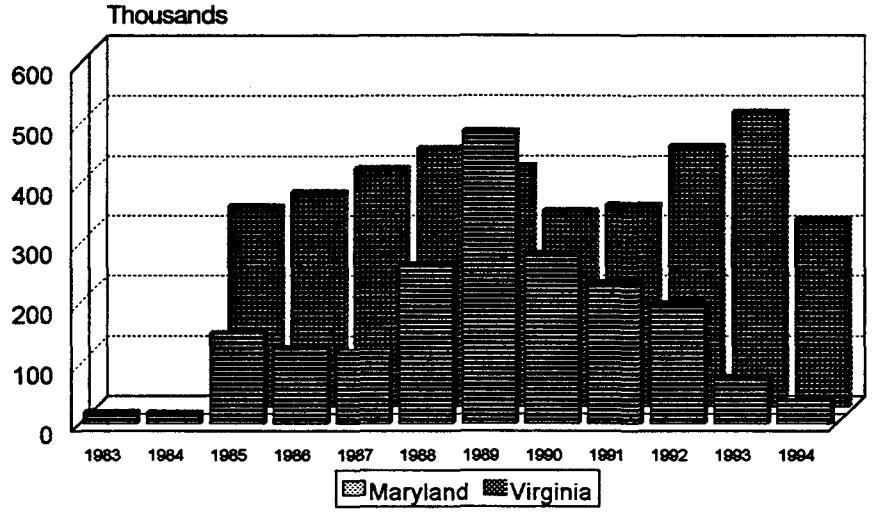
Peak outmigration for juvenile shad above Conowingo occurred in October. Catch per effort during this

time period was 2.46, a decrease from the long-term average of 6.74 (SRAFRC Technical Meeting, December, 1994). Catch effectiveness was adversely affected by water clarity which allowed shad to avoid being caught. Otolith analysis was completed on adult shad (n=287) from Conowingo. Results indicate that only 10% of the otoliths showed wild microstructure. Additional otoliths (n=59) taken from adults sampled from Susquehanna Flats showed that 44% were wild. A total of 664 juvenile shad otoliths were analyzed during 1994. Hatchery origin fish comprised between 50% and 82% of the juvenile fish sampled above the dams. The proportion of wild juveniles (n=54) sampled below Conowingo Dam was 61%.

Potential for Overfishing

In August, 1994, Maryland proposed a regulation to prohibit the harvest of American shad from Maryland coastal waters. To date, no action has been taken on the regulation. Maryland coastal shad landings have ranged from 20,000 to 487,800 pounds between 1983 and 1994 (Figure 2.2), with an average of 168,334 pounds per year. The 1994 coastal harvest was 38,500 pounds. Virginia coastal shad landings have ranged from 300,000 pounds to 490,000 pounds from 1985-1993. In 1994, they decreased to 311,000 pounds.

Figure 2.2. American shad landings from the Atlantic Ocean & seaside bays



According to the findings of the ASMFC Shad and Herring Technical Committee, alosid bycatch is declining. The river herring bycatch in the menhaden and mackerel fisheries will continue to be monitored.

Research and Monitoring

Maryland DNR has characterized the adult American shad and river herring spawning stocks since 1979. The 1989 year-class (age 5, sexes combined) was the most abundant year-class sampled in the upper Bay during 1994 while the 1990 year-class (age 4, sexes combined) was most abundant in the Nanticoke River. The number of repeat spawners increased in the upper Bay but showed no linear trend in the Nanticoke River. Estimates of total annual mortality increased during 1994 which suggests continued exploitation of the upper Bay population despite the moratorium on harvest (Markham et al. 1995). During 1994, catch-per-unit-of-effort (CPUE) for adult alewife herring increased slightly and blueback herring CPUE decreased. Estimates of river herring mortality from the Nanticoke River system have been relatively low with a stable age composition (Markham et al. 1994).

During 1994, 1,323 American shad were sampled by the VMRC Stock Assessment Program. The mean total length of the 1994 collection was 508 mm (20 inches). The VMRC program also collected 300 American shad for use in a genetic identification study being conducted by the Virginia Commonwealth University.

Juvenile finfish surveys have been used to develop alosid indices of abundance. These indices measure the relative size of each new year class. In Maryland, juvenile alosids are sampled from the Patuxent, Chester, Choptank and Nanticoke rivers (May-Sept.). Since 1985, juvenile alewife herring in all river systems have been increasing. Juvenile blueback herring have shown a marginal increase over the same time period (Markham et al. 1995). Trends in juvenile herring abundance have been difficult to detect since the indices tend to fluctuate with environmental conditions. A total of 36 juvenile shad were collected by electrofishing from the Susquehanna Flats between August and November. Otolith analysis indicated 60% were of wild origin and 40% were hatchery fish (n=55). No significant trend in juvenile American shad abundance has been detected since 1990. An additional 22 shad were caught by Maryland's Estuarine Finfish Recruitment Project (surveys the Potomac, Nanticoke, and Choptank Rivers and upper Bay). American shad indices from this project have averaged 0.69 fish per seine haul (1966-1994). The 1994 index (0.27) was below the average, but was a slight increase from 1993 (0.19). The VIMS juvenile trawl survey provides some information on the abundance of alewife herring in Virginia rivers (James, York and Rappahannock Rivers). Over the last 12 years, the alewife index has ranged between 0.02 (1991) and 0.90 (1981). Since the low in 1991, the index has gradually been increasing to a high of 0.71 (1993) (Bonzek et al. 1995).

As part of the American shad restoration efforts in the Bay, MDNR and the Potomac Electric Power company began a program in 1992 to propagate and stock hatchery-raised shad in the Patuxent River. Approximately 1.0 million juvenile shad were released into the river during 1994. A proportion of the juvenile fish have been tagged with coded wire tags for future identification and evaluation. The river will be monitored to determine the survival of juvenile shad but the full impact of the effort will not be measured for another three or four years when the adults return to spawn.

Habitat Loss and Degradation

The Fish Passage Restoration Program has been successful in opening spawning habitat to anadromous fish. In Virginia, a total of 88.6 miles of blocked spawning habitat has been reopened. For Bay tributaries in Virginia, the total 10-year goal is to reopen 413 miles of anadromous fish spawning habitat. Six dams are currently on schedule for fish passage. They are: Bosher's Dam on the James River/ Ashland Mill Dam on the South Anna River; Ruffins Mill Pond Dam on Massaponax Creek; Chandler's Mill Pond Dam on Chandler's Mill Run; Harvell Dam on the Appomattox River; and, Embrey Dam on the Rappahannock River.

Chemical (Hg, Pb, Cd, Zn, Cu) sensitivity experiments on shad larvae were conducted during 1994. Preliminary results indicate that American shad are very sensitive to chemical toxins, overlapping the sensitivity of striped bass. These results suggest significant implications for water quality requirements in targeted shad restoration areas and further studies have been proposed (memo from Hartwell, Sept. 1994).

Conclusion

The *Alosa* populations in the Chesapeake Bay continue to occur in low abundance. The population estimate of American shad in the upper Bay increased during 1994 in spite of a general decline in their abundance along the Atlantic coast. The Fish Passage Program continues to open additional habitat for spawning alosids. Areas to be emphasized during 1995 are:

1) Conduct a thorough review of the 1989 Chesapeake Bay Alosid Fishery Management Plan and decide whether a revision is necessary;

2) Continue to participate in reevaluating the ASMFC coastal shad and herring FMP;

3) Continue to monitor the coastal harvest of American shad and evaluate the need for more restrictive harvest measures;

4) Continue to collect basic biological information on the stock status of alosids in Chesapeake Bay; and,

5) Continue to work with the Fish Passage Program to open potential spawning areas.

References

Atlantc States Marine Fisheries Commission (ASMFC). 1994. 1994 Annual review of interstate fishery management plans. Special Report No. 33, ASMFC Commission and Science Committee.

Bonzek, C., P.J. Geer, and H. Austin. 1995. Juvenile fish trawl survey, 1979-1994. Virginia Institute of Marine Science, February, 1995.

Loesch, J.G. and S.M. Atran. 1994. History of Alosa fisheries management: Virginia, a case study. Anadromous Alosa Symposium, Tidewater chapter, American Fisheries Society, Bethesda, Maryland. p.1-6.

Markham, C.A., J.P. Mowrer, A.A. Jarzynski, R.A. Sadzinski, and D.R. Weinrich. 1995. Investigation of anadromous alosids in Chesapeake Bay. U.S. Fish & Wildlife, F-37-R, Federal Aid Annual Report.

Savoy, T. and V. Crecco. 1994. Factors affecting the recent decline of blueback herring and American shad in the Connecticut River. Ct. Fisheries Division. Report to the Atlantic States Marine Fisheries Commission, October 1994.

Winslow, S.E. 1994. American shad fisheries of North Carolina with emphasis on the Albemarle Sound area. Anadromous Alosa Symposium, Tidewater Chapter, American Fisheries Society, pp 72-80.

Chesapeake Bay Alosid Implementation Matrix

Problem Area	Action	Date	Comments
1. Declining alosid abundance	1.1.1 Continue shad moratorium in MD's portion of the Chesapeake Bay.	Continue 1994 Continue Continue	The 1994 population estimate for adult American shad in the upper Bay was 129,482 fish. This was an increase from the 1993 estimate of 47,563 fish. VA implemented a moratorium on the harvest of American shad from the Bay in 1994. DCFM implemented a moratorium on shad during 1992. PRFC will continue their 2 fish/person/day creel limit.
	1.1.2 VA will follow ASMFC recommendation to limit exploitation rate on shad and herring to 25%.	1994	VA implemented a moratorium on shad harvest from the Bay during 1994.
	1.2 Control river herring catch, including: by system, regulate areas slated for restoration, gear and/or seasonal restrictions.	1990	No restrictions have been implemented for river herring.
	1.3 Hickory shad fishery will follow the same management actions as for shad fishery (see Action 1.1.1).	Continue	MD (1981) and DC (1992) will continue moratorium on hickory shad. PRFC will continue 2 fish/person/day creel limit.
	1.4 Protection will be given to alosids in the Susquehanna as restoration efforts continue.	Continue	
2. Overfishing	2.1 Jurisdictions will participate in the ongoing ASMFC alosid management program, with the goal of providing adqueate protection to the component of the coastal stock which returns to the Chesapeake Bay to spawn.	Continue	MD,VA and PRFC are participating in the the development of Amendment #1 for the ASMFC Shad and Herring FMP. Tentative completion date is spring 1996.
	2.2 A) Implement a coastal shad tagging program to determine which stocks are being exploited in the intercept fishery.	1991-1992	Results from the tagging study indicate that the coastal fishery is mixed and highly variable from year to year.
	B) Control the coastal intercept fishry through a combination of gear restrictions, seasonal and areal closures, and harest limits.	1994	Coastal shad seasons were in effect in MD & VA in 1992. MD continue a season during 1993 & 1994 (Feb-Apr). MD also proposed a regulation to prohibit the harvest of shad from coastal waters but no action was taken in 1994. VA had no coastal season during 1993 or 1994.
	C) Continue to monitor and document the territorial seas intercept fishery for American shad.	1994	MD coastal landings were 38,500 lbs. & VA landings were xxxxxxx lbs. during 1994.
	2.3.1 Virginia will control river herring harvest during spawning migrations through gear restrictions & spawning area closures.	1992	VA restricted the use of commercial fishing gear in the spawning areas in the Chickahominy River below Walker's Dam.
	2.3.2 MD & VA will monitor river herring bycatch through the MAFMC.	In effect	River herring bycatch is being monitored under the MAFMC Squid, Mackerel and Butterfish FMP.
3. Stock Assessment	3.1 Continue to collect alosid data: a) Collect alosid juvenile data;	Continue	On-going VIMS, MDNR and DCFM alosid juvenile surveys.
	b) MD will continue project in upper Bay to estimate adult shad;	Continue	Adult shad work on the Nanticoke River was discontinued because of lack of tag returns.
	c) VA will improve the assessment of shad stocks in territorial waters & improve catch & effort data through mandatory reporting.	Continue	
	d) Continue VMRC stock assessment;	Continue	

Problem Area	Action	Date	Comments
	e) VA will initiate ocean intercept tagging program;	1991-1992	Tagging work completed in 1992. Results indicated coastal catch is mixed and highly variable.
	f) MD will examine exploitation rates of herring in selected tributaries & improve landings data;	Continue	Mortality rates have been calculated for herring on the Nanticoke River.
	g) VA will implement a survey of alosid spawning grounds & associated biological data;		
	h) A joint effort will be made to investigate the status of shad in the Potomac.	Continue	DCFM has been sampling the upper Potomac for shad and river herring since 1991.
4. Habitat Loss and Degradation	4.1 Implement the Chesapeake Bay Fish Passage Plan: A) - I) Implement various fish passage projects.	Variable	Refer to Fish Passage Plan and Annual Progress Rept. for details.
	J) Coordinate resources for restocking efforts.	Continue	Approximately 1.0 million hatchery-raised shad were released into the Patuxent River during 1994. Restoration efforts continued on the Susquehanna River.
	K) Establish measures to protect reintroduced fish stocks.	1990	Regulations to protect reintroduced herring have not been implemented in Maryland.
	L) Monitor impact of fish passage projects.	Continue	Biological monitoring has occurred on a limited basis. The utilization of new fish passage facilities has been documented. Funding not available for extensive coverage.
	4.2.1 MD & PA will continue to work within SRAFRC's ongoing programs to ensure downstream passage for juveniles and adults.	Continue	
	4.2.2 A) Promote use of Susquehanna brood stock for PA restocking.	Continue	
	B) VA will expand funding for Pamunkey/Mattaponi shad hatcheries.	1993	
	4.3 A) - E) Technical issues regarding water quality at Conowing Dam.	Continue	Standards were implemented in 1989 and have been monitored ever since.
4. Habitat Loss and Degradation (cont'd)	4.4 Establish new water classification system based on living resources, habitat, and water quality.		
	4.5 Promote Bay Agreement water quality commitments.	Variable	Preliminary American shad baseline water quality sensitivity studies were conducted in 1994. Results indicate that shad are very sensitive to chemical toxins.

LEGEND:

ASMFC= Atlantic States Marine Fisheries Commission
DCFM= District of Columbia, Fisheries Management
MDNR= Maryland Department of Natural Resources
PRFC = Potomac River Fisheries Commission
SRAFRC = Susquehanna River Anadromous Fish Restoration Commission
VIMS = Virginia Institute of Marine Science
VMRC = Virginia Marine Rexources Commission

Chapter 3
Blue Crab Management Plan

Introduction

The blue crab resource supports the most valuable commercial fishery in the Chesapeake Bay, as well as a highly valued recreational fishery. Currently, the blue crab population in the Chesapeake Bay appears to be in a low phase of population abundance. Various fishery independent indices based on long-term data sets indicate a significant decrease in catch per unit effort (CPUE) of juvenile crabs and the fishable segment of the stock. The most recent Baywide indices indicate that the blue crab population is likely to remain in a low phase through 1995. The decline in CPUE is also reflected in the dredge fishery landings and in comparable measures of adult female abundance from Virginia's trawl survey. Concurrently, fishing effort has increased substantially while commercial harvest per unit of effort has declined. Volstad et al. (1994) calculated exploitation rates of 50% to 92% from 1991 to 1993 for crabs subject to the Chesapeake Bay fishery (Table 3.1). These collective patterns are symptomatic of a fishery in the process of being overharvested. Rothschild et al. (1992) data suggest that managers should be concerned about the calculated high rates of fishing mortality in relationship to variability in stock size. Prudent management measures are necessary to control fishing effort and prevent a major decline in the fishery. Conservative management is also necessary to prevent a stock collapse if environmental conditions coincidentally deteriorate.

Table 3.1. Estimated absolute abundance and rate of exploitation in Chesapeake Bay from winter dredge survey (Volstad *et al.*, 1994).

Year	Absolute Number of Crabs (millions)	Crabs Harvested (millions)	(u) Exploitation Rate (all crabs)	(u) Exploitation Rate ($\geq$ 50mm)
1991	893.3	274.5	0.31	0.92
1992	440.0	164.1	0.37	0.50
1993*	653.3	306.0	0.47	0.83

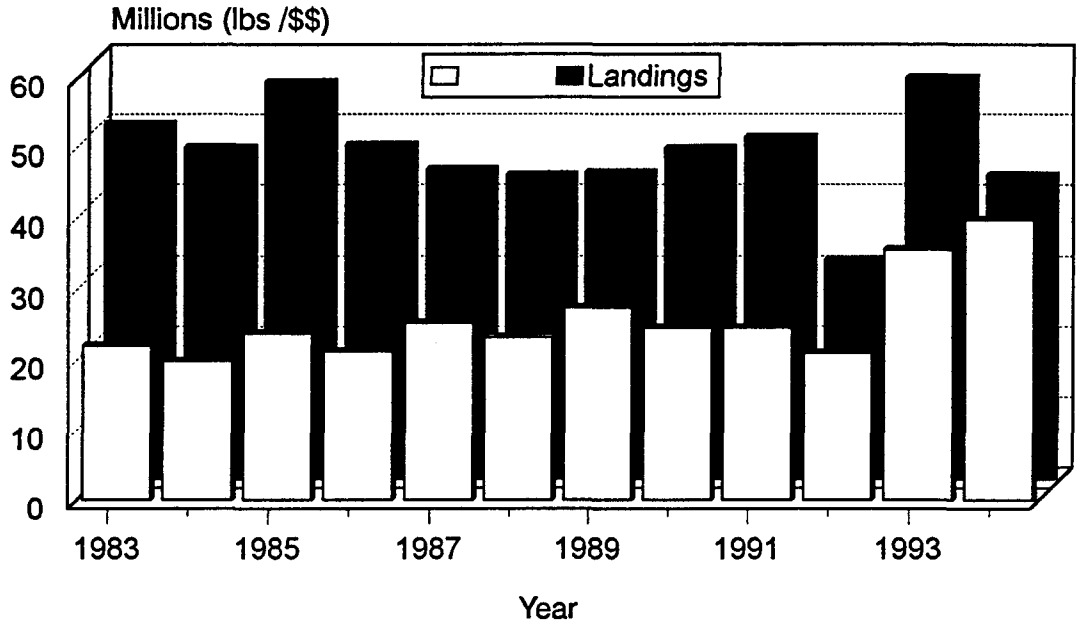
*1993 corrected for updated commercial landings

In 1989, a Blue Crab Fishery Management Plan (BCFMP) was developed and included information on life history, the fishery, status of the resource, habitat, laws and regulations, and management problems, strategies and actions. During 1994, the BCFMP was completely revised. The new draft BCFMP has been updated with current information pertaining to biology, ecology, habitat issues, fisheries, and social and economic issues. The problem areas and management strategies of the revised BCFMP are discussed below. For greater detail, refer to the draft 1995 BCFMP.

Fishing Pressure

Annual commercial landings in Maryland have averaged 46.0 million pounds (MDNR 1983-1994). Commercial crab landings for 1994 were 43.5 million pounds, a decrease from 57.6 million pounds in 1993

Figure 3.1. Maryland commercial blue crab landings and value

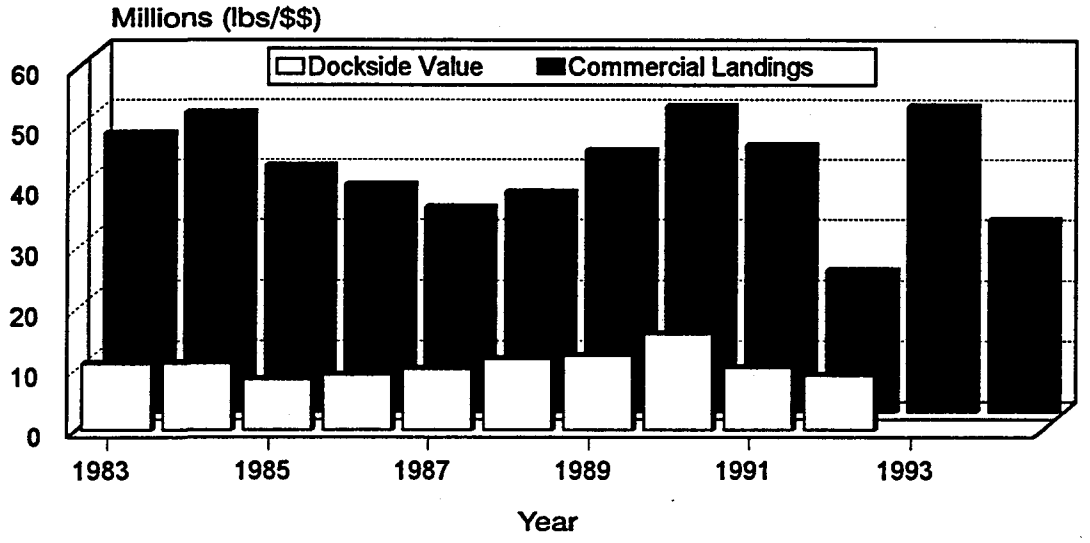


(Figure 3.1). Maryland changed their reporting system for crabs at the beginning of 1994 from an estimated harvest method based on random, subsampling of commercial harvesters to a direct enumeration of crab catch by all licensed harvesters. Preliminary hard crab commercial landings from Virginia for 1994 are 31.6 million pounds. Annual commercial landings in Virginia have averaged 40.5 million pounds since 1983 (Figure 3.2). Virginia implemented mandatory reporting for all commercial harvesters in 1993 and the large increase in landings for that year may be an artifact of the new reporting system. Anecdotal observations in Virginia indicate 1994 was not an exceptional year for the fishery, and comparisons of reporting systems indicate 1993 was a slightly above 1992 landings.

Research indicates that there is a significant stock/recruitment relationship in the Chesapeake Bay blue crab population. The number of young produced (recruited) is affected by low levels of adult spawning stock as well as by environmental factors. Spawning potential can be directly linked to the number of female crabs which are subject to harvest by the hard crab pot fishery, winter dredge fishery and soft crab fishery. Catch statistics from the Virginia commercial dredge fishery (composed almost entirely of mature female crabs) show a significant decline in winter harvests from 1976 to 1994. A decline in adult female abundance has been observed in the fishery independent trawl survey conducted in the James, York, and Rappahanock Rivers over the same time period. When the two data sets are compared, they correlate well. The dredge

fishery is preceded by the summer hard crab fishery which has had relatively stable landings. There is evidence in Maryland and the Potomac River that the stability in hard crab landings is due, in part, to a greater amount of effort by commercial crabbers. Declines in the winter dredge fishery and spring peeler fishery are evidence that females are being intercepted at some earlier time.

Figure 3.2 Virginia blue crab commercial landings and value



1993 change in reporting system

The development of fishing targets which will identify relationships between abundance and harvest for the blue crab resource is in progress. These targets may include measures of optimum abundance, fishing mortality rates, spawning stock biomass and/or yield per recruit. They will be used as an index from year to year to determine if fishing pressure is increasing and should allow early detection of harvest rates that are too high to sustain the resource. In order to protect the blue crab resource, limits have been placed on fishing effort and on the number of participants. The new laws and regulations adopted in Maryland and Virginia to contain commercial and recreational fishing effort will be evaluated to determine their effectiveness and are summarized below.

Virginia Regulations and Legislation effective in 1994 and 1995:

Virginia reduced the crab dredge daily catch limit from 25 to 20 barrels for the 1993/94 season. The Commission also adopted regulation limiting entry into the crab dredge fishery. The sale of crab dredge licenses is limited to those persons who held licenses and were actively engaged in the fishery as of March 31, 1994. No new licenses will be issued until the number of valid licenses decreases to 225 through attrition.

Regulations were implemented to limit the size of dredges to a maximum width of 8 feet. A committee will be assembled to evaluate dredge size limits and make recommendations for the 1995/96 season.

In October, 1994, Virginia approved a regulatory package of conservation measures and limits on effort in the commercial fishery for blue crabs. A winter crab sanctuary was established upriver from the Hampton Roads Bridge Tunnel where dredging is prohibited. A second summer spawning sanctuary was established bayside of Kiptopeke on the eastern shore where crabbing is prohibited June 1 through September 15. Gear limits were set on peeler pots with 400 pots per vessel from April 1 through June 30; 400 pots per person are allowed July 1 through November 30. A crab pot and peeler pot season was established April 1 through November 30. Four cull rings are required in crab traps/pounds and two cull rings are required in hard crab pots to facilitate the release of small crabs.

Maryland Regulations and Legislation effective in 1994:

Maryland's Limited Entry Bill was passed during 1994 and limits new entries into the commercial fishery. Maryland has had a delayed entry program since 1988 which required a person to wait two years upon application before receiving a commercial license. Any person whose name was on the two year waiting list in Maryland prior to April 1, 1994, will receive a license two years after the date of application. The Limited Entry Bill gives the Department of Natural Resources authority to establish a prescribed number of people to participate in any given fishery. Once the two year waiting list is exhausted, no new licenses will be issued for that fishery until the number of licenses drops below the prescribed number. As licenses are lost voluntarily, by revocation, expiration or death, the fishery will be capped at a maximum number of participants, and fishing effort will be limited.

Maryland has adopted a new license system for crabbing. The new license structure, to take effect in 1995, retains the Limited Crab Harvester License (up to 50 pots) and consolidates licenses for more than 50 pots and all other gears into one Crab Harvester License. Crab Harvesters are limited to 300 crab pots per vessel, and licensees may buy single and double allocations for one to two crew members which permits 300 additional pots per allocation, not to exceed 900 pots per boat. The Tidal Fish License, which consolidates finfish, shellfish and crabs in one license, is also limited to 300 pots with allocations up to 900 pots per boat.

Times when commercial and recreational crabbers can set and fish their gear in Maryland were defined in regulation in 1994 (see Appendix A). To limit effort in the number of man hours spent fishing, start and end times were staggered to minimize conflicts between user groups.

The noncommercial crab license was eliminated through legislation. Maryland currently has no licensing system fro recreational crabbers, which now includes crabbers who were previously licensed as noncommercial crabbers. Unlicensed recreational crabbers were limited to 5 crab traps and/or rings per person while the licensed noncommercial crabber was allowed up to 50 traps and/or rings. All recreational crabbers are now limited to 10 traps and/or rings per person, not to exceed 25 traps and/or rings per boat. Trotline, which was limited to 500 feet for recreational crabbers and unlimited for noncommercial crabbers, is now limited for all recreational crabbers to 1000 feet per person, not to exceed 2000 feet per boat. Recreational harvest is now limited to no more than one bushel per person and no more than 2 bushels per boat.

The maximum number of crab pots which can be set from private property in Maryland is two. Some counties prior to 1994 were allowed four.

The impact of the new regulations will take several years to evaluate. A panel will convene after four years to review the status of the resource and make any additional recommendations.

Wasteful Harvesting Practices

Optimum use of the blue crab resource can be promoted by eliminating and/or reducing wasteful harvest practices. Harvesting small crabs, crabs of poor quality (buckram crabs which have recently shed their exoskeletons and have small amounts of meat), sponge crabs (female crabs with eggs), and green crabs (a peeler crab without red or pink coloration in the swim fin) for shedding operations does not optimally utilize the resource. In order to reduce the number of sub-legal crabs retained in crab pots, cull rings (circular openings in the mesh of crab pots) are required to allow the release of undersized crabs. Effective in 1994, Virginia requires two cull rings (one $2^5/_{16}$" and one $2^3/_{16}$" diameter) in all hard crab pots. The larger ring may be closed in some areas to retain small, legal crabs. Maryland also required one $2^5/_{16}$" cull ring in all hard crab pots in 1994, though the ring may be obstructed if the gear is fishing for peeler crabs.

Crab pots lost to storms or left abandoned are attractive refuge sites for crabs and fish, and result in mortality. Weak or dead animals in traps attract other organisms and the pots become self-baiting. A biodegradable escape panel is currently under development for testing in the Chesapeake Bay, and other options to discourage deliberate abandonment are being investigated.

Small crabs are susceptible to the soft and peeler fishery. Size limits for soft/peeler crabs are a useful tool for reducing juvenile mortality, increasing the yield per recruit, and may make Chesapeake Bay's product more competitive. A new market for "thumb-nail size" soft-shell crabs may be opening in Virginia and may command a greater price per pound than any crab from the Bay. Maryland size limits for soft and peeler crabs are 3" and 3.5", respectively. Virginia currently has no size limits. Alternative methods for protecting small crabs in Virginia's soft/peeler fishery, such as cull rings in peeler pots, were investigated. Virginia currently requires four $1^1/_2$" cull rings in all peeler pounds/traps.

Stock Assessment Deficiencies and Research Needs

The development of blue crab fishing targets and assessment of the blue crab stock is dependent on fishery and biological data. New reporting methods for the commercial fishery and fishery independent surveys will be used to monitor trends in catch and effort, produce reliable estimates of blue crab abundance, and contribute to the understanding of the relationship between harvest and stock size. Information is needed on the recreational harvest of blue crabs. Virginia currently requires all recreational crabbers to report on harvest and effort. Maryland will propose a recreational crabbing license as a means to obtain recreational harvest data. The baywide effort to collect population data will continue. Maryland and Virginia will continue the winter dredge survey, used as an annual assessment of the abundance, distribution, and mortality of blue crabs. They will also continue to encourage research on the stock/recruitment relationship.

Regulatory Issues

Conflict between commercial crabbers and recreational boaters has become a serious problem in some of the more densely populated areas of Maryland and Virginia. There is competition for trotline space in the tributaries. Conflicts among user groups will be minimized by applications of time, area and gear

restrictions. These limits will provide a means to allocate space and harvest. Activities will be coordinated among Bay jurisdictions to insure optimal baywide usage of the blue crab resource.

The interstate shipment of peelers and soft crabs may circumvent efforts to protect the Bay stock from illegal fishing activities.

Chesapeake Bay blue crab harvest has accounted for over 50% of the national blue crab landings for the past two decades (Orth and van Montfrans, 1990). As more countries develop crab fisheries and processing techniques, the crab supply worldwide will continue to grow. If the Chesapeake Bay product is to remain competitive in the domestic and international market, it is important to acknowledge the relationship between the long-term health of the resource and the ability to compete in an international market (Petrocci and Lipton 1994). In the Chesapeake region, Petrocci and Lipton warn of the effects of overcapitalization, high levels of fishing pressure and competition that drive the product price up. They recommend limited access to the fishery to prevent overcapitalization, increase productivity and lower the cost of harvesting crabs. Concern must be focused on the health of the resource, rather than short-term availability from one season to the next, to remain competitive in the global market.

Habitat Issues

Estimates of juvenile abundance for the York and Rappahannock Rivers have been calculated and demonstrate the relative importance of vegetated habitats to young juvenile blue crabs. Juvenile blue crab densities are an order-of-magnitude greater in seagrass than in unvegetated areas. Currently, there are approximately 25,000 hectares of SAV in Chesapeake Bay (Orth et al. 1991), approximately 10% of the historical abundance (Stevenson and Confer 1978). Most of the major SAV declines in Chesapeake Bay have occurred outside the primary settlement and nursery areas for the blue crab. However, these vegetated habitats are of vital importance to maintaining high population abundances of crabs that they should be recognized and preserved.

The recommended minimum dissolved oxygen requirement for target species in the Chesapeake Bay, including blue crabs, is 5 mg/L (Jordan et al. 1992). Juveniles may have a lower tolerance than adults (Stickle et al., 1989), therefore, needing a higher minimum oxygen level. Achieving minimum standards of dissolved oxygen requirements and SAV recovery efforts are dependent on the ability of the Bay jurisdictions to accomplish the goal of a 40% reduction in controllable nutrient sources. Meeting this goal will require capping nutrient loads once the 40% reduction is accomplished to account for the effects of population growth and reducing atmospheric nitrogen greater than that required by the federal Clean Air Act.

Conclusion

The blue crab resource in the Chesapeake Bay appears to be in a low phase of population abundance. In order to protect the reproductive potential of blue crabs, limits have been placed on fishing effort and the number of participants. The new restrictions and their effectiveness at stabilizing fishing effort need to be evaluated. If these actions are successful at limiting fishing effort, the plan will have met its objective of being a "problem preventing" rather than a "problem solving" plan. The following areas should be emphasized during 1995:

1) Monitor the new laws and regulations adopted in 1993 and 1994 to contain blue crab fishing effort and determine their effectiveness;

2) Continue to monitor the commercial and recreational harvest of blue crabs;

3) Develop criteria for establishing blue crab fisheries targets, and;

4) Work through the newly established blue crab steering committees to evaluate current management processes and recommend additional actions regarding the blue crab fishery, if necessary.

References

Orth, R. and J. van Montfrans. 1990. Utilization of marsh and seagrass habitats by early stages of *Callinectes sapidus*. II. Spatial and temporal patterns of molting. Bull. Mar. Sci. 46:95-104.

Orth, R., J. Nowak, A. Frisch, K. Kiley and J. Whiting. 1991. Distribution of submerged aquatic vegetation in the Chesapeake Bay and tributaries and Chincoteague Bay, 1990. U.S. EPA, Chesapeake Bay Program, Annapolis, MD. 261 pp.

Petrocci, C. and D. Lipton. 1994. The Warmwater Crab Fishery in Asia: Implications for the ChesapeakeBay Blue Crab Industry. MD Sea Grant Extension Program, VA Sea Grant Marine Advisory Program. 45 pp.

Rothschild, B., J. Ault, E. Patrick, S. Smith, H. Li, T. Maurer, B. Daugherty, G. Davis, C. Zhang, and R. McGarvey.1992. Assessment of the Chesapeake Bay Blue Crab Stock. Univ. of Maryland, Chesapeake Bay Biological Lab. CB92-003-036, CEES 07-4-30307, Solomons, Maryland.

Stevenson, J. and N. Confer. 1978. Summary of available information on Chesapeake Bay submerged vegetation. U.S. Fish and Wildlife Service Office of Biol. Serv. FWS/OBS-78/76.

Stickle, W., M. Kapper, L. Liu, E. Gnaiger and S. Wang. 1989. Metabolic adaptations of several species of crustaceans and molluscs to hypoxia: tolerance and microcalorimetric studies. Biol. Bull. 177:303-312.

Volstad, J., B. Rothschild and T. Maurer. 1994. Abundance estimation and population dynamics of the blue crab in the Chesapeake Bay. Report submitted to Maryland Department of Natural Resources, Fisheries Department. Annapolis, MD. 53pp.

1995 (1996) Blue Crab Management Plan Implementation Matrix

PROBLEMS AND STRATEGIES	ACTIONS	DATE	COMMENTS
I. Increased Fishing Effort *1.1 Fishing Effort* New laws and regulations adopted in MD and VA to contain commercial and recreational fishing effort and protect stocks will be evaluated to determine their effectiveness.	1.1.1 New reporting methods will be used to determine actual harvest, biological composition of catch, and the effectiveness of current regulations for maintaining safe levels of harvest.	1994	M D changed from estimated harvest to direct enumeration (1994), VA changed from voluntary survey to mandatory reporting (1993).
	1.1.2 New reporting methods for commercial harvest will be compared with previous methods to standardize catch data in the two periods.	MD, 1994 VA, indeterminate	MD is in process of comparing reporting systems; preliminary data shows a close relationship. VA has not begun comparisons.
	1.1.3 Maryland will determine a maximum number of commercial crabbing licenses and licenses with crew allocations as required under new Limited Entry law (Sect. 4-210).	1996	Original implementation date was 1995 but legislation changed it to 1996.
	1.1.4 The impact of regulations and law to cap effort in Maryland and Virginia will be evaluated. A joint panel from MD and VA will convene after four years to review the status of the resource baywide and the effectiveness of current regulations and will make recommendations.	1998	MD will form a Blue Crab Steering Committee in 1995, and VA will form a Committee in 1995. The two committees are coordinating efforts and evaluating current regulations.
	1.1.5 Targets will be established through analysis of historical fishery independent data sets and landings data to identify relationships between abundance and harvest. Should overfishing be detected, measures will be taken to reduce fishing mortality to levels that are within the boundaries of defined targets and which permit restoration of the stock to its former capacity.	1995	This action item is underway, but is not scheduled to yield final results until 1996. In addition, the Chesapeake Bay Stock Assessment Committee will conduct a stock assessment in 1995.

PROBLEMS AND STRATEGIES	ACTIONS	DATE	COMMENTS
	1.1.6 Maryland and Virginia will monitor recreational crab data to determine if further restrictions on the recreational fishery are necessary.	MD, see Action 3.2.2-3 VA, ongoing	MD, see Action 3.2.2-3 VA, established a recreational license for crabbers wishing to use more gear, and implemented a mandatory reporting system for licensed recreational crabbers.
2. Wasteful Harvesting *2.1 Economic Yeild* Optimum use of the blue crab resource will be promoted by eliminating and/or minimizing wasteful harvest practices, and by informing the consumer of poor quality or poor value crabs and discourage their purchase.	2.1.1 MD and VA will continue to promote the release of buckrams.	Ongoing	
	2.1.2 MD will investigate publicizing optimal bushel weight ranges for the various types of crabs and establishing minimum weight limits for each.	1996	
	2.1.3 MD and VA will educate the consumer about wasteful harvesting practices and their effects on the resource so they may be better informed when purchasing crabs.	1996	Need cooperation with the Department of Agriculture in order to be successful.
2.2 *Cull Apparatus* The biological benefits and economic impact of cull rings will be investigated to determine specific seasons when cull rings may be obstructed.	2.2.1 Maryland will define seasons for peeler fishing with hard crab pots (pots with mesh size 1.5 inches or greater) for which cull rings may be obstructed to minimize the impact on the resource and maximize economic benefits	1997	Current regulation allows cull rings to be obstructed anytime a potter is fishing for peeler crabs.
	2.2.2 VA will continue the mandatory use of cull rings throughout the hard crab pot season.	On-going	VA required a second cull ring in all hard crab pots.
	2.2.3 VA has initiated studies to determine the economic impact of the cull ring requirement and will continue research to determine the significance of allowing obstructed cull rings for short periods of time.	On-going	Studies completed investigated the percent of legal-size crabs that may escape from cull rings of different sizes. The information was used to define regulations for mandatory cull ring use.

PROBLEMS AND STRATEGIES	ACTIONS	DATE	COMMENTS
	2.2.4 VA is investigating the use of cull rings in peeler pots and will consider mandatory cull rings in peeler pots and peeler pounds.	1995	Cull rings were tested for use in peeler pots and results are being evaluated. Cull rings are required in peeler pounds.
2.3 Female Harvest Landings and fishery independent data will be reviewed to determine if low reproductive potential and poor spawning success are resulting from female harvest.	2.3.1 MD will investigate the interstate trade of blue crabs to quantify the number of sponge crabs and other types of crabs (which may not be legally harvested in MD) coming into the state.	1996	This information would be helpful for implementing 2.3.2 and implementation dates may have to be changed to reflect this.
	2.3.2 MD will investigate the effects of prohibiting the import of sponge crabs, or crabs from which the egg packet has been removed, and consider regulations if the action is deemed biologically necessary.	1995	
	2.3.3 VA will consider the expansion (time and/or area) of the spawning sanctuary. Additional sanctuaries or closed areas may be established.	1995	VA established one new summer sanctuary for spawning crabs, and one winter sanctuary for females overwintering near spawning grounds.
	2.3.4 MD will evaluate the use of female crabs as eel bait in eel pots.	1996	This will be an on-going endeavor. Statistics are currently being collected through crab reporting.
	2.3.5 VA and MD will continue to collect data on female size at maturity, migration, distribution and harvest by sex to study the effect of female harvest on crab population dynamics.	On-going	MD will investigate female harvest by year and month, and by gear type to consider new regulation in 1995. VA estimated female harvest by gear type for management purposes in 1994.
2.4 Abandoned Pots Causes of abandoned pots will be investigated, the deliberate abandonment of crab pots will be discouraged, and escape mechanisms in pots will continue to be researched.	2.4.1 VA and MD will continue to address regulation of abandoned crab pots, including significant fines that may discourage deliberate abandonment.	1995	
	2.4.2 VA and MD will continue to investigate materials for biodegradable escape panels and latches in crab pots and escape mechanisms for air breathing animals.	On-going	A prototype for testing in the Chesapeake Bay is in the making.

PROBLEMS AND STRATEGIES	ACTIONS	DATE	COMMENTS
	2.4.3 VA and MD will investigate the feasibility of establishing used pot disposal sites in Bay counties and other incentives.	1996	
	2.4.4 VA and MD will educate commercial crabbers about the problems of abandoned crab pots and MD will educate property owners about the effects of pots left unattended.	1996	
	2.4.5 VA and MD will investigate placement of identification on crab pots so that lost pots may be returned and purposeful abandonment will be discouraged.	1995	
	2.4.6 MD will identify sources of abandoned pots.	1995	
2.5 Shedding Mortality Information will be provided to shedders to minimize mortality in shedding operations.	2.5.1 MD and VA will continue to provide technical information to shedding operations that promote reduction of peeler mortalities associated with holding practices.	On-going	
	2.5.2 VA established a commercial shedding license, effective January 1, 1994, and will monitor data reports.	On-going	Data not yet available.
	2.5.3 MD and VA will continue to educate watermen on problems related to green crab mortality.	On-going	
	2.5.4 MD will investigate a joint venture with commercial watermen's associations to establish a state-of-the-art shedding facility for the purpose of research and to educate the shedding industry.	1996	

PROBLEMS AND STRATEGIES	ACTIONS	DATE	COMMENTS
3. Stock Assessment Deficiencies 3.1 Commercial Reporting New reporting methods will be used with continued fishery independent surveys to monitor trends in catch and effort, produce reliable estimates of blue crab abundance, and understand the fishery and the relationships between harvest and stock.	3.1.1 MD and VA will monitor commercial records in order to evaluate the relationship between fishery dependent and fishery independent estimates of abundance	On-going	MD will conduct this study in 1995.
3.2 Recreational Harvest There will be a Baywide effort to collect recreational catch and effort data and to evaluate the economic impact of the recreational harvest	3.2.1 As of 1993, VA requires annual reporting by all licensed recreational crabbers including weight harvested, location of harvest, days fished, and amount of gear used. This data will be used to estimate recreational harvest and effort.	On-going	To date, 361 licenses were sold in 1993 and catch data is not yet available.
	3.2.2 MD will seek a recreational crabbers license requirement.	1995	Previous legislation has not been adopted.
	3.2.3 MD will develop a method of estimating recreational catch to improve monitoring of the blue crab resource. Data collected will be compatible with Virginia.	1995	CBSAC will fund a design for a recreational crab survey in Chesapeake Bay in 1995.
3.3 Research Needs The Baywide effort to collect population data on blue crabs will continue, and current methods will be improved to assure baywide uniformity of data sets and achieve reliable and more accurate catch estimates.	3.3.1 MD and VA will continue cooperation in the Baywide winter dredge survey and continue to refine data analysis as a consistent annual assessment of the abundance, distribution, and mortality of the crab resource.	On-going	Recent data is presented in this progress report.
	3.3.2 MD and VA will continue to encourage research on recruitment-stock and stock-recruitment relationships and how environmental parameters affect fluctuations in crab abundance.	On-going	MD will investigate stock-recruitment relationships in 1995.

PROBLEMS AND STRATEGIES	ACTIONS	DATE	COMMENTS
4 Regulatory Issues 4.1 Commercial/Recreational Conflict Conflicts among user groups and the general boating public can be minimized by rational application of time, area and gear restrictions to allocate space and harvest of the resource.	4.1.1 MD and VA will continue to monitor conflicts between crabbers and recreational boaters and enforce existing regulations on open and closed crabbing areas and buoy-free channels.	On-going	MD will hold a series of public meetings in 1995 to provide information to recreational and commercial crabbers, and the public.
	4.1.2 Maryland has staggered start and end times for recreational and commercial crabbing. The effectiveness of these time limits will be monitored.	1994	Analysis of effectiveness is ongoing.
4.2 Interstate Trade MD and VA will continue to investigate the biological and economic effects of size limits on the soft crab fishery and the need to coordinate soft and peeler size limits.	4.2.1 MD will consider a ban on the importation of crabs which do not meet State requirements.	1995	Would require a change in legislation.
	4.2.2 MD and VA will work to achieve consistent Baywide standards for minimum sizes of all crabs harvested in the Bay.	1995	Virginia considered soft/peeler limits and were rejected based on public comments.
	4.2.3 MD will investigate the extent of importation of southern blue crab.	1995	This information is necessary for considering Action 4.2.1.
5 Public Health and Consumer Concerns 5.1 Personal Consumption Minimum weight standards and volume will be considered for the various types of blue crabs.	5.1.1 MD will evaluate the necessity of establishing a minimum bushel weight for various grades of crabs.	1996	
	5.1.2 MD will define by regulation the minimum volume of a crab bushel, as well as potential substitutes, such as the waxed cardboard seafood box.	1996	

PROBLEMS AND STRATEGIES	ACTIONS	DATE	COMMENTS
5.2 Foreign Import Efforts will be made to insure that consumers are aware of the origin of the crab products they purchase.	5.2.1 Imported crab meat shall be identified as such in Maryland as required by Section 21-339 of Annotated Code of Maryland, Health Article.	1994	In effect.
	5.2.2 In addition to foreign crab meat, the interstate shipment of crab products shall be surveyed in Maryland.	1997	Would have to be coordinated with the Department of Agriculture and possibly with Sea Grant.
6 Habitat Degredation 6.1 Anoxia MD, PA, and DC have outlined a Tributary Strategy that will reduce the amount of nutrients from tributaries to the Bay 40% by the year 2000 to meet the Bay Program's nutrient reduction goal. Oxygen content goals for the Bay are also recommended.	6.1.1 Implement goals of tributary strategies. 6.1.2 Dissolved oxygen standards for baywide adoption are recommended and goals for optimum survival of juvenile and adult blue crab should be as follows: a.All waters of Chesapeake Bay and its tidal tributaries should contain a minimum of 1.0 mg/L dissolved oxygen at all times, and b.a minimum duration of 12 hours of dissolved oxygen content between 1.0 and 3.0 mg/L with a 48 hour minimum return frequency of $\leq$3.0 mg/L and $\geq$1.0 mg/L, and c.all above pycnocline waters of Chesapeake Bay and its tidal tributaries should contain a monthly average of 6.0 mg/L dissolved oxygen.	2000 In effect upon adoption of Plan	
6.2 SAV and Intertidal Wetlands The Chesapeake Bay Program is committed to achieving a net gain in SAV distribution, abundance and species diversity in the Bay and tidal tributaries over present populations. The Bay jurisdictions will maintain a priority status on protection of SAV and intertidal wetlands.	6.2.1 The Chesapeake Bay jurisdictions will work to restore SAV to their historic levels.	Tier I: On-going Tier II: 2005 Tier III: after tier II	Baywide SAV declined in 1994.

PROBLEMS AND STRATEGIES	ACTIONS	DATE	COMMENTS
	6.2.2 MD and VA will prepare a report on blue crab habitat and biology and identify critical habitat utilized by the species, evaluate projected growth to the Bay watershed and make recommendations on regulating coastal development for permitting agencies.	1996	MD, in cooperation with VA, will prepare a document in 1995 which links land use to aquatic habitat for use during land use permitting decisions.
	6.2.3 MD will consider limits on scraping for hard crabs in the early crabbing season.	1995	
6.3 Water Quality The Chesapeake Bay Program will continue its commitment to toxins reduction and control, particularly in localized regions near discharge points and where toxins are accumulated.	6.3.1 Regions of concern will be identified within criteria set by the Chesapeake Bay Toxics Strategy. Within regions of concern the sources and amounts of pollution will be determined, control methods will be explored and implemented and important habitats within the area and land uses with negative effects will be identified.	On-going	

Chapter 4
1994 Oyster Fishery Management Plan

Introduction

As the ecological value of the oyster (*Crassostrea virginica*) resource to water quality was recognized and disease became more limiting, an improved framework was needed for managing the oyster resource. During 1994, a revision of the 1989 Oyster Fishery Management Plan (FMP) was completed and signed by the signatories of the Chesapeake Bay Agreement. The goal of the 1994 Oyster FMP is to ***enhance the production of oysters in the Chesapeake Bay ecosystem by restoring habitat, controlling fishing mortality, promoting aquaculture and continuing the repletion programs.*** Recommendations from both the Virginia Holton Plan (VHP) and the Maryland Oyster Roundtable (MOR) were incorporated into the revised FMP. The Holton Plan recommendations were the result of discussions by a 33-member "Blue Ribbon" panel to restore Virginia's oyster industry. The MOR recommendations came from a 40-member committee of aquaculturists, environmentalists, legislators, scientists, watermen, and representatives from government agencies on how to bring back oyster stocks in Maryland. One of the major innovations from the MOR was the establishment of oyster recovery areas (ORAs). Restoration areas can be found in the Chester, Choptank, Magothy, Nanticoke, Patuxent, and Severn Rivers. These areas are targetted for restoring oyster populations and monitoring the results.

Since a revised Oyster FMP has recently been completed, the following discussion is a summary of the problem areas and management strategies defined in the new plan. For a more extensive discussion of each management recommendation and action, refer to the 1994 Oyster FMP.

Disease

Disease was identified as one of the major impediments to restoring oyster stocks in the Chesapeake Bay. Several strategies were developed to address the disease issue. They include monitoring oyster stocks in the Bay for the prevalence and intensity of disease, minimizing the spread of disease, implementing a National Oceanic and Atmospeheric Administration (NOAA) coordinated research program, and continuing research on disease-resistant oysters.

Repletion Programs

State repletion programs have focused on increasing oyster harvest by moving shell and transplanting seed oysters. The programs are limited by natural reproduction (spat set), disease infection, the amount of available shell or cultch, and funding. Maryland and Virginia currently have no disease-free, seed-producing areas and transplanting seed may facilitate the spread of disease. The Bay jurisdictions will adapt, as appropriate, their repletion programs to enhance oyster production without encouraging the spread of disease. The programs may be modified as new initiatives from the MOR and VHP are implemented. Repletion efforts will be monitored and evaluated after three years (1997).

Habitat/Water Quality

There has been a loss of three-dimensional structure of oyster bars within the Bay. Reef flattening has taken oysters out of the higher water column where currents bring fresh food supplies and oxygen, making them particularly vulnerable to siltation. The reduction in reef surface area has also reduced

theamount of substrate for oyster larvae to settle. The Bay jurisdictions will restore physical oyster habitat through the Maryland and Virginia Aquatic Reef Program (refer to the 1994 Aquatic Reef Habitat Plan for details). The jurisdictions will also work to ensure that water quality is maintained at levels to support healthy oyster populations.

Management to Increase Oyster Production

Disease, the decrease in oyster habitat, variability in recruitment and harvest pressures have placed considerable constraints on oyster production. New technology is needed for the restoration, culture, and production of oysters. To allow progress for private oyster aquaculture ventures, efforts will be made to assist and encourage private industry. Maryland and Virginia will initiate a grant program with matching funds from the private industry, for oyster restoration, culture and production. Maryland will increase hatchery production of oyster larve and seed oysters. The jurisdictions will also reduce and control fishing mortality.

Collection of Management Quality Data

Oyster population data and harvest information is currently being collected but improvements in bar-specific data will be made. In addition to research data on disease, research will also be encouraged on spawning stock density necessary to repopulate an area decimated by disease, natural and fishing mortality rates, the stock/recruitment relationship, factors affecting abundance, and survival and growth of larvae and juveniles. The jurisdictions will continue to collect quantitative data on oyster stocks, habitat, and diseases.

Management for Maryland Oyster Recovery Areas (ORAs)

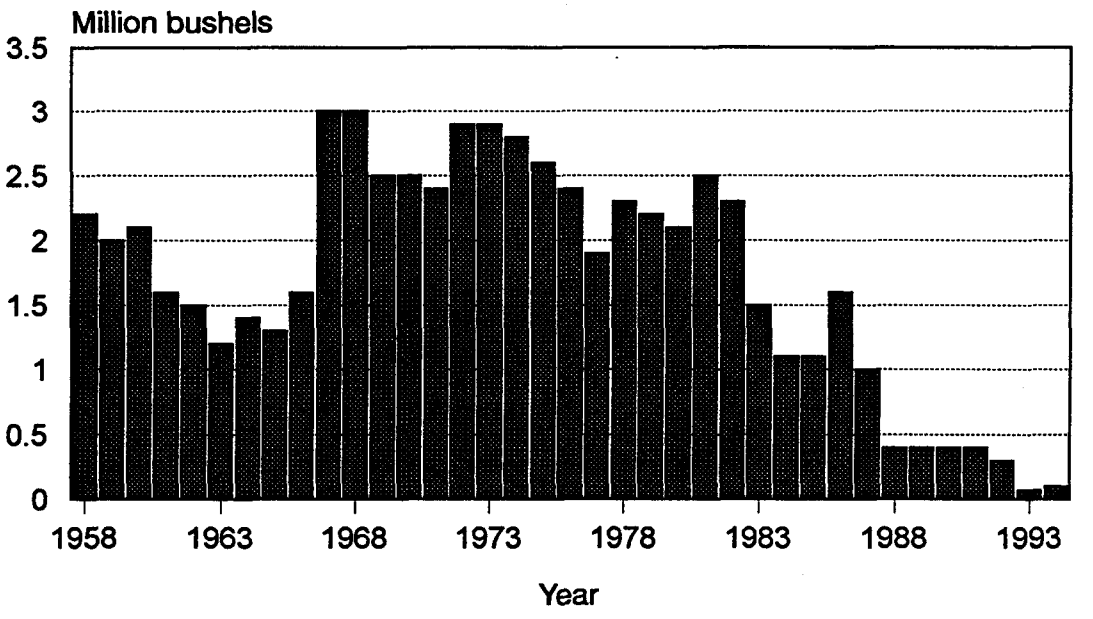
Geographic areas, termed Oyster Recovery Areas (ORAs), have been designated in low salinity reaches of the Bay and its tributaries where MSX and Dermo, oyster parasitic diseases, are less viable. These areas will be used to evaluate different methods of rehabilitating, rebuilding and restoring oyster populations. Transplantation activities such as moving shell and seed will be limited. Regulations have been proposed to establish specific ORA zones and limit shellfish activities in the Chester, Choptank, Severn, Magothy, Nanticoke and Patuxent Rivers. These regulations are the first phase of implementing a program to enhance oyster populations in the Bay.

Current Status of the Oyster Fishery

As of December 1994, the preliminary harvest report for the Maryland 1994/95 oyster season is 121,000 bushels. The catch is about 20% greater than the 1993/94 season (Figure 4.1). The increased harvest is from areas that were previously out-of-production, i.e., upper Tangier Sound and tributaries, upper Little Choptank, Harris Creek on the Tred Avon and the Wicomico River (western shore). These areas are now productive as a result of the 1991 and 1992 spat set and reduced levels of disease mortalities. In Virginia, the preliminary 1994/95 harvest is 30,000 bushels (Figure 4.2). On the Potomac River, the preliminary 1994/95 harvest is 1,569 bushels.

An annual fall oyster survey is conducted in Maryland to determine recruitment levels, mortality, disease prevalence and population status. Preliminary observations suggest that spat set was poor during 1994. Disease mortality has decreased to pre-1991 levels but mortality due to a major freshet (influx of freshwater) was significant. The following areas exhibited between 20% and 80% mortality: Cabin Creek and up-river on the Choptank; above Spaniard Point on the Chester River; above a line running from Mountain Point to Rock Hall in the upper Bay; above Swan Point on the Potomac River; and above Mills Point on the Wicomico River (MDNR Shellfish Program, pers. comm.).

Figure 4.1. Maryland commercial oyster landings by season

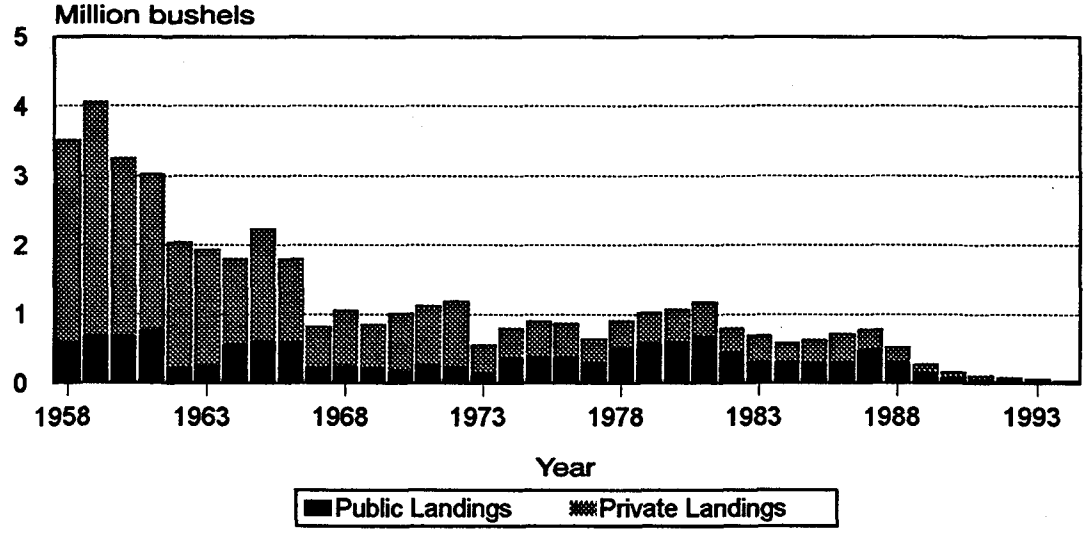


An annual fall survey is also conducted in Virginia. Preliminary observations suggest that spat set was almost nonexistent during 1994 except for the James River. Harvesting in Virginia's portion of the Bay (except the James River) was closed in 1994/95 due to the extremely low population levels. Disease prevalence in 1994 was not significantly different from other recent years. Population levels in the James River appear to be stable primarily due to a shortened workday (12:00 noon) during the past two years. A quota of 80,000 bushels of seed oysters was set for the James River which will probably be caught by the end of March 1995.

Conclusion

The 1989 Chesapeake Bay Oyster FMP was revised during 1994 to reflect the limiting influence of disease and the ecological value of the oyster resource. During 1995, the Bay jurisdictions should focus on implementing the revised plan.

Figure 4.2. Virginia oyster ground production by season



1994 OYSTER FISHERY MANAGEMENT PLAN IMPLEMENTATION MATRIX

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

PROBLEM AREAS & STRATEGIES	ACTIONS	DATE	COMMENTS
	1.3.3. a) VA is conducting an environmental impact assessment on the introduction of a non-native oyster, *C. gigas.* b) MD will conduct an environmental impact assessment on the introduction of a non-native oyster as a contingency plan if the action items in this plan are not enough to increase oyster stocks in the Bay.	Continue Open	Specific guidelines on the research of triploid individuals are being developed. Maryland will utilize the results of the VA assessment to avoid duplicating efforts.
2. Repletion Programs 2.1 Minimize the possibility of spreading MSX and Dermo.	2.1.1. Implement the disease strategies and actions defined in the Disease Section of this management plan to minimize the spread of disease	Variable	Implementation depends on actions defined in the previous management section
2.2 Maintain and adapt current repletion programs to promote natural oyster production and meet the changing needs of the resource.	2.2.1. MD will maintain the state repletion program as funds are available at current levels (2 million bushels of shell & 500,000 bushels of seed if spat set permits). As new initiatives by the MOR are implemented, the repletion program may be modified.	Continue	The amount of shell and seed may be variable from year to year depending on availability. Repletion efforts will be monitored then evaluated after 3 years (1997)
	2.2.2. MD will continue the fall dredge survey.	Continue	The survey provides data on oyster mortality, recruitment (spat set), and disease patterns that help direct the repletion
	2.2.3. MD will provide fresh shell to the state hatchery and community groups for habitat enhancement and develop a policy on the minimum desiccation period to prevent the spread of MSX and Dermo with fresh shell.	1995	
	2.2.4. MDNR will support the ORA efforts by providing the program with a percentage of available shell. The amount of shell will be determined annually.	1995	For 1994/1995, 200,000 bushels of shell will be available.
	2.2.5. VA will restore two major areas where setting is good, the James and Rappahannock Rivers, forming sanctuaries for maintaining the stock.	Begin in 1994	Restoration efforts will include: locating the best substrate; prohibiting harvest; adding shell or other material to build reef structure; adding seed; and, monitoring growth
	2.2.6. VA will turn and clean or add cultch to oyster beds near sanctuary reefs in the James and Rappahannock Rivers to prepare them to receive spat set from sanctuary areas.	1995	The cleaning and shelling procedure will include: identifying the best areas; delineating the best time; monitoring growth; setting a harvest quota; and, implementing the quota.

PROBLEM AREAS & STRATEGIES	ACTIONS	DATE	COMMENTS
	2.2.7. a) Continue to monitor the repletion efforts and adjust the timing and location of shell and seed planting based on the best available data. b) VA will establish a computer data-base system to monitor the progress of the repletion program on a bar by bar basis.	a) Continue b) 1995	Maryland has been compiling a computer-based oyster data system as an on-going effort.
	2.2.8. When the hatchery production of seed is adequate to meet planting needs, the repletion programs will be modified to eliminate the spread of disease with seed plantings.	Open	Implementation is dependent on seed production.
3. Habitat/Water Quality 3.1 Conduct a phased program to evaluate and implement projects to restore the physical habitat for oysters.	3.1.1. Restore physical oyster habitat through the Maryland and Virginia Aquatic Reef Program.	Variable	See specifics in the 1994 Aquatic Reef Habitat Plan.
	3.1.2. Redefine sanctuaries with adequate geographic extent and distinctiveness.	Variable, beginning in 1994	
	3.1.3. Evaluate innovative techniques for restoring physical oyster habitat, conduct projects such as cleaning bottom areas, and evaluate optimal physical structures and alternative materials for rebuilding oyster bars.	1995	
3.2 Will work to ensure that water quality is maintained at levels necessary to support healthy oyster populations.	3.2.1. Current programs established under the CBP to reduce pollutant sources that adversely affect oyster stocks will be maintained.	Continue	The Tributary Strategy will work to identify specific measures to protect and restore water quality for the benefit of living resources including Bay oysters.
	3.2.2. Local, state, and federal agencies will utilize their permitting and environmental review programs to ensure that oyster habitat is not adversely affected by the discharge of pollutants, dredging, and other human activities.	Continue	

PROBLEM AREAS & STRATEGIES	ACTIONS	DATE	COMMENTS
	3.2.3. The ORA advisory committees will assess the potential impact of activities which may adversely affect oysters inn ORA's and provide recommendations to the appropriate agencies for prevention and restoration of adequate water quality.	1995	
4. Management to Increase Oyster Production 4.1 Work to improve and increase oyster production in the private and public oyster fisheries.	4.1.1. Prepare a comprehensive analysis of past and current oyster culture techniques and other relevant areas to help focus effort and finances into projects with the best chances of success.	1995	Existing expertise and experience in the National Marine Fisheries Service will be utilized.
	4.1.2. MD will increase the hatchery production of oyster larvae and seed oysters by maximizing production at Horn Pt. and using fresh shells supplied by MDNR.	Continue	Field surveys are currently underway to evaluate plantings of hatchery reared seed which will guide utilization of larvae and seed from state facilities.
	4.1.3. MD will establish remote setting sites for eyed-larvae purchased from public or private hatcheries, in appropriate locations with low levels of MSX and Dermo	1995	
	4.1.4. Encourage private companies to develop oyster hatcheries.	1995	Encouragement will include competitive bidding for contracts to provide oyster larvae and seed for ORA's and other areas.
	4.1.5. Initiate a grant program with matching funds provided by private industry, to stimulate the development of innovative techniques for oyster restoration, culture and production.	Dependent on funding	
	4.1.6. MDNR will establish a pilot permitting program for oyster aquaculture demonstration projects.	1994	As of February 1994, a draft document entitled, Oyster Aquaculture Permit Guidelines 1994 has been developed (see Appendix V in this plan for details).
	4.1.7. MDNR will establish an aquaculture permit clearinghouse service for applicants.	1994	Includes: designating a single point of contact, tracking permit applications, coordinating state agencies and preparing a permit handbook.

PROBLEM AREAS & STRATEGIES	ACTIONS	DATE	COMMENTS
	4.1.8. Will define the acreage available for leasing oyster bottom.	Variable beginning in 1994	
	4.1.9. The enforcement of property rights relevant to private oyster aquaculture will be added to the public education program.	1995	
	4.1.10. VMRC will develop and operate a depuration facility to utilize oysters in less than optimum water quality situations.	1995	The development of a depuration facility will not lessen the need to continue to improve water quality.
4.2 Reduce and control fishing mortality.	4.2.1. Maryland will utilize specific guidelines to control fishing mortality.	1995	Harvest rates will be determined and adjustments made on annual fishing mortality rates.
	4.2.2. Evaluate the potential advantages and disadvantages of a "slot limit" with a minimum size for harvesting of 2.5" and a maximum size of 4" for areas impacted by disease.	Begin in 1994	Slot limit already in effect for PRFC. MD will collect oysters over 4" from diseased areas and test their resistance to disease. The patent tong survey will provide estimates of the impact of harvesting small oysters from the population.
	4.2.3. VMRC will manage the public oyster grounds in the James River, Rappahannock River, Pocomoke/Tangier Sounds and Seaside Eastern Shore.	Variable	
5. Collection of Management Quality Data	5.1.1. Continue to collect quantitative data on oyster stocks, habitat and diseases and make the information available in an annual report.	Annually	
	5.1.2. VMRC will establish a computer data-base system for the collection, storage and analysis on a bar-by-bar basis, updated weekly, of information to estimate standing stock and establish yearly catch quotas.	1995	Data will include daily entries for total landings, boat numbers, landings per boat, area harvested, and number of harvesters per boat.
	5.1.3. The fisheries agencies will make oyster data available to the research community as needed to investigate suggested research topics or in connection with other research.	1994	

LEGEND:
CBP - Chesapeake Bay Program
MDNR - Maryland Department of Natural Resources
MOR - Maryland Oyster Roundtable
ORA - Oyster Recovery Area
PRFC - Potomac River Fisheries Commission
VIMS - Virginia Institute of Marine Science
VMRC - Virginia Marine Fisheries Commission

Chapter 5
Bluefish Fishery Management Plan

Introduction

The Chesapeake Bay Bluefish Fishery Management Plan was adopted in 1990 and followed the guidelines recommended by the coastal management plan . The coastal plan was prepared by the Mid-Atlantic Fishery Management Council (MAFMC), adopted by the Atlantic States Marine Fisheries Commission (ASMFC) in 1989, and approved by the Secretary of Commerce in 1990. The current mandatory requirements of the ASMFC/MAFMC plan and implementation schedule is as follows:

1) Each state must restrict the possession of bluefish (*Pomatomus saltatrix*) by anglers to not more than 10 fish/person/day or have an ASMFC-approved conservation equivalent. Compliance by: September 1, 1994.

2) Each state (except GA, SC & ME) must restrict its commercial fishery to the quota adopted under procedures specified in the FMP. Compliance by : Immediate.

In addition, the 1994 coastal FMP review team made the following recommendations:

a) Each state enact a license for fishermen to sell bluefish.

b) Each state implement the provisions of the coastal FMP (as stated in #1 & #2).

c) Each state implement allocation systems and controls on the bluefish commercial fishery.

d) The National Marine Fisheries Service (NMFS) target the collection of commercial landings and that statistics on size, age composition and gear type be collected.

e) The states should encourage research on catch and release mortalities and the information provided to recreational anglers.

f) A fee should be charged for all commercial permits issued by the state of landing or the NMFS which would discourage their purchase by recreational anglers trying to circumvent the possession limit.

g) The MAFMC, NMFS and ASMFC should investigate if the total percent share of the commercial fishery which exceeded 20% in 1993 was due to a shift of effort by recreational fishermen from bluefish to other species (ASMFC 1994).

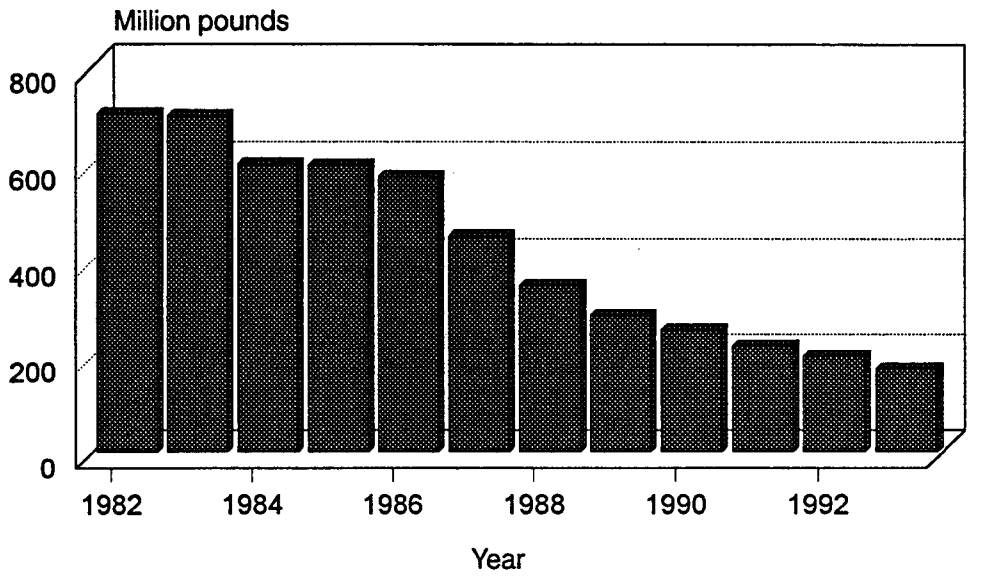
Creel limits and size limits were implemented by the Bay jurisdictions as part of the Chesapeake Bay Bluefish Plan in 1991. The current creel limit is 10 fish/person/ day. In addition, Maryland and the Potomac River have a minimum size limit of 8". The Bay jurisdictions are in compliance with ASMFC/MAFMC recommendations for bluefish. The Chesapeake Bay Bluefish FMP is scheduled for a substantive review in June 1995. The FMP

workgroup will evaluate each strategy and action item in the 1990 plan for its effectivesness in reaching the plan's objectives and make a decision to either revise or amend the plan.

Stock Status and Increased Fishing Pressure

The status of the Atlantic coast bluefish stock has changed from fully exploited to over-exploited and is at a low level of abundance. This determination is based on trends in fishing mortality rates, spawning stock biomass (SSB) levels and recruitment. There has been an increase in fishing mortality from approximately 0.2 (1982) to approximately 0.45 (1993). The current fishing mortality rate exceeds the biological reference point used to define overfishing. The ASMFC Bluefish FMP defines overfishing as $F_{msy} = 0.2$ or the level of fishing at maximum sustainable yield. Spawning stock biomass has declined from 653.6 million pounds (1982) to 172.4 million pounds (1993) (Figure 5.1). Since 1989, recruitment has been below average and the 1993 year class was the lowest since 1975. Because of the current status of the bluefish stock, an ASMFC Bluefish Technical Committee, Advisory Panel, and Plan Development Team were formed during 1994. A Scoping/Informational document was prepared by the MAFMC for a public hearing process which began in December, 1994 and will continue into 1995. When the public hearings are completed, the development of Amendment #1 to the ASMFC Bluefish FMP will begin.

Figure 5.1 Estimated spawning stock biomass for Atlantic coast bluefish stock



The recreational catch of bluefish along the Atlantic coast has steadily declined from 130.9 million pounds (1986) to 30.8 million pounds (1993). The 1993 coastal recreational

landings were considerably lower than the 1979-1993 average of 93.7 million pounds (Kline et al., 1994). The estimated recreational catch of bluefish from Maryland in 1993 was 193,187 fish, a decrease from the 1992 estimate of 621,229 fish (MRFSS). Preliminary MRFSS 1994 recreational landings for the Chesapeake region are not available.

The MAFMC/ASMFC Bluefish FMP defined two indices or triggers for implementing controls on the bluefish fishery. In 1993, it was determined that the criteria for implementing the controls had been met and a commercial quota was recommended for the 1994 fishing season .The quota was calculated using the average recreational catch from 1990-1992 (MRFSS data). The 1994 coastwide commercial quota was 11.4 million pounds. Each state's allocation was based on the 10 year average of commercial landings between 1978 and 1987. Maryland's allocation was 2.8% of the total or 323,000 pounds. Virginia's quota was 10.7% of the total or 1.2 million pounds. Neither state met their 1994 quota. Maryland commercial landings were 155,643 pounds and Virginia landings were 532,000 pounds. States were asked to prepare an implementation plan for monitoring their quotas. Since there were no enforcement measures included in the coastal bluefish FMP, the quota was only considered a "target" quota (ASMFC Bluefish memo, 1993). All state plans for implementing the commercial quota were approved by the ASMFC Bluefish board.

The commercial fishery is projected to equal or exceed the 20% limit during 1995 and will require a commercial quota. The original purpose of a quota was to maintain historical allocations of harvests between commercial and recreational fisheries and, as written, does not require a biological basis. The 1995 quota will be based on a three-year average of the recreational catch between 1991and 1993. The average coastal recreational harvest during this period was 38.3 million pounds. If the 38 million pounds is the allowable 80% recreational harvest, the allowable 20% commercial harvest for the entire coast is 9.6 million pounds, i.e. 38,332,000 divided by .8 (47,915,000) multiplied by .2 equals 9,583,000. State allocations would then be determined by the total commercial catch in the most recent ten year period (1983-1992). Maryland's allocation for 1995 is 2.9% or 274,373 pounds. Virginia's allocation is 9.5% or 913,788 pounds. The state's percentage and quota will change each year depending on the most recent data for the recreational harvest (3 year average) and commercial landings (10 year average).

Wasteful Harvest Practices

The harvest of "snapper" bluefish (fish < than 12") has increased due to a directed recreational fishery on juvenile fish and as a result of bycatch in the South Atlantic (Kline et al., 1994). As a result, minimum size limits and more restrictive creel limits will be discussed during 1995. "Catch and Release"programs have been initiated for the recreational fishery in Maryland to help educate the general public about the need to minimize over-exploitation and waste in the bluefish and other finfish fisheries. The MAFMC/ASMFC bluefish scoping document has also recognized the need for educational programs promoting conservation.

The bycatch of small bluefish may have been reduced in Maryland by the increased minimum mesh size for gill nets and otter trawls to 3 inches. In Virginia, a 2 7/8 inch minimum mesh size for gill nets was established in 1990, while trawling in all state waters has been prohibited since 1989. The Bay jurisdictions continue to support the use of bycatch reduction devices (BRDs) in the southern coastal fisheries.

As recommended by the MAFMC coastal FMP, a 10 fish recreational creel limit has been in effect in the Bay jurisdictions since 1991 to reduce waste in the recreational fishery. Maryland, Potomac River, and Delaware are the only jurisdictions at this time to implement a minimum size limit as a waste reduction measure.

Research and Monitoring

The Virginia Institute of Marine Science (VIMS) conducts a juvenile trawl survey to monitor the abundance of young fish in the Virginia portion of the Chesapeake Bay and its three major tributaries (James, York, and Rappahannock Rivers). The bluefish juvenile data from this survey suggest that since 1979, strong year-classes occured in 1981, 1984, 1989 and 1990 and poorest year-classes occured in 1979-1980, 1985-1987, and 1991. Data for 1993 and 1994 is incomplete. VIMS also conducts a haul seine survey which targets juvenile striped bass. An index of age 0 bluefish indicates that poor recruitment occured in 1986 and 1992. There is no evidence that the increase in the striped bass stock has adversely affected bluefish recruitment (18th SAW). Bluefish were sampled by month for length and sex through the VMRC Stock Assessment Program. Bluefish ranged between 232.5 mm (9.1") and 917.5 mm (36.1") in length. Based on size data, most bluefish available in the Virginia portion of the Bay were age 1 and 2.

Bluefish were sampled in the mid- and lower Chesapeake Bay during the summer by the Maryland Comprehensive Finfish Program. During 1994, the bluefish sampled from pound nets ranged from 121 mm to 503 mm. Bluefish abundance has historically been variable in Maryland's portion of the Bay due to environmental factors such as temperature and salinity, and stock considerations such as current low stock levels.

Conclusion

The commercial catch of bluefish has been limited to 20% of the total catch (recreational plus commercial landings) by the implementation of a quota system. The change in stock status from fully-exploited to over-exploited will require closer monitoring efforts during 1995. States will also need to consider more restrictive management measures. Areas to be emphasized during 1995 are:

1) Implement and monitor the 1995 commercial quota for bluefish;

2) Consider the recommendations of the coastal FMP Review Team and their implementation.

References

ASMFC 1994. 1994 Annual Review of Interstate Fishery Management Plans: Bluefish. C.Zawacki (ed). October, 1994.

Kline, L.L, C. Moore and D. Keifer. 1994. Report on status of stock and bluefish (Pomatomus saltatrix) fishery management. Special Rept. No. 40 of the Atlantic States Marine Fisheries Commission, December, 1994.

18th SAW. Report of the 18th Stock Assessment Workshop/Stock Assessment Review Committee, NEFSC CRD94-22; Bluefish Assessment, 1994 Report of the SARC Pelagic/Coastal Subcommittee, Mark Terceiro (ed). NEFSC CRD94-15.

CHESAPEAKE BAY BLUEFISH IMPLEMENTATION SCHEDULE

Problem Area	Action	Date	Comments
1. Stock Status & Increased Fishing	1.1.1 Continue to participate in scientific & technical meetings for managing bluefish along the coast & in estuarine waters.	Continue	
	1.1.2.1 Will adhere to state allocations established by the MAFMC/ASMFC if commercial harvests levels meet criteria in the coastal plan.	Continue	A quota of 323,000 pounds was established for Maryland in 1994, 2.8% of the mid-Atlantic projections of 11.4 million pounds. Virginia's quota for 1994 was 10.7% (1,219,000 lbs.) of the total. 155,643 pounds from Maryland and 532,000 pounds from Virginia.
	1.1.2.2 Will continue present licensing requirements for harvest and sale; VA will establish a 10 fish creel limit for its commercial hook & line fishery & pursue a license for that fishery.	1991 Continue	
	1.1.2.3 MD will establish a 10 fish/person/day recreational creel limit. VA & PRFC instituted a 10 fish creel in the summer of 1990. Creel limits and minimum legal sizes may be modified as appropriate.	1991 Continue	A 10 fish creel limit is enforced by the Bay jurisdictions.
2. Wasteful Harvest	2.1.1 A 10 fish creel limit will minimize wastage.	Continue	A 10 fish creel limit is enforced by the Bay jurisdictions (1991).
	2.1.2 Educate the general public about the need to reduce waste in the bluefish fishery.	1991 Continue	Programs geared towards children are helping.
	2.1.3 Assess factors causing waste in the commercial fishery and identify potential solutions.	1991 Continue	
3. Research Needs	3.1.1 Improve the catch and effort data collected from the bluefish commercial fishery in the Bay.	Continue	Mandatory reporting is in effect in all Bay jurisdictions.
	3.1.2 Assess methods for improving recreational & charter catch/effort data needed to evaluate biological and economic impacts.	Continue	
	3.1.3 Encourage research to collect data on bluefish.		
4. Habitat Issues	4.1 Continue to set goals for water quality and habitat, review programs established under the 1987 Bay Agreement.	Continue	

LEGEND: ASMFC = Atlantic States Marine Fisheries Commission MRFSS = Marine Recreational Fisheries Statistics Survey
MAFMC = Mid-Atlantic Fisheries Management Council PRFC = Potomac River Fisheries Commission

Chapter 6
Weakfish/Spotted Seatrout Fishery Management Plan

Introduction

Weakfish

The weakfish (*Cynoscion regalis*) stock from Maryland to North Carolina has been experiencing growth and recruitment overfishing since 1983 (Boreman and Seagraves 1984). An ASMFC weakfish FMP was adopted in 1985 and recommended: a delay in harvest until age 1; the use of trawl efficiency devices (TEDs) in the southern shrimp fisheries; and cooperative interstate research. A Chesapeake Bay Weakfish/Spotted Seatrout FMP was completed in December 1990 and recognized the overfishing problem. The continued decline in weakfish landings prompted the development of ASMFC Amendment #1 in 1992. Amendment #1 proposed a phased reduction in exploitation by 15% during 1992, meeting a 50% reduction by 1995, and restoring the stock over a 10 year period. An interim 25% reduction in exploitation was recommended for 1993 and 1994. Procedures for determining whether a jurisdiction was in compliance with ASMFC recommendations was added to Amendement #1. No State was judged in compliance during 1993 by the Weakfish Technical Committee. States were encouraged to fully implement the recommendations of Amendment #1 during 1994. A draft Amendment #2 has been developed as a provisional measure to stabilize the decline of weakfish stocks until a more comprehensive plan is adopted. Amendment #2 proposes coastwide minimum size limits, a reduction in exploitation by 25% for the 1995/1996 fishing season, minimum mesh sizes and a reduction in bycatch by 50% in the southern shrimp fishery.

Maryland adopted a 14" TL minimum size limit for weakfish and spotted seatrout for the recreational fishery in September 1994 and continued a 12" TL minimum size limit for the commercial fishery. A commercial fishing season for weakfish and spotted seatrout was implemented from October 1 through November 30 (no weekend fishing) for the Atlantic Ocean, its coastal bays and tributaries. In Virginia, the minimum size limit for weakfish varied by gear type and so did the closed season. The commercial size limit was between 9" (pound net & haul seine) and 12" (gill net, trawl). The commercial and recreational hook & line size limit was 14" with a 10 fish/person/day creel limit. The PRFC had a 12" TL minimum size limit for weakfish and spotted seatrout and a 4 fish/person/day creel limit.

With the federal adoption of the Atlantic Coastal Fisheries Cooperative Management Act, ASMFC has issued the following FMP compliance requirements for weakfish (as of August 1994):

1) All states with a directed fishery (MD, VA and PRFC included) must have a 12" minimum size limit or a conservation equivalent. Compliance date: 7/31/94.

2) All states with a directed fishery must implement a harvest control strategy to reduce annual exploitation (the proportion of existing stock harvested in a given period) by 25% for the fishing year 4/1/94- 3/31/95. Compliance date: 7/31/94.

3) All states with a directed fishery must implement a control strategy such that their fishing mortality rates (rate at which fish die due to fishing) do not exceed F=0.34 (F_{20}). Compliance date: 3/20/95.

4) All states with a directed fishery must submit a plan to the Weakfish Management Board implementing the necessary controls for approval or disapproval. Compliance date: 7/31/94.

5) North Carolina, South Carolina, Georgia and Florida must reduce bycatch mortality of weakfish in the shrimp trawl fishery by 50%. Compliance date: 3/30/95. Plans must be submitted prior to June 1 each year.

6) New Jersey, Delaware, Maryland, Virginia, North Carolina and the Potomac River Fisheries Commission must implement appropriate mesh sizes to achieve 75% escapement of minimum size weakfish. Compliance date: 1/1/95.

All state plans for achieving a 25% reduction in weakfish exploitation for the recreational fishery during the April 1, 1995 through March 31, 1996 fishing year, were approved. The PRFC will maintain a 14" minimum size limit and a 10 fish creel limit. Maryland and Virginia will implement one of the combination size and creel limit options as specified by ASMFC (either a 14" size limit and a 10 fish creel or a 12" size limit and a 4 fish creel). Management measures to reduce commercial exploitation during 1995/1996 have not been finalized. Bay jurisdiction commercial proposals include a minimum size limit, minimum mesh size, and seasonal and areal closures. A more comprehensive management scenario will be developed during 1995/1996 (Amendment #3).

Spotted Seatrout

An ASMFC FMP for spotted seatrout (*Cynoscion nebulosus*) was developed and adopted in 1984. Amendment #1 was adopted in 1991 and defined a spawning potential ratio (SPR) of at least 20% to minimize the possibility of recruitment failure. The 1994 ASMFC review team concluded that the goal and objectives of the 1984 plan were still valid but full implementation of the recommendations has not been achieved. The recommendation to establish a minimum size limit of at least 12" TL has occurred in all states that have declared an interest in spotted seatrout (Maryland to Florida). The collection of improved catch and effort data from the commercial and recreational fisheries has also been initiated based on ASMFC recommendations. Additional recommendations that need to be fully implemented include the development of methodologies to monitor stock status such as pre-recruit indices, virtual population analyses, and size composition and the annual incorporation of new data and research findings (ASMFC 1994b). A combined weakfish and spotted seatrout Chesapeake Bay FMP was adopted in 1990.

Overfishing and Stock Status

Weakfish

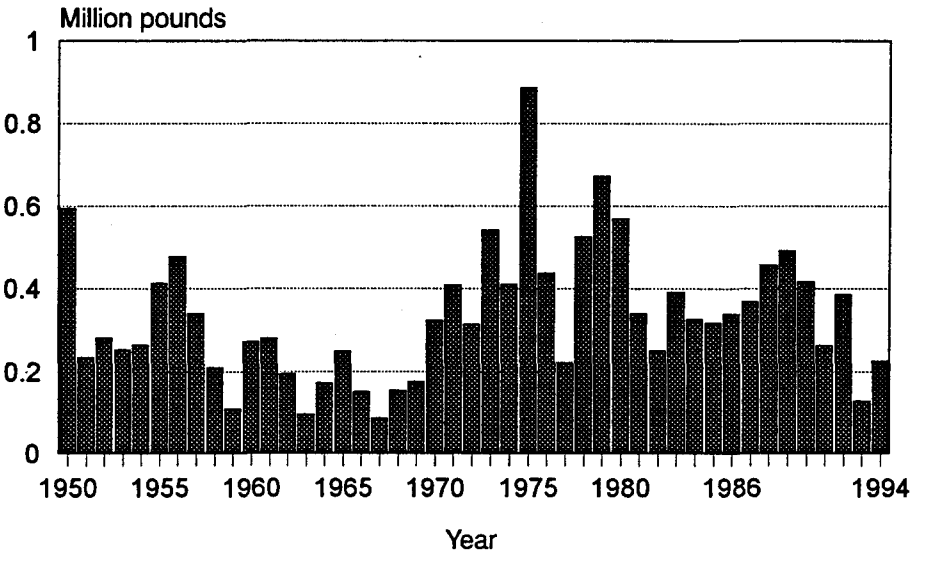
The weakfish stock along the Atlantic coast is overfished. A biological reference point of F=0.22 or exploitation rate of 17% has been defined as a target for the weakfish stock which is equal to a maximum spawning potential of 20% of an unfished spawning stock. Current average annual exploitation has been estimated at 63% or F=1.23. The current average exploitation rate would need to be lowered by 73% to reach the biological reference point (ASMFC 1994a). Comprehensive management measures to reach the reduction in exploitation will be defined in Amendment #3. Until then, Amendment #2 requires a 25% reduction in weakfish exploitation during April 1, 1995 through March 31, 1996. Weakfish recruitment has been low but stable while commercial and recreational harvests, and biomass have declined (ASMFC 1994a).

There is some concern whether the current state plans for managing weakfish adequately implement fishing controls relating to the landing of fish from the EEZ. Weakfish harvest from the EEZ has comprised from 52% to 55% of the coastal harvest in the past two years. The ASMFC weakfish FMP would be less effective if the EEZ harvest is not controlled.

In 1994, the commercial harvest of weakfish was 224,000 pounds from Maryland and 1.0 million

pounds from Virginia (Figures 6.1 and 6.2). In 1994, the Maryland harvest increased from 1993 (136,000 pounds) and Virginia landings stayed about the same (1.1 million pounds). Virginia received approval in 1994 to establish an effort reduction for its pound net fishery.

Figure 6.1. Maryland commercial landings for weakfish



Fishermen were allowed to forfeit gear licenses to avoid a seasonal closure. At least 65% of 58 licencees who harvest weakfish used this alternative management strategy for the 1994/95 season (VMRC, weakfish report). A limited entry system has already been established (1994) for pound nets in Virginia which caps existing effort. The 1994 weakfish recreational harvest data from MRFSS is not available. Data from Maryland charterboat logbooks, which only characterizes a portion of the recreational harvest, indicate that 69,000 pounds (50,600 fish) of weakfish were harvested from the Bay and 700 pounds (900 fish) from the coastal areas. Fish caught from the Bay averaged 1.36 pounds while fish caught from the coastal areas averaged 0.78 pounds. Recreational landings from coastal Maryland are probably under-reported due to the non-resident, transient nature of the Ocean City charterboats.

Spotted Seatrout

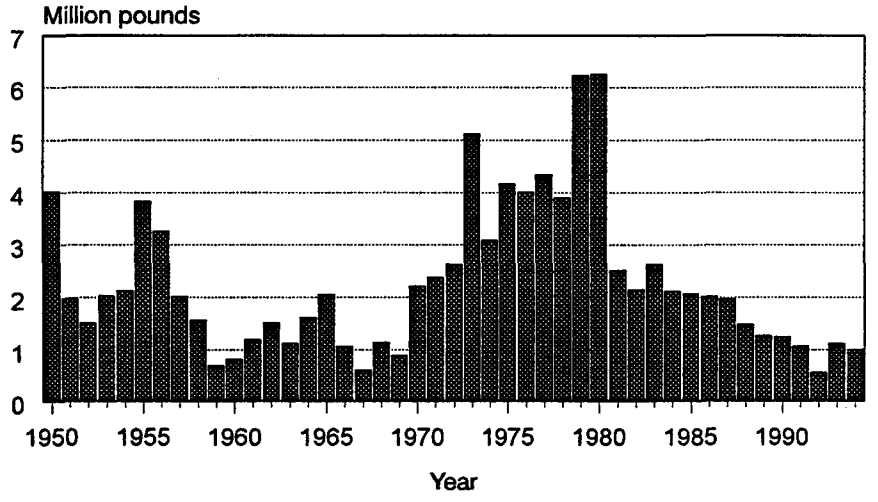
There is not enough catch and effort data to assess the status of the spotted seatrout stock along the Atlantic coast (ASMFC 1994b). Preliminary population analyses of local spotted seatrout stocks from Florida and South Carolina indicate a need to reduce fishing effort in order to maintain a SPR of 20%. Recreational catches of spotted seatrout have averaged 2.0 million fish (MRFSS data, 1984-1993). Recreational fishing pressure has been increasing in the South Atlantic region and there is some concern over declining recreational catches in Florida.

There were no reported commercial landings recorded for spotted seatrout from Maryland in 1993 or 1994. Virginia commercial landings during 1994 was 42,000 pounds, a slight increase from 1993 (38,000 pounds). Data from Maryland charterboat logbooks indicate that 5,000 pounds (4,500 fish) were harvested from the Bay and 66 pounds (81 fish) were harvested from the coastal areas. Fish caught in the Bay were larger than fish caught from the coastal areas.

Bycatch

The catch of small weakfish and spotted seatrout in non-directed fisheries and subsequent mortality associated with the discard is a problem. The use of experimental escape panels in Virginia pound nets has been investigated as an alternative option to reducing exploitation of weakfish in the Bay. Two years of field work has shown this option reduces the incidental take of weakfish less than 10" TL. Virginia has submitted a proposal for funding under the SK grant program to further quantify the percentage of weakfish (under 10") released by this device. This research is intended to provide ASMFC with a quantitative evaluation of the reduction in small weakfish caught in pound nets with escape panels installed.

Figure 6.2. Virginia commercial landings for weakfish



Losses to the weakfish stock from the scrap/bait fisheries have been included in the most recent stock assessment for weakfish. Estimates of scrap/bait landings were based on data from the Virginia and North Carolina trawl, pound and haul seine fisheries. In order to estimate weakfish bycatch in the southern shrimp fishery (Georgia through North Carolina), a ratio of 0.25 pounds of weakfish to 1 pound of shrimp was utilized. Nearly 90% of the estimated weakfish discards are age 0 fish (Gibson 1994). Assessments have shown that discards of fish from the southern shrimp trawl fishery reduces weakfish yield per recruit and spawning stock biomass per recruit (Vaughan et al. 1991, Crecco 1993). Southern states are required to reduce the bycatch of weakfish (Amendment #2). To date, only the North Carolina shrimp trawl fisheries have implemented management measures to achieve a 50% reduction in bycatch.

Field studies and testimonies by fishermen have disputed the accuracy of current theoretical lengths used to determine mesh size requirements for weakfish. Changes in gill net and trawl minimum mesh sizes recommended by ASMFC have been placed on hold until more information is compiled on mesh selectivity. An empirical mesh selectivity study is needed to determine the effects of fish density, net hanging aspects, area, season, and fishing techniques (Weakfish Amendment #2). Several coastal states are participating in minimum mesh size studies and data will be available in 1995.

Research and Monitoring

There are trawl surveys conducted along the Atlantic coast that determine a juvenile index for weakfish and large trawl surveys that sample population characteristics (age, length, weight, CPUE). Population characteristics are also sampled from commercial fisheries. During 1994, the Maryland Multifish Project sampled commercial pound nets from the mid-Bay region [Pt. Lookout (Potomac River) to Stillpond Cr. (Sassafrass R.)]. Weakfish ranged from 216 mm (8.5") to 394 mm (15.5") with a mean length of 290 mm (11.4"). The Maryland Marine Fisheries Project sampled juvenile weakfish (< 203 mm or 8") from the coastal bays. The 1994 weakfish trawl index was 4.3, ranking 5th over 23 years (Casey et al., in prep.). Virginia monitored weakfish population characteristics from both the recreational and commercial fisheries. During 1994, the Stock Assessment Program processed 13,830 fish. Weakfish ranged from 152.4 mm (6") to 795.0 mm (31.1") with a mean length of 302.3 mm (11.9").

There are no spotted seatrout research projects currently in progress in Maryland or Virginia. There are several research projects being conducted in the southern Atlantic region which include: determining the rates of utilization and movements of spotted seatrout; locating and mapping spawning aggregations; deriving juvenile abundance indices and relating them to adult abundance; collecting life history information on age and growth, and size and age at maturity (ASMFC 1994b).

Conclusion

The weakfish stock is overfished. Recommendations for reducing exploitation have not been fully implemented by the coastal states and fishing mortality has not decreased. The ASMFC has defined several compliance issues which will become effective during 1995. Currently, the coastal states are required to reduce weakfish exploitation by 25% during 1995/1996. The status of spotted seatrout has not been defined but there is some evidence from the south Atlantic that suggests abundance has decreased. Research projects in the south Atlantic are in progress to help define the situation. The following areas should be emphasized during 1995 for the weakfish and spotted seatrout stocks:

1) Fully implement the ASMFC recommendations to reduce exploitation by 25% during the 1995/1996 fishing season;

2) Continue to collect biological data on both species and monitor the recreational and commercial catch; and

3) Continue to coordinate with ASMFC and the MAFMC to coordinate management activities between state waters and the EEZ.

References

Atlantic States Marine Fisheries Commission (ASMFC). 1994a. Review of the ASMFC Fishery Management Plan for Weakfish. R.T. Christian (ed.). Special Rept. No. 33.

Atlantic States Marine Fisheries Commission (ASMFC). 1994b. Review of the ASMFC Fishery Management Plan for Spotted Seatrout. R.T. Christian (ed.). Special Rept. No. 33.

Boreman, J. and R.J. Seagraves. 1984. Status of weakfish along the Atlantic coast, 1984. Nat. Mar. Fish. Ser., NEFC, Woods Hole Lab. Ref. Doc. No. 84-19, p.27.

Casey, J.F., S.B. Doctor, and A.E. Wesche. (in prep). Investigation of Maryland's Atlantic Ocean and coastal bay finfish stocks. Fed. Aid. Proj. No. F-50-R-3. MDNR, Tidewater Admin., Fisheries Division.

Crecco, V.A. 1993. Changes in F_{20} and F_{20sp} for Atlantic coast weakfish following increases in the minimum size limit and reductions in current F. Connecticut Division Marine Fisheries. Report to the ASMFC weakfish technical committee.

Gibson, M.R. 1994. Alternative estimates of weakfish bycatch in shrimp trawl fisheries in the South Atlantic using shrimp effort and relative weakfish abundance data. Report to the ASMFC Weakfish Technical Committee, Nov. 1994.

Vaughan, D.S., R.J. Seagraves and K. West. 1991. An assessment of the status of the Atlantic weakfish stock, 1982-1988. Special Report No. 21. Atlantic States Marine Fisheries Commission.

CHESAPEAKE BAY WEAKFISH/SPOTTED SEATROUT IMPLEMENTATION MATRIX

Problem Area	Action	Date	Comments
1. Overfishing	1.1.1 MD, VA & PRFC will continue stock assessment work & analyses of catch/effort data described in Action 2.1 to improve management measures for controlling overharvest.	Continue	The weakfish stock is overfished. Recommendations for reducing exploitation have not been fully implemented by the coastal states and fishing mortality has not decreased. The ASMFC has defined several compliance issues.
	1.1.2.a) MD & PRFC will propose an increase in the minimum size limit for weakfish from 10" to 12";	In effect	PRFC implemented a 14" size limit for their recreational and commercial fishery for weakfish.
	b) VA will continue to enforce its minimum size limit of 9" for weakfish;	No longer applies	VA. has implemented a 10" size limit for the haul seine & pound net fisheries and a 12" minimum size limit for H&L and gill net with a 10% tolerance by weight.
	c) Bay jurisdictions will pursue discussions on a consistent baywide minimum size for weakfish.	No longer an issue	
	1.1.3 MD, PRFC & VA will continue to enforce their 12" minimum size limit for spotted seatrout.	Continue	PRFC has a 13" minimum size limit (1992); VA has a 14" size limit with a 5% tolerance for haul seine & pound nets; MD has a 12" size limit (1993).
	1.1.4 MD will continue its Delay of Application program for commercial fishing licenses to control fishing effort. VA will continue to pursue a limite & delayed entry program.	Not applicable	MD adopted a limited entry law during 1994 which supercedes the delayed entry program. VA implemented a delayed entry program (1993) and has limited entry authority.
	1.1.5 MD, PRFC & VA will evaluate recreational & commercial creel limits for weakfish & spotted seatrout H&L fisheries, & implement them as needed.	1994	All Bay jurisdictions adopted a minimum size limit for weakfish and spotted seatrout and had a 10 fish/person/day creel limit in effect.
	1.2 a) MD will collect information from pound net, ocean gill net & ocean trawl fisheries to develop managment strategies for reducing the non-directed bycatch of small weakfish and other species;	Continue	VMRC continued its stock assessment activities including collecting biological data on weakfish. MD collected length frequency data from Multifish and Marine Monitoring projects. Weakfish were also sampled from the ocean trawl fishery.
	b) VA will continue to monitor the species composition & biological characteristics of bait harvested in its pound net fishery. Will take action as needed to reduce the incidental bycatch of small weakfish;	Continue	VA has continued experimenting with the use of escape panels in pound nets. Continued working with Nroth Carolina on the escapement of small weakfish.
	c) MD, PRFC & VA will work through MAFMC/ASMFC to encourage protection of immature weakfish caught in NC fisheries.	Continue	The jurisdictions continue to work with ASMFC/MAFMC to promote the use of bycatch reduction devices (BRDs).
2. Stock Assessment & Research Needs	2.1 a) Continue to support stock identification research. Coordinated studies on the relative contribution of various estuaries to the coastal weakfish stock will be initiated.	Continue	

Problem Area	Action	Date	Comments
	b) Continue VMRC's stock assessment to collect biological data from commercial catch. A weakfish population study including mortality estimates & yield models is proposed;	On-going	
	c) Continue to collect landings data, sample pound nets, pursue limited & delayed entry, & require mandatory reporting; supplement MRFSS & charterboat logbooks.	Continue	
	d) Continue baywide trawl survey.	On-going	MD and VIMS trawl surveys provide some data on juvenile weakfish abundance.
3. Habitat Loss and Degradation	3.1 1-7) Continue to set specific objectives for water quality goals & review management programs.	Continue	
4. Recreational & Commercial Conflicts	4.1 Continue to address fishing conflicts & issues with existing advisory groups.	Continue	
	4.2 a) VMRC adopted a uniform marking system & a minimum mesh size of 2 7/8" for gill nets in tidal waters.	Continue	
	b) MD adopted a marking system based on VA's scheme for drift gill nets in the striped bass fishery.	Continue	

LEGEND:

ASMFC= Atlantic States Marine Fisheries Commission
MAFMC= Mid-Atlantic Fisheries Management Council
MRFSS= Marine Recreational Fisheries Statistics Survey
PRFC= Potomac River Fisheries Commission
VIMS= Virginia Institute of Marine Science
VMRC= Virginia Marine Resources Commission

Chapter 7
Summer Flounder Fishery Management Plan

Introduction

An Atlantic State Marine Fisheries Commission (ASMFC) Management Plan for summer flounder (*Paralichthys dentatus*) was adopted in 1982. The Mid-Atlantic Fishery Management Council (MAFMC) completed and adopted a federal plan for summer flounder in 1988. Several amendments have been jointly developed by ASMFC and the MAFMC since the adoption of the plans, and provide a comprehensive management program for summer flounder. The most recent amendment, #6, was approved in May, 1994. It allows nets with a cod end mesh size less than that established in the plan, on a vessel if they are properly stowed. It also changed the specifications for setting recreational management measures until after the Marine Recreational Fishery Statistics Survey (MRFSS) data are available. The current mandatory requirements for summer flounder are as follows (ASMFC Schedule for Compliance, FMPs):

1) Each state must submit a plan for managing its commercial quota including plans for size limits and mesh regulations for the 1995 fishery.

2) Each state shall close its summer flounder commercial fishery and prohibit landings when its quota is reached.

3) Each state shall establish a 13 inch minimum size limit for its commercial fishery.

4) Each state shall establish a minimum mesh size of 5 1/2 inches for trawl nets, as specified in the management plan.

5) Each state shall establish a 14 inch (TL) minimum size limit for its recreational fishery.

6) Each state (except Maine and New Hampshire) shall establish a possession limit for its recreational fishery. (The creel limit for 1994 was 8 fish/person/day and will be the same for the 1995 recreational fishery.)

7) Each state (except Maine and New Hampshire) shall establish a recreational fishing season. (The 1994 season was April 15-October 15. For 1995 is no season.)

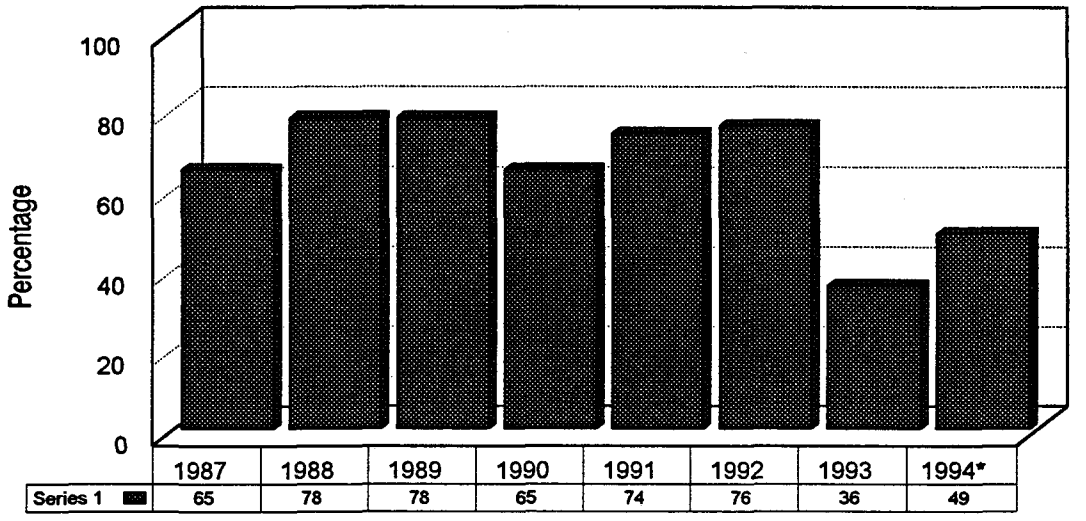
The Bay jurisdictions are currently in compliance with ASMFC/MAFMC recommendations. In 1991, the Chesapeake Bay Program developed and adopted a FMP for flounder following the ASMFC/MAFMC guidelines and addressing issues relating to the the stock in the Chesapeake region. The status of the Chesapeake Bay Summer Flounder FMP has been reviewed annually since 1992 (Annual Progress Report for FMPs, 1992 & 1993). The following is an update on the status of the stock and management measures that have occurred during 1994. For complete details, refer to the 1991 Chesapeake Bay Summer Flounder Fishery Management Plan.

Stock Status

The summer flounder stock is overfished but management measures recommended by the MAFMC/ASMFC and implemented through the Chesapeake Bay Summer Flounder FMP have been

successful at reducing exploitation. Data from the NMFS Northeast Fisheries Science Center spring survey indicate a stable level of spawning stock biomass during 1993-1994. Over the last 10 years, fishing exploitation has been between 46% and 78% (SAW 1994). With the implementation of a commercial quota and comparable recreational restrictions, the fishing exploitation rate dropped from 76% in 1992 (F=1.7) to 36% in 1993 (F=0.54) (Figure 7.1). A target fishing mortality rate of F=0.53 was set for 1993-1995 by MAFMC/ASMFC.

Figure 7.1. Exploitation rates for summer flounder stock



MAFMC data * Preliminary data

The summer flounder stock has been managed under a coastwide quota since 1993. The allocation of the coastal quota between the commercial and recreational fisheries is based on historical data, with 60% of the total quota allotted to the commercial fishery and 40% to the recreational fishery. The 1994 coastwide recreational harvest limit for summer flounder was 10.7 million pounds. The 1994 limit represented a 30% increase in harvest from 1993, identical to the increase in commercial quota (Table 7.1). The 1994 commercial quota was 15.6 million pounds, with 324,100 pounds allocated to Maryland and 3.2 million pounds allocated to Virginia. State allocations are also based on historical commercial records with 2% of the catch allotted to Maryland and 21.3% allotted to Virginia. The 1994 commercial quota was adjusted in November 1994, to 18.6 million pounds as a result of a court order. The adjusted 1994 allocations for Maryland and Virginia, were 335,196 pounds and 3.9 million pounds, respectively. In recent years, between 85% and 90% of the commercial harvest landed in Maryland and Virginia has been harvested from the EEZ (3-200 miles offshore).

Fishing mortality is expected to increase to between 0.7 and 0.8 with the landing of the adjusted 1994 quota (ASMFC 1994). As of January 1995, the total commercial harvest during 1994 was 14.3 million pounds or 77% of the adjusted 1994 commercial quota. During 1994, Maryland harvested 160,400 pounds or 48% of its allocation and Virginia harvested 3.0 million pounds or 78% of its allocation. The projected increase in fishing mortality may not be as high as expected because the quota was not reached. However, fishing mortality is still expected to increase because of poor recruitment in 1993 (the lowest since 1988) and

an increase in the exploitation of younger fish (SAW 1994). The age composition of the stock remains truncated with only 12% of the spawning stock biomass at age 3 and older. A recovered, "healthy" stock is expected to have 77% of the spawning stock biomass at age 3 and older. Expanding the age structure of a stock has several advantages. Since the summer flounder fishery is dependent on incoming recruitment, protection of the most recent year classes is important. Protecting older fish increases egg production as larger and older females are usually more fecund.

Table 7.1. Management Measures Implemented for the Summer Flounder Stock

MANAGEMENT MEASURES	1993	1994	1995
Coastwide harvest (millions of lbs)	20.7	26.7	22.5
Commercial quota (millions of lbs)	12.4	16.0	14.7
Recreational harvest (millions of lbs)	8.4	10.7	7.8
Commercial minimum size (inches)	13	13	13
Minimum mesh size (inches, diamond/square)	5.5/ 6.0	5.5/ 6.0	5.5/ 6.0
Recreational size limit	14	14	14
Recreational creel limit	* 6	8	8
Recreational season	May 15- Sept 30	**Apr 15- Oct 15	Open year-round

* MD not in compliance with a 10 fish creel; VA and PRFC not in compliance with a 10 fish creel and no season.
** VA season May 1-Oct 30; MD season May 1-Nov 30; PRFC season May 27-Oct 31.

Overfishing

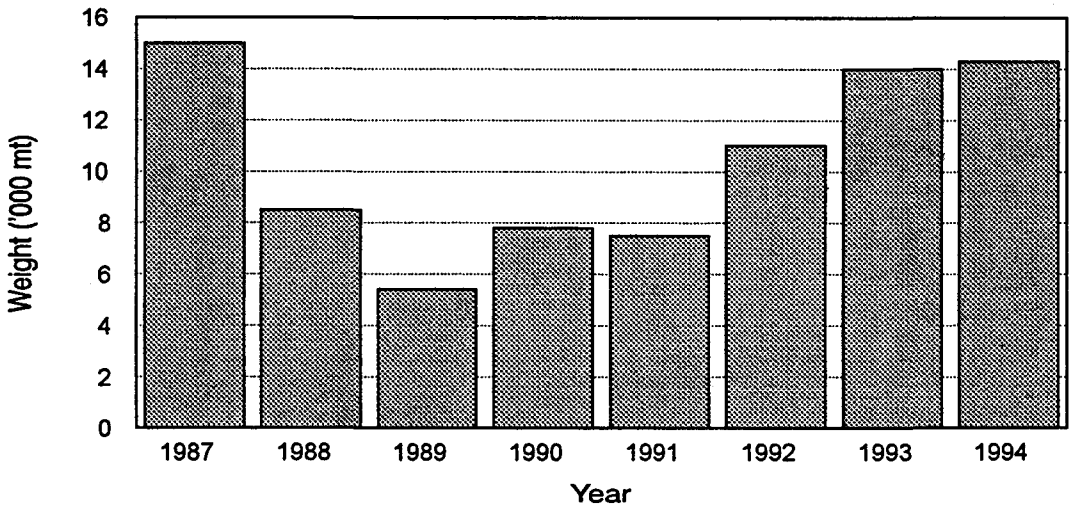
Overfishing for the summer flounder stock has been defined by MAFMC/ASMFC as fishing in excess of the F_{max} level or F=0.23. Over the last ten years or more, fishing mortality has been higher than F_{max}. Implementing a quota system for the management of summer flounder has significantly reduced fishing mortality. The F_{max} level equates to a spawning stock biomass (SSB) per recruit level of 20%. Spawning stock biomass reached a low in 1989 but since then, has been gradually rebuilding (Figure 7.2). The 1994 SSB is expected to be close to the 1993 level.

The Bay jurisdictions will implement the 1995 summer flounder quota recommended by the MAFMC/ASMFC. The jurisdictions will use the commercial landings data collected by NMFS to monitor commercial catch and close the commercial fishery if/when the quota is reached. The 1995 quota is 299,551 pounds and 3.1 million pounds for Maryland and Virginia, respectively. Minimum size limits (13" commercial & 14" recreational) and minimum mesh sizes will remain in effect. An 8 fish/person/day creel

limit and a fishing season from January 1 to December 31 is recommended for the recreational fishery.

There is continued concern from commercial and recreational fishermen about the disparity between the recreational and commercial size limits. The NMFS data on mesh sizes indicate that 50% of the 13" summer flounder caught by 5.5/6.0 inch meshes will escape. It is the intent of the MAFMC that both fisheries target fish greater or equal to 14 inches. The 13" commercial limit was allowed in order to minimize the discard mortality in the fishery.

Figure 7.2. Estimated spawning stock biomass for summer flounder



MAFMC data

The bycatch of flounder in non-directed fisheries and discard mortality associated with the catch of undersized fish have been defined as problems for the stock. Currently, summer flounder may only be landed by those vessels with moratorium permits. However, fishermen harvesting scallops (using dredges) may land as many flounder as they catch, as long as they meet the minimum size limit, trip limit or closures that are in effect. The scallop fishery is managed under the Atlantic Sea Scallop FMP which has implemented a moratorium on entry into the fishery and has limited effort. The issue currently under discussion is whether to allow sea scallop fishermen to land their bycatch of flounder when a state closure is in effect. Discard data from the offshore trawl fishery has been examined by the stock assessment committee. Based on length frequency data from 1989-1992, proportions at age, length at age, and weights at age were used to characterize the 1993 summer flounder commercial fishery. Preliminary results suggest that large quantities of summer flounder are not being discarded due to trip limits or seasonal fishery closures (SAW 18).

Amendment #1 (see attachment #1) to the Chesapeake Bay Summer Flounder FMP was drafted during 1994 in response to the coastal commercial quota and the small percentage allocated to Maryland. Acceptance of the amendment would give Maryland the authority to develop a limited entry program for the commercial summer flounder fishery. The amendment has been endorsed by the FMP Workgroup. It will be

sent to the Living Resources Subcommittee for approval and then to the Principal Staff Committee for adoption during 1995.

Stock Assessment and Research Needs

The Stock Assessment Review Committee (SARC) prepared an updated stock assessment of the coastwide stock of summer flounder between 1989 and 1993; provided catch and SSB options at various levels of fishing mortality; and provided catch and SSB forecasts. Indices of abundance are currently calculated from data obtained by the NEFC offshore survey, the Massachusetts spring and fall inshore surveys, the Connecticut fall trawl survey, and the Rhode Island fall trawl survey. Young-of-the-year indices are available from North Carolina, Virginia, Maryland, Delaware, Rhode Island and Massachusetts. Information from these states indicate that the spatial distribution of recruitment success may not be uniform over a geographic range (SAW 18).

The Virginia Institute of Marine Science (VIMS) juvenile fish trawl survey has been a good indicator of year-class strength for summer flounder. The VIMS indices for 1992 and 1993 were the lowest years in the survey since 1987 and 1988. The 1994 index was 1.1. The VIMS trawl survey samples only the Virginia portion of the Bay and does not include coastal areas. Maryland DNR conducts a trawl survey in the coastal bay area which samples juvenile flounder. The 1994 index was the fourth highest value over the last 23 years at 8.2 fish per tow (Figure 7.3). Fishery-dependent sampling in the mid-Bay area (MD Multifish Project) indicated that both young-of-the-year and adult fish are caught by pound nets. Fish were most abundant between 317 mm and 394 mm (12.5" and 15.5"). Estimated coastwide recruitment (Age 0) decreased from 42.8 million fish (1992) to 20.5 million fish (1993). Predicted recruitment for 1994 has been calculated at 32.2 million fish (SAW 18). The VMRC stock assessment data indicate that 5.5% of summer flounder sampled (n=2984) from the commercial fishery in state waters (all gear types) were less than 330 mm (13"). Pound nets, which landed the majority of summer flounder caught in state waters, had 5.9% of the sample catch (n=2761) measuring less than 13".

Research recommendations by the stock assessment committee include: continued sea sampling programs to monitor the effects of FMP management actions and quantify discard levels; continue the winter trawl survey to provide precise indices of abundance and mortality estimates; update the biological reference points to reflect the different partial recruitment of age 1 fish; update the recruitment indices through 1993; update maturity schedules and fecundity estimates based on histological examination of summer flounder ovaries; and revise recreational catch statistics after the MRFSS data is revised.

Conclusion

The summer flounder stock continues to be overfished but the implementation of a coastwide quota has been successful at reducing exploitation. Exploitation rates from 1992 to 1993 decreased from 76% to 36%. The exploitation rate is expected to increase as a result of a poor recruitment in 1993 and increased exploitation of younger fish. Spawning stock biomass has been gradually rebuilding from a low in 1989. The age structure of the stock continues to be compressed with few fish older than age 3. The following areas should be emphasized during 1995:

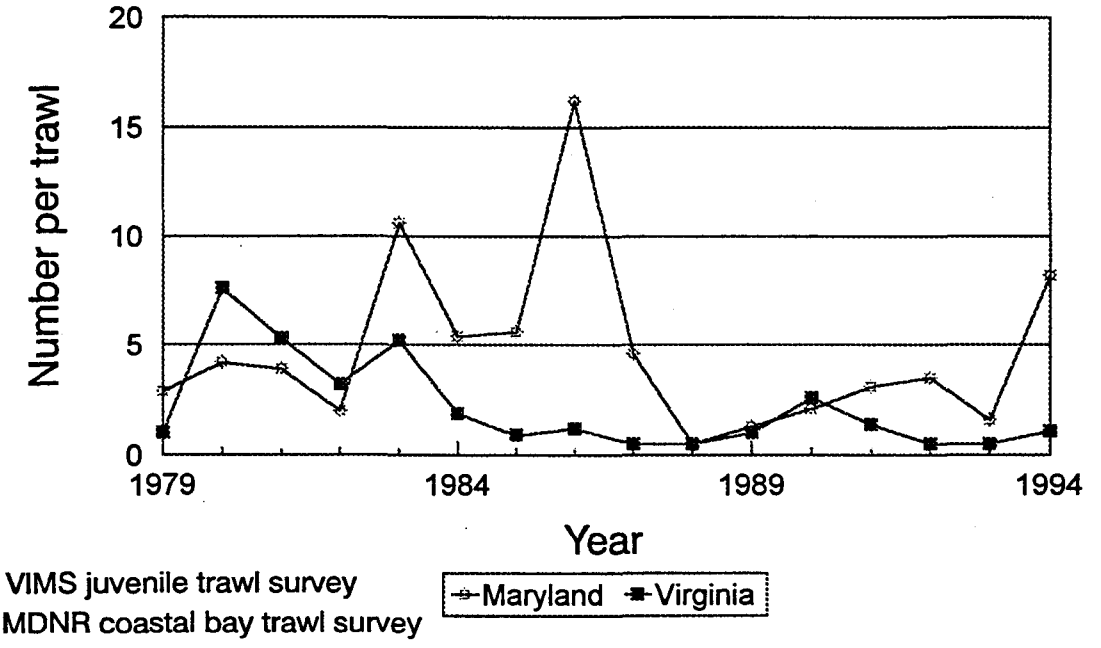
1) Implement the MAFMC/ASMFC recommendations for the 1995 summer flounder fishery;

2) Monitor the 1995 commercial quota and close the fishery if/when it is necessary;

3) Continue research and monitoring efforts to characterize the age structure of the Chesapeake Bay and coastal populations; and,

4) Continue the VIMS and Maryland trawl surveys to monitor recruitment in the Chesapeake Bay region.

Figure 7.3. Summer flounder juvenile indices from Maryland and Virginia



References

Atlantic States Marine Fisheries Commission (ASMFC). 1994. 1994 Annual Review of Interstate Fishery Management Plans. (ed.) R.T. Christian. ASMFC Management and Science Committee.

Stock Assessment Workshop (SAW) 18. 1994. Advisory Report on Stock Status, Northeast Fisheries Science Center, National Marine Fisheries Service, Woods Hole, Massachusetts

CHESAPEAKE BAY SUMMER FLOUNDER IMPLEMENTATION MATRIX

Problem Area	Action	Date	Comments
1. Overfishing	1.1a. MD, VA & PRFC will propose an increase in their minimum size limit for recreationally caught flounder from 13" to 14".	1992 1993	PRFC implemented a 14" size limit beginning in 1992. MD & VA implemented a 14" size limit in 1993.
	1.1b. MD, VA & PRFC will propose creel limits & seasonal restrictions in compliance with MAFMC recommendations.	Continue	The MAFMC recommended an 8 fish creel & an Apr 15- Oct 15 season. Bay jurisdictions implemented an 8 fish creel and different seasons (see Table #).
	1.1c. Commercial size limits will remain in effect for VA & MD; PRFC will propose a 14" size limit. A 5.5" or 6" min. mesh size will be implemented in all directed flounder trawl fisheries.	1992 1993 Continue	PRFC established 14" size limit for the commercial fishery in 1992. MD & VA had a 13" size limit during 1993 & 1994. VA has a ban on trawling in state waters. MD implemented a 5.5" min. mesh size for the directed trawl fishery (beginning 1993).
	1.1d. Commercial fisheries will be subject to a quota administered by MAFMC. Each state's fishery will close when its quota is met.	Continue	Commercial quota system started in 1993 and continued during 1994. MD was allotted 324,100 lbs & VA was allotted 3.2 million lbs.
	1.2a. VA & MD will implement a 5.5" diamond or 6" square mesh in all directed trawl fisheries to allow escapement of immature flounder.	1993 Continue	MD implemented a 5.5"diamond or 6" square mesh for the flounder trawl fisheries in 1993. VA has a ban on trawling in state waters.
	1.2b. VA & MD will promote implementation of 5.5" diamond or 6" square mesh in all EEZ directed founder trawl fisheries.	Continue	The minimum mesh size for trawls in the EEZ went into effect in Nov. 1992.
	1.3a. MD will collect information from pound nets & ocean trawl fisheries to develop strategies for reducing bycatch of undersized flounder & other species.	1993 Continue	MD implemented a pound net sampling program beginning in 1993 and continuing during 1994.
	1.3b. VA will monitor species composition & biological characteristics of its pound net fishery & take steps to reduce bycatch as needed.	Continue	
	1.3c. MD,VA & PRFC will work with the MAFMC & ASMFC to encourage the protection of immature flounder.	Continue	
2. Stock Assessment and Research Needs	2.1 The jurisdictions will conduct stock identification work.		VMRC continued their stock assessment work, collecting length & age data.
	2.2 Continue collection of data from commercial catches.	Continue	VMRC samples commercial fishery in the Bay. MD sampled pound nets and offshore trawl catches.
	2.3 Continue on-going commercial fisheries statistics programs; VA will pursue its mandatory reporting system; VA & MD will continue to supplement the MRFSS.	Variable	Mandatory reporting was implemented in VA (1993). All participants in the summer flounder trawl fishery are required to report in NMFS logbooks.

Problem Area	Action	Date	Comments
	2.4 Continue the baywide trawl survey to measure size, age, sex, distribution, abundance and CPUE.	Continue	MD conducts a multi-species sampling program from pound nets & fykes nets throughout the Bay. Also conducts a juvenile trawl survey in the coastal bays. VIMS also conducts a baywide trawl survey.
3. Habitat Issues	3.1 Promote the objectives of the Chesapeake Bay Agreement to improve water quality.	Continue	During 1994, the Bay Program continued to create and protect habitat, prevent pollution, enhance living resources, educate and involve the public and monitor and measure progress.

LEGEND:

ASMFC = Atlantic States Marine Fisheries Commission
CPUE = Catch per unit of effort
EEZ = Exclusive Economic Zone, 3-200 miles offshore
MAFMC = Mid-Atlantic Fisheries Management Council
MRFSS = Marine Recreational Fisheries Statistics Survey
NMFS = National Marine Fisheries Service
PRFC = Potomac River Fisheries Commission
VIMS = Virginia Institute of Marine Science
VMRC = Virginia Marine Resources Commission

Chapter 8
Atlantic Croaker and Spot Fishery Management Plan

Introduction

The Atlantic States Marine Fisheries Commission (ASMFC) Fishery Management Plans (FMP) for Atlantic Croaker (*Micropogonias undulatus*) and Spot (*Leiostomus xanthurus*) were adopted in 1987. The Commission's recommendations focused mainly on research and monitoring. The South Atlantic Fishery Management Board has asked the ASMFC staff to begin the preparation of an amendment to define management measures necessary to achieve goals of the ASMFC FMP. The current ASMFC FMP does not contain specific management measures and compliance issues. In 1991, the Chesapeake Bay Atlantic Croaker and Spot FMP was completed. Review of the Chesapeake Bay FMP is scheduled for 1996.

Status of the Stock and Fishery

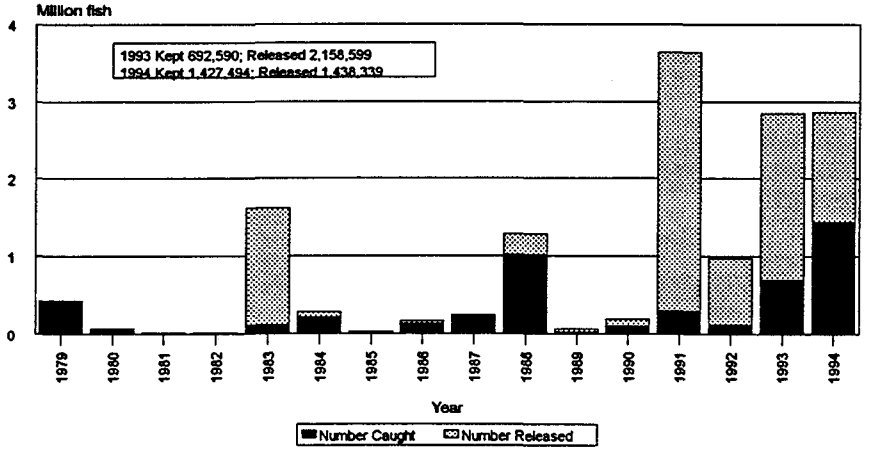
The abundance of croaker and spot in Chesapeake Bay is highly variable and dependent upon environmental conditions. During 1994, the jurisdictions conducted fishery independent and dependent surveys to monitor the relative abundance of croaker and spot within the Chesapeake Bay region.

Atlantic Croaker

Juvenile recruitment is dependent upon survival of winter temperatures. Fishery independent trawl and seine surveys during 1994 indicated recruitment was at moderate levels but was well below recent "dominant" yearclass levels (VIMS 1994; D. Cosden and S. Doctor, MDNR pers. comm.).

Croaker is one of the most frequently caught sportfish in Chesapeake Bay. Marine Recreational Fisheries Statistics Survey (MRFSS) estimated that Virginia sportfishermen caught 14.0 million croaker (includes both kept and released) during 1994. This catch was nearly twice the 1993 estimate of 7.7 million fish. Maryland sportfishermen had another exceptional year with an estimated 3.2 million croaker caught (Figure 8.1). Average weights remained at approximately 0.60 pounds (MRFSS data). Data from Maryland's charterboat logbooks indicated an increase in landings during 1994 with 223,595 fish being harvested at an average weight of 1.04 pounds.

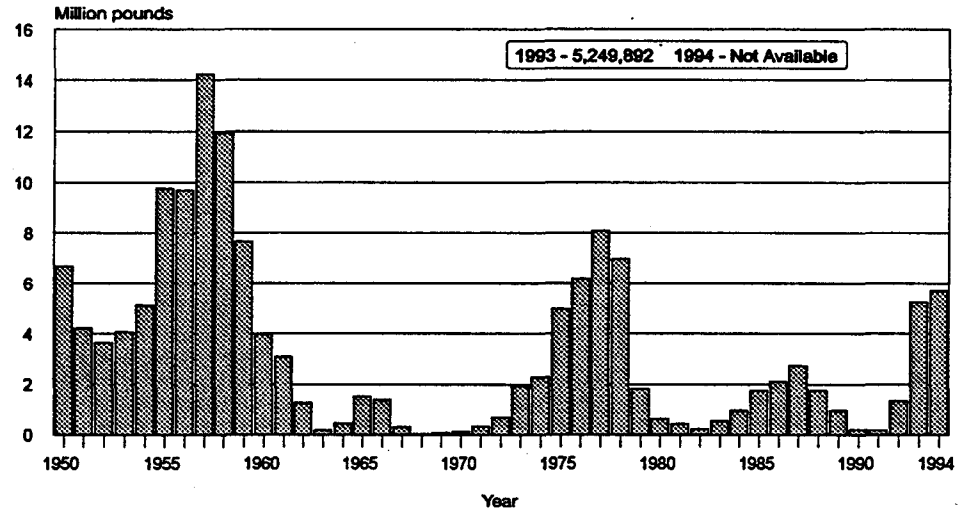
Figure 8.1. Recreational Catch Estimates For Croaker in Maryland*



* 1979 and 1980 catches are combined.
Source: MRFSS data

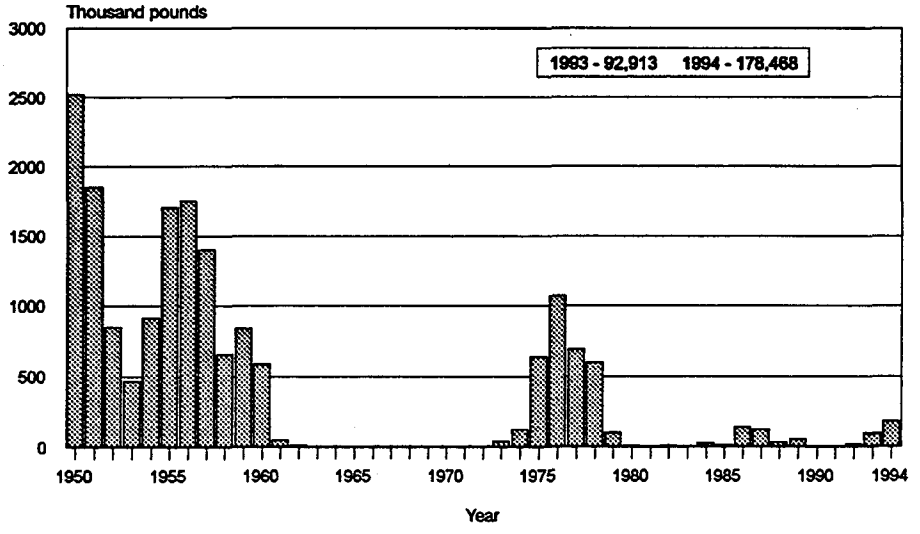
Baywide commercial croaker landings have increased in recent years to levels seen in the late 1970's. During 1993, Maryland and Virginia harvested 93,000 and 5.2 million pounds, respectively. Harvest during

Figure 8.2. Commercial Croaker Landings in Virginia



Source: NMFS data

Figure 8.3. Commercial Croaker Landings in Maryland



Source: NMFS data

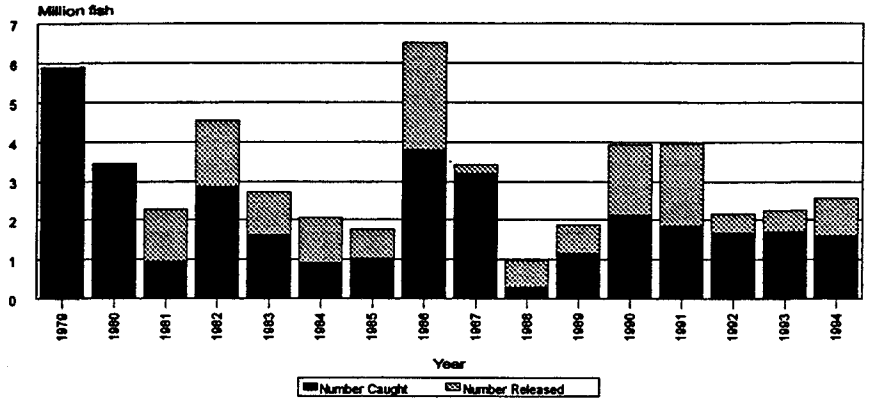
1994 increased to 178,000 pounds in Maryland and 5.7 million pounds Virginia (Figures 8.2 & 8.3). It is difficult to determine the relationship between landings and abundance without effort information. Historic trends indicate that landings increase significantly as strong year classes recruit to the fishery, remain high for a few years, and then decline as the the year class passes through the fishery (Uphoff & Piavis 1993). Croaker indices from baywide juvenile surveys have remained at moderate levels for several years with a strong year class reported from Maryland in 1991. Successive years of good recruitment with a reduction in bycatch from the North Carolina fisheries, appears to be having a positive effect on the croaker population in the Bay.

Spot

Recruitment of spot, like croaker, is highly variable and dependent on environmental conditions. Juvenile spot are a major component in fishery independent trawl and seine surveys along the Atlantic coast. The abundance of juvenile spot in Virginia and Maryland has fluctuated with no apparent trend. Juvenile indices in Virginia during 1994 remained low for the fourth year in a row (VIMS 1994). After five years (1989-1993) of poor recruitment in Maryland, recruitment was average during 1994 (D. Cosden and S. Doctor, MDNR pers. comm.). The appearance of a "dominant" yearclass has not occurred since the late 1980's.

Spot are also one of the most frequently caught sportfish in Chesapeake Bay. The MRFSS estimated that Virginia sportfishermen caught 5.5 million spot (kept and released) during 1994. This was a substantial increase from the 1993 estimate of 3.5 million spot. Maryland spot catch during 1994 was estimated at 2.8 million fish. The Maryland recreational harvest has been between 2.2 and 2.6 million fish since 1992 (Figure 8.4). Average weights in Maryland increased slightly from 0.32 pounds in 1993 to 0.39 pounds in 1994 (MRFSS data). Data from Maryland charterboat logbooks indicate spot catches nearly doubled in 1994 at 754,008 fish and average weights remained at slightly over 0.5 pounds. Since spot are frequently caught and usually not targeted, recreational reporting is probably not as accurate as other species.

Figure 8.4. Recreational Catch Estimates For Spot In Maryland*

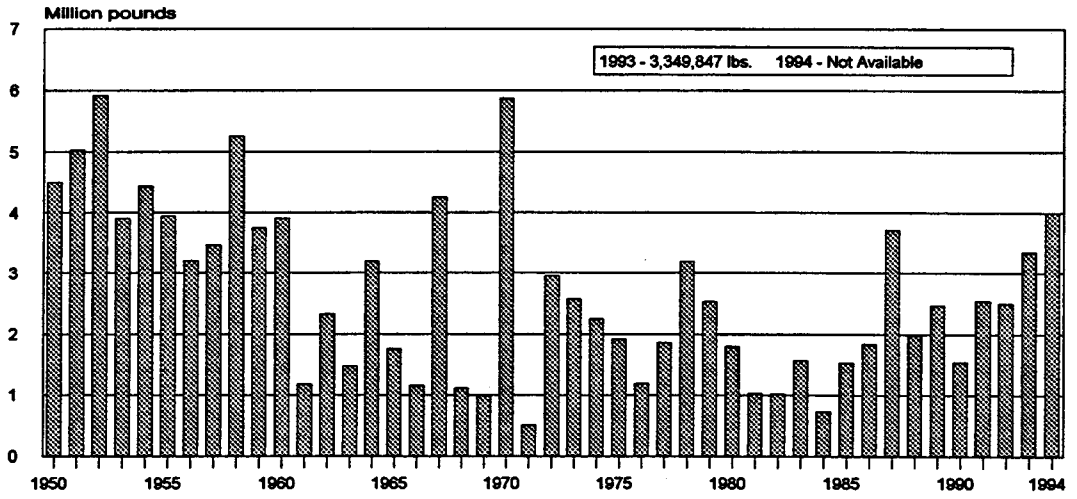


* 1979 and 1980 catches are combined.
Source: MRFSS data

Commercial spot landings within the Chesapeake Bay region, though lower than historical data, have increased slightly during the 1990's (Figures 8.5 & 8.6). However, without catch-and-effort data it is difficult to determine the relationship between landings and abundance. Virginia and Maryland harvested 3.3 million

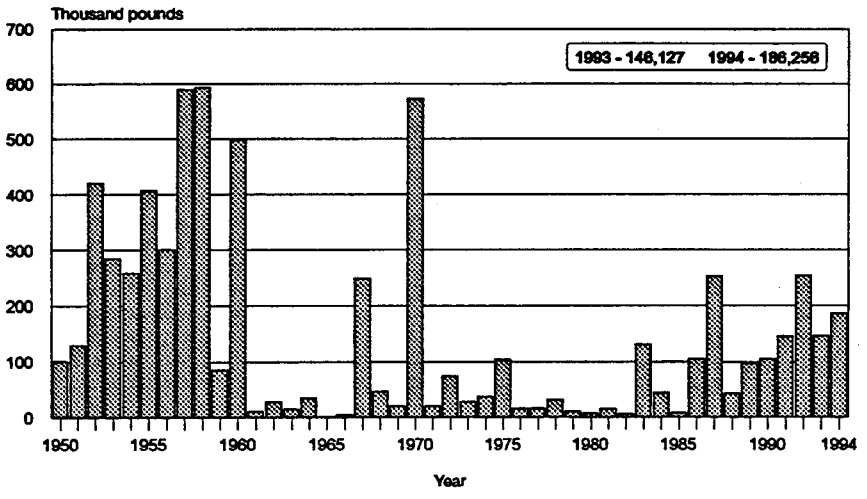
and 146,000 pounds during 1993, respectively. The harvest in Maryland during 1994 increased to 186,000 pounds. Preliminary Virginia commercial landings for spot are approximately 4.0 million pounds.

Figure 8.5. Commercial Spot Landings in Virginia



Source: NMFS data

Figure 8.6. Commercial Spot Landings in Maryland



Source: NMFS data

Increase Yield-Per-Recruit

Bay jurisdictions continue to promote increases in yield-per-recruit by delaying entry into the fishery until at least age 1. Maryland has a 9-inch minimum size limit and 20 fish creel limit for the recreational croaker fishery and a 10-inch minimum size limit for the commercial croaker fishery. The Potomac River Fisheries Commission has a 10-inch minimum size limit for croaker. These harvest restrictions should protect age 0 and a portion of age 1 croaker. Harvest restrictions have not been implemented for Virginia's croaker fishery. A minimum size limit has not been implemented for the spot fishery.

Recruitment to the recreational fishery was examined using MRFSS data. In 1994, almost all croaker (99%) harvested in Maryland were age 1+ according to length-at-age data. Assuming the maximum length of age 0 spot is 200 mm (Geer 1993; Casey et al. 1993), more than 87% of spot sampled in Maryland were age 1+. Although a large number of croaker and spot are released by recreational anglers, a hook-and-release study indicated mortality was negligible (May 1993). The MRFSS length-frequency data for Virginia was not available.

Commercial spot landings from the lower Chesapeake Bay and coastal waters of Virginia and North Carolina (1988-1991) indicated age 1 croaker were not fully recruited to any gears sampled (Barbieri et al. 1994). However, this may reflect the exclusion of scrap fish. Maryland's Multifish Program sampled pound nets for croaker and spot. The 1994 data indicated full recruitment occurred at age 2 and age 1 for croaker and spot, respectively (Piavis et al. 1995). There appears to be size selectivity by gear for spot in Virginia with full recruitment occurring at age 1+ for all gears except pound nets (Geer 1993;VMRC data).

Harvest of Small Croaker and Spot

The bycatch of small croaker and spot in Chesapeake Bay fisheries has not been documented and remains a concern for the stocks. The Bay jurisdictions continue to promote the use of trawl efficiency devises (TEDs) and bycatch reduction devices (BRDs) through the ASMFC and the MAFMC. The potential loss of age 0 croaker and spot as bycatch in the Maryland pound net fishery should be minimal. Maryland's coastal trawl fisheries land few croaker and spot. Minimum mesh size requirements for summer flounder and weakfish probably allow escapement of age 0 croaker and spot. Virginia prohibits trawling and requires a 2-7/8-inch minimum mesh size for gill nets. An escape panel study is ongoing and may provide a means of reducing bycatch in the pound net fishery. Virginia has no size or landing restrictions on croaker or spot, resulting in a scrap market of small fish for crab pot bait, pet food, and fish meal (Geer 1993). Virginia requires mandatory commercial reporting, but estimates of bycatch are unavailable because species composition is not recorded.

Research and Monitoring Needs

Fisheries data continues to be collected for the Chesapeake Bay region but effort and landings statistics are insufficient to determine trends in abundance. The relationship between parental stock size and environmental factors on yearclass strength should be determined. Mortality of age 0 croaker and spot in the Bay should be monitored.

Maryland's Multifish Program uses scales to age croaker. The accuracy in determining croaker age from scale patterns is approximately 60%. For this reason, Maryland stopped aging croaker during 1994 and now relies upon age 1 length data to monitor management objectives. A recent study reported an otolith-ageing procedure which was more precise (>99%) within and among readers (Barbieri et al. 1993). Otoliths

appear to be the best structure for ageing croaker in the Chesapeake Bay (Kline 1993). It would be an improvement in determining age of croaker to switch from scale age analysis to otolith analysis.

The VMRC Stock Assessment Program collected biological information on both croaker and spot during 1994. A total of 15,498 croaker were measured and ranged between 160 mm (6.3") and 424 mm (16.7"). The average croaker size was 264 mm (10.4"), similar to the 1993 (n=16,890) average of 254 (10.0"). A total of 10,213 spot were measured and ranged between 145 mm (5.7") and 284 mm (11.2"). The average spot size was 234 mm (9.2") compared to the 1993 (n= 6,846) average of 224 mm (8.8").

Conclusion

Adult abundance and juvenile recruitment of croaker and spot are highly variable from year to year. The stocks do not appear in need of any additional management measures at this time. The following areas should be emphasized during 1995:

1) Continue to monitor commercial and recreational harvests of croaker and spot;
2) Promote the harvest of croaker and spot age 1 and older;
3) Promote the use of escape panels in pound nets to release small croaker and spot; and,
4) Monitor bycatch of small croaker and spot and implement BRDs where appropriate.

References

Barbieri, Luiz R., M.E. Chittenden Jr., and C.M. Jones. 1994. Age, growth, and mortality of Atlantic croaker, Micropogonias undulatus, in the Chesapeake Bay region, with a discussion of apparent geographic changes in population dynamics. Fisheries Bulletin 92:1-12.

Bonzek, Chris, P.J. Geer, and H. Austin. 1994. VIMS juvenile fish trawl survey. Virginia Sea Grant Marine Advisory Program, Gloucester Point, Virginia.

Casey, James F., S.B. Doctor, and A.E. Wesche. 1993. Investigation of Maryland's Atlantic Ocean and coastal bay finfish stocks. Federal Aid Project No.F-50-R-3. Maryland Department of Natural Resources, Tidewater Administration, Fisheries Division. Annapolis, Maryland.

Geer, Patrick. 1993. Virginia Report for Atlantic Croaker and Spot. Special Report No. 25 of the Atlantic States Marine Fisheries Commission. Washington, D.C.

Kline, Lisa L. 1993. A summary of "life history, population dynamics, and yield-per-recruit modeling of Atlantic croaker, Micropogonias undulatus, in the Chesapeake Bay area". Special Report No. 25 of the Atlantic States Marine Fisheries Commission. Washington, D.C. May,

Piavis, Paul G., E.J. Webb, III, B.H. Pyle, and D.R. Weinrich. 1994. Comprehensive sampling of resident and migrant Chesapeake Bay recreational finfish. Maryland Department of Natural Resources, Tidewater Administration, Fisheries Division. Project number F-51-R-1. Annapolis, Maryland.

Uphoff, James H., Jr. and P.G. Piavis. 1993. Maryland Report for Atlantic Croaker and Spot. Special Report No. 25 of the Atlantic States Marine Fisheries Commission. Washington, D.C.

CHESAPEAKE BAY ATLANTIC CROAKER AND SPOT IMPLEMENTATION SCHEDULE

Problem Area	Action	Date	Comments
1. Stock Status	1.1 MD, VA, and PRFC will continue to participate in scientific and technical meetings for management of the fishery along the Atlantic coast and in estuarine waters.	Continue	Coordination of croaker and spot data between coastal states continues. The annual 1994 ASMFC review did not result in any state compliance issues for 1995.
	1.2.1a MD and PRFC will continue a 10 inch minimum size limit for croaker.	Changed in 1993 Continue	The recreational size limit for croaker was changed to 9 inches with a creel limit of 25 fish/day in MD. The 10 inch size limit stayed in effect for the commercial fishery. The PRFC has continued its 10-inch minimum size limit.
	1.2.1b VA will implement a minimum size limit for croaker if suggested by length-frequency analyses currently being conducted by VIMS & ODU.	Began 1992	No minimum size limit has been established for croaker in VA.
	1.2.2 Jurisdictions will evaluate the need for implementing a minimum size limit for spot.	Began 1992	No minimum size limit is recommended at this time.
2. Harvest of Small Spot and Croaker	2.1.1a Jurisdictions will promote the development and use of trawl efficiency devices in the southern shrimp fishery and promote the use of bycatch reduction devices in the finfish trawl fishery.	Continue NC regs. on BRDs in effect spring 1995	Jurisdictions have worked through ASMFC/MAFMC to promote the use of TEDs and BRDs. Use of these devises has been successful in eliminating some bycatch of small fish including croaker and spot.
	2.1.1b VA will continue its prohibition on trawling in State waters and will maintain its 2-7/8 inch minimum mesh size for gill nets.	Continue	
	2.1.1c MD will continue its 4-6 inch gill net restriction during June 15 through September 30 and implement a 3 inch minimum mesh size along the coast.	1992 Continue	MD prohibits summer gill net and anchor and stake gill net use at anytime in the Bay.
	2.1.1d PRFC will continue prohibition on gill net fishing during the summer.	Continue	
	2.1.2 Jurisdictions will investigate the magnitude of bycatch problem and consider implementing bycatch restrictions for the non-directed fisheries in the Bay.	1992 Continue	VA continues to examine the effects of escape panels in reducing the bycatch of juvenile finfish. Data indicates bycatch mortality of age 0 croaker and spot is minimal in MD fisheries.

Problem Area	Action	Date	Comments
3. Research & Monitoring Needs	3.1 VMRC stock assessment program will continue to analyze size and sex data from Atlantic croaker and spot collected from VA commercial fisheries.	Continue	VA will continue to provide stock assessment data on croaker and spot.
	3.2a MD & PRFC will encourage research on croaker and spot biology, i.e. estimates of abundance, recruitment, and reproductive biology.	Continue	
	3.2b VA will continue to fund VIMS and ODU stock assessment research, specifically designed to provide estimates of population abundance, recruitment, and reproduction.	Continue	
4. Habitat and Water Quality	4.1a-g Continue to set water quality goals and review management programs under the 1987 Chesapeake Bay Agreement.	Continue	The Bay Program will begin to focus on the relationship between habitat and fisheries.

Legend: MD = Maryland
VA = Virginia
PRFC = Potomac River Fisheries Commission
ASMFC = Atlantic States Marine Fisheries Commission
VIMS = Virginia Institute of Marine Sciences
ODU = Old Dominion University
NC = North Carolina
MAFMC = Mid-Atlantic Fisheries Management Council
VMRC = Virginia Marine Resources Commission

Chapter 9
Americal Eel Management Plan

Introduction

The American eel (*Anquilla rostrata*) is a catadromous species that spends most of its life in rivers, lakes, and estuaries and migrates to the ocean to spawn. Although its life cycle is not well understood, the eel is believed to spawn only once and die on its spawning grounds in the Sargasso Sea. There are several life stages for the eel beginning with the larval form or leptocephalus stage. The eel enters the Chesapeake Bay as an elver (2"-5") from late March to mid-April. Large quantities of elvers are susceptible to harvest at impoundments as the small eels migrate upstream toward freshwater.

Since the adoption of the Chesapeake Bay American Eel Fishery Management Plan (FMP) in 1991, growth overfishing has been a concern. As a slow-growing creature, the eel could be overfished if constraints were not placed on the harvest of immature eels. The majority of eels found in the Bay are immature. It is believed that as they begin their spawning migration out of the Bay, they undergo a metaphorphosis and reach maturity upon reaching the spawning grounds. In Maryland, the harvest of eels less than 6" is limited to 25 per person per day. As recommended by the Bay FMP, a baywide minimum mesh size of ½ by ½" for eel pots is in effect. Maryland regulations were adopted in the summer of 1994. Virginia has had a minimum mesh size restriction and escape panel requirement for eel pots since 1990 and a ban on taking elvers since 1977. The Potomac River Fisheries Commission (PRFC) has required a mesh size since 1983 and a minimum elver size since 1992. The minimum mesh regulation was imposed as a means to conserve the Chesapeake Bay eel stock, reduce the possibility of growth overfishing, and prevent the wastage of small eels.

Stock Status

The characterization of the American eel population in the Chesapeake Bay is dependant upon commerical fishery statistics. Chesapeake Bay commercial landings have fluctuated and include mostly eels caught for the live-eel market. The size most preferred by the live-eel industry is between 1 and 1½ pounds. The preliminary 1994 harvest for Maryland is 295,867 pounds (Figure 9.1) with a dollar value of $465,263 or $1.57 per pound. The 1994 harvest represents a 33% increase over the 1993 landings of 221,900. In 1993, price per pound was $1.04 which was below the average of $1.74 per pound. The number of Maryland watermen reporting a harvest of eels has ranged from 11 (1985) to 94 (1991). In 1994, 66 individuals reported catching eels. Over the last ten years, the catch per fishermen has increased from 2,061 pounds to 4,392 pounds. Landings for Virginia indicate a steady harvest level for 1991-1993 of approximately 600,000 pounds each year (Figure 9.2). Preliminary 1994 landings show an increase to 800,000 pounds.

Although the demand for eel as trotline bait has declined, there appears to be greater interest in elvers for finfish bait and aquaculture. The latter is dependent on the harvest of elvers since attempts at large scale spawning in the lab have not been successful. In the Chesapeake Bay, eels may take as long as five years to reach the one pound size (citation size). The farther north, the larger and older eels become before reaching maturity. To date, there are no established commercial eel farming operations in the Chesapeake region. However, there is renewed interest in the taking of elvers for stocking. The Small Farm Institute of the University of Maryland has begun evaluating eel farming along with its other fish farming operations. The jurisdictions agree that until information is available on optimizing yield per recruit, a 6" minimum size limit will prevent the development of an elver fishery.

Figure 9.1 Reported American eel commercial landings from Maryland

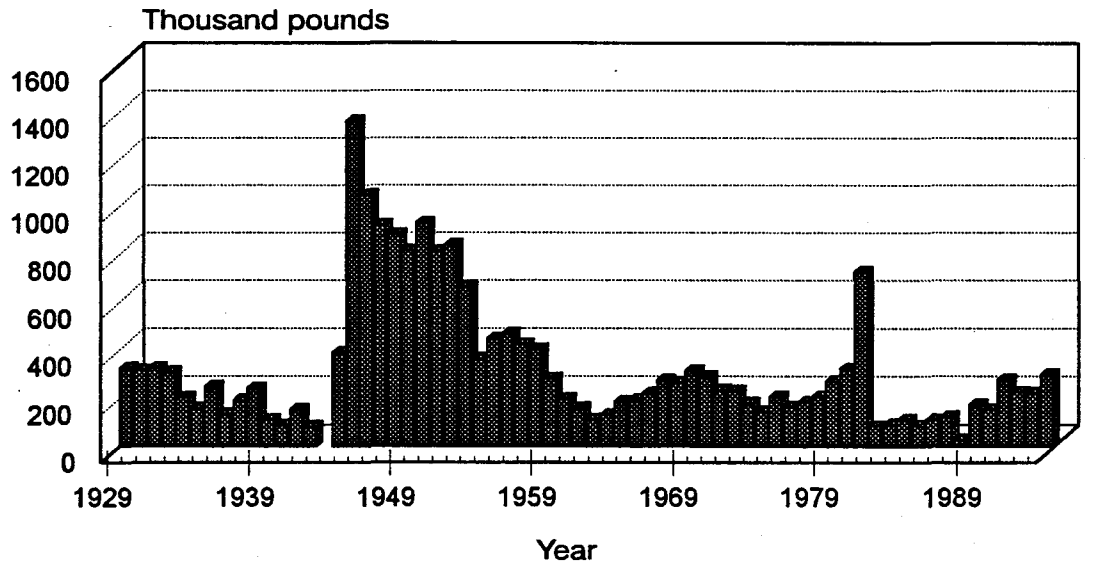
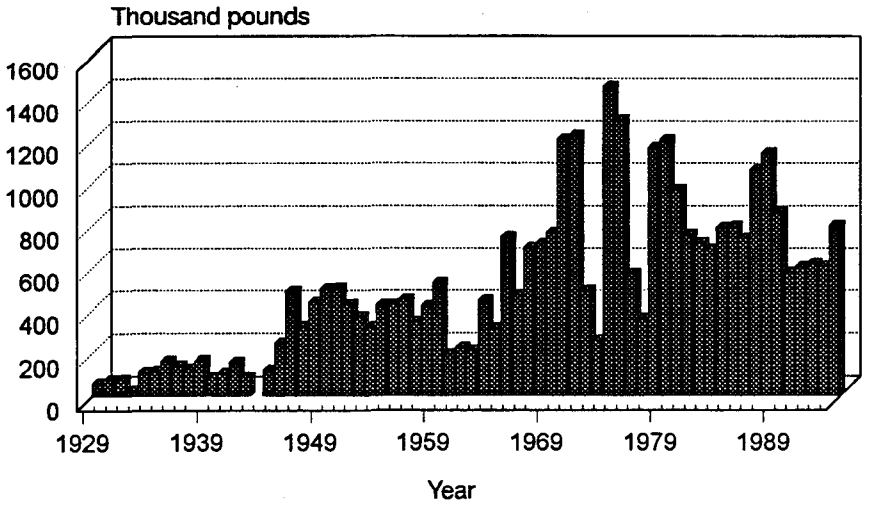


Figure 9.2 American eel commercial landings from Virginia



American Eel Fishery

Historically in the Chesapeake Bay region, there were two distinct industries for eels: the crab bait market which uses eels 0.5 - 1.0" in diameter and 10 - 14" long for trotlines, and the live-eel market which prefers eels at least 13" long and weighing about 1½ pounds. The importance of eels for trotline bait has decreased. The crab trotline fishery in Maryland is shifting to cheaper bait other than eels. At the same time, the live-eel market has increased. This may be the result of an advanced network of live-eel buyers which has facilitated the eel export market. In addition, there is a growing interest for an elver fishery to supply aquaculture endeavors.

The harvest of eels caught for personal use as bait by licensed crabbers has been historically unknown but estimates are as high as 1.7 million pounds. Beginning in 1993, a question on the amount of eel used as crab bait was added to the Maryland crab reporting forms. Crabbers reported using a total of 23,000 pounds of eels for crab bait, a surprisingly low amount. The question regarding the amount of eel used per day by licensed crabbers needs further evaluation. Sportfishermen are also utilizing live eels as bait for striped bass and cobia. The use of eels for bait needs to be monitored.

Research Needs

Fishery- independent eel research in the Bay region has not been initiated. Basic stock assessment data and information for American eel in the Chesapeake Bay remains inadequate. Size and age composition, maturity, growth rates, mortality rates, and estimates of abundance are not available. There is a limited amount of fishery dependent and fishery independent data (Foster, 1980-1984). Catch information from the crab trotliners in Maryland should improve estimates of the bait eel harvest. Besides the lack of basic biological and fisheries data, socioeconomic information is not available. Although the plan has encouraged research to collect information on eels from the Chesapeake Bay, no studies have begun. American eel has been recommended as a species to be added to the third edition of the Habitat Requirements for Chesapeake Bay Living Resources. As a catadromous species, the eel would be a valuable addition to the collection of living resources currently used as health indicators for the Chesapeake Bay. Until additional biological data is available to better characterize the Chesapeake stock, management strategies will be conservative.

Habitat and Water Quality Issues

The eel resource will benefit as more river miles are opened to migrating fish species. Migrating elvers and eels are hindered by dams and other stream blockages. Restoring self-sustaining populations of American eels to their historic ranges is an integral part of the Fish Passage Plan. As more passages are opened to migrating fish, stock assessment strategies for newly introduced eel stocks should be developed by Maryland and Pennsylvania.

The construction of four hydropower dams on the lower river in the 1900s blocked nearly 350 miles of river habitat. According to an agreement among Maryland, Pennsylvania, and the electric companies, three dams will be breached by 1997 and by the year 2000, the Susquehanna River will be opened as finfish habitat. As eels are restored to these historic areas within the Chesapeake watershed, eels may be subject to additional fishing pressures. Pennsylvania has agreed to consider recreational and commercial fishing regulations on eels that are compatible with the other Bay jurisdictions.

Conclusions

The status of American eels in the Chesapeake Bay is not clear and stock assessment analyses have not been completed. Management recommendations have been directed at reducing the possibility of growth overfishing (implementing minimum mesh size) and protecting elvers (eels < 6"). A preliminary assessment of the bait eel harvest by licensed Maryland crabbers indicates that trotliners are using fewer eels than previously estimated. Until stock information is available, the Bay jurisdictions will rely on commercial statistics to monitor harvest trends. Areas of prime importance during 1995 are:

1) Continue to monitor the commercial harvest of eels;

2) Evaluate effects of the minimum size limit and minimum mesh size for eel pots;

3) Evaluate the impacts of using live eels for bait;

4) Continue to monitor the commercial crab bait eel catch in Maryland; and,

5) Continue to promote basic research.

CHESAPEAKE BAY AMERICAN EEL IMPLEMENTATION SCHEDULE

Problem Area	Action	Date	Comments
1. Stock Status	1.1 MD & PRFC will adopt a 6" minimum size limit. VA will continue a prohibition on taking elvers & adjust definition to correspond to a 6" minimum size limit.	1992 1993	The 6" minimum size will prevent the development of an elver fishery. In MD, 1994 regulations were adopted limiting the harvest of eels less than 6" to 25 per day.
	1.2 MD will implement a ½ by ½" mesh size for eel pots. VA & PRFC will continue to enforce their ½ X ½" mesh. VA will continue to enforce ½ by 1" escape panels in ½ by ½" mesh pots.	1993	MD, VA, and PRFC currently enforce the ½ X ½" minimum mesh size for eel pots. DC plans to implement the ½ X ½" minimum mesh size by 1996.
	1.3 Upon restoration of eels to the Susquehanna River basin PFC will adopt regulations to prevent over fishing of small eels.		Dependent on the fish passage implementation schedule.
2. Bait Fishery	2.1 MD will require the reporting of eels used for crab bait on crab reporting forms.	1993	Information gathered from the Crab Reporting Forms needs further evaluation. Preliminary data indicates that previous estimates may have been too high.
3. Research Needs	3.1 Continue to collect catch & effort data from live eel fishery & begin monitoring crab bait fishery.	Continue	Basic stock assessment and biological monitoring is needed.
	3.2 Encourage research to collect basic biological and socioeconomic information		Requires coordination with other agencies and universities. Small eel farming research project ongoing with the University of Maryland Eastern Shore.
4. Habitat and Water Quality Issues	4.1 Continue to provide stream passage.	Continue	Requires coordination with other agencies.
	4.2 Continue to set specific objectives for water quality goals and habitat requirements.	Continue	

LEGEND: PRFC = Potomac River Fisheries Commission

Chapter 10
Black Drum Fishery Management Plan

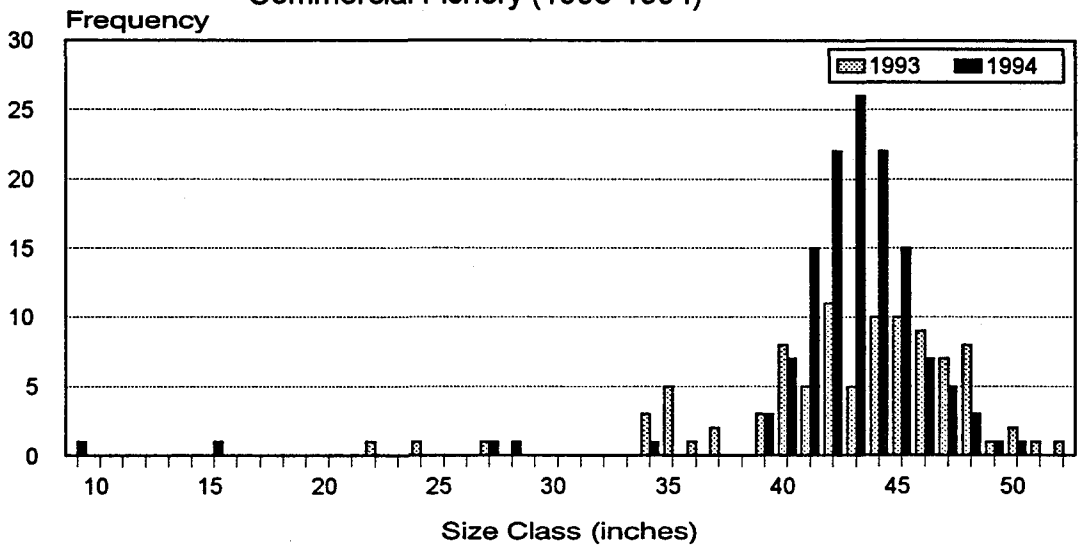
The Chesapeake Bay and Atlantic Coast Black Drum (*Pogonias cromis*) Fishery Management Plan is currently the only plan for this species along the Atlantic Coast. Adopted in 1993, the plan is scheduled for a complete review in 1997.

Status of Stocks

While the Chesapeake Bay region supports a limited black drum fishery, stock status remains uncertain. Important biological and fisheries information is lacking for a complete assessment of the stock. States continue to promote research on characterizing these components, but until more information is available, managers must rely upon existing data for management recommendations. Fishery monitoring efforts in Virginia have indicated extreme short-term fluctuations in black drum abundance. Although long-term effort data is lacking , variable seasonal movements question whether catch-per-unit-effort (CPUE) data reflect variations in stock abundance (Chesapeake Bay Black Drum FMP, 1993). Age and size data from Chesapeake Bay fisheries suggest reasons other than overfishing for these fluctuations. Black drum reach sexual maturity at age 2 and approxmately 16 inches. The current harvest from the Bay is dominated by large adults.

Virginia's Stock Assessment Program sampled the commercial catch and found that the majority of black drum harvested in 1994 were in excess of 40 inches (Figure 10.1). During the same year, Virginia

Figure 10.1. Black Drum Length Frequencies in Virginia's Commercial Fishery (1993-1994)

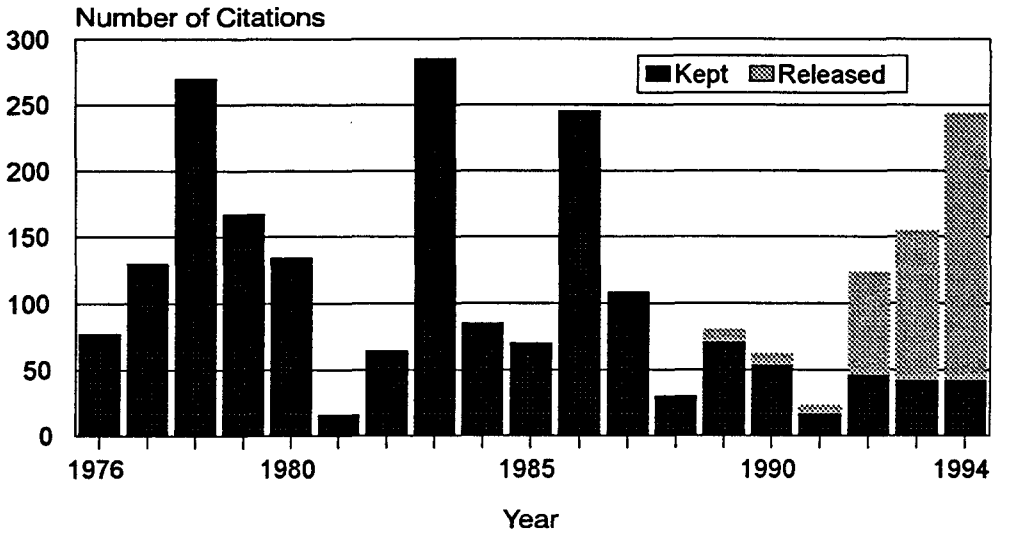


Sorce: VMRC data

issued 200 sportfishing citations for releasing fish over 44 inches and 43 citations for fish kept in excess of 70 pounds (Figure 10.2). In addition, the number of citations issued in Virginia has been increasing since

1991 after several low years. Black drum harvested by charterboats in Maryland during 1994 averaged 52 pounds. The number of citations issued in Maryland for fish over 40 pounds has remained at a high level since 1990 with 108 citations issued in both 1993 and 1994. Although citation records provide some information on numbers and size of black drum caught in the Bay, effort information is not available and probably varies from year-to-year.

Figure 10.2. Virginia Black Drum Citations (1976-1994)*



*Minimum size for kept fish of 75 lbs., 1976-82 and 70 lbs. 1983-94.
*Minimum size for released fish of 44", 1989-Present.

Source: VA Saltwater Fishing Tournament data

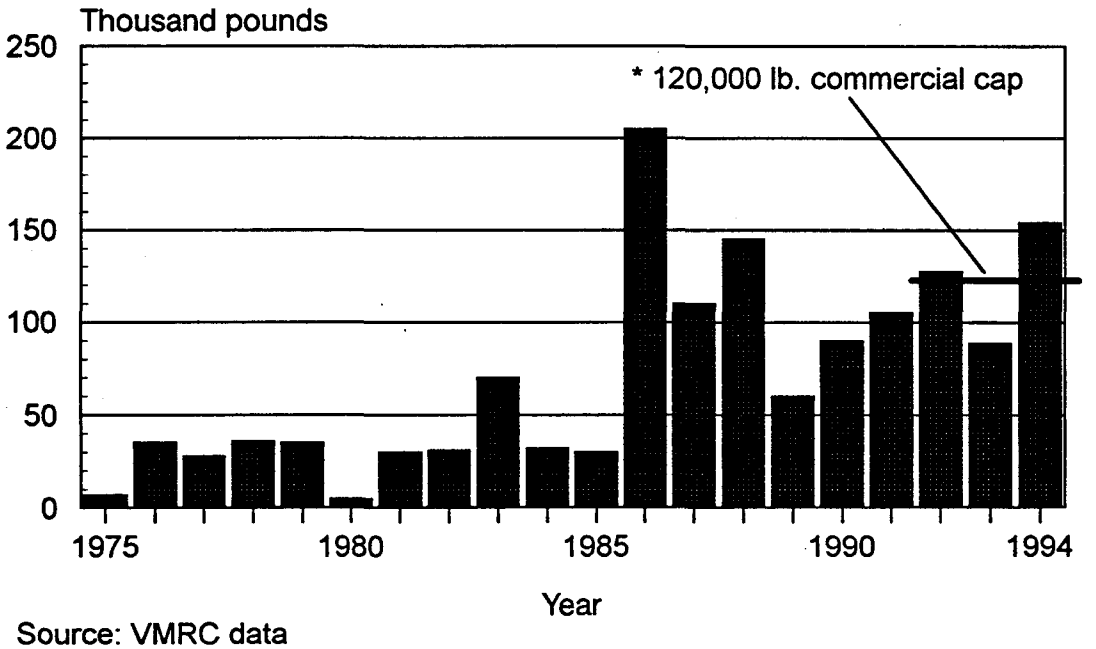
The migration of black drum in the Chesapeake Bay is not well understood but probably contributes to the short-term fluctuations in landings. Virginia's tagging program provides information on the movements of the stock. A total of 149 black drum between 7 and 16 inches were tagged near Norfolk, VA from September 9 to October 21, 1993. No fish were tagged in 1994. Six tag returns have been reported which indicate a southward, fall migration out of the Bay and along Virginia's coast (VMRC data). An angler based tagging program will be implemented in 1995 as a result of Saltwater License Funds and should provide a wider distribution of tags. Maryland supports Virginia's tagging efforts and will begin a telemetry study in 1995 to determine the distribution of black drum in Maryland's portion of the Bay.

Fishing Mortality

The impact of fishing on the stock is unknown. For this reason, Bay jurisdictions continue to monitor and regulate the recreational and commercial fisheries to prevent their expansion. Virginia monitors its commercial fishery through a mandatory permit and reporting system and the recreational fishery through the Marine Recreational Fisheries Statistics Survey (MRFSS). Harvest restrictions include a 16-inch minimum size limit, 120,000 pound commercial cap, and a 1 fish/person/day recreational creel limit. Size and creel restrictions limit the harvest of immature fish and protect the spawning stock. Virginia gill netters

accounted for most of the 154,073 pounds harvested during 1994, which exceeded 1993's harvest of 88,385 pounds (Figure 10.3, VMRC data). The 120,000 pound commercial cap was met and the fishery was closed in early June. A sudden rush of drum towards the end of the season, coupled with tardy reporting caused the overage. Attempts will be made in 1995 to emphasize the importance of timely reporting. While the number of permittees has remained stable, Virginia began limiting entry into the commercial black drum fishery in 1994. Recreational landings are currently unavailable for 1994. The MRFSS estimates of black drum harvest were 866 and 304,717 pounds for 1992 and 1993, respectively. The recreational estimates indicate the extreme degree of year-to-year fluctuations.

Figure 10.3. Virginia Commercial Black Drum Landings



Source: VMRC data
* Mandatory reporting since mid-1987.

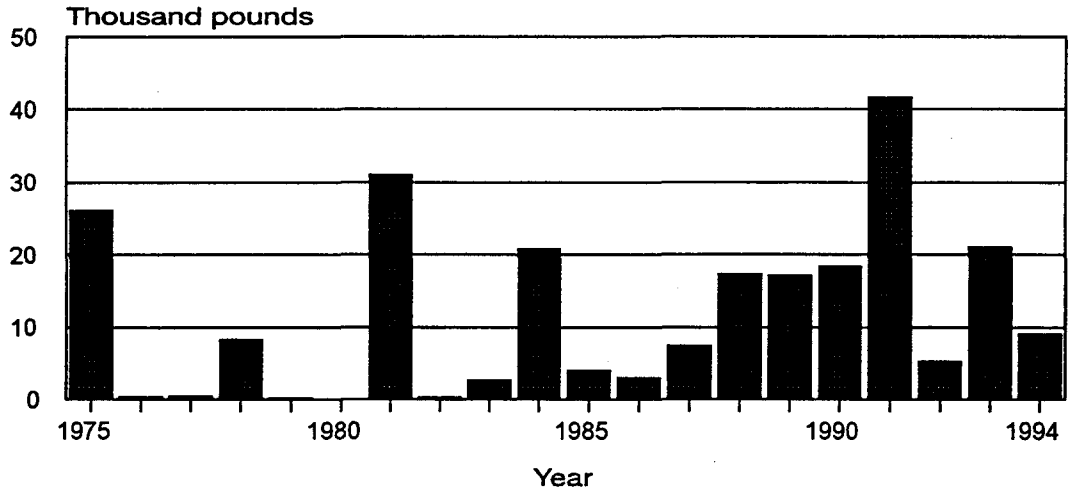
The commercial fisheries in Maryland and the Potomac River are nondirected and account for a small fraction of the Chesapeake Bay's total black drum harvest. Maryland's commercial harvest for 1994 was 9,044 pounds (Figure 10.4). This was a decrease from the 1993 harvest of 21,051 pounds. Catches occurred almost exclusively in Chesapeake Bay waters from April through August with peaks in June and July (MDNR data). The recreational fishery in Maryland is also of short duration and is not accurately represented by the MRFSS. For example, black drum were absent in Maryland according to the 1994 MRFSS, yet Maryland charterboat logbooks recorded harvesting 42,930 pounds, 93% of which were harvested in June. In addition, Maryland's Saltwater Fishing Tournament issued 108 citations in 1994 for fish 40 pounds and greater. Maryland adopted new regulations for black drum during 1994. A 16" minimum size limit was implemented for both the recreational and commercial fisheries. A recreational creel limit of 1 fish/person/day was implemented for the recreational fishery and a commercial quota of 30,000 pounds was implemented for the commercial fishery in the Chesapeake Bay and its tributaries. Commercial watermen will be required to obtain a free permit and report on forms issued by the Department. The Potomac River

Fisheries Commission has adopted a 16-inch minimum size limit and 1 fish/person/day creel limit for both their recreational and commercial fisheries.

Gear Conflicts

Virginia established a special black drum management zone which includes "high use" recreational areas such as Cabbage Patch and Latimer Shoals. This zone has been successful in minimizing conflicts between commercial and recreational anglers. Regulations prohibit the use of gill net or trot line from 7:00 AM to 8:30 PM within the established zone between May 1st and June 7th. Gear conflicts have not been a problem in Maryland and the Potomac River.

Figure 10.4. Maryland Commercial Black Drum Landings



Source: MD data

Conclusion

There is uncertainty in the status of the Chesapeake Bay black drum stock. Research and monitoring efforts should focus on the information needed to conduct a complete stock assessment. The new regulations implemented in 1994 are appropriate for stabilizing the harvest and protecting the stock until more information becomes available. Areas to be emphasized during 1995 are:

1) Continue to monitor the recreational and commercial fisheries and improve fishery statistics, and

2) Participate in tagging efforts

References

Chesapeake Bay Program. 1993. Chesapeake Bay Black Drum Fishery Management Plan - Agreement Commitment Report. Annapolis, MD.

CHESAPEAKE BAY AND ATLANTIC COAST BLACK DRUM IMPLEMENTATION MATRIX

Problem Area	Action	Date	Comments
1. Status of Stocks	1. VA will continue tagging black drum to determine coastal movements of the Chesapeake Bay stock, fund research to determine age, fecundity, and spawning periodicity, and sample the commercial and recreational catch to determine length, weight, and sex. MD will continue to support the Old Dominion black drum tagging study.	Continue	In 1995, VA's tagging program will expand to include an angler based program and MD will begin a telemetry study.
2. Fishing Mortality	2a. VA will limit the entry into the commercial black drum fishery and continue to require each commercial black drum fishermen and buyer to obtain a permit and report weekly during the season. VA will continue a 16-inch minimum size limit, 120,000 pound commercial quota, a 1 fish/person/day recreational creel limit, and continue monitoring commercial and recreational landings.	1994; 1992; Continue	VA will emphasize the need for timely reporting in 1995.
	2b. MD will adopt a 16 inch minimum size limit and a 1 fish/person/day recreational creel limit.	1994	The minimu size limit also applies to the commercial fishery.
	2c. PRFC will consider similar size and bag limits once VA and MD regulations are established.	1994	PRFC adopted a 16-inch minimum size limit and 1 fish/person/day creel limit for the recreational & commercial fisheries.
	2d. MD and PRFC will assess the need for commercial black drum harvest restrictions as data becomes available.	1994	MD implemented a 30,000 lb. quota for the commercial fishery & requires a permit & mandatory reporting. PRFC implemented a 1 fish/person/day limit.
3. Gear Conflicts	3. VA has established a Special Black Drum Management Zone, for "high use" areas. During May 1 through June 7, no gill net or trot line may be in the established zone from 7:00 AM to 8:30 PM.	1992; Continue	
4. Habitat Issues	4.1-7 Bay jurisdictions will continue to set water quality goals and review management programs under the 1987 Chesapeake Bay Agreement.	Continue	

Legend: VA = Virginia
MD = Maryland
PRFC = Potomac River Fisheries Commission

Chapter 11
Red Drum Fishery Management Plan

The 1984 Atlantic States Marine Fisheries Commission's (ASMFC) Red Drum FMP was amended in 1991. Amendment #1was developed jointly between the Commission and the South Atlantic Fishery Management Council (SAFMC). The plan adopted by the Council prohibits the harvest of red drum from the Exclusive Economic Zone (EEZ, 3-200 miles offshore), thereby placing regulatory responsibility for the harvest of red drum at the state level. The following requirements are specified in the ASMFC Red Drum plan:

1) Each state must implement either of the following two alternatives: a) 18" minimum size with only one fish over 27"; or B) 14" minimum size limit with no fish allowed over 27". Compliance required by: March 20, 1995.

2) Each state must implement a 5 fish daily bag limit or equivalent conservation measures approved by the ASMFC South Atlantic State-Federal Fisheries Management Board. Compliance required by March 20, 1995.

In 1993, jurisdictions of the Chesapeake Bay adopted the Chesapeake Bay Red Drum FMP. The SAFMC and the South Atlantic Board are currently reevaluating red drum management, which may result in the development of another amendment to the 1984 FMP. A complete review of the Chesapeake Bay Red Drum FMP is scheduled for 1997. Currently, jurisdictions of the Chesapeake Bay are in compliance with the ASMFC FMP recommendations.

Overfishing

The Atlantic coast red drum stock is overfished. Excessive harvests of immature red drum along the Atlantic coast has caused the spawning stock to fall to a 2-3% spawning stock biomass per recruit (SSBR) level. A SSBR of 30% is deemed necessary for a healthy stock. The low level of spawning stock, along with a 70% annual fishing mortality rate on fish 1-3 years old, is cause for concern in the fishery (Chesapeake Bay Red Drum FMP, 1993).

Even though landings from the Chesapeake Bay region comprise a minor component of the coastal fishery, Bay jurisdictions have adopted management measures sufficient to provide a rate of escapement for juveniles greater than 10% to support management efforts along the coast. An 18-inch total length minimum size limit and 5 fish/person/day creel limit, with one fish over 27-inches has been implemented for red drum in the Chesapeake Bay and along the Maryland and Virginia coast. The need for further reductions in the fishery to achieve a target spawning biomass per recruit level of 30% will be determined by future stock assessments.

The bycatch of immature red drum has not been a problem in Chesapeake Bay fisheries because small fish are infrequently encountered. However, Virginia's escape panel study which focusses on reducing the bycatch of weakfish (grey trout) less than 10 inches in the pound net fishery should indirectly increase the escapement of immature red drum. Ongoing research in North Carolina will provide an insight to the effectiveness of gear efficiency devices.

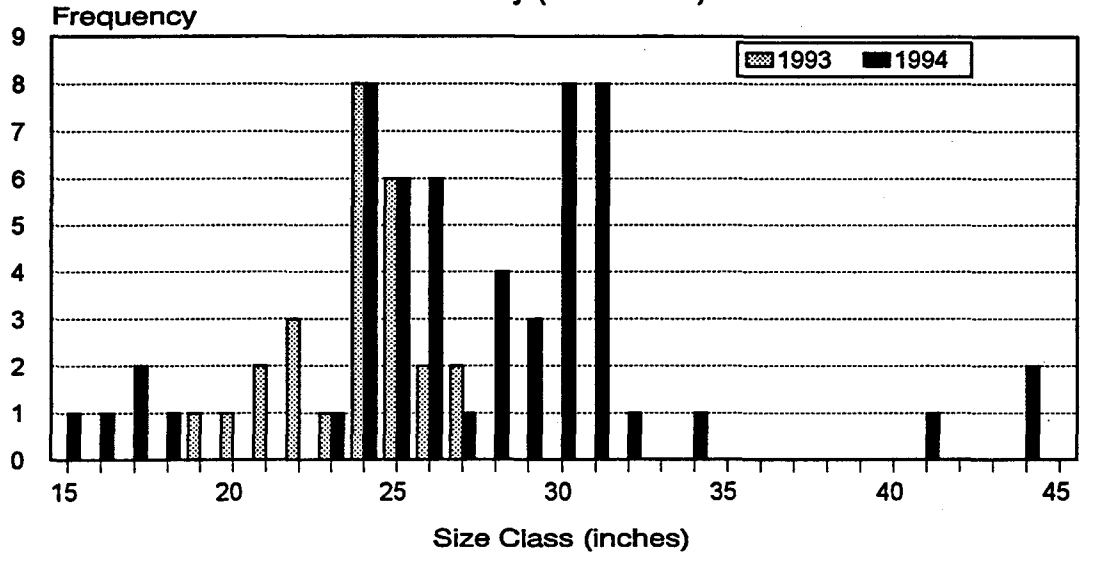
Stock Assessment and Research Needs

Managers lack important biological and fisheries data to effectively manage the red drum resource. In particular, information on the stock-recruitment relationship of red drum within the Chesapeake Bay and their movements into and out of the Bay is lacking. Data from both the recreational and commercial fisheries should be improved.

Research on the contribution of Chesapeake Bay red drum recruitment and mixing of recruits from various coastal nursery areas is encouraged. Virginia's tagging program is ongoing. A total of 100 red drum between 15 and 22 inches were tagged near Norfolk, Virginia from September 9 to October 21, 1993. One red drum was tagged in 1994. Twenty-two tag returns were reported (20 by hook and liners) within two months, with recapture locations indicating a southward, late fall migration out of the Bay and along the Virginia coast. Since then, only one tag return has been reported (VMRC data). Future tag returns should provide more information on red drum movements in the Chesapeake region.

The VMRC's Stock Assessment Program collects biological data from commercial catches of red drum. In 1994, length and weight data were collected from 55 fish , more than double the number of fish sampled in 1993. In 1993, 96% of the fish sampled were between 19 and 28 inches while in 1994 80% were between 24 and 32 inches (Figure 11.1). These length groups most likely represent a strong 1991 year-class based on North Carolina's length at age data (Ross et al. 1995). Average weights for 1993 and 1994 were 7.0 and 10.0 pounds, respectively.

Figure 11.1. Red Drum Length Frequencies in Virginia's Commercial Fishery (1993-1994)

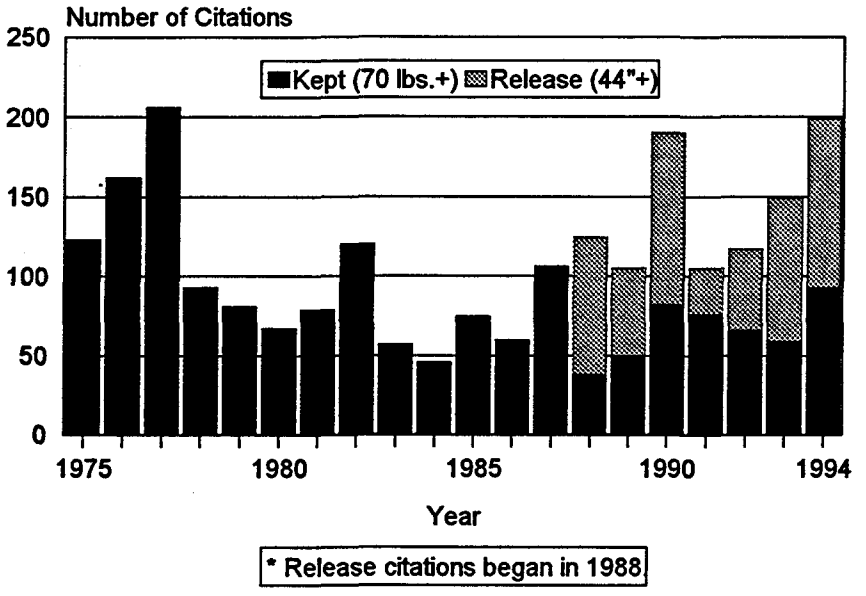


Source: VMRC data

The Bay jurisdictions continue to collect fisheries data for red drum. They are also examining how survey techniques can be improved to capture the intermittent nature of the recreational fishery. Commercial landings in Maryland and the Potomac River during 1994 were 867 and 0 pounds, respectively ((MDNR and PRFC data). Virginia's 1994 commercial landings are unavailable but 8,622 pounds were reported in 1993

(VMRC data). Marine Recreational Fisheries Statistics Survey (MRFSS) estimates for 1994 indicate less than 30,000 red drum were caught in Virginia and no red drum were reported caught in Maryland. Maryland's charterboat logbook data from the Bay, however, reported 2 red drum averaging 23.5 pounds and three citations were issued for 3 red drum 40 pounds and larger. MRFSS estimates for 1993 indicate 11,815 red drum averaging 2.9 pounds and 0 red drum were landed in Virginia and Maryland, respectively. Although the MRFSS estimates indicate no red drum were caught in Maryland in 1993, 2 red drum averaging 14 pounds were reported by the charterboat fishery and 5 citations were issued. In Virginia, the number of citations issued has recently increased (Figure 11.2). Citation information does not include estimates of effort which probably varies from year to year.

Figure 11.2. Virginia Red Drum Citations (1975-1994)*



Source: VA Saltwater Fishing Tournament data

Conclusion

The harvest of red drum from the Chesapeake Bay region accounts for a small percentage of the total Atlantic coast landings. Because the stock is overfished, Bay jurisdictions have supported management efforts along the coast by implementing harvest restrictions recommended by the ASMFC. Further harvest restrictions may be necessary to reach the target SSBR of 30%. Research and monitoring efforts are priority issues and should focus on information needed to conduct a stock assessment. The following areas should be emphasized during 1995:

1) Continue to monitor the commercial and recreational harvest of red drum from the Chesapeake Bay;

2) Investigate how the MRFSS can be improved to capture the nighttime and intermittent nature of the red drum fishery;

3) Continue red drum tagging studies to determine movements of juvenile red drum once they leave the Chesapeake Bay; and

4) Work with the ASMFC and SAFMC to coordinate management efforts along the coast.

References

Chesapeake Bay Program. 1993. Chesapeake Bay Red Drum Fishery Management Plan - Agreement Commitment Report. Annapolis, MD.

Ross, J.L., T.M. Stevens, and D.S. Vaughan. 1995. Age, Growth, Mortality, and Reproductive Biology of Red Drums in North Carolina Waters. Transactions of the American Fisheries Society 124:37-54.

Chesapeake Bay Red Drum Fishery Management Plan

Problem Area	Action	Date	Comments
1. Overfishing	1.1.1 VA will continue to enforce a 5 fish creel limit and an 18 inch minimum size limit with one fish over 27 inches in the recreational fishery.	1992; continue	
	1.1.2 MD and the PRFC will implement a 5 fish creel limit and an 18 inch minimum size limit with one fish over 27 inches in the recreational fishery.	1994	MD regulations became effective in July, 1994.
	1.2a Jurisdictions will investigate the potential for using bycatch reduction devices in nonselective fisheries.	1992; continue	VMRC is conducting a study on escape panels in pound nets.
	1.2b VA and MD will work with the MAFMC and ASMFC to develop and require more efficient gear to reduce bycatch and/or discards.	1992; continue	
2. Stock Assessment and Research Needs	2.1 Jurisdictions will support fecundity research and tagging studies to determine movements of juvenile red drum, and develop juvenile indices. MD and VA will continue the Baywide trawl survey of estuarine finfish species and crabs.	1993; continue	VA conducts an on-going tagging program which includes red drum.
	2.2 VMRC Stock Assessment Program will continue to collect biological data from commercial catches of red drum.	1993; continue	
	2.3 Jurisdictions will continue commercial fisheries statistics programs. VA will implement a limited and/or delayed entry program and a mandatory reporting system for commercial licensees. VA and MD will continue to supplement the Marine Recreational Statistics Program. MD will continue the Baywide Trawl Survey.	1993; continue	VA implemented a two year delay program limiting the number of commercial licensees.
3. Habitat Issues	3.1 Jurisdictions will continue to set specific objectives for water quality goals and review management programs established under the 1987 Chesapeake Bay Agreement.	1993; continue	Jurisdictions will examine how habitat can be better incorporated into fishery management plans.

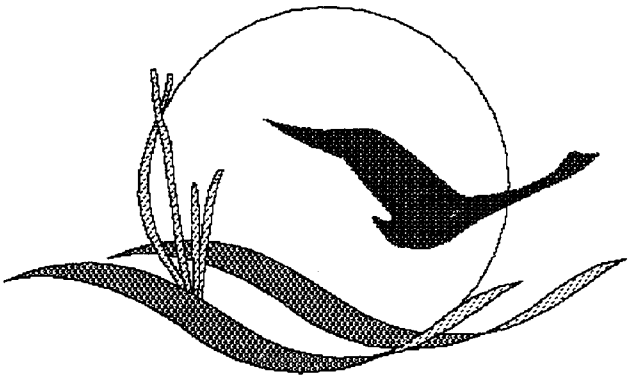
Legend:
VA = Virginia
MD = Maryland
PRFC = Potomac River Fisheries Commission
MAFMC = Mid-Atlantic Fisheries Management Council
ASMFC = Atlantic States Marine Fisheries Commission
VMRC = Virginia Marine Resources Commission

Chesapeake Bay Program

The Chesapeake Bay Program is a unique regional partnership leading and directing restoration of Chesapeake Bay since 1983. The Chesapeake Bay Program partners include the states of Maryland, Pennsylvania, and Virginia; the District of Columbia; the Chesapeake Bay Commission, a tri-state legislative body; the U.S. Environmental Protection Agency, which represents the federal government; and participating citizen advisory groups.

In the *1987 Chesapeake Bay Agreement*, Chesapeake Bay Program partners set a goal to reduce the nutrients nitrogen and phosphorus entering the Bay by 40% by the year 2000. In the *1992 Amendments to the Chesapeake Bay Agreement*, partners agreed to maintain the 40% goal beyond the year 2000 and to attack nutrients at their source--upstream in the tributaries. The Executive Council guided the restoration effort in 1993 with five directives addressing key areas of the restoration, including the tributaries, toxics, underwater bay grasses, fish passages, and agricultural nonpoint source pollution. In 1994, partners outlined initiatives for habitat restoration of aquatic, riparian, and upland environments; nutrient reduction in the Bay's tributaries; and toxics reductions, with an emphasis on pollution prevention.

Since its inception, the Chesapeake Bay Program's highest priority has been the restoration of the Bay's living resources--its finfish, shellfish, bay grasses, and other aquatic life and wildlife. Improvements include fisheries and habitat restoration, recovery of bay grasses, nutrient reductions, and significant advances in estuarine science.



U.S. Environmental Protection Agency
Chesapeake Bay Program Office
410 Severn Avenue
Annapolis, MD 21403
1-800-YOUR BAY