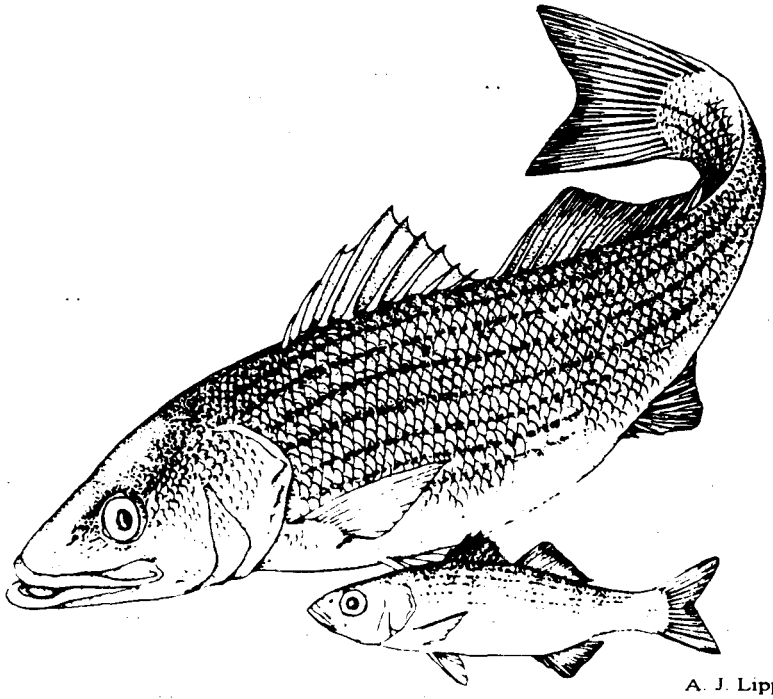
903R95007 CBP/TRS 132/95
February 1995

Chesapeake Bay Striped Bass Fishery Management Plan



A. J. Lippson

Annual Progress Report
1994

Chesapeake Bay Program

Printed on Recycled Paper

Chesapeake Bay Striped Bass Fishery Management Plan

Annual Progress Report 1994

A Commitment Progress Report
from the Living Resources Subcommittee

Printed by the United States Environmental Protection Agency for the Chesapeake Bay Program

TABLE OF CONTENTS

List of Tables and Figures..... i

Introduction..... 1

Background..... 1

Stock Status..... 3

Fishery Dependent Monitoring..... 4
- Maryland..... 4
- Virginia..... 7
- Potomac River..... 10
- District of Columbia..... 11

Stock Monitoring..... 12
- Maryland..... 12
- Virginia..... 16
- District of Columbia..... 18
- Cooperative Baywide Tagging Mortality Study..... 19

Enforcement Program..... 19
- Maryland..... 19
- Potomac River..... 20
- District of Columbia..... 20

Water Quality and Habitat Issues..... 20

Conclusion..... 21

References..... 30

Implementation Plan..... 32

LIST OF TABLES AND FIGURES

Tables

1. Harvest of striped bass from Maryland by fishing year and fishery (pounds) 22
2. Harvest of striped bass from Virginia by fishing year and fishery (pounds) 22
3. Harvest of striped bass from the Potomac River by fishing year and fishery (pounds) 22
4. Summary of the estimated striped bass losses from the Maryland fisheries during the 1993/1994 season due to illegal fishing, hook and release mortality, and bycatch 23
5. Annual striped bass juvenile indices from Maryland and Virginia, 1980-1994 24
6. Summary of hatchery striped bass recovered during Maryland's Chesapeake Bay Stock Assessment surveys and the coastal tagging survey, September - May 1993 25

Figures

1. Coastwide female striped bass spawning stock biomass (SSB) 26
2. Length-frequency distributions of commercial pound net catches from Fall 1970, Fall 1992, and Fall 1993 27
3. Age-frequency distributions of commercial drift gill net catches, Winter 1981-82, Winter 1992-93, and Winter 1993-94 28
4. Length-frequency distributions of Maryland's recreational harvest in 1979-1980, 1992, and 1993 29

INTRODUCTION

Protection of the striped bass (Morone saxatilis) resource has been guided by mandatory coastwide management under the auspices of the Atlantic States Marine Fisheries Commission (ASMFC) since 1984. A Chesapeake Bay fishery management plan (FMP) for striped bass was developed and adopted in 1989 as part of the 1987 Chesapeake Bay Agreement to address specific Chesapeake Bay issues and implement ASMFC recommendations. As a result of coordinated, interjurisdictional management efforts, the coastal striped bass stock has been declared restored to historic levels as of January 1, 1995. This assessment is based on a projected spawning stock biomass of mature Chesapeake Bay females exceeding the historical high average (calculated for 1960-1972, ASMFC 1994). In addition, estimated fishing mortality rates have been below current target levels (F=0.25); juvenile recruitment has been excellent; and catch-per-unit-of-effort (CPUE) has been steadily increasing.

Since management plans need to be adaptive and flexible to respond to the changing status of a particular resource, each FMP is reviewed annually. The review provides a format for evaluating the progress of a plan, updating management measures, and incorporating new research information. The Striped Bass FMP has been reviewed in reports in 1991, 1992, and 1993. The Striped Bass FMP was also reviewed by an independent fisheries management plan re-assessment task force during 1993 (Report to the Living Resources Subcommittee, July, 1993). The Task Force concluded that the Bay jurisdictions were in compliance with the FMP and recommended that several actions be reevaluated. The FMP is scheduled for a substantive review and revision in August 1995. Another Chesapeake Bay committee, the Fisheries Target Setting Task Force, will be developing specific targets for the striped bass resource. The targets will follow ASMFC guidelines and compliance requirements and will be included in either a revised FMP or an amendment to the plan.

The following report is an overview of the background, fishery dependent and independent monitoring of the fisheries, research, regulations, and enforcement of the 1989 Striped Bass FMP during 1993/1994. For specific information on the plan, refer to the 1989 Chesapeake Bay Striped Bass Management Plan.

BACKGROUND

Striped bass are one of the most sought after commercial and recreational finfish in the Chesapeake Bay. Beginning in the mid-1970's, their abundance, especially in the Chesapeake Bay began to decline, primarily due to overfishing. In 1981, the ASMFC developed a coastwide management plan for striped bass. Although the ASMFC recommended management strategies, they lacked regulatory authority. As a result, states were at their own discretion to

implement recommendations. Stock abundance and recruitment continued to decline. Amendments were developed recommending more stringent controls on the harvest of striped bass. Management measures were aimed at protecting the 1982 and following year-classes until females could spawn at least once. States along the Atlantic coast from Maine to Virginia began implementing restrictions on the harvest of striped bass. In 1984, Congress passed legislation providing federal authority to close striped bass fisheries in those states which did not comply with ASMFC recommendations. In the Chesapeake Bay region, Maryland enacted a moratorium on striped bass fishing on January 1, 1985 and Virginia enacted size limits and seasonal restrictions. Four years later the Potomac River and Virginia fisheries were closed.

As states along the coast began implementing harvest restrictions, striped bass abundance began to improve. The criteria for managing a fishery under a transitional regime were developed in ASMFC Amendment #3. The Maryland juvenile index was selected for monitoring recruitment and as a trigger for beginning a transitional fishery. The transitional management regime specified a target fishing rate (F) of 0.25 or approximately 20% of the legal size fish being harvested. The Striped Bass Scientific and Statistics Committee agreed that an F=0.25 would provide a low level of harvest while allowing the stock to rebuild. In 1989, the Maryland juvenile index was the highest value since 1970 and triggered the beginning of a transitional management regime. The ASMFC established measures to control fishing along the coast through combinations of size limits, seasons and creel limits. Monitoring fishing levels and implementing research were accomplished through state programs approved by ASMFC. In the Chesapeake region, limited recreational and commercial fisheries were reopened for the 1990/1991 season.

In October 1989, ASMFC adopted Amendment #4 which provided for changes in management regulations and monitoring programs based on stock status. Amendment #4 addressed the following issues: procedures for making changes to state regulations; requirements of state monitoring programs; calculation of juvenile indices (change to geometric mean instead of the arithmetic mean to reduce index variability and increase the reliability of estimating annual harvest quotas); mandatory minimum sizes; and, the Delaware River as a producer area. During 1992, ASMFC concluded that the states had implemented management measures which kept fishing mortality at the level specified in Amendment #4. Additional changes to Amendment #4 were adopted in May 1993. It provided for a year-round coastal recreational fishery at a minimum length of 34" or larger, and scaled seasonal closures for minimum lengths between 28" and 34". Language was also added to ensure that producer areas maintain a fishing mortality rate at or below F=0.25.

With the striped bass resource declared recovered, Amendment #5 is being developed to consolidate the procedures and programs of

Amendment #4 and eliminate the management measures no longer considered appropriate. The goal of Amendment #5 is to provide management guidelines for the long-term maintenance of a self-sustaining spawning stock and provide for the restoration and maintenance of critical habitats. It will include a model for estimating spawning stock biomass (SSB) in the Chesapeake Bay which has been used to define stock recovery and evaluate management regimes. Amendment #5 will be considered an interim strategy between the transitional fishing guidelines at F=0.25 and a fully restored fishery at F=0.50.

STOCK STATUS

In May, 1994, the ASMFC striped bass board declared the striped bass stock restored to historic levels as of January 1, 1995. This declaration was based on the results of a stock simulation model of coastal female SSB (Rugolo et al. 1994). The average historical spawning stock biomass calculated for 1960-1972 has been adopted as a reference level and used as a definition of recovery (Figure 1). An index of stock biomass developed from the Maryland spring spawning stock CPUE data is strongly correlated with the SSB model (Hornick et al. 1994). In the last several years, there has been approximately a five-fold increase in the abundance of spawning female striped bass in the Maryland portion of the Chesapeake Bay. Maryland studies have also indicated a progressive increase in overall stock size with the number of year-classes reaching levels comparable to the mid- 1970s.

Since the Hudson and Chesapeake stocks contribute significantly to the coastal migratory stock, their status has traditionally been used to indicate the status of the Atlantic coast stock. More recently, contributions from the Delaware and Albemarle/Roanoke areas have been acknowledged. Tag-recapture studies from the Maryland Chesapeake stock indicate that mortality rates have been at or below the transitional target of F=0.25. The most recent estimate of fishing mortality from the Chesapeake Bay (MD and VA, combined) was F=0.09 (ASMFC 1994). Data from the Hudson River indicates that fishing mortality is below the target rate of 0.25. Preliminary data from Delaware also suggest that mortality rates are below target levels.

Overall recruitment and CPUE data indicate that Atlantic striped bass stocks continued to grow during 1993 and 1994. Recruitment levels for striped bass were excellent all along the Atlantic coast during 1993, with record or near-record juvenile indices from all major producer areas. The Maryland juvenile striped bass survey, conducted since 1954, has been used intensively as an indicator of stock status not only for the Chesapeake Bay but for the Atlantic coast. In 1993, the Maryland juvenile index arithmetic mean was 39.8 (13.9 geometric mean), a value significantly higher than 30 of 36 previous years. In

Virginia, an adjusted overall geometric mean is calculated to measure relative juvenile abundance. The Virginia juvenile index in 1993 was 18.1, the highest value over a 21 year sampling period and was three and half times the overall average index of 5.3 (Austin et al. 1993a). The 1989 supplement to the ASMFC Striped Bass plan recommended the development of a baywide juvenile index. Year-to-year variability within each river system make it difficult to determine a baywide index. There is also a problem with the lack of a baywide data set to statistically validate a juvenile index. In a few more years, the Maryland experimental gill net and Virginia pound net monitoring data may provide a data set of sufficient time duration to use for validation. A baywide juvenile index should be pursued since Virginia waters account for approximately 30% of the Chesapeake Bay stock (Austin et al. 1993b).

The CPUE data from different areas along the Atlantic coast suggest that there has been an increase in relative abundance, a trend that has been occurring over the last five years. The mean CPUE from the Marine Recreational Fishery Statistics Survey (MRFSS) has been increasing since 1989. During 1993, approximately 5.6 million fish were caught by recreational anglers, the highest recorded value since the survey started in 1979.

FISHERY DEPENDENT MONITORING

Monitoring the commercial and recreational harvest of striped bass and sampling the catch for age, size and sex composition are essential to meeting management needs. Data from commercial and recreational landings are important for assessing harvest distribution among user groups, identifying and/or revising existing management recommendations, and substantiating fishing mortality rates derived from fishery independent monitoring programs for each jurisdiction during 1993-1994. A comparison of striped bass harvested by fishing year, type of fishery, and jurisdiction can be found in Tables 1-3.

MARYLAND

Maryland Department of Natural Resources (MDNR) developed a harvest control model (Rugolo and Jones 1989) to manage a limited striped bass fishery and control fishing mortality at 18% to 20% of the stock. The quota based system has been in effect since 1990. The total fall 1993 to winter 1994 quota for resident premigratory striped bass for all user groups combined was 2,097,715 pounds. This was an increase from the 1992-93 quota of 1,636,000 pounds. The quota was allocated as follows: recreational fishery, 891,529 pounds (42.5%); commercial fishery, 891,529 pounds (42.5%); and charterboat fishery, 314,657 pounds (15%). The Atlantic Coast commercial quota remained at 25,000 pounds. Quotas remained the same for the 1994/1995 fishing year.

Spring Recreational Fishery

The spring recreational striped bass fishery was open from May 1 through May 31, 1993 and limited to 3,000 fish. Recreational anglers wishing to participate in this fishery were required to possess a valid striped bass fishing permit unless fishing from a charterboat. During this time period the following restrictions were in effect: a 36 inch minimum size limit; a 1 fish/angler/season creel limit; area closures to protect fish on spawning grounds; mandatory tagging and reporting of kept striped bass at designated check-in stations; prohibition of gaffs and natural bait; and prohibition of possession of striped bass while on the water between 8 p.m. and 5 a.m. MDNR monitored harvest, biological characteristics of the landings, and fishing effort through telephone surveys, check-in station reports, and charterboat logbooks. The total estimated harvest of 2,719 fish (61,640 pounds) was based on estimates from the recreational (2,116 fish) and charterboat (603 fish) fisheries. A total of 34,910 permits were issued by May 31, 1993 compared to 31,937 in 1992. Check station results indicate that 661 fish were checked in during the 1993 spring season. These ranged from 36 to 55 inches TL and 15 to 52 pounds. The average length and weight were 39 inches TL and 23 pounds, respectively. Based on length-at-age calculations, it appears that the spring 1993 harvest was primarily 8-10 year-old fish with 7 to 21+ year-old fish present.

The 1994 spring trophy fishery followed 1993 restrictions with only minor changes. The cap for 1994 increased to 5,000 fish and the creel limit was set at 1 fish/angler/day and 3 fish/angler/season for private boat fishermen. Charterboat fishermen were allowed to catch 1 fish/day throughout the season. Mandatory tagging, reporting and charterboat logbooks continued to be required in 1994. Fishing effort continued to increase in 1994 with 42,773 permits being sold. Total estimated harvest is not yet available for the 1994 spring season.

Fall Recreational Fishery

The fall 1993 recreational season in the Bay was open from October 1 through November 21, 1993. Restrictions included: a minimum size of 18 inches, a one fish/angler/day creel limit; a special striped bass fishing permit; fishing during daylight hours only; and a gaff prohibition. Maryland's Atlantic coast recreational season was open from July 15 through November 30, 1993 and was not included in the Bay quota but had the following restrictions: a creel limit of 1 fish/angler/day with a minimum size of 28 inches TL. A total of 146,821 fishing permits were issued prior to closure of the season. This was an increase from the 136,182 permits issued in 1992, indicating that fishing effort increased. Recreational harvest estimates were based on access-intercept and telephone surveys. A total estimate of 649,018 pounds (113,810 fish) or 73% of the recreational Bay quota was harvested in 1993. Catches from private boats averaged 24.8 inches TL and 5.8 pounds. The catch was comprised primarily of 4-7 year-

old fish with fish 3-11 years old being represented. The total number of legal and sublegal striped bass released was 56,182 and 396,385 fish, respectively.

Seven days were added to the Chesapeake Bay recreational season in 1994 extending it from September 24 through November 22. Fishing effort continued to increase in 1994. Preliminary results indicate 166,471 permits were sold when the fishery closed. Preliminary harvest estimates range from 631,739 to 650,699 pounds for the Chesapeake Bay recreational season (MDNR data). These estimates are based on new methods using tag return data. MRFSS estimates for the Chesapeake Bay and Atlantic Coast will be available early 1995.

Charterboat Fishery

Regulations for the 1993 charterboat fishery were the same as the recreational fishery except that the creel limit was 2 fish/angler/day, and charterboat anglers were not required to obtain a striped bass fishing permit. Charterboat captains wishing to participate in the charterboat fishery were required to declare their intent. Mandatory logbooks were issued to each captain and were used to determine harvest. The total estimated 1993 harvest was 349,531 pounds (57,960 fish) which was 11% over the charterboat quota. Average weight was 5.9 pounds. The total number of striped bass released from charterboats was 34,093.

The 1994 charterboat fishery followed regulations for the 1993 fishery. Preliminary logbook estimates for 1994, indicate 57,965 fish (296,201 pounds) were harvested. Average weight was 5.1 pounds. Logbooks also reported 91,288 striped bass were released. Final logbook estimates will be available in 1995. Preliminary estimates for the 1994 charterboat fishery, based on tag return data, indicate 482,098 pounds were harvested (MDNR data).

Commercial Fishery

The Chesapeake Bay and Atlantic coast 1993-1994 commercial fishery were regulated under a quota system. License holders were required to declare their intent to fish and state which gear type they would use. The Chesapeake Bay commercial quota was allocated according to gear type with drift gill nets being assigned 73% (650,817 lbs.), pound net and haul seine, 25% (222,882 lbs.), and hook and line, 2% (17,850 lbs.). The pound net/haul seine season was September 15 through November 12, 1993, and hook and line season was November 15 through December 7, 1993. The drift gill net fishery was split into three components: 1) December 1 through December 17, 1993; 2) January 3 through January 17, 1994 and January 24 through January 26, 1994; and 3) February 1 through February 14, 1994 and February 21, 1994. Daily quotas were determined and used to distribute harvest. The Atlantic coast quota was not allocated according to gear type but was available to both drift gill netters and otter trawlers between December 1, 1993 and February 28, 1994 until individual quotas were met. The

minimum size was 18 and 28 inches for the Chesapeake Bay and Atlantic coast, respectively and each landed striped bass had to have been tagged and checked-in at a designated check station. Daily and weekly check station reports were the basis for determining the commercial harvest. The total 1993-94 Chesapeake Bay commercial harvest was 858,622 pounds or 96% of the total Chesapeake Bay quota. Harvest by gear type included: pound net (181,215 lbs.); haul seine, (22,156 lbs.); hook and line, (8,188 lbs.); and drift gill net, (647,063 lbs.). The total Atlantic coast harvest was 4,065 pounds or 16.3% of the Atlantic coast quota. The total Maryland commercial harvest was 862,687 pounds or 94% of the state-wide quota of 917,500 pounds. In addition to monitoring landings, the commercial fishery was randomly sampled to obtain biological data. A total of 3,746 fish were sampled during the pound net season. The mean total length for this sampling period was 20.7 inches. During the Chesapeake Bay gill net season, the commercial catch was subsampled at randomly selected check stations. The mean total length for this sampling period was approximately 22.0 inches and age 5 (1989 year-class) fish were most abundant in all areas sampled. Biological monitoring of the commercial hook and line fishery was not conducted due to the patchy nature of fishing activity, and the small individual quotas.

Restrictions for the 1994/1995 commercial striped bass season are identical to the 1993/1994 season except for minor season changes. The pound net/haul seine season was August 29 through November 11, 1994; and hook and line season was November 23 through November 30, 1994. Preliminary harvest results from the 1994 commercial season include: 237,308 pounds (95% of quota), pound net/haul seine fishery; and 46,954 pounds (263% of quota), hook and line fishery.

Non-directed Mortality

Striped bass losses due to bycatch and illegal harvest were calculated in order to estimate sources of non-directed mortality. Specifically, MDNR estimated losses from 1) the recreational and charterboat fisheries; 2) the commercial striped bass fisheries; and 3) the commercial white perch and American shad fisheries. Overall, estimated losses due to bycatch and poaching activities in Maryland's 1993-94 fishing season ranged between 97,217 and 240,734 striped bass (Table 4). A complete description of the assumptions and calculations for each fishery can be found in the Maryland DNR monitoring report (MDNR 1994). Estimates of non-directed striped bass losses during the 1994/1995 fishing season are not yet available.

VIRGINIA

Recreational Fishery

For the first time since 1990, Virginia's recreational fishery was strictly a weekend fishery (Thursday - Sunday). The

recreational fishing season, including charterboats, was October 28 through December 19, 1993. No quota was established for the recreational fishery. Daily creel limits were 2 fish/angler. Minimum size limits were 18 inches and 28 inches for the Chesapeake Bay and Atlantic Coast, respectively. A maximum size limit of 36 inches was in effect for all areas but recreational fishermen were allowed to keep one fish 48 inches or larger as part of their two fish creel limit.

Virginia relied exclusively on the National Marine Fisheries Service (NMFS) MRFSS for recreational catch estimates. Estimates are calculated using access-intercept (catch estimates) and telephone surveys (trip estimates). In 1993, the MRFSS instituted new procedures for estimating trips. Because trend data is important in fishery management, 1993 catch estimates were calculated using both the "old" and "new" method, however, the "new" estimates are more accurate. The MRFSS hopes to provide "new" estimates for 1990-1993 by the end of 1994.

"Old" and "new" methods produced recreational harvest estimates of 76,540 and 67,127 striped bass, respectively. An average fish weight of 6.5 pounds was calculated using the "old" method. An estimated 495,450 pounds were harvested during the 1993 recreational fishery.

Restrictions for Virginia's 1994 fishery were similar to 1993 except: 1) no maximum size limits; 2) the season was adjusted to October 27 through December 18, 1994, to fit the Thursday - Sunday schedule; and 3) the Atlantic Coast season was extended, December 19, 1994 through March 31, 1995, with a 1 fish/day/person creel and 28 inch minimum size limit. MRFSS estimates for the 1994 recreational fishery will not be available until early 1995.

Charterboat Fishery

A total of 167 permits were issued to charterboat captains in 1993. Of these, only 54.5% actually fished. The estimated 1993 charterboat harvest, from captain's reports, was 4,663 striped bass. A total of 1,773 striped bass were measured and a length-frequency distribution was estimated for the entire recreational fishery harvest. Striped bass 20 to 25 inches TL accounted for 42% of the recreational harvest.

Virginia's 1994 charterboat fishery followed recreational fishery restrictions. Harvest estimates for 1994 will not be available until 1995.

Commercial Fishery

Virginia's 1993 commercial striped bass season was split into two fishing periods to accommodate fishermen and the temporal and spatial distribution of striped bass and gear type used in harvesting. The first period was open March 1 through March 31, 1993, for fyke nets only. The second period was open to all other

gear types (gill net, pound net and haul seine), September 15 through December 31, 1993.

A commercial harvest quota of 211,000 pounds, which has been in effect since 1990, was set for 1993. During each fishing period a limited entry system, in combination with the mandatory fish-tagging program, allowed the quota to be distributed by gear type as follows: gill net (147,700 pounds); pound net (52,750 pounds); haul seine (6,330 pounds); and fyke net (4,220 pounds). Fishermen were allowed to fish one gear type, except during the second fishing period when hook and line could be used to supplement their primary gear harvest. Size limits were the same as the recreational fishery except commercial fishermen were not allowed to harvest striped bass larger than 36 inches.

All commercial fishermen and striped bass buyers (first sale from harvester) were required to obtain permits from the VMRC. First sale buyers were required to submit a final report of daily purchases to the VMRC one week after the spring and fall seasons closed. Daily catch records were due one week after the spring season and on a monthly basis for fall fishermen. The commercial harvest for 1993 was derived from written reports submitted from harvesters and buyers and totaled 2,274 and 207,709 pounds for the spring and fall fishery, respectively.

No biological data were collected during the spring fyke net fishery. During the fall fishery, VMRC staff collected data on length, weight, age, and sex composition. The average length and weight was 24.7 inches TL and 5.7 pounds, respectively. Length and weight were similar to 1992 but slightly larger than fish measured in 1990 and 1991. Fish aged 7+ comprised 15% of the 1992 and 1993 samples but only 2.5% in 1990 and 1991. This increase in size and age could be a result of fishermen selecting larger fish for market or an increase in number of older fish. Males accounted for 70% of the fish sampled in 1990 through 1993.

Virginia's 1994/1995 commercial fishery had minor changes. The fall season did not open until October 1 but the closure date remained December 31, 1994. The spring 1995 fishery will again be open in March. Seasonal quotas for each gear type were identical to those in 1993. However, individual tag allocations decreased slightly due to an increase in the number of fishermen and slightly larger fish being harvested. Harvest estimates and catch characteristics for the 1994/1995 fishery are currently unavailable.

Non-directed Mortality

Data to estimate non-directed mortality in Virginia's commercial fisheries are limited. The estimated illegal harvest for 1993 is 225 striped bass weighing 1,220 pounds. This is based on the number of striped bass that the Virginia Marine Police confiscated in 1993, and is a minimum estimate. Striped bass

bycatch occurs in other commercial fisheries but is primarily restricted to the winter and spring shad, white perch and herring gill net fisheries. An estimate of bycatch mortality in 1993 was limited to Virginia's shad fishery with a total of 55,294 striped bass weighing 237,738 pounds. Non-directed striped bass mortality estimates for 1994 are unavailable.

POTOMAC RIVER

Recreational Fishery

The 1993 Potomac River recreational striped bass season was scheduled for 29 days, October 1 through 19 and November 5 through 14 with a 1 fish/person/day creel limit, a 18 inch minimum, and a 36 inch maximum size limit. Due to very low harvest estimates, the fishery was extended 7 days to November 24. The Potomac River Fisheries Commission (PRFC) has regulated the recreational fishery since 1990 through a mandatory free fishing permit system. A total of 7,097 permits were issued in 1993 which is an increase from 6,644 in 1992. Efforts by the PRFC to increase permit return rates continued in 1993 and appears to be somewhat successful. Although the overall return rate was slightly less than last year, return rates for renewal permittees was 63.5% compared with a 44% rate for first-time permittees. The 1993 estimated recreational harvest of striped bass from the Potomac River was 120,899 pounds (21,385 fish). This estimate was based upon fisheries data collected from returned 1993 permits as well as non-respondent data gathered from a 1991 study.

The 1994 Potomac River recreational fishery was September 30 through October 23, 1994 and November 4 through November 15, 1994. Creel and size limits were unchanged from 1993, but the maximum size limit was removed. The number of permits issued in 1994 dropped slightly to 6,813. The preliminary harvest estimate, with 53%% permits returned, is 50,000 pounds.

Charterboat Fishery

The charterboat season began on October 8 in 1993 and was scheduled to run until November 7 or until the 22,860 pound cap was reached. Low catch estimates and numbers of charterboats operating in the Potomac prompted the PRFC to extend the season by one week. Monitoring efforts remained unchanged from 1992 and consisted of mandatory catch reports. Logbooks indicated 9,857 pounds (1,925 fish) were harvested by the charterboat fishery which was 43% of their quota.

The only change for the 1994 charterboat fishery was the season, October 1 through November 6, 1994. Preliminary harvest was 6,000 pounds, as of December.

Commercial Fishery

The 1993-1994 Potomac River commercial fishery was identical

to the 1992 cap of 155,000 pounds. Fishing seasons and quota allocations were delineated according to gear type. The commercial seasons and quotas were: hook and line, Wednesdays and Thursdays, August 4 though September 3, 1993 (10,000 lbs); pound net, Monday through Friday, August 23 through September 3, 1993 and October 4 through November 19, 1993 (35,000 lbs); and gill net, November 29 through December 23, 1993 and February 1 through March 5, 1994 (110,000 lbs). Fishermen were required to tag individual striped bass prior to landing. Reporting requirements remained unchanged from 1992 and was the basis for monitoring harvest. Estimates for the commercial harvest are: hook and line, 7,380 pounds; pound net, 43,967 pounds; and gill net, 91,395 pounds for a total of 142,742 pounds (24,451 fish), 92% of the quota.

Seasons for 1994-1995 fishing year included: hook and line, August 8 through September 29, 1994 and November 28 through December 23, 1994; pound net, August 22 through August 26, 1994 and October 3 through November 18, 1994; and gill net, November 23 through December 23, 1994 and February 6 through March 10, 1995. Estimates for the 1994 fishery are preliminary: hook and line, 6,250 pounds; pound net, 28,861 pounds; and gill net, 47,149 pounds.

Non-directed Mortality

Additional striped bass losses due to poaching and hook and release mortality were calculated according to ASMFC recommendations. A 15% rate was used to calculate illegal harvest and an 8% rate was used to calculate hook and release mortality. During the 1993 fishing season, 47,364 pounds (9,629 fish) of striped bass were lost due to poaching and hook and release mortality (PRFC 1994). Non-directed mortality estimates for striped bass during 1994 are unavailable.

DISTRICT OF COLUMBIA

Recreational Fishery

The recreational season extended from June 7 to November, 1993 with a minimum size limit of 18 inches, maximum size limit of 36 inches, and creel limit of 1 fish/angler/day. The sale of recreational catch was strictly prohibited.

In 1993, a total of 11,916 licenses were sold to anglers fishing in the District of Columbia. Of these, 4,150 were sold to District of Columbia residents and 7,113 were sold to non-residents. In addition, there were 653 short-term licenses sold for 14 day angling.

Commercial Fishery

There is no commercial season in the District of Columbia.

STOCK MONITORING

In addition to monitoring the commercial and recreational harvest of striped bass, fishery independent monitoring is required to evaluate stock status. The essential elements of a long-term monitoring program include: the annual assessment of juvenile abundance; spawning stock assessment; stock characterization (age distribution, catch per unit effort (CPUE), size distribution, and sex ratios); stock identification, and tagging.

MARYLAND

The objectives of Maryland's stock assessment studies include characterizing and monitoring the spawning and resident/premigratory stocks, assessing the relative abundance of juvenile striped bass, determining the contribution of hatchery striped bass to the population, and participating in baywide and coastal striped bass tagging studies. The following is a summary of the Striped Bass Stock Assessment Program (SBSA) during 1992/1993, the fall 1993 mortality study and preliminary results from 1994. Except for work completed in 1994, details can be found in Hornick et al. (1993).

Spawning Stock Survey

Excessive fishing mortality on Chesapeake Bay spawning stocks during the 1970's and early 1980's reduced the number of spawners and diversity in age and size of spawners which resulted in decreased reproductive potential. Management actions were set in the 1989 Chesapeake Bay Striped Bass FMP (i.e. size limits and fishing mortality rates) to allow a limited fishery and provide growth in the spawning stock.

Maryland has monitored the striped bass spawning stock since 1982. This survey enables biologists to examine how actions set in the ASFMC FMP and the Chesapeake Bay Striped Bass FMP have impacted the Chesapeake Bay spawning stock. In 1993 and 1994, data was collected from experimental drift gill nets and commercial pound nets on age, size, sex composition and relative abundance from the Choptank River, Potomac River, and upper Bay. Results indicate that the Chesapeake Bay spawning stock continues to diversify in age and size, and increase in abundance.

The number of year-classes representing the male spawning stock increased to ten in 1993. In 1988, when the survey expanded to include the Potomac River only five year-classes were present. The upper Bay male spawning stock was predominately composed of age 3, 4, and 5 year-old striped bass. The age composition of the Choptank River and Potomac River male spawning stock was more evenly distributed between 2 and 8 year-old fish. Age 4 males were the most abundant cohort in all sampling areas, indicating good recruitment by the strong 1989 year-class.

The number of year-classes present in the female spawning stock has more than doubled since 1988. In 1993, striped bass 3 to 18 years of age were present. The majority of these fish were between 6 and 11 years old.

The female component of the 1993 spawning stock was comprised of more than 60% age 8+ striped bass. When pooled with male striped bass, the Baywide percentage of fish age 8+ was 15% in 1993. In 1993, the ASMFC decided to use a spawning stock biomass index (SSB) of 56.22 as a target for a recovered fishery instead of a percentage of age 8+ fish. The SSB model calculated that this level would be surpassed in 1995 (Figure 1).

Data for the 1994 spawning stock survey are being analyzed, however, some results are available. Note that sampling was not conducted in the Potomac River in 1994. The number of year-classes in the male spawning stock increased to twelve in 1994. Age distributions among sampling areas remained similar to 1993 and the 1989 year-class was again the most abundant.

Striped bass 3 to 16 years-old represented the 1994 female spawning stock. The majority of fish were between 5 and 11 years of age. Females from the 1986 and 1988 year-classes were most abundant in the upper Bay. The 1985 year-class was most abundant in the Choptank River.

The percentage of age 8+ fish continued to show improvement in 1994. Females age 8+ comprised over 70% of the female component and total baywide percentage of age 8+ fish increased to 19%.

Egg Presence-Absence Survey

A field trial of presence-absence egg sampling was conducted during 1994 in the Choptank and Nanticoke Rivers. These results were contrasted with historic data to investigate baywide spawning biomass trends, develop criteria for assessing whether spawning stock was at a self-sustaining level, and evaluate spawning population recovery. The successful 1994 field trial indicated that egg present-absence sampling has a place in Maryland's monitoring of striped bass spawning stock. The ease of interpretating egg presence-absence in the field allowed for a preliminary assessment of spawning stock, available to managers within the same timeframe that recruitment is assessed by the juvenile survey. Detailed information can be found in Uphoff Jr. 1994.

Juvenile Survey

Maryland's 1993 striped bass juvenile survey produced a baywide arithmetic mean (AM) of 39.8 and geometric mean (GM) of 14.1. This was a record value, significantly higher than all years since 1970, except for 1989, and significantly greater than the AM target period average (TPA) of 12.0. The TPA is the average of indices from 1959 through 1972 and has been suggested as a period of

general stock health (ASMFC 1989). Of the four major spawning and nursery areas sampled each produced record or near record values in 1993 (Table 5). Sampling from auxiliary sites also produced record results in 1993.

Maryland's 1994 striped bass juvenile survey produced a bay-wide AM of 16.1 and GM of 6.4 (Table 5). Of the four major spawning areas sampled, each produced values well above the TPA, except for the Potomac River. Auxiliary sampling in 1994 continued in the upper Bay and Patuxent River, and produced above average values. Additional auxiliary sites were sampled in the Wye and Miles Rivers in 1994. It appears these sites had good production but their values still need to be compared to past data.

The continued importance of the JI survey is reflected in its many uses. The JI is related to adult relative abundance, used as a projection tool in the SSB model to determine stock size and health, and used in establishing quotas by the Harvest Control Model.

Resident/Premigratory Stock Survey

Maryland continued its fall and winter stock assessment and commercial fishery monitoring during the 1992-1993 fishing year. Commercial pound nets were sampled in September and October, 1992 and commercial and experimental drift gill nets were sampled from December, 1992 through February, 1993. The objective of this survey is to characterize the age, size and relative abundance of the resident/premigratory striped bass stock.

Striped bass from the 1988 (age 5) and 1989 (age 4) year-classes dominated both the pound net and gill net fisheries. The 1990 (age 3) and 1984 through 1987 (ages 6-9) year-classes comprised the remainder of the harvest. Striped bass older than age 10 were not encountered during sampling and were presumed to be fully recruited to the coastal migratory stock. Ages 4 through 7 have been the predominate age-classes targeted in the fall pound net and winter drift gill net fishery for the past three years.

Mean lengths of the total catch from pound nets increased from upper to lower Bay sampling areas. This trend was also evident during fall 1991 pound net sampling and coincides with the age differences observed between sampling areas. Younger striped bass were more abundant in upper and middle Bay samples.

Since the re-opening of the striped bass fishery in 1990, the commercial gill net fishery has been sampled onboard commercial watermen's boats. This allowed Maryland biologists to obtain estimates of abundance. However, these abundance estimates are dependent upon a number of factors, including individual fishermen, mesh sizes, and area fished, which resulted in inconsistencies from year to year. Abundance estimates, therefore, characterize commercial catch and not the resident striped bass population.

Because of these problems, CPUE estimates will no longer be obtained from the fishery and characterization of the 1993-1994 commercial gill net catch will occur by sampling catches at check-in stations.

Only some of the results for the 1993-1994 fishing year are available. Striped bass aged 2 (1992) to 10 (1984) were represented in the fall 1993 pound net samples. The 1989 year-class was most abundant and the majority of fish were between 3 and 8 years of age. Average weights for the upper, middle, and lower Bay are 3.9, 5.8 and 4.2 pounds, respectively.

A total of 9 age classes (ages 3-11) were represented in winter 1993-1994 gill net samples. Age 5 (1989 year-class) fish were most abundant followed by age 6 (1988 year-class) fish. Check-in station sampling was divided into Northern (above Bay Bridge), Eastern (Eastern shore below Bay Bridge), and Western (Western shore below Bay Bridge) areas. Mean lengths were: 22.0 inches TL, Northern; 22.8 inches TL, Eastern; and 21.5 inches TL, Western. Average weights for the Eastern and Northern areas were 4.9 and 4.0 pounds, respectively.

The effects of intensive management on striped bass stocks over the last 14 years are evident from Maryland's Chesapeake Bay resident population. Length-frequencies and the number of age classes present in Maryland's resident population has increased substantially (Figure 2 & 3). Management measures have also dramatically altered Maryland's recreational harvest. The presence of a wide range of sizes and age-classes has allowed selective harvest of larger striped bass not previously available in Maryland's resident population (Figure 4).

Tagging

Maryland participated in the Cooperative Coastal Striped Bass Tagging Program during the 1992/1993 and 1993/1994 sampling seasons. Fish were tagged from the resident/premigratory and spawning stock in the Bay, and Maryland biologists also participated in a tagging cruise off the coast of Virginia and North Carolina. These tagging studies provide valuable information on stock movements and fishing mortality rates.

During the 1992/1993 sampling season a total of 2,998 (412 resident/premigratory and 2,586 spawning) striped bass were tagged in the Chesapeake Bay and 530 were tagged in the territorial sea south of Cape Henry, VA.

During the 1993/1994 sampling season, in the Chesapeake Bay, 4,899 resident/premigratory fish were tagged as part of a directed mortality study and 2,035 fish were tagged during the spring spawning survey. During the 1994 North Carolina tagging cruise 4,632 fish were tagged.

Hatchery Fish Sampling

Maryland continued hatchery production in 1993 to enhance striped bass spawning stocks. Hatchery fish are implanted with a small magnetically detectable coded wire tag (CWT). A major component of Maryland's sampling involved scanning fish for the presence of hatchery implanted CWT's to determine hatchery contribution to the population.

A total of 11,206 striped bass were scanned during 1992/1993 sampling and 298 tested CWT positive (2.6%). Separation by sampling mode included: 4.3%, pound nets; 2.8%, main bay gill nets; 1.0%, Choptank River gill nets; 2.0%, spring spawning stock survey; and 0.1%, juvenile survey (Table 6). During the 1993 coastal tagging operation, 577 fish were scanned and 34 (5.9%) tested CWT positive.

During the fall 1993 pound net sampling survey, 2,033 fish were scanned and 74 (3.6%) were positive. A total of 4,235 fish were scanned during 1993-1994 winter gill net sampling and 6.0% were positive. At the time of Maryland's 1994 juvenile survey, hatchery fish had only been stocked in the Nanticoke River. The juvenile survey crew scanned 2,619 juveniles throughout the Chesapeake Bay, 517 from the Nanticoke River, but all scanned negative. Reduced stocking efforts and abundant 1993 and 1994 year-classes have overwhelmed contributions from hatchery fish. In the 1994 spring spawning survey approximately 3,300 fish were scanned and 106 (3.2%) tested positive. Coastal tagging results in 1994 are preliminary. Approximately 1,500 fish were scanned and 59 (3.9%) tested positive.

Annual trends in hatchery contribution are difficult to detect because no statistical analyses have been conducted. It appears that a increased percentage of Chesapeake Bay hatchery fish have migrated from the resident stock to the coastal stock.

VIRGINIA

The following is a review of Virginia's 1993 striped bass monitoring programs for 1993. Details can be found in Virginia Marine Resources Commission (VMRC) Striped Bass Report (1994).

Ichthyoplankton Monitoring Survey

Management actions were implemented within the Chesapeake Bay in early 1985 in order to reduce fishing mortality rates and protect and enhance the spawning stock. Olney et al (1991), recorded substantial increases in egg production and spawning stock size in the latter part of the 1980's. In 1989, the Virginia Department of Game and Inland Fish (VDGIF) initiated a spring electroshocking survey of the York River system. An area of overlap existed in the Pamunkey River where ichthyoplankton and electroshocking data collection occurred. Ideally, observations of

increased egg production in the Pamunkey should parallel adult catch rates. However, electrofishing CPUE during 1989-1993 found an increase in male but not female abundance on the spawning grounds. Mean annual CPUE of females have not corresponded to biomass estimates based on the VIMS egg production model. Because an increase in female abundance was expected due to harvest restrictions, concerns about the validity of the data generated in these surveys has mounted. Whether assessment techniques have accurately reflected trends in female abundance is unknown. All resources and effort in 1994 were directed towards a critical analysis of historical data resulting from these two surveys in the York River system during the five year period 1989-1993.

Spawning Stock Monitoring Survey

VIMS Anadromous Fish Program has been monitoring the striped bass spawning stock using experimental gill nets and pound nets on the Rappahannock River since the early 1980's. In 1993, gill net and pound net CPUE was greatest for males from the 1988 year-class and females from the 1987 year-class.

Since 1988, the VDGIF, USFWS, VIMS, and VMRC have attempted to enhance the Chesapeake Bay spawning stock by stocking hatchery-reared fingerlings in the York River system. Personnel from the VDGIF and United States Fish and Wildlife Service (USFWS) collected spawning stock data while electrofishing for broodfish from February to June of 1989-1992. In 1993, female CPUE was substantially higher than those from 1989-1991. Despite problems in locating large (age 8 and older) females, the CPUE for older females remained close to the 1992 record high value. Most of the observed decrease in female CPUE occurred in younger age-classes. This is probably related to the fact that young females are always abundant in the upper rivers. Sampling efforts were concentrated downstream because large females were concentrated further downstream in 1993 where the majority of sampling occurred.

Juvenile Survey

The striped bass juvenile index from the Virginia Chesapeake Bay nursery areas in 1993 was 18.1 and was the highest on record (Table 5). Recruitment success in the York River drainage was the highest for the entire time series with fish being abundant in both the Pamunkey and Mattaponi Rivers. In 1993, both the Chickahominy and main stem of the James and produced record values. The Rappahannock River produced its third highest year-class and contributed to the record 1993 index.

VIMS continued to sample auxiliary index stations in 1993 to account for the annual variability in the center of young-of-the-year abundance. This annual variability makes it difficult to provide an accurate state-wide index of annual juvenile recruitment. This issue was addressed with support from the Chesapeake Bay Stock Assessment Committee (CBSAC) and in 1993 a baywide index was developed from scaled, geometric means, weighted

by area of spawning ground in each producing river but has not yet been approved by the ASMFC.

VIMS also validated the Virginia's juvenile index with CPUE from a fishery-independent monitoring program. The juvenile index is related to subsequent year abundance of age 1 to age 3+ cohorts in fall Rappahannock River pound net catches.

Tagging

A total of 42,165 wild striped bass have been tagged and released in the James (17,730) and Rappahannock Rivers (24,435) since 1987. The USFWS has reported over 11,000 returns for both rivers, combined.

In fall 1992, VIMS tagged and released 491 striped bass in the James River. The size of the fish ranged between 15.4 and 26.2 inches fork length (FL) with 50% between 15.8 and 19.7 inches FL. The 1989 and 1990 year-classes accounted for 75% of the total tagged fish.

In spring 1993, VIMS tagged and released 621 striped bass in the Rappahannock River. Tagged fish ranged between 22.2 and 44.1 inches FL. Male striped bass between 21.7-23.6 inches FL and females 24.0-25.6 inches FL were most abundant. Catch-per-unit-effort (CPUE) data was also collected during spring tagging operations. Results were similar to data collected by the Anadromous Fish Program with females from the 1987 and males from the 1988 year-classes dominating the age composition.

DISTRICT OF COLUMBIA

During 1993, the District of Columbia sampled for striped bass with gill nets, a bagless seine, and an electroshocking boat on a monthly basis at seven fixed sites (Potomac River, 4; Anacostia River, 2; and Washington Channel, 1). In addition, ichthyoplankton surveys were conducted at these sites. The study period extended from the last week of February to the last week of December.

Catch rates indicate the maximum number of fish were caught in July. The catch consisted primarily young-of-year fish. Striped bass were not found in the District waters earlier than April or later than November.

Age analysis of the adult population shows fish age 1 to 8 were present. Age 1 fish were most abundant and the frequency of older fish (age 2-8) gradually reduced.

The 1993 young-of-year index for striped bass set a new record for that area of the Chesapeake Bay. The index was 7.02 with all sites combined. However, if only sites where young-of-year were actually collected are taken into consideration, the index rises to

30.64.

A total of eight striped bass were tagged with USFWS anchor tags. No recaptures were reported.

COOPERATIVE BAYWIDE TAGGING MORTALITY STUDY

The VMRC, PRFC, and MDNR implemented a baywide mark-recapture program to estimate the rate of exploitation in the Bay and the abundance of the resident, premigratory stock over 18 inches. The study was conducted prior to the fall 1993 recreational, charterboat, and commercial striped bass season. Reporting rate, exploitation rate, population abundance, and directed fishing mortality rate were estimated. There was a high degree of variability associated with the reporting rate (75%) due to the number of tags issued in each region of the Bay and the number of associated recoveries. The rate of exploitation (the fraction of the total population taken as catch) by the recreational and charterboat fisheries for the entire Bay was 0.05. The estimated fishing mortality rate due to the recreational, charterboat, and commercial fisheries was 0.09. These rates are well below the F = 0.25 recommended by the ASMFC. The estimated number of fish in the baywide, resident premigratory striped bass stock, 18 inches and larger, was 6.6 million. The baywide estimate of stock abundance was 7.7 million (Rugolo et al. 1994).

ENFORCEMENT PROGRAM

MARYLAND

Natural Resource Police (NRP) officers concentrated aggressive enforcement efforts on areas of heavy fishing activity, using highly visible operations (patrol vessels, cars, and aircrafts) as a deterrent during 1993 and 1994. NRP officers also continued soliciting active participation of the public, including fishermen, to report fishing violations by calling a toll free "Catch a Poacher" line.

In 1993, NRP police spent an average of 2,914 hours per month enforcing striped bass regulations. A total of 85,497 striped bass checks were conducted resulting in 484 arrests and 118 written warnings. Arrests and warnings were most frequently for untagged fish, possession during the closed season, and fishing without a license.

Preliminary results for 1994 indicate NRP officers spent an average of 2,255 hours per month enforcing striped bass regulations through November. To date, 86,748 striped bass checks have been conducted resulting in 1,960 arrests and 149 written warnings. Possession of striped bass during the closed season continues to be

a problem throughout the year, accounting for 1,650 arrests in August. Other enforcement problems frequently encountered are untagged fish, undersized fish, and fishing without a license.

POTOMAC RIVER

Law enforcement in the Potomac is done by the cooperative efforts of Maryland NRP and Virginia Marine Patrol officers. Defendants are tried through the Maryland or Virginia District Court systems and statistics on inspections, arrests, etc. are maintained by the respective agencies.

Each boat fishing during the striped bass season is required to have in possession a valid permit. Officers are requested to initial the log sheet on each permit at each boarding. A sport fishing flyer is given with each recreational striped bass permit. It includes information on season, size, and creel limits for all species in the Potomac River in addition to striped bass.

DISTRICT OF COLUMBIA

The enforcement of fishing regulations is entrusted with the District of Columbia Harbor Police who monitor angling activities on a daily basis. No infractions were reported in 1993.

WATER QUALITY AND HABITAT ISSUES

Restoring and improving habitat and water quality for living resources have been priorities of the Chesapeake Bay Program. Actions towards fish passage, wetlands, monitoring, toxics, exotic species, submerged aquatic vegetation (SAV), nutrient reduction, and atmospheric deposition are being implemented. The water quality and habitat requirements for striped bass have been defined and reported by Setzler-Hamilton and Hall in the document entitled: Habitat Requirements for Chesapeake Bay Living Resources (Funderburk et al. 1991). To date, habitat sections within each Chesapeake Bay FMP have been generic and similar from plan to plan. Both the Fisheries Management Plan Reassessment Task Force and the Chesapeake Bay Foundation have recommended strengthening the FMP habitat actions and utilizing them for managing habitat. There are some inherent problems in moving from water quality and habitat improvements to enhanced fish production. The effects of habitat alteration and water quality on fish populations are generally indirect, gradual and unquantifiable (Burns 1991). Fish habitat consists of a wide range of physical, chemical and biological factors. Modifications of fish habitat can vary along a geographic range or across a temporal spectrum and present a very complex situation. To add another level of complication, fish can also respond to their environment by changes in their behavior, growth,

reproduction, and physiology. The FMP Workgroup will begin a comprehensive review of habitat issues and how they relate to fish production during 1995. The ultimate goal of this project will be to develop habitat sections in the FMPs that can be utilized as a vehicle for encouraging and justifying resource conservation by those agencies with regulatory authority over modifications to terrestrial and aquatic ecosystems (Carter, in prep).

One of the goals of the ASMFC Amendment #5, to the interstate plan, is to provide for the restoration and maintenance of critical habitats for striped bass. In order to accomplish this task, critical habitats and environmental factors that limit long-term maintenance and productivity must be identified and standards of environmental quality adopted and promoted. Amendment #5 will include a description of striped bass spawning, nursery, and adult resident habitats; narratives on the present status of habitats and impacts on the fisheries; and the identification and distribution of essential habitats. The status of habitats will include current threats and effects on the ability to harvest and market. Once these parameters are described by ASMFC, they can be applied to the Chesapeake Bay region. Each state will be required to implement management measures that protect striped bass habitat so that existing habitat is preserved; incompatible activities between state and federal fishery management agencies are avoided; and historical habitat is restored, improved or enhanced.

CONCLUSION

Coordinated, interjurisdictional management efforts have restored coastal striped bass stocks to historic levels (as of January 1, 1995). This assessment is based on a projected spawning stock biomass of mature Chesapeake Bay females exceeding the historical high average (calculated for 1960-1972, ASMFC 1994). In addition, estimated fishing mortality rates have been below current target levels (F=0.25); juvenile recruitment has been excellent; and CPUE has been steadily increasing. The ASMFC is developing Amendment #5 to provide management guidelines for the long-term maintenance of a self-sustaining spawning stock and provide the restoration and maintenance of critical habitats. During 1995, areas that should be emphasized to improve striped bass management are:

1) Adopt Amendment #5 to the ASMFC Fishery Management Plan.
2) Review and revise the Chesapeake Bay FMP to account for changes in Amendment #5.
3) Continue to refine the spawning stock biomass (SSB) model.
4) Continue and improve efforts to monitor commercial and recreational (including charterboat) harvests.
5) Review and improve the habitat section, focussing on how habitat issues relate to striped bass production, so it can be used to justify the protection and enhancement of critical habitats.

Table 1. Harvest of striped bass from Maryland by fishing year and fishery (pounds).

Fishing Season	*1990/91	*1991/92	*1992/93	1993/94
Commercial (Bay)	133,912	326,986	791,210	856,622
Commercial (Coast)	4,926	14,454	17,770	4,065
Recreational	413,896	460,866	844,973	649,018
Charter boat	97,971	159,218	229,259	349,531
Trophy	closed	7,973	22,834	61,640

* Final totals for each fishery. Previously reported numbers were preliminary.

Table 2. Harvest of striped bass from Virginia by fishing year and fishery (pounds).

Fishing Season	1990/91	1991/92	1992/93	1993/94
Commercial	264,250	201,830	205,192	209,983
Recreational	180,000	210,690	214,455	495,450
Charter boat	* 8,000	* 9,540	*10,364	436,326

* New estimates should be available in 1995.

Table 3. Harvest of striped bass from the Potomac River by fishing year and fishery (pounds).

Fishing Season	1990/91	1991/92	1992/93	1993/94
Commercial	168,479	216,755	127,398	142,742
Recreational	63,186	162,500	193,738	120,899
Charter boat	18,204	14,193	28,378	9,857

Table 4. Summary of the estimated striped bass losses from the Maryland fisheries during the 1993/1994 season due to illegal fishing, hook and release mortality, and bycatch (MDNR 1994).

Fishery	Gear	Losses (# of fish)	Losses (lbs)
Recreational subtotal		Hist. 192,461 New 89,673	* *
Commercial	pound net gill net hook & line ocean trawl	385 poaching- 1,500 sublegal bycatch- 4,894 410 69	1,001 3,375 * 820 324
White Perch	gill net	150 - 40,879	150 - 40,879
American Shad	ocean gill net	138	846
TOTAL		97,217 - 240,736	*

* Data not available.

Table 5. Annual striped bass juvenile indices from Maryland and Virginia, 1980-1994.

YEAR	MARYLAND (Arithmetic Mean)	MARYLAND (Geometric Mean)	VIRGINIA
1980	2.0	1.0	2.5
1981	1.2	0.6	1.6
1982	8.4	3.5	2.7
1983	1.4	0.6	3.5
1984	4.2	1.6	4.4
1985	2.9	0.9	2.4
1986	4.1	1.3	4.8
1987	4.8	1.5	15.8
1988	2.7	0.7	7.6
1989	25.2	4.9	11.2
1990	2.1	1.0	7.3
1991	4.4	1.5	3.8
1992	9.0	2.3	7.3
1993	39.8	14.0	18.1
1994	16.1	6.4	

Table 6. Summary of hatchery striped bass recovered during Maryland's Chesapeake Bay Stock Assessment surveys and the coastal tagging survey, September 1992 - May 1993.

Fall Pound net (Sept. - Oct. 1992)

System	Total Caught	Number Scanned	Number Positive	Percent Positive
Upper Bay	1524	806	17	2.1
Middle Bay	2306	1245	71	5.7
Lower Bay	1225	537	24	4.5
TOTAL	5055	2588	112	4.3

Winter Gill Net (Jan. - Feb. 1993)

System	Total Caught	Number Scanned	Number Positive	Percent Positive
Choptank R.	98	97	1	1.0
Main Bay	1989	1939	55	2.8
Total	2087	2036	56	2.8

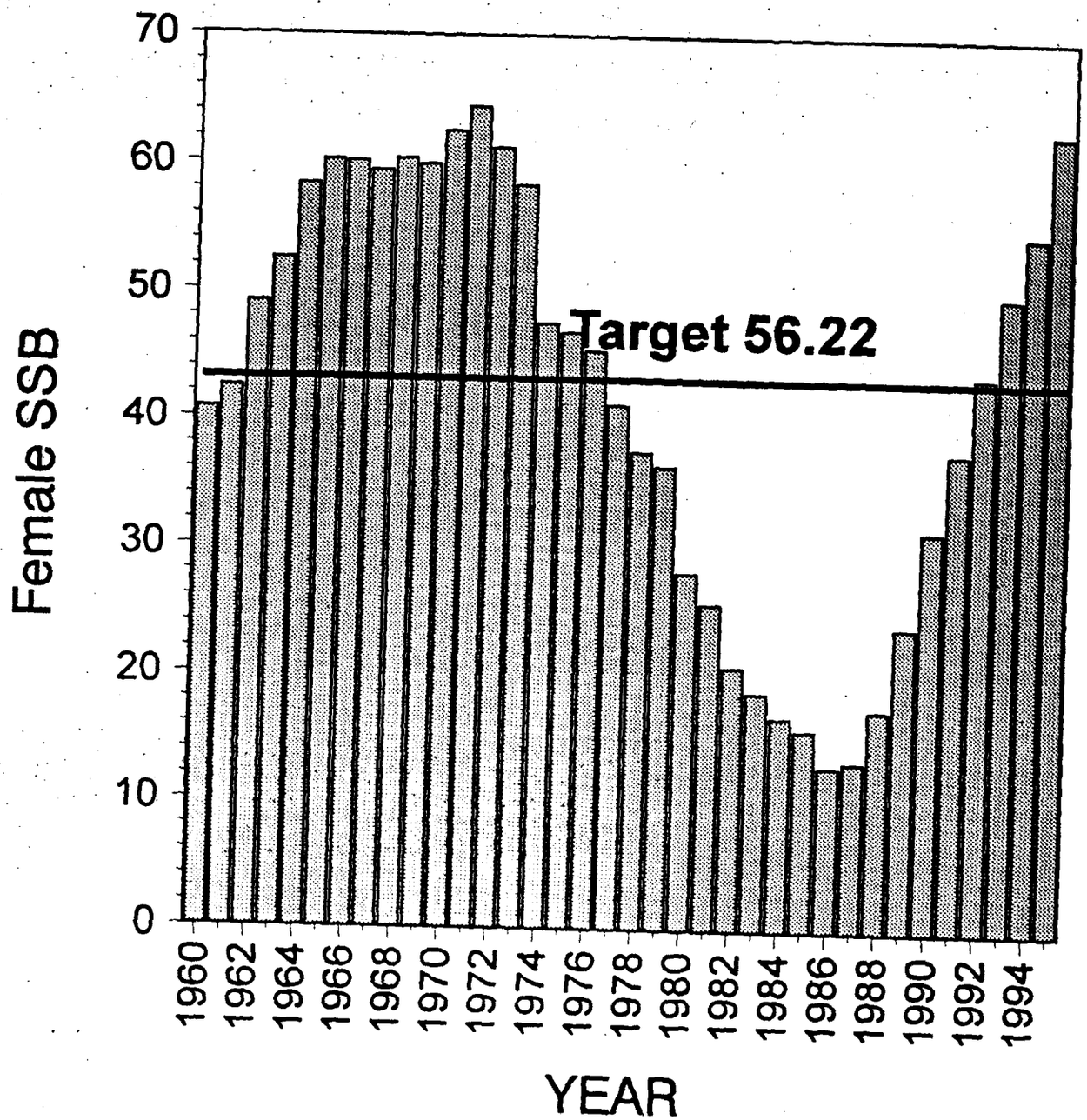
Spring Spawning Stock (April - May 1993)

System	Total Caught	Number Scanned	Number Positive	Percent Positive
Choptank R.	3287	2812	93	3.3
Potomac R.	1803	1784	13	0.7
Upper Bay	3062	1986	24	1.2
TOTAL	8152	6582	130	2.0

Coastal Tagging Survey (Feb. 1993)

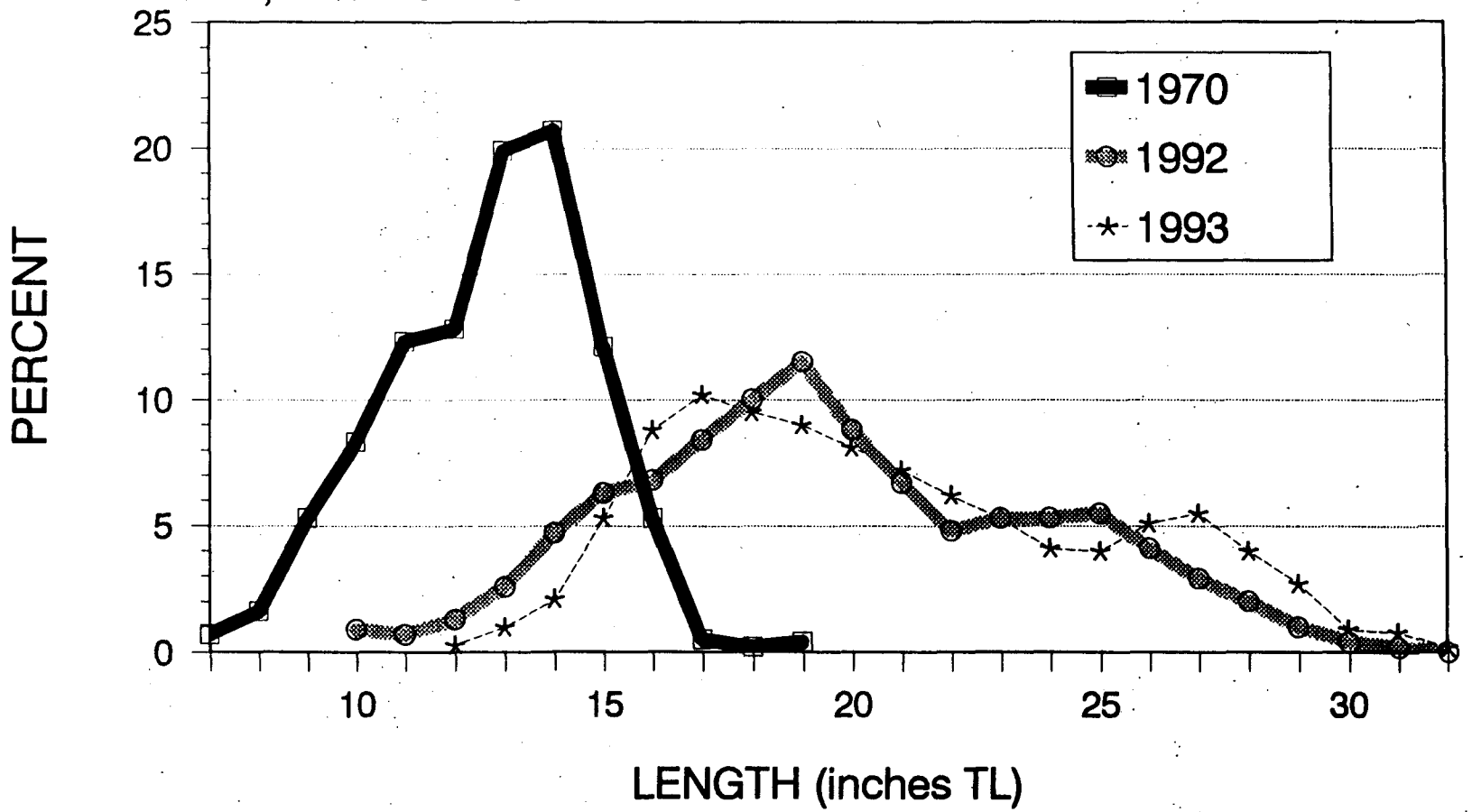
System	Total Caught	Number Scanned	Number Positive	Percent Positive
TOTAL	577	577	34	5.9

Figure 1. Coastwide female striped bass spawning stock biomass (SSB).



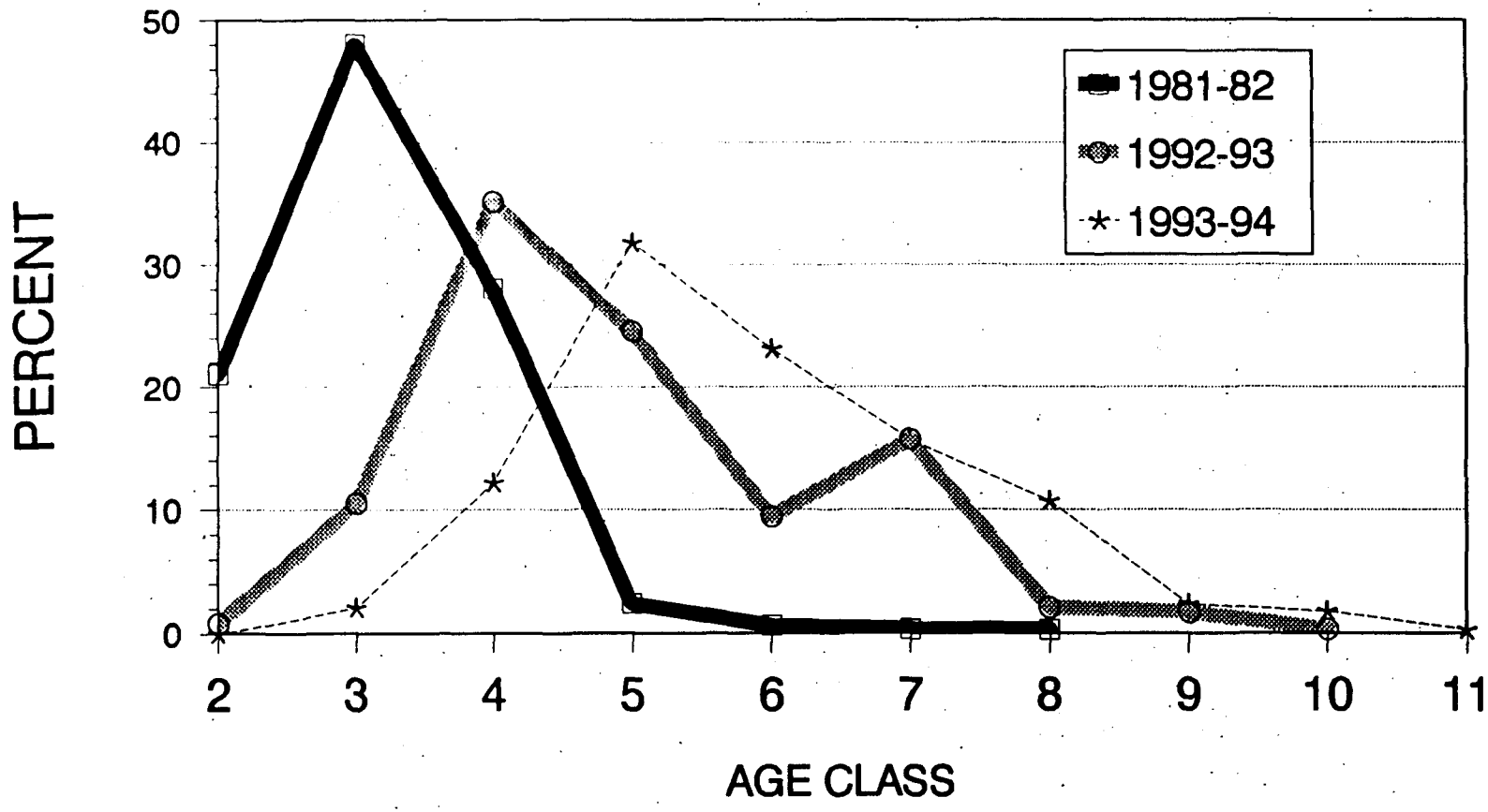
Source: Rugolo et al., 1994

Figure 2. Length-frequency distributions of commercial pound net catches from Fall 1970, Fall 1992, and Fall 1993.



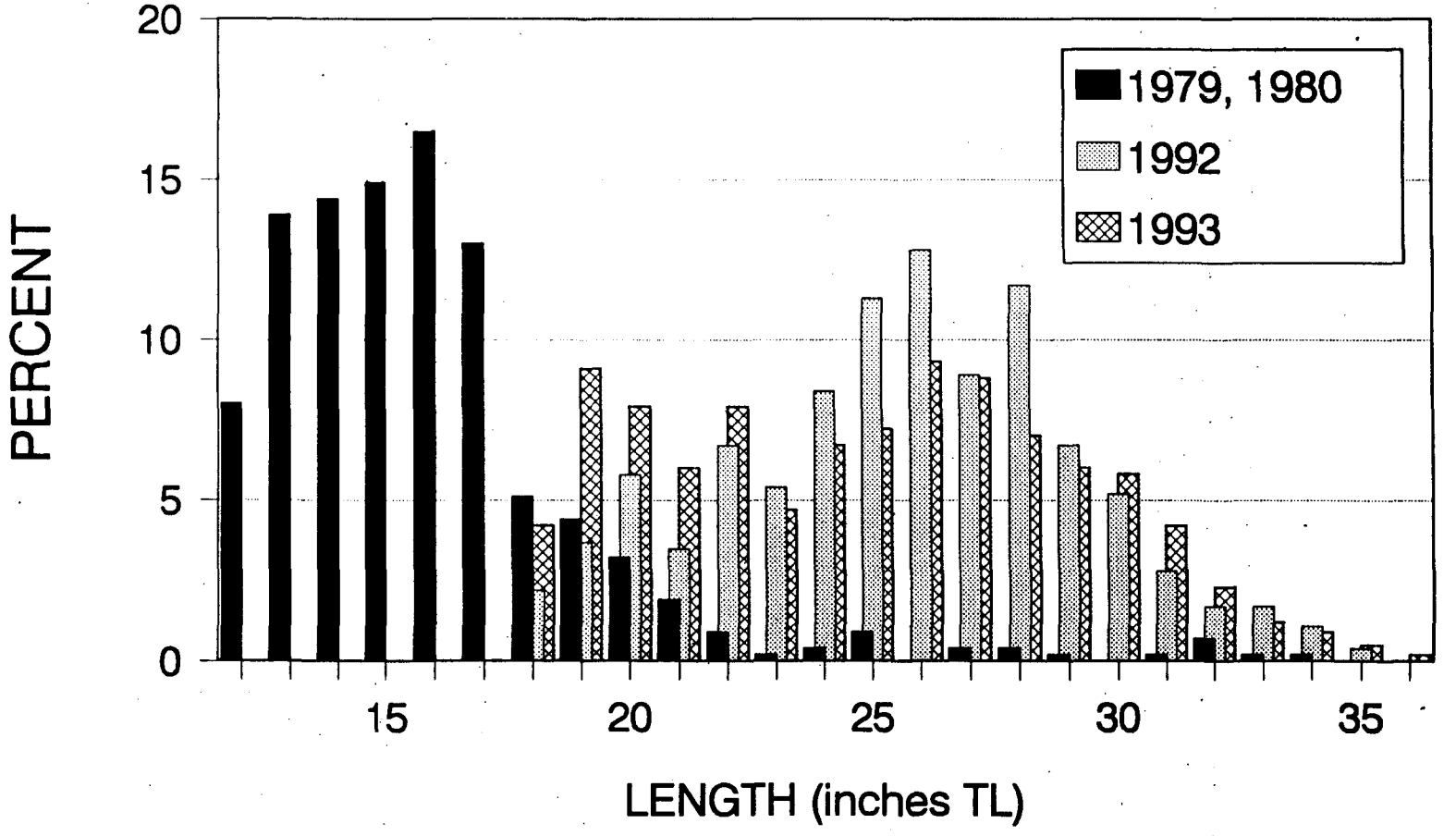
MDNR Striped Bass Stock Assessment Data

Figure 3. Age-frequency distributions of commercial drift gill net catches, Winter 1981-82, Winter 1992-93, and Winter 1993-94.



MDNR Striped Bass Stock Assessment Data

Figure 4. Length-frequency distributions of Maryland's recreational harvest in 1979 - 1980, 1992, and 1993.



MDNR Striped Bass Stock Assessment Data

References

ASMFC 1994. Atlantic States Marine Fisheries Commission 1994 Annual Review of Interstate Fishery Management Plans: Atlantic Striped Bass (Morone saxatilis). John Field, ed. October, 1994. p. 33-39.

Austin, H.M., A.D. Estes and D.M. Seaver. 1993a. Estimation of juvenile striped bass relative abundance in the Virginia portion of the Chesapeake Bay. Annual Progress Report 1993. Virginia Institute of Marine Science, Gloucester Point, Virginia.

Austin, H.M., J.A. Colvocoresses, and T.C. Mosca, III. 1993b. Develop a Chesapeake baywide young-of-the-year striped bass index. Final Report to the Chesapeake Bay Stock Assessment Committee, Cooperative Agreement No. NA16FU0393-01.

Hornick, H.T., R.K. Schaefer, D.T. Cosden, K.J. Booth, D.M. Goshorn, J.L. Markham, M.L. Gary, C.B. McCullough, and W.S. Barbour. 1993. Investigation of striped bass in Chesapeake Bay. USFWS Federal Aid Performance Report. Project No. F-42-R-6. Maryland Department of Natural Resources, Annapolis, Maryland.

Maryland Department of Natural Resources. 1994. Maryland's spring and fall 1993, and winter 1994 striped bass harvest and background fishing losses. Maryland Department of Natural Resources, Annapolis, Maryland.

Olney, J.E., J.D. Field, and J.C. McGovern. 1991. Striped bass egg mortality, production, and female biomass in Virginia Rivers, 1980-1989. American Fisheries Society. 120:354-367.

Potomac River Fisheries Commission. 1994. The 1993 striped bass harvest report. A special report to ASMFC, March 1994. Potomac River Fisheries Commission, Colonial Beach, Virginia.

Rugolo, L.J., P.W. Jones. 1989. A recruitment-based interseason harvest control model for Chesapeake Bay striped bass. Maryland Dept. of Natural Resources, Annapolis, Maryland.

Rugolo, L.J., P.W. Jones, R.K. Schaefer, K.S. Knotts, H.T. Hornick and J.L. Markham. 1994. Estimation of Chesapeake baywide exploitation rate and population abundance for the 1993 striped bass stock. Maryland Dept. of Natural Resources, Annapolis, Maryland.

Rugolo, 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, ASMFC. May, 1994. p. 1-30

Uphoff Jr., J. H. 1994. Spawning stock status of striped bass in Maryland's Chesapeake Bay, 1955-1994 determined by egg presence-absence. Fisheries Division, Technical Report 12. Maryland Dept. of Natural Resources, Annapolis, Maryland.

Virginia Marine Resources Commission (VMRC). 1994. Review of Virginia's 1993 striped bass fisheries and monitoring programs. A Report to the ASMFC Striped Bass Technical Committee. VMRC, Newport News, Virginia.

CHESAPEAKE BAY STRIPED BASS IMPLEMENTATION PLAN 1994

Problem Area	Action	Date	Comments/Notes
1.1 Overfishing.	1.1.1 The jurisdictions will utilize a combination of harvest restrictions to meet target fishing mortality rates.	Began 1990, continued through 1994.	The striped bass stock has been declared restored as of January 1, 1995. Jurisdictions will establish strategies to meet transitional fishing mortality targets.
	1.1.2 The jurisdiction will cap commercial harvest with a quota not to exceed 20% of the average annual commercial catch from 1972-1979.	Began 1990, continued through 1994.	The MD harvest is governed by a harvest control model. During 1993 and 1994, the commercial quotas were: 891,529 lbs., MD; 211,000 lbs., VA; 155,000 lbs., PRFC; and no commercial fishing in DC.
1.2 Reduced spawning stock.	1.2.1 The jurisdictions will establish a minimum size limit of 18 inches in the Bay.	Began 1990, continued through 1994.	An 18 inch minimum size limit has allowed the stock to increase in size and diversify in age and length. The Atlantic coast minimum size limit is 28 inches and Maryland's spring trophy size limit is 36 inches. Size limits are being reviewed for the transitional fishery.
	1.2.2 The jurisdictions will prohibit the keeping and sale of sublegal striped bass bycatch.	Began 1990, continue through 1994.	Harvest of sublegal fish has been minimized with mesh size restrictions. Regulations are in place that prohibit the possession and sale of fish under 18 inches. Losses due to sublegal bycatch have been estimated.
	1.2.3 The jurisdictions will establish a maximum size limit of 36 inches in the Bay.	Began 1990, discontinued in 1994.	Maximum size limits were set as a conservative measure. Stocks have recovered and jurisdictions are eliminating maximum size limits.

1.3 Reduced number of spawners.	1.3.1 During the transition fishery, age VIII and older females will be protected until they comprise a certain percentage of the female spawning population.	Began 1990, continued through 1994.	The ASMFC declared the striped bass stock recovered based on the results of a stock simulation model of coastal female spawning stock biomass (SSB). The SSB model was agreed upon as a management tool in place of protecting age 8+ females because it reduces the amount of error strong year-classes have on the population.
	1.3.2 During a recovered fishery, females age VIII and older will be protected at a certain percentage of the spawning population.	Open	The SSB model will be used to monitor and protect a sustainable spawning population.
	1.3.3 Maryland and Virginia will continue hatchery production to enhance the striped bass spawning stock.	Continue	Stocking has been restricted but efforts continue to enhance areas where striped bass abundance remains at low levels.
	1.3.4 Hybrid and non-native striped bass stocking will be restricted according to ASMFC guidelines.	Began 1991, continued through 1994.	
2.1 Allocation issues.	2.1.1 Maryland quota will be allocated as follows: 42.5% commercial; 42.5% recreational; and 15% charter. Virginia and Potomac River Fisheries Commission will use various restrictions to equitably allocate harvest.	Began 1990, continued through 1994.	Commercial quotas for each jurisdiction were allocated by gear type. The 1993/1994 and 1994/1995 recreational caps were: 891,529 lbs., MD recreational; 314,657, MD charterboat. The VA and PRFC recreational fisheries had a creel limit and seasonal restrictions.
	2.1.2 Commercial fishing seasons will be closed when harvest caps are reached, regardless of time during season.	Began 1990, continued through 1994.	Jurisdictions continue to monitor the commercial harvest of striped bass.
2.2 Gear restrictions.	2.2.1 The jurisdictions will establish minimum mesh sizes for gill nets.	Began 1990, continued through 1994.	Jurisdictions continue to enforce minimum mesh sizes targeting striped bass 18 inches and larger: 5 inches, MD and VA; and 5.25 inches, PRFC.

2.2 Gear restrictions (continued).	2.2.2 Maryland and Virginia will require drift gill nets to be marked, tended, and recovered daily. Other Virginia gill nets must be marked. Potomac River Fisheries Commission will continue fixed location for gill nets.	Began 1990, continued through 1994.	Regulations vary between jurisdictions.
	2.2.3 Maryland and Virginia will establish a maximum length of gill net allowed. Potomac River Fisheries Commission will establish a maximum number of gill net licenses.	Began 1990, continued through 1994.	Regulations have been enacted.
	2.2.4 Maryland and Virginia will establish annual quotas for their commercial fisheries.	Began 1990, continued through 1994.	Commercial harvest caps were enacted (see Action 1.1.2). Daily and seasonal limits were also established.
2.3 Selling and buying striped bass.	2.3.1 A) Maryland will establish check stations; B) Virginia dealers and watermen will be required to have a special permit to sell; C) Sale by *recreational and charter* fishermen will be prohibited.	Began 1990, continued through 1994.	A) MD established check stations. B) VA established a permit system for harvesters and dealers. C) Regulations were established.
	2.3.2 Jurisdictions will establish reporting systems for buyers and commercial watermen.	Began 1990, continued through 1994.	MD watermen are required to maintain daily logs and submit it at the end of the season and dealers call in daily and submit weekly submittals. VA watermen and dealers must submit weekly reports. PRFC watermen report weekly.
2.4 Seasons, creel limits, and fishing areas.	2.4.1 A-E Jurisdictions will establish fishing seasons in the Bay with as much consistency as possible.	Began 1990, continued through 1994.	Seasons differed slightly because of striped bass migratory patterns and local practices. Refer to the annual report for seasons. Season restrictions are being reviewed.

2.4 Seasons, creel limits, and fishing areas (continued).	2.4.2 Maryland will prohibit commercial striped bass fishing on weekends and at night.	Began 1990, continued through 1994.	MD has established regulations prohibiting commercial striped bass fishing on weekends and at night. MD also prohibits recreational fishing at night.
	2.4.3 Jurisdictions will maintain striped bass fishing areas.	Began 1990, continued through 1994.	Striped bass area restrictions are being reviewed.
	2.4.4.1 Jurisdictions will establish creel limits of up to 5 fish for the recreational and charter fisheries.	Began 1992, continued through 1994.	MD fall creel limits: 1 fish/person/day, recreational; and 2 fish/person/day, charterboats. VA: 2 fish/person/day. PRFC and DC: 1 fish/person/day. Creel limits are being reviewed.
	2.4.4.2 Maryland may allow one trophy fish per boat during a May trophy season.	Began 1992, continued through 1994.	MD 1993: 1 fish/angler/season. MD 1994: 1 fish/angler/day and 3 fish/season.
2.5 Monitoring	2.5.1 Jurisdictions will monitor striped bass harvest using a variety of methods.	Began 1990, continued through 1994.	Jurisdictions used a combination of access/intercept and telephone surveys, check stations and reports from harvesters and dealers.
	2.5.2 District of Columbia will conduct an angler survey to determine striped bass catch and effort.	Began 1991, continued through 1994.	
2.6 Management and enforcement authority.	2.6.1 Jurisdictions will develop appropriate mechanisms for timely management of the striped bass resource.	Began 1990, continued through 1994.	Jurisdictions have the authority to regulate their fisheries. Regulations permit the opening and closing of seasons when quotas/caps are reached.
	2.6.2 Jurisdictions will adopt consistent enforcement policies.	Began 1990, continued through 1994.	Jurisdictions continued to maintain an aggressive enforcement program.
3.1 Stock assessment and research needs.	3.1 Jurisdictions will continue their efforts to collect stock information.	Continue	These programs include assessment of juvenile and adult abundance, monitoring the fisheries, tagging for stock discrimination, migration and mortality estimates.

3.1 Stock assessment and research needs (continued).	3.2 Jurisdictions will review, update, and initiate studies as needed on reproduction, early mortality, etc.	Variable	Jurisdictions are in the progress of developing a baywide juvenile index.
4.1 Water quality.	4.1 Jurisdictions will continue to support the commitments under the 1987 Chesapeake Bay Agreement.	Continue	Significant habitat improvements have been made within the mainstem of the Bay. Tributary and Basinwide Toxics Reduction and Prevention Strategies have been adopted and will further enhance Bay habitat.

LEGEND
MD = Maryland
VA = Virginia
PRFC = Potomac River Fisheries Commission
DC = District of Columbia