

*Fisheries Management Report No. 24 of the
Atlantic States Marine Fisheries Commission*



Amendment #5 to the
Interstate Fishery Management Plan for
Atlantic Striped Bass

March 1995

DEDICATION



DAVID G. DEUEL

This document is dedicated to the memory of David G. Deuel. Dave was a dedicated National Marine Fisheries Service employee who devoted his career to improving the conservation and management of the striper. His selfless efforts were instrumental in the passage of the Striped Bass Conservation Act in 1984 and the recovery that we are celebrating today. He will be sorely missed by all that had the opportunity to work with him, but his contribution to the conservation and management of our fisheries will not be forgotten.

EXECUTIVE SUMMARY

The Atlantic striped bass (*Morone saxatilis*) has for centuries been one of the most important coastal species from Maine to Cape Hatteras, supporting historic valuable commercial and recreational fisheries. The popularity of this species to fishermen, the complex nature of its seasonal distribution, and decline in harvest and poor recruitment during the 1970s stimulated interest in the development of a cooperative interstate fisheries management plan. In 1981, the Atlantic States Marine Fisheries Commission (ASMFC) developed and adopted the *Interstate Fisheries Management Plan for the Striped Bass of the Atlantic Coast from Maine to North Carolina* (FMP). The FMP has been amended four times previously, most recently by *Supplement to the Striped Bass FMP -- Amendment #4*. Under this program, Atlantic striped bass have made the most significant recovery ever experienced for a coastal finfish species; and are likely to increase to record levels over the next few years. The Atlantic States Marine Fisheries Commission declared that the Chesapeake Bay stocks of Atlantic striped bass, which support the greatest portion of the coastal stock, was recovered as of January 1, 1995.

Amendment #4 addressed a reopening fishery in the initial stages of stock recovery. It used an adaptive management strategy which allowed the Commission to make revisions to the management program in response to changing circumstances. Since 1991, five addenda were adopted by the Commission making changes to the specific requirements of Amendment #4. In addition to these multiple revisions, management under Amendment #4 has become cumbersome, since it is silent or vague on many of its principal points. Thus, the Striped Bass Management Board of the ASMFC has decided to prepare and adopt Amendment #5 which is contained in this document.

Amendment #5 completely replaces the original FMP and all subsequent amendments and addenda. The goal of Amendment #5 is to *perpetuate, through cooperative interstate fishery management, migratory stocks of Atlantic striped bass so as to allow a commercial and recreational harvest consistent with the long-term maintenance of self-sustaining spawning stocks and to provide for the restoration and maintenance of their critical habitat*. In order to achieve this goal, the Amendment adopts the following objectives:

- 1) To prevent overfishing.
- 2) To allow harvest which maintains spawning stock biomass (SSB) in a condition which provides for perpetuation of self-sustaining spawning stocks in each designated spawning area, based on maintaining young-of-the-year indices, SSB, or other measures of spawning success at or above historical levels as established in the plan.
- 3) To achieve compatible and equitable management measures among jurisdictions throughout the fishery management unit.
- 4) To promote cooperative interstate research, monitoring and law enforcement.
- 5) To identify critical habitats and environmental factors that limit long term maintenance and productivity of east coast migratory striped bass.
- 6) To adopt and promote standards of environmental quality necessary to the long term maintenance and productivity of east coast migratory striped bass throughout their range.
- 7) To establish criteria, standards, and procedures for plan implementation as well as determination of states' compliance with management plan provisions.

The management unit for the fishery includes all coastal migratory striped bass stocks of the east coast of the United States.

The Amendment is organized into six sections. *Section One* is introductory material, including a summary background on the resource, the fishery and its habitat. Detailed information on these matters will be included in a Source Document, a compilation of technical information to support fisheries management. *Section Two* contains the Goals and Objectives of the fishery management program under this Amendment. *Section Three* contains the specification of the parameters of the management program. This is essentially the theoretical basis for the management program and how it will operate. It also contains requirements for information necessary to carry out the management program. *Section Four* contains the management regime for implementation by the states. *Section Five* specifies the minimum compliance requirements for states under the Atlantic Striped Bass Conservation Act, and specifies procedures for determining compliance. *Section Six* deals with needed and recommended research.

The basic pattern of the amendment is to adopt a target fishing mortality rate, and then to establish regulatory programs for recreational and commercial fisheries that will meet this target. The preferred alternative regime under the Amendment is as follows:

Recreational Fisheries:

Minimum size limit of 20 inches in producer areas and 28 inches along the coast; a creel limit of one fish per day in producer areas (two fish per day in Virginia recreational fisheries and Virginia, Potomac River Fisheries Commission (PRFC), and Maryland charterboat fisheries) and two fish per day in coastal fisheries. Fishing seasons are variable between producer areas, and 365 days in coastal areas. The target fishing mortality rate under this regime is $F=0.40$, preceded by an initial two-year interim rate of 0.33. See page 28 for further details on recreational fisheries.

Commercial Fisheries:

Flexible quota and the applicable size limits from the recreational fishery.

Other Measures:

States will be allowed to propose alternative management regimes that would meet the target fishing mortality rate. States will also be required to carry out specific monitoring programs -- both fishery dependent and fishery independent. The Amendment also specifies needed research programs.

Compliance:

States listed under the Atlantic Striped Bass Conservation Act are required to be in compliance with this Amendment once it is finally adopted. A state that is found out of compliance is subject to having all of its striped bass fisheries closed by the federal government under the terms of a moratorium. The amendment specifies which management measures are mandatory compliance requirements under the law, the schedule for coming into compliance, and how compliance determinations will be made.

FOREWORD

The Plan Development Team (Team) for Amendment 5 (Amendment or Plan) was chaired by Mr. John Field, Striped Bass Coordinator, Atlantic States Marine Fisheries Commission (ASMFC) and consisted of: Dr. R. Wilson Laney, of the South Atlantic Fisheries Resources Coordination Office, Southeast Region, U.S. Fish and Wildlife Service (USFWS), who served as principal Plan writer; Mr. Peter Himchak, New Jersey Division of Fish, Game and Wildlife; and Mr. Gary Shepherd, Northeast Fisheries Center, Northeast Region, National Marine Fisheries Service (NMFS). Other individuals who either drafted and edited portions of the Plan or who prepared reports from which the Plan writers liberally borrowed text and tables were Dr. Victor Crecco, Connecticut Marine Fisheries Office; Mr. John H. Dunnigan, Executive Director, ASMFC; Mr. Mark Gibson, Rhode Island Division of Fish, Wildlife and Estuarine Resources; Mr. Phil Jones and Dr. Louis Rugulo, Maryland Department of Natural Resources; Mr. Paul Perra, Interstate Fishery Management Plan Coordinator, ASMFC; and Mr. Harold Upton, Striped Bass Coded Wire Tag Coordinator, ASMFC. The Team worked under the direction of the ASMFC Striped Bass Advisory Panel (Chairman, Damon Tatem, North Carolina), Management Board (Chairman, Philip Coates, Massachusetts Division of Marine Fisheries), Stocking Committee (Chairman, Roy Miller, Delaware Division of Fish and Wildlife), Tagging Working Group (Chairman, Andy Kahnle, New York Department of Environmental Conservation) and Technical Committee (Chairman, Dr. Victor Crecco, Connecticut Department of Environmental Protection). Addresses, telephone and facsimile numbers for these individuals are provided in the Amendment 5 Source Document (ASMFC, in preparation).

Funding for this effort was provided by the states of Massachusetts, Connecticut, New York, New Jersey, Delaware, Virginia, North Carolina and the District of Columbia through Sport Fish Restoration Act funds. In addition, funds from the USFWS, NMFS, and mitigation payments from New England Power supported preparation of Amendment 5. Mr. Paul Perra, ASMFC Interstate Fisheries Management Plan Coordinator, Ms. Connie Young-Dubovsky, former Striped Bass Coordinator and presently with the USFWS in Washington, D.C., and Mr. John Field served as principal contacts at ASMFC. Extensive support and input required for preparation of this document were provided by state and federal agency representatives on the ASMFC Striped Bass Technical Committee and Stock Assessment Committees.

The Team expresses profound gratitude to the many individuals who made contributions to the preparation of Amendment 5. These include the professional staff of the state and federal agencies, primarily those responsible for management of interjurisdictional fishery resources, who have reviewed the Amendment and provided their comments and suggestions for improvements. Included also are the many representatives of conservation groups and interested recreational and commercial striped bass fishermen who have written letters and attended public hearings to express their opinions and ideas.

Finally, the habitat components of the plan were developed in consultation with the Ad-Hoc Habitat Working Group of the ASMFC and the ASMFC Habitat Committee. Dr. David Stevenson, Maine Department of Marine Resources, chaired the Ad-Hoc Habitat Working Group, and the Habitat Committee is chaired by Mr. Tom Fote, ASMFC Commissioner from New Jersey. Ms. Dianne Stephan is the ASMFC Habitat Coordinator and facilitated review and distribution of all habitat-related Plan aspects. Amendment 5 serves as the initial Interstate Fishery Management Plan for incorporating the draft habitat outline for ASMFC Fishery Management Plans. The outline is undergoing concurrent development by the Ad-Hoc Habitat Working Group and Habitat Committee.

Appreciation is extended also to the ASMFC support staff for overseeing the final production and distribution of this report.

TABLE OF CONTENTS

DEDICATION	i
EXECUTIVE SUMMARY	ii
FOREWORD	1
1. INTRODUCTION	6
1.1 Background Information	6
1.2 Description of the Resource	7
1.2.1 Striped Bass Life History	7
1.3 Habitat Considerations	8
1.3.1 Description of Habitat	8
1.3.1.1 Spawning Habitat	8
1.3.1.2 Nursery Habitat	8
1.3.1.3 Adult Resident Habitat and Migratory Routes	8
1.3.2 Present Status of Habitats and Impacts on Fisheries	8
1.3.2.1 Quantity	9
1.3.2.2 Quality	9
1.3.2.3 Loss and Degradation	9
1.3.2.4 Current Threats	10
1.3.2.5 Effect on the Ability to Harvest and Market	10
1.3.3 Identification and Distribution of Essential Habitats	11
1.4 Description of the Fishery	13
1.4.1 Coastwide	13
1.4.1.1 Commercial	13
1.4.1.2 Recreational	13
1.4.1.3 By-catch in Other Fisheries	13
1.4.1.4 Economic Impact of the Fishery	14
1.4.2 By state	14
1.4.2.1 Commercial	14
1.4.2.2 Recreational	14
1.4.2.3 By-catch	15
1.4.2.4 Economic Impact of the Fishery	15
1.5 Explanation of Adaptive Management Approach and Existing Plan	16
1.6 Technical Documentation for New Amendment	16
2. GOAL AND OBJECTIVES.	17
3. MANAGEMENT PROGRAM SPECIFICATIONS/ELEMENTS	18
3.1 Assessing Annual Recruitment	18
3.1.1 Calculation of Juvenile Abundance Indices	19
3.1.2 Requirements for Measurement and Use of Indices	19
3.1.3 Juvenile Abundance Index Surveys Required	20
3.2 Estimating Spawning Stock Biomass	20

3.2.1	Definition and Explanation	20
3.2.2	Measurement and Use	20
3.2.3	Requirements for Monitoring Spawning Stock Biomass	21
3.3	Annual Fishing Mortality Target and Measurement	21
3.3.1	Definition	21
3.3.2	Target Fishing Mortality Rates	21
3.3.3	Requirements for Fishing Mortality Rate Calculations	22
3.4	Stocking	26
3.4.1	Need and Use	26
3.4.2	Maintaining Health, Genetic Integrity and Biodiversity	27
3.4.3	Monitoring Results (Survival, Creel, Spawning)	28
3.5	Summary of Monitoring Requirements	28
3.6	Bycatch Reduction.	28
4.	MANAGEMENT PROGRAM IMPLEMENTATION	30
4.1	Habitat Conservation and Restoration	30
4.1.1	Preservation of Existing Habitat	30
4.1.2	Avoidance of Incompatible Activities	30
4.1.3	Fisheries Practices	31
4.1.4	Habitat Restoration, Improvement and Enhancement	31
4.2	Recreational Fisheries	31
4.3	Commercial Fisheries	35
4.4	Alternative State Management Regimes	35
4.4.1	Procedures	35
4.5	Adaptive Management	37
4.5.1	Procedures	37
4.6	Non-Restored Producer Areas	37
4.7	Management Institutions	38
4.7.1	ASMFC and ISFMP Policy Board	38
4.7.2	Striped Bass Management Board	38
4.7.3	Striped Bass Plan Review Team	38
4.7.4	Striped Bass Technical Committee	38
4.7.5	Striped Bass Stock Assessment Committee	38
4.7.6	Striped Bass Citizens Advisory Panel	39
4.7.7	Secretaries of Commerce and Interior	39
5.	COMPLIANCE	40
5.1	Mandatory Compliance Items for States	40
5.1.1	State Programs	40
5.1.1.1	Transition to Amendment 5	40
5.1.1.2	Changes to State Programs	40
5.1.2	State Reporting	40
5.1.3	Mandatory Measures to be Included in State Programs	42
5.1.3.1	Regulatory Requirements	42
5.1.3.2	Monitoring Requirements	42
5.1.3.3	Enforcement Requirements	42
5.2	Procedures for Determining Compliance	42
5.3	Recommended Management Measures	43

6.	CONTINUING RESEARCH NEEDS	45
	6.1 Habitat Information Needs/Recommendations for Future Research	45
	6.2 Stocking	45
	6.3 Stock Assessment and Population Dynamics	45
7.	REFERENCES	46
8.	APPENDIX I	48

Section 1. INTRODUCTION

Implementation of Amendment 4 to the Atlantic States Marine Fisheries Commission (ASMFC) Striped Bass Management Plan (the Plan) in 1989 has resulted in improved status of the East Coast migratory stocks of striped bass as reflected in improving catch rates, age structure, and recruitment, yet opportunities exist for further improvements. Adaptive management has allowed some flexibility for individual state management within the guidelines of the Plan. Improved stock status and questions of equitability among states have resulted in a request by the member states to clarify the procedures used in the determination of state compliance. Confidence has been expressed on the part of the member states that management measures can be clarified and compliance and non-compliance more explicitly defined. Additionally, a definition of a restored fishery was developed at the request of the member states to address improved stock status. Stock restoration has been defined as the point at which estimated spawning stock biomass (see Section 3.2) reaches or exceeds the average level observed during the period 1960-1972. This issue was addressed in Amendment 4 only as a future task.

1.1 Background Information

The striped bass (*Morone saxatilis*), has historically been one of the most important recreational and commercial fishes in the region from Maine through North Carolina. Annual commercial landings of striped bass along the East Coast from the early 1960's to the mid 1970's generally ranged between 8 and 14 million pounds. Recreational harvests, while not well documented, may have equaled commercial landings in magnitude.

Steady declines in the abundance of striped bass, particularly Chesapeake Bay stocks, began in the early 1970's, as evidenced by drastic declines in commercial harvest and other indicators of striped bass abundance and spawning success. This decline in the commercial harvest and the perceived decline in production of striped bass precipitated a number of legislative and administrative actions aimed at stopping and reversing the striped bass decline. An amendment to the Anadromous Fish Conservation Act, passed in 1979, created the Emergency Striped Bass Study (ESBS) program. The objective of the program was to conduct research to identify factors contributing to the striped bass decline, monitor the status of the stocks, and assess the economic consequences of the decline. The ASMFC prepared in 1981 a coastwide management plan for the anadromous stocks of striped bass along the Atlantic Coast as part of its Interstate Fisheries Management Program. The Plan specified recommended management measures, focusing particularly on size limits and spawning period closures, which the individual states could implement to enhance the status of East Coast striped bass stocks. Because ASMFC does not have direct regulatory authority over individual state fisheries, implementation of the Plan's recommendation was at the discretion of the individual states.

The decline in stocks continued, and concerns were raised that the actions recommended in the 1981 plan were insufficient to protect the remaining striped bass populations. The result of those concerns was promulgation of a series of amendments to the Plan, stipulating more stringent limitations on striped bass exploitation. Extensive studies were initiated with both federal and state funding, aimed at identifying factors which were contributing to the striped bass population decline. During this same period, Congress passed legislation (PL 98-613, the Atlantic Striped Bass Conservation Act) that provides for federal imposition of a moratorium on striped bass harvest in those states that fail to implement and enforce management measures contained in the ASMFC Plan. This deviation from traditional state regulatory control over striped bass fisheries has resulted in very detailed analysis and evaluation of all existing and proposed regulations by all parties potentially affected.

The heightened sensitivity to the technical basis for and potential impact of current regulations led to the determination that the information base provided in the 1981 ASMFC plan was badly outdated, due particularly to the extensive amount of striped bass research and study which has gone on since that plan was written. In addition, the amendments to the plan and the factual information supporting those amendments were not documented in a single source available to any interested party. These factors led the ASMFC Striped Bass Management Board to conclude that a rewrite of the Plan was in order. Also, Amendment 3 to the Plan specified that 95% of the females would be protected until a predetermined trigger based on the Maryland juvenile index was attained. Amendment 4 was needed to address management of a transitional fishery once that trigger was reached. The culmination of that process was the adoption of Amendment 4 to the Plan by the Commission in October 1989. That amendment and its addenda present management guidelines and specifications which currently guide interstate striped bass management up to the point of adoption of this Amendment.

1.2. Description of the Resource

Readers who desire a comprehensive description of the Atlantic Coast migratory stock of striped bass are referred to the Source Document for Amendment 5 (ASMFC, in preparation) and to previous documents which have comprehensively reviewed this stock or its components (Bain and Bain 1982, Fay et al. 1983, Hill et al. 1989, ASMFC 1990). Further information which summarizes recent research on Atlantic coastal migratory striped bass and the fisheries in each jurisdiction is provided in the annual reports to Congress prepared by the U.S. Departments of Commerce and Interior to comply with Section 7(b) of the Anadromous Fish Conservation Act (16 U.S.C. 757 g.; see USDOC and USDO, 1993, and *Ibid.*, 1994 for the most recent summaries).

This brief resource description is summarized from the reports referenced above and is intended only to provide the reader with the basic information necessary to understand how Atlantic Coast migratory striped bass relate to their essential habitats, and the significance of the commercial and recreational striped bass fisheries to the economy and culture of the Atlantic Coast.

1.2.1 Striped Bass Life History

The striped bass is a long-lived (at least up to 29 years of age, Merriman 1941) species which normally spends the majority of its adult life in coastal estuaries or the ocean, migrating north and south seasonally, and ascending rivers to spawn in the spring. Mature female striped bass (age 4 and older) produce large quantities of eggs, which are fertilized by mature males (age 2 and older) as they are released into waters of riverine spawning areas. The fertilized eggs drift downstream with currents while developing, eventually hatching into larvae. The larvae and postlarvae begin feeding on microscopic animals during their downstream journey. After their arrival in the nursery areas, located in river deltas and the inland portions of coastal sounds and estuaries, they mature into juveniles. They remain in coastal sounds and estuaries for two to four years, and then they migrate to the Atlantic Ocean. In the ocean, fish tend to move north during the summer, and to the south during the winter. Important wintering grounds for the mixed stocks are located from offshore of New Jersey to as far south as Virginia and North Carolina, historically including the North Carolina sounds. With warming water temperatures in the spring, the mature adult fish migrate to the riverine spawning areas to complete their life cycle. In general, the Chesapeake Bay spawning areas produce the majority of coastal migratory striped bass.

1.3 Habitat Considerations

1.3.1 Description of Habitat

Atlantic Coast migratory striped bass use coastal rivers as spawning sites and nursery areas, which include the lower portions of the rivers and their associated bays and estuaries. Adult habitats include coastal rivers and the nearshore ocean (Figure 1). These habitats are distributed along the coast from Maine through North Carolina. Use of these habitats by migratory striped bass may increase or diminish as the size of the population changes.

1.3.1.1 Spawning Habitat

Striped bass spawn in rivers throughout range. Historically, striped bass probably spawned in all larger rivers along the Atlantic Coast prior to the construction of dams and deterioration of water quality (ASMFC 1990). For many stocks, spawning areas are fresh to brackish waters and are located generally in the first 25 miles of freshwater in the river, with salinities of 0-5 parts per thousand (ppt). Some fish, such as those in the Hudson, Rappahannock, Roanoke and Neuse Rivers, migrate over a hundred miles upstream from the river mouths to spawn (Janicki et al. 1985). Others spawn short distances upriver, still within tidally influenced areas. Presently used spawning reaches are described for Atlantic Coast rivers in ASMFC (in preparation) and in Section 1.3.3 of this document.

1.3.1.2 Nursery Habitat

Nursery habitats for Atlantic Coast migratory striped bass occur downstream of spawning areas and include the inland portions of coastal sounds and estuaries. Although little is known about specific movements and distributions of juveniles (Hill et al. 1989), juveniles in Virginia move downstream to higher salinities during their first summer. Juveniles in general tend to move downstream and shoreward as they grow (Fay et al. 1983). Young-of-year fish from the Hudson River may move offshore in the fall (Hill et al. 1989), and although no evidence exists for offshore migration of juveniles in other stocks, juveniles may winter in deeper waters further downstream (Fay et al. 1983). Known nursery areas for each stock are described in ASMFC (in preparation) and depicted in Section 1.3.3.

1.3.1.3. Adult Resident Habitat and Migratory Routes

The Atlantic Coast migratory stock of striped bass is currently distributed from the St. Lawrence estuary in Canada southward to Cape Hatteras, North Carolina. Adult striped bass migrate to spawning grounds in the spring, descend to coastal sounds and estuaries following spawning, and migrate generally northward in the ocean in the summer, returning generally southward during the fall and winter. Some striped bass may winter in their native or other mid-Atlantic coastal rivers (Fay et al. 1983) while others may congregate on wintering grounds located offshore in depths up to 60 feet. Migratory pathways and wintering areas as determined from fishery independent sampling programs and tagging studies are fully described in ASMFC (in prep.).

1.3.2 Present Status of Habitats and Impacts on Fisheries

Fisheries management measures cannot successfully sustain striped bass stocks if the quantity and quality of habitat required by the species are not available. Harvest of fisheries resources is a major factor impacting population status and dynamics and is subject to control and manipulation; however, without adequate habitat quantity and quality, the population cannot exist (Richkus 1989).

Status of Atlantic Coast migratory striped bass habitats was most recently reviewed in ASMFC (1989, 1990). Concerns that the decline of striped bass populations which occurred in the late 1970's and early 1980's was related to habitat degradation led to intensive study into possible linkages between habitat degradation and striped bass populations. The results of these studies, conducted under the auspices of the ESBS, have been published in annual reports to Congress to which the reader is referred for detailed information (USDOC and USDOJ, 1990; *Ibid.*, 1993, *Ibid.*, 1994). The information presented here is summarized from the referenced reports.

1.3.2.1 Quantity

Little information exists which quantifies the area of existing or historical striped bass habitat. No attempt has been made to quantify the existing area of striped bass habitat coastwide. Efforts currently underway in the National Oceanic and Atmospheric Administration (NOAA) to integrate survey data from all east coast estuaries into a common database should eventually allow the production of maps and calculation of areas used by striped bass (T.A. Lowery and D.M. Nelson, NOAA, Silver Spring, Maryland, personal communication).

Some information has been compiled for spawning area extent in river miles. Spawning areas for major spawning rivers are identified in ASMFC (1990, Appendix B; Fay et al. 1983; Hill et al. 1989).

Nursery areas for migratory striped bass consist of the areas in which the larvae, postlarvae and juveniles grow and mature. These areas include the spawning grounds and downstream areas through which the larvae and postlarvae drift after hatching, as well as the downstream portions of rivers and adjacent estuaries in which they feed, grow and mature. Juvenile striped bass which depart from coastal bays and estuaries prior to reaching adulthood also use the nearshore Atlantic Ocean as a nursery area. These areas are depicted in Figure 1.

The area used by adult migratory striped bass consists of the nearshore Atlantic Ocean from Maine to North Carolina in the vicinity of Cape Hatteras; inlets which provide ingress to coastal bays and estuaries; and riverine habitat upstream to the spawning grounds. Atlantic Coast migratory striped bass generally tend to move north in the ocean during the summer, and southward and inshore in the winter. Adult habitats are depicted in Figure 1.

1.3.2.2 Quality

The quality of striped bass habitats has been compromised largely by impacts resulting from human activities. Impacts which may have contributed to declines in striped bass include toxic contaminants, low pH resulting from acidic deposition, elevated levels of metals, reduced oxygen levels, changes in temperature resulting from hydropower or flood control discharge regimes, blockage of spawning areas due to dam construction, thermal pollution, turbidity, and water intakes which entrain or impinge young striped bass. Specific examples of the effects of these impacts on striped bass populations are contained in Fay et al. (1983), Hill et al. (1989) and ASMFC (1990).

1.3.2.3 Loss and Degradation

It is generally assumed that striped bass habitats have undergone some degree of loss and degradation; however, few studies exist which quantified impacts in terms of the area of habitat lost or degraded. Some indications of the degree to which loss and degradation have occurred are provided in ASMFC (1990).

Loss due to water quality degradation is evident in the northeast Atlantic coast estuaries. The New

York Bight is one example of an area which has regularly received deposits of contaminated dredged material, sewage sludge and industrial wastes. These deposits have contributed to oxygen depletion and the creation of large masses of anoxic waters during the summer months. Elevated levels of PCBs have been documented in Hudson River striped bass and other coastal species, suggesting that it may be derived from coastal waters as well as from the Hudson River (ASMFC 1990). Lastly, results from ESBS studies suggest that survival of striped bass postlarvae may be adversely impacted in some Chesapeake Bay tributaries; however, a large spawning stock in conjunction with an extended spawning season may override some consequences of poor water quality (ASMFC 1990).

Some losses have likely occurred due to the intense coastal development which has occurred during the last several decades, although no quantification has been done. Losses have likely resulted from dredging and filling activities which have eliminated shallow water nursery habitat. Further functional losses have likely occurred due to water quality degradation resulting from point and non-point source discharges. Intensive conversion of coastal wetlands to agricultural use also is likely to have contributed to functional loss of striped bass nursery area habitat.

Other functional loss of riverine and estuarine areas may result from changes in water discharge patterns resulting from withdrawals or flow regulation. Estuarine nursery areas for striped bass, as well as adult pre-spawning staging areas and wintering areas, may be affected by prolonged extreme conditions resulting from inland water management practices. Rozengurt and Haydock (1994) contend that such extreme conditions in many cases can result from the synergistic impact of the "four insidious D's of watershed management: dams, diversions, dewaterings and deforestation." This impact is evident by examining the historical and postimpoundment deviations of spring, as well as annual, runoff discharges from some central Atlantic coast rivers. Postimpoundment flow deviations are significantly greater than historic deviations, resulting in cumulative losses in runoff discharges as well as sediment load, organic and inorganic estuarine inputs, oxygen and other resources (Rozengurt et al. 1985). Rozengurt and Haydock (1994) note that the same scenario has led to the dramatic decline or extirpation of entire ecosystems, including the associated fisheries, in the Black, Azov, Caspian and Aral Seas, and the Columbia and Colorado Rivers.

Some functional losses of estuarine and riverine habitat have occurred as a consequence of accidental catastrophic events. One example is the spill of kepone into the James River which resulted in the closure of the local striped bass fishery. Another example is a spill of oxygen consuming wastes into the Roanoke River, which resulted in a massive kill of adult striped bass (Mulligan, 1991).

1.3.2.4 Current Threats

Current threats to striped bass include impacts which have resulted from the human activities discussed above, as well as from presently proposed and future activities. Potentially serious threats stem from the continued alteration of freshwater flows and discharge patterns to spawning, nursery and adult habitats in rivers and estuaries. Additional threats in the form of increased mortality resulting from placement of additional intakes in spawning and nursery areas will occur, although the impacts may be mitigated to some degree with proper screening. Placement of jetties which disrupt current flow patterns into and out of coastal estuaries and lagoons may also affect migration patterns or habitat use.

1.3.2.5 Effect on the Ability to Harvest and Market

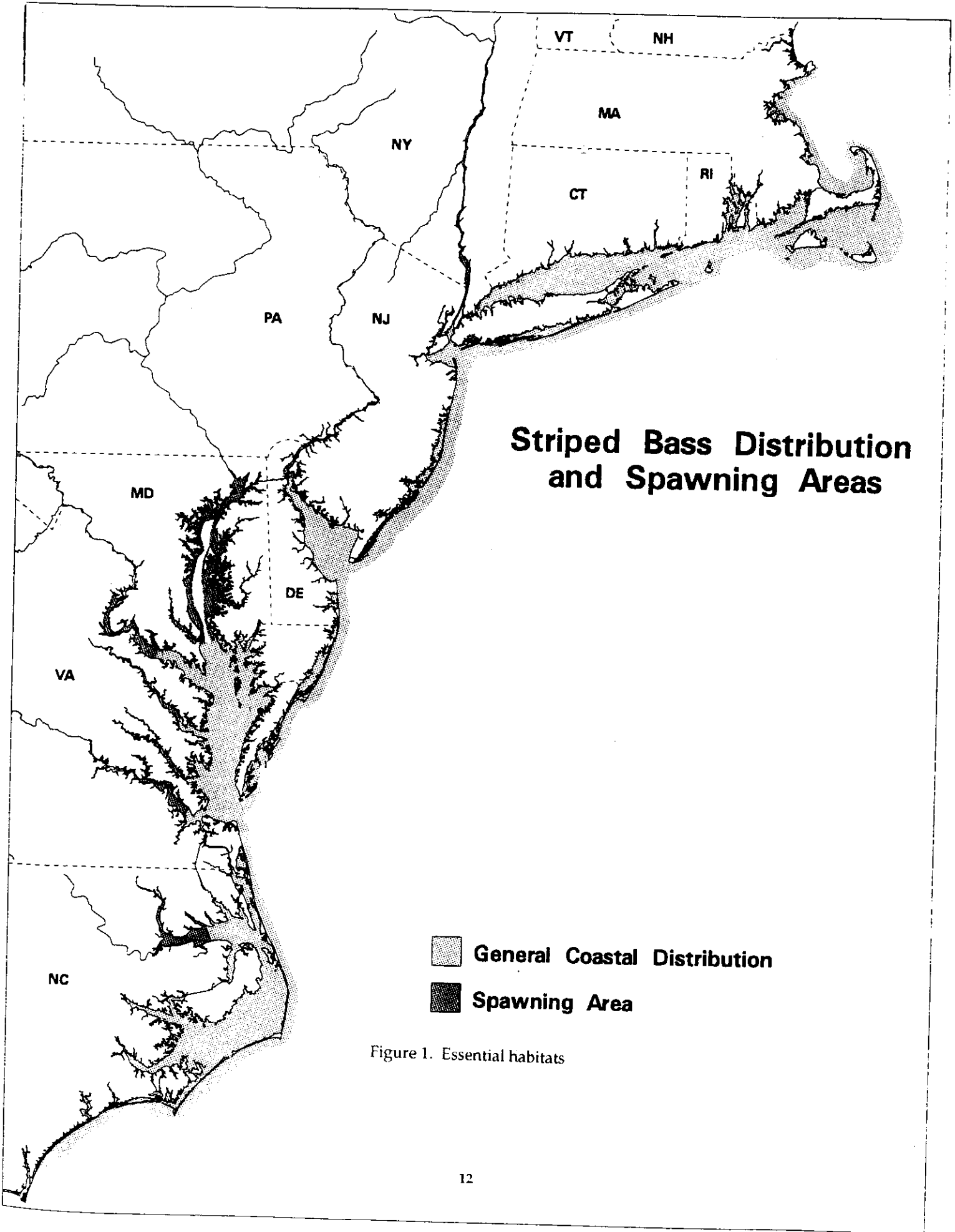
Impacts to striped bass habitat may have two different effects on the ability to harvest and market striped bass. Impacts which result in mortality over and above that which would occur naturally at any life stage will reduce the size of the population and thereby ultimately reduce the size of the

allowable harvest. Such impacts include impingement and entrainment, lethal levels of contamination, and blockages or other changes in spawning grounds which could reduce or eliminate reproductive success. Impacts which may not increase mortality, but reduce or eliminate marketability include non-lethal levels of contaminants which may render fish unfit for human consumption, or changes in water quality which may reduce fish condition or appearance to a point where they are unmarketable. One example of the former case is the Hudson River population, where reproductive success has been high, but fish are unmarketable due to poly-chlorinated biphenyl (PCB) contamination (Anon., 1976-present).

1.3.3 Identification and Distribution of Essential Habitats

All habitats described above are deemed essential to the continued sustainability of the Atlantic Coast migratory striped bass stock as it presently exists. These habitats are depicted in Figure 1. More detailed maps of essential habitats are included in the Source Document (ASMFC in prep.). The record high reproductive success which occurred in 1989 and 1993 suggests that the amount of spawning habitat presently available can produce a strong juvenile year class, under appropriate climatic conditions. It also suggests that adequate nursery and adult habitat exist to sustain the stock.

Without a specific goal for restoration of historic or potential striped bass habitat, it is difficult to describe all "essential habitat" along the Atlantic coast. States may wish to identify areas targeted for restoration as essential habitat. These additional areas may be necessary for achieving historic striped bass production levels in those jurisdictions.



Striped Bass Distribution and Spawning Areas

- General Coastal Distribution
- Spawning Area

Figure 1. Essential habitats

1.4 Description of the Fishery

Striped bass have formed the basis of one of the most important fisheries on the Atlantic coast for centuries. Early written accounts recorded their great abundance, and they have been regulated since European settlement of North America. They remain a significant component of both commercial and recreational fisheries on the Atlantic coast as a result of the recovery which has occurred following the partial moratorium imposed from 1984 to 1989.

1.4.1 Coastwide

Catch statistics for the striped bass fisheries on the Atlantic coast are compiled by the NMFS for both commercial and recreational fisheries. The information that follows is derived from summary reports prepared on an annual basis by NMFS.

1.4.1.1 Commercial

Commercial harvest peaked at almost 15 million pounds in 1973. The harvest then declined to 3.5 million pounds in 1983, a 77 percent decrease.

The commercial fishery has been allowed to grow slowly since its reopening in 1990. The harvest in 1989 was 285,000 pounds, increasing to 823,000 pounds in 1990, 1.15 million pounds in 1991, 1.7 million pounds in 1992, and 1.7 million pounds in 1993, even though harvest was restricted. Most of this growth resulted from the fact that Maryland has been permitted to impose flexible quotas which have risen with increasing stock size.

1.4.1.2 Recreational

The growing popularity of saltwater sport-fishing in the 1960's and 1970's resulted in shifts in harvest. Since 1979, the first year sport harvest was surveyed by the Marine Recreational Fishery Statistics Survey, sport harvest has ranged from 28 to 65 percent of the total harvest. Sport harvest in weight of striped bass dropped from a high of over 6.5 million pounds in 1979 to 1 million pounds in 1984. The decline reflected more stringent management, overfishing, and habitat degradation.

Recent sport harvest has grown from a low of 3.1 million pounds in 1990, 3.5 million pounds in 1991, 4.8 million pounds in 1992, and 6.6 million pounds in 1993. Some of the increase in sport harvest was the result of increases in minimum length regulations. Due to the regulations, the average weight of striped bass landed by sport anglers has increased since 1980. The 1993 harvest was 101 percent by *weight* of the recorded high in 1979, yet the 1993 harvest in *numbers* of fish was only 41 percent of the 1979 harvest. (The referenced years of Marine Recreational Fishery Statistics Survey (MRFSS) data should be considered preliminary until published by the National Marine Fisheries Service.)

1.4.1.3 By-catch in Other Fisheries

Catch of striped bass which occurs in fisheries directed at other species is referred to as by-catch. By-catch also refers to undersized, illegal, or unmarketable striped bass caught in directed fisheries. By-catch can result in mortality in addition to that which results from fishing and is one component of what is collectively referred to as "nonharvest" mortality (see Section 3.2). Estimates of by-catch are difficult to obtain, since few studies have focused specifically on that issue. States with large commercial fisheries for striped bass and other species generally have more precise estimates of by-catch losses than states with small commercial fisheries. by-catch losses contribute to the overall

mortality of striped bass and are important to consider in the current and future management of the fisheries.

Estimates of incidental by-catch striped bass mortality are available from several studies (reviewed in Dorazio et al. 1994). Assumptions which have been made for the purposes of estimating by-catch mortality include 17 to 33 percent in a winter gill net fishery, and 3.5 percent for striped bass caught in trawls.

1.4.1.4. Economic Impact of the Fishery

A recent economic study shows that anglers spent an estimated \$136 million in retail sales coastwide in 1993 to pursue striped bass (Southwick and Teisl, 1995). The same study showed that, conservatively, recreational striped bass fishing from Maine to North Carolina generated a total economic impact (accounting for associated industries such as tackle manufacturing, boat construction, etc.) of \$270 million, 4,000 jobs, and \$11 million in federal income tax.

In 1993, the total value of coastwide commercial landings of striped bass equaled \$2,791,000. Very conservatively, this translated to a total economic impact (accounting for associated industries such as net manufacture, boat insurance, etc.) of 1,490 jobs and \$53,609,000 coastwide (Southwick and Tiesl, 1995).

1.4.2 Description By State

Each state compiles the results of both commercial and recreational fisheries annually and provides a report to the ASMFC. Information provided below is based on the state reports which are on file with the ASMFC.

1.4.2.1 Commercial

From 1980 to 1992, the majority of commercial striped bass harvest by weight was taken in Maryland (27 percent), New York (18 percent), Massachusetts (17 percent), North Carolina (14 percent), and the Potomac River (14 percent). Rhode Island and Virginia also had significant commercial landings during this period. The distribution of harvest has shifted since the severe restrictions of the 1980's. Since the reopening of the fishery in 1990, Maryland accounts for 26 percent of the harvest, followed by Massachusetts (21 percent), Virginia (18 percent), the Potomac River (14 percent), New York (11 percent) and North Carolina (7 percent). Several jurisdictions (e.g. Maine, New Hampshire, Connecticut, Pennsylvania, Washington D.C., New Jersey) currently have no commercial fishery for striped bass.

1.4.2.2 Recreational

From 1979 to 1992 the majority of striped bass sport harvest was taken in New York, Massachusetts, New Jersey and Maryland. The NMFS sampling program of recreational anglers indicates that an increased interest in striped bass angling has occurred, with the total estimated number of trips increasing since 1988 to almost 4 million in 1992. (The referenced years of Marine Recreational Fishery Statistics Survey (MRFSS) data should be considered preliminary until published by the National Marine Fisheries Service.)

1.4.2.3 By-catch

Few data exist on a state-by-state basis for by-catch of striped bass in other recreational or commercial fisheries. By-catch in commercial fisheries has occurred in those states with spring Alosid fisheries, and in those states with offshore winter fisheries for spiny dogfish (*Squalus acanthias*). These fisheries usually employ either pound nets or gill nets in estuarine waters, and gill nets offshore. Striped bass captured in pound nets may be released with little or no mortality if the nets are regularly checked. Those captured in gill nets tend to experience higher mortality. Additional analysis of existing data or additional studies must be conducted to derive more accurate estimates of by-catch in commercial fisheries for other species.

By-catch has been evaluated to some degree in the spiny dogfish winter fishery conducted off North Carolina. Investigations by NMFS during the 1994 fishery indicated that by-catch of striped bass did occur in that fishery. Estimates of the total by-catch ranged from 14,000 pounds to 125,300 pounds, depending on the assumptions used in the calculations. The Technical Committee had few concerns about this particular by-catch issue from a biological perspective, especially in light of the large and recently expanding stock of Atlantic striped bass. This estimate, however, is dependent on the accuracy of the field data on which it is based. The Technical Committee and Management Board have requested that additional investigations be conducted to further quantify the by-catch in this and other commercial fisheries.

When developing their annual reports to ASMFC, states within the management unit currently use an 8% mortality for hooked and released striped bass in the recreational fishery. In other words, the states assume that 8% of the fish hooked and released by anglers subsequently die. The actual value probably varies with the water temperature and salinity encountered at the time of capture. Generally, survival of striped bass hooked and released tends to be higher at higher salinities and lower temperatures. Using current Marine Recreational Fisheries Statistics Survey (MRFSS) landings estimates and the 8% value, recreational hook and release activity results in a loss of approximately 14,000 pounds of striped bass per day during the entire recreational season (April-December).

1.4.2.4 Economic Impact of the Fishery

There was a considerable range in statewide expenditures by recreational striped bass fishermen in 1993, with retail sales estimates ranging from \$585,000 to \$41.4 million (Southwick and Tiesl, 1995). The highest economic impact (accounting for associated industries such as tackle manufacturing, boat construction, etc.) from striped bass anglers occurred in Massachusetts (\$82 million), Maryland (\$61 million), and New Jersey (\$43 million). Total 1993 state sales tax generated from striped bass sportfishing was over \$7.7 million.

Available economic models for commercial striped bass fisheries generated regional (not state-by-state) estimates of the industry's financial impact in 1993. These models indicated that the mid-Atlantic region (New York, New Jersey, Delaware, Maryland, and Virginia) generated the highest economic activity through commercial striped bass fishing, yielding \$41,000,000 in total (accounting for all associated industries in addition to dockside landings value). The New England region (Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut) and the South Atlantic region (North Carolina for the purposes of this plan) were roughly equal in economic impact, yielding approximately \$6.4 million each.

It should be noted that these data and those in Section 1.4.1.4 simply indicate the business and financial activity resulting from the use of the striped bass resource. Economic value, on the other hand, is a non-business measure that estimates the value people receive from an activity after subtracting their costs and expenditures. This concept is also known as *consumer surplus*. Consumer

surplus is a useful but difficult quantity to measure, and current constraints prevented an in-depth analysis of this issue.

1.5 Explanation of Adaptive Management Approach and Existing Plan

The term "adaptive management" means that fishery managers must evaluate the response of the population to the regulatory measures employed and react to changes. This ensures that managers are prepared to change a fishery management plan as necessary to ensure that the goal and objectives of the plan are met. Adaptive management requires that the fishery and population are monitored to an extent sufficient to allow the managers to assess how well the plan is performing. Necessary corrections must be made to the management regime if indications are that the population is declining, or that landings exceed levels desired. If landings are too high, or the population is not stable or growing, additional restrictions on harvest must be imposed. If on the other hand, landings are low, and population growth is high, harvests may be increased. Amendment 5 will use this adaptive management approach.

1.6 Technical Documentation for New Amendment

In order to reduce the length of Amendment 5 and restrict its content to major provisions and a minimum of explanatory text, supporting documentation has been placed in the Amendment 5 Source Document (ASMFC, in preparation). The Source Document will be available from the ASMFC in 1995 and will contain extensive materials which depict essential habitats and provide detailed explanations of the science behind the Atlantic coast migratory striped bass management process.

Section 2. AMENDMENT #5 GOAL AND OBJECTIVES

Goal:

To perpetuate, through cooperative interstate fishery management, migratory stocks of striped bass so as to allow a commercial and recreational harvest consistent with the long term maintenance of self-sustaining spawning stocks and to provide for the restoration and maintenance of their essential habitat.

Objectives:

- 1) To prevent overfishing.
- 2) To allow harvest which maintains spawning stock biomass in a condition which provides for perpetuation of self-sustaining spawning stocks in each designated spawning area, based on maintaining young-of-the-year indices, SSB, or other measures of spawning success at or above historical levels as established in the plan.
- 3) To achieve compatible and equitable management measures among jurisdictions throughout the fishery management unit.
- 4) To promote cooperative interstate research, monitoring and law enforcement.
- 5) To identify critical habitats and environmental factors that limit long term maintenance and productivity of east coast migratory striped bass.
- 6) To adopt and promote standards of environmental quality necessary to the long term maintenance and productivity of east coast migratory striped bass throughout their range.
- 7) To establish criteria, standards, and procedures for plan implementation as well as determination of states' compliance with management plan provisions.

Management Unit:

All coastal migratory striped bass stocks of the east coast of the United States*.

*This does not include the Exclusive Economic Zone (3-200 nautical miles offshore), which is managed separately by the National Marine Fisheries Service.

Section 3. MANAGEMENT PROGRAM SPECIFICATIONS/ELEMENTS

This section describes the operational (as opposed to regulatory) procedures for states to follow in implementing Amendment 5. The requirements described below concern both fishery independent and fishery dependent monitoring programs, as well as stocking and hatchery operations.

In both regulatory and operational considerations, Amendment 5 makes a distinction between producer areas and coastal areas. Producer areas are typically estuaries or river systems in which a discreet population of striped bass regularly spawns each spring. Producer areas must meet the following criteria under Amendment 5:

- Primarily small native fish are available in the defined area.
- Traditional fisheries in the area have historically targeted small fish.
- The defined area is one in which fish reside more or less continuously until they join the coastal migratory stock between ages 2 and 6.

Currently, the following producer areas are defined for management under Amendment 5:

Hudson River (New York, New Jersey): Tidal waters of the Hudson River from river mile 156 downstream to a line between Rockaway Point (on western Long Island) and Sandy Hook, New Jersey.

Delaware Bay (New Jersey, Pennsylvania, Delaware): The bay and estuary west of a line drawn from Cape May, New Jersey to Cape Henlopen, Delaware.

Chesapeake Bay (Maryland, Potomac River Fisheries Commission, District of Columbia, Virginia): Tidal portions of mainstem Chesapeake Bay and its tributaries north of a line extending from Cape Charles, Virginia to Cape Henry, Virginia.

Albemarle Sound/Roanoke River (North Carolina): The sound and estuary from a line across Oregon Inlet, North Carolina upstream to Roanoke River mile 137.

Other producer areas can be designated at the discretion of the Management Board. The term "coastal areas" refers to all other regions within the Management Unit.

3.1 Assessing Annual Recruitment

Annual juvenile recruitment (appearance of juveniles in the ecosystem) of striped bass which comprise the Atlantic Coast migratory population is measured in order to provide an indication of future stock abundance. When low numbers of juvenile fish (age 0) are produced in a given year, recreational and commercial catches from that yearclass may be lower four years later when the surviving fish become available to the fisheries. Recruitment is measured by sampling current year juvenile fish abundance in nursery areas. Currently, these juvenile abundance indices are determined annually for stocks in the Kennebec River, Hudson River, Delaware River, Chesapeake Bay and its tributaries, and Roanoke River/Albemarle Sound. Since there is a time delay of several years between the measurement of recruitment and initial harvest of those fish, managers have ample time to protect yearclasses which

have not yet been exploited.

Under Amendment 5, the juvenile index values serve as input to the spawning stock biomass model (see Section 3.2) which is used to estimate future population levels. They also will continue to serve as an "early warning signal" to fishery managers (see Section 3.1.2 #8, below).

3.1.1. Calculation of Juvenile Abundance Indices

All required juvenile abundance indices, or JAI's, (see Section 3.1.3) shall be reported as a geometric mean. The method for calculating the geometric mean is described in ASMFC 1992 and Crecco 1992. Use of the geometric mean value will reduce the probability of a single value unduly influencing management action.

3.1.2. Requirements for Measurement and Use of Juvenile Indices

- 1) The sampling protocol (stations, sampling intensity and gear type) shall be consistent through time for the period for which the index is to be used. For new indices, the following information will be required: details of the sampling design of the study yielding the data used to develop the index; a description of the analyses performed; and a presentation of the results of those analyses. The Technical Committee shall review any such submittal and either accept or reject it. If rejected, the Committee will provide a written explanation to the sponsor explaining the reasons for rejection.
- 2) In order to be validated, the index should exhibit a significant ($p < 0.05$) positive correlation to either the magnitude of future landings (lagged 2-7 years) from that stock, or to the relative abundance of the same yearclass later in life (i.e., relative abundance of juveniles versus the relative abundance of yearling fish of the same yearclass).
- 3) Currently, values used for recruitment in management models are derived from the the Maryland JAI, and this will continue until other indices are incorporated into the model.
- 4) For decisions concerning ASMFC management, the Maryland JAI will be calculated using the scaled geometric mean, as given in Crecco (1992). A weighting system incorporating recent and developing information on spawning area contributions shall be considered by the Stock Assessment Subcommittee for implementation by the Board.
- 5) The Commission and States are responsible for incorporating the use of the scaled, weighted geometric mean into all analyses which currently use the Maryland JAI.
- 6) Individual indices can be used to guide the management of individual stocks in individual producer areas (see Section 3.2).
- 7) The Management Board may require juvenile abundance surveys in new producer areas.
- 8) The Technical Committee shall annually examine trends in all required Juvenile Abundance Index surveys. If any JAI shows recruitment failure (i.e., JAI is lower than 90% of all other values in the dataset) for three consecutive years, then appropriate action should be recommended to the Management Board. The Management Board shall be the final arbiter in all management decisions.

3.1.3. Juvenile Abundance Index Surveys Required

The following states are currently required to conduct juvenile abundance index surveys on an annual basis: Maine for the Kennebec River; New York for the Hudson River; New Jersey for the Delaware River; Maryland for Chesapeake Bay tributaries; Virginia for Chesapeake Bay tributaries; and North Carolina for Roanoke River/Albemarle Sound. Table 1 summarizes required juvenile abundance index surveys.

3.2. Estimating Spawning Stock Biomass

3.2.1. Definition and Explanation

In recent years, stock assessment scientists have been working to establish a better understanding of striped bass stock dynamics. Accordingly, personnel from Maryland Department of Natural Resources developed a model to estimate the total weight of sexually mature striped bass females in upper Chesapeake Bay and along the Atlantic coast (Rugolo et al., 1994). The Spawning Stock Biomass (SSB) model uses the juvenile abundance indices obtained in the Maryland portion of Chesapeake Bay since 1954 to estimate historic levels of SSB. The model can also estimate future relative population size under given regulatory programs.

3.2.2. Measurement and Use

The predictive abilities of the SSB model are its true utility. Managers can examine the effects of proposed regulations (e.g. minimum sizes, F rates) and biological factors (e.g. recruitment variability) on the adult female population. Since female biomass is the currency of reproductive potential in the population, the model's output describes the past, current, and future ability of the stock to replenish itself through annual reproduction. Additionally, the comparison of current SSB estimates to historical high reference levels (estimated from 1960-1972) allows managers to evaluate the relative health of the population and its rate of recovery (or decline).

Currently, the Maryland juvenile indices are the only ones used in the SSB model. However, other indices from the Virginia Chesapeake Bay, Hudson River, Delaware River, Albemarle Sound/Roanoke River, and the Kennebec River (see section 3.1) can and should be used in an SSB model to examine population trends in those systems as noted above. The Technical Committee and Management Board will determine when and how these analyses are to be incorporated into management plan decision-making.

In addition to the SSB modelling, the relative size of spawning stocks is estimated directly via fishery-independent surveys in various producer areas. These surveys often involve the use of commercial fishing gears or electrofishing to capture actively spawning adults on the spawning grounds in producer estuaries.

A virtual population analysis (VPA) shall be designed during the first two years of plan implementation (1995-1996). The VPA, derived chiefly from fishery-dependent data, will permit the Technical Committee and Management Board to annually examine the population of legal size striped bass coastwide. The VPA will also allow the calculation of a total allowable catch (TAC) for the management unit, and the possibility of implementing total (sport + commercial) harvest quotas for each state. Since the VPA must be tuned with fishery-independent data, it is critical that all major producer areas (Hudson River, Delaware River, Chesapeake Bay, Albemarle Sound/Roanoke River) are surveyed annually for spawning stock assessment.

3.2.3. Requirements for Monitoring Spawning Stock Biomass

- 1) The Technical Committee shall examine output from the Spawning Stock Biomass (SSB) model annually, and use those projections in conjunction with fishing mortality rates (see section 3.3) and Juvenile Abundance Indices (see section 3.1) to assess stock status and regulatory efficacy. If SSB estimates are projected to fall below the reference level, the Technical Committee and Management Board shall consider revising the current harvest regulations (see Section 4.5, Adaptive Management).
- 2) Jurisdictions bordering producer areas (currently New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and North Carolina) shall be responsible for conducting spawning stock assessment surveys in those areas for at least 1995-1996. Accepted studies for fulfilling this requirement currently include: **New York:** Hudson River haul seine survey and shad by-catch analysis; **Maryland:** Gill net surveys; **Virginia:** spring pound net survey; **North Carolina:** spring electroshocking survey of spawning stock; **Pennsylvania-New Jersey-Delaware:** Delaware River electroshocking/gill net survey (See Table 1).
- 3) The Technical Committee shall annually compare estimates of relative spawning stock size derived from the SSB model and from fishery-independent spawning stock surveys. If these estimates differ significantly, then the Technical Committee shall examine both datasets to determine if fishery regulations should be modified. Any difference in spawning stock estimates shall be reported to the Management Board and Advisory Panel for their immediate consideration.

3.3. Annual Fishing Mortality Target and Measurement

3.3.1. Definition

Total mortality of wild striped bass has essentially two components: natural mortality (M) and fishing mortality (F). Fishing mortality is the rate at which fish are removed from the population by human activities. These activities include both intentional legal harvest (F_{dir} or *directed* fishing mortality), and background or nonharvest mortality which includes poaching, by-catch, and hook-and-release mortality. Background mortality has proven extremely difficult to measure, but available evidence suggests the instantaneous background mortality rate is approximately 0.1. Background mortality and directed mortality together equal total fishing mortality.

Fishing mortality rates are estimated using a variety of fishery dependent and fishery independent data. These include catch curve analyses from both recreational and commercial fisheries and tag/recapture studies. Unfortunately, the linkage between most harvest regulations and F rates is difficult to predict: the success of regulations in attaining target F rates is usually determined through retrospective analysis (i.e., examining the previous year's results). Therefore, as regulatory measures are relaxed under Amendment 5, it is critical that intensive fishery monitoring be sustained. If total F rates are too high (i.e., overshooting the target rate), the Management Board can consider imposing stricter regulations coastwide (see Section 4.5).

3.3.2. Target Fishing Mortality Rates

The maximum fishing mortality rate that a fish population can support over time is termed F at maximum sustainable yield or F_{msy} . This level of fishing mortality is not intended to maximize harvest or economic benefit from the fishery; rather, it is a predetermined, safe rate which maintains stock size for a long-term, self-sustaining population of striped bass. At the preferred size limit option

stock size for a long-term, self-sustaining population of striped bass. At the preferred size limit option of 20 inches in producer areas and 28 inches along the coast (see section 4.2), the recovered Atlantic striped bass population can sustain an $F_{msy} = 0.40$. At this rate, approximately 30% of legal sized fish are killed by human activity each year.

Under Amendment 4, the transitional target mortality rate was $F=0.25$, except for the Hudson River stock which had a target F of 0.5. This higher rate was permitted for the Hudson River population because it never experienced the collapse observed in other segments of the striped bass population. Concerns about overshooting the target F_{msy} , because of difficulty in measuring current year fishing rates, and possibly overharvesting the coastal stock, prompted the Management Board to phase in the F_{msy} over a two year period, using a so-called interim F (F_{int}) that is half-way between 0.25 and F_{msy} (i.e., $F = 0.33$).

3.3.3. Requirements for Fishing Mortality Rate Calculation

- 1) Catch composition information will be gathered by those states with commercial fisheries (currently Massachusetts, New York, Rhode Island, Delaware, Maryland, Virginia, Potomac River Fisheries Commission, North Carolina) and by those states with significant recreational fisheries (Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Maryland, Virginia, and the Potomac River Fisheries Commission). Samples shall be representative of location and seasonal distribution of catch, and appropriate biological data shall be collected (See Table 2).
- 2) Representative catch and effort data will be gathered by those states with significant commercial fisheries (currently Massachusetts, New York, Maryland, Virginia, Potomac River Fisheries Commission) and by those agencies monitoring recreational fisheries (National Marine Fisheries Service, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Maryland, Virginia, Potomac River Fisheries Commission) (See Table 2).
- 3) Striped bass tagging programs currently executed by the U.S. Fish and Wildlife Service, National Marine Fisheries Service, Southeastern Monitoring and Assessment Program, Massachusetts Division of Marine Fisheries, New York Department of Environmental Conservation, New Jersey Department of Environmental Protection, Maryland Department of Natural Resources, Virginia Marine Resources Commission, and North Carolina Division of Marine Fisheries will be continued to generate estimates of migration and mortality rates (See Table 1).
- 4) Except as noted below, member states will implement appropriate regulations to ensure an interim fishing mortality rate (e.g., $F_{int} = 0.33$) that is half-way between $F=0.25$ and F_{msy} (see Section 4). This interim F will be the target F for at least the first two fishing years of Amendment 5 implementation (1995-1996). After that time, with the Management Board's approval, the target fishing rate may be elevated to the full F_{msy} .
- 5) Each year the Technical Committee shall statistically compare the composite estimate of F to the target F . If the composite estimate is significantly greater than the target value in a given year, then no harvest elevation should be recommended to the Management Board for the next fishing year. If the coastwide estimate exceeds the target value for two consecutive years, then harvest reduction will be recommended for the succeeding fishing year. The Management Board shall be the final arbiter in deciding final harvest levels, and may take action as provided in Section 4.5.

Table 1. Fishery-independent monitoring and tagging programs required under Amendment 5.

STUDY CATEGORY	NEEDS & GENERAL GUIDELINES	STATE/RESPONSIBLE AGENCY	SAMPLING AREAS	ACCEPTED METHODOLOGY	OBJECTIVES
Juvenile indices	<p>NEED: Modelling and documentation of key environmental variables which may affect recruitment.</p> <p>GUIDELINES: Indices should be validated and produce reliable, representative measures of catch per unit effort (geometric mean)</p>	ME-DNR	Kennebec R.	Juvenile abundance surveys	Provide reliable index of juvenile abundance in each producer area
		NY-DEC	Hudson R.		
		NJ - DEP	Delaware R.		
		MD-DNR	Ches. Bay tribs.		
		VA-MRC	Ches. Bay tribs.		
		NC-DMF	Albemarle Sound		
Spawning Stock Assessment	<p>NEED: Identification of trends in spawning stock biomass as indication of stock recovery.</p> <p>GUIDELINES: Survey should produce reliable representation of age, size and sex composition of spawning stock.</p>	NY-DEC	Hudson R. ¹	Haul seine/stake & gill net	Reliable estimates of abundance (CPUE), age and length distribution, and sex composition for each system annually.
		PA-FBC	Delaware R. ²	Electrofishing	
		DE-DFW	Delaware R. ³	Electrofishing	
		MD-DNR	Upper Bay ⁴ Potomac R. ⁵	Experimental drift gill net	
		VA-MRC	Rappahannock R. James R. ⁷	Exp. anchor gill net, pound net, fyke net	
		NC-DMF	Roanoke R. ⁸ Albemarle Sound ⁹	Electrofishing	

¹Hudson R., West Point to Catskill; ²Delaware R., state line to the Tacony-Palmyra Bridge; ³Delaware R., Del. Mem. Bridge to state line; ⁴Upper Ches. Bay, (Worton Point to Elkton); ⁵Potomac R. (Maryland Pt. to White Stone Pt.); ⁶Rappahannock R., (Tappahannock to Fredericksburg); ⁷James R., (Dancing Pt. to Tax Pt.); ⁸Roanoke R., (upriver to spawning grounds); ⁹Albemarle Sound (western sound approaches to river).

Table 1 cont'd.

STUDY CATEGORY	NEEDS & GENERAL GUIDELINES	STATE/RESPONSIBLE AGENCY	SAMPLING AREAS	ACCEPTED METHODOLOGY	OBJECTIVES
Stock characterization	<p>NEED: Characterization of age structure of coastal migratory stock and calculation of mortality rates.</p> <p>GUIDELINES: Survey should produce reliable representation of age, size and sex composition of coastal stock and reliably measure catch per unit effort.</p>	NY-DEC	Long Island	Haul Seine Survey	<p>Reliable age, size and sex composition of coastal stock and measurement of CPUE.</p>
		USFWS	NC, VA ocean	SEAMAP cruise	
		NMFS	NC, VA Ocean	SEAMAP cruise	
Tagging	<p>NEED: Calculation of migration and mortality rates.</p> <p>GUIDELINES: All spawning stocks should be included.</p>	MA-DMF	Coop. Anglers	Tagging Programs	<p>Obtain reliable estimates of mortality, survival, migration rates, migration pathways, growth rates, and indication of habitat use.</p>
		NY-DEC	Long Island		
		NJ-DEP	Delaware Bay		
		MD-DNR	Chesapeake Bay		
		VA-MRC	Chesapeake Bay		
		USFWS	Atlantic Ocean		
		NMFS	Atlantic Ocean		

Table 2. Required fishery-dependent monitoring programs under Amendment 5.

STUDY CATEGORY	NEEDS & GENERAL GUIDELINES	RESPONSIBLE STATES/AGENCIES
Commercial catch composition	<p>NEED: Define structure of exploitation, calculation of mortality rates, VPA</p> <p>GUIDELINES: Samples should be representative of location and seasonal distribution of catch, can should include size and sex composition. Collection of scales is conditional; if scale:age relationships from previous years are validated, indirect methods may be used.</p>	States with commercial fisheries (MA, NY, RI, DE, MD, VA, PRFC, NC)
Commercial catch and effort	<p>NEED: Track mortality in a general way, VPA</p> <p>GUIDELINES: Surveys should produce reliable measures of catch (numbers and weight) and effort in gear days fished.</p>	States with significant commercial fisheries (MA, NY, MD, VA, PRFC)
Recreational catch composition	<p>NEED: Define structure of exploitation, calculation of mortality rates, VPA.</p> <p>GUIDELINES: Samples should be representative of location, seasonal distribution, and age and size frequency (including sublegals).</p>	MA, RI, CT, NY, NJ, MD, VA, PRFC
Recreational catch and effort	<p>NEED: Track mortality in a general way, VPA</p> <p>GUIDELINES: States named should supplement NMFS MRFSS to achieve 20% CV, or may propose specialized striped bass surveys to better assess harvest. MRFSS without supplementation may be used by other states with a recreational fishery.</p>	NMFS, MA, RI, CT, NY, NJ, MD, VA, PRFC

3.4. Stocking

Complete details and justification for the requirements of the plan with regard to stocking are contained in Revised Special Report No. 10 of the ASMFC (Upton 1994). The report was developed by the Striped Bass Stocking Committee of the ASMFC. Members represent Atlantic Coast states from Maine to North Carolina who have an interest in stocking striped bass and/or their hybrids, as well as representatives from the U.S. Fish and Wildlife Service.

Reexamination of the issues associated with stocking, after a number of years of conducting stocking programs, made evident the need for updated requirements for inclusion in Amendment 5.

3.4.1. Need and Use

- 1) Evaluation of the return of adult females to the spawning grounds shall continue for all studies in which significant numbers of hatchery fish were marked.
- 2) Stocking for enhancement purposes shall be terminated except in those systems where striped bass have been absent or when the adult population and reproduction have been at low levels for several years.
- 3) Surveys of recreational and commercial striped bass fisheries shall continue in order to quantify benefits of stocking programs to both pre-migratory and coastal populations.
- 4) Stocking of hatchery-reared striped bass should be recognized as only one tool available to resource managers and the appropriateness of this tool will vary with circumstances.
- 5) Stocking for mitigation purposes shall be at the discretion of the states.
- 6) If striped bass are to be stocked in coastal waters a sufficient number must be marked to allow determination of survival and percentage of contribution to natural stocks.
- 7) All striped bass shall be marked if one million or less are stocked.
- 8) If more than one million are to be stocked, the percentage to be marked shall be based on the number of striped bass released and the estimated number in the natural stock.
- 9) Binary coded wire tags shall be used to mark fingerlings released in all coastal waters. Other tagging methods which also differentiate release sites and date might be substituted under certain circumstances upon recommendation by the ASMFC Striped Bass Stocking Committee to the ASMFC Striped Bass Management Board.
- 10) Binary coded wire tag codes shall contain information sufficient to identify each lot of striped bass stocked.
- 11) Under certain circumstances hatchery fish of sufficient size shall be marked with tags recognizable to fishermen so that individuals may report recoveries.
- 12) Programs among and within states shall be coordinated by adhering to requirements of Amendment 5.
- 13) Each state shall take appropriate regulatory or statutory action to insure that striped bass

stocking by private entities into coastal waters is conducted in accordance with requirements of Amendment 5.

14) All striped bass stocking and evaluation activities shall be reported to ASMFC to allow for the dissemination of information to other interested parties.

3.4.2. Maintaining Health, Genetic Integrity and Biodiversity

1) Striped bass tested and proven to be carriers of the infectious pancreatic necrosis (IPN) virus shall not be stocked into natural waters and especially not into waters with salmonids.

2) To reduce the spread of disease, when striped bass are to be stocked or transported into states which culture salmonids, these fish shall be screened for IPN and other pathogens. It is incumbent upon potential striped bass shippers to be aware of each state's policies and regulation on disease screening prior to shipping to that state. It is the state's prerogative to allow shipment of striped bass into its jurisdiction.

3) States receiving striped bass may require screening for pathogens.

4) States shall report shipping and disease screening requirements for striped bass to the ASMFC so that this information can be readily disseminated.

5) Genetic integrity of Atlantic coast striped bass shall be maintained within river basins including specific rivers of the Chesapeake Bay.

6) Only progeny from native brood stock, when available, shall be stocked in river basins and coastal waters.

7) Progeny from brood stock from adjacent rivers or hydrologically similar systems shall be used if native brood stock do not exist. If non-native fish are to be stocked, these activities shall be reported to the ASMFC.

8) Brood stock hatchery practices, such as the number of females needed for hatchery production from a specific system, detection of striped bass-hybrid backcrosses, and the use of hatchery-reared fish as brood stock shall be further investigated, especially if any new stocking initiative is to occur. Interim policy dictates a conservative approach by using as many females as possible and avoiding the use of hatchery-reared females or males to prevent over-representation from a particular gene pool.

9) Hybrids shall be restricted to inland freshwater reservoirs or to other systems in which escapement and reproduction is not likely. The ASMFC recommends the use of pure striped bass for inland stocking programs.

10) Neither striped bass nor hybrids shall be stocked in coastal or inland waters without prior notification and approval of the proper and official state fishery agencies

11) Commercial aquaculture operators must understand that escapement of hybrids and non-native striped bass will not be allowed, and that concerned agencies should be alerted to this policy. The ASMFC encourages the development and use of sterile fish for all aquaculture operations.

3.4.3. Monitoring Results (Survival, Creel, Spawning)

- 1) Phase I or phase II fish may be used for stocking as long as they are marked to avoid confounding young-of-year surveys.
- 2) Juvenile and adult surveys shall be continued to determine the most cost-effective release strategies such as age at release and release condition such as salinity, temperature, and time of day for future potential stocking programs.
- 3) The existing cooperative tagging program shall be coordinated on a coast-wide basis in order to avoid duplication of tag codes, and to make sure that resources such as wand tag detectors are used to the fullest extent possible.
- 4) A central database and archive for the coded wire tags and data shall be maintained by the ASMFC and USFWS, so that the standardization and sharing of the data are facilitated. The intent is to allow for a flow of information among states, federal agencies and interested parties.
- 5) Coded wire tags shall be placed only in the left operculum.
- 6) Stocking strategies shall be further investigated and evaluated in order to maximize benefits achieved through stocking.
- 7) The purpose of stocking and planned evaluation must be documented before further stocking programs are initiated.
- 8) The evaluation program should be budgeted at a value equal to the cost of the stocking program.

3.5. Summary of Monitoring Requirements

Monitoring requirements which are required under Amendment 5 are summarized in Tables 1 and 2. As indicated in Section 5, the monitoring requirements are necessary during 1995 and 1996. The Management Board, upon recommendation from the Technical Committee, will make a determination, prior to 1997, as to which programs, if any, may be dropped (see Section 6.3).

3.6. By-catch Reduction

States and federal agencies shall make every effort to assess the magnitude of by-catch discard mortality occurring in waters under their jurisdiction. In those cases where by-catch is documented as a serious problem or issue, the involved jurisdiction(s) shall make such documentation available immediately to the Technical Committee, Advisory Panel, and Management Board. Any documentation shall include, at a minimum, the following information:

- 1) location, target species, and season of fishery or fisheries involved;
- 2) gear and gear specifications used in the fishery (e.g., gill nets, 6.5" mesh size);
- 3) an estimate of pounds or numbers of striped bass taken per unit of effort in the fishery (e.g., lb. per trip), as well as an estimate of total striped bass by-catch in the fishery;

4) an estimate of how long (e.g., years, months, weeks) striped bass by-catch has occurred as a serious problem in the fishery

Where appropriate, the National Marine Fisheries Service (NMFS) and/or the U.S. Fish and Wildlife Service (USFWS) shall assist states with preparing the required report. The Technical Committee and Advisory Panel shall review such information, and prepare reports for the Management Board. After reviewing these reports, the Management Board may recommend remedial steps to be taken by the involved jurisdictions (e.g., gear restrictions, seasonal/geographic closures, etc.), and may ask the jurisdictions to continue documenting the problem until it is resolved to the Management Board's satisfaction.

In general, states shall undertake every effort to reduce or eliminate the loss of striped bass from the population due to by-catch discard mortality. The Technical Committee shall examine trends in estimated by-catch annually.

Section 4. MANAGEMENT PROGRAM IMPLEMENTATION

4.1. Habitat Conservation and Restoration

Each State should implement protection for striped bass habitat within its jurisdiction in order to ensure the sustainability of that portion of the migratory stock which either is produced or resides within its boundaries. Such a program should inventory historical habitats, identify habitats presently used and specify those which are targeted for restoration, and impose or encourage measures to retain or increase the quantity and quality of striped bass essential habitats.

4.1.1. Preservation of Existing Habitat

- 1) States in which striped bass spawning occurs should notify in writing the appropriate federal and state regulatory agencies of the locations of habitats used by striped bass. Regulatory agencies should be advised of the types of threats to striped bass populations and recommended measures which should be employed to avoid, minimize or eliminate any threat to current habitat quantity or quality.
- 2) Where available, States should seek to designate striped bass essential habitats for special protection. Tools available include High Quality Waters or Outstanding Resource Waters designations. Designations should, where possible, be accompanied by requirements of nondegradation of habitat quality, including minimization of nonpoint source runoff, prevention of significant increases in contaminant loadings, and prevention of the introduction of any new categories of contaminants into the area (via restrictions on National Pollutant Discharge Elimination System (NPDES) discharge permits for facilities in those areas).
- 3) State fishery regulatory agencies should develop protocols and schedules for providing input on water quality regulations to the responsible agency, to ensure that water quality needs for striped bass are met.
- 4) State fishery regulatory agencies should develop protocols and schedules for providing input on Federal permits and licenses required by the Clean Water Act, Federal Power Act, and other appropriate vehicles, to ensure that striped bass habitats are protected.
- 5) Water quality criteria for striped bass spawning and nursery areas should be established or existing criteria should be upgraded to levels which are sufficient to ensure successful reproduction (reference Richkus (1990)) for suggested criteria. Any action taken should be consistent with Federal Clean Water Act guidelines and specifications.
- 6) All State and Federal agencies responsible for reviewing impact statements and permit applications for projects or facilities proposed for striped bass spawning and nursery areas shall ensure that those projects will have no or only minimal impact on local stocks. Natal rivers of stocks considered depressed or undergoing restoration are of special concern. Any project which would result in the elimination of essential habitat should be avoided.

4.1.2. Avoidance of Incompatible Activities

- 1) Federal and State fishery management agencies should take steps to limit the introduction of compounds which are known to be accumulated in striped bass tissues and which pose a threat to human health or striped bass health (see Table 10.1 in ASMFC (1990)).

2) Each State should establish windows of compatibility for activities known or suspected to adversely affect striped bass such as navigational dredging, bridge construction, and dredged material disposal and notify the appropriate construction or regulatory agencies in writing.

3) Projects involving water withdrawal (e.g. power plants, irrigation, water supply projects) should be scrutinized to ensure that adverse impacts resulting from impingement, entrainment, and/or modification of flow and salinity regimes due to water removal will not adversely impact on striped bass stocks.

4) Each state which encompasses spawning rivers and/or producer areas within its jurisdiction should develop water use and flow regime guidelines which are protective of striped bass spawning and nursery areas and which will ensure the long-term health and sustainability of the stock.

4.1.3. Fisheries Practices

1) The use of any fishing gear which is deemed by management agencies to have an unacceptable impact on striped bass essential habitat should be prohibited within appropriate essential habitats (e.g. trawling in spawning areas or primary nursery areas should be prohibited).

4.1.4. Habitat Restoration, Improvement and Enhancement

1) Each state should survey existing literature and data to determine the historical extent of striped bass occurrence and use within its jurisdiction. An assessment should be conducted of those areas not presently used for which restoration is feasible.

2) Every effort should be made to eliminate existing contaminants from striped bass habitats where a documented adverse impact occurs.

3) States should work in concert with the USFWS and NMFS, Office of Habitat Protection, to identify hydropower dams which pose significant impediment to striped bass migration and target them for appropriate recommendations during Federal Energy Regulatory Commission relicensing.

4.2. Recreational Fisheries

In order to achieve annual fishing mortality targets, recreational fisheries will be constrained by a regime of size limits, bag limits and seasons. A basic regime for these limits is established, and states are given the opportunity to vary according to a specified table of equivalency (Tables 3-5) and submitting an alternative management proposal as indicated in Section 4.4. If a jurisdiction uses harvest caps in its recreational fishery, any exceedance shall be subtracted from the following year's recreational quota. States are strongly discouraged from establishing recreational fisheries on spawning grounds during the spawning season.

Preferred Alternative: 20-inch minimum size in producer areas, 28-inch minimum size in coastal areas. Creel limits for the interim fishery ($F=0.33$) are: two fish creel limit along the coast and a one fish creel limit in producer areas (except as noted in Tables 3-5). Interim fishing season lengths are variable between producer areas (Tables 3-4), while a 365 day season is allowed in coastal areas. Management measures for the Hudson River are still under development: until they are finalized, New York and New Jersey may implement a 28 inch minimum size and two fish creel limit (18 inch minimum size and one fish creel allowed above the George Washington Bridge).

These limits and the alternatives allowed to states are detailed in Tables 3-5. This alternative meets the interim target fishing mortality rate of $F=0.33$. Seasons and/or creel limits may be expanded when the Management Board decides to instate the full $F_{msy} = 0.40$.

Spring recreational fisheries in producer areas: Producer area jurisdictions will be allowed to institute spring recreational fisheries on migratory striped bass. Proposals for such fisheries must be reviewed by the Technical Committee and approved by the Management Board in accordance with Section 4.4. Such proposals must include harvest restrictions consisting of a minimum size equal to or greater than 28 inches, a specific fishing season, and a harvest cap.

Table 3. Recreational seasons and creel limits for various size limits in Chesapeake Bay under an interim $F=0.33$

SIZE LIMIT (in.)	FISHING SEASON LENGTH (Days)		
	Percent change in harvest	1 fish creel ¹	2 fish creel ¹
18	-6	107	93
20	0	114	99
22	+5	120	104
24	+10	125	109
26	+13	129	112
28	+15	131	114

¹Season lengths at 1 fish creel also apply to Virginia charterboat and recreational, PRFC charterboat, and Maryland charterboat fisheries which will maintain a 2 fish creel limit. All other jurisdictions or fisheries wishing to impose 2 fish creel limits must follow the seasons under the column "2 fish creel". For Hudson River fisheries, see Section 4.2.

Table 4. Recreational seasons and creel limits for various size limits in Delaware Bay under an interim $F=0.33$.

SIZE LIMIT (in.)	Percent change in harvest	Season (days)	Creel
18	-24	Appendix I	1
20	-20	Appendix I	1
22	-18	Appendix I	1
24	-12	Appendix I	2
26	-8	Appendix I	2
28	0	365	2
30	+13	365	2
32	+35	365	2
34	+80	365	2

Table 5. Recreational seasons and creel limits for various size limits in coastal jurisdictions under an interim $F=0.33$

SIZE LIMIT (in.)	Percent change in harvest	Season (days)	Creel
18	-24	Appendix I	1
20	-20	Appendix I	1
22	-18	Appendix I	1
24	-12	Appendix I	1
26	-8	Appendix I	1
28	0	365	2
30	+13	365	2
32	+35	365	2
34+	+80	365	2

4.3. Commercial Fisheries

In order to achieve fishing mortality targets, commercial fisheries will be constrained by a size limit and a state-by-state quota. Producer area jurisdictions are strongly discouraged from establishing commercial fisheries on spawning grounds during striped bass spawning season.

Preferred Alternative: Commercial fisheries will be constrained by the same size limit regime established for recreational fisheries in producer and coastal areas. In addition, commercial fisheries in each state will be limited to a flexible statewide quota as specified in Tables 6 and 7 for the interim fishery ($F = 0.33$). The Management Board may change these quotas annually in response to stock size change, and when the full F_{msy} is instated. In the event that a state exceeds its quota, the amount of the excess must be deducted from the state's allowable quota for the following year.

4.4. Alternative State Management Regimes

A state may, with the approval of the Management Board, vary their regulatory specifications contained in Sections 4.2. and 4.3., so long as that state can show to the Board's satisfaction that the target fishing mortality rate (see Section 3.3.) will be not be exceeded. Alternative management regimes may also include other indices of their equivalency (e.g., eggs-per-recruit), in addition to target fishing mortality rate protection. Under no circumstances will states be allowed to institute minimum sizes below 18 inches in alternative management regimes.

4.4.1. Procedures

- A) A state may submit a proposal for a change to its regulatory program or any mandatory compliance measure under this amendment to the Commission. Such changes shall be submitted to the ASMFC staff, which shall distribute the proposal to the Management Board, the Plan Review Team, the Technical Committee, the Stock Assessment Subcommittee and the Advisory Panel.
- B) States must submit proposals at least two weeks prior to the Technical Committee's spring or fall meeting.
- C) The Plan Review Team is responsible for gathering the comments of the Technical Committee, the Stock Assessment Subcommittee and the Advisory Panel, and presenting these comments to the Management Board for decision.
- D) The Management Board will decide whether to approve the state proposal for an alternative management program if it determines that it is consistent with the target fishing mortality rate then applicable, and the goals and objectives of this amendment.

Table 6. Striped bass commercial quotas for producer area jurisdictions for 1995-1996, under a variety of size limits. First value is quota for 1995, second is for 1996.

State	Quota (lb./1000)				
	18"	20"	22"	24"	26"
Delaware (Delaware Bay)	77/77	84/84	92/92	95/95	99/99
Maryland (Chesapeake Bay)	1,222 2,016	1,058 1,145	925 819	746 617	531 471
PRFC (Chesapeake Bay)	229/379	199/215	174/154	140/116	100/88
Virginia (Chesapeake Bay)	780 1,286	675 730	590 522	476 394	339 300

Table 7. Striped bass commercial quotas for coastal area jurisdictions for 1995-1996, under a variety of size limits. First value is quota for 1995, second is for 1996.

State	Quota (lb./1000)					
	24"	26"	28"	30"	32"	34+"
New Hampshire	4/4	4/4	4/4	4/4	4/4	4/4
Massachusetts	883 809	833 795	807 812	778 795	845 794	999 802
Rhode Island	185 170	175 167	170 171	163 167	177 167	210 168
New York	807 740	762 727	738 742	711 727	772 725	913 733
New Jersey ¹	245 225	231 221	224 225	216 221	234 220	277 222
Delaware (ocean)	12 11	11 10	11 11	10 10	11 10	13 11
Maryland (ocean)	100 91	94 90	91 92	88 90	95 90	113 91
Virginia (ocean)	106 98	101 96	97 98	94 96	102 96	120 97
North Carolina (ocean)	365 335	345 329	334 336	322 329	350 328	413 332

¹New Jersey commercial cap allocated to recreational fishery.

4.5. Adaptive Management

The Management Board may vary the requirements specified in this Amendment as a part of adaptive management in order to achieve the goals and objectives specified in Section 2. Specifically, the Management Board may change target fishing mortality rates, size limits, creel limits, seasonal restrictions, commercial fishery quotas and the restoration status of producer areas. Such changes will be instituted to be effective on January 1 or on the first fishing day of the following year, but may be put in place at an alternative time when deemed necessary by the Management Board.

4.5.1. Procedures

A. The Plan Review Team will continually monitor the status of the fishery and the resource and report on that status to the Management Board on or about May 1. The PRT will consult with the Technical Committee, the Stock Assessment Subcommittee and the relevant Advisory Panel, if any, in making such review and report. The report will contain recommendations concerning proposed adaptive management revisions to the management program.

B. The Management Board will review the report of the PRT, and may consult further with the Technical Committee, the Stock Assessment Subcommittee or the Advisory Panel. The Management Board may direct the PRT to prepare an addendum to effectuate any changes it deems necessary. The addendum shall contain a schedule for the states to implement its provisions.

C. The PRT will prepare a draft addendum as directed by the Management Board, and shall distribute it to all states for review and comment. A public hearing will be held in any state that requests one. The PRT will also request comment from federal agencies and the public at large. After a 30-day review period, the PRT will summarize the comments and prepare a final version of the addendum for the Management Board.

D. The Management Board shall review the final version of the addendum prepared by the PRT, and shall also consider the public comments received and the recommendations of the Technical Committee, the Stock Assessment Subcommittee and the Advisory Panel; and shall then decide whether to adopt or revise and adopt the addendum.

E. Upon adoption of an addendum implementing adaptive management, states shall prepare plans to carry out the addendum, and submit them to the Management Board for approval, according to the schedule contained in the addendum.

4.6. Non-restored Producer Areas

The Albemarle Sound/Roanoke River system is not yet restored, and is covered by the provisions of this Amendment. Beginning in 1994, the state of North Carolina began the implementation of a two-year plan for the conservation of this fishery as a follow-up to the Congressionally mandated North Carolina Study Board Report. The Striped Bass Management Board has approved implementation of this plan for one year. In April, 1995, the Management Board will consider whether to extend approval of the use of the North Carolina management plan for another year. If not, or in April, 1996 at the latest, the Management Board will decide on the management regime to be applied in the Albemarle Sound/Roanoke River fishery.

The status of the Delaware Bay producer area is difficult to determine at present. The estuary's juvenile abundance indices (JAI's) have only been determined since 1980, and the Technical Committee

has been unable to examine historic and recent trends in spawning stock biomass for the resident stock of striped bass. Nonetheless, recent JAI's have been at or above record levels and estimated fishing mortality rates in the system have been below target levels. In considering the treatment of the Delaware Bay stock under Amendment 5, the Technical Committee examined these promising data, and noted that the stock--which mixes extensively with the Chesapeake Bay population--would essentially be fished at whatever F was imposed in neighboring ecosystems. Accordingly, the Management Board voted to allow the Delaware Bay jurisdictions (Delaware, Pennsylvania, and New Jersey) the option of managing their producer area stocks of striped bass at the same target F rate as the Chesapeake Bay jurisdictions.

4.7. Management Institutions

4.7.1. Atlantic States Marine Fisheries Commission and ISFMP Policy Board

The Atlantic States Marine Fisheries Commission and the Interstate Fisheries Management Program Policy Board are generally responsible for the oversight and management of the Commissions fisheries management activities. The Commission must approve all fishery management plans and amendments thereto, including this Amendment #5; and must also make all final determinations concerning state compliance or noncompliance. The ISFMP Policy Board reviews recommendations of the various Management Boards and, if it concurs, forwards them on to the Commission for action.

4.7.2. Striped Bass Management Board

The Striped Bass Management Board is established by the Commissions ISFMP Policy Board and is generally responsible for carrying out all activities under this Amendment. It establishes and oversees the activities of the Plan Review Team, the Technical Committee and the Stock Assessment Subcommittee; and requests the establishment of the Commissions Striped Bass Advisory Panel. Among other things, the Management Board makes changes to the management program under adaptive management, approved state programs implementing the amendment and alternative state programs under Section 4.3. The Management Board reviews the status of state compliance with the FMP at least annually, and if it determines that a state is out of compliance reports that determination to the ISFMP Policy Board under the terms of the ISFMP Charter.

4.7.3. Plan Review Team

The Plan Review Team is a small group whose responsibility is to provide all of the staff support necessary to carry out and document the decisions of the Management Board. It will be chaired by an ASMFC Striped Bass Coordinator. The PRT is directly responsible to the Management Board for providing all of the information and documentation necessary to carry out the Board's decisions.

4.7.4. Technical Committee

The Striped Bass Technical Committee will consist of one representative from each jurisdiction and federal agency with an interest in the striped bass fishery. Its role is to act as a liaison to the individual state agencies, providing information to the management process and review and recommendations concerning the management program. The Technical Committee will report to the Management Board, normally through the Plan Review Team.

4.7.5. Stock Assessment Subcommittee

The Stock Assessment Subcommittee will consist of those scientists with expertise in the assessment of

striped bass populations. Its role is to assess striped bass populations and provide scientific advice concerning the implications of proposed or potential management alternatives, or to respond to other scientific questions of the Management Board. The Stock Assessment Subcommittee will report to the Management Board as well as the Technical Committee.

4.7.6. Advisory Panel

The Striped Bass Advisory Panel is established according to the Commissions Advisory Committee Charter. Members of the Advisory panel are citizens who represent a cross-section of commercial and recreational fishing interests and others who are concerned about striped bass conservation and management. The Advisory Panel provides the Management Board with advice directly concerning the Commissions striped bass management program. Normally, the Advisory Panels meetings will be held at and in conjunction with selected Management Board meetings.

4.7.7. Secretaries of Commerce and the Interior

Under the Atlantic Striped Bass Conservation Act, if the Commission determines that a state is out of compliance with the FMP it reports that finding to the Secretaries of Commerce and the Interior. The Secretaries are then required by the federal law to impose a moratorium on fishing for striped bass in that states waters until the state comes back into compliance. This authority has been used once in the administration of Amendment #4. In addition, the Commission has accorded NMFS and USFWS voting status on the ISFMP Policy Board and the Striped Bass Management Board; and the federal agencies participate on the Plan Review Team, the Technical Committee and the Stock Assessment Subcommittee.

Section 5. COMPLIANCE

Under the provisions of the Atlantic Striped Bass Conservation Act, all states (including Washington D.C. and Potomac River Fisheries Commission (PRFC)) are required to implement the provisions of this Amendment. This section sets forth the specific requirements with which states must comply under the law, and the procedures that will govern the evaluation of compliance.

5.1. Mandatory Compliance Items for States

5.1.1. State Programs

A state will be found out of compliance if;

- a. its regulatory and management programs for striped bass have not been approved by the Management Board,
- b. it fails to meet any implementation schedule established for this amendment (see section 5.4.) or any addendum prepared under adaptive management (see Section 4.5.);
- c. it has failed to implement a change to its program when determined necessary by the Management Board;

or

- d. it fails to adequately enforce any aspect of its regulatory and management programs.

5.1.1.1 Transition to Amendment 5

Each state may begin its implementation of this Amendment on April 1, 1995. By March 21, 1995, each state must submit its striped bass regulatory program to the Striped Bass Technical Committee, for approval by the Management Board.

5.1.1.2. Changes to State Programs

Each jurisdiction's striped bass regulations and management program must be approved by the Management Board. States may not implement any regulatory changes concerning striped bass, nor any management program changes that affect their responsibilities under this Amendment, without first having those changes reviewed by the Technical Committee and approved by the Management Board. Also, any jurisdiction using a fishery model is required to submit any changes to its input parameters, including tuning procedures and model formulation, to the Technical Committee for its review and the Technical Committee will report its findings to the Management Board. See Section 4.4, "Alternative State Management Regimes", for reporting procedures.

5.1.2. State Reporting

Each state must submit an annual report concerning its striped bass fisheries and management program on or before April 1 each year, beginning April 1, 1995. The report shall cover:

- a. the previous calendar year's fishery and management program including activity and results of monitoring, regulations which were in effect and harvest, including estimates of nonharvest losses, following the outline contained in Table 8; and
- b. the planned management program for the current calendar year summarizing regulations that will be in effect and monitoring programs that will be performed, highlighting any changes from the previous year.

Table 8. Format required for Annual State Report.

- I. Harvest and losses
 - A. Commercial fishery
 - 1. Characterization of fishery (seasons, cap, gears, regulations)
 - 2. Characterization of directed harvest
 - a. Landings and method of estimation
 - b. Catch composition
 - i. Age frequency
 - ii. Length frequency
 - iii. Sex
 - c. Estimation of effort
 - 3. Characterization of losses (poaching, bycatch, etc.)
 - a. Estimate and method of estimation
 - b. Estimated catch composition (length and/or age)
 - B. Recreational Fishery
 - 1. Characterization of fishery (seasons, cap, gears, regulations)
 - 2. Characterization of directed harvest
 - a. Landings and method of estimation
 - b. Catch composition
 - i. Age frequency
 - ii. Length frequency (legal and sublegal catch)
 - c. Estimation of effort
 - 3. Characterization of losses (poaching, hook and release mortality, etc.)
 - a. Estimate and method of estimation
 - b. Estimated catch composition
 - C. Other Losses
 - D. Table 1. Harvest and losses - including all above estimates in numbers and weight (pounds) of fish, and mean weight per fish for each gear type.
- II. Required fishery independent monitoring programs
 - A. Description of requirement as outlined in Amendment 5
 - B. Brief description of work performed
 - C. Results (as applicable to program)
 - 1. Juvenile indicies
 - a. Index of abundance
 - b. Variance
 - 2. Spawning stock assessment
 - a. Length frequency
 - b. Age frequency
 - c. Sex
 - 3. Stock characterization
 - a. Length frequency
 - b. Age frequency
 - c. Sex
 - d. Catch per unit effort
 - 4. Tagging
 - a. Number of fish tagged

5.1.3. Mandatory Measures to be Included in State Programs

5.1.3.1. Regulatory Requirements

All state programs must include a regime of restrictions on recreational and commercial fisheries consistent with the requirements of Sections 4.2. and 4.3.; except that a state may propose an alternative management program under Section 4.4., which, if approved by the Management Board, may be implemented as an alternative regulatory requirement for compliance under the law.

5.1.3.2. Monitoring Requirements

All state programs must include the mandatory monitoring requirements contained in Section 3.5. and Tables 1 and 2. States must submit proposals for all intended changes to required monitoring programs which may affect the quality of the data, or the ability of the program to fulfill the needs of the fishery management plan. State proposals for making changes to required monitoring programs will be submitted to the Technical Committee at least two weeks prior to its spring or fall meeting. Proposals must be on a calendar year basis. The Technical Committee will make recommendations to the Management Board concerning whether the proposals are consistent with Amendment 5.

In the event that a state realizes it will not be able to fulfill its fishery independent monitoring requirements, it should immediately notify the Commission in writing. The Commission must be notified by the planned commencement date of the monitoring program. The Commission will work with the state to develop a plan to secure funding or plan an alternative program which will satisfy the needs outlined in Amendment 5. If the plan is not implemented 90 days after it has been adopted, the state will be found out of compliance with Amendment 5.

5.1.3.3 Enforcement Requirements

All state programs must include law enforcement capabilities adequate for successfully implementing the jurisdiction's striped bass regulations. The adequacy of a state's enforcement activity will be measured by semi-annual reports submitted to the ASMFC Law Enforcement Committee and the Plan Review Team. Such reports will be presented at the regular ASMFC spring and fall meetings, and will follow the format shown in Table 9. The first reporting period will cover the period from September 1 through February 28 (report at spring meeting), and the second period will extend from March 1 through August 31 (report at the fall meeting).

5.2. Procedures for Determining Compliance

a. The Plan Review Team will continually review the status of state implementation, and advise the Management Board at any time that a question arises concerning state compliance. The PRT will review state reports submitted under Section 5.1.2. and prepare a report by May 1 for the Management Board summarizing the status of the resource and the fishery (see Section 4.5.1.a.) and the status of state compliance on a state-by-state basis.

b. Upon review of a report from the Plan Review Team, or at any time by request from a member of the Management Board, the Management Board will review the status of an individual state's compliance. If the Management Board finds that a state's approved regulatory and management program fails to meet the requirements of this section, it may recommend that the state be found out of compliance. The recommendation must include a specific list of the state's deficiencies in implementing and enforcing the Amendment and the actions that the state must take in order to come back into compliance.

c. If the Management Board recommends that a state be found out of compliance as referred to in the preceding paragraph, it shall report that recommendation to the ISFMP Policy Board for further review according to the Commissions Charter for the Interstate Fisheries Management Program.

d. The state that is out of compliance or subject to a recommendation by the Management Board under the preceding subsection may request at any time that the Management Board reevaluate its program. The state shall provide a written statement concerning its actions which justify a reevaluation. The Management Board shall promptly conduct such reevaluation, and if it agrees with the state, shall recommend to the ISFMP Policy Board that the determination of noncompliance be withdrawn. The ISFMP Policy Board and the Commission shall deal with the Management Boards recommendation according to the Commissions Charter for the Interstate Fisheries Management Program.

5.3. Recommended Management Measures

States are strongly encouraged to implement the management measures contained in Section 3.4. (stocking), Section 4.1. (habitat requirements), and Section 6 (research).

5.4 Implementation Schedule

States must implement this Amendment according to the following schedule:

March 21, 1995: States must submit state programs to implement Amendment #5 for approval by the Management Board. Programs, including monitoring programs, must be implemented upon approval by the Management Board.

April 1, 1995: States with approved management programs may begin implementing Amendment #5.
States must submit reports on 1994 fisheries.

Table 9. Format for biannual law enforcement reports.

STATE _____ Reporting Period _____ 19__

Contact Person/Telephone _____

I. Enforcement Data:

1. Total Staff-Hours Striped Bass Enforcement _____
2. Total Number of Inspections Made _____
3. Total Number of Complaints Received _____
4. Total Number of Enforcement Actions Taken:
 - a. Total Cases _____
 - b. Total Warnings _____
5. Total Pounds of Striped Bass Seized _____

II. Narrative Discussion: (Include for the recreational and commercial fishery: Current regulations; current levels of participation and recent trends; most prevalent commercial gear(s) used; general attitudes towards regulations and their effectiveness; regulatory problems, if any; recent large cases or major investigations.)

Section 6. CONTINUING RESEARCH NEEDS

6.1. Habitat Information Needs/Recommendations for Future Research

- 1) Document the impact of power plants and other water intakes on larval, postlarval and juvenile mortality in spawning and nursery areas, and calculate the resultant impact to adult stock size.
- 2) Define restrictions necessary for implementation of projects in spawning and overwintering areas and develop policies on limiting development projects seasonally or spatially.

6.2. Stocking

- 1) Additional research is needed on the potential of disease transfer among striped bass, other anadromous species, and warmwater species.
- 2) Research concerning larval and juvenile mortality and abundance should continue.
- 3) A better understanding of the genetic implications of interactions between hatchery stocks and endemic populations is needed. Areas of concern include: loss of genetic variability among and within populations; tradeoffs (genetic) of supportive or supplemental stocking; and brood stock management practices.

6.3. Stock Assessment and Population Dynamics

- 1) Conduct sensitivity analysis on current state and federal fishery dependent and independent monitoring programs to determine which, if any, may be eliminated. Programs determined essential will be used to improve and establish a coastwide virtual population analysis model.
- 2) Investigate density-dependent effects on striped bass biological indices and population dynamics.
- 3) Resolve the issue of whether a slot size limit designed to protect larger brood female striped bass would be more beneficial to the stock than the present system.
- 4) Develop and execute methods to incorporate non-Maryland JAI's into a coastwide SSB model.

Section 7. REFERENCES

- Anonymous. 1976-present. Health advisory: chemicals in sport fish and game. New York Department of Health, Albany, NY.
- Atlantic States Marine Fisheries Commission. 1981. Interstate fisheries management plan for the striped bass of the Atlantic coast from Maine to North Carolina. Atlantic States Marine Fisheries Commission, Washington, D.C.
- 1989. Supplement to the striped bass FMP - Amendment #4. Atlantic States Marine Fisheries Commission, Washington, D.C. Fisheries Management Report No. 15. 60 pp.
- 1990. Source document for the supplement to the striped bass FMP - Amendment #4. Atlantic States Marine Fisheries Commission, Washington, D.C. Fisheries Management Report No. 16.
- 1992. Supplement to the striped bass FMP - Amendment #4. Addendum III - Calculation of juvenile indices. Atlantic States Marine Fisheries Commission, Washington, D.C. 5 pp.
- In prep. Source document for the supplement to the striped bass fmp - Amendment #5. Atlantic States Marine Fisheries Commission, Washington, D.C. Fisheries Management Report No. _ _ pp.
- Bain, M.B. and J.L. Bain. 1982. Habitat suitability index models: coastal stocks of striped bass. U.S. Fish and Wildlife Service, Office of Biological Services, Washington, D.C. FWS/OBS-82/10.1. 29 pp.
- Crecco, V.A. 1992a. Alternative regulations for the striped bass recreational fishery along the Atlantic coast: a revision of Table 8.2. Report to the Atlantic States Marine Fisheries Commission, Washington, D.C.
- Crecco, V.A. 1992b. Revised striped bass juvenile indices from the Maryland survey based on the geometric mean. Report to the Atlantic States Marine Fisheries Commission, Washington, D.C.
- Crecco, V.A. 1994. Alternative regulations for the striped bass recreational fisheries along the Atlantic coast consistent with Amendment 5. CT Marine Fisheries Division, Old Lyme, CT. August 15, 1994. 25 pp.
- Fay, C.W., R.J. Neves and G.B. Pardue. 1983. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic) -- striped bass. U.S. Fish and Wildlife Service, Division of Biological Services, Washington, D.C. FWS/OBS-82/11.8. U.S. Army Corps of Engineers, Waterways Experiment Station, Coastal Ecology Group, Vicksburg, MS. TR EL-82-4. 36 pp.
- Gibson, M.R. 1992. Methods for estimating season reductions in the striped bass recreational fishery along the coast. Report to the Atlantic States Marine Fisheries Commission, Washington, D.C. 20036.
- Hill, J., J.W. Evans and M.J. Van Den Avyle. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic) -- striped bass. U.S. Fish and Wildlife Service, Division of Biological Services, Washington, D.C. Biological Report 82(11.118). U.S. Army Corps of Engineers, Waterways Experiment Station, Coastal Ecology Group, Vicksburg,

MS. TR EL-82-4. 35 pp.

Janicki, A., W.P. Saunders, L.C. Scott, J. Kinsman and S.V. Ottinger, 1985. An inventory of water quality data for some Atlantic Coast striped bass spawning rivers. Martin Marietta Environmental Systems. Report prepared for U.S. Fish and Wildlife Service, National Fisheries Center, Kearneysville, West Virginia.

Merriman, D. 1941. Studies on the striped bass of the Atlantic coast. U.S. Fish and Wildlife Service Fishery Bulletin. 50:1-77.

Mulligan, J. 1991. Ambient monitoring. pp. 42-47 *in* R.A. Rulifson and C.S. Manooch, III, Eds. Roanoke River water flow committee report for 1990. U.S. Department of commerce, national Oceanic And Atmospheric Administration, national Marine Fisheries Service, Southeast Fisheries Center, Beaufort Laboratory, NC. NOAA Technical Memorandum NMFS-SEFC-291. 433 pp.

Rozengurt, M.A., M.J. Herz and M. Josselyn. 1985. The impact of water diversions on the river-delta-estuary-sea ecosystems of San Francisco Bay and the Sea of Azov. pp. 35-62 *in* Proceedings of San Francisco Bay. National Oceanic and Atmospheric Administration, Washington, D.C. Estuary-of-the-Month Seminar Series, No. 6.

Rozengurt, M.A. and I. Haydock. 1994. The role of inland water development in the systemic alteration of the coastal zone environment. pp. 755-760 *in* Proceedings Watershed '93: A National Conference on Watershed Management. U.S. Environmental Protection Agency, Washington, D.C. Report 840-R-94-002.

Rugulo, L.J., V.A. Crecco and M.R. Gibson. 1994. Modeling stock status and the effectiveness of alternative management strategies for Atlantic coast striped bass. Summary Report to the Striped Bass Management Board, Atlantic States Marine Fisheries Commission, Washington, D.C. 30 pp.

Southwick, R. and M. Teisl. 1995. Economic impact study for the Atlantic States Marine Fisheries Commission striped bass fishery management plan. ASMFC, Washington, D.C. 25 pp.

U.S. Dept. of Commerce and U.S. Dept. of Interior (USDOC/USDOI). 1990. Emergency striped bass research study report for 1989. U.S. Departments of Commerce and Interior, National Marine Fisheries Service and Fish and Wildlife Service, Silver Spring, MD, and Washington, D.C. 60 pp.

----- 1993. Emergency striped bass research study report for 1991. U.S. Departments of Commerce and Interior, National Marine Fisheries Service and Fish and Wildlife Service, Silver Spring, MD, and Washington, D.C. 35 pp.

----- 1994. Striped bass research study report for 1992. U.S. Departments of Commerce and Interior, National Marine Fisheries Service and Fish and Wildlife Service, Silver Spring, MD, and Washington, D.C. 32 pp.

Upton, Harold. 1994. Striped bass stocking recommendations. Atlantic States Marine Fisheries Commission, Washington, D.C. Revised Special Report No. 10. 25 pp.

Appendix I

Instructions for calculating and instituting coastal recreational season reductions for conservation equivalency

1. Unless they implement seasonal closures, coastal states are required to implement a 28" or greater minimum size in their recreational fisheries. Coastal states may implement smaller minimum sizes with specific seasonal closures.
2. For purposes of designating the seasonal reduction required by a coastal state that sets a minimum recreational size limit below 28", the calculations given by Crecco (1992a) will be used and are referred to in Tables 3,4, and 5 of this plan.
3. Seasons will be calculated using Table A of this Appendix, which is derived by analyzing striped bass harvest by region using the National Marine Fisheries Service (NMFS) Marine Recreational Fishery Statistics Survey (MRFSS) database (Gibson, 1992). This table will be updated annually or as necessary when new information is available. Examples for calculating seasonal reductions are presented in Table B.
4. Seasonal closures must be limited to no more than two continuous time blocks, so that assumptions concerning distribution of effort and recoupment will not be violated.

Table A. Fitted striped bass harvest by region from the Weibull model applied to MRFSS data, 1990-1993. NNE = Northern New England (ME, NH, MA); SNE = Southern New England (RI, CT); Mid-Atl = Mid-Atlantic (NY, NJ, DE, MD coast, VA coast, NC coast)

Day	N NE	S NE	Mid-Atl
1	0.00000	0.00000	0.00000
3	0.00000	0.00000	0.00000
15	0.00000	0.00000	0.00000
22	0.00000	0.00000	0.00000
29	0.00000	0.00001	0.00000
36	0.00000	0.00003	0.00000
43	0.00000	0.00007	0.00000
50	0.00001	0.00017	0.00000
57	0.00003	0.00034	0.00000
64	0.00007	0.00063	0.00000
71	0.00014	0.00109	0.00000
78	0.00026	0.00181	0.00001
85	0.00048	0.00286	0.00002
92	0.00083	0.00437	0.00003
99	0.00139	0.00646	0.00006
106	0.00224	0.00930	0.00011
113	0.00350	0.01307	0.00019
120	0.00533	0.01798	0.00033
127	0.00792	0.02427	0.00053
134	0.01151	0.03221	0.00085
141	0.01641	0.04209	0.00133
148	0.02296	0.05420	0.00202
155	0.03160	0.06887	0.00303
162	0.04282	0.08642	0.00445
169	0.05717	0.10716	0.00642
176	0.07525	0.13139	0.00913
183	0.09772	0.15934	0.01281
190	0.12521	0.19122	0.01772
197	0.15836	0.22711	0.02420
204	0.19766	0.26702	0.03267
211	0.24348	0.31082	0.04359
218	0.29590	0.35821	0.05752
225	0.35466	0.40876	0.07506
232	0.41909	0.46185	0.09689
239	0.48800	0.51671	0.12372
246	0.55970	0.57241	0.15622
253	0.63205	0.62794	0.19504
260	0.70259	0.68219	0.24065
267	0.76879	0.73408	0.29328
274	0.82827	0.78261	0.35282
281	0.87922	0.82688	0.41866
288	0.92056	0.86622	0.48965
295	0.95213	0.90023	0.56400
302	0.97467	0.92874	0.63932
309	0.98959	0.95188	0.71280
316	0.99868	0.97003	0.78146
323	1.00371	0.98375	0.84251
330	1.00623	0.99371	0.89383
337	1.00735	1.00065	0.93426
344	1.00779	1.00526	0.96385
351	1.00794	1.00819	0.98378
358	1.00799	1.00996	0.99597
365	1.00800	1.01096	1.00267

Table B. Examples of calculations for recreational seasons. The cumulative catch percentage by region by day is arranged in Table A. The catch is calculated in 7 day intervals to correspond to weeks of the year. Corresponding calendar dates suggested are for 1995.

Example 1

Region: Northern New England
Required harvest reduction: 20%
Type of season: Early close
Season: Jan. 1 - Aug. 31

Read up the column for northern New England to find the day that corresponds closest to (but not less than) 0.80, which in this case is Day 274 or October 1. Season would then be: Jan. 1 through October 1.

Example 2

Region: Northern New England
Required harvest reduction: 20%
Type of season: Delayed opening

Read down to the day corresponding to 0.20 or greater, which is Day 211 or July 30. Season would then be July 30 through December 31.

Example 3

Region: Northern New England
Required harvest reduction: 20%
Type of season: Delayed opening and early close

A state may want to delay the season and also truncate it by taking a 10% harvest reduction in the beginning and a 10% reduction at the end. In this case, one would read down the column to the day corresponding to 0.10 or greater (Day 134) and up the column to the day corresponding to 0.90 or greater (Day 288). Thus, the shortened season would extend from May 14 through October 15.

Example 4

Region: Northern New England
Required harvest reduction: 20%
Type of season: Mid-season closure

A mid-season closure should result in the required 20% harvest reduction. Therefore, one possible closure would be to close at the day corresponding to 0.40 or higher and reopen on the day corresponding to 0.60 (Day 232 through Day 253). The *open* season would then be from January 1 through August 20 (Day 232) and then September 10 (Day 253) through December 31.