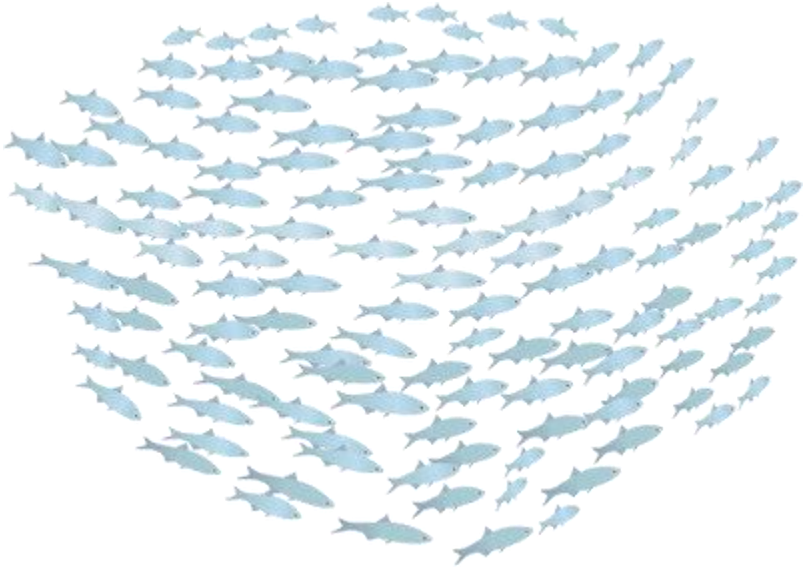
2012 Fishery Management Plan
Report to the Legislative Committees



Prepared by

Maryland Department of Natural Resources
Fisheries Service
Fishery Management Plans Program

September 2013

MARYLAND DEPARTMENT OF NATURAL RESOURCES

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September 2013

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2012 Fishery Management Plan (FMP) Updates (September 2013)

This document addresses the requirement to regularly report on the status of each managed stock in the Chesapeake Bay and Coastal Bays of Maryland as required under Natural Resources Article Section 4-215. The report consists of a species introduction and implementation table for each FMP. The introduction page contains information on the FMP background, stock status, management measures, the fisheries and issues/concerns. The implementation table is a synopsis of all the management strategies and actions found in the FMP, implementation dates, and current status of the management action. The boldface type highlights the most recent comments.

Background

Under the 1987 Chesapeake Bay Agreement and the 1992 Amendments, the Bay jurisdictions developed a series of FMPs for commercial, recreational, and selected ecologically valuable species. The Chesapeake Bay FMPs provide a framework for the Bay jurisdictions to generate compatible, coordinated management measures to conserve and utilize a fishery resource. As ecosystem-based management plans begin to be developed, the FMP framework will become even more important for delineating a baywide approach. Since a large fraction of the managed fish species in the Chesapeake Bay spends a portion of their life history outside the Bay boundaries, fishery management measures must be coordinated on a regional and coastal basis. For coastal migratory species, the federal Mid-Atlantic Fishery Management Council (MAFMC) develops management measures for species mainly found in the Exclusive Economic Zone (EEZ or 3-200 miles offshore). For species utilizing the inshore area (0-3 miles offshore), the Atlantic States Marine Fisheries Commission (ASMFC) defines compliance requirements. The ASMFC requires the states to prepare annual compliance reports for the following species: American eel, Atlantic croaker, Atlantic menhaden, Atlantic striped bass, Atlantic sturgeon, black sea bass, bluefish, horseshoe crabs, mackerel, shad and herring, scup, spot, summer flounder, and weakfish. Beginning in 2013, a compliance report is also required for spotted seatrout. Additional information on stock status and fishery management measures for these migratory fish species can be found at www.asmfc.org and www.mafmc.org. Coastal fishery requirements are mandated along the Atlantic coast. The Chesapeake Bay FMPs outline how Bay jurisdictions will implement coastal compliance requirements and identify any additional issues specific to the Bay region. The Maryland Coastal Bays FMPs outline how species are managed in the Coastal Bays. Maryland's Coastal Bays FMPs are part of a larger plan, the Comprehensive Coastal Management Plan (CCMP). The CCMP was thoroughly reviewed during 2012 and 2013. Both new and updated recommendations expected to be finalized by December 2013.

In addition to the Chesapeake Bay Program process, Natural Resource Article §4-215 (b)(1-24), Annotated Code of Maryland states that the Department of Natural Resources shall prepare fishery management plans for a list of species. Once a plan has been developed and signed off, it is incorporated by reference into COMAR. A 2010 legislative bill gave the Department authority to create fishery management plans without the need to annually amend §4-215 to add new species to the list of managed species. The bill requires the Department to address overfishing when data shows that it is an issue. The Department also consults with the Tidal and Sport Fisheries Advisory Commissions for their input when developing management strategies and actions.

Introduction

Fifteen (15) Chesapeake Bay Fishery Management Plans (FMPs) encompassing 21 species and over 260 commitments have been adopted by the Chesapeake Bay Program's Executive Council. In addition, Maryland has developed 4 state-specific FMPs: Yellow

Perch, Coastal Bays Blue Crab, Coastal Bays Shellfish, Brook Trout; and a technical report for catfish. A Black Bass FMP was drafted and reviewed by the DNR fisheries advisory groups and stakeholders during 2013. It is scheduled for completion by December 2013 A draft Chesapeake Bay Shellfish FMP is in progress.

Fishery management plans are updated on a regular basis and periodically reviewed to evaluate progress towards meeting goals and objectives. An FMP update consists of Fisheries Service (FS) staff compiling the most recent information on the status of management strategies and actions for each FMP species. An FMP review consists of a more intensive evaluation of a species FMP goal, objectives, management strategies and actions, the current stock status, and any outstanding species issues. The review is conducted by the species-specific biologists and FMP staff. In order to maintain effective management strategies that reflect the changing needs of fishery resources, the review team: 1) examines the monitoring data for status and trends of the species being reviewed; 2) updates the recreational and commercial fishery statistics; 3) implements coastal recommendations (ASMFC and/or MAFMC); 4) integrates habitat and trophic considerations; 5) tracks the progress/implementation of management actions; 6) addresses any new issues; and , 7) makes recommendations for adaptive management, i.e., whether to continue with the current management framework, amend the plan or revise the plan. The plan review team's recommendations are presented to the Sport Fisheries Advisory Commission and the Tidal Fisheries Advisory Commission as part of the review process. The commissions provide additional input. If an amendment or revision is recommended by the review team, the process for developing FMPs begins. In 2013, the review process also included the 2012 Fisheries Service Allocation Policy.

During 2012 and 2013, the Fisheries Service Plan Review Teams (FS PRT), completed reviews on the 1989 Chesapeake Bay Alosid Management Plan and 1998 Amendment #1, the 1990 Chesapeake Bay Weakfish and Spotted Seatrout Fishery Management Plan and the 2003 Chesapeake Bay Program Weakfish (Cynoscion regalis) Fishery Management Plan, and the 2002 Maryland Tidewater Yellow Perch Fishery Management Plan. In addition, three plans are still in the review process: the 1989 Chesapeake Bay Striped Bass Management Plan and 1998 Amendment #1, the 1997 Chesapeake Bay Blue Crab Management Plan and Amendments #'s 1 and 2, and the 2006 Maryland Brook Trout Management Plan.

Fish Habitat and Land Conservation

Maryland Fisheries Service (FS) has identified land development as one of the major threats to fish habitat. However, fisheries managers have no authority to regulate land use. To address this challenge, FS is developing strategies to work with constituents to communicate fisheries' concerns. The message is "land conservation = fish conservation." Studies have been conducted to assess the impacts of impervious surface on fish and fish habitat. A DNR study on the Choptank River (1980-1990) examined the survival rate of striped bass larvae and agricultural best management practices (BMPs). Larval survival increased with the increased adoption of BMPs especially those that conserved soil, reduced run-off and reduced the use of pesticides and fertilizers. Two agricultural methods were notable, conservation tillage and cover crops.

Another DNR Fisheries study examined how the amount of impervious surface (due to the amount of development) affects water quality and then impacts fish spawning. The DNR Fish Habitat Team examined the number of herring eggs or larvae present in a stream. They found that the number of herring decreases with increasing development. As rural watersheds (impervious surface less than 10%) transitioned to suburban watersheds (greater than 10% impervious surface), the number of streams with eggs or larvae decreased. A study on larval yellow perch feeding success also found negative effects due to increasing impervious surface in a watershed. For more details about these studies go to

http://www.dnr.maryland.gov/fisheries/fhep/pdf/CBC_Land_Conservation_Fish_Conservation_Fact_Sheet.pdf

These studies illustrate how important land use decisions are to fish management. Land use policies and conservation strategies need to be better aligned with fishery management strategies.

As a conservative recommendation, impervious surface should be kept below 8% to minimize the effects on the aquatic habitat and fish. As impervious surface increases above 10%, fishery resources are less able to cope with the stress of poor quality habitat. The Fisheries Habitat and Ecosystem Program within DNR's Fisheries Service has developed a map to help guide conservation and land management. First, they identified high quality anadromous fish habitat. Then they added stressors that limit fish distribution and production, specifically the effects of impervious surface. The areas were ranked into three categories (good, fair, and poor) based on the potential to support anadromous fish spawning under the existing levels of development. For more detailed information on the Habitat and Ecosystem Program go to http://www.dnr.maryland.gov/fisheries/fhep/index.asp?p=pub

Marine Recreational Information Program (MRIP)

Recreational fishery statistics are an important part of any stock assessment. Scientists need to know how many fish are taken, how much effort was used to catch the fish, and where the fish were caught. The National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS) is responsible for collecting statistics on marine recreational fishing and calculating harvest estimates. Most stakeholders are familiar with the NMFS recreational fishing statistics program known as the Marine Recreational Fisheries Statistics Survey or MRFSS. The MRFSS program began in 1981 and has calculated recreational harvest since then. The recreational fishery estimates have been used in conjunction with commercial fishery statistics to develop fishery management policies and actions.

Beginning in 2008, NMFS began a new process to improve the estimation of recreational harvest. The program is being implemented in three concurrent phases: evaluation of current methods; identification and testing of new methods; and implementation of improved methodologies (MRIP 2011). MRIP has accomplished the following: utilized the National Saltwater Angler Registry; tested alternative effort survey approaches; created a new catch estimation methodology; improved the collection of catch data; and improved data timeliness. Improvements to the methodology include better angler dockside surveys, improved statistical precision, and more frequent reporting. As a result, new estimates for recreational catch by species have been calculated. The new MRIP estimates replace the previous MRFSS recreational estimates. The new recreational catch estimates improve the accuracy of the estimates by removing statistical bias. Since historic estimates are particularly important data for stock assessments, the recreational catch estimates have been recalculated. Prior to 2004, the dockside survey design was different and not compatible with the new methodology. During 2012, MRIP developed a revised method to recalculate catch estimates going back in time as far as possible.

The recalculation of recreational harvest estimates has resulted in species-specific changes. Some new catch estimates go up, some go down and some stay about the same. There is no overall trend in catch estimates from the previous MRFSS estimates. On a coastwide basis, approximately 20% of the species harvest estimates differed by more than or less than 15% of the previous estimates. Species harvest estimates that were considerably different from past estimates include mid-Atlantic scup and species from other areas (Maine- Atlantic cod and haddock; Gulf of Mexico – mutton snapper and black grouper; South Atlantic – black and red grouper; and Atlantic yellowfin tuna).

The new MRIP recreational harvest estimates will not directly change any of the species' stock status. However, as species stock assessments come up for new assessments, the MRIP estimates will be used along with all other pertinent data, to determine the stock status and provide data for management strategies. Management actions may need to be amended or revised based on the new assessments.

Improvements to recreational harvest estimates will continue under MRIP. During 2012, MRIP evaluated a number of pilot projects including: an electronic logbook reporting system for charter boats; enhanced angler dockside survey; and additional ways to report estimates on a more timely basis. For more detailed information on MRIP, go to http://www.countmyfish.noaa.gov/index.html. The new and improved MRIP methodologies are expected to be fully implemented in 2014.

2012 Maryland FMP Report (July 2013)
Section 1. American Eel ((*Anguilla rostrata)*

A benchmark stock assessment for the Atlantic Coast American eel stock was completed in 2012. The peer review team concluded that the stock is depleted and currently at low levels[1]. Although coastwide commercial fishery landings have declined, it cannot be determined if current fishing levels are too high.

The life history strategy of the American eel is unique. Eels spawn in the Sargasso Sea and their larvae (called leptocephalii) are carried by currents along the entire Atlantic coast from South America to Greenland. The larvae change into glass eels, then elvers, and migrate into estuaries, rivers and streams. They continue to grow into larger, immature yellow eels and remain in freshwater habitats as long as 14 years. They finally begin their maturation process as silver eels when they migrate back to the Sargasso Sea to spawn and begin their life cycle again. As a result of this unique life history, American eels comprise one panmitic population, i.e., they are a single-breeding population with random mating. They occur in the broadest array of habitats, more than any other fish species. Their range of habitats includes open ocean, estuaries, large coastal tributaries, rivers, small freshwater streams, lakes and ponds. Although the population is panmitic, there are distinct habitat-related differences in size and sex ratio. Their range of habitats and complex life history make them difficult to assess.

A Chesapeake Bay American Eel Fishery Management Plan (CBFMP) was adopted in 1991. The goal of the CBFMP is to manage the American eel population in the Chesapeake Bay and its tributaries so that harvest does not exceed the natural capacity of the population to maintain its size from year to year. The CBFMP was reviewed in 2011 and the plan review team concluded that the 1991 management framework is still appropriate for managing the population in Chesapeake Bay. Since the stock has been depleted, new coastal management measures are under discussion (see Addendum III below).

The ASMFC adopted a coastal FMP for American Eel in 1999. The purpose of the coastal FMP is to reverse any local or regional declines in abundance and institute consistent fishery-independent and dependent monitoring programs along the coast. Fishery-independent monitoring guidelines require all states to implement a young-of-the-year (YOY) monitoring project (2001-present). Minimum monitoring criteria include one sampling site monitored four times a week for a six-week period. Standardized YOY surveys have been completed in Maryland since 2000. Each jurisdiction is required to complete an ASMFC annual compliance report

Addendum I (2006) to the coastal ASMFC FMP required a catch and effort monitoring program. Addendum II (2008) recommended stronger regulatory language to improve upstream and downstream passage at dams. The ASMFC drafted Addendum III (2012) to reduce mortality and increase conservation of all life history stages. The public comment for the draft addendum ended in June 2013. The addendum includes a range of options: a moratorium or quota allocation; reductions in catch & effort, seasonal closures, habitat recommendations, and future monitoring requirements. The ASMFC Management Board will be discussing the Working Group's recommendations for managing each life stage (glass, yellow & silver) at the August 2013 meeting. For the most current information on the status of the addendum go to http://www.asmfc.org/

Stock Status

The American eel stock along the Atlantic coast was assessed in 2010/2011 and peer-reviewed in March 2012. The review team concluded that the American eel coastal stock is depleted[1]and at historically low levels. The reasons for the current status are due to a combination of historic overfishing and habitat loss. Habitat has been lost due to blockages (mostly dams) on rivers and streams and mortality from passing through hydroelectric turbines. In addition, the stock may also have experienced impacts from parasites and disease, and unexplained mortality at sea. Unfavorable wind-driven currents may affect recruitment into estuaries making climate change effects a concern. The ASMFC Stock Assessment Subcommittee (SASC) conducted a depletion-based stock reduction analysis (DB-SRA). Although the American eel stock is depleted, the overfishing and overfished status in relation to the biomass and fishing mortality reference points cannot be stated with confidence[1]. The coastal states will continue monitoring and collecting data in order to develop biological reference points in the future and implement recommended management measures to reduce mortality.

An age- and sex-structured assessment model for American eels in the Potomac River was completed and published in 2011[2]. Model results indicate that between 1980 and 2008 estimated recruitment, biomass and abundance decreased. Exploitation during this same time period exceeded $F_{50\%}$ Declines in recruitment have been reported from other places along the Atlantic coast.

Since habitat loss due to stream/river blockages has contributed to reductions in American eel, the Maryland Fish Passage Program added eels to its list of targeted species. Blockage removal projects consider whether or not eels would benefit from implementing a proposed project. The ASMFC published the Proceedings of a Workshop on American Eel Passage Technologies (July 2013). The workshop participants agreed that traditional fish passage structures (fishways and fish lifts) are ineffective at passing juvenile eels and that specialized eel passage structures are necessary.

Current Management Measures/The Fishery

Maryland commercial eel landings were 556,093 pounds during 2012. The highest reported annual landings since the 1990s occurred in 2011 (Figure 1). Landings have exceeded the time series mean of 332,578 pounds for last three consecutive years. Landings from the Chesapeake Bay (includes Virginia and the Potomac River commercial landings) typically account for about 60% of the coastwide harvest of eels.

In 2012, eel pot catch-per unit-effort (CPUE) in state tidal waters was 0.72 pounds per pot. The CPUE has ranged from 0.71-0.86 pounds per pot in seven of the last eight years with the exception in 2006. At that time, CPUE was the highest (1.01) and effort was the lowest in the 21-year time series (Figure 1).
Eel pot effort steadily declined from 1999 through 2009, but increased by more than 100% by 2011 over the 2009 low (Figure 2). Eel pot effort in 2012 declined slightly from 2011 levels but remained approximately 35 % above the time series mean.

In 2012, licensed commercial crabbers harvested 26,964 pounds of American eel for use as trotline bait with a CPUE of 0.83 pounds per pot. Reported harvest of eels as trotline bait in 2012 is in line with the 18-year time series mean of 25,404. It should be noted that eel landings reported on crab harvester forms are not reported to NMFS and therefore, not included in the reported Maryland commercial landings.

Currently, there is a minimum size limit of 6" in Maryland, Virginia, and on the Potomac River to protect elvers (eels less than 6"). There is a minimum mesh size of ½ x ½" for eel pots and smaller mesh sizes are required to have escape panels. There are no harvest limits. Current monitoring projects include a young-of-the-year abundance survey conducted in the Coastal Bays, fishery dependent sampling from the pot fishery, a fishery independent pot survey in the Sassafras River, and a silver eel survey in a first order stream to the Corsica River.

Issues/Concerns
The U.S. Fish and Wildlife Service is reconsidering listing American eel as an endangered species. They received a petition in 2010 to list American eel under the Endangered Species Act from the Council for Endangered Species Reliability. A similar petition was received in 2004 and after a 3-year process concluded that the stock did not warrant listing as an endangered species. However, the latest petition presents substantial scientific and commercial information that indicates a listing for eels may be warranted.

A significant glass eel fishery exists due to high market demand from Japan. Currently the price of a pound of glass eels is around $2000. Although it is illegal to harvest glass eels from the Chesapeake Bay, the high market price makes them very attractive to poachers. Since glass eels migrate into inland waters in large, concentrated quantities, they are especially vulnerable to illegal harvest. Along the coast, only Maine and South Carolina maintain a legal glass eel fishery.

American eel provide a significant ecosystem service as a primary host for freshwater mussel larvae. Mussels provide important ecological services as water filters in freshwater. Providing fish passage so American eels have the opportunity to move into freshwater habitat will facilitate the rebuilding of freshwater mussel populations.

Figure 1. American eel commercial landings and effort from Maryland, 1950-2012 (MDNR data)

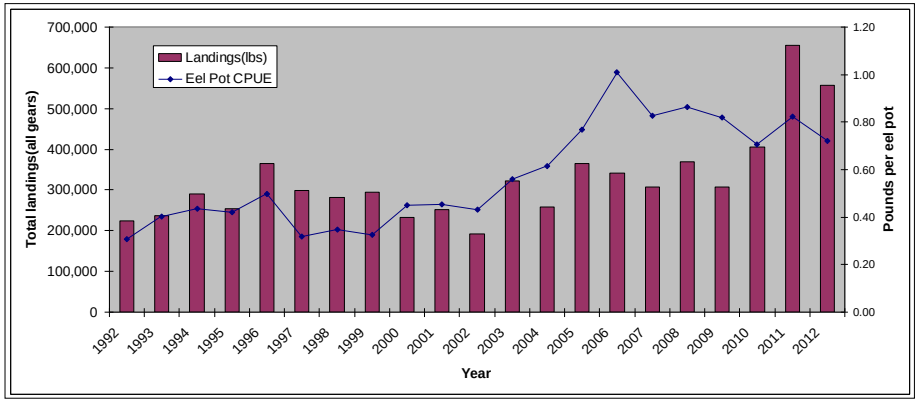
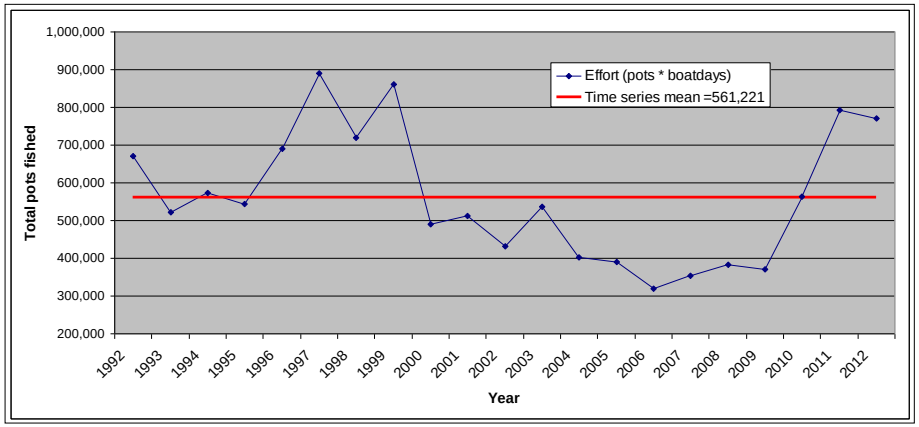


Figure 2. Total annual commercial eel pot effort (eel pots * boat days), 1992-2012.



Research Needs

The ASFMC Stock Assessment identified the following research needs for American eel: improve the accuracy of commercial catch and effort data; estimate catch and effort for personal-use and the bait fisheries; estimate non-directed fishery losses; improve estimates of recreational catch and effort; improve understanding of the distribution of eels along the coast; improve understanding of coastwide recruitment trends; improve understanding of spawning and maturation; improve upstream and downstream passage for all life history stages; and, improve understanding of habitat needs and availability[1].

[1] ASMFC American Eel Stock Assessment Peer Review, *Terms of Reference & Advisory Report of the American Eel Stock Assessment Peer Review*, Stock Assessment Report No. 12-01 of the Atlantic States Marine Fisheries Commission, March 2012

[2] Fenske,KH.,Wilber, MJ., Secor, DH & Fabrizio, MC. 2011. Can. J. of Fish. & Aqua. Sci., published on the web, 10, 1139/p2011-038

1991 Chesapeake Bay American Eel Management Plan Implementation Table (updated 07/13)			
Problem Area	**Action**	**Date**	**Comments**
1. Stock Status Strategy 1.1 The jurisdictions will adopt a conservative management approach until stock assessment analyses have been completed for American eels in the Bay.	1.1 Maryland and PRFC will adopt a 6" minimum size limit. Virginia will continue a prohibition of taking elvers and adjust definition to correspond to a 6" minimum size limit	1992 1993 Continue	A coastal stock assessment was conducted in 2005/2006 but failed some of the terms of reference. **A new coastal stock assessment was completed in 2011 and peer-reviewed in 2012. The stock assessment concluded that eels are depleted along the coast. MD data from fishery independent pot survey (1999-present) indicate a stable abundance in MD portion of CB.** All eels available for harvest are pre-spawn fish. The 6" minimum size prevents the development of an elver fishery. The recreational limit in MD is 25 eels/day. Recreational limit in VA and by PRFC is 50 eels/day. ASMFC has recommended a 50 eel limit.
	1.2 MD will implement a ½ by ½" mesh size for eel pots. Eel pots in MD with undersize mesh require a 16 in^2 escape panel of ½ x ½" mesh. VA & PRFC will continue to enforce their ½ x ½" mesh. VA will continue to enforce ½ by 1" escape panels in ½ x ½ mesh pots	1993 Continue	MD, VA and PRFC currently enforce the ½ x ½" minimum mesh size for eel pots**.** In MD, pots with mesh size <1/2" require escape panels. **Maryland commercial eel harvest for 2012 was 556,093 pounds.** Commercial landings from the Chesapeake Bay during 2011 were 840,009. Maryland harvested 731,622 lbs and VA harvested 108, 387 (NMFS data).
	1.3 Upon restoration of eels to the Susquehanna River basin PFBC will adopt regulations to prevent over fishing of small eels.	On-going	Fish passage goals have been adopted for the Bay and Tributaries. Eels were added to the 2010 SRAFRC plan with specific actions for eel passage on the Susquehanna River.
2. Bait Fishery Strategy 2.1 Catch and effort statistics for the American eel crab bait fishery will be obtained.	2.1 MD will require the reporting of eels used for crab bait on crab reporting forms	1993 2007 Continue	Information gathered from the Crab Reporting Forms indicated that previous bait estimates were probably too high. Commercial harvest data is continually being improved**.** Beginning in 2007, ASMFC required all coastal states/jurisdictions to collect both catch and effort information from their eel fisheries. MD commercial crabbers are required to report their harvest and effort of eels used for crab bait on the crab reporting forms. These forms changed in 2010 and may have resulted in an increase in reporting. Currently, commercial crabbers can use up to 50 eel pots with no catch limit.
3. Research Needs Strategy 3.1 The	3.1 Continue to collect catch & effort data from live eel fishery and begin monitoring crab bait fishery	Continue	Basic stock assessment and biological monitoring is needed. MD conducts an annual population

jurisdictions will increase their understanding of the American eel resource in the Chesapeake Bay. Important research topics include but are not limited to the following: fishery independent estimates of abundance; mortality rates; the effects of fishing exploitation on growth; the factors that influence recruitment in the Bay; and how economic aspects affect the eel fishery.			study which was started in 1997 to present. ASMFC adopted Addendum I to the Coastal Eel FMP (Feb. 2006).in order to improve data collection and subsequent stock assessments.
	3.2 Encourage research to collect basic biological and socioeconomic information	Continue 2000 2001 2004 2006 Continue	Since an ASMFC coastal eel FMP was adopted in 2000, states are required to conduct an annual young of year survey (started in 2001). USFWS determined there was no need to list eels as endangered or threatened (2004) but a new petition was submitted in 2011. The review is currently in progress. Continued emphasis on collecting stock assessment data especially commercial catch and effort data. In 2006, MD initiated an annual fishery independent eel pot survey and silver eel survey. MDNR also samples for disease prevalence (since 2006). Between 30 and 60% of the eels sampled showed evidence of parasites in their swim bladders.
4. Habitat and Water Quality Issues Strategy 4.1 The jurisdictions will continue to promote the commitments of the 1987 Chesapeake Bay Agreement. The achievement of the Bay commitments will lead to improved water quality and enhanced biological production. In addition, the jurisdictions have committed to providing upstream passage for migratory fishes. **(A new Bay agreement was adopted in 2000 and the President's Executive Order in 2009)**	4.1 Continue to provide stream passage	2000 2005 2009 On-going	A new CBP fish passage goal to open additional 1,000 miles of tributary by 2014 was adopted in 2005. The 2009 Executive Order modified the goal to include 100 projects and 1,000 stream miles by 2025. ASMFC approved Addendum II to the Coastal FMP (2008) which places increased emphasis on improving upstream and downstream eel passage. **USFWS conducted a study to determine the timing & cues for out-migrating eels in the Shenandoah River. Results of the study indicate that outmigration is variable and sometimes protracted. The removal of Embry Dam on the Rappahannock River in VA has resulted in an increasing numbers of eels as far as 100 miles upstream.**
	4.2 Continue to set specific objectives for water quality goals and habitat requirements.	Continue	The Chesapeake Bay Program has continued to emphasize water quality and habitat commitments. Additional actions were added the C2K including stream health guidelines which should improve eel habitat. Eels are widely distributed in many aquatic habitats and are impacted by low DO, contaminants and water removal projects. The new fish passage goal is part of the CBP's Action Plan. A new Chesapeake Bay Program Watershed Plan has been drafted and includes water quality and fish passage goals and objectives.

ASMFC= Atlantic States Marine Fisheries Commission
C2K= Chesapeake 2000 agreement
CBP = Chesapeake Bay Program
DO = Dissolved oxygen
FMP= Fishery Management Plan
MDNR = Maryland Department of Natural Resources
NMFS = National Marine Fisheries Service
PRFC= Potomac River Fisheries Commission
USFWS = United States Fish & Wildlife Service

2012 Maryland FMP Report (July 2013)
Section 2. American shad (*Alosa sapidissima*) and hickory shad (*Alosa mediocris)*

Chesapeake Bay FMP

Overall, American shad abundance remains low despite a decades-long moratorium and increased access to spawning habitat. Population abundance trends, however, differ by area. Abundance has increased in the upper Chesapeake Bay since 2007 but remains well below historic levels. American shad abundance in the Potomac River exceeded the ASMFC restoration target of 31.1 lbs/pound net day for the second consecutive year. Bycatch mortality from Atlantic mackerel and Atlantic herring trawl fisheries may contribute to limited coastwide restoration success. In contrast to American shad, wild hickory shad abundance continues to increase in systems that are stocked and are considered restored in the Patuxent River.

The Atlantic States Marine Fisheries Commission (ASMFC) adopted the Interstate Fishery Management Plan for Shad and River Herring in 1985. In response, Chesapeake Bay jurisdictions implemented the Chesapeake Bay Alosid Management Plan (CBFMP) in 1989 to coordinate shad and river herring management. The CBFMP identified declining abundance, over-fishing, insufficient research and monitoring, and habitat loss as problems. The CBFMP set guidelines to continue the American shad moratorium; remove stream blockages and reopen historic habitat; and continue stocking hatchery-raised fish. The CBFMP Amendment #1 (1998) continued the shad moratorium, initiated review of criteria to reopen a shad fishery, and initiated development of measurable restoration targets.

ASMFC implemented Amendment I to the Interstate Fishery Management Plan for Shad & River Herring in 2000. The amendment mandated a 40% reduction in the American shad ocean intercept fishery by 2003 and closure by 2005. In-river commercial fisheries were also limited. ASMFC Addendum I (2002) clarified hatchery-rearing requirements for Alosa species. Amendment 3 (2010) was enacted by ASMFC in response to the continued lack of restored American shad abundance. Amendment 3 established an instantaneous total mortality (fishing and natural) benchmark of Z_{30}, refined the juvenile recruitment failure definition to be more conservative, mandated states to monitor bycatch and discards, and required states with commercial and/or recreational (excluding catch and release) American shad fisheries to have approved fishing and habitat sustainability plans. Maryland and Potomac River Fisheries Commission submitted fishing recovery plans in 2012. Habitat restoration plans are due to ASMFC by October of 2013.

During 2012, a DNR Plan Review Team evaluated the CBFMP, including Amendment #1, to determine if the strategies and actions provided an appropriate management framework to address management changes implemented by ASMFC. The PRT determined that the CBFMP's strategies and actions were adequate to meet ASMFC compliance requirements and Chesapeake Bay management goals. After input from the Maryland Sport Fisheries Advisory Commission (SFAC) and the Tidal Fisheries Advisory Commission (TFAC), the PRT recommended no changes to the CBFMP.

In 2006, the National Oceanic and Atmospheric Administration's Chesapeake Bay Fisheries Ecosystem Advisory Panel adopted a Fisheries Ecosystem Plan for Chesapeake Bay. In 2009, Maryland Sea Grant facilitated development of Ecosystem-based Fisheries Management for Chesapeake Bay Alosine Background and Issue Briefs (American shad, hickory shad, alewife herring, and blueback herring; http://www.mdsg.umd.edu/sites/default/files/files/EBFM-Alosines-Briefs.pdf in cooperation with state, federal, and academic representatives. The issues section examined four stressor categories: habitat (migratory barriers, flow and water quality, land-use ecology, and physical alteration), food web (forage, competition, predation, freshwater ecology, and vectors of biological material), stock dynamics (stock assessment history, anthropogenic mortality, life history, connectivity, and stock structure), and socioeconomic (cultural, economic, and environmental considerations, restoration, and management guidelines). For more information on the EBFM process, go to http://www.mdsg.umd.edu/programs/policy/ebfm.

Stock Status

American shad harvest in Maryland declined drastically during the 1970s [1]. Maryland Department of Natural Resources (MD DNR) population estimates for the Conowingo Dam tailrace indicate that American shad abundance increased from 1998 to 2001, decreased after 2001, remained at low levels through 2007, and has trended upward since 2008 (Figure 1). The 2012 American shad population estimate for the Susquehanna River below Conowingo Dam was 111,000 fish (Figure 1). American shad abundance in the Potomac River is measured using an index based on the number of shad pounds per pound net day. The Potomac River restoration target is 31.1 lbs of American shad per pound net day; the mean commercial pound net landings during the 1950s. Abundance has steadily increased since 2000 and has exceeded the restoration target since 2011 (Figure 1; E. Cosby, Potomac River Fisheries Commission, pers. comm.).

Abundance of wild (non-hatchery) and repeat (spawned in previous years) spawning American shad varies among river systems. Approximately 71% of American shad in the Conowingo Dam tailrace were of wild stock [2], an increase of 9% from 2011. Thirty-four percent of males and 73% of females were repeat spawners [2] in 2012. These are significant increases compared to the 28% males and 25% females observed in 2011. In the Nanticoke River, the proportion of wild spawners decreased from 84% in 2011 to 55% in 2012. Repeat spawners increased from 13% of males in 2011 to 40% in 2012. For females, the number of repeat spawners in 2011 (29%) increased to 56% in 2012 [2]. Thirty-four percent of male and 60% of female shad in the Potomac River were repeat spawners in 2012 [2].

The proportion of wild adult hickory shad in Patuxent River has been at least 80% for more than three consecutive years. This population is considered self-sustaining and restored (B. Richardson, MD DNR, pers. comm.). Hickory shad in Choptank River are showing a similar, improving population trend which suggests that population is also recovering. The Marshyhope Creek population has not changed despite stocking efforts, which have been discontinued. In the lower Susquehanna River, the proportion of repeat spawning hickory shad adults has remained stable since 2004. Sixty-four percent of hickory shad in Deer Creek were repeat spawners in 2012 [2]. Only 22 hickory shad were encountered in the Nanticoke River, an, insufficient number to estimate abundance.

The National Oceanic and Atmospheric Administration's marine recreational fisheries statistics survey stopped collection of American shad and hickory shad data in 2009.

Current Management Measures

Harvest of American shad in Chesapeake Bay has been prohibited by Maryland since 1980, Potomac River Fisheries Commission since 1982, and Virginia since 1994. Maryland allows commercial fishermen a two fish per day bycatch of dead American shad for personal use. No sale of American shad bycatch is allowed in Maryland. Virginia maintains an American shad bycatch permit for the gillnet fishery. Up to 10 fish per vessel is allowed from permitted areas so long as a greater number of spot, croaker, bluefish, catfish, striped bass or white perch are landed. Pennsylvania and New York have also prohibited harvest of American shad in the Susquehanna River basin. All Atlantic coast states closed their American shad ocean intercept fisheries in 2005.

Maryland enacted a hickory shad moratorium in 1981. Virginia prohibited hickory shad harvest in 1994. The District of Columbia and PRFC prohibited hickory shad harvest in 1992 and 1995, respectively.

The Mid-Atlantic Fishery Management Council enacted an incidental shad and river herring bycatch limit of 520,000 pounds for the Atlantic mackerel fishery [3]. The Atlantic mackerel fishery will be closed early if fishermen fail to meet the incidental bycatch requirement. Increased reporting and monitoring are also required. Bycatch reduction requirements will be implemented through Amendment 14 to the fishery management plan for Atlantic mackerel, squid, and butterfish in 2014. Similarly, the New England Fishery Management Council has proposed Amendment 5 to the Atlantic Herring FMP. Amendment 5 would increase monitoring and reporting of river herring and shad bycatch for vessels and dealers in the Atlantic herring fishery[4]. Increased monitoring will require additional observers on fishing vessels. Strategies to reduce river herring and shad bycatch may draw on lessons learned by the Squid Trawl Network's efforts to reduce butterfish and river herring bycatch (http://www.squidtrawlnetwork.com). The commercial fisheries will be responsible for funding a portion of the increased cost to monitor bycatch.

The Fisheries

In Maryland, commercial bycatch losses mostly occur during the spring pound and fyke net fisheries. Bycatch is limited to two dead American shad for personal use.

Recreational catch and release fisheries for American and hickory shad occur in the tailrace below Conowingo Dam. Catch and release fisheries – primarily hickory shad – also occur in Deer Creek and Octoraro Creek, which are tributaries to the lower Susquehanna River. MD DNR initiated a voluntary angler logbook program for both American and hickory shad in 1998 [2]. The MD DNR also conducts an annual creel survey of shoreline anglers at the Conowingo Dam tailrace. Results from the American shad logbook and angler surveys indicate a decreased catch rate in the mid to late 2000s (Figure 2). This trend mirrors the catch rate trend of the MD DNR tagging survey (Figure 2). Hickory shad catch rates have remained relatively constant over time (Figure 2).

Figure 1. American shad passed at Conowingo Dam's east fish lift [5], American shad population estimate for the Conowingo Dam tailrace [2], and the status of American shad restoration in the Potomac River (E. Cosby, Potomac River Fisheries Commission, pers. comm.).

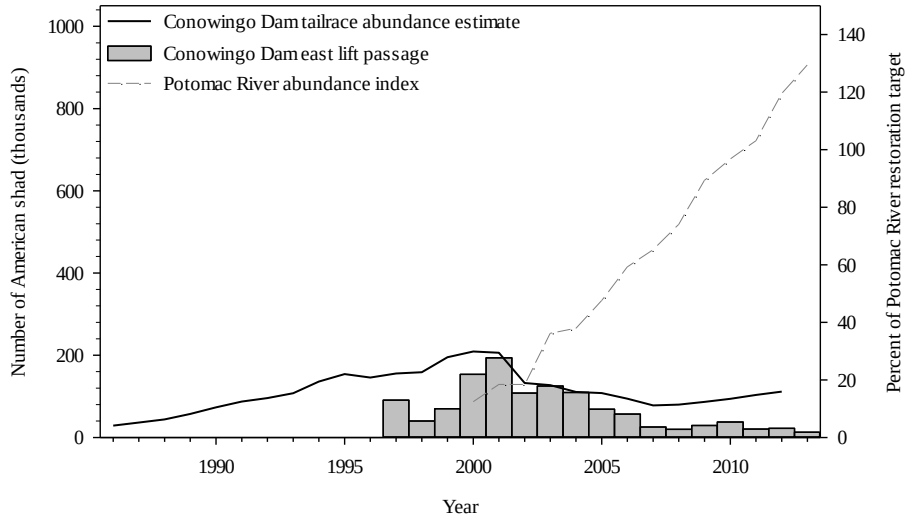
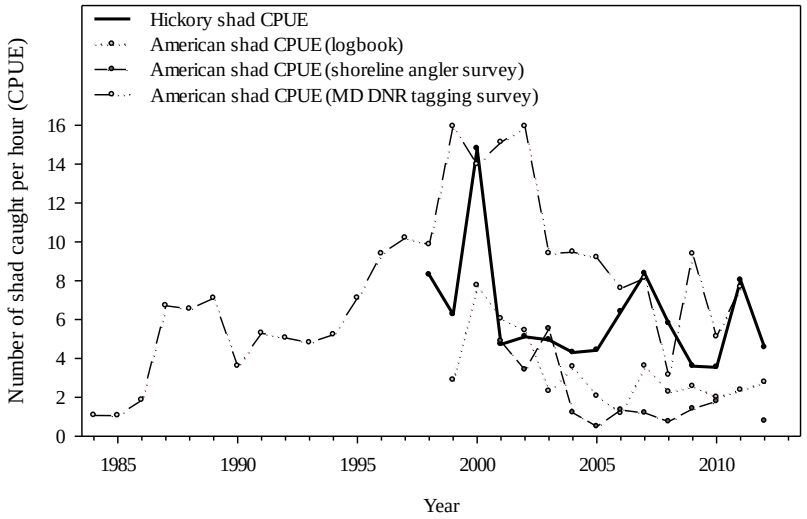


Figure 2. Average catch per hour from the MD DNR tagging study, the recreational angler logbook surveys for hickory shad and American shad, and American shad catch and release fishery below Conowingo Dam [2].



Issues/Concerns

The accuracy of using scales to age American shad and assess repeat spawning remains problematic [6]. Comparison of scale age with a fish's known age revealed a notable amount of bias and error. Percent agreement among 13 biologists varied between 50% and 77%. Ageing accuracy was greatest for young shad ages 3-6 (34% - 49%), but decreased significantly for age 7 fish (12%) and age 8 fish (4%). Otolith sampling is not a feasible option because of the depressed stock status.

American shad abundance in the lower Susquehanna River increased from 1998 to 2001, decreased after 2001, and has increased since 2008. The effect of multiple mortality sources such as ocean bycatch, dam turbines, pollution, and predation on shad abundance is unknown. Additional data are required to estimate total mortality and develop appropriate biological benchmarks.

References

[1] Capossela, K. M. 2013. Maryland's 2012 compliance report: American Shad (*Alosa sapidissima*) Hickory Shad (*Alosa mediocris*) Alewife Herring (*Alosa pseudoharengus*) Blueback Herring (*Alosa aestivalis*). Maryland Department of Natural Resources, Annapolis, Maryland.

[2] Maryland Department of Natural Resources. 2013. Chesapeake Bay Finfish Habitat Investigations. US FWS Federal Aid Project F-61-R-8 2011 – 2012. Annapolis, Maryland.

[3] MAFMC. 2013. Council Recommends First-Ever Cap on River Herring and Shad Catch. Press Release. June 18, 2013.

[4] Fisheries of the Northeastern United States; Atlantic Herring Fishery; Amendment 5, 78:106 Fed. Reg. 33020-33040 (2013) (proposed rule).

[5] Pennsylvania Fish and Boat Commission. 2011. Susquehanna River American shad. from http://www.fish.state.pa.us/shad_susq.htm

[6] McBride, R. S., M. L. Hendricks, and J. E. Olney. 2005. Testing the validity of Cating's (1953) method for age determination of American shad using scales. Fisheries, 30:10, 10-18.

Alewife herring *(Alosa pseudoharengus)* and blueback herring *(Alosa aestivalis)*

Chesapeake Bay FMP

River herring populations are currently depleted [1]. Commercial landings were at all time lows from 2006 to 2011. Due to the decline and persistent low levels of river herring, Maryland did not develop an ASMFC river herring sustainability plan to keep the fisheries open. Consequently, Maryland closed its commercial and recreational fisheries (December 2011) after 35 years at historic low levels.

ASMFC adopted the Interstate Fishery Management Plan for Shad and River Herring in 1985. In 1989, Chesapeake Bay States implemented the Chesapeake Bay Alosid Management Plan (CBFMP) to coordinate shad and river herring management. The CBFMP identified declining abundance, over-fishing, insufficient research and monitoring, and habitat loss as problems. The CBFMP set guidelines to reduce river herring fishing mortality and remove impediments to historic habitat.

ASMFC enacted Amendment 2 to their FMP in 2009 to address coastwide declines in alewife and blueback herring stocks. Amendment 2 required states to have an ASMFC approved river herring sustainability plan by 2012 or close their river herring fisheries. Sustainability plans require development of a river herring juvenile index to monitor spawning adults and collection of commercial and recreational fisheries statistics including bycatch data. Maryland closed its river herring fisheries. As required by ASMFC, Maryland submits an annual compliance report.

In 2006, the National Oceanic and Atmospheric Administration's Chesapeake Bay Fisheries Ecosystem Advisory Panel adopted a Fisheries Ecosystem Plan for Chesapeake Bay. In 2009, Maryland Sea Grant facilitated development of an Ecosystem-based Fisheries Management for Chesapeake Bay Alosine Background and Issue Briefs (American shad, hickory shad, alewife herring,and blueback herring) in cooperation with state, federal, and academic representatives. The issue section examined four stressor categories: habitat (migratory barriers, flow and water quality, land-use ecology, and physical alteration), food web (forage, competition, predation, freshwater ecology, and vectors of biological material), stock dynamics (stock assessment history, anthropogenic mortality, life history, connectivity, and stock structure), and socioeconomic (cultural, economic, and environmental considerations, restoration, and management guidelines). For more information on the EBFM process, go to http://www.mdsg.umd.edu/programs/policy/ebfm.

Stock Status

The ASMFC's 2012 river herring stock assessment determined that alewife and blueback herring abundance is depleted [2]. Furthermore, mean age and maximum length have decreased. Total mortality (Z) in 2012 was 1.43 for blueback herring and 1.10 for alewife herring [3]. These values are below the $Z_{collapse}$ thresholds of 2.0 – 3.0 for alewife herring and 1.6 - 3.2 for blueback herring.

Juvenile alewife and blueback herring abundance has been monitored in the Nanticoke River and Baywide since 1980. Juvenile abundance indices (JAI) have varied among years without trend [3]. Initial stock-recruit analyses indicated that a river herring JAI was a predictor of future year class strength (L. Barker, Maryland Department of Natural Resources, pers. comm.). ASMFC's Herring Stock Assessment Sub-committee decided not to pursue development of stock-recruit indices.

Beginning in 2009 alewife and blueback herring recreational data are no longer available from the Marine Recreational Information Program due to inadequate sampling. The recreational river herring fishery in Maryland was minimal and only limited data was available. The next ASMFC river herring trend analysis is scheduled for 2017 and the next benchmark assessment is scheduled for 2022.

Current Management Measures

Maryland, Virginia, and the Potomac River Fisheries Commission instituted a recreational and commercial river herring moratorium as of January 1, 2012. All river herring and river herring products imported into either state must include a bill of lading or commercial invoice from a state with an approved river herring fishery.

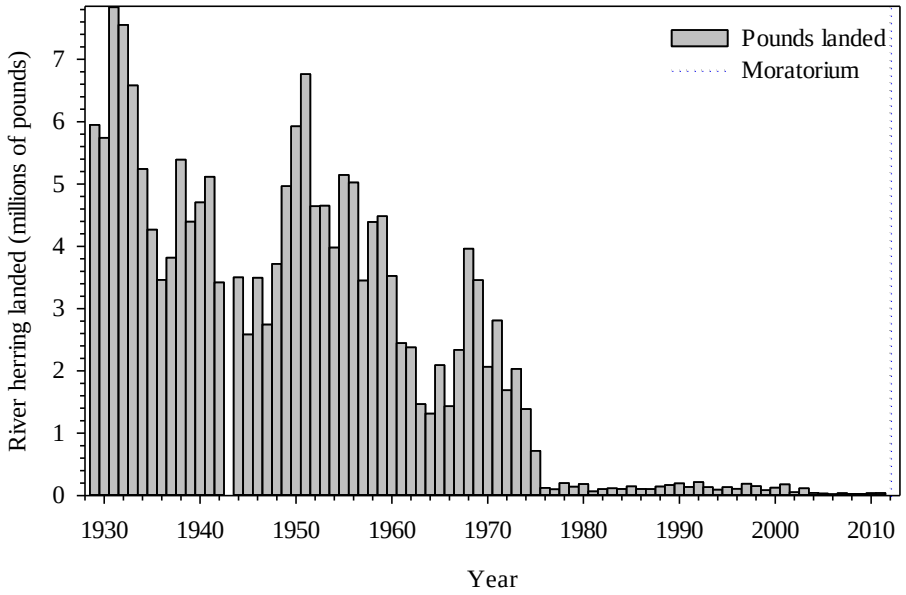
The Mid-Atlantic Fishery Management Council (MAFMC) enacted an incidental shad and river herring bycatch limit of 520,000 pounds for the Atlantic mackerel fishery [4]. The Atlantic mackerel fishery will be closed early if fishermen fail to meet the incidental bycatch requirement. Increased reporting and monitoring are also required. Bycatch reduction requirements will be implemented through MAFMC Amendment 14 to the fishery management plan for Atlantic mackerel, squid, and butterfish in 2014. Similarly, the New England Fishery Management Council has proposed Amendment 5 to the Atlantic Herring FMP. Amendment 5 would increase monitoring and reporting of river herring and shad bycatch for vessels and dealers in the Atlantic herring fishery [5]. Increased monitoring will require additional observers on fishing vessels. Strategies to reduce river herring and shad bycatch may draw on lessons learned by the Squid Trawl Network's efforts to reduce butterfish and river herring bycatch (http://www.squidtrawlnetwork.com). The commercial fisheries will be responsible for funding a portion of the increased cost to monitor bycatch.

The Fisheries

All commercial and recreational river herring fisheries in Maryland are under a moratorium. Herring commercial landings appear to cycle from high to low approximately every 20 years (Figure 1). During that time a trend of decreased landings was evident. Maryland Department of Natural Resources (MD DNR) has monitored alewife and blueback herring from the Nanticoke River and other portions

of Chesapeake Bay since 1980. Commercial river herring landings were in decline since the mid-1900s, but the landings declined precipitously after 1968 (Figure 1). River herring landings have failed to rebound since 1976. Catch per unit effort (CPUE) for blueback herring haa decreased since 1989 while alewife herring CPUE has not changed since 1989.

Figure 1. Commercial river herring landings in Maryland: 1929 – 2011 [3,6]. The vertical dotted line marks the 2012 river herring harvest moratorium.



Issues/Concerns

River herring age is determined from scales using the same methodology as for American shad (previously discussed). As with American shad, river herring ages determined by scales have not been validated using fish with known age [2]. Validation of scale ageing and standardization of ageing methods are needed.

Misidentification of river herring species is relatively common. Alewife and blueback are easily confused and they have also been confused with young hickory shad and American shad. The magnitude of identification errors within the offshore trawl fisheries has not been determined.

River herring mortality sources include harvest, bycatch, discard, dam turbines, pollution, and predation. Ocean trawl bycatch of immature river herring is of particular concern [2]. The Mid-Atlantic Fishery Management Council is increasing the number of bycatch observers on offshore vessels of the Atlantic Mackerel fishery [4]. The New England Fishery Management Council proposed a similar rule for the Atlantic herring fishery [5]. Additional observer data would improve development of management benchmarks.

Adult access to suitable spawning habitat has been impeded by blockages such as dams. Data is insufficient to determine the efficiency of fishways and bypass channels. Removal of blockages is preferred. Two large dams on the Patapsco River have been removed (Union and Simkins) and two dams still remain on the river's mainstem. Pre-removal data collection, engineering design, and permitting are underway for removal of Bloede Dam.

A river herring fishery independent gill net survey was conducted by MD DNR in the Northeast River, upper Chesapeake Bay. Data from the survey is required by Amendment 2 to ASMFC's FMP.

National Resources Defense Council petitioned the National Marine Fisheries Service (NMFS) to designate alewife and blueback herring as threatened species (http://www.nero.noaa.gov/prot_res/CandidateSpeciesProgram/RiverHerringSOC.htm). NMFS determined that designation of either species as threatened or endangered was not warranted at this time.

References

[1] Atlantic States Marine Fisheries Commission. 2012. River Herring Stock Stock Assessment Overview (May 2012). Atlantic States Marine Fisheries Commission. Arlington, Virginia.

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[3] Maryland Department of Natural Resources. 2013. Chesapeake Bay Finfish Habitat Investigations. US FWS Federal Aid Project F-61-R-8 2011 – 2012. Annapolis, Maryland.

[4] MAFMC. 2013. Council Recommends First-Ever Cap on River Herring and Shad Catch. Press Release. June 18, 2013.

[5] Fisheries of the Northeastern United States; Atlantic Herring Fishery; Amendment 5, 78:106 Fed. Reg. 33020-33040 (2013) (proposed rule).

[6] Capossela, K. M., H. Rickabaugh, Jr., and T. Jarzynski. 2011. Maryland's 2010 American Shad (*Alosa sapidissima*), Hickory Shad (*Alosa mediocris*), Alewife Herring (*Alosa pseudoharengus*) and Blueback Herring (*Alosa aestivalis*) compliance report. Maryland Department of Natural Resources, Annapolis, Maryland.

1998 Amendment 1 to the 1989 Chesapeake Bay Alosid Management Plan Implementation Table (updated 8/2013)			
Strategy	Action	Date	Comments
1.1 1 The Bay jurisdictions will reevaluate the criteria for reopening a fishery in the Chesapeake Bay during the Alosid FMP revision process. Until new criteria are determined, the moratorium will remain in place for American and hickory shad in the Chesapeake Bay.	1.1 The Bay jurisdictions will continue the moratorium on American shad in Chesapeake Bay.	1989 On-going 2009 - 2011 On-going **2012**	The Bay jurisdiction will reevaluate the criteria for reopening a fishery in Chesapeake Bay during the Alosine FMP revision process. The coastal intercept fishery was closed December 2004. The Bay moratorium remains in place for American and hickory shad. MD Sea Grant coordinated development of a Chesapeake Bay Ecosystem-based Fishery Management Plan (EBFMP). Chesapeake Bay jurisdictions continue to follow ASMFC requirements. http://www.asmfc.org/shadriverherring.htm **MD and PRFC developed ASMFC approved sustainability plans for American shad.**
1.2 A special target-setting task force was charged to "establish measurable restoration targets" for American shad in the Bay. Eight spawning/nursery areas that historically supported substantial recreational and commercial fisheries were used to develop tributary-specific, quantitative recovery targets. The task force recommended that the stock recovery targets proposed for American shad be incorporated into the Alosid management plan.	1.2 The bay jurisdictions will incorporate the shad restoration targets into the revised Alosine FMP	1999 2007 2008 On-going 2010 **2012**	River specific targets were proposed in 1997, but no action was taken. STAC held a 2007 workshop on Alosine targets. The white paper did not include targets. The CBP shad abundance index was expanded from the Susquehanna River to include the James, York, and Potomac Rivers. The index is based on fish passage on the Susquehanna and James Rivers, commercial bycatch CPUE on the Potomac River, and gill net CPUE on the York River. For more information: http://www.chesapeakebay.net/issues/issue/shad No relationship exists between adult and juvenile shad abundance limiting the usefulness of a JAI. Any relationship that may exist is masked by at-sea mortality. **The CBP Fisheries GIT recommended that the shad abundance indicator be reevaluated. An ad hoc workgroup was assembled to evaluate the current American shad indicator. The workgroup has the option to recommend either a new shad indicator or status-quo by the end of 2012/beginning of 2013.**

1989 Chesapeake Bay Alosid Management Plan Implementation Table (updated 8/2013)			
Strategy	Action	Date	Comments
1.1.1 Removing the moratorium on Maryland American shad will not occur until the stocks of American shad in the upper Bay are fully recovered. Reestablishing a fishery will occur when annual population estimates in the upper Bay increase for three consecutive years and stock size reaches at least 50% of historical levels (approximately 500,000 fish) during one of those three years. Regulations will be established to ensure that initial annual exploitation in the upper Bay does not exceed 10% when the fishery is opened. Stock levels will be determined from an annual stock estimation study and exploitation rates will be established based on recreational and commercial surveys.	1.1.1 American shad abundance in the upper Bay has improved but has not sufficiently recovered to warrant an open fishery. American shad abundance is also low in other Maryland river systems. Maryland will continue the moratorium on American shad in the Chesapeake Bay.	1980 On-going 1982 On-going 1992 On-going 1998 **2013**	Shad stocks have fluctuated since the moratorium began in 1980. Spawning adult population is estimated annually for the Conowingo Dam tailrace. Population estimates for shad in the Upper Bay ended due to the loss of commercial pound nets in the Susquehanna Flats. Criteria to reopen the fishery are lacking. Limited hickory and American shad bycatch harvest is allowed from the Potomac River pound net and gill net fisheries. PRFC has had a moratorium on directed shad harvest in Potomac River since 1982. DCFM implemented a moratorium on shad harvest within District of Columbia waters of the Potomac River in 1992. CBAMP Amendment 1 supersedes Strategy 1.1.1 restoration criteria **No stock allocation for Alosa species has been developed due to the moratorium. Resource allocation will be revisited when Alosa stocks are deemed recovered.**
1.1.2 Virginia will follow ASMFC recommendations for a 25% exploitation rate for alosids [*sic*].	1.1.2 Virginia will utilize the Virginia Marine Resources Commission's Stock Assessment Program and the fishery surveys of the Virginia Institute of Marine Science to assess current Alosid *[sic]* exploitation is above the 25% rate, Virginia will take the appropriate steps to limit fishing effort.	1994 Continue 2010 On-going **2012**	VA implemented a moratorium on the harvest of American and hickory shad from the Bay in 1994. ASMFC allows a limited American shad commercial bycatch harvest in the James, York, and Rappahannock rivers for the anchored and staked gill net fisheries. VA has an allowable catch for Native American tribe(s). PRFC adopted a moratorium on directed harvest of river herring for the Potomac River. **VA implemented a river herring moratorium**

1989 Chesapeake Bay Alosid Management Plan Implementation Table (updated 8/2013)			
Strategy	Action	Date	Comments
		On-going	**January 1, 2012 as specified by ASMFC.**
1.2 Maryland will recommend management of river herring on a system by system basis. Criterion for closing a system to river herring harvest will be based on juvenile indices from 1985 through 1989 and commercial harvests over the last 10 years. Maryland, Pennsylvania and Virginia will recommend that harvest from all systems slated for restoration be regulated or closed. Technical criterion will be submitted to ASMFC for reevaluation of the 0% exploitation rate for river herring in Maryland. In addition, Maryland will control the harvest of river herring by one or a combination of the following harvest limits; harvest season; areal closures; or gear restrictions. Virginia will use similar measures to control harvests of river herring, American shad and hickory shad.	1.2 River herring harvest will be controlled. Types of management actions which will be considered in the regulation of river herring are as follows: Harvest – Quotas would be a reasonable regulation if the size of the spawning stock in a given year was predictable Seasons – Setting a season during a segment of the "average" spawning period to regulate exploitation Areal closures – Restrict exploitation in those areas where the potential for harvest is greatest such as restricted portions of migratory routes or at migration barriers Gear restrictions – Restrict large-volume harvesting by pound nets and/or haul seines	On-going - 2012 2012 On-going 2012	No harvest restrictions were implemented for river herring until 2012. Commercial harvest of river herring declined due to low market demand and uncertain stock status. Commercial and recreational river herring fisheries were closed on January 1, 2012. All river herring and river herring products imported into MD and VA must include a bill of lading or commercial invoice. MD and VA do not have an ASMFC approved sustainable fishery plan for river herring. PA prohibited the harvest of river herring in the Susquehanna River watershed.
1.3 Maryland will continue the moratorium on the fishery for hickory shad and consider opening a recreational fishery when the American shad stocks have recovered.	1.3 Management actions and strategies for American shad and hickory shad will not be separated due to the paucity of information available for hickory shad and by nature their similar life history.	On-going 1996 Continue	MD (1981) and DC (1992) and PRFC (1995) continue moratorium on hickory shad. Recent monitoring results suggest hickory shad are rebuilding in the Bay. Larval and juvenile hickory shad have been stocked in the Patapsco, Patuxent, Choptank, and Nanticoke rivers. Patuxent River hickory shad are considered restored and stocking has been discontinued. Only the Choptank River was stocked in 2011 & 2012.
1.4 Pennsylvania will continue to prohibit the harvest of American shad in the Susquehanna River and its tributaries, and American and hickory shad in the Conowingo Reservoir while restoration efforts are in progress.	1.4 As restoration of alosids [*sic*] progresses over dams in the Susquehanna River, additional regulations in Pennsylvania will be promulgated to protect these species until a degree of restoration is achieved	On-going Continue 2009 Discontinued	PA prohibits the harvest of American and hickory shad in the Susquehanna River watershed. The recreational catch and release fishery below Conowingo Dam will continue. No Alosa recreational catch data are available after 2008 because of inadequate sampling.
2.1 Maryland, Pennsylvania and Virginia will continue to participate in the ongoing ASMFC-coordinated coastal fishery stock identification and ocean landing studies of alosids [*sic*].	2.1 Maryland, Pennsylvania and Virginia will participate in the ongoing ASMFC alosid [*sic*] management program, both in Board and Scientific and Statistical Committee activities, with the goal of providing adequate protection to the component of the coastal stock which returns to the Chesapeake Bay to spawn.	On-going 1997 1999	MD, VA, and PRFC participate in the ASMFC shad management board and technical committee. ASMFC conducted a stock assessment in 1997. Amendment 1 to the ASMFC shad plan adopted a strategy to keep fishing mortality below F_{30}.

1989 Chesapeake Bay Alosid Management Plan Implementation Table (updated 8/2013)			
Strategy	Action	Date	Comments
		2007	ASMFC Amendment 3 specified the American shad total mortality threshold to Z_{30} for the coastal stock. The ASMFC 2007 stock assessment report was completed. The ASMFC Review Panel recommended the development of population specific reference points. American shad and river herring mortality rates have increased. Alosa bycatch in ocean fisheries are contributors, but data is limited. Bycatch mortality in Chesapeake Bay has not been estimated.
		2012	**The ASMFC Management Board approved the 2012 river herring stock assessment.**
		2012-2013	**MAFMC adopted Amendment 14 which imposes a 520,000 lb. Alosa bycatch limit to the Atlantic mackerel fishery. NEFMC has proposed Amendment 5 to the Atlantic herring FMP. Both amendments will increase at-sea observers and bycatch reporting.**
2.2 Virginia will follow ASMFC recommendations to reduce shad harvest to a 25% exploitation rate.	2.2 A) Implement a coastal shad tagging program to determine which stocks are being exploited in the intercept fishery	1991-1992	Results from the tagging study indicated that the coastal fishery is mixed and highly variable from year to year.
	2.2 B) Control the coastal intercept fishery through a combination of gear restrictions, seasonal and area closures, and harvest limits	1993 2005 On-going	ASMFC Amendment 1 required closure of the coastal intercept fishery by December 2004.
	2.2 C) Continue to monitor and document its territorial sea intercept fishery for American shad	1993 2004 On-going	VA is required to monitor coastal commercial harvest.
2.3.1 Virginia will follow ASMFC recommendations to reduce river herring harvest to a 25% exploitation rate.	2.3.1 Virginia will control river herring harvest during spawning migrations through gear restrictions and spawning area closures.	1992 On-going	The harvest of river herring has declined for a number of reasons including a loss of spawning habitat due to dams, commercial fishing and as by-catch from the Atlantic herring and squid/butterfish/Atlantic mackerel ocean fisheries.
		2012 Completed	Action 2.3.1 was superceded by the ASMFC's 2012 moratorium on river herring harvest.
2.3.2 Maryland and Virginia will ensure that river herring by-catch in the foreign and domestic mackerel fisheries is minimized.	2.3.2 Maryland and Virginia will monitor river herring by-catch through the mid-Atlantic Fishery Management Council and support the following recommendations: a) The foreign fishery will stay 20 miles offshore.	In effect On-going	River herring bycatch will be monitored under Amendments 14 and 15 to the MAFMC Atlantic Mackerel/Squid/Butterfish FMP. They are under review by NMFS.

1989 Chesapeake Bay Alosid Management Plan Implementation Table (updated 8/2013)			
Strategy	Action	Date	Comments
			Northwest Atlantic Fisheries Organization (NAFO) monitors international fishing fleets. The United States is no longer a member of NAFO.
	2.3.2 b) Maximum by-catch of 1% for river herring in the foreign and domestic mackerel fisheries with a cap on total allowable by-catch.	In effect On-going	River herring bycatch is monitored by the MAFMC, NEFMC, NMFS, and NAFO.
	2.3.2 c) Intercept fisheries will be discouraged.	**2012-2013**	**MAFMC adopted Amendment 14 which imposes a 520,000 lb. Alosa bycatch limit to the Atlantic mackerel fishery. NEFMC has proposed Amendment 5 to the Atlantic herring FMP. Both amendments will increase at-sea observers and bycatch reporting. Monitoring and bycatch reduction applies to trawl fisheries in federal waters.**
3.1 The jurisdictions will collect specific data on alosined species to improve stock assessment databases.	3.1 A) Maryland will continue the alosid [*sic*] juvenile survey and develop an index of stock abundance. Virginia will continue to collect shad and herring juvenile abundance data with the objective of developing a baywide index of abundance for these species. (Currently being implemented) The juvenile index will be used in conjunction with adult stock estimates to trigger regulatory changes and harvest rates.	Continue 2009 Continue 2010 Discontinued Pending	VIMS, MD DNR and DCFM have Alosine juvenile surveys and calculate indices for each species. - The last several years indicate an increase in juvenile Alosines. ASMFC Amendment 2 requires river herring JAI surveys. VA & MD continue to provide data to coastal stock assessment Preliminary stock recruit indices for river herring were developed and presented to the ASMFC's Herring Stock Assessment Sub-committee (SAS). The effect of bycatch, environmental factors, and stock change on the relationship requires further study. No trends were detected for American shad and there was insufficient data for hickory shad. The SAS decided not to pursue development of the indices. MD will implement a river herring bycatch monitoring program by 2016.
	3.1 B) Maryland will continue research projects for American shad in the upper Bay and Nanticoke River which provide annual estimates of adult shad. (Currently being implemented)	Continue Discontinued 2009 Continue 2011	Adult shad tagging project on the Nanticoke River was ended due to a lack of tag returns. ASMFC Amendment 2 requires adult river herring spawning/population assessment. The Nanticoke River commercial survey is the current data source for the river herring spawning population assessment. The Nanticoke River commercial

1989 Chesapeake Bay Alosid Management Plan Implementation Table (updated 8/2013)			
Strategy	Action	Date	Comments
			survey will continue during the moratorium.
		2013	**A fishery independent gill net survey was conducted in the Northeast River to monitor spawning river herring.**
	3.1 C) Virginia will improve assessment of current fishing rates on shad stocks in territorial waters and seek to improve catch and effort data through mandatory reporting. (1990)	1995 Continue	Commercial landing data have been improved on a coastwide basis with the establishment of ACCSP. Limited American shad bycatch fisheries exist.
	3.1 D) The VMRC Stock Assessment Program will provide additional fishery dependent data collection for Virginia's shad fisheries (on-going)	On-going	Required by the ASMFC.
	3.1 E) Virginia will initiate an ocean intercept tagging program to determine stock composition in the coastal shad fishery (1990)	1991-1992 Completed	Tagging work completed in 1992. - Results indicated coastal catch is mixed and highly variable. - Other tagging work has been considered.
	3.1 F) Maryland will examine the exploitation rates of alewife and blueback herring in selected tributaries of the Chesapeake Bay and improve the accuracy and utility of herring landings. (1990)	1990 On-going	Mortality rates are calculated for river herring in the Nanticoke River. Exploitation rates have not been a priority.
	3.1 G) Virginia will cooperate with research institutes to implement a survey of selected shad and herring spawning grounds, compiling information on basic spawning stock characteristics including relative adult abundance, juvenile abundance, size, age and sex ratios. (Currently being implemented)	1990 Completed 2009 2009 on-going	A map of historic shad and herring spawning areas has been completed. Tributary-specific targets were considered. The FMPC and ad hoc Fish Passage workgroups met to discuss how to address the development of targets. No targets were adopted. CBSAC sponsored a workshop to evaluate different methodologies and recommended a multi-metric approach. ASMFC Amendment 2 requires adult river herring spawning/population assessment.
	3.1 H) American shad abundance will be investigated in the Potomac River, a system of historic importance, through a joint effort by Maryland, Virginia, and District of Columbia. (1991)	 1991 On-going 2011	MD striped bass juvenile seine and gill net surveys collect American shad data. DCFM has been sampling the upper Potomac for shad and river herring since 1991. The juvenile survey on the Potomac indicates shad are increasing in abundance especially since 2000. Juvenile shad indices have ranged from 1.05 (2010)

1989 Chesapeake Bay Alosid Management Plan Implementation Table (updated 8/2013)			
Strategy	Action	Date	Comments
			to 13/3 (2004). The 2011 JAI was 1.99 (GM). The abundance of juvenile Alosa spp is highly variable and involves density dependent processes that regulate year class strength.
		2013	The PRFC American shad pound net survey indicates that CPUE in the Potomac River is **129%** of the ASMFC restoration target.
4.1 The Chesapeake Bay Program's Fish Passage Workgroup has analyzed the problem of impediments to Alosid [*sic*] migration and presented its recommendations for acceptance in December 1988. Maryland will develop a multi-faceted program based on the program's recommendations to restore spawning habitat to migratory fishes by removing blockages. Virginia, through its Anadromous Fish Restoration Committee, will develop a comprehensive inventory of dams and other impediments restricting the migration of the shad and river herring to their historical spawning grounds and establish fish passage facilities. The Pennsylvania Fish Commission (PFC) will continue to refine its inventory of low head dams through SRAFRC and continue to promote fish passage at structures on the Susquehanna River tributaries having the potential for Alosid [*sic*] spawning and nursery habitat. Maryland, Virginia, District of Columbia, U.S. Fish and Wildlife Service and Corps of Engineers will continue its work for fish passage at Little Falls and Rock Creek.	4.1 The District of Columbia, Maryland, Pennsylvania and Virginia will implement the plan adopted by the Fish Passage Workgroup to remove barriers. Projects include: A) Permanent fish passage facilities are being designed and will be constructed at Conowingo Dam at a cost of $12.5 million. (1989)	Variable Completed 2011	Actions 4.1A - 4.1C, 4.1E, and 4.1G - 4.1I have been completed. Actions 4.1D, 4.1F, and 4.1J – 4.1L are underway. Conowingo Dam East Fish Lift is operational. The last significant blockage in MD for spawning American shad passage is the Conowingo Dam.
	4.1 B) Design planning and implementation of fishways at Holtwood, Safe Harbor and York Haven dams on the Susquehanna River. (In progress)	1986 Completed 2010 Continue **2012** Continue	Fishways have been constructed. Fishway improvements are periodically implemented to boost fish passage efficiency. Holtwood Dam fishway is being renovated to improve upstream passage of Alosa. **York Haven Power Company, LLC submitted an application to FERC to construct a "nature-like" fishway. Shoreline and in-river designs are being reviewed.**

1989 Chesapeake Bay Alosid Management Plan Implementation Table (updated 8/2013)			
Strategy	Action	Date	Comments
		2012	**American shad telemetry study did not detect any unusual behavioral movement patterns in the Conowingo Dam tailrace.**
	4.1 C) A comprehensive inventory of dams and other impediments restricting the migration of shad and river herring to their historical spawning grounds has been completed. (1989)	1990 2011/2012 Completed	Action completed. The Nature Conservancy in conjunction with NOAA, USFWS, MDNR, PA BGC and VGIF completed a GIS based Chesapeake Fish Passage Prioritization tool to prioritize dam removal based on ecologically relevant metrics.
	4.1 D) Removal of stream blockages, re-stocking efforts, and construction of fish ladders at sites of barriers on priority streams and rivers will begin. (1990)	Continue 1989-2007 Ongoing 2009 2010 Continue 2011 2011-2013 Completed 2010 **2012-2013**	1,838 miles of Chesapeake Bay stream habitat was reopened in PA, VA, and MD for anadromous fish from 1988 through 2005. VA has removed 6 dams, breached 3, and build passage structures at 9 as of 2012. Several fish passage projects are being pursued. Virginia dam removal status is available at http://www.dgif.virginia.gov/fishing/fish-passage/ The revised fish passage goal is now 2,807 miles of steam opened by 2025. From 1986 to 2003, >340 million American shad fry and fingerlings were cultured and released in Susquehanna, James, Pamunky, Mattaponi, Rappahannock, Potomac & Choptank rivers. Rappahannock River stocking began in 2003. Patuxent River hickory shad have been restored and stocking discontinued. Limited monitoring will continue. Marshyhope stocking was discontinued after 2011. Hickory shad stocking will continue in the Choptank River. American shad are only stocked in the Choptank River as of 2011. Additional wells were drilled at Manning hatchery and liners added to existing ponds to accommodate increased river herring culture. Union Dam and Simkins Dam on Patapsco River were removed. **Removal of Bloede Dam on the Patapsco River is underway and in the design**

1989 Chesapeake Bay Alosid Management Plan Implementation Table (updated 8/2013)			
Strategy	Action	Date	Comments
		2013 Continue	**phase.** **Experimental stocking of American shad, hickory shad, and river herring in the Patapsco River began in 2013. The project will stock for 3 years with 2 additional years of monitoring.**
	4.1 E) A demonstration fish ladder project has been developed with the Chesapeake Bay Foundation and the town of Elkton as an example with public access. (1989)	Completed	Elkton dam fishway was built in 1993. Thousands of herring and resident fish have used the fishway to access 12 miles of upstream habitat for spawning, forage, and cover. Fish Passage staff documented over 7,000 alewife and blueback herring using the fishway in 1999. Town of Elkton created a bypass channel around the dam which increased from bank incision and erosion upstream. Sediment accumulation has increased at the entrance and exit of the fishway that has to be dredged roughly every 2 years. The number of herring using the fishway has significantly decreased since 2005, which corresponds with the time frame for the coast wide decline of both shad and herring.
	4.1 F) A program to reduce turbine mortalities by implementing guidance and avoidance techniques, i.e., use of fish attraction or avoidance devices to guide shad away from turbines to "sluice gate".(1991)	1992 1994 1997 2001 2009-2013 Completed	YOY American shad survival from passage through a Kaplan turbine (Conowingo Dam) is 95%. YOY shad survival was 90% for a single runner Francis turbine at Holtwood Dam. YOY shad survival at double runner Francis turbines was 77% at Yorkhaven Dam and 83% at Holtwood Dam. Exelon Generating Company L.L.C. funded a study to estimate YOY American shad mortality from a single runner Francis turbine at Conowingo Dam during the FERC relicensing process. YOY survival was 90%. Entrainment of adult, out-migrating American shad is projected to be high. Adult shad survival is 80-90% at Francis turbines and 84% at Kaplan turbines. No study of avoidance devices has been planned.
	4.1 G) Fish passage facilities on the James and Rappahannock Rivers will be established. (Currently being implemented)	1999 Completed	Vertical slot fishway completed at Boshers Dam on the James River, the last in the fall zone of Richmond. This reopened 137 miles of the mainstem James and over 150 miles of major

1989 Chesapeake Bay Alosid Management Plan Implementation Table (updated 8/2013)			
Strategy	Action	Date	Comments
			tributaries.
		2005 Completed	Embrey Dam was removed from the Rappahannock River reopening 106 miles of the Rappahannock and Rapidan rivers.
	4.1 H) The recently constructed passage facility on the Chickahominy River at Walker's Dam will be evaluated for its effectiveness. (1990)	1989 Completed	A double Denil fishway on Walkers Dam was rebuilt in 1989 by the City of Newport News to allow passage of migratory fish. Alosa, blueback herring, alewife and American shad have been documented using the fishway.
	4.1 I) Fish passage facilities at Little Falls Dam on the Potomac River will restore about 10 miles of spawning habitat and at Rock Creek park will open an additional 5 miles of spawning habitat.	1999 - 2000 Completed	A hydraulic model and construction of Little Falls Dam fish passage has been completed. Fish passage effectiveness has been difficult to measure.
	4.1 In addition to the strategies detailed in the Fish Passage Plan, several aspects must be coordinated with the Fishery Management Plan:	Continue	Hatchery-rearing methods are standardized. MD, VA, and PA strip spawn. DE hatchery spawning is hormone free. Jurisdictional coordination is good.
	J) Sources of adult fish used for restocking areas will be coordinated with other states and agencies. (1990)	Continue	All American shad broodstock used by MD, VA, PA, and USFWS are from the Potomac River. MD stocks larval, early juvenile, and late juvenile stages to improve stocking success rate.
	4.1 K) The reintroduction of alosid [*sic*] stocks will require specific regulatory measures to protect the newly-introduced fish until populations have been established.	Continue	Moratorium in place for American and hickory shad. Hickory shad data is insufficient for most tributaries to determine population status.
		2010	Juvenile downstream survival has to be improved at dams having Francis turbines: Holtwood and York Haven. Little attention has been given to downstream passage of post-spawn adults.
		2011	Moritoriunm is in place for river herring.
		2013	**Allocation of shad and herring resources among stakeholders has been deferred until the species stocks are declared restored.**
	4.1 L) Monitoring is essential in gauging the impact of fish passage projects on restoration efforts.	1999 Continue	ASMFC Amendment 2 encourages assessment of fishway passage efficiency/inefficiency for river herring.
		Continue	Boshers Dam vertical slot fishway is monitored for passage each spring. American shad plus 23 other species are known to use the passage.

1989 Chesapeake Bay Alosid Management Plan Implementation Table (updated 8/2013)			
Strategy	Action	Date	Comments
		Continue	Fishways are monitored on a limited basis as new ladders are constructed. A 10 year fish passage monitoring goal of 50% coverage is being considered. Fishway efficiency has been difficult to measure. Passage indices should be explored.
4.2 Restoration of shad and river herring to suitable unoccupied habitats will be accomplished by introducing hatchery-raised juveniles or transplanting gravid adults. Present policy fully supports the transplantation of adult shad using fish passage facilities at Conowingo Dam under the assumption of reasonable outmigration. However, if outmigration is not obtained, then the effects of transporting adults from the population below the dam needs to be reevaluated.	4.2.1) Maryland and Pennsylvania will continue to work within SRAFRC's ongoing programs as described in the annual workplan to evaluate methods for ensuring successful downstream passage for juveniles and adults. This will include spill, diversion devices, and bypass systems.	Continue 2002 2010 **2012**	SRAFRC adopted a new Alosine Management and Restoration Plan for the Susquehanna River Basin in 2002. Restoration Plan was revised in 2010 http://www.dec.ny.gov/docs/fish_marine_pdf/r7fsrafcfinal.pdf. **York Haven Power Company, LLC submitted an application to FERC to construct a "nature-like" fishway at York Haven Dam. Shoreline and in-river designs are being considered.**
	4.2.2 A) Maryland, Pennsylvania, and Virginia working within SRAFRC, will promote using Susquehanna River brood stock for hatchery production.	Discontinued 2002 Continue Continue	Brood stock are no longer collected from the Susquehanna River. MD, VA, PA, and USFWS use American shad brood stock collected from the Potomac River. 10% of eggs collected from Potomac River brood stock must be returned to the Potomac as mitigation for egg removals. Susquehanna River American shad spawned at MD hatcheries have had poor fertilization rates. Funding is not available to determine the cause. Population level impact of poor fertilization rates in the wild stock [in situ] has not been determined. Normandeau Associates, Inc. spawns Susquehanna River American shad for experimental stocking in PA.
	4.2.2 B) Virginia will expand funding to the recently constructed Pamunky/Mattaponi Indian Reservation shad hatcheries.	1993	Funding was from VMRC, but is now provided by VDGIF.
4.3.1 Technical issues concerning water quality standards for dissolved oxygen and minimum flows in the Susquehanna River below Conowingo Dam have been negotiated.	4.3.1 The following technical issues have been accepted. A) Adoption of Maryland water quality standard for dissolved oxygen of 5.0 mg/liter in the Susquehanna River below Conowingo Dam (1989)	Continue	Standards were implemented in 1989 and have been monitored ever since. New water quality criteria for living resources have been adopted. Water quality sampling protocols are being reviewed during the FERC relicensing process.
	B) Installation of turbine venting systems and intake air injection capabilities (1991)	1988 – 1991	All 7 Francis turbines now have turbine venting systems and partial intake air injection system.
	C) Operation of turbines as necessary to meet the	Continue	Power generation is adjusted as needed.

1989 Chesapeake Bay Alosid Management Plan Implementation Table (updated 8/2013)			
Strategy	Action	Date	Comments
	D.O. standard (1989)		
	D) Monitored spills as necessary (1989)	Continue	Water releases are closely monitored to maximize pool volume.
	E) A schedule of minimum and continuous flows (1989)	Continue	The dam and reservoir are managed to meet required water flows. However, the minimum flow (cfs) is not consistently maintained, but rather allowed to fluctuate below the minimum within the management window.
4.4 Maryland DNR has proposed new criteria for use in the revised water use classification and water quality standards system setting standards for temperature, dissolved oxygen, pH, amount of suspended solids and a number of "priority pollutants" in anadromous fish spawning areas.	4.4 Establish new categories in the water classification system to guide resource management based on the physical habitat and water quality characteristics. The revised system would define anadromous fish spawning areas as either Class II waters (fresh, nontidal warm water streams, creeks and rivers) or Class III waters (tidal estuarine waters and Chesapeake Bay).	2007 2011	Maps delineating particular habitats of concern are used for developing water quality standards. Revised habitat prioritization maps have been completed by CBP.
4.5 The District of Columbia, Maryland, Pennsylvania and Virginia will cooperatively evaluate the available scientific data on the effects of impaired water quality on alosids [*sic*] as a means of developing more effective water quality criteria for spawning and hatching areas and take action now to reduce pollution from several sources.	4.5) The first three action items are commitments under the 1987 Chesapeake Bay Agreement. Maryland DNR, PFC, DC and VMRC will not carry out the specific commitments, but are involved in setting the objectives of the programs to fulfill the commitments and reviewing the results of the action programs. The achievement of these commitments will lead to improved water quality and enhanced biological production. A) Develop and adopt a basinwide plan that will achieve a 40% reduction of nutrients entering the Chesapeake Bay by the year 2000. 1) Construct public and private sewage facilities. 2) Reduce the discharge of untreated or inadequately treated sewage. 3) Establish and enforce nutrient and conventional pollutant limitations in regulated discharges. 4) Reduce levels of nutrients and other conventional pollutants in runoff from agricultural and forested lands. 5) Reduce levels of nutrients and other conventional pollutants in urban runoff.	On-going Variable May 2009 2007 2009	Chesapeake Bay Program develops, revises, and monitors goals and strategies for air pollution. For more information: http://www.chesapeakebay.net/issues/issue/nutrients http://www.chesapeakebay.net/issues/issue/wastewater http://www.chesapeakebay.net/issues/issue/sediment http://www.chesapeakebay.net/issues/issue/stormwater_runoff http://www.chesapeakebay.net/issues/issue/development New commitments were established in the Chesapeake 2000 Agreement. For Alosines, priority populations will be identified and tributary-specific targets developed. STAC sponsored a workshop during 2007 to develop restoration targets. Executive Order 13508 by President Barack Obama required federal agencies to increase cooperation and leadership, coordinate with state and local government, and enforcement of Clean Water Act.

1989 Chesapeake Bay Alosid Management Plan Implementation Table (updated 8/2013)			
Strategy	Action	Date	Comments
		2009 2010 **2012**	EPA is mandating restoration criteria and actions for Chesapeake Bay States. EPA developed a Chesapeake Bay watershed TMDL. States must have EPA approved plans with 2 year milestones or face fines and other sanctions. Various jurisdictions have filed legal challenges to the EPA TMDL. Jurisdictions submitted Phase I watershed implementation plans (WIPS) in 2010 and **Phase II WIPS in 2012**.
	4.5 B) Develop and adopt a basinwide plan for the reduction and control of toxic materials entering the Chesapeake Bay system from point and nonpoint sources and from bottom sediments. 1) Reduce discharge of metals and organic compounds from sewage treatment plants receiving industrial wastewater. 2) Reduce the discharge of metals and organic compounds from industrial sources. 3) Reduce levels of metals and organic compounds in urban and agriculture runoff. 4) Reduce chlorine discharges to critical finfish areas.	On-going	Chesapeake Bay Program develops, revises, and monitors goals and strategies for air pollution. For more information: http://www.chesapeakebay.net/issues/issue/chemical_contaminants
	4.5 C) Develop and adopt a basinwide plan for the management of conventional pollutants entering the Chesapeake Bay from point and nonpoint sources. 1) Manage sewage sludge, dredge spoil and hazardous wastes. 2) Improve dissolved oxygen concentrations in the Chesapeake Bay through the reduction of nutrients from both point and nonpoint sources. 3) Continue study of the impacts of acidic conditions on water quality. 4) Manage groundwater to protect the water quality of the Chesapeake Bay. 5) Continue research to refine strategies to reduce point and nonpoint sources of nutrient, toxic and conventional pollutants in the Chesapeake Bay.	2011 2008 On-going **2011** **Continue**	Some Alosa spawning reaches appear to be sand and gravel deficient and may impair egg survival. MD DNR and USACE are studying sand and gravel transport at the Simkins Dam removal site (Patapsco River) as well as possible negative effects of accumulated sand and gravel behind blockages. MD DNR Fisheries Service is studying spawning and hatching success with associated habitat and watershed conditions including land use. **Sediment accumulation behind Conowingo Dam is nearing capacity. At capacity, the Dam will no longer reduce sediment, nutrient and other pollutant inputs to Chesapeake Bay. Options being considered for sediment removal and disposal include sediment bypass, quarry infill, use as landfill material, construction material, and Blackwater Wildlife Refuge marsh restoration.**

1989 Chesapeake Bay Alosid Management Plan Implementation Table (updated 8/2013)			
Strategy	Action	Date	Comments
	4.5 D) Develop and adopt a plan for continued research and monitoring of the impacts and causes of acidic atmosphere deposition into the Chesapeake Bay. This plan is complimented by Maryland's research and monitoring program on the sources, effects, and control of acid deposition as defined by Natural Resources Article Title 3, Subtitle 3A, (Acid Deposition: Sections 3-3A-01 through 3-3A-04). 1) Determine the relative contributions to acidic deposition from various sources of acid deposition precursor emissions and identify any regional variability. 2) Assess the consequences of the environmental impacts of acid deposition on water quality. 3) Identify and evaluate the effectiveness and economic costs of technologies and non-control mitigative techniques that are feasible to control acid deposition into the Bay.	On-going	Chesapeake Bay Program develops, revises, and monitors goals and strategies for air pollution. For more information: http://www.chesapeakebay.net/issues/issue/air_pollution

Acronyms:
ACCSP – Atlantic Coastal Cooperative Statistics Program
ASMFC – Atlantic States Marine Fisheries Commission
C2K – Chesapeake 2000 Agreement
CBP - Chesapeake Bay Program
CBSAC – Chesapeake Bay Stock Assessment Committee
DCFM – District of Columbia Fisheries Management
EBFMP – Ecosystem Based Fisheries Management
FERC – Federal Energy Regulatory Commission
FMP - Fishery Management Plan
FMPC – Fisheries Management Planning and Coordination
GIS – Geographic Information System
GM – Geometric Mean
JAI – Juvenile Abundance Index
MAFMC – Mid-Atlantic Fisheries Management Council
MD DNR – Maryland Department of Natural Resources
NEFMC – New England Fishery Management Council
PRFC – Potomac River Fisheries Commission
SRAFRC – Susquehanna River Anadromous Fish Restoration Committee
STAC - Chesapeake Bay Program, Scientific and Technical Advisory Committee
USACE – United States Army Corps of Engineers
VIMS – Virginia Institute of Marine Science
VMRC – Virginia Marine Resource Commission

2012 Maryland FMP Report (September 2013)
Section 3. Atlantic croaker (*Micropogonias undulatus*) and Spot (*Leiostomus xanthurus*)

Chesapeake Bay FMP

The most popular species pursued by near-shore anglers fishing near the bottom within the mid to lower portions of the Chesapeake Bay are Atlantic croaker and spot. The Chesapeake Bay Atlantic Croaker and Spot Fishery Management Plan (FMP) was adopted in 1991. The FMP's goal is to: "Protect the Atlantic croaker and spot resource in the Chesapeake Bay, its tributaries, and coastal waters, while providing the greatest long term ecological, economic, and social benefits from their usage over time." To accomplish this goal, management strategies were developed to prohibit the harvest of small fish of both species, mostly under age 1, and to recommend monitoring and research programs for stock assessments and habitat needs.

The Atlantic States Marine Fisheries Commission (ASMFC) adopted coastal FMPs for each species in 1987. The main purpose of the plans was to decrease the number of small fish caught as bycatch in the coastal shrimp trawl fishery. Bycatch reduction devices were required in the offshore coastal areas and have successfully reduced the number of small fish caught in the trawl fishery. There are currently no interstate requirements for Atlantic croaker or spot.

Atlantic croaker - Biological reference points (BRPs) were established for croaker in the mid-Atlantic region in 2005. The BRPs were revised in 2011 (Addendum 1) following the 2010 ASMFC stock assessment and now apply to the entire Atlantic coastal stock [1]. The BRPs set targets for fishing mortality and spawning stock biomass and fishing mortality. The BRPs are ratio-based. For the threshold, if $F/F_{MSY}=1$, overfishing is occurring. If $SSB/ (SSB_{MSY} (1-M))) =1$, the coastal stock is overfished. The 2011 ASMFC Atlantic Stock Assessment Technical Committee evaluated the stock assessment triggers in 2011 and found no evidence to alter management [1]. The ASMFC Atlantic croaker plan review team accepted the 2011 review of the FMP in August, 2012 [2]. The 2013 ASMFC Action Plan calls for the development of an addendum to consider alternate croaker trigger mechanisms.

Maryland is required to complete an annual Atlantic croaker compliance report for ASMFC. This report describes the fishery, management program for Atlantic croaker, including fishery dependent and independent monitoring, regulations, commercial harvest reports and recreational catch estimates [3]. Juvenile indices (seine and trawl) for the Maryland portion of the Chesapeake Bay have been calculated for every year since 1959.

Atlantic croaker Stock Status – According to the 2010 benchmark assessment [4], overfishing is not occurring but overfished status could not be determined due to data limitations. Biomass has been increasing and the age-structure of the population has expanded since the late 1980's. Atlantic croaker is considered a single stock along the entire Atlantic Coast. Monitoring data from Maryland's portion of the Chesapeake Bay indicate a broad and stable size and age structure. The strong 2008 year-class was fully recruited into the fishery in 2011 [4].

The Fisheries

Figure 1. Maryland commercial landings of Atlantic croaker from 1929-2012 (2012 landings preliminary; NMFS and Maryland DNR [3]). The horizontal line is the mean for the time series.

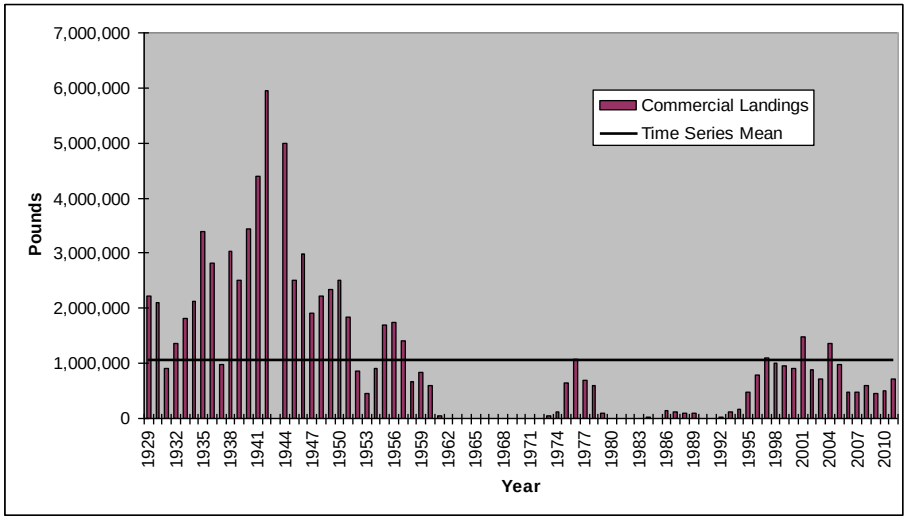


Figure 2. Maryland estimated recreational harvest and release for Atlantic croaker: 1981-2012 [3]. The horizontal line is the harvest mean for the time series.

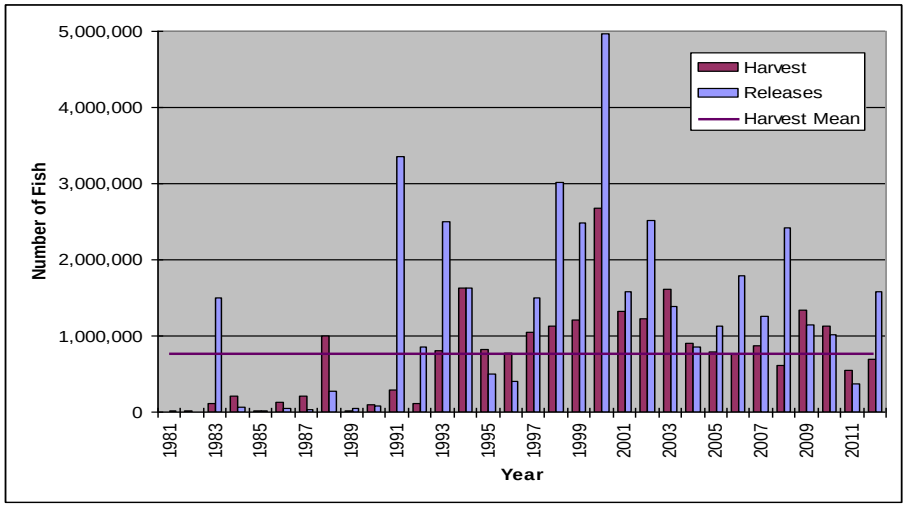


Figure 3. Virginia commercial landings of Atlantic croaker: 1950-2012 [7].

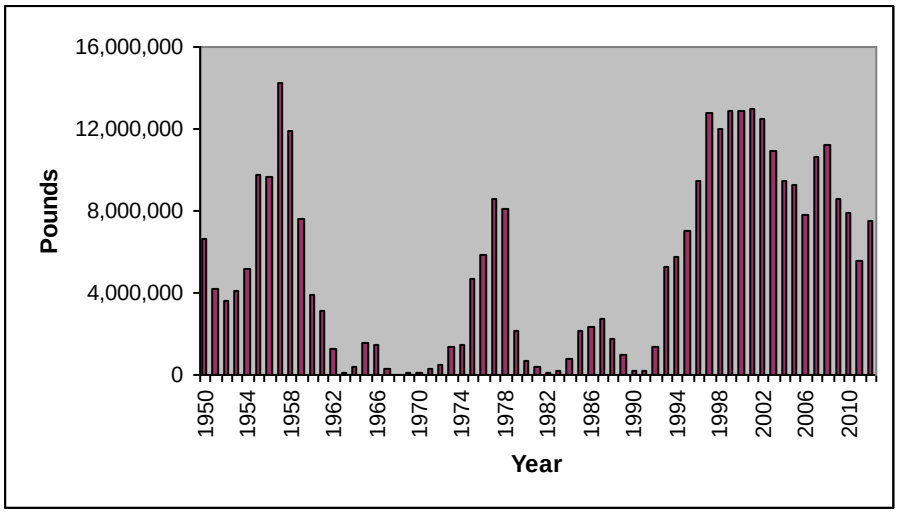
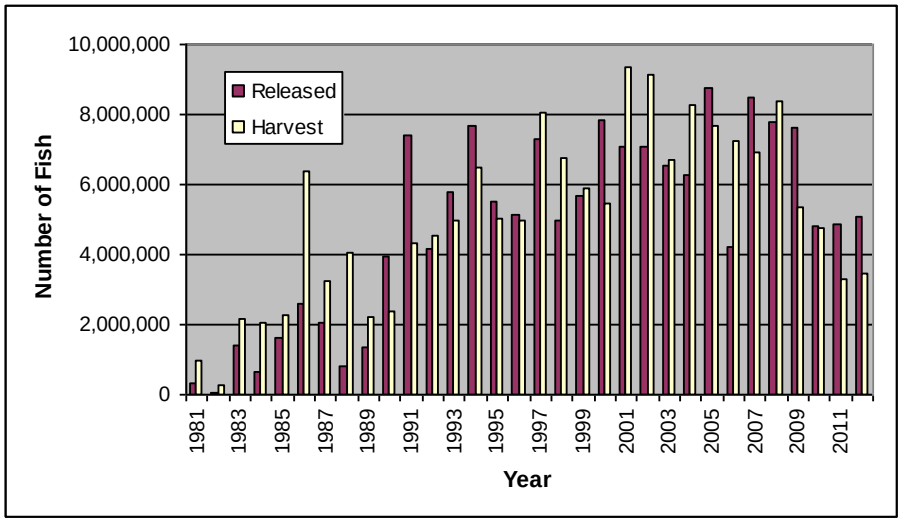


Figure 4. Virginia estimated recreational Atlantic croaker harvest and release, 1981-2012 [8].



Spot - Maryland is a member of the ASMFC Spot Plan Review Team (PRT) and they prepare and recommend actions (if needed) in a status report [5]. The ASMFC South Atlantic State-Federal Fisheries Management Board approved the omnibus amendment for Spanish mackerel, spot and spotted seatrout [6]. A management trigger for spot is included in the recently approved omnibus amendment and will help the ASMFC Management Board monitor the status of the stock until a full coastwide stock assessment can be completed. The Management Board will be prompted to consider management action if two of five relative abundance indices, at least one of which must be from a fishery-independent data source, are equal to or less than the respective data set's 10th percentile. The relative abundance indices are from the coastwide recreational and commercial landings, SEAMAP-South Atlantic trawl catch-per-unit-effort (CPUE), NMFS bottom trawl CPUE and Chesapeake Bay seine survey CPUE. The Spot Plan Review Team met in 2012 and did not recommend any management actions but recommended that the Board review trigger data mid-year rather than wait until the November 1 deadline for compliance reports. The 2013 ASMFC Action Plan calls for the evaluation of spot management triggers.

Spot Stock Status– Overfishing and overfished status remain unknown. Catch per unit effort (CPUE) data have been used to evaluate the status of spot. CPUE values are highly variable and differ by gear type. There is some concern that there is a declining trend. Four juvenile indices (JI) are calculated in an evaluation of the status of spot in Maryland. For the Chesapeake Bay, a JI is calculated for spot from the MD DNR Blue Crab Trawl Survey (BCS) and another from the Maryland Estuarine Juvenile Finfish Survey (EJFS). In addition to the Chesapeake Bay JIs, two coastal

bay JIs are derived from trawl and seine data. These indices are highly variable. Chesapeake Bay juvenile indices indicated a very strong 2010 year class but all four 2011 JIs were low. The 2011 spot index derived from the EJFS JI was the lowest since 1967.

Figure 5. Maryland and Virginia commercial landings of spot: 1981-2012 [7].

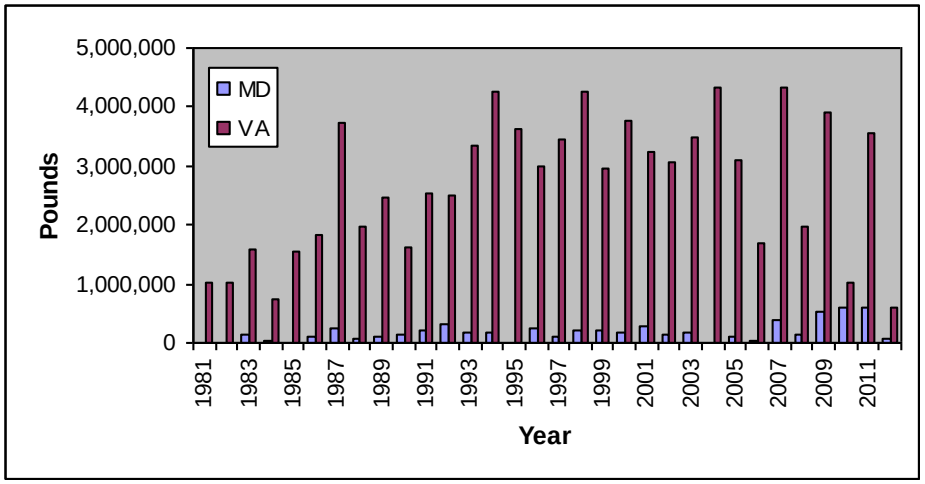
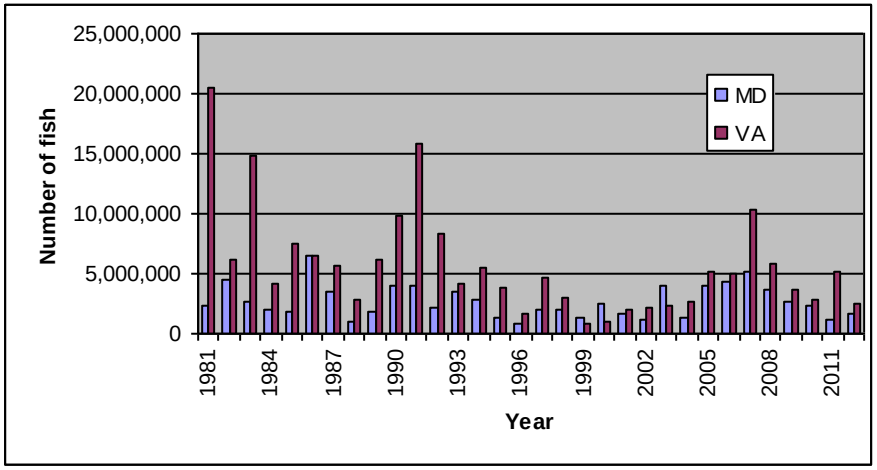


Figure 6. Maryland and Virginia total estimated recreational spot catch: 1981-2012 [8]



Management Measures

There are currently no management measures required by ASMFC to restrict the commercial or recreational fisheries for either croaker or spot. The recently approved omnibus amendment does not require development of additional management criteria [6]. Nor does the omnibus amendment implement BRPs that define overfishing and overfished [6]. The coastal states are required to compile commercial and recreational harvest statistics and monitoring data. Maryland has a recreational minimum size limit of 9 inches for croaker and a creel limit of 25 fish per person per day. There is a commercial season from March through December, a 9 inch minimum size limit, and no harvest restrictions for spot. Annual spot compliance reports are due November 1 to ASMFC starting in 2012 [6]

Issues/Concerns

Continued monitoring of the commercial and recreational harvest of both croaker and spot is important in order to obtain data for conducting stock assessments and evaluating the status of the stocks. There is some concern about the decreasing trend in commercial landings of spot along the coast. The ASMFC Spot PRT will continue to monitor the trend and make management recommendations if necessary. The use of circle hooks to reduce recreational discard mortality is encouraged. Both species are caught indirectly and together during other fishing activities; bycatch mortality is a continued concern. Small spot, for example, could account for as much as 80% of the shrimp trawl catch by weight and 60% by number, depending on area [9]. States are encouraged to use bycatch reduction devices to reduce bycatch.

Spot, also known as Lafayettes in the northern part of their range, have been increasingly used as bait in the recreational striped bass fishery of the Chesapeake Bay. The consequences of using spot as bait are unknown and a cause for concern to some recreational fishermen. Requests to increase restrictions on “spot-pots” are being evaluated.

A winter kill in Chesapeake Bay estimated at two million juvenile spot occurred in late December 2010 and was associated with a sudden cold snap. The consequences of this winter kill are unknown.

Spot and croaker are important prey items for predators such as spotted seatrout, red drum, striped bass, marine mammals and many bird species. Their importance as prey and their dependence on coastal estuaries for juvenile habitat make them a consideration in ecosystem management.

Atlantic croaker survival to adulthood may benefit from increased temperatures due to climate change. A coupled climate change-population model has forecast both increased northern distribution and a 60-100% increase in average spawning biomass at current levels of fishing [10].

References:

[1] Annual Review of Assessment Triggers. 2011. Atlantic States Marine Fisheries Commission Atlantic Croaker Technical Committee.

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1991 Chesapeake Bay Program Atlantic Croaker and Spot Fishery Management Plan Implementation (updated 09/13)			
Problem Area	**Action**	**Date**	**Comments**
Stock Status Annual abundance of Atlantic croaker and spot is highly variable from year-to-year. Little information is available on the causes of stock fluctuations.	Action 1.1 CBP jurisdictions will continue to participate in scientific and technical meetings for managing Atlantic croaker and spot along the Atlantic coast and in estuarine waters.	2005 2009 Continue	CBP jurisdictions will continue to monitor Atlantic croaker and spot stocks and cooperate with the ASMFC to manage stocks through inter-jurisdictional management measures. BRPs were adopted for the coastal croaker stock in 2005 and updated in 2010. Current estimates of F and SSB indicate that the croaker stock is healthy and overfishing is not occurring (ASMFC 2010). The status of the coastal spot stock is undeterminable. No stock assessment has been completed and available data indicate contradictory trends. The ASMFC Spot PRT has been monitoring stock status through reports to the South Atlantic Management Board, including development of management triggers. Data from the MD Estuarine Juvenile Finfish Survey is one of five state and regional indices considered for triggering management The omnibus amendment's adaptive management section allows states to implement management changes more quickly. **Spot compliance reports are now due to ASMFC annually starting in 2013 for the 2012 season.**
.	Action 1.2.1 A) MD and the PRFC have a minimum size limit for Atlantic croaker. B) VA does not have a minimum size limit for Atlantic croaker.	Continue 1993	CBP jurisdictions will promote the increase in yield per recruit for the Atlantic Croaker and spot fisheries. MD has a 9" minimum size limit for the croaker recreational and commercial fisheries. MD & PRFC also have a 25 fish/person/day creel limit. MD has an open commercial season from March thru December. VA does not have any restrictions.
	Action 1.2.2 CBP jurisdictions will evaluate the need to implement a minimum size limit for spot.	1992 2009 Continue	No recommendations have been made. There is some concern over declining juvenile abundance. Georgia is the only coastal state with a minimum size limit (8"). The ASMFC omnibus amendment, approved in 2011, does not require additional management criteria but recommends implementation of conservation measures when any two measures of relative abundance indices (with at least one a fishery independent index) are equal to or below the data set's 10th percentile.

1991 Chesapeake Bay Program Atlantic Croaker and Spot Fishery Management Plan Implementation (updated 09/13)			
Problem Area	**Action**	**Date**	**Comments**
Harvest of Small Croaker and Spot Incidental bycatch and discard mortality of small croaker and spot in non-directed fisheries is substantial and has the potential to significantly impact croaker and spot stocks.	Action 2.1 A) Through the ASMFC, the jurisdictions will promote the development and use of trawl efficiency devices (TEDs) in the southern shrimp fishery and promote the use bycatch reduction devices (BRDs) in the finfish trawl fishery. B) Virginia will continue its prohibition on trawling in state waters. Virginia will maintain its $2^{7}/_{8}$ inch minimum mesh size for gill nets C) Maryland will continue its 4-6 inch gill net restriction during June 15 through September 30 and implement a 3 inch minimum mesh size along the coast. D) PRFC will continue its prohibition on gill net fishing in the summer.	Continue Continue 1992 Continue	Commercial trawling is prohibited within the Chesapeake Bay in both MD and VA. The 2004 Croaker Stock Assessment indicated that the coastal states were successful at reducing mortality on age 1 fish. The commercial & recreational catch-at-age data showed an increasing age distribution with a few croaker at age 12. The stock assessment analyses indicated that the shrimp bycatch estimates are important to consider in the calculations but there needs a more comprehensive evaluation. ASMFC encourages states to use bycatch reduction devices (BRDs). MD currently allows attended gill nets with a stretched mesh size of 3 1/8 to 3 ½ inches from January 1 through March 15 and 2 ½ to 3 ½ inches between March 16 and December 31 in the Chesapeake Bay and tributaries, with location restrictions during striped bass spawning seasons. The minimum stretched gill net mesh size in MD waters is 2 ½ inches. Virginia has a minimum gill net stretched mesh of 2 7/8”**. Maryland is evaluating its regulations and gear definitions for “spot pots” for the baitfish harvest.**
	Action 2.1.2 CBP jurisdictions will investigate the magnitude of the bycatch problem and consider implementing bycatch restrictions for the non-directed fisheries in the Bay	1992 On-going	CBP jurisdictions have evaluated the effectiveness of bycatch reduction panels in pound nets and PRFC requires reduction panels for all pound nets. Some coastal states are using panels to reduce bycatch of small fish.
Research and Monitoring Needs There is a lack of stock assessment data for both Atlantic croaker and spot stocks in the Chesapeake Bay.	Action 3.1 VMRC stock assessment program will continue to analyze size and sex data from Atlantic croaker and spot collected from the VA commercial fishery.	Continue	The amount of data available for croaker improved and provided the basis for the 2003/2004 coastal stock assessment. The 2010 ASMFC coastal stock assessment update (benchmark) concluded that the coastal Atlantic croaker population is a single stock. Addendum 1 to the ASMFC FMP changed the management unit to a single stock and modified the BRPs. Stock assessment data for Atlantic croaker and spot is collected by the MD Estuarine Juvenile Finfish Survey, and VIMS Juvenile Abundance Surveys (formerly known as the VIMS Trawl Survey and the VIMS Juvenile Seine Survey), NEAMAP and ChesMMAP.

1991 Chesapeake Bay Program Atlantic Croaker and Spot Fishery Management Plan Implementation (updated 09/13)			
Problem Area	**Action**	**Date**	**Comments**
	Action 3.2 A) MD and PRFC will encourage research to collect data on croaker and spot biology, especially estimates of population abundance, recruitment, and reproductive biology. B) VA will continue to fund its stock assessment research conducted by the conducted by VIMS and ODU, specifically designed to provide the estimates of population abundance, recruitment, and reproductive biology.	Continue Continue	An Atlantic Croaker Ageing Workshop was held in October 2008 and resulted in a standardized ageing procedure. High priority research & monitoring recommendations include: determining migratory patterns; collecting life history information; evaluating bycatch and discard practices; and examining reproductive strategies. Spot up to age 3 are regularly represented in the commercial fishery. Commercial catch-at-age data has contracted the last several years. Length-at-age and weight-at-age have decreased for ages 1-3. Spot age 4 to 6 years are not seen every year and when present, only account for a small percentage of harvest. Recommendations for spot in the 2011 omnibus amendment include: monitoring data and gear studies on discards from the shrimp, recreational and commercial fisheries; expanding sampling; assessing BRDs; continuing development of fishery-dependent and fishery-independent size and sex specific relative abundance estimates; evaluating juvenile indices to predict year class strength; improving catch and effort statistics; and developing stock assessment analyses such as a yield-per-recruit analysis and determining the onshore vs offshore components of the fishery. **Commercial pound net sampling in Maryland's portion of the Chesapeake Bay was conducted bi-weekly from May to September, 2012. Atlantic croaker mean total lengths decreased in 2012 for the third consecutive year to 274mm due to an increased number of smaller croaker. Gill net samples (n=571) were larger and averaged 296mm and were likely a result of gear selectivity. Ages of pound net collected croaker ranged from 0 to 8 years. Thirty-four percent were age four, 22% were age three, 22% were age two, 10% were age 0 and 6% were age five. Coastal Bay trawl surveys showed 2012 results close to the time series means per hectare and per trawl. Maryland seine surveys showed high geometric means for juvenile croaker in Chesapeake Bay in 2012[3].**

1991 Chesapeake Bay Program Atlantic Croaker and Spot Fishery Management Plan Implementation (updated 09/13)			
Problem Area	**Action**	**Date**	**Comments**
Habitat and Water Quality Issues Habitat alteration and water quality impact the distribution of finfish species in the Chesapeake Bay	Action 4.1 CBP jurisdictions will continue to set specific objectives for water quality goals and review management programs established under the 1987 Chesapeake Bay Agreement. The Agreement and documents developed pursuant to the Agreement call for: A) Developing habitat requirements and water quality goals for various finfish species. B) Developing and adopting basinwide nutrient reduction strategies. C) Developing and Adopting basinwide plans for the reduction and control of toxic substances. D) Developing and adopting basinwide management measures for conventional pollutants entering the Bay from point source and non-point sources. E) Quantifying the impacts and identifying the sources of atmospheric inputs on the Bay system. F) Developing management strategies to protect and restore wetlands and submerged aquatic vegetation (SAV). G) Managing population growth to minimize adverse impacts to the Bay environment	Continue 2000 on-going	Water quality and living resource commitments were updated and renewed in the Chesapeake Bay 2000 Agreement. These activities include the discharge of toxic pollutants or excessive nutrients into the Chesapeake Bay and its tributaries, interruption or changes in water discharge patterns, deposition of solid waste, sewage sludge or industrial waste into the Bay (which may lead to anoxic conditions), rapid coastal development, unregulated agricultural practices, net coastal wetland loss or the dredging of contaminated sub-aqueous soils. Based on the most recent available data, scientists project that 58% of the pollution reduction efforts needed to achieve the Bay restoration goals have been implemented since 1985. Excess nitrogen, phosphorus and sediment are the major pollutants. The greatest challenge to achieving restoration is population growth and development which destroys forests, wetlands and other natural areas. Habitat and water quality objectives and actions were delineated in the President's Executive Order and provide more current strategies for managing resources in the Chesapeake Bay. Estuaries are designated as Habitat Areas of Particular Concern (HAPC) for spot. The Chesapeake Bay Program developed a new draft Watershed Agreement that is scheduled for completion in December 2013. The new agreement proposes some new and updated outcomes for water quality and habitat.

Acronyms:

ASMFC = Atlantic States Marine Fisheries Commission;
BRPs = Biological Reference Points
CHESFIMS = Chesapeake Bay Fishery Independent Multispecies Fisheries Survey
ChesMMAP = Chesapeake Bay Multispecies Monitoring and Assessment Program;
CBP = Chesapeake Bay Program
FMP = Fishery Management Plan;
ODU = Old Dominion University;
PRFC = Potomac River Fisheries Commission
PRT = Plan Review Team
VIMS = Virginia Institute of Marine Science

2012 Maryland FMP Report (June 2013)
Section 4. Atlantic Menhaden (*Brevoortia tyrannus*)

Based on new biological reference points adopted in 2011, the coastal menhaden stock is not overfished but overfishing is occurring. The Atlantic States Marine Fisheries Commission (ASMFC) adopted Amendment 2 in 2012 to address overfishing and states are required to reduce coastwide landings by 20%.

ASMFC Fishery Management

A coastal Atlantic menhaden fishery management plan (FMP) was developed by the Atlantic States Marine Fisheries Commission (ASMFC) in 1981. The plan was revised in 1992, amended in 2001 (Amendment 1) and currently managed under Amendment 2 (2012) and several addendums (2004, 2005, 2006, 2009). Since the 2009 coastal stock assessment was updated and revised in 2010, new biological reference points were developed and adopted in ASMFC Addendum V (2011). The goal of Addendum V is to increase abundance, to increase spawning stock biomass, and to increase menhaden availability as forage. The 2011 threshold and target equate to a maximum spawning potential (MSP) of 15% and 30%, respectively. ASMFC adopted Amendment 2 in 2012 to reduce fishing mortality and end overfishing. In addition, the amendment seeks to reduce the risk of recruitment failure, to reduce the impacts to other species that are dependent on menhaden as prey, and to minimize adverse effects on the fishery. For more detailed information on Amendment 2, go to the ASMFC website http://www.asmfc.org/ ASMFC has placed a high priority on developing ecosystem-based reference points to address the forage needs of predator species but they are expected to take several years to develop. Menhaden are important prey for striped bass, weakfish and bluefish.

There is no Chesapeake Bay fishery management plan (FMP) for Atlantic menhaden. Menhaden was one of the species slated for the development of an ecosystem-based fishery management plan (EBFMP). Maryland Sea Grant facilitated the EBFM process and developed biological briefs on key ecosystem topics for menhaden in Chesapeake Bay. More information on the EBFM process and the completed menhaden briefs can be found at the following website address: http://www.mdsg.umd.edu/programs/policy/ebfm.

Stock Status

Biological reference points (BRPs) were established in ASMFC Amendment 1 and updated in 2004. A benchmark assessment was conducted during 2009, peer reviewed, and released in 2010. The assessment included two new components: a factor for aging error and natural mortality rates that varied with age and time of year. The assessment was updated with data from 2009 through 2011. The results indicate that fishing mortality rates have been above the overfishing limit reference point. As a result, overfishing is occurring but the stock is not believed to be overfished. Currently, with the amount of uncertainty associated with the assessment, it is difficult to say for sure if the stock is overfished. Coastal recruitment indices have been low since the 1980s. In Maryland, juvenile menhaden are sampled annually through the Estuarine Juvenile Finfish Survey. The index of juvenile menhaden has been low since 1992 (Figure 1). The 2010 BRPs are considered interim benchmarks until the next coastal assessment which is scheduled for 2014. The BRPs are expected to protect the spawning stock and to take into account the needs of top predators. The development of new management actions and reduced harvest should contribute to improve recruitment.

Management Measures

The coastal overfishing designation has resulted in management measures to reduce harvest by 20%. Based on the 2010 BRPs, a total allowable catch (TAC) of 170,800 mt (376,549,574 lbs) was calculated for the Atlantic states for 2013. The coastal TAC was allocated state by state based on average state landings (2009-2011). Maryland's quota is 1.37% of the TAC or 2,320 mt (5,116,976 lbs). The Potomac River and Virginia portion of the TAC are 0.62% and 85.32%, respectively. Since Maryland has no regulations for menhaden other than a prohibition on purse seining, new regulations are required to implement the ASMFC management measures. Maryland submitted emergency regulations, effective June 1, 2013, to address the quota, catch limits, bycatch, permitting and monitoring requirements. For specific information on the new regulations go to http://dnr.maryland.gov/fisheries/regulations/proposedregulations.asp

The commercial menhaden fishery is composed of two different components: the reduction fishery (fish caught by purse seines and processed for fish oil/fish meal) and the bait fishery (fish for other commercial and recreational fisheries such as the blue crab fishery). Purse seining, the predominant gear type for harvesting menhaden, is not allowed in the Maryland portion of the Chesapeake Bay. However, menhaden are harvested from pound nets for the bait fishery. Virginia allows purse seining in the lower bay. Omega Protein has a menhaden reduction plant in Reedville, Virginia, which is the only active menhaden reduction factory on the Atlantic coast. ASMFC Addendum II (2006) established a harvest cap (109,020 mt) for the reduction fishery in Chesapeake Bay. With the adoption of ASMFC Amendment 2, there has been a 20% reduction in the harvest cap based on average landings from 2001-2005. The new harvest cap for Chesapeake Bay reduction fishery is 87,216 mt (192,278,382 lbs). The cap is not based on a scientifically quantified method but is designed to prevent all of the reduction fishery from occurring in the Bay.

The Fishery

Maryland commercial fishermen harvested 12.5 million pounds of menhaden in 2012 (Figure 2). It was the largest reported harvest in more than 30 years. Virginia commercial fishermen harvested 413.84 million pounds in 2011 (Figure 3) similar to the previous year. The total harvest for Virginia includes Chesapeake Bay and Atlantic coast landings; and harvest from both the bait and reduction fisheries. The cap on the purse seine harvest from the Chesapeake Bay was not reached during 2012 and has not been reached since it was implemented in 2006. Biological monitoring from the Maryland pound net (bait) fishery indicated that the majority of harvested menhaden were age 2 fish (57%). Only about 3% of the fish were age 5 and older.

Issues/Concerns

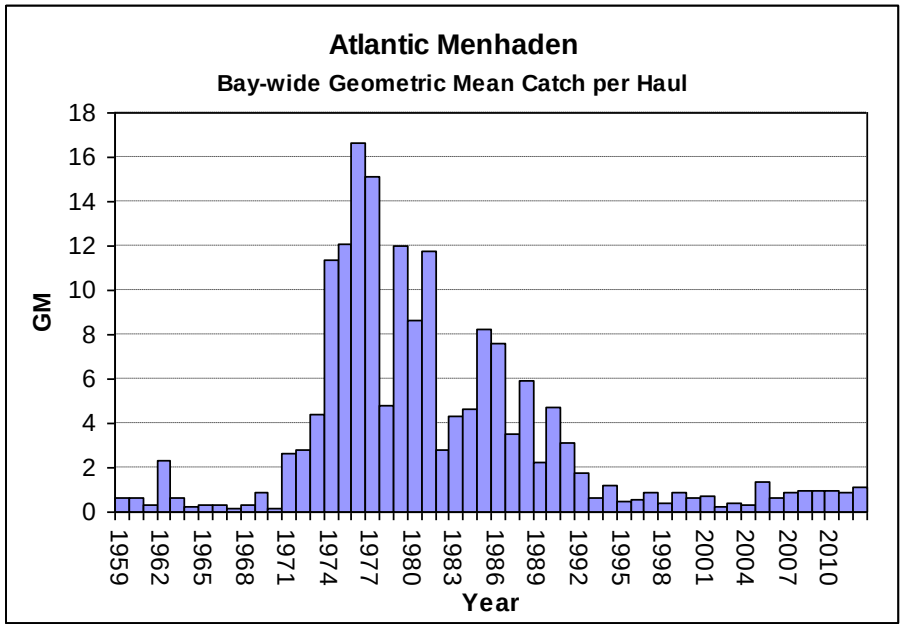
Significant changes in management will need to be in place by June 1, 2013 to meet the state-specific quotas set forth by ASMFC compliance requirements. Currently, Maryland has a monthly reporting system for the majority of harvested species. Beginning in June 15 , watermen will need to report menhaden on a daily or weekly basis. Maryland will evaluate how the 2013 harvest quota is managed and reevaluate the process for 2014.

Menhaden have a unique role in the Chesapeake Bay ecosystem as both a primary filter-feeder and an important forage species for top predators (striped bass, bluefish, osprey, etc). The development of ecosystem-based biological reference points would be useful for managing the

stock. Menhaden support a major commercial fishery and are the Bay's largest fishery by weight. Consequently, they also are an economically important species.

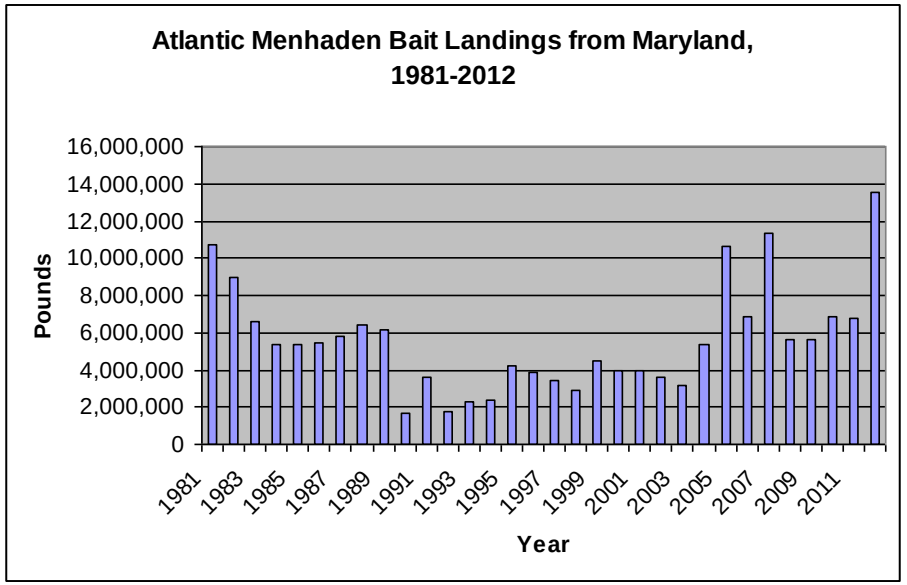
Two ways to improve the menhaden stock assessments (and recommended by ASMFC) are the development of a coastwide fishery-independent survey to assess adult abundance at age and better estimates of natural mortality by age class.

Figure 1. Geometric mean catch per haul of menhaden juveniles in the Maryland portion of the Chesapeake Bay, 1959-2012



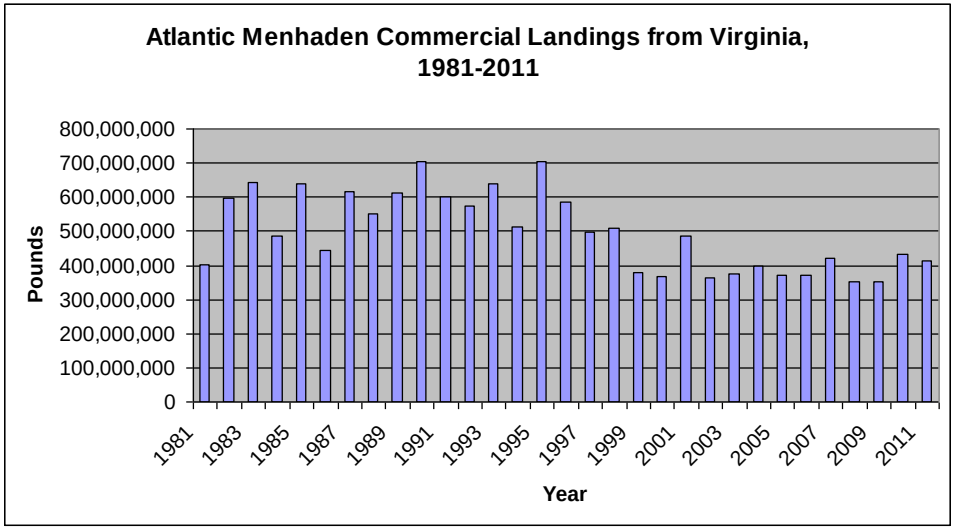
(from Durell et al. 2012)

Figure 2.



(MNDR data)

Figure 3.



(NMFS data)

2012 Maryland FMP Report (July 2013)
Section 5. Black Drum (*Pogonias cromis*)

Chesapeake Bay FMP

A new coastwide Atlantic States Marine Fisheries Commission (ASMFC) Fishery Management Plan (FMP) for black drum was adopted in 2013.[1] The FMP was initiated because of increased harvest, inconsistent coastwide regulations, the unknown condition of the stock and concerns about harvesting immature and breeding black drum. The 2012 Atlantic States Marine Fisheries Commission (ASMFC) Action Plan, a guiding document, includes tasks to "continue to support monitoring and other data collection to improve information available for assessments of spot, kingfish and black drum" and to add members as needed to represent black drum fishery interests to the South Atlantic Species Advisory Panel.

Prior to the new coastal ASMFC plan, the Chesapeake Bay Fishery Management Plan (CBFMP) for black drum was the only regional fishery management plan (FMP) for black drum on the Atlantic Coast. It was adopted in 1993 to address concerns about potential overfishing.. Maryland's Fisheries Service conducted a review of the 1993 Chesapeake Bay Fishery Management Plan (CBFMP) for Black Drum in 2010 and determined that the plan was still an appropriate framework for managing the black drum stock.

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Stock Status

There is no formal stock assessment of black drum from the Chesapeake Bay or the Atlantic Coast. The black drum stock status is unknown. Tagging data suggest there is one Atlantic coastal stock. ASMFC initiated a benchmark stock assessment and peer review in 2012 to be completed in 2015[2]. Maryland has some biological data from 1999 when watermen were paid for samples but have not collected much data since that time. Virginia indicated in 2005 that black drum did not appear to be overfished but they cautioned that "many unknowns surround the stock and its harvest". A Florida stock assessment in 1995 suggested that stocks could sustain harvest at the time. Some biological information is available from Gulf of Mexico black drum but evidence suggests that this is a separate stock.

Current Management Measures

Maryland closed its Chesapeake Bay commercial black drum fishery in 1999, but retains a limited coastal commercial fishery with a 1500 pound annual limit. Virginia manages its commercial fishery through limited entry and a total allowable catch of 120,000 pounds. Both states have a 16 inch minimum size limit with a commercial catch report requirement. Virginia established a management zone in the southeast portion of the Chesapeake Bay for black drum, further restricting some commercial gear. The fishery is presently largely recreational and both states limit recreational harvest to one fish over 16".

Issues/Concerns

Age-growth studies by Old Dominion University showed an average age of 34 years and a maximum age of 64 years. Long-lived species make stock assessments difficult to conduct. Lacking a formal stock assessment, management of the species by Chesapeake Bay states and the PRFC is precautionary.

There are occasional requests from the Maryland commercial fishery to consider re-opening the commercial harvest of black drum in Chesapeake Bay. In addition, the 16" minimum size limit does not protect all immature black drum. Females generally reach maturity at 4 to 6 years of age and at a size over 21".

Delaware and New Jersey have discussed the development of a joint DE-NJ black drum FMP as well as an increase in the minimum size limit to 32", but the minimum size limit remains 16" with a bag limit of three in 2013 in both states. There is concern that the fisheries along the coast target juvenile black drum and that the coastal fisheries have expanded.

The Fisheries

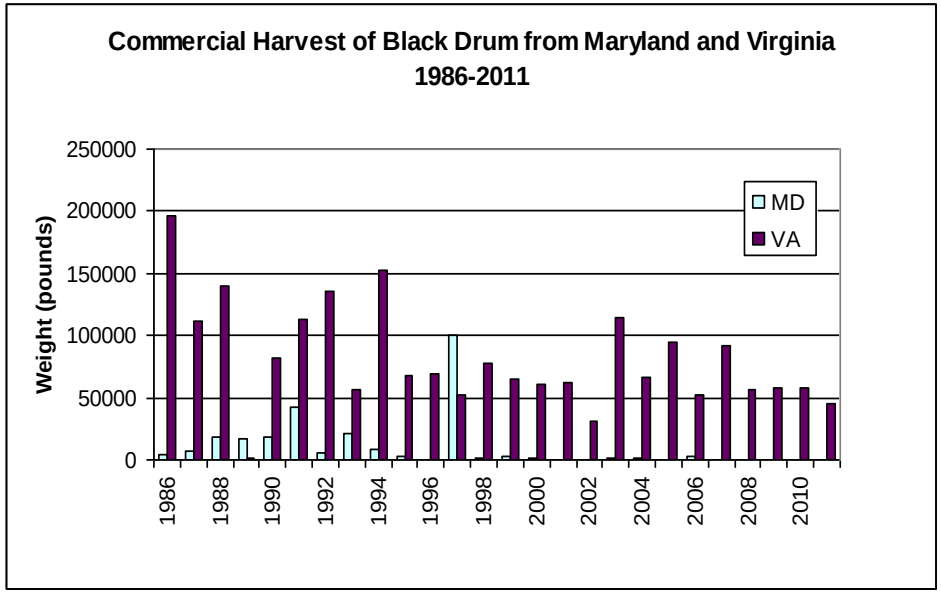


Figure 1. Commercial harvest reporting of black drum harvest from Maryland and Virginia from 1986 through 2011 [3].

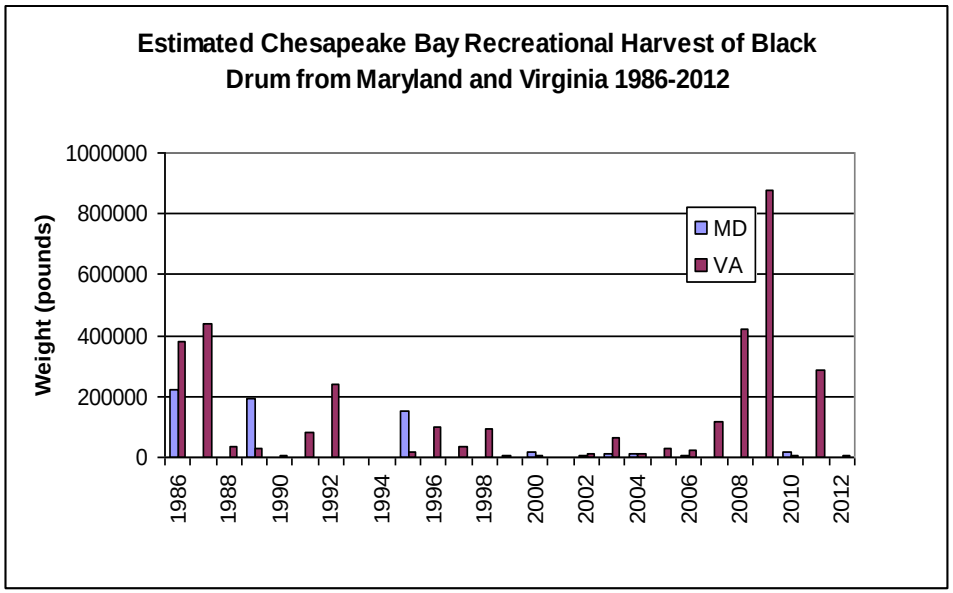


Figure 2. Recreational Harvest Estimate (MRIP) of Black Drum from Chesapeake Bay by Maryland and Virginia from1986 through 2012[4].

References

[1] Atlantic States Marine Fisheries Commission, June 2013. Interstate Fishery Management Plan for Black Drum

[2] 2012 Annual Report of the Atlantic States Marine Fisheries Commission, February 2013.

[3] Personal communication from the National Marine Fisheries Service, Fisheries Statistics Division. July 30, 2013. http://www.st.nmfs.noaa.gov/st1/commercial/.

[4] Personal communication from the Natuonal Marine Fisheries Service, Fisheries Statistics Division. July 30, 2013. http://www.st.nmfs.noaa.gov/st1/recreational/index.html.

[5] Atlantic States Marine Fisheries Commission. 2013. Research Priorities and Recommendations to Support Interjurisdictional Fisheries Management. Special Report #89, ASMFC, Arlington, VA. 58pp.

1993 Chesapeake Bay Program Black Drum Implementation (updated 7/13)

Problem Area	Action	Date	Comments
1. Status of Stock	1. Virginia (VA) will continue tagging black drum to determine coastal movements of the Chesapeake Bay Stock, fund research to determine age, fecundity, and spawning periodicity, and sample the commercial and recreational catch to determine length, weight, and sex. Maryland (MD) will continue to support the Old Dominion University (ODU) drum tagging study	Continue Completed **2013**	VA's tagging program is opportunistic and the ODU tagging study is complete. ODU has an ongoing otolith aging study for black drum**.** Forty-eight black drum were collected in 2007 with an average age of 33.8 years and ranging from 0 to 64 years. MD conducted an adult tagging program from commercial pound nets in 1998 and 1999. There have been a few tag returns each year since the program ended**.** ASMFC conducted a data workshop in April, 2013 to discuss the availability and state of black drum data and concluded there was sufficient data to develop an ASMFC FMP **which was adopted in May 2013. ASMFC has identified high and moderate fishery-dependent research priorities [5] High priorities include better estimates of recreational fishing, studies to estimate catch and release mortalities, increased spatial and temporal coverage of age samples, and a high reward tagging program to improve return rates. High priority fishery-independent recommendations include increased age samples, prioritized sampling of adults where state regulations preclude collection of fishery dependent sizes, improved coverage of black drum habitat, and continued life history studies, especially of adults.** **Night sampling will be implemented by MRIP in 2013.**
2. Fishing Mortality	2a VA will limit entry into the commercial black drum fishery & continue to require commercial black drum fisherman & buyer to obtain a permit and report weekly. VA will continue a 16-inch minimum size limit, 120,000 pound commercial quota, a 1 fish/person/day recreational creel limit, and continue monitoring commercial and recreational landings.	1992; 1994; Continue	Fully implemented VA will emphasize the need for timely reporting.
	2b MD will adopt a 16 inch minimum size limit and a 1 fish/person/day recreational creel limit	1994 Continue	MD REG: COMAR 08.02.05.15 The minimum size limit (16") with a creel limit of 1 fish/person/day and a maximum of 6 fish/boat.
	2c Potomac River Fisheries Commission (PFRC) will consider similar size and bag limits once VA and MD regulations are established	1994 Continue	PFRC adopted a 16-inch minimum size limit and 1 fish/person/day creel limit for recreational and commercial fisheries

1993 Chesapeake Bay Program Black Drum Implementation (updated 7/13)

Problem Area	Action	Date	Comments
	2d MD and PFRC will assess the need for commercial black drum harvest restrictions as data becomes available	1994 Continue	MD- Beginning in 1999, the commercial catch of black drum from the coastal bays and tributaries, and the Chesapeake Bay and its tidal tributaries is prohibited except for scientific investigation. Total allowable landings from the Atlantic Ocean are 1,500 pounds.
3. Gear Conflicts	3. VA has established a Special Black Drum Management Zone, for "high use" areas such as the Cabbage Patch and Latimer Shoals. During May 1 through June 7, no gill net or trot line may be in established zone from 7:00 AM to 8:30 PM.	1992; Continue	Established to address commercial and recreational area and time conflicts
4. Habitat Issues	4.1-7 Bay jurisdictions will continue to set water quality goals and review management programs under the 1987 Chesapeake Bay Agreement	Continue	The Chesapeake 2000 Agreement renewed the commitment to improve water quality and habitat for living resources. The 2009 President's Executive Order provided additional water quality and habitat goals for living resources. The Chesapeake Bay Program is currently drafting a new Watershed Agreement with habitat and fisheries outcomes. Juvenile black drum utilize shallow water. Black drum feed on crabs, oysters, mussels and clams within the Bay. They have been collected in seine and trawl surveys of the Coastal Bays.

Acronyms

ASMFC – Atlantic States Marine Fisheries Commission
COMAR – Code of Maryland Regulations
MRIP – Marine Recreational Information Program
ODU – Old Dominion University

2012 Maryland FMP Report (August 2013)
Section 6. Black Sea Bass (*Centropristis striata*)

Chesapeake Bay FMP

The coastwide black sea bass stock was declared rebuilt in 2010 by the Atlantic States Marine Fisheries Commission (ASMFC). Beginning in 2011, states have been allowed to adjust regulations to better meet their fisheries needs. This is important for Maryland since black sea bass support important recreational and commercial coastal fisheries within the state. This management approach was implemented after tagging studies indicated that black sea bass movements are regional rather than coast wide. Black sea bass favor structural habitats such as cold water corals in federal waters (>3 nautical miles offshore), oyster reefs in Chesapeake Bay, and natural hard bottom. The coastal management framework is being evaluated on a yearly basis.

The Chesapeake Bay and Atlantic Coast Black Sea Bass Fishery Management Plan (CBFMP) was adopted in 1996. At that time, the black sea bass stock was overfished. The CBFMP was developed to reduce fishing mortality particularly on juvenile black sea bass. The Chesapeake Bay and coastal bays are nursery areas for juvenile black sea bass which utilize reef structures and submerged aquatic vegetation (SAV). Protecting these two habitats is part of the Chesapeake Bay Program's habitat goals.

Black sea bass are managed coastwide with a joint ASMFC and Mid-Atlantic Fishery Management Council (MAFMC) multispecies FMP that was approved in 1996. Black sea bass are one component of a multispecies FMP that also includes summer flounder and scup. Black sea bass from Cape Hatteras, NC to the US-Canadian border are managed as one stock. The joint coastal FMP implemented permit requirements for charter boats, commercial fishermen, and seafood dealers. Degradable materials were specified and required on all traps and pots to prevent "ghost fishing" by lost gear. Criteria to designate special management zones around artificial reefs were given. A progressive implementation schedule was instituted to increase minimum length, reduce landings, modify gear as specified, and introduce a commercial quota system. Several addenda and one amendment have been developed to make a series of modifications to the overfishing mortality threshold and target exploitation rate. Addenda XXI, XXII, and XXIII provided flexibility for regional management measures during the 2011, 2012, and 2013 fishing seasons, respectively. Since 1996, black sea bass fishing mortality (F) has been reduced and the spawning stock biomass has increased. Maryland is required to complete an annual compliance report for ASMFC.

Stock Status

Black sea bass are protogynous hermaphrodites. They begin life as a female but between ages 2 to 5 (9 – 13") they change sex becoming male. Protogynous species increase the amount of uncertainty associated with stock assessments. A new stock assessment methodology was used in 2009 because of black sea bass' unusual life cycle. Reference points and stock status should be viewed with caution [1].

The Northeast Data Poor Stocks Working Group determined in 2012 that the black sea bass stock is not overfished [2] and overfishing is not occurring. These determinations were made based on revised biological reference points (BRP). The fishing mortality (F) target reference point is 0.42 and the threshold F is 0.44. During 2011 F was 0.21. The spawning stock biomass (SSB) target reference point is 24 million pounds and the threshold SSB is 12 million pounds. The 2011 SSB was 24.6 million pounds. The most recent coastal stock assessment was in 2010 and the next one has not yet been scheduled.

Trawl and beach seine surveys in Maryland's coastal bays are used to monitor black sea bass juvenile abundance. Data from these and other similar surveys indicate that juvenile abundance can be a predictor of adult abundance. In Maryland, the geometric mean catch per unit effort (CPUE) for juveniles has varied annually since the surveys began in 1989. No juvenile CPUE trend is evident for either the trawl or beach seine surveys. Maryland does not collect fishery-dependent black sea bass data.

Current Management Measures

Coastwide, the commercial fishery is allocated 49% of the total allowable catch and the recreational sector is allocated the remaining 51%. The 2013 coastwide commercial quota is 2.17 million pounds and the recreational quota is 2.26 million pounds [4]. Maryland receives 11% of the commercial quota or 240,000 pounds. Within a given fishing season, excess quota in one state can be transferred to another state that has exceeded its quota.

The Maryland commercial black sea bass fishery is under limited entry. To enter the fishery, a licensed fisherman must arrange for a permit transfer. Individual fishing quotas are assigned to each black sea bass permit card. Beginning in 2011, allocation of Maryland's annual black sea bass quota is based on the permit holder's proportion of the prior year's total harvest (in Maryland). Quota reserved for permits holders who do not enter the fishery is reallocated among declared permit holders. However, an individual is not allowed to have >20% of the quota. Overages are deducted from the following year's quota allocation. Quota is allocated among four commercial sectors: 87% pots, 11% trawl, 1% hook and line, and 1% for all other fishing gear. Licensed fishermen without a commercial black sea bass permit card are limited to landing 50 lbs per day. The commercial fishery has an 11" minimum size limit.

Maryland's recreational harvest, combined with Delaware's and Virginia's, is less than three percent of the coastwide harvest. In Maryland, recreational harvest in Chesapeake Bay and coastal waters is managed with a 12½" minimum size and 20 fish per person per day. The recreational fishing season is closed from October 15 to 31.

The Fisheries

Maryland's commercial harvest quota for 2012 was 188,000 pounds and 141,000 pounds were harvested (Figure 1). As of August 2013, 188,000 pounds of Maryland's 240,000 pound quota had been landed.

In Maryland, >75% of the recreational black sea bass fishery occurs in the Exclusive Economic Zone (federal waters) [3]. As of 2012, states have been allowed to establish their own regulations to comply with ASMFC requirements. Recreational quota is not allocated among the states. Instead, a coastwide total allowable landings (TAL) quota is assigned. The recreational TAL for 2012 was 1.32 million pounds and 2.26 million pounds for 2013. Maryland's 2012 recreational harvest was 42, 200 pounds (proportional standard error = 35.1) and has varied little since 2006 (Figure 2) [5, 6].

Figure 1. Black sea bass harvested by the commercial fishery in Maryland: 1950 – 2013 [6,7]. (2013 Preliminary harvest, August 8, 2013 [7)].

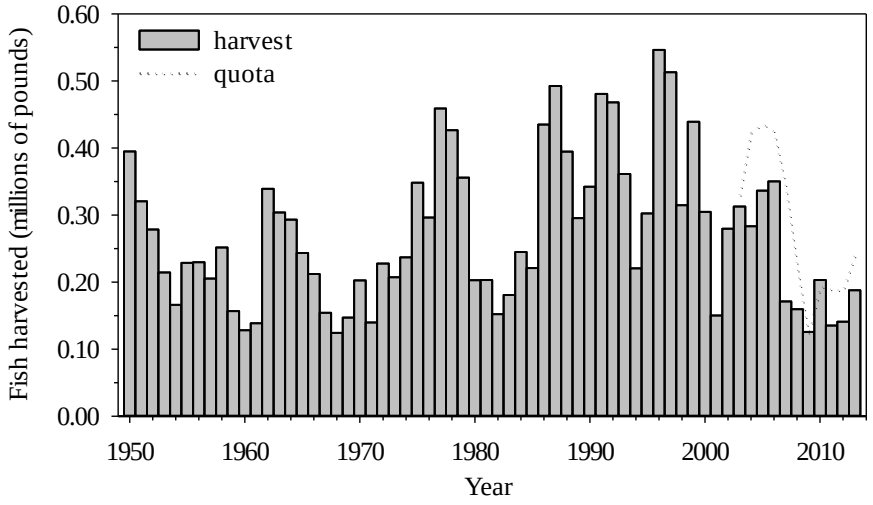
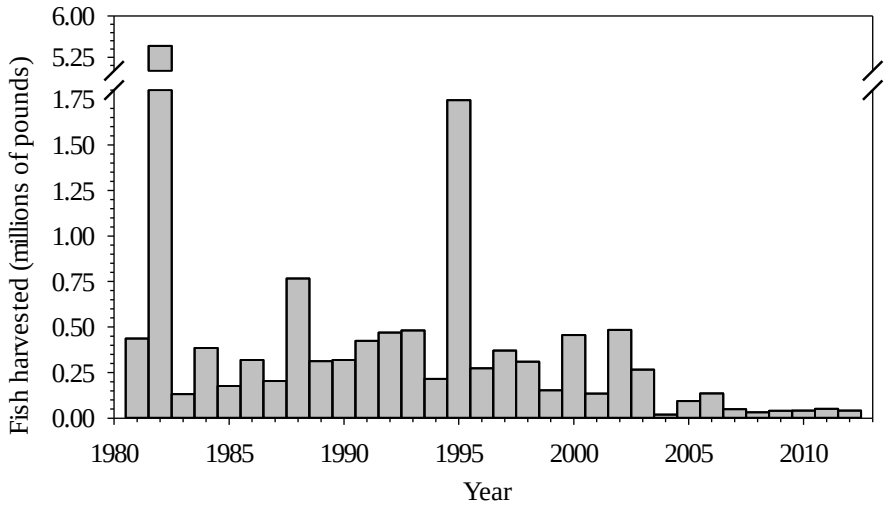


Figure 2. Estimated recreational harvest of black sea bass from Maryland: 1981-2012 [6].



Issues/Concerns

Tagging results indicate that black sea bass migration is limited to regional scales. An age-based model is being used to account for the regional variability. Addenda XXI, XXII, and XXIII have been implemented to facilitate regional management including state-to-state quota transfer. This management framework is being proposed on an annual basis.

A lot of uncertainty exists regarding stock status and the reliability of time series survey data. Even though the stock assessment model has been accepted, caution is advised when establishing catch limits [8].

References

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1996 Chesapeake Bay and Atlantic Coast Black Sea Bass Fishery Management Plan Implementation Table (updated 8/2013)			
Strategy	**Action**	**Date**	**Comments**
1.1) Reduce fishing mortality, increase YPR and provide more escape opportunities for small BSB to the spawning stock. A maximum spawning potential level of 22-30% should be achieved.	1.1a) The Bay jurisdictions will implement a 9" minimum size limit for commercial and recreational BSB fisheries in year 1 (1996) and year 2 (1997) of the plan. Beginning in year 3 (1998), the minimum size will be determined by MAFMC on an annual basis. Regulations will be written so that they are applicable to all fish landed in a state, whether caught in state or federal waters.	1996 1997 Continuing	BSB have exceeded the survey index since 2003 and are not considered overexploited. The minimum size limit for the commercial fishery is 11 inches and for the recreational fishery is 11.5 inches with a 25 fish/day /person creel limit.
		2003	In MD, individual commercial BSB quota and limit are identified on a BSB permit card. Non permitted individuals are limited to landing ≤50 lbs. MD & VA have an 11" minimum size limit for the commercial fishery.
		2004	MD recreational minimum BSB size limit increased to 12.5"with a creel limit of 25/person/day
		2009	VA recreational minimum BSB size limit increased to 12.5"with a creel limit of 25/person/day.
		On-going	No changes in minimum size or creel limit.
	1.1b) Based on the MAFMC Monitoring Committee's evaluation of the success of the FMP relative to the overfishing reduction goal, additional restrictions such as seasonal closures, creel limits, quotas, and limited entry, may be established.	Continuing 2000 2002	Amendment 13 of the MAFMC and ASMFC's Summer Flounder, Scup and BSB FMP changed the management of the commercial fishery from coastal quarterly quotas to state by state allocations. MD and VA will receive 11% and 20% respectively of the commercial TAL in 2005.
		2003	MD is allotted 11% of coastwide landings and VA is allotted 20%. The BSB fishery is open year round in MD & VA until quota is met.
		2010	MD & VA implemented recreational closures from January 1 to May 21 and October 12 to October 31.
		2010	The most recent stock assessment update was in 2010.
		2012	**The black sea bass coastal stock is not overfished and overfishing is not occurring. This determination was based on the 2012 revised coastal BRPs (includes data through 2011).**

1996 Chesapeake Bay and Atlantic Coast Black Sea Bass Fishery Management Plan Implementation Table (updated 8/2013)			
Strategy	**Action**	**Date**	**Comments**
1.2) Management agencies will require the use of escape panels, trawl efficiency devices, selective mesh sizes, culling devices and/or other methods to promote gear efficiency and reduce bycatch.	1.2a) VA, MD, and PRFC will investigate the potential for innovative devices designed to reduce the bycatch of juvenile finfish in non-selective fisheries. Continued testing of these bycatch reduction devices will be encouraged.	2000 Continue	PRFC tested plastic escape panels for pound nets. The device can provide escapement provide escapement for up to 80% of undersized fish.
	1.2b) VA and MD will work with MAFMC/ASMFC to develop and require the use of more efficient gear consistent with policies designed to reduce bycatch and/or discards.	As specified	No specific gear alterations have been recommended.
	1.2c) VA and MD will implement a mesh size of 4.0 inch diamond mesh for trawl vessels harvesting more than 100 pounds of BSB per trip. Changes in minimum mesh size will be implemented based on MAFMC/ASMFC recommendations. VA will continue its ban on trawling in state waters. PRFC will continue its ban on Potomac River.	1996 1980 1981 1992 2004	Mesh size requirements for the commercial fishery are appropriate for the minimum size requirements. MD COMAR 08.02.05.21: Minimum mesh: larger nets are required to possess a minimum of 75 meshes of 4 ½" diamond mesh in the codend or the entire net must have a minimum mesh size of 4 ½" throughout; smaller nets must have 4.5" mesh or larger throughout. Maximum roller rig trawl roller diameter ≤ 18"
	1.2 d) VA and MD will require escape vents in BSB pots, based on the recommendations of MAFMC/ASMFC. The minimum size requirements will be considered after the MAFMC completes its study on escape vents.	Continuing 1996 1996 1996	Chesapeake Bay Program (CBP) jurisdictions are in compliance with vent requirements in pots and traps. MD COMAR: Unobstructed escape vent in holding chamber of at least 2 ½" diameter, if circular, or 2 ½" stretched mesh size if square. 4VAC20-950-40: Two escape vents of 2 ½" circular dimension, 2" square dimension, or 1 3/8" by 5 ¾" rectangular dimension. MD & VA require hinges or fasteners on one side panel or door made of the following materials: a) Untreated hemp, jute, or cotton string of 3/16" or less diameter; b) Magnesium alloy, timed float releases (pop-up devices), or similar magnesium alloy fasteners; or c) ungalvanized or uncoated iron wire of 0.094" or less in diameter.
	1.2e) The jurisdictions will define a BSB pot for enforcement requirements as recommended by the MAFMC.	2002 2008	Was not defined because CBP jurisdictional commercial fishermen use lobster pots and fish traps to catch both lobster and black sea bass. MD COMAR 08.02.05.02: (9) "Fish pot" means a single, finfish entrapment net device, without associated wings or leads, consisting of: (a) An enclosure of various shapes covered with

1996 Chesapeake Bay and Atlantic Coast Black Sea Bass Fishery Management Plan Implementation Table (updated 8/2013)			
Strategy	**Action**	**Date**	**Comments**
			wire, fabric, or nylon mesh webbing of not less than 1 ½" stretched mesh size; (b) One or more conical entrance funnels; (c) One or more unobstructed escape vents, in the holding chamber, of at least 2 ½" in diameter, if circular, or 2 ½" stretched mesh size if square. VA does not have a fish pot definition.
	1.2f) VA and MD will require that BSB pots and traps have biodegradable hinges and fasteners on one panel or door.	1996 Completed 2002	MD & VA require hinges or fasteners on one side panel or door made of the following materials: a) Untreated hemp, jute, or cotton string of 3/16" or less diameter; b) Magnesium alloy, timed float releases (pop-up devices), or similar magnesium alloy fasteners; or c) ungalvanized or uncoated iron wire of 0.094" or less in diameter. Pots and traps having wooden slats will remove one set of parlor slats so it is 1 1/8" apart.
2.1) VA and MD will work with the Institute of Marine Science, Old Dominion, and University of Maryland to promote research concerning the effects of sex-reversal. The stock assessment departments of VMRC, MDNR, and PRFC will continue to collect information on size composition in commercial catches as part of a coastwide effort to monitor the effects of minimum sizes on BSB stocks.	2.1a) Research on effects of hermaphrodism on yield, spawning stock and other parameters will be encouraged. VMRC's stock assessment department, in cooperation with VIMS, will attempt to determine the appropriate size at which sex reversal takes place for BSB in this region.	Continuing 2009	Although the stock has been rebuilt, management measures have been kept conservative because of unknown population dynamics due to hermaphrodism. Increased uncertainty in the stock assessment model, because black sea bass are protogynous hermaphrodites, was incorporated.
	2.1b) VA will continue its annual VIMS Trawl Survey, of estuarine finfish species and crabs found in VA Bay waters, to measure size, age, sex, distribution, abundance, and catch-per-unit-effort (CPUE).	1997 2002 Continuing	BSB were sporadically caught during the 2002-2006 trawl surveys. The majority of BSB abundance and biomass exist in Virginia waters of the Chesapeake Bay. Typically, BSB are first observed during the summer and peak during the fall portions of the survey. BSB may be observed during spring trawls. BSB caught range from ~70 mm to 270 mm total length. In 2002 to 2003 80%-90% were age 1 ranging from ages 0 to 2 From 2002 to 2006 >75% were female, except in 2004 (57%), and 50% maturity was at 228 mm. 17%-20% caught from May-September were male.
2.2) The jurisdictions will promote research to define movements and mortality of BSB between state and federal waters.	2.2a) VMRC's Stock Assessment Program will continue to collect biological data (age, size, sex) from commercial catches of BSB.	Continuing	Biological data is used for the coastal stock assessment.
	2.2b) Research on migration of BSB between inshore and offshore areas will be encouraged. Tagging experiments to provide data on BSB migration may be funded from sales of VA saltwater fishing licenses.	Continuing	In VA, black sea bass is 1 of 10 species currently being tagged in the Virginia Volunteer Angler Gamefish Tagging Program.
	2.2c) PRFC will collect information on BSB harvested and discarded in the Potomac River pound	Continuing	PRFC continues to collect BSB harvest data.

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Strategy	**Action**	**Date**	**Comments**
	net fishery as part of a two year pound net study funded by the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA).		
2.3) MD, VA and PRFC will continue to support interjurisdictional efforts to maintain a comprehensive database on a baywide scale.	2.3a) The jurisdictions will collect information on commercial landings.	2008 2010	MD does not have a fishery-dependent monitoring program. Data is occasionally collected from the recreational for-hire fishery. Northeast Data Poor Stocks Working Group determined that BSB are undergoing overfishing, but the stock is not overfished. ASMFC Technical Committee declared stock rebuilt. Revised BRPs are $F_{40\%}$ = 0.42 and $SSB_{40\%}$ = 27.6 million pounds. Overfished threshold is $SSB_{threshold}$ = 13.8 million pounds ($\frac{1}{2}SSB_{40\%}$). In 2011 F = 0.21 and SSB = 24.6 million pounds. Well within BRPs.
	2.3b) VA will continue to supplement MRFSS data with more detailed catch statistics at the state level.	1996-1997 2012	MRFSS is used to collect recreational catch data. MRFSS has been replaced with the MRIP survey.
	2.3c) MD will require mandatory reporting for all black sea bass landed in Maryland, wherever harvested.	Continue	Data is included in commercial fishery statistics.
3.1a) Restoration of aquatic reefs would lead to increased habitat for black sea bass. Jurisdictions will continue to expand and improve their current oyster restoration programs with periodic program evaluations to ensure maximum success. Specific attention should be focused on aquatic reefs in the salinity range of the black sea bass.	3.1aA) MD and VA will continue implementation of the 1994 Oyster FMP which combines the recommendations of both the VA Holton Plan and the MD Roundtable Action Plan.	Continued 2008 On-going	CBP jurisdictions developed a 2004 Oyster Management Plan (2005) which combines the FMP and habitat objectives. It includes reef development using reclaimed and fresh oyster shell, oyster repletion and oyster sanctuary and harvest reserve areas. Maryland is currently managing oyster restoration under the Maryland 10-point Action Plan. *Crassostrea virginica* (native oyster) and not *Crassostrea ariakensis* (Asian oyster) will be used for reef development following the Environmental Impact Statement for Oyster Restoration in Chesapeake Bay Including the Use of a Native and/or Nonnative Oyster. Maryland is implementing a 10-point Oyster Restoration and Aquaculture Development Plan. Theplan increases the network of oyster sanctuaries from 9% of available habitat to 25%. The priority targeted restoration area is in Harris Creek
	3.1aB) MD and VA will continue the implementation of the Aquatic Reef Habitat Plan.	Continued 2007 Continue	Artificial Reef Committee, Maryland Artificial Reef Initiative, and Maryland's Artificial Reef Management Plan were developed and several reefs have been created in Bay and the Atlantic Ocean. Reefs are qualitatively monitored with underwater video.

1996 Chesapeake Bay and Atlantic Coast Black Sea Bass Fishery Management Plan Implementation Table (updated 8/2013)			
Strategy	**Action**	**Date**	**Comments**
		2010 On-going	ARC and MARI have begun support for shallow water (<20 ft.) reef projects. For a complete list of reef sites go to http://www.dnr.state.md.us/fisheries/reefs/
3.1b) The creation of new artificial reefs and the expansion and improvement of preexisting reefs will provide additional habitat for the BSB population.	3.1bA) Jurisdictions will continue to maintain, expand, and improve their artificial reef programs.	Continuing 1996-2006 2007 2008 Continue 2011	In VA, artificial reefs are being funded through Recreational Advisory Board. All artificial reefs created by funds from recreational license revenues adhere to the gear type prohibition. MD terminated its program in 1996. Artificial reef development was administered in the Chesapeake Bay by MD Environmental Service and in the Atlantic Ocean by the Ocean City Reef Foundation (OCRF). MD Artificial Reef Committee and the MD Artificial Reef Initiative (MARI) were established to develop reefs in cooperation with OCRF. Both MARI and OCRF accept private donations while MD contributes funds when available for reef development projects. 44 NY subway cars were deployed off Ocean City. USN Destroyer *Radford* is being prepared for reefing. Ship continues to be tested for contaminants. Additional funding is required. Permits are pending. OCRC continues to deploy small steel hulled vessels and concrete material for reef development. USN Destroyer *Radford* was reefed on August 10, 2011. The vessel has since broken into 3 pieces but remains upright.
	3.1bB) VA recently prohibited use of all gear except recreational rod and reel, hand-line, spear, or gig on four artificial reefs in state waters.	Continuing 1998	MD and VA both adopted legislation that prohibits hydraulic clamming (and crab dredging in VA) in or near SAV beds.
3.2) Jurisdictions will continue efforts to "achieve a net gain in submerged aquatic vegetation distribution, abundance, and species diversity in the Chesapeake Bay and its tributaries over current populations	3.2a) Protect existing SAV beds from further losses due to degradation of water quality, physical damage to plants, or disruption to the local sedimentary environment as recommended by Chesapeake Bay SAV Policy Implementation Plan. • Protect SAV and potential SAV habitat from physical disruption. Implement a tiered approach to SAV protection, giving highest priority to protecting Tier I and II areas but also protecting Tier III areas from physical disruption.	Continue	MD implemented a living shorelines program in 1970 to encourage vegetative shoreline stabilization. Regulations are in place to prohibit dredging through SAV beds. Tiered designation and prioritization of SAV beds has not been implemented. Avoidance of dredging, filling and construction impacts to SAV is strictly enforced by MDE and USACE with input from DNR, USFWS, and NMFS.

1996 Chesapeake Bay and Atlantic Coast Black Sea Bass Fishery Management Plan Implementation Table (updated 8/2013)			
Strategy	**Action**	**Date**	**Comments**
	• Avoid dredging, filling or construction activities that create turbidity sufficient to impact nearby SAV beds during the SAV growing season. • Establish an appropriate undisturbed buffer around SAV beds to minimize the direct and indirect impacts on SAV from activities that significantly increase turbidity. • Preserve natural shorelines. Stabilize shorelines, when needed, with marsh plantings as a first alternative. Use structures that cause the smallest increase in local wave energy where planting vegetation is not feasible. • Educate the public about the potential negative effects of recreational and commercial boating on SAV and how to avoid or reduce them.	2003 2011 2008	MD has not established undisturbed buffers. VA has established buffer criteria. The revised SAV goal adopted by Chesapeake Bay Program is restoration of 185,000 acres of SAV by 2010 and planting 1,000 acres of SAV by 2008. Only 15% of restoration target was met by 2008. There's been very little long-term survival from SAV plantings. STAC reviewed the SAV restoration projects during 2011and concluded that the projects were operationally successful but functionally unsuccessful. The restoration planting goal was revised to 20 acres per year. MD legislated that shoreline stabilization projects must use living shoreline techniques unless demonstrated to be infeasible.
	3.2b) Set and achieve regional water and habitat quality objectives that will result in restoration of SAV through natural revegetation as recommended by the Chesapeake Bay SAV Policy Implementation Plan.	Continuing	Water quality criteria have been adopted http://www.chesapeakebay.net/restoringwaterquality.aspx?menuitem=14728.
	3.2c) Set regional SAV restoration goals in terms of acreage, abundance, and species diversity considering historical distribution records and estimates of potential habitat as recommended by the Chesapeake Bay SAV Policy Implementation Plan.	2003 2011 On-going	Bay wide SAV restoration goal was 1,000 acres planted by 2008. Restoration planting goal was revised to 20 acres per year. Little progress has been made since 2010. **Two acres were planted in 2012.** See Chesapeake Bay Program website for updates on SAV restoration. http://www.chesapeakebay.net/indicators/indicator/planting_bay_grasses
3.3) Establish a goal of no net loss of wetlands and a long term goal of a net resource gain for tidal and nontidal wetlands as recommended in the Chesapeake Bay Wetlands Policy.	3.3) Jurisdictions should strive towards achieving the following, especially in the salinity range of BSB. • Define the resource through inventory and mapping activities. • Protect existing wetlands. • Rehabilitation, restoring and creating wetlands. • Improving education. • Further research.	Continuing 2006 Continuing 2006 Continue 2009	Programs have been expanded to the tributaries. GIS mapping activities are underway to target protection and restoration efforts habitat resources, but habitats are not targeted for a single, specific species' benefit. MD developed a Blue Infrastructure that includes mapping of BSB habitats such as structural habitat and SAV. MD developed a Blue Infrastructure that includes mapping structural habitat and SAV. Wetland mosquito ditches from the 1930s-1940s are being

1996 Chesapeake Bay and Atlantic Coast Black Sea Bass Fishery Management Plan Implementation Table (updated 8/2013)			
Strategy	**Action**	**Date**	**Comments**
		Continue **2012**	plugged to reduce tidal flow and restore wetland hydrology and function. Wetland enhancement and restoration is tracked cumulatively among tidal and non-tidal wetlands and salinity regimes. Between 2010 and **2012**, wetland acres established or re-established in **MD = 1,646** and in **VA = 16,853**. Wetland acres enhanced or rehabilitated since 1998 among Chesapeake Bay jurisdictions is **107,239**. See Chesapeake Bay Program website for updates on wetland rehabilitation and restoration. http://www.chesapeakebay.net/indicators/indicator/wetlands_enhancement_and_rehabilitation http://www.chesapeakebay.net/indicators/indicator/restoring_wetlands
3.4) Jurisdictions will continue efforts to improve baywide water quality through the efforts of programs established under the 1987 Chesapeake Bay Agreement. In addition, the jurisdictions will implement new strategies, based on recent program reevaluations, to strengthen deficient areas.	3.4a) Based on the 1992 baywide nutrient reduction plan reevaluation, the jurisdictions will: • Expand program efforts to include tributaries. • Intensify efforts to control nonpoint sources of pollution from agriculture and developed area. • Improve on current point and nonpoint source control technologies.	Continue 2009 2012/2013	Maps that indicate regions of concerns for living resources have been developed. See Chesapeake Bay Program website for updates on nutrient reduction. http://www.chesapeakebay.net/status_reducingpollution.aspx?menuitem=19859. President Obama executive order recommitting federal agencies to Bay restoration and regulatory enforcement. The Chesapeake Bay Program is drafting a new Watershed Agreement with proposed outcomes for water quality and nutrient reduction.
	3.4b) Based on the 1994 Chesapeake Bay Toxics Reduction Strategy Reevaluation Report, the jurisdictions will emphasize the following four areas: • Pollution Prevention: Target "Regions of Concern" and "Areas of Emphasis. • Regulatory Program Implementation: Insure that revised strategies are consistent with and supplement pre-existing regulatory mandates. • Regional focus: Identify and classify regions according to the level of contaminants.	Continue	See Chesapeake Bay Program website for updates on nutrient reduction. http://www.chesapeakebay.net/status_reducingpollution.aspx?menuitem=19859 Chesapeake Bay Program is monitoring levels of mercury, PCBs, PAHs, organophosphate and organochloride pesticides.

1996 Chesapeake Bay and Atlantic Coast Black Sea Bass Fishery Management Plan Implementation Table (updated 8/2013)			
Strategy	**Action**	**Date**	**Comments**
	• Directed Toxics Assessment: Identify areas of low level contamination, improve tracking and control of non-point sources.		
	3.4c) The jurisdictions will continue to develop, implement and monitor their tributary strategies to improve bay water quality.	Continuing	Ambient water quality criteria of DO, water clarity, and chlorophyll-a have been adopted for the Chesapeake Bay (April 2003).

Acronyms

ASMFC – Atlantic Marine Fisheries Commission
BSB – Black Sea Bass
CB – Chesapeake Bay
COMAR – Code of Maryland
CPUE – Catch per Unit Effort
DO – Dissolved Oxygen
F – Fishing Mortality
FMP – Fisheries Management Plan
GIS – Geographic Information System
MAFMC – Mid-Atlantic Fisheries Management Council
MDE – Maryland Department of the Environment
MDNR – Maryland Department of Natural Resources
MRFSS – Marine Recreational Fisheries Statistics Survey
NMFS – National Marine Fisheries Service
PAH – Polycyclic Aromatic Hydrocarbon
PCB – Polychlorinated Biphenyl
PRFC – Potomac River Fisheries Commission
SAV – Submerged Aquatic Vegetation
SSB – Spawning Stock Biomass
STAC – Scientific and Technical Advisory Committee
TAL – Total Allowable Catch
USACE – U.S. Army Corps of Engineers
USFWS – U.S. Fish and Wildlife Service
VAC – Code of Virginia
VIMS – Virginia Institute of Marine Science
VMRC – Virginia Marine Resource Commission
YPR – Yield per Recruit

2012 Maryland FMP Report (June 2013)
Section 7. Blue Crab (*Callinectes sapidus)*

The female-specific biological reference points (adopted in 2011) were used to assess the blue crab stock in Chesapeake Bay. Overfishing is not occurring and the stock is not overfished. Although current abundance is below the target level, abundance is above the threshold (the minimum number of female crabs) and has increased since 2011. The recruitment estimate for 2012 was the largest value recorded over the last 24 years (Figure 1) but survival was low based on the 2012-2013 winter dredge survey (WDS) results. Since the number of spawning-age female crabs is still below the target, conservative management measures have been continued.

The Chesapeake Bay Program (CBP) adopted a Blue Crab Fishery Management Plan (FMP) in 1989. The plan was revised in 1997 with the following objectives: provide long-term protection for the blue crab stock and maintain a stable stock; establish quantitative targets (such as abundance, biomass, or other indices) and biological reference points. In 2003, Amendment #1 to the 1997 CBP Blue Crab FMP was adopted. The purpose of Amendment #1 was to formally adopt biological reference points for managing the resource; to reaffirm strategies for reducing fishing effort; and to recognize the importance of biological monitoring, habitat protection and ecosystem processes. Amendment #2 was developed in 2011 to formally adopt the new female-specific reference points and to recognize the importance of fishery-independent and fishery-dependent monitoring. Amendment #2 was incorporated by reference into Maryland regulation in September 2012.

Stock Status

The Chesapeake Bay blue crab stock is currently not overfished and overfishing is not occurring. A stock assessment was completed and peer reviewed in 2011. The 2011 stock assessment used an integrated estimate of management reference points and stock status. Previous stock assessments did not directly link the two parameters. As a result of the 2011 stock assessment, new female-specific biological reference points (BRPs) based on estimates of age 0+ female crabs (the exploitable stock) and the abundance of age 1+ female crabs (an index of the spawning stock) were adopted. A comparison of the former and current BRPs is found in Table 1. The new BRPs changed the historical perspective of the stock. Under the new BRPs, the female spawning stock would have been considered overfished from 2001-2003 (Figure 2).

In order to ensure that male abundance does not drop below a critical level relative to female abundance, the Bay jurisdictions developed conservation points of reference for male crabs. The points of reference for 2012 were a male exploitation fraction <66% and a male to female operational sex ratio > 0.57. After applying these reference points to the 2012-2013 monitoring data, there was no detectable relationship between the sex ratio and male exploitation and, therefore, not biologically meaningful. New criteria for determining management action on male blue crabs are recommended (2013 Chesapeake Bay Blue Crab Advisory Report). No additional management actions for male crabs are recommended at this time.

The Baywide winter dredge survey (WDS) is the primary indicator of blue crab stock status in Chesapeake Bay. The WDS provides an annual estimate of over-wintering blue crab abundance by age and gender. The abundance of female spawning age crabs (age 1+) is used to determine if the population is overfished. The results of the 2012-2013 WDS indicated that there were 147 million age 1+ blue crabs. This number is below the recommended target but above the new threshold (Figure 2). The number of spawning- age female crabs increased by over 50% since 2012.

Management Measures

A control rule for the blue crab stock has been used to assess the status of the stock since 2001. Control rules describe a variable as a function of another variable that management can influence or have some control over[2]. Determining the variables depends on the characteristics of the stock and the fishery. These variables are then used to develop definitions of biological reference points, i.e., targets and thresholds. In developing a control rule, the selection of a target is risk-averse even though it is expected that the target may be exceeded because of natural annual variability. Currently, the control rule for blue crabs is based on spawning stock biomass and exploitation.

In Maryland, catch limits and closed periods are implemented to maintain an allowable female harvest that is associated with the 46% exploitation target. The allowable female harvest changes with estimated annual abundance. Maryland DNR determines the allowable harvest and then develops a suite of limits designed to achieve but not exceed the allowable harvest. The crabbing industry provides input on which combinations of limits work best for the industry via the Blue Crab Industry Advisory Committee.

The Fishery

As the population level increases, maintaining the exploitation target results in an increase in harvest. The 2012 baywide (Maryland & Virginia) commercial harvest was approximately 62.6 million pounds (Figure 3) which resulted in a 23% exploitation rate. The percentage of females removed by harvest in 2012 was approximately 10% which was well below the recommended target (25.5%) and threshold (34%) (Table 1). Recreational harvest is assumed to be approximately 8% of the total harvest. Since recreational crabbers can no longer harvest female crabs the estimated harvest is now based on 8% of the male harvest or 3.9 million pounds baywide. Adding up the harvest from each fraction of the harvesting sectors and

across the entire Chesapeake Bay, the 2012 total harvest was approximately 60.o million pounds, a slight decrease from 71.6 million pounds in 2011.

Issues/Concerns

Although management measures have successfully allowed the blue crab population to increase over the last few years, conservation measures need to remain in place to ensure that the population remains robust and at target levels. The blue crab population is subject to naturally high variability from year to year due to environmental factors. For example, during 2010-2011, the extremely cold winter weather resulted in about a 30% winter kill of adult crabs. In the previous winter season there was about an 11% mortality rate. In addition, recruitment is strongly influenced by environmental factors and can affect the number of juveniles that enter into the population. These factors emphasize the need to determine an appropriate margin of conservation to account for environmental variability.

Latent effort – the number of people holding fishing licenses that have not been actively harvesting crabs but could return to the fishery at any time – continues to be a management concern. Maryland and Virginia have been successful at reducing the number of people holding crabbing licenses through a federally funded license buy-back program in 2009 and 2010 but more could still be done. New methods for calculating recreational catch and effort is also needed to fully characterize total removals by the fishery. Maryland is developing new recreational blue crab regulations through the regulatory scoping process. Proposed recreational regulations should be available by September 2013.

Maryland DNR received federal disaster funding in 2008 (through 2012) to assist management efforts and to mitigate impacts to watermen from a declining blue crab fishery. The Maryland General Assembly also directed capital funding towards the efforts. Funding has been used for buying back commercial blue crab licenses; evaluating alternative management systems for the blue crab fishery; providing quality assurance of crabmeat products; creating new marketing programs and economic opportunities; removing derelict (ghost) pots; and seeking sustainability certification for the blue crab fishery and industry. During 2012, a pilot study led by an industry-based group, tested a new way to accurately report harvest data in a more timely fashion using electronic technology. This is a new co-management approach between the crab harvesters and MDNR. The new electronic reporting method will continue during 2013.

Maryland began a text messaging system to help watermen stay abreast of blue crab regulations and any seasonal changes that may occur. Watermen can subscribe to receive text message reminders a day or two before a regulation change goes into effect.

Enforcement

The enforcement of commercial and recreational fishing regulations is critical to management success. Some of the federal disaster money has been directed to improving enforcement of blue crab conservation/management measures. In Maryland, the Natural Resource Police (NRP) hired additional officers to provide a dedicated enforcement effort for crab management. The NRP has successfully increased the total number of enforcement hours, dedicating over 11,000 hours to crab enforcement.

Conclusion

The Bay jurisdictions will continue to investigate alternative strategies to improve management of the blue crab resource. The jurisdictions will continue to examine ways to address effort in the fishery. Although harvest accountability and reporting for both the commercial and recreational fisheries have improved, more improvements are needed. Since female abundance is not at target levels, the jurisdictions need to maintain conservative management measures and make adjustments to ensure that harvest levels are commensurate with abundance indices.

Table 1. Comparison of the female-specific biological reference points (adopted in 2011) and the combined sexes biological reference points (former).

	Reference Points		Stock Status		
	Target	**Threshold**	**2011**	**2012**	**2013**
Female-specific Exploitation Fraction	**25.5%**	**34%**	25%	10%	TBD*
Former Exploitation Fraction (males & females)	46%	53%	45%	23%	TBD*
Abundance (millions of female crabs)	**215**	**70**	190	97	147
Former Abundance (millions of male & female crabs)	200	86	254	178	189

(2013 Chesapeake Bay Blue Crab Advisory Report) *Exploitation fraction cannot be calculated until the 2013 harvest data is complete

References

[1] Miller, T., Wilberg, M., Davis, G., Sharov, A., Colton, A., Lipcius, R., Ralph, G., Johnson, E., and Kaufman, A. 2011. Stock Assessment of the Blue Crab in Chesapeake Bay. Tech. Rept. Series No. TS-614-11 of the University of Maryland Center for Environmental Science

[2]Restrepo, V. and J. Powers. 1999. Precautionary control rules in US fisheries management: specification and performance. ICES Journal of Marine Science, 56:846-852

Figure 1. Index of total blue crab abundance (density of all crabs, all sizes) from the Winter Dredge Survey 1990-2012 with 95% confidence interval bars.

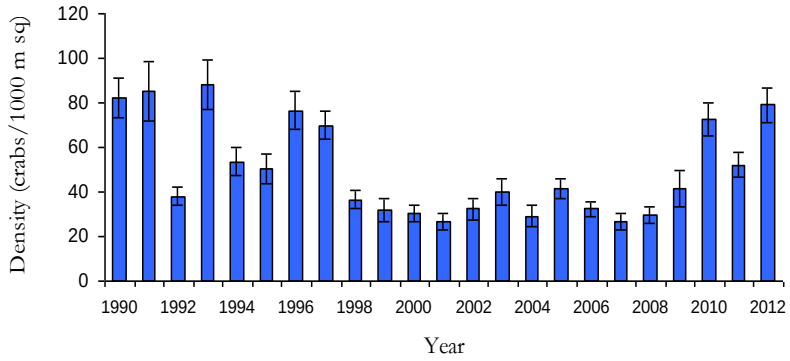
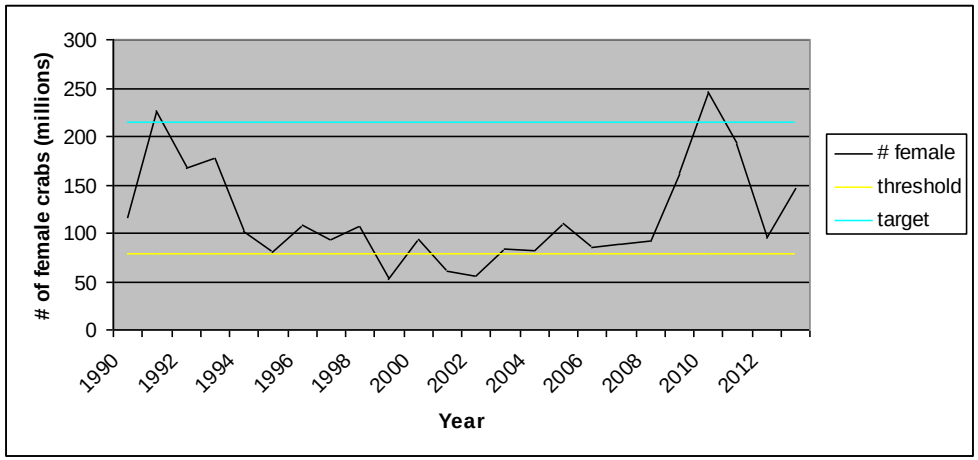
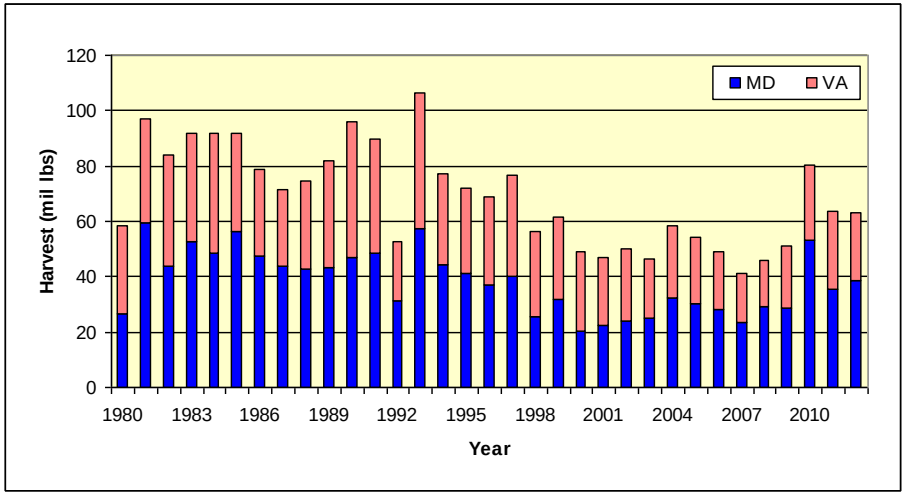


Figure 2. Number of spawning age female crabs in Chesapeake Bay, 1990-2013



MDNR/VIMS Data

Figure 3. Chesapeake Bay Commercial Blue Crab Harvest, 1980-2012



MDNR & VMRC data

2003 Chesapeake Bay Program Blue Crab Fishery Management Plan Amendment (updated 06/2013**)**			
Problem Area	**Action**	**Date**	**Comments**
Stock Status Strategy Chesapeake Bay stock has stabilized at historically low levels but continues to be at risk for recruitment failure.	Action 1 CBP jurisdictions will adopt a threshold fishing mortality rate that preserves 10% of the blue crab spawning potential, relative to an unfished stock, and a minimum stock size threshold.	Began in 2001; formally adopted in 2003 2011 Continue	The 2005 Stock Assessment recommended using the exploitation fraction (the proportion of the vulnerable population that is harvested each year) instead of F for evaluating BRPs. The 2010 exploitation estimate was below the threshold and has been below the threshold since 2008. As a result of the 2011 stock assessment results, new female-specific targets and thresholds were adopted. The new female target and threshold are 215 million female crabs and 70 million female crabs, respectively. **Female abundance is currently below the target level.**
	Action 2 CBP jurisdictions will adopt a target fishing mortality of F_{20}, which if achieved, will increase the blue crab spawning potential from 10% to 20% relative to that of an unfished stock.	Began in 2001; formally adopted in 2003 Continue	The target fishing mortality (F) was replaced by the exploitation target of 46%. As a result of the 2011 stock assessment results, the female-specific exploitation target and threshold are 25.5% and 34%, respectively. **The 2012 female-specific exploitation was 10%, well below the target level.**
	Action 3 CBP jurisdictions will develop control rules based on the biological reference points (BRPs) for managing the blue crab resource. (The control rule was adopted in 2001 and updated in the 2005 stock assessment. It represents the relationship between adult crab abundance, exploitation and management reference points. **The new 2011 control rule is a major improvement over the previous model because it integrated the calculation of reference points within the model rather than using two separate processes as in the 2005 assessment.)**	2003 2005 2006 2008 **2011**	In 2006 the overfishing limit was defined as 86 million age 1+crabs (threshold value). An interim target of 200 million age 1+ crabs was established in 2008. The blue crab stock was not overfished in 2010. **Based on the new female-specific BRPs, the blue crab stock is not overfished and overfishing is not occurring.**

2003 Chesapeake Bay Program Blue Crab Fishery Management Plan Amendment (updated 07/2012)

Problem Area	Action	Date	Comments
	Action 4 CBP jurisdictions will utilize the results of fishery-independent surveys to determine stock status.	On going	**Results of the 2012-2013 Winter Dredge Survey (WDS) indicated the abundance of female age 1+ crabs was 147 million crabs. Spawning-age crab abundance was below the target but above the threshold.**
Fishing Effort Strategy CBP jurisdictions will adjust fishing effort to achieve the adopted BRPs.	Action 5 CBP jurisdictions will reduce the exploitation rate of legal-sized blue crabs to meet the target BRPs.	Began in 2001; continue 2008 2011	The Bay jurisdictions implemented new regulations in 2008 & 2009 to reduce exploitation on female crabs. Harvest regulations have been adjusted as needed to meet the target exploitation rate. In 2011, exploitation rates were changed to female-specific rates. Exploitation rates have been below the target since 2010. The 2011 baywide harvest was 71.6 million lbs. and **the 2012 baywide harvest was 60.0 million lbs.** There is a large amount of latent effort in the blue crab fishery (latent effort = fishing effort not currently utilized). In MD there are approximately 6,000 individuals with commercial crab licenses but only about 2,000 are actively crabbing. MD has implemented a buy-back program for LCC (limited crab catcher) licensees. VA has also implemented a buy-back program and utilized a reverse auction system. Between 2009 and 2010, MD reduced the LLC by about 700 licensees resulting in about a 35,000 pot reduction in effort. **The states will continue to explore other methods of reducing latent effort. The 2013 Chesapeake Bay Blue Crab Advisory Report recommended further evaluation of latent and active effort.**
Monitoring Strategy CBP jurisdictions will collect fishery -	Action 6 CBP jurisdictions will continue to monitor blue crab resources in the bay and work towards developing a baywide monitoring	On going	In 2010/2011, recruitment, as measured by the abundance of age 0 crabs in the WDS, remained low and was below the average recruitment of 258

2003 Chesapeake Bay Program Blue Crab Fishery Management Plan Amendment (updated 07/2012)			
Problem Area	**Action**	**Date**	**Comments**
dependent and fishery-independent data on blue crab resources.	approach		million crabs. Although the number of juveniles had declined, it was one of the largest juvenile abundance indices since 1998. In 2011/2012, recruitment was the highest on record. **The 2012-2013 WDS results indicate that recruitment has declined by almost 50%.**
Habitat Strategy CBP jurisdictions will identify and protect critical blue crab habitat.	Action 7 MD and VA will consider designating additional sanctuary areas to protect blue crab habitat based on new research data.	Continue	Closure of the VA blue crab spawning sanctuary (928 square miles) was extended an additional month (May-Sept) to protect female crabs. The EBFM life history brief indicates that blue crabs occupy a wide range of estuarine habitats and utilize a series of habitats sequentially along a salinity gradient.
	Action 8 CBP jurisdictions will continue to protect SAV in potential, post-larval settlement areas.	Continue	Sav beds in near shore habitats provide essential habitat for blue crabs, especially during their post larval and juvenile stages. SAVs provide critical shelter for many key species besides crabs. SAVs help improve water clarity, add oxygen to the water, and reduce shoreline erosion.
	Action 9 CBP jurisdictions will restore and protect SAV in the Chesapeake Bay to achieve the new goal of 185,000 acres by 2010.	Continue	Actions have been identified by CBP jurisdictions to achieve this goal, including the attainment of water quality in shallow-water bay grass designated use areas. In 2009, there were 85,899 acres of bay grasses throughout the Bay, which was 46 percent of the goal and an increase of 9,039 acres from 2008. SAV in 2011 decreased by 21% to an estimated 63,074 acres compared to an estimated 79,664 acres in 2010. Three factors contributed to the decrease: the hot summer in 2010 caused a die-off of grasses; heavy rains in spring 2011 decreased water clarity; and then fall 2011 the hurricane added additional sediment. **In 2012, there were an estimated 48,191 acres of underwater grasses in the Chesapeake Bay, 26% of the 185,000-acre goal.**

2003 Chesapeake Bay Program Blue Crab Fishery Management Plan Amendment (updated 07/2012)			
Problem Area	**Action**	**Date**	**Comments**
Ecosystem strategy CBP jurisdictions will incorporate information on ecosystem processes relating to blue crabs as it becomes available and utilize the information to determine management actions as necessary	Action 10 CBP jurisdictions recognize the value of salt marsh-fringed habitats and will promote the protection and restoration of marsh-fringed shorelines, creeks and coves	Continue	Salt marsh habitats protect molting blue crabs and support many other prey species. These areas are susceptible to shoreline development and should be protected.
	Action 11 Utilize the guidelines from the Fisheries Ecosystem Plan (FEP) to incorporate multi-species and ecosystem considerations into existing CBP fishery management plans.	Began 2005 Continue	A new EBFM operational structure was facilitated through MSG. An EBFM blue crab species team was formed in late 2008. The team completed biological briefs on important blue crab issues. This information is available at **http://www.mdsg.umd.edu/programs/policy/ebfm/** The recommendation from the group is to use the briefs when the Blue Crab FMP is revised.
	Action 12 As data becomes available on food web dynamics, adjust fishing mortality rates on the blue crab population to include predator and prey needs.	On-going	Blue crabs play an important role in the food web of the bay. They are prey for important species of finfish and are predators on other species such as mollusks. Blue crabs play a key role in the trophic dynamics of the Bay & are considered the foremost benthic consumer in the Bay foodweb.
	Action 13 Evaluate the impact of non-native crab introductions on the blue crab population and develop recommendations accordingly.	On-going	There is concern over the interaction of blue crabs with non-native species of crabs, which include the green, mitten and Japanese shore crab. In 2006 MD adopted regulations that prohibit the transport of green or Japanese crabs. MD also adopted regulations to prohibit the import, transport, purchase, possession, sale or release of mitten crabs. The states have implemented education and outreach programs to highlight the problems associated with invasive species.

Acronyms:
BRP= biological reference points
CBSAC= Chesapeake Bay Stock Assessment Committee
CBP= Chesapeake Bay Program
EBFM = Ecosystem based fisheries management
FMP = Fishery Management Plan
MSG = Maryland Sea Grant
QET = Quantitative Ecosystem Team

2012 Maryland FMP Report (July 2013)
Section 8. Bluefish (*Pomatomus saltatrix*)

Chesapeake Bay FMP

Bluefish are popular with recreational anglers because they are strong fighters. Commercial fisheries are relatively minor due in part to the lower food value: flesh is less firm, spoils quickly in warm weather, and does not freeze well. Bluefish are pelagic and migrate seasonally between Maine and Florida. Estuaries and other nearshore habitats are used as nurseries and by juveniles.

The Chesapeake Bay Bluefish Fishery Management Plan (CBFMP) was adopted in 1990 and amended in 2003. The CBFMP Amendment #1 adopted the Mid-Atlantic Fisheries Management Council (MAFMC) and the Atlantic States Marine Fisheries Commission (ASMFC) coastal overfishing definition and rebuilding schedule. Furthermore, CBFMP Amendment #1 introduced ecosystem based management by incorporating water quality improvements, habitat conservation, and multi-species interactions into the management process.

The coastal bluefish stock is jointly managed under the MAFMC/ASMFC FMP. The coastal FMP was initially developed to address the concerns raised by recreational fishermen about harvest by tuna purse seine fisheries. The bluefish FMP is the first FMP developed jointly by an interstate commission and regional fishery management council. The MAFMC/ASMFC FMP was amended in 1998 to prevent recruitment overfishing, reduce fishing waste, improve cooperative management among states, maximize availability, and improve biological understanding. Maryland is required to submit an annual compliance report to ASMFC. The compliance report describes the fishery dependent and independent monitoring, current regulations, commercial and recreational landings, and planned management actions [1]. Addendum I to Amendment 1 was approved in February of 2012. The goal for Addendum 1 was to significantly increase the amount of bluefish age and length data collected annually [2]. States having >5% of bluefish harvest, plus Virginia, were required to increase sampling; Maryland is not one of those states.

Stock Status

There is no formal Chesapeake Bay stock assessment. Bluefish stock status is derived from the Atlantic coast stock assessment. A stock assessment was completed in 2012 [3]. The bluefish stock has been rebuilt since 2008; it is not overfished and overfishing is not occurring [3,4]. Catch and juvenile recruitment were included in the age-structured assessment program (ASAP) model to estimate fishing mortality (F) and stock biomass. Fishing mortality in 2011 was 0.114 which is less than the target F_{MSY} of 0.19. Fishing mortality has remained low since 2000. Total stock biomass in 2011 was 293 million lbs which was below the target biomass of 324 million lbs but above the threshold biomass of 162 million lbs [3]. Stock biomass was stable, however, biomass is projected to decline based on declining abundance and poor recruitment from 2009-2011 [3].

Current Management Measures

Annual stock assessments are used to set yearly TACs. Bluefish allocation, among coastal jurisdictions and fisheries, is based on historic landings data (1981-1989).. Seventeen percent of the total allowable catch (TAC) is allocated to the commercial fishery and the other 83% of the TAC is allocated to the recreational fishery. The commercial TAC is managed with state-by-state quotas. Maryland receives 3% of the coastwide commercial quota [4].

The 2013 Atlantic coast TAC was 9.08 million pounds for the commercial fishery and 14.1 million pounds for the recreational fishery[5]. Maryland's 2013 commercial quota is 272,000 pounds [5]. The bluefish season is open all year (January 1 – December 31) for both the commercial and recreational fisheries. Maryland's minimum size limit is 8" for the commercial and recreational fisheries. The recreational fishery has a daily limit of 10 fish per person in Maryland state waters.

The Fisheries

Maryland's commercial landings in 2012 were 149,000 pounds [6] (Figure 1). Recreational catch estimates have been revised as a part of the Marine Recreational Information Program (MRIP). Catch estimates have been recalculated for 2004-2011 to provide more accurate estimates and replace those previously made by the Marine Recreational Fisheries Statistics Survey (MRFSS). The MRIP estimate was 114,000 fish for the Maryland recreational fishery in 2012[6] (Figure 2)**.**

Issues/Concerns

A single-age key was developed from limited data and is used in the assessment of the coastwide stock. States are encouraged to increase collection of age data for a broader size range [4]. Additional age/length data is needed to address shortcomings in the stock assessment model.

Discard mortality may be an important factor for bluefish stock assessments. Recreational discard mortality data is limited, but it is estimated to be 15%. However, recent studies suggest it could be higher [3]. Commercial discard mortality is considered negligible [5].

Age-0 bluefish have a bi-modal (spring and summer) recruitment pattern. There is evidence that there is some spawning during the fall months. The contribution of recruits from each season to the adult population is uncertain, which increases model complexity. This uncertainty is an additional source of error.

The NMFS survey was modified in 2009 due to replacement of the FV Albatross IV with the FSV Henry B. Bigelow. The vessel change altered several factors such as the net size, tow speed, and areas surveyed [3]. The survey area was reduced to the outer third of the inshore strata set was sampled by the Bigelow. A conversion coefficient is used for Bigelow data so that they can both be used.

References

[1] Durell, E.Q. 2011. Maryland 2010 Bluefish (*Pomatomus saltatrix*) Compliance Report To the Atlantic States Marine Fisheries Commission. Maryland Department of Natural Resources.

[2] ASMFC. 2011. Addendum I to Amendment 1 to the bluefish fishery management plan. Atlantic States Marine Fisheries Commission. Alexandria, VA.

[3] National Marine Fisheries Service. 2012. Bluefish 2012 stock assessment update. US Dept Commerce, Northeast Fishery Science Center.

[4] Waine, M. 2011. 2011 Review of the Atlantic States Marine Fisheries Commission fisheries management plan for bluefish (*Pomatomus saltatrix*). Atlantic States Marine Fisheries Commission. Alexandria, VA.

[5] Fisheries of the Northeastern United States; Atlantic Bluefish Fishery; 2013 and 2014 Atlantic Bluefish Specifications, 78:88 Fed. Reg. 26523-26526 (2013) (final rule)

[6] Personal communication from the National Marine Fisheries Service, Fisheries Statistics Division. June 12, 2013.

[7] ASMFC. 2012. Amendment 2 to the Interstate Fishery Management Plan for Atlantic menhaden. Atlantic States Marine Fisheries Commission. Alexandria, VA.

Figure 1. Commercial bluefish landings in Maryland since 1950 [6]. Landings for 2013 are as of July 3.

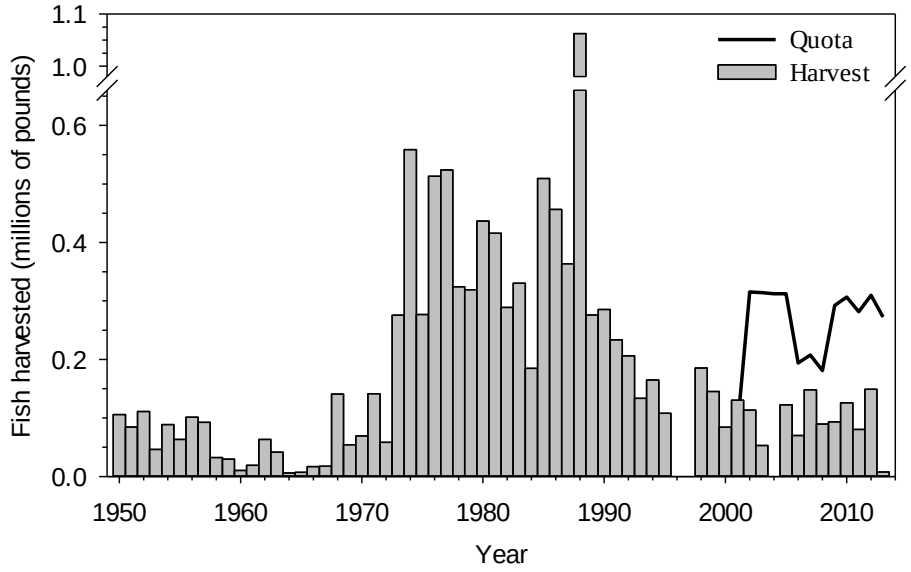
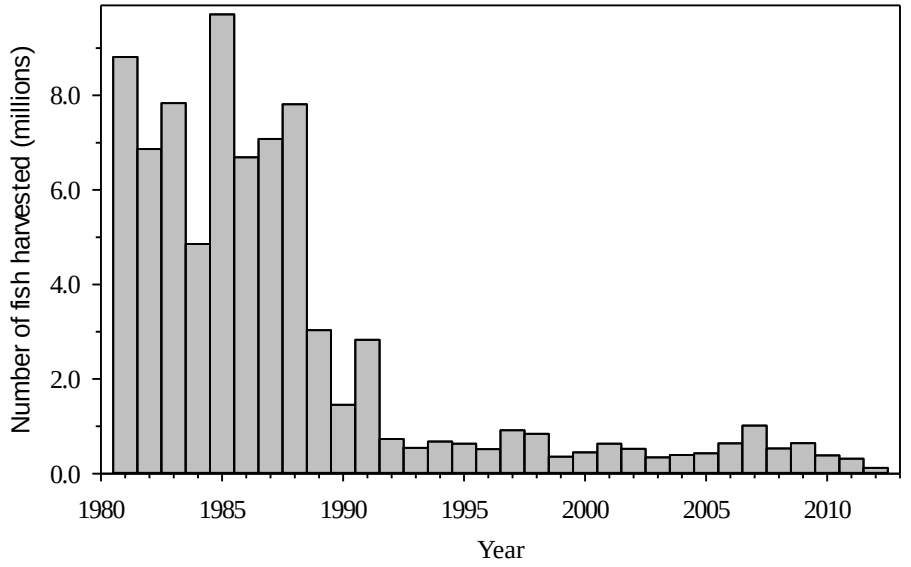


Figure 2. Number of bluefish harvested by the recreational fishery in Maryland since 1981 [6].



2003 Amendment I to the 1990 Chesapeake Bay Program (CBP) Bluefish Fishery Management Plan (FMP) (updated 07/2013)			
Problem Area	**Action**	**Date**	**Comments**
Stock Status Management Strategy CBP jurisdictions will continue to utilize management strategies that decrease fishing mortality and help increase bluefish abundance.	**Action 1.0** CBP jurisdictions will continue to participate in scientific and technical meetings for managing bluefish along the coast and estuarine waters.	1999 Continue	MAFMC/ASMFC Amendment 1 was adopted in 1999. Amendment 1 to the CBP FMP was adopted in 2003. BRPs based on the 2005 coastal stock assessment were Fmsy= 0.19 and Bmsy = 147,052 mt. The model that calculates population abundance has been annually updated since 2005. The output from the model is used to set the annual TAC. The stock was declared rebuilt in 2009. Current mortality estimates indicate an F below the threshold (F=0.4) and target (F=0.19).
	Action 1.1 CBP jurisdictions will adopt the MAFMC/ASMFC overfishing definition, and adhere to the 9-year rebuilding schedule for the coast wide management of bluefish	1999 Continue 2009 On-going	The 9-year rebuilding schedule reduced F: F=0.51(1999-2000) F=0.41(2001-2003) F=0.31(2004-2007) Based on the most recent stock assessment and FMP review, the bluefish stock is considered rebuilt. **The stock is not overfished and overfishing is not occurring.**
Fishery Management Strategy CBP jurisdictions will adhere to the coastal commercial and recreational TAL designated by MAFMC /ASMFC.	**Action 2.0** CBP jurisdictions will adhere to the commercial TAL established by MAFMC/ASMFC. Individual state-by-state quotas are based on historic landings from 1981-1989.	Continue	TAL may vary annually. The **2012 commercial TAL is 272,000 lbs for MD and 1.08 million lbs for VA. TAL includes a research set-aside quota.**
	Action 2.1 CBP jurisdictions will continue to require licenses for harvest and sale; Virginia requires a license for its commercial hook and line fishery and established a 10 fish creel limit.	1991	In VA, any species not managed under a coastal quota system is subject to the corresponding recreational creel limit for that species in the commercial hook and line fishery.
	Action 2.2 CBP jurisdictions will adhere to the coastal recreational harvest level established by the MAFMC/ASMFC. Virginia and the PRFC instituted a 10 fish creel limit in the summer of 1990. Maryland established a 10 fish recreational creel limit in 1991. Creel limits and minimum legal sizes may be modified as a.	1990 1991 Continue	Historically, recreational landings have accounted for 80-90% of the total catch. ASMFC sets an annual RHL. The **proposed RHL for 2012 is 17.2 million lbs. TAL includes a research set-aside quota.** A 10 fish creel limit is enforced by CBP jurisdictions. MD also implemented an 8 inch minimum size limit (MD COMAR 08.02.05.10 April 29th, 1991).
Research and Monitoring	**Action 3.0** CBP jurisdictions will continue to	Continue	Mandatory reporting is in effect in all CBP jurisdictions. MAFMC created a RSA program which allows up to 3% of the TAC to be sold and the money used to fund

2003 Amendment I to the 1990 Chesapeake Bay Program (CBP) Bluefish Fishery Management Plan (FMP) (updated 07/2013)			
Problem Area	**Action**	**Date**	**Comments**
Strategy Data collected from multiple independent fishery surveys contribute to coastal research and monitoring efforts of bluefish.	collect catch and effort data from the commercial fishery and expand the economic data to include dollar value of the commercial fishery and the annual dockside value received for bluefish in CBP jurisdictions.		research projects. **NMFS is soliciting proposals under the 2011 RSA program to address research priorities for several species, including bluefish.**
	Action 3.1 CBP jurisdictions will assess methods for improving recreational and charter catch/effort data needed to evaluate biological and economic impacts.	Continue 2011 On-going	MD requires logbooks for charter boats. Beginning in 2004, coastal species managed by quota are electronically reported in real time**.** The MRIP is now implemented with the new Chesapeake Bay and Coastal sport fishing license to provide a more comprehensive assessment of recreational fishing statistics than the MRFSS. MRIP data includes comparisons with MRFSS data back to 2004.
	Action 3.2 CBP jurisdictions will continue to collect fishery independent data on bluefish.	On-going	The ChesFIMS and ChesMAP surveys provided some data used to help manage bluefish in Chesapeake Bay. The ChesFIMS survey ended in 2005. Bluefish are regularly sampled during the MDNR summer pound net sampling program.
Habitat Management Strategy CBP jurisdictions are currently evaluating studies that will identify and delineate bluefish habitat and water quality parameters critical to bluefish in the Chesapeake Bay. The identification and development of trophic level relationships will also become possible with the establishment of	**Action 4.0** CBP jurisdictions continue to set goals for water quality, habitat restoration and protection to address commitments established under Chesapeake Bay 2000 agreements.	2003 2009 2010 2012 **2013**	Bluefish habitat was identified in Amendment #1 to the Chesapeake Bay Bluefish FMP. President Barack Obama's executive order recommitted federal agencies to Bay restoration and regulatory enforcement. EPA established a Bay wide TMDL (aka: pollution diet). Each jurisdiction must establish 2 year milestones for progress towards meeting its TMDL. Legislation has been passed for restrictions on new developments using septic systems. **Legislation for a stormwater fee based on impervious surface coverage was enacted.** Chesapeake Bay Program is monitoring levels of mercury, PCBs, PAHs, organophosphate and organochloride pesticides. Ambient water quality criteria of DO, water clarity, and chlorophyll-a have been adopted for the Chesapeake Bay. See Chesapeake Bay Program website for updates on water quality criteria http://www.chesapeakebay.net/restoringwaterquality.aspx?menuitem=14728 nutrient reduction.

2003 Amendment I to the 1990 Chesapeake Bay Program (CBP) Bluefish Fishery Management Plan (FMP) (updated 07/2013)			
Problem Area	**Action**	**Date**	**Comments**
CHESFIMS in 2001 and ChesMAPP in 2002 and the utilization of coastal multispecies models of Atlantic menhaden, striped bass, weakfish and bluefish.			http://www.chesapeakebay.net/status_reducingpollution.aspx?menuitem=19859
	Action 4.1 CBP jurisdictions will regulate land and water activities that may negatively impact essential water quality parameters for bluefish such as temperature, dissolved oxygen and turbidity.	Continue	The CBP continues to implement strategies to reduce nutrients and improve water quality in the Bay. Planting forest buffers, controlling stormwater runoff and reducing agricultural and urban non-point nutrient inputs are part of the current action plan. MD developed curriculum "Where Do We Grow from Here?" about population growth and its impacts on the Bay. See Chesapeake Bay Program website for updates on land stewardship. http://www.chesapeakebay.net/status_protectingwatersheds.aspx?menuitem=19876
	Action 4.2 CBP jurisdictions will monitor activities that may negatively impact SAV types where bluefish have demonstrated a significant degree of association.	2003 Continue	CBP monitors SAVs in the Chesapeake Bay by annual aerial survey. The revised SAV goal adopted by Chesapeake Bay Program is planting 1,000 acres of SAV by 2008 and restoration of 185,000 acres of SAV by 2010. **170 acres have been planted to date (0.02 in 2011).** VIMS annually surveys SAV distribution in Chesapeake Bay. **2012 SAV acreage was 45,700 (25% goal).** MD has developed a Blue Infrastructure that includes mapping structural habitat and SAV. Regulations are in place to prohibit dredging through SAV beds. Tiered designation and prioritization of SAV beds has not been implemented. Avoidance of dredging, filling and construction impacts to SAV is strictly enforced by MDE and USACE with input from DNR, USFWS, and NMFS. MD has not established undisturbed buffers. VA has established buffer criteria.
	Action 4.3 CBP jurisdictions will monitor important forage species, when identified by fishery independent surveys, to insure that activities such as directed fisheries or incidental by-catch in non-directed fisheries, do not adversely affect forage species abundance. If fishing activities are contributing to higher fishing mortality (F) of important managed	In progress **2012**	Fish collected from ChesFIMS & ChesMAPP surveys may provide stomachs for predator/prey analyses of juvenile and adult bluefish in the Chesapeake Bay. Variability of the abundance of forage fish in the Chesapeake Bay is also being examined by independent research project out of CBL. The ChesFIMs was discontinued after 2005 because of lack of funding. **ASMFC determined that menhaden are being overfished and that fishing mortality needs to be reduced [7]. The coastwide TAC is a 20% reduction from the average harvest during 2009-2011. Virginia is allocated 85% of the TAC while Maryland and PRFC are allocated 1.4% and 0.62%, respectively. Implementation is in 2013.**

2003 Amendment I to the 1990 Chesapeake Bay Program (CBP) Bluefish Fishery Management Plan (FMP) (updated 07/2013)			
Problem Area	**Action**	**Date**	**Comments**
	forage species, such as Atlantic menhaden, Atlantic croaker, spot and/or blue crab, additional management measures may be necessary.		
	Action 4.4 CBP jurisdictions will monitor the abundance of important bluefish forage species that are not managed under CBP FMPs, such as bay anchovies and Atlantic silversides	On-going	MD and VA juvenile seine surveys monitor the abundance of anchovies and silver sides. Non- managed forage fish abundance is being examined by an independent, CBL research project.
	Action 4.5 CBP jurisdictions will continue to identify predator/prey interactions, both inter- and intra- species competition and other interactions that might effect the management of bluefish.	On-going **2012**	Data from the ChesFIMS and the ChesMAP surveys will be utilized to identify and delineate ecological relationships. Development of multispecies fishery management plans may result from this data. **A multispecies predator/prey model is being developed by ASMFC that includes bluefish, menhaden, striped bass, and weakfish [7].**

Acronyms

ASMFC – Atlantic States Marine Fisheries Commission
B_{msy} – Biomass maximum sustainable yield
BRP – Biological Reference Point
CBL – Chesapeake Biological Laboratory
CBP – Chesapeake Bay Program
CHESFIMS – Chesapeake Bay Fishery Independent Multispecies Survey
CHESMAP – Chesapeake Bay Multispecies Monitoring & Assessment Program
COMAR – Code of Maryland
F – Fishing Mortality
FMP – Fishery Management Plan
F_{msy} – Fishing mortality at the "threshold" biological reference point. If F is at a rate beyond this point (F_{msy}), overfishing is occurring because the fishing of the stock has gone beyond the stock's maximum sustainable yield (MSY).
MAFMC – Mid-Atlantic Fisheries Management Council
MDNR – Maryland Department of Natural Resources
MRFSS – Marine Recreational Fisheries Statistics Survey
MRIP – Marine Recreational Information Program
NMFS – National Marine Fisheries Service
PRFC – Potomac River Fisheries Commission
RHL – Recreational Harvest Limit
RSA – Research Set-Aside
SAV – Submerged Aquatic Vegetation
TAC – Total Allowable Catch
TAL – Total Allowable Landings

2012 Maryland FMP Report (July 2013)
Section 9. Maryland Catfish Species

Introduction

Catfish are important to recreational and commercial fishermen throughout the Chesapeake Bay. Several different species of catfish occur in Maryland including two invasive, non-native species. The non-native blue (*Ictalurus furcatus*) and flathead (*Pylodictis olivaris*) catfish populations have spread into nearly every major tributary of the Chesapeake Bay (Figure 1). Their populations have increased in abundance and expanded their range beyond their usual salinity tolerance. Blue and flathead catfish are top apex predators in the ecosystem which raises concerns about their effects on native fish communities. The Chesapeake Bay Program's Sustainable Fisheries Goal Implementation Team (SFGIT) has recognized invasive catfish as a problem. Both species are listed in Maryland regulations as "Nuisance and Prohibited Species" and are on the "No transport" list which prohibits anglers from moving them to other waters of the state. However, both catfish species have been established in areas outside of what would be considered "normal" movement. It is likely that non-native species have been spread by angler transport. There are conflicting concerns between supporting recreational/ commercial fishing opportunities and curtailing an "invasive" species. Actively removing blue and flathead catfish from established areas is not possible

White catfish (*Ameiurus catus*) and brown bullheads (*A. nebulosus*) are native to the area. Channel catfish (*Ictalurus punctatus*) were introduced into the Potomac River around the end of the 19th century. The channel catfish spread throughout the Bay region, reaching Maryland's portion of the Chesapeake Bay in the late 1950's. They are now ubiquitous in the region and are considered naturalized. Blue catfish were also introduced to the Potomac River in the 1970s and have been found in high numbers from the 1990's to present. Flathead catfish were introduced to the James River in Virginia between 1965 and 1977. Additional introductions are believed to have occurred in the upper Chesapeake Bay within the last 10 years and flathead catfish are now commonly found there.

A Fishery Management Plan has not been written for catfish in Chesapeake Bay but a technical report was written in 1998. The technical report summarized catfish knowledge and recommended a survey of catfish populations to determine stock status in the Chesapeake Bay.

Stock Status

A population assessment of channel catfish was completed in 2010[1] and updated in 2012. A surplus production model for the Head of Bay (HOB), Choptank River, and the Potomac River was used to assess the stock. Fishery dependent and independent relative abundance indices were also calculated. In addition to indices for commercial landings, the spring drift gill net surveys in the HOB, Choptank and Potomac Rivers and fyke net survey index for the Choptank River was used in the surplus production models. Estuarine Juvenile Finfish Survey (EJFS) data were used to determine relative juvenile catfish abundance and as qualitative supporting data. The HOB surplus production model showed a population biomass decline during the 1990's after a period of population growth in the 1980's. Relative stock density data from fyke nets sampled in the Choptank River indicates that channel and white catfish relative abundance is above the average for the time series (Figures 2 and 3)[2]. White catfish juvenile recruitment during 2012 was not detectable and juvenile channel catfish were below average abundance (Figure 4). Although data was collected on adult white catfish, sample sizes were low and could not be used to calculate relative stock densities and length frequencies.

Management

There are no minimum size limits, no creel limits or closed seasons on any catfish species for either the commercial or recreational fisheries in tidal waters. Area and gear restrictions apply to commercial fishermen but are not catfish-specific. In non-tidal waters, there is a 5 fish/person/day creel limit with a 10 fish possession limit and no minimum size limit for channel catfish.

Fishery Statistics

The catfish commercial fishery is important in the Chesapeake Bay region (Figure 5). When harvest peaked in 1996, catfish were the second highest landed species by weight. In 2008, catfish landings were third highest by weight. Since 2009, the catfish commercial landings are reported by species. In the last few years, flathead and blue catfish have entered the commercial fishery and an active market exists for these invasive species. Catfish are caught in commercial fish pots, fyke nets, and pound nets. They are sold in both "dead" and "live" markets.

The recreational fishery for catfish is also important, but there are no recent surveys of recreational catfish catch in Maryland. The Marine Recreational Information Program (MRIP) does not collect data on catfish. In some western shore tributaries of Chesapeake Bay, guided trophy fisheries exist and utilize catch-and-release activity especially for the larger, invasive blue catfish. Recreational catfish size records are frequently broken.

Issues of Concern

Introduced non-native catfish are invasive species. Both blue and flathead catfish compete with native species for forage. Fishermen most likely have moved these invasive species to different areas within the Bay in misguided attempts to "improve" fishing conditions. Declines of channel catfish biomass have corresponded to the

appearance of the blue catfish in Potomac River surveys[1]. Blue catfish inter-specific competition and predation may hinder channel catfish population recovery. The native white catfish have declined in many areas and circumstantial evidence suggests their decline may be correlated to the expansion of non-native, invasive catfish species. This may also have consequences to the recoveries of ospreys and eagles that rely upon native and naturalized fish species for high quality forage.[3] The Sustainable Fisheries Goal Implementation Team (GIT) of the Chesapeake Bay Program has developed a policy on invasive catfish species and is working on an action plan. The policy agrees to develop and implement management strategies to reduce invasive catfish populations and mitigate their spread. The ASMFC adopted a Resolution on Non-Native Invasive Catfish (2011) that does not support the introduction or transport of non-native invasive species; it identifies the need for more research; and supports the development of management efforts to reduce/minimize the impacts of invasive catfish species.

Catfish do not undertake long migrations and can occur throughout the year in degraded habitats. They accumulate toxins, especially PCBs and pesticides, and MDE has posted consumption advisories for many areas such as Patapsco Harbor, Baltimore Harbor, Middle River and portions of the Elk River, Back River, Anacostia River and Potomac River. In addition to the human health advisories, catfish found in some habitats, such as the Anacostia River, exhibit high rates of skin and liver tumors, likely a result of exposure to polynuclear aromatic hydrocarbons (PAHs) in contaminated sediments[4].

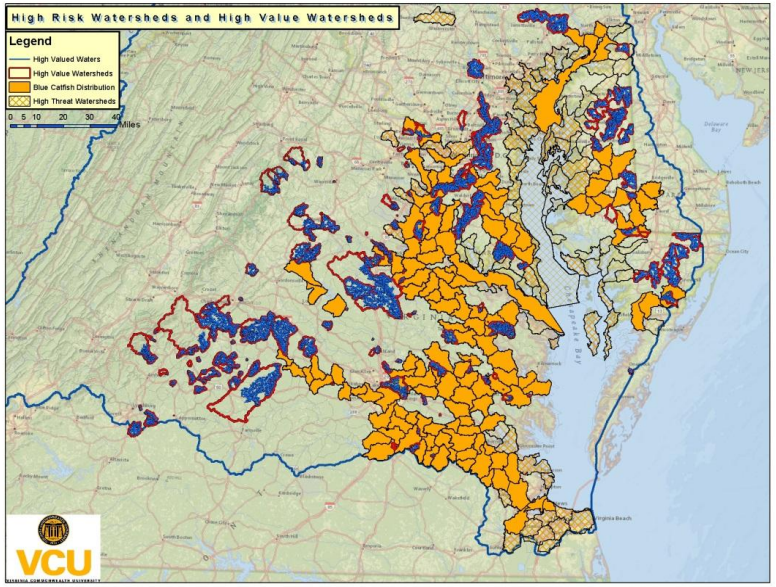


Figure 1. Current (solid polygons) and forecasted (cross-hatched polygons) distribution of blue catfish in Chesapeake Bay waters below Conowingo Dam. Geospatial units are 12-digit watersheds (HUCs). Data are compiled from several sources, including VCU, VIMS, VDGIF, and MdDNR; data were current as of 1 April, 2013.

References:

[1]Piavis, P. and E. Webb III. 2010. Population assessment of channel catfish in Maryland with special emphasis on Head-of-Bay stocks. In Chesapeake Bay finfish and habitat investigations. Maryland Department of Natural Resources. Report F-61-R-5. Annapolis, Maryland.

[2]Piavis, P. and E. Webb III. 2013. Population vital rates of resident finfish in selected tidal areas of Maryland's Chesapeake Bay. Project No.1, Job No.1 *In* Chesapeake finfish and habitat investigations. Maryland Department of Natural Resources. Report F-61-R. Annapolis, Maryland.

[3]Viverette, C.A., G.C. Garman, S.P. McIninch, A. C. Markham, B.D. Macko. 2007. Finfish-waterbird trophic interactions in tidal freshwater tributaries of the Chesapeake Bay. Waterbirds 30 (Special Publications 1):50-62.

[4]Pinkney, A.E., J.C. Harshbarger, E.B. May, and W.L. Reichert. 2002. Tumor prevalence and biomarkers of exposure and response in brown bullheads (Ameiurus nebulosus) from the Anacostia River, Washington, D.C. and Tuckahoe River, Maryland. CBFO-C02-07.

[5]Durell, E.Q., and Weedon, C. 2011. Striped Bass Seine Survey Juvenile Index Web Page. http://www.dnr.state.md.us/fisheries/juvindex/index.html. Maryland Department of Natural Resources, Fisheries Service.

Figure 2. Channel catfish relative abundance (N/net day) from the Choptank River fyke net survey, 2000 – 2012. Horizontal line indicates time series average relative abundance.[2]

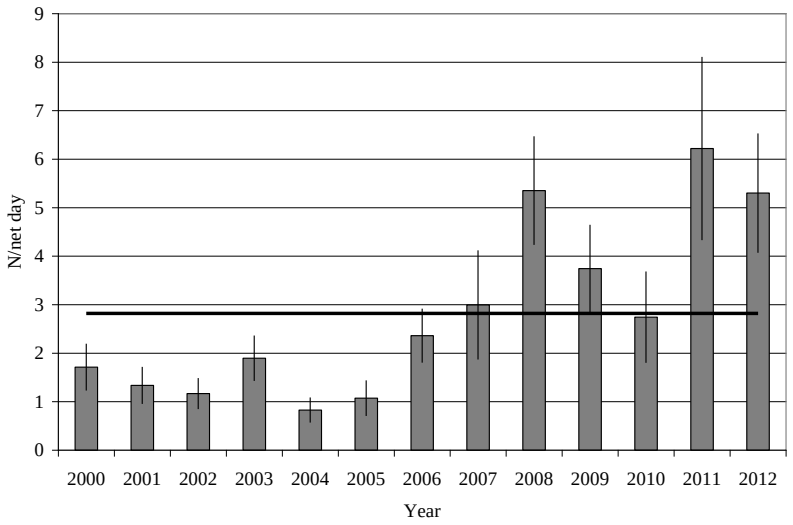


Figure 3. White catfish relative abundance (N/net day) from the Choptank River fyke net survey, 2000 – 2012. Horizontal line indicates time series average relative abundance.[2]

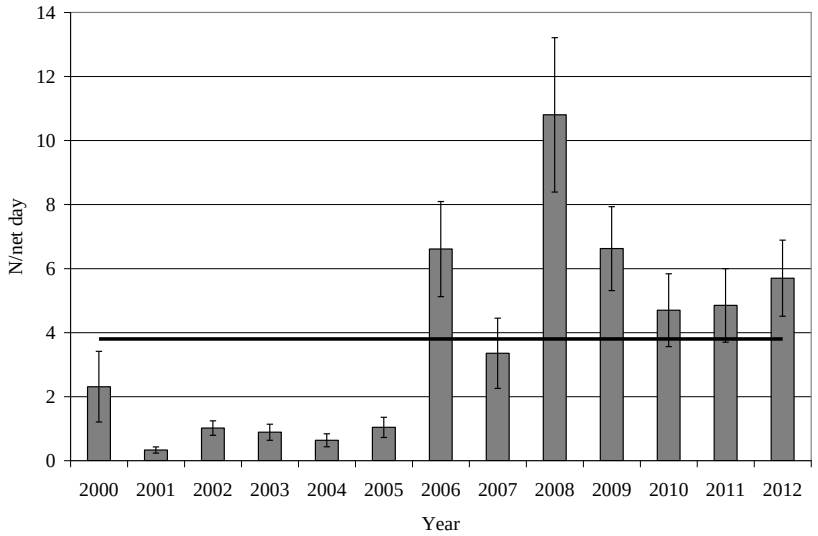


Figure 4. Maryland young-of-year (YOY) geometric mean catch per haul of channel catfish, 1975-2011.[5]

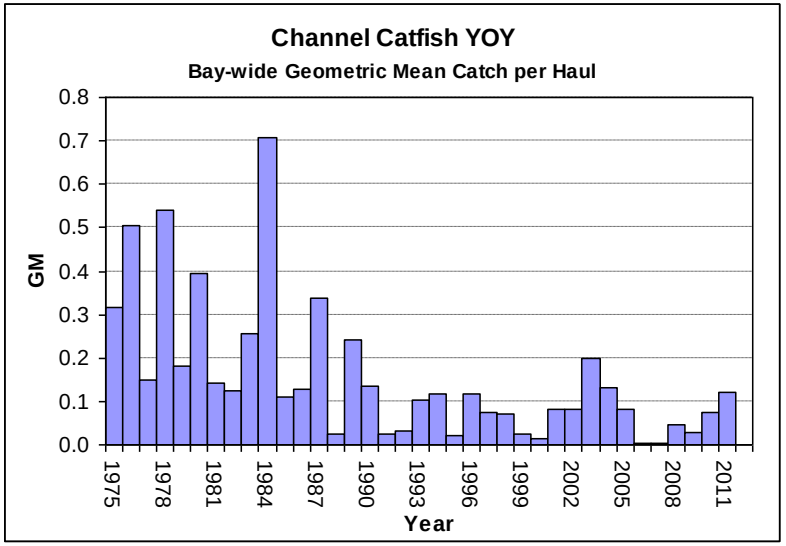
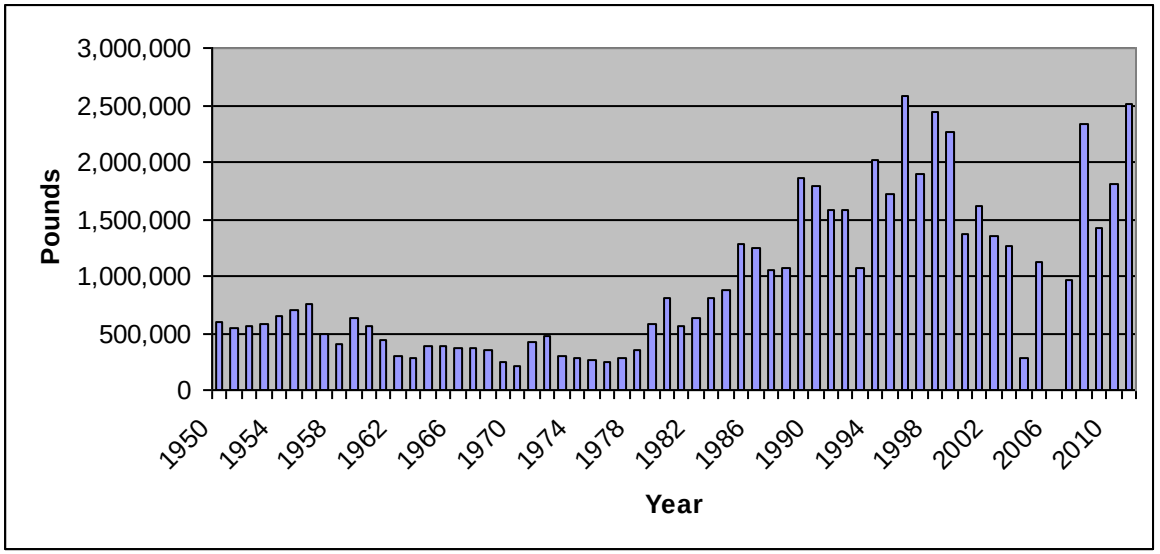


Figure 5. Maryland commercial catfish landings (NMFS data)



2012 Maryland FMP Report (July 2013)
Section 10. Maryland Coastal Bays Blue Crab (*Callinectes sapidus)*

Blue crabs in the Coastal Bays are managed under the 2001 Coastal Bays Blue Crab Fishery Management Plan (FMP). The plan sets forth management measures to conserve the coastal blue crab stock, protect its ecological and socio-economic values, and optimize the long-term utilization of the resource. The 2001 Coastal Bay Blue Crab FMP was reviewed during 2010. The Plan Review Team determined that the plan is still an appropriate framework for managing the resource.

The development of the FMP was triggered by the Comprehensive and Conservation Management Plan (CCMP) adopted for Maryland's Coastal Bays in 1999. This plan recognized Maryland's Coastal Bays as a separate, unique ecosystem from the Chesapeake Bay and recommended that the Maryland Department of Natural Resources address fishery issues specific to Maryland's Coastal Bays. The CCMP is reviewed and updated on an annual basis. A comprehensive review of the CCMP is currently in progress and will result in updated goals, objectives and actions.

Stock Status

The Coastal Bays Finfish Investigation (CBFI) samples blue crabs as part of their trawl survey. Data indicate that blue crab relative abundance in the Coastal Bays has fluctuated without trend, although numbers have been decreasing over the last few years. Catch-per-unit-effort (CPUE), a relative measure of abundance, was 365.4 crabs/hectare from the trawl data and 44.5 crabs/haul from the seine data during the 2012 sampling season. In 2011, CPUE was 537.1 crabs/hectare and 49.0 crabs/haul. Additional fishery independent data collected by the CBFI trawl survey indicate that the mean size of blue crabs in the Coastal Bays is smaller than the mean size of blue crabs in the Chesapeake Bay. This is most likely a result of the higher salinities found in the Coastal Bays. Recruitment of juveniles into the Coastal Bays is largely driven by environmental and hydrologic elements of the Atlantic Ocean waters. Although there is evidence that some internal recruitment is occurring, it is hypothesized that the majority of juveniles that take up residence in Maryland's Coastal Bays are transported by ocean currents from the mouth of the Chesapeake and Delaware Bays. Recent climate change analysis indicates that oceanic currents are influenced by the total amount of carbon dioxide in the atmosphere (greenhouse effect) and the rate of carbon dioxide increase. The complex factors that drive circulation patterns are non-linear. As a result, circulation patterns could change much faster than previously indicated.

Fishery Statistics

Maryland's Coastal Bays support both a commercial and recreational blue crab fishery. The 2012 harvest of hard, soft and peeler crabs from the Coastal Bays was slightly higher than in 2011 (Figure 1). Annual commercial harvest of blue crabs from the Coastal Bays has ranged from 0.54 to 2.4 million pounds with an average harvest of 1.3 million pounds. The recreational fishery is primarily a small boat fishery due to limited public shoreline/pier/bulkhead access. Recreational harvest of blue crabs in the Coastal Bays is undocumented. Estimates of recreational harvest from the Chesapeake Bay are believed to be between 8 and 11% of the commercial harvest. Whether or not this estimate is feasible for the Coastal Bays is unknown.

Management Measures

DNR manages the Coastal Bays commercial blue crab fishery through daily catch limits (25 bushels/boat/day), seasons (closed between Dec 31 & Apr 1), gear restrictions (no scrapes or dredges), size limits (minimum 5" for hard crabs and 3 ½" for soft crabs), limited entry, and other management strategies as necessary to control fishing effort. DNR manages the recreational blue crab fishery in the Coastal Bays through daily catch limits (1 bushel/person/day and no more than 2 bushels/boat/day), gear restrictions (no more than 600 ft of trotline/person or two 600 ft. trotlines/boat; 10 collapsible traps or crab net rings/person or 25 trips or rings/boat), and minimum size limits. Special regulations are in place for crabbing in Worcester County and may change annually (see COMAR for a complete list of restrictions).

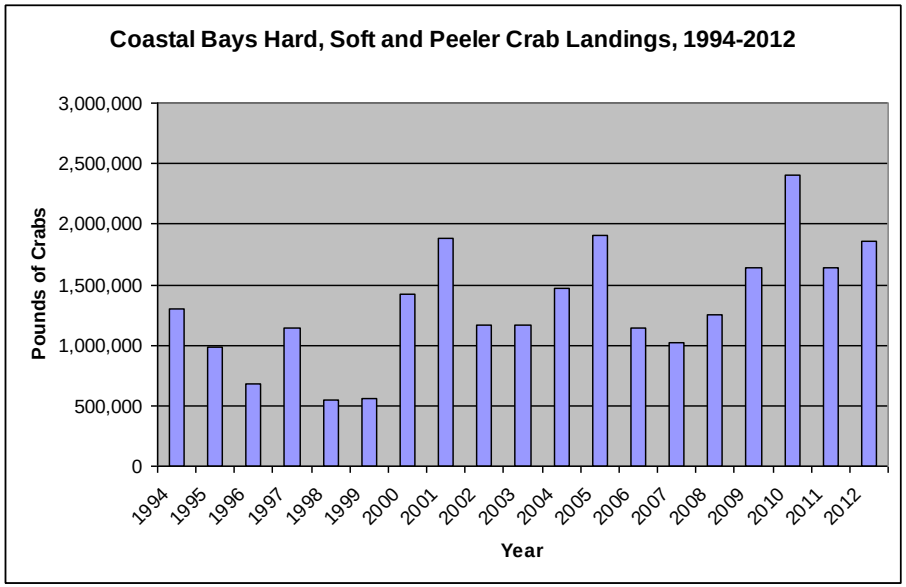
Concerns/Issues

A parasitic dinoflagellate, *Hematodinium* sp., has been found to cause mortality in blue crabs from the Coastal Bays. Studies conducted in 2005 and 2006 indicated that the number of infected crabs follows a seasonal pattern increasing from late summer through December. Results indicated that salinity and water temperature are vital components to the proliferation of the parasite and associated mortality. There is still much that is unknown about *Hematodinium* sp. and its effects on the blue crab population in the coastal bays. Research is needed to better understand the mortality associated with this disease so that fisheries managers can work to maintain optimum sustainable blue crab population from Maryland's coastal bays.

Maryland DNR began implementing an electronic method of reporting blue crab harvest in the Chesapeake Bay during 2012. Providing timely and verifiable harvest data on a daily basis is the first step towards improving the blue crab management system. Watermen from the Coastal Bays will begin participating in the voluntary program during 2013.

Regulations have been proposed to restructure recreational crabbing licenses. However, any new recreational license regulations would not apply to Maryland's coastal bays. Landowners that use crab pots off their docks are required to install a turtle excluder device to keep terrapins from drowning in pots.

Figure 1



(MDNR data)

2001 Coastal Bays Blue Crab Fishery Management Plan Implementation (last update 7/13)		
Objective/Problem	**Action**	**Implementation**
Obj. 1. Improve our understanding of how *Hematodinium* contributes to the mortality and population abundance of blue crabs. Prob. 1.1: Research and Monitoring.	**1.4.1** DNR and MCBP will identify potential funding sources to support the following research and monitoring activities: a) Assess the impact of *Hematodinium* in the coastal bays blue crab population (i.e. identify what intensity of *Hematodinium* infection causes mortality, and identify other factors, environmental and/or biological, that may influence blue crab mortality from *Hematodinium*). b) Identify factors which influence *Hematodinium* proliferation, elucidating different life stages, determining the full life cycle of the parasite, and eventual production of a more specific diagnostic tool either by immunoassay or molecular assay techniques. c) Examine how crabs become infected with *Hematodinium*.	Current research includes monitoring prevalence in MD coastal bays. Research is ongoing with the NOAA Oxford Cooperative. University of MD Eastern Shore, and VIMS. A 2010/2011 University of MD project found the presence of *Hematodinium* sp. in 9% of the water & sediment samples
	1.4.2 DNR will define the criteria under which a Marine Protected Area can be effective in assessing the impacts of *Hematodinium* on blue crabs	The Coastal Bays Fisheries Advisory Committee has discussed MPAs without any specific outcome.
Obj. 2. Improve our understanding of blue crab biology and stocks. Prob. 2.1: Stock Status	**Action 2.1.1:** Adopt an overfishing threshold consistent with Chesapeake Bay that preserves a minimum of 10 percent of the blue crab's spawning potential (F_{10} percent), and a fishing target that preserves 20 percent of an unfished stock. (F_{20} percent).	No targets and thresholds have been determined for Coastal Bays blue crabs. **Reported landings of hard, soft and peeler crabs from the Coastal Bays was 1.9 million lbs (2012). Average landings have been approximately 1.4 million lbs.**
	2.1.2:DNR will work towards implementing the necessary research and monitoring programs to determine the appropriate fishing mortality rates that will achieve the established fishing target of F_{20} percent. (Chesapeake Bay mortality rates (fishing and natural) are not necessarily transferable to Maryland's coastal bays.)	There is no direct blue crab monitoring in the Coastal Bays but data is collected through the Coastal Bays fishery independent trawl and seine survey. Research needs have not been defined.
	2.1.3: DNR will work towards allocating funds specific to the Department's coastal bays blue crab monitoring program and data analysis.	No specific funds are designated for blue crab monitoring in the Coastal Bays but data is collected through an ongoing fisheries monitoring program.

2001 Coastal Bays Blue Crab Fishery Management Plan Implementation (last update 7/13)		
Objective/Problem	**Action**	**Implementation**
	2.1.4: DNR and MCBP will encourage research that examines the stock - recruitment relationship of blue crabs in the coastal bays, level of localized reproduction and entrapment of larvae, and effects of environmental parameters which influence fluctuations in crab abundance (i.e. including this action in the FMP will identify these research needs as a high priority which will better enable DNR, MCBP, Universities and others to obtain support for funding these research projects).	No research completed.
	2.1.5: DNR will examine the utility of developing a public outreach indicator(s) of blue crab abundance that can be used to inform the community on the annual status of blue crab stocks in the coastal bays.	Dependent on all the actions specified in Objective 2 .
Prob 2.2: Commercial Catch and Effort Data.	**2.2.1:** DNR will establish, implement and evaluate a commercial reporting monitoring program to obtain accurate catch and effort data from anyone crabbing commercially in Worcester County consistent with recommendations of the Atlantic Coast Cooperative Statistics Program. a) Evaluate the effectiveness of the A pilot@ daily logbook reporting system implemented in 2000 for commercial crab harvesters and dealers in Worcester Co b) Consider using the Chesapeake Bay's commercial crab reporting system, but make it specific to the coastal bays, including more detailed information on location of harvest and effort data.	As a result of the pilot system, blue crab reporting went from a monthly summary to a daily logbook. The daily logbook program was expanded to the entire state in 2001. **A pilot study was conducted in the Chesapeake Bay during 2012 to evaluate the use of an electronic reporting system to improve the timely reporting of catch statistics. A few crab harvesters from the Coastal Bays have agreed to participate in study during 2013.**
	2.2.2: DNR will improve the enforcement of mandatory monthly reporting	New penalties are now in effect which create a more effective system for commercial fishing licensees who are late or don't turn in their fishing reports. The new penalty system should improve reporting.
Prob. 2.3: Recreational Catch and Effort Data.	**2.3.1:** DNR will design and implement a recreational crabbing survey in the coastal bays consistent with the pilot recreational crabbing survey in Chesapeake Bay.	A project to determine the design of a survey was completed.

2001 Coastal Bays Blue Crab Fishery Management Plan Implementation (last update 7/13)		
Objective/Problem	**Action**	**Implementation**
.		Implementation limited due to lack of funding. Maryland Blue Crab Volunteer Angler Survey started in 2008 and was expanded in 2009.
	2.3.2: DNR will identify potential funding mechanisms to fund and complement monitoring efforts outlined in Strategies 2.3.1 and 2.1.1.	No funding has been identified.
Prob. 2.4: Invasive, Non-indigenous Species	**2.4.1:** DNR will continue to monitor the abundance and impact of green crabs and other invasive, non-indigenous crab species.	Ongoing but limited due to lack of funding. In eastern North America, green crabs have been shown to significantly reduce populations of shellfish including soft shell clams, scallops and hard clams.
	2.4.2: DNR will evaluate the following management strategies related to green crabs: a) DNR will prohibit the possession and sale of imported green crabs, and promote the harvest and sale of locally harvested green crabs. b) DNR will prohibit the importation and sale of green crabs.	Green crabs have not been prohibited as bait. They are prohibited from being transported (COMAR 08.02.19.04)
	2.4.3: DNR will continue to work with Maryland's Non-Indigenous Species Task Force to examine invasive species issues, and develop an Aquatic Nuisance Species Plan to become eligible for Federal funding	A Maryland plan has not been developed. However, the Aquatic Nuisance Species Task Force developed a management plan for green crabs for the entire U.S. in 2002.
	2.4.4: MCBP will develop an outreach program (i.e. brochures) to educate the coastal bays community on the impacts of exotic species.	Impacts of exotic or non-native species was included in Shifting Sands (2009), a book about the Coastal Bays.
Prob. 2.5: Functional Role of Blue Crabs in the Natural Ecological Community.	**2.5.1:** DNR will examine methods/studies to better understand the natural ecological functions of blue crabs in the coastal bays, including the establishment of a Marine Protected Area in the coastal bays.	No studies have been conducted on marine protected areas.
Obj.3. Maintain an economically stable and	**3.1.1:** DNR will improve the accuracy of effort data in the coastal bays' commercial blue crab fishery by implementing actions related to Problem 2.2 - Commercial Reporting.	See comments Action 2.2.2.

2001 Coastal Bays Blue Crab Fishery Management Plan Implementation (last update 7/13)		
Objective/Problem	**Action**	**Implementation**
sustainable commercial blue crab fishery.		
	3.1.2: DNR will continue to manage the coastal bays commercial blue crab fishery through the use of time limits, seasons, gear restrictions, catch limits, size limits, limited entry, and other management strategies as necessary, to prevent further increases in fishing effort. a) **Gear Restrictions** - Prohibit the taking of blue crabs in the coastal bays by scrape and dredge to prevent these fisheries from developing, and lessen the gear impacts on blue crab habitat; b) **Time Restrictions** - Establish similar time restrictions to those in the Chesapeake Bay to prevent a shift in crabbing effort from the Chesapeake Bay to the coastal bays during years when crab abundance is low in the Chesapeake Bay. 1) For 2001 - Prohibit the taking of crabs for commercial purposes between 2:00 p.m. and 5:30 a.m.	Completed. Prohibition of scrapes & dredges has been enacted. (COMAR.08.02.03.06E) Time restrictions have been enacted. (COMAR.08.02.03.06D2) Closed season enacted: November 1 to April 1. (COMAR 08.02.03.06C)
Prob. 3.2: Harvest of Female Crabs,	**3.2.1:** DNR will continue to prohibit the harvest of sponge crabs, and limit the taking of female crabs in the coastal bays through the use of time limits, seasons, area closures, gear restrictions, catch limits, and size limits, as necessary. a) **Area Closures** - DNR will delineate areas where female blue crabs are concentrated (Action 5.2.1(a)), and determine the appropriate time periods for which commercial crabbing and hydraulic clam dredging should be allowed within these areas. The following areas have been identified as potential closure areas but need to be delineated further: 1) The Convention Hall site, bayside of Ocean City roughly between 36th and 50th Street; and 2) The Therefore site, in southern Isle of Wight Bay; 3) The Bridge site, just north of the Verrazano Bridge on the barrier island side. b) **Catch and Size Limits** - Determine if the current catch and size limits for female crabs are appropriate.	Ongoing.
	3.2.2: DNR will investigate the economic impact of prohibiting the possession and sale of sponge crabs within the state.	Completed. (Lipton and Sullivan 2002).
Prob. 3.3: Wasteful Harvest Practices.	**3.3.1** DNR will require unobstructed cull rings in crab pots from June 1 through April 30, and will adjust cull ring requirements based upon further research (peeler pot cull ring study being planned on Chesapeake Bay).	Ongoing
	3.3.2: DNR will determine if measures are necessary to reduce the bycatch mortality of crabs in the hydraulic clam dredge fishery (i.e. Action 3.2.1(a) - prohibition of hydraulic clam	Hydraulic Clam Dredging is currently prohibited in Maryland's

2001 Coastal Bays Blue Crab Fishery Management Plan Implementation (last update 7/13)		
Objective/Problem	**Action**	**Implementation**
	dredging in areas where female crabs are concentrated).	Coastal Bays, 2007. Natural Resource Article § 4-1002
	3.3.3: DNR will continue to require terrapin excluders in crab pots set for noncommercial purposes, encourage watermen to install terrapin excluders in commercial crab pots, and investigate the feasibility (i.e. effects on catch; economic impact) of requiring terrapin excluders in all crab pots set in the coastal bays.	Ongoing. (Lukacovic et al. 2005)
	3.3.4: MCBP will coordinate an annual/seasonal volunteer effort to locate and remove derelict pots.	Ongoing.
Obj. 4. Improve the recreational crabbing experience. Prob. 4.1: Satisfaction of Recreational Crabbers.	**4.1.1:** DNR and MCBP will obtain information on satisfaction levels of recreational crabbers in the coastal bays to evaluate the effectiveness of management measures.	No recreational crabbing surveys have been completed.
	4.1.2: DNR will examine the effects of habitat quality on the success rates of recreational crabbing in the coastal bays.	No studies have been conducted.
	4.1.3: DNR and MCBP will develop and distribute the following information pertaining to the recreational crab fishery in the coastal bays: a) Recreational crabbing brochure summarizing crabbing restrictions; b) Recreational crabbing sign for access points (i.e. boat ramps and fishing/crabbing piers); c) Maps of land-based public access and boat based crabbing locations, list of boat ramps and marinas with rental boats, and recreational crabbing tips.	Ongoing.
	4.1.4: DNR, MCBP, Town of Ocean City and Worcester County will work towards increasing the number of land-accessible areas for recreational crabbing.	Ongoing.
Obj. 5. Protect, maintain and enhance blue crab habitat. Prob. 5.1: Submerged Aquatic Vegetation (SAV).	**5.1.1:** DNR will alleviate the impact of hydraulic clam dredging and prop scarring to SAV in the coastal bays by: a) Prohibit hydraulic clam dredging in SAV; b) Annually documenting the areas and extent of impact; c) Researching seagrass recovery time; d) Investigating the use of buoys to mark beds, SAV setbacks, depth restrictions, GPS equipment to identify boundaries, and education as tools to protect beds from damage; and e) Implementing and enforcing necessary regulations to protect SAV from hydraulic clam dredging.	Hydraulic Clam Dredging is currently prohibited in Maryland's Coastal Bays, 2007. Natural Resource Article § 4-1002

2001 Coastal Bays Blue Crab Fishery Management Plan Implementation (last update 7/13)		
Objective/Problem	**Action**	**Implementation**
	5.1.2: By implementing Action 3.1.2, DNR will prohibit the taking of blue crabs in the coastal bays by scrape and dredge to prevent these fisheries from developing and impacting SAV.	Completed.
	5.1.3: DNR and MCBP will continue to identify SAV species needing protection and activities needing restrictions.	Ongoing.
	5.1.4: MCBP will expand surveys/citizens monitoring to ground truth SAV species composition and determine accuracy of photo interpretive maps.	**Most recent survey results indicate that SAV decreased 8% from 5,445 ha (13,455 ac) in 2011 to 4,988 ha (12,326 ac) in 2012.** SAV beds in Maryland's Coastal Bays appear to be an important area of primary habitat for fish.
	5.1.5: DNR and Natural Resources Conservation Service (NRCS) will develop habitat requirements for the growth of seagrasses in the coastal bays by: a) DNR will develop water quality requirements for seagrasses; b) DNR will identify areas that meet water quality requirements for restoration purposes; c) NRCS will compile data relating coastal bay soil types to bottom communities and identify other variables having effects on seagrass establishment and maintenance; and d) NRCS will complete soil mapping effort for entire coastal bays	a) Completed (Maryland Department of Natural Resources 2004). b) Ongoing. c) Completed by MGS & DNR. d) Not yet initiated.
Prob. 5.2: Overwintering Habitat.	**5.2.1:** DNR will identify and protect blue crab overwintering areas in the coastal bays by: a) Delineating and mapping overwintering areas; and b) Prohibiting hydraulic clam dredging in important overwintering areas year-round, unless data indicates that these areas can be opened on a seasonal basis (see Action 3.2.1(a)). c) DNR will define the criteria under which a Marine Protected Area can be effective in protecting blue crab overwintering areas.	No mapping has occurred for blue crabs. Hydraulic clam dredging is prohibited (2007). No steps have been taken to define marine protected areas.
Prob. 5.3: Shallow Water and Shoreline Habitats.	**5.3.1:** DNR will support actions in the CCMP, specifically "Challenge 1.9 of the Fish and Wildlife Section" to protect and enhance shallow water and shoreline habitats important to blue crabs. DNR and Worcester County are the lead agencies for the majority of these actions. Refer to the CCMP for more specific information on these actions.	Ongoing.
Prob. 5.4: Dissolved Oxygen.	**5.4.1:** DNR will support actions in the CCMP, specifically in the "Water Quality" section and "Fish and Wildlife" section to minimize the impacts of unsuitable dissolved oxygen levels to blue crabs in the coastal bays. Maryland's Coastal Bays Program, Town of Ocean City, and Worcester County are the lead agencies for the majority of these actions. Refer to	Ongoing. (Maryland Department of Natural Resources 2004).**The CCMP is undergoing a thorough review which should be**

2001 Coastal Bays Blue Crab Fishery Management Plan Implementation (last update 7/13)		
Objective/Problem	**Action**	**Implementation**
	the CCMP for more specific information on these actions.	**completed by December 2013.**
	5.4.2: DNR will identify areas which have unsuitable levels of dissolved oxygen (i.e. < 3 mg/L) for blue crabs.	Ongoing. (Maryland Department of Natural Resources 2004).
Prob. 5.5: Nutrient, Sediment and Chemical Inputs.	**5.5.1:** DNR will support actions in the "Water Quality" section of the CCMP to control nutrient, sediment and chemical inputs which will protect and enhance blue crab habitats. Worcester County and Maryland's Coastal Bays Program are the lead agencies for the majority of these actions. Refer to the CCMP for more specific information on these actions.	Ongoing. (Maryland Department of Natural Resources 2004).
Obj. 6. Improve enforcement of crabbing restrictions. Prob. 6.1: Enforcement of Conservation Measures.	**6.1.1:** DNR will consider increasing the number of enforcement personnel in the coastal bays, specifically during the crabbing season.	NRP hires seasonal staff to increase patrols during summer months. Penalties for violating regulations and enforcement procedures have been enhanced over the past several years.
	6.1.2: DNR will consider expanding the Natural Resource Police reserve officer program.	The reserve officer program is composed of volunteers committed to performing non-law enforcement duties that would otherwise be performed by commissioned police officers.

Acronyms:
DNR = Department of Natural Resources
MCBP = Maryland Coastal Bays Program
NRP = Natural Resources Police

2012 Maryland FMP Report (July 2013)
Section 11. Maryland Coastal Bays Hard Clam (*Mercenaria mercenaria)*

Coastal Bays FMP

Since the ban on mechanical harvesting methods in 2008, there has been little to no commercial harvest of clams from the Maryland portion of the Coastal Bays. In 1999, a Comprehensive and Conservation Management Plan was adopted for Maryland's Coastal Bays. This plan distinguished Maryland's Coastal Bays as a separate, unique ecosystem from the Chesapeake Bay and recommended that the Maryland Department of Natural Resources (MDNR) address fishery issues specific to Maryland's Coastal Bays. In accordance with this plan, a Coastal Bays Hard Clam Fishery Management Plan (FMP) was adopted in 2002 to conserve the coastal stock, protect its ecological and socio-economic values, and optimize the long-term utilization of the resource. During 2010, the Coastal Bays Hard Clam Plan was reviewed by the Plan Review Team (PRT). The PRT recommended a revision of the plan because the majority of actions are no longer valid due to the ban on dredging. The revision is scheduled for 2014.

Stock Status

Since 1993, the MDNR Shellfish Division has conducted fishery-independent hard clam surveys in the Maryland Coastal Bays. During the five years since the enactment of the dredging ban, trends in the survey findings have varied depending on geographic region. In 2013, hard clam densities in all five bays were either stable or have increased (MDNR Shellfish Monitoring & Assessment Program). Recruitment has also been variable by region but overall appears to have increased.

During the first two years following the elimination of hydraulic escalator dredging, the southern bays (Chincoteague and Newport) continued to experience declining hard clam densities. Hard clam densities in Chincoteague Bay fell to record low levels, a full order of magnitude below the 1952 benchmark. Since 2010 this trend has reversed, with Chincoteague Bay densities doubling to 1993 levels, though still well below historic densities (Figure 1). Likewise, the hard clam population has increased in Sinepuxent Bay over the past two years, but remains at less than half of its 1953 level. The most encouraging results have been from the northern bays (Assawoman and Isle of Wight), which have shown relatively substantial increases since dredging was eliminated. Note that this population expansion actually began before the dredging ban went into effect with sizable recruitment to the population evidenced in 2008 that subsequently went unharvested. Particularly in Isle of Wight, which generally experiences good hard clam recruitment, the post-dredging ban average hard clam density has nearly tripled the pre-ban average (Figure 2). However, over the past three years Isle of Wight clam densities have leveled off below their historic highs, and recruitment has sharply dropped. The population in Assawoman Bay has quadrupled from critically low densities in 2006, but is only at about 37% of the historic high.

Despite the great improvement in Isle of Wight Bay, hard clam densities remain well below historic benchmarks in the remaining regions of the Coastal Bays. The causes of these generally poor densities have not been determined. Low population densities could result from recruitment failures due to unfavorable water quality conditions for hard clam survival[1] (such as brown tide blooms) and possible increased predation by blue crabs [2] and other predators such as cownose rays.

Current Management Measures

Hard clams minimum size limit is 1" and only hand-held harvesting devices are allowed in the Coastal Bays. In 2007, the Maryland state legislature passed a law prohibiting the harvesting of clams and oysters in the Coastal Bays by hydraulic escalator dredge, power dredging, or other mechanical means. This statute went into effect in September, 2008 and essentially eliminated the commercial fishery. The fishery may resume at some point in the future if stocks build to densities high enough to support manual means of harvesting.

The Historical Fishery

Commercial effort and harvest has varied over the years. Harvests in the mid-1990's were below 25,000 pounds per year. Successful recruitment during this period was followed by an increase in landings, which exceeded 100,000 pounds in 1999 and peaked at 163,000 pounds in 2002. Since the prohibition of hydraulic dredging, commercial fishery landings have been negligible. The statewide harvest was reported to be only 368 pounds in 2010[3]. Information from the recreational fishery is largely unknown. The minimum size for the recreational fishery is 1" (transverse measurement) with a 250/person/day limit.

Issues and/or Concerns

Most of the strategies and actions in the 2002 Coastal Bays Hard Clam Fishery Management Plan were developed to address hydraulic dredging. Since the use of hydraulic dredges is prohibited, these strategies and actions are now obsolete. A revised plan is scheduled for development.

User conflicts and stakeholder opposition, especially from shoreline property owners, continue to hinder the expansion of hard clam aquaculture in the Maryland Coastal Bays.

Non-native green crabs (*Carcinus maenas*) have been introduced, most likely as bait bucket introductions. This species has been recognized by the federal Aquatic Nuisance Species Task Force as an aquatic nuisance species. Green crabs are known

clam predators and their impact on the hard clam population is uncertain. Although small pockets of green crabs may be established in the Coastal Bays, they are neither abundant nor widely distributed. The green crab is listed as a "species prohibited from transport" in MD (COMAR 08.02.19.04) and they may not be collected and used as bait in areas where they are not established.

Compliance with the National Shellfish Sanitation Program (NSSP) model ordinance is currently in place and affects the handling of hard clams intended for human consumption. Handlers are required to cool clams and deliver them to Department of Health and Mental Hygiene (DHMH) certified shellfish dealers within 12 hours after harvest (or cooled to specific temperatures within 12 hours).

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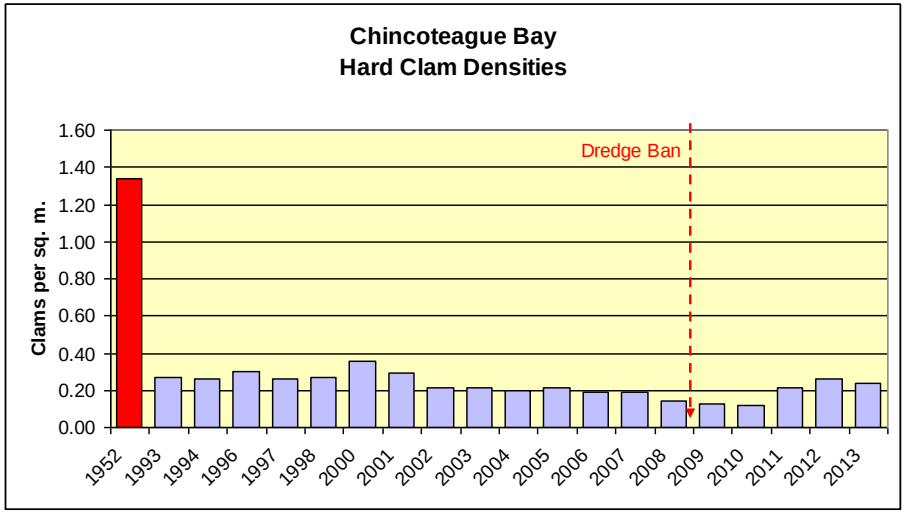


Figure 1. Chincoteague Bay hard clam densities before and after the dredging ban and the historic benchmark density (red bar) (MDNR data)

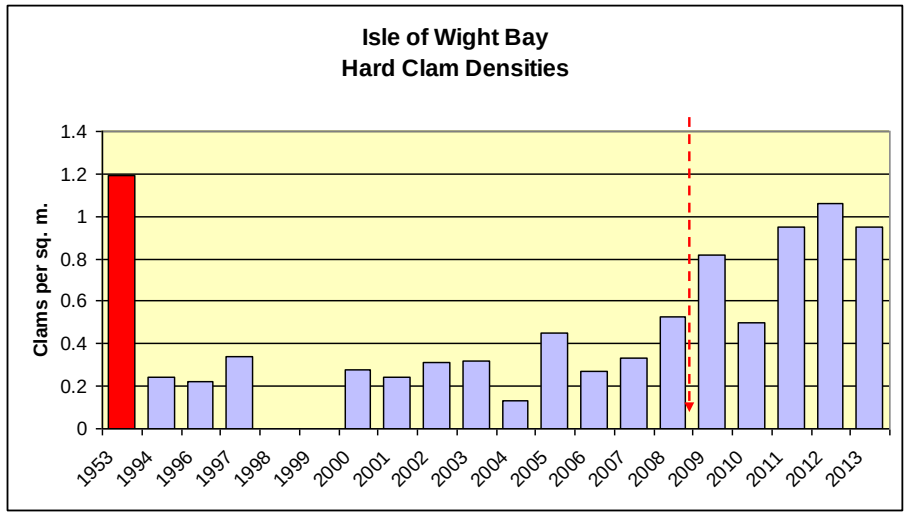


Figure 2. Isle of Wight Bay hard clam densities before and after the dredging ban (indicated by red arrow) and the historic benchmark density (red bar) (MDNR data).

References

1. University of Maryland Center for Environmental Science. Integration and Application Network. Indicators – Coastal Bays Health Index – Maryland Coastal Bays Report Card – EcoCheck. 2009. http://www/eco-check.org/reportcard/mcb/2009/indicators/coastal_bays_health_index/

2. Tarnowski, M. 2007. Hard-Shell Clam *Mercenaria mercenaria*. http://www.dnr.state.md.us/fisheries/fishfacts/hardshell_clam.asp

3. Personal communication from the National Marine Fisheries Service, Fisheries Statistics Division, Silver Spring, MD.

4. Waterway Improvement Capital Program Benefits, Needs, and Opportunities. 2011. Legislative report prepared in response to the 2011 Joint Chairman's Report, Sept. 2011. 23p.

2002 Coastal Bays Hard Clam Fishery Management Plan (updated 07/13)		
Objective/Problem	**Action**	**Implementation**
Obj.1. Enhance and perpetuate hard clam stocks. Prob 1.1: Mortality of Small Clams	**1.1.1** Investigate the importance of habitat closures (MDE restricted areas, SAV closures, and shoreline setback areas) to recognize their benefits as hard clam broodstock protection areas.	Ongoing. Results to date have not shown significant improvement in clam densities within SAV beds. With the prohibition on mechanical harvesting there has been no commercial activity for the past 5 seasons**.** Limited recreation-only harvest areas and sanctuaries are preferred alternatives to closures and moratoriums.
	1.1.2 Develop an action plan for improving hard bottom habitat (i.e., shell or other suitable substrate) to reduce predation on small clams. The action plan will include the identification of: a) Planting materials and sources; b) Enhancement areas; and c) Funding sources (i.e. improved reporting of commercial hard clam harvest will increase funding generated through the shellfish tax which could be used towards bottom enhancement activities).	Pilot studies on habitat improvement indicate that clam survivorship is enhanced but not sufficiently high enough to justify the expense and logistical difficulties associated with such activities. The absence of commercial harvesting resulted in no tax revenue for the past 5 years.
Obj.2. Manage for a viable commercial hard clam harvest to maintain an economically stable fishery. Prob. 2.1: Potential Economic Harship to Commercial Clammers Caused by the "Boom and Bust" Nature of the Fishery	**2.1.1** DNR will limit the number of individuals into the commercial hard clam fishery by permit only based upon those individuals who have landed at least 100 bags of hard clams (as documented by DNR dealer reports) in Maryland's coastal bays in at least 2 years between the 1990/91 and 2000/01 seasons. Using these criteria, a total of 22 individuals would qualify for this permit. This permit should be transferable with a license, or to an individual who purchases a clam rig from an individual who meets the criteria stated above, and relinquishes their permit to the new clam rig owner. DNR will evaluate this action within 3 years to determine if the desired outcomes are being achieved. This action is consistent with actions 5.1.2 and 6.1.3.	Completed. However, lawyers determined that this was legally inadvisable. This objective and action needs further investigation and discussion given the absence of commercial harvest. Limited entry and IFQs continue to be discussed.
	2.1.2 DNR will develop a plan (i.e. reporting requirement from commercial clammers) to improve the collection of catch, effort and economic data from the commercial hard clam fishery to assist managers in evaluating the impacts of future management decisions.	There are gaps in the hard clam harvest data but harvest can be estimated from buy tickets (if the hard copies are still available). There has been no commercial harvesting during the past 5 seasons. Commercial clam harvesters are required to report their daily catch of all clam species starting in September 2011.
Obj. 3. Evaluate the feasibility of hard clam aquaculture opportunities. Prob 3.1: Establishing Hard Clam Aquaculture	**3.1.1** Evaluate the legal, institutional and economic incentives and barriers to private aquaculture at the local, state, and federal level in Maryland.	This was done as part of the Maryland Legislative Task Force on Seafood and Aquaculture. DNR will be lead agency as of July 1, 2011 in permit processing. An aquaculture training conference was hosted by UMD, in cooperation with MD DNR, NOAA CBO and the Oyster Recovery

2002 Coastal Bays Hard Clam Fishery Management Plan (updated 07/13)		
Objective/Problem	**Action**	**Implementation**
		Partnership. Three aquaculture open houses were held in 2010. An aquaculture financing loan program was announced by Gov. O'Malley. Representatives from the Maryland Oyster Aquaculture Financing Program discussed the loan program at the open houses and began the business planning and application processes. MD DNR and DHMH launched a commercial shellfish tagging program begining in October, 2011 to meet the requirements of the National Shellfish Sanitation Program (NSSP). Hard clam tagging was implemented in the 2012-2013 license year. Other changes (such as taking and landing times, cooling, shading) needed to comply with NSSP changes have been implemented through regulation.
	3.1.2 Identify problems with the permitting process, and make recommendations to specific agencies to solve those problems.	This was done through the above task force, reinforced with information from a range of states at the Maryland Aquaculture Development Conference held in Annapolis in August 2003. Permitting process has improved and will continue to address the myriad laws and regulations of the past 100 years which preserved wild harvest at the expense of aquaculture.
	3.1.3 Simplify the application process, and designate a single point contact at DNR to assist potential applicants with aquaculture permits, questions related to the regulatory requirement, guidance through the permitting process and fulfilling of regulatory obligations, tracking permit applications, and coordinating state agency permitting activities to aquaculture permits.	The leasing laws were entirely revised in 2009, including the provision for pre-approved lease areas in the coastal bays to streamline the process. Two areas have since been pre-approved: South Point Shoal and Whale Gizzard Shoal. Because these areas have been pre-screened for leasing conflicts, the application process is shorter. MD DNR has been designated as the lead agency for coordinating all aquaculture permitting as of 7-01-11 (SB 847 & HB 1053). DNR will issue water column leases

2002 Coastal Bays Hard Clam Fishery Management Plan (updated 07/13)		
Objective/Problem	**Action**	**Implementation**
		and staff the Aquaculture Coordinating Council and Aquaculture Review Board. The lease application was simplified in 2010. It is now a single joint application with the US Army Corps of Engineers, Baltimore Office and the MD DNR. One lease for hard clam aquaculture was approved in 2010. One additional applicant pursued a submerged land lease application in 2012. One older lease hard clam aquaculture operation began reporting harvest under new reporting requirements in effect since June, 2012.
	3.1.4 DNR will evaluate the feasibility of hard clam aquaculture in Maryland's coastal bays by: a) Identifying potential areas and size of area for hard clam aquaculture; b) Initiating and providing funding for pilot hard clam aquaculture studies; c) Investigating the economic impact of hard clam aquaculture; and d) Assessing the ecological impacts associated with hard clam aquaculture	a) This was not meant to designate where shellfish farmers would be compelled to site their operations (already taken care of in MD law with regard to leasing). It should be used as a point of reference for the types of bottom most beneficial for the production of hard clams and oysters. Pre-approved leasing areas have been evaluated and proposed**.** b) This has been done through the development of a shellfish nursery at Gordon's Shellfish (supported by the MIPS program) and trials with several types of production methods. Information on what works best according to the bottom types and circulation patterns in the area, and the management objectives of the operator have been considered. c) Ongoing - but hard clam aquaculture has revolutionized the Florida fishing industry and kept many former fishermen in business when they had few other options. It is a multi-million dollar industry in VA where the production of high quality shellfish runs ahead of MD. d) A study of the incidence of the clam

2002 Coastal Bays Hard Clam Fishery Management Plan (updated 07/13)		
Objective/Problem	**Action**	**Implementation**
		disease QPX (MDNR/VIMS was completed. Continue to monitor mortality in farmed clams for disease (none reported). MDNR conducted a study of hard clam growth in the presence of brown tide. Proposals were submitted to fund a two-year study on commercial hard clam aquaculture and SAVs but because of budget problems, neither has been funded. A literature review was presented to the coastal bays STAC.
Obj 4. Enhance and promote the recreational hard clam fishery. Prob. 4.1: Limited Access and Knowledge of Recreational Clamming Opportunities in Maryland's Coastal Bays	**4.1.1** DNR will develop and distribute a public outreach brochure illustrating recreational clamming areas, access points, methods and harvest restrictions.	This is a low priority and has not been initiated. Increased education on recreational harvest should include the responsibility and mechanism to report harvest. This may be an opportunity for Coastal Baykeeper input.
	4.1.2 DNR will work with the Town of Ocean City and Worcester County to improve access to recreational clamming areas	Boat ramps and associated facilities continue to be constructed and renovated with funding provided in full or in part by the DNR Waterway Improvement Fund, funded by boat taxes. Most recently, the West Ocean City Harbor ramp, built in 1988, was renovated over four months and re-opened, June, 2011. Due to decreased revenues (50% since FY2006), DNR was able to fund only 19% of the state and local boating access and dredging projects[4].
	4.1.3 DNR will investigate the feasibility of planting seed to establish and/or enhance areas for recreational clamming, and if feasible, develop a seeding strategy.	Not yet initiated. Low priority.
	4.2.1 DNR will reduce the recreational catch limit for hard clams from 1 bushel to 250 hard clams per person per day.	Effected in 2002.
Obj.5. Minimize conflicts between coastal bay user groups and commercial hard clam fishermen.	**5.1.1** DNR will prohibit commercial clamming in the area between the Ocean City Airport at Marker 13 northward to the Rt. 90 Bridge on Saturdays (Sundays currently closed) between September 15 through October 15, and April 15 through May 31.	Effected in 2002. Action item to be moved to history/background in new FMP which will be totally revised to include aquaculture.

2002 Coastal Bays Hard Clam Fishery Management Plan (updated 07/13)		
Objective/Problem	**Action**	**Implementation**
Prob. 5.1: Conflict Between Recreational Fishermen and Commercial Clammers.		
	5.1.2 DNR will limit the number of individuals into the commercial hard clam fishery by permit only based upon those individuals who have landed at least 100 bags of hard clams (as documented by DNR dealer reports) in Maryland's coastal bays in at least 2 years between the 1990/91 and 2000/01 seasons. Using these criteria, a total of 22 individuals would qualify for this permit. This permit should be transferable with a license, or to an individual who purchases a clam rig from an individual who meets the criteria stated above, and relinquishes their permit to the new clam rig owner. DNR will evaluate this action within 3 years to determine if the desired outcomes are being achieved. This action is consistent with actions 2.1.2 and 6.1.3	Legally inadvisable (see Sec. 2.1.1). Action item to be addressed in 2.1.1.
	5.1.3 DNR will reduce the bycatch allowance of hard clams for recreational purposes in the hydraulic dredge fishery from 1 bushel to 250 hard clams per person per day.	Effected in 2002. Action item is no longer needed.
Prob. 5.2: Conflict Between Shoreline Property Owners and Commercial Clammers.	**5.2.1** DNR will establish a maximum noise level limit for commercial vessels consistent with the recreational limit	Regulation clarified to reference existing reg. (COMAR 08.18.03.03) establishing maximum noise levels all for vessels in Maryland. This action item may be addressed in aquaculture permitting.
Obsolete – Mechanical harvesting now prohibited.	**5.2.2** DNR will increase the shoreline setback distance for which a person may not catch hard clams with a hydraulic dredge in front of federal or state-owned property from 150 to 300 feet	Effected in 2002.
	5.2.3 DNR's Natural Resource Police will monitor the causes of reported noise complaints to facilitate future management decisions related to this issue.	Study conducted by NRP of 5 clam boats found that all were in compliance with muffler and noise level regulations.
	5.2.4 DNR will investigate the impacts of prohibiting or restricting the written permission provision that allows an individual to catch hard shell clams with a hydraulic dredge within the shoreline setback of 300 feet.	Written permission provision eliminated in 2002.
Obj. 6. Minimize ecological impacts associated with the commercial and recreational hard clam fisheries. Prob. 6.1: Community Concern on the Ecological Effects of Commercial Hydraulic Clam Dredging.	**6.1.1** DNR and Maryland's Coastal Bays Program will educate the public on the ecological effects of hydraulic clam dredging and the importance of the commercial hard clam fishery to the coastal bays community.	A literature review was compiled documenting the impact of hydraulic escalator dredging and other harvesting and natural disturbances on marine ecosystems. A new FMP will discuss ecosystem based recommendations and habitat improvement.
Obsolete – hydraulic escalator dredges now prohibited.	**6.1.2** DNR will encourage studies to evaluate the ecological impacts of hydraulic clam dredging in Maryland coastal bays.	Action is obsolete and can be deleted.

2002 Coastal Bays Hard Clam Fishery Management Plan (updated 07/13)		
Objective/Problem	**Action**	**Implementation**
	6.1.3 DNR will limit the number of individuals into the commercial hard clam fishery by permit only based upon those individuals who have landed at least 100 bags of hard clams (as documented by DNR dealer reports) in Maryland's coastal bays in at least 2 years between the 1990/91 and 2000/01 seasons. Using these criteria, a total of 22 individuals would qualify for this permit. This permit should be transferable with a license, or to an individual who purchases a clam rig from an individual who meets the criteria stated above, and relinquishes their permit to the new clam rig owner. DNR will evaluate this action within 3 years to determine if the desired outcomes are being achieved. This action is consistent with actions 2.1.2 and 5.1.2.	Legally inadvisable (see Sec. 2.1.1). Action can be deleted as it is addressed in 2.1.1.
Prob. 6.2: Direct Impact to Submerged Aquatic Vegetation (SAV) by Commercial Hydraulic Clam Dredging	**6.2.1** DNR will continue to prohibit the use of hydraulic clam dredges in SAV beds, and delineate existing SAV beds as necessary to maintain this protection over time.	Obsolete – hydraulic escalator dredges now prohibited.
Obsolete – hydraulic escalator dredges now prohibited.	**6.2.1a** The Maryland Coastal Bays Fishery Advisory Committee shall become the local group to develop and provide recommendations to DNR regarding the delineation of SAV closure areas to harvest from hydraulic clam dredging.	Obsolete – hydraulic escalator dredges now prohibited.
	6.2.1b DNR will continue to foster the support among legislators to make recommended changes in the SAV law which would benefit all stakeholder groups by making the delineation and enforcement process more manageable, and the closure areas consistent over a longer period of time	Ongoing.
	6.2.2 DNR and the National Park Service will investigate the feasibility and funding options for using Global Positioning System (GPS) units to improve the ability for clammers to comply with SAV closure areas and offset the maintenance cost associated with using buoys to identify SAV closure areas.	There has been no commercial activity for the past 4 years. No action to date.
Prob. 6.3: Potential Impact to Overwintering Blue Crabs by Commercial Hydraulic Clam Dredging. **Obsolete – hydraulic escalator dredges prohibited.**	**6.3.1** DNR will evaluate the need to restrict hydraulic dredging in important female blue crab overwintering areas by: a) Delineating female blue crab overwintering areas; *b) Determining the significance or contribution of these overwintering crabs to the coastal bays blue crab population;* c) Determining the magnitude of overwintering blue crab bycatch in the hydraulic clam dredge fishery; and d) Assessing the impact of dredging activity on overwintering female blue crabs.	Preliminary study was conducted by the MDNR Coastal Fisheries Program. Obsolete – hydraulic escalator dredges now prohibited.
Obj. 7. Protect, maintain and enhance important hard clam habitats. Prob. 7.1: Water Quality	**7.1.1** Develop strategies to restore water quality in areas closed to harvesting hard clams because of pollution	Ongoing.
Prob. 7,2: Hard Bottom Habitat	**7.2.1** Develop an action plan for improving hard bottom habitat (i.e shell or other suitable substrate) to reduce predation on small clams. The action plan will include the identification of:	Studies on habitat improvement indicate that clam survivorship is enhanced but not sufficiently high enough to justify the

2002 Coastal Bays Hard Clam Fishery Management Plan (updated 07/13)		
Objective/Problem	**Action**	**Implementation**
	a) Planting materials and sources; b) Enhancement areas; and c) Funding sources.	expense and logistical difficulties associated with such activities.
Prob. 7.3: Navigational Channel Dredging and Edge Disposal.	**7.3.1** The MD Coastal Bays Navigation and Dredging Advisory Group (NADAG) will seek comments from DNR's Shellfish Program on the potential impacts of proposed dredging activities on hard clams.	MDNR is routinely consulted during the permitting process on projects that may impact hard clams.
Prob. 7.4: Growth of Noxious Algal Blooms.	**7.4.1** DNR and MCBP will identify potential funding sources to support the following research and monitoring activities: 1) Assess the potential impact that noxious algal blooms have on hard clam populations; and 2) Identify factors which might contribute to noxious algal blooms.	MDNR conducted a study on the impact of brown tide on clams in culture. Sampling for harmful algal blooms and analyses of causes is ongoing at MDNR.
Obj. 8: Minimize the impacts of non-indigenous invasive species. Prob. 8.1: Green Crabs.	**8.1.1** DNR with the advice of Maryland's Coastal Bays Fishery Advisory Committee will implement measures to minimize the impact of green crabs and Japanese shore crab on the hard clam population in Maryland's coastal bays, and coordinate this effort with Delaware and Virginia.	Not yet initiated
	8.1.2 DNR will continue to work with Maryland's Non-indigenous Species Task Force to examine invasive species issues, and develop an Aquatic Nuisance Species plan to become eligible for Federal funding	This action is to be deleted and replaced with specific language on green crabs in a new FMP.
Obj. 9. Implement fisheries dependent and independent monitoring programs to obtain sufficient and accurate data for managing hard clams Prob. 9.1: Stock Assessment	**9.1.1** DNR will continue to survey the hard clam resource on annual basis in Maryland's coastal bays to facilitate management decisions.	Ongoing. This action will be included in stock assessment discussion in a revised FMP.
Prob. 9.2: Assessment of Bottom Enhancement Activities.	**9.2.1** Design and implement a program to monitor the efficacy of bottom enhancement activities.	The results of pilot studies suggest that such a program would not be cost-effective. See action 7.2.1
Prob. 9.3. Commercial Catch, Effort and Economic Data.	**9.3.1** DNR will establish, implement and evaluate a commercial reporting program to obtain accurate catch, effort and economic data from anyone harvesting hard clams in Maryland's coastal bays. This action is consistent with action 2.1.2.	Not yet initiated. There has been no commercial harvesting during the past 4 seasons.
Prob. 9.4: Recreational Catch, Effort and Economic Data.	**9.4.1** DNR will facilitate the design and implementation of a recreational clamming survey in Maryland's coastal bays.	Questions on recreational clamming were included as part of a broader 2006 angler survey by UMES.

Acronyms:

DHMH = Department of Health and Mental Hygiene
FMP = Fishery Management Plan
IFQs = Individual Fishing Quotas
MDNR = Maryland Department of Natural Resources
MIPS = Maryland Industrial Partnerships
NOAA CBO = National Oceanographic and Atmospheric Administration, Chesapeake Bay Office
NRP = Natural Resource Police
SAV = Submerged Aquatic Vegetation
STAC = Scientific & Technical Advisory Committee
UMD = University of Maryland
UMES = University of Maryland Eastern Shore
VIMS = Virginina Institute of Marine Science

2012 Maryland FMP Report (July 2013)
Section 12. Horseshoe Crab (*Limulus polyphemus*)

Chesapeake Bay FMP

There is an ecological relationship between horseshoe crabs and migratory shorebirds, particularly the red knot (*Calidris canutus rufa*). Migratory shorebirds rely on horseshoe crab eggs as food on their spring migration to their Arctic breeding grounds. This relationship prompted the Atlantic States Marine Fisheries Commission's (ASMFC) Management Board to implement an Adaptive Resource Management (ARM) framework. The ARM framework incorporates the biological requirements of the horseshoe crab and red knot populations along with the bait fishery and biomedical industry [1]. Survey data indicate that mid-Atlantic horseshoe crab abundance has been increasing while Hudson River and New England populations have declined [1,2]. Although mid-Atlantic horseshoe crab abundance has increased, red knot abundance remains depressed.

The Chesapeake Bay and Atlantic Coast Horseshoe Crab Fishery Management Plan (CBFMP) was adopted in 1994. The CBFMP prohibited the harvest of horseshoe crabs during the spawning season as a conservation measure for protecting their eggs and providing an important food resource for shorebirds. The plan established a spawning stock census of horseshoe crabs, stricter harvest reporting standards, and a program to delineate important spawning areas. In 1998, the ASMFC adopted the Interstate Fishery Management Plan for Horseshoe Crabs.

ASMFC's Addendum I (2000) to the Interstate Fishery Management Plan for Horseshoe Crab established state-by-state quotas on bait landings that were 25% below reference period landings. Addendum II (2001) allowed quota transfer between states. Addendum III (2004) further reduced commercial harvest and added seasonal closures in New Jersey, Delaware, and Maryland. These additional restrictions were implemented to further increase horseshoe crab egg abundance, a major dietary component for migratory shorebirds including the red knot. The red knot population has decreased since the 1980s and may be related to horseshoe crab egg abundance.

Addendum IV (2006) instituted seasonal and spatial harvest restrictions in Maryland and Virginia. Harvest restrictions apply only to the bait fishery. In addition, no more than 40% of Virginia's quota can be harvested east of the COLREGS line (determined by the International Regulations for Preventing Collisions at Sea and determine the "rules of the road" followed by vessels at sea). They must also have a minimum male to female ratio of 2:1 if landed in Virginia. Addenda V (2008) and VI (2010) continued the Addendum IV restrictions for Maryland and Virginia. Addendum VII (2012) implemented the ARM framework in 2013 to optimize horseshoe crab harvest while conserving both shorebird and horseshoe crab abundance.

A plan review team (PRT) reviewed the CBFMP in 2011. The PRT recommended amending the CBFMP to address two issues: 1) adopt the ASMFC's ARM framework and 2) address the lack of genetic and spawning data for horseshoe crabs within Chesapeake Bay.

Stock Status

Horseshoe crabs caught in Maryland waters include individuals from three separate spawning stocks: Maryland, Virginia, and Delaware Bay. Juvenile and adult male indices from the Delaware Bay region show evidence of population recovery [3,] There is no detectable abundance trend for adult females. Increased stock biomass is attributed to harvest closures and decreased fishing mortality. Horseshoe crab abundance has been in decline since 2009 in the New York region and since 2004 in the New England region [2]. These declines may indicate a northward shift in harvest pressure [2].

Delaware Bay egg density increased 3-fold from 2009 to 2010 (42,400 eggs/m^2 to 136,000 eggs/m^2, respectively) [4,5]; a significant increase in egg density since 2005. Egg density has decreased annually since 2010. Egg density in 2012 (35,000 eggs/m^2) was comparable to that measured in the mid-2000s [2]. Peak egg density generally coincides with peak shorebird migration.

Reported biomedical mortality from harvest to release was 1.3% in 2012. However, a 15% bleeding and release mortality is used for the stock assessment. In 2011, a mortality range of 5-30% was included in the ARM assessment. Estimated annual mortality averaged 70,567 crabs from 2007 - 2012 [2]. The annual mortality threshold for crabs bled by the biomedical industry is 57,500 crabs.

Current data is insufficient to develop overfishing and overfished reference points [2]. A coastal horseshoe crab stock assessment update began in 2013.

Current Management Measures

For Maryland, the 2013 commercial quota is 255,980 male horseshoe crabs. Any quota overages are deducted from the next year's quota. Horseshoe crab harvest is prohibited from December 1 to June 7. From June 8 to July 10 horseshoe crabs can be harvested from waters beyond 1 mile of Maryland's Atlantic coast. Harvesters with a horseshoe crab permit are allowed 150 crabs per person per day. Horseshoe crab harvest is allowed in all tidal waters of Maryland from July 13 to November 30 and daily catch limits are indicated on the harvester's license. Harvesters without a horseshoe crab permit are limited to 25 crabs per person per day. All harvest is limited to Monday through Friday. Harvest of female horseshoe crabs is prohibited.

The harvest of male horseshoe crab for the biomedical industry and scientific research is allowed during seasonal closures. Limulus Amebocyte Lysate (LAL), extracted from horseshoe crab blood, is used to screen injectable drugs, biologics, medical devices, and raw materials for the presence of endotoxins. All crabs harvested for bleeding must be returned to the waters where they were caught within 48 hours. Crabs purchased from bait harvesters must be returned to the bait harvester after being bled. A chain of custody form must accompany all batches of horseshoe crabs. Biomedical mortality has exceeded the threshold since 2007 and demand for LAL has increased. The ASMFC Plan Review Team has recommended management actions be taken by the Management Board [2].

The U.S. Fish and Wildlife Service coordinates a coast-wide tagging program. Biomedical, conservation outreach, and research entities tag horseshoe crabs annually. The ASMFC Horseshoe Crab Technical Committee developed tagging program guidelines to make data collected more applicable to management issues. Over 226,000 crabs have been tagged with a return rate of 11%.

The ARM analysis revealed two circumstances that affect red knot demography and annual survival: 1) horseshoe crab abundance and red knot body mass at departure from Delaware Bay, and 2) arctic snow conditions upon arrival at the breeding grounds. The ARM workgroup developed five horseshoe crab management alternatives [6]: 1) a full harvest moratorium on both sexes; 2) a harvest limit of 250,000 males and 0 females; 3) a harvest limit of 500,000 males and 0 females; 4) a harvest limit of 280,000 males and 140,000 females; and 5) a harvest limit of 420,000 males and 210,000 females. An adaptive management approach is being used to identify which alternative to implement. Alternative #4 is currently in place.

In addition, genetic variability in red knot body mass thresholds may be an important factor for their annual survival. To date, the migratory red knot population has not shown any evidence of recovery despite the four-fold reduction in horseshoe crab harvest [6].

The Fisheries

Maryland's commercial quota has remained at 170,000 horseshoe crabs since 2004. Landings in 2012 were 169,087 horseshoe crabs or 27% of the coastwide landings (Figure 1). Maryland commercial landings have remained relatively stable since 1998 either at or below the quota except for an overage of 1,464 crabs in 2007.

ASMFC's horseshoe crab Plan Review Team (PRT) recommended that Virginia implement area-specific quota reductions in 2011 to reduce their quota by at least 21,600 crabs. The reduction would compensate for quota overages in 2009 and 2010. Late reporting of additional overages was also a concern.

The number of crabs landed coastwide for biomedical bleeding (not bait) has increased since the mid-2000s. Bleeding mortality has been estimated at 15%. A crab mortality threshold of 57,500 crabs was established in 1998. Horseshoe crab mortality in the biomedical sector has exceeded the threshold each year since 2007 (Figure 2). Due to consistent violation of the mortality threshold, the ASMFC Plan Review Team recommended that the ASMFC Management Board consider actions to decrease biomedical use and mortality of horseshoe crabs [2].

Issues/Concerns

Future congressional funding for the Virginia Tech benthic trawl horseshoe crab survey is unlikely [2,7]. Data from this survey is critical for use of the ARM model and stock assessments. The trawl survey is relatively inexpensive ($200,000) [2]. The biomedical industry provided partial funding for the 2012 trawl survey. These analyses are necessary to ensure that horseshoe crab spawning stock and egg production are sufficient to support migratory shorebird feeding (esp. red knot).

Reductions in Mid-Atlantic harvest quotas, particularly in Delaware Bay, may have redirected harvest to the New York and New England fisheries. If so, then current harvest levels within these regions may be unsustainable [7].

Biomedical bleeding mortality has exceeded the threshold mortality of 57,500 crabs since 2007. Recent research in Massachusetts suggests that mortality related to biomedical bleeding is double the 15% level currently used for management [7]. An increase in estimated biomedical mortality would significantly increase the extent of mortality overages. The ASMFC Plan Review Team recommended that the Management Board consider implementation of additional restrictions on the biomedical industry [2].

The bait industry has been importing three Asian horseshoe crab species to supply the bait market and take advantage of increased bait prices. Two concerns are associated with importation of these non-native species: introduction of non-native parasites and pathogens; and possible human health risks from the neurotoxin tetrodotoxin found in one of the Asian species [2].

In 2007, USFWS determined that the red knot is a candidate for ESA protection, but emergency listing was not warranted at that time. The USFWS will reevaluate red knot for endangered species listing in 2013. New Jersey changed its state status for red knot from threatened to endangered [2].

Figure 1. Maryland's commercial horseshoe crab landings and quota from 1998-2013 [8,9]. The 2013 quota is restricted to male horseshoe crabs.

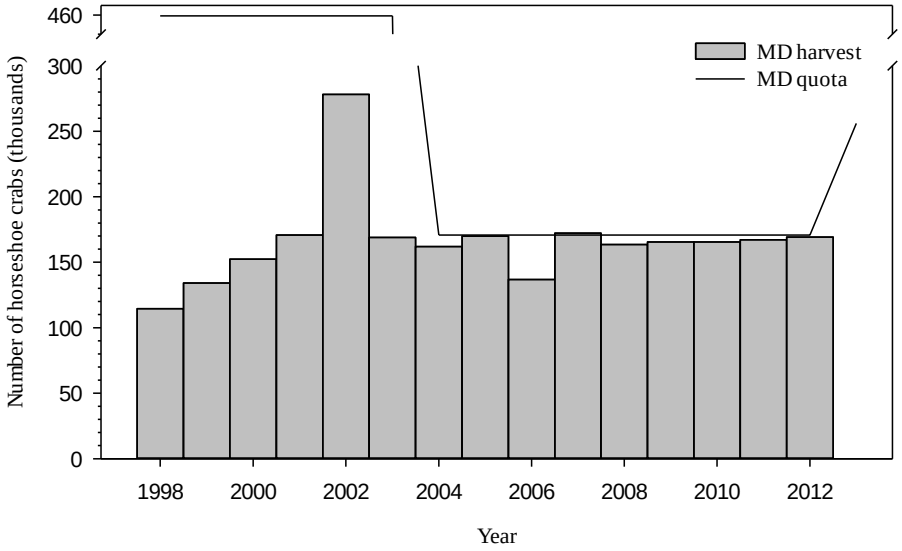
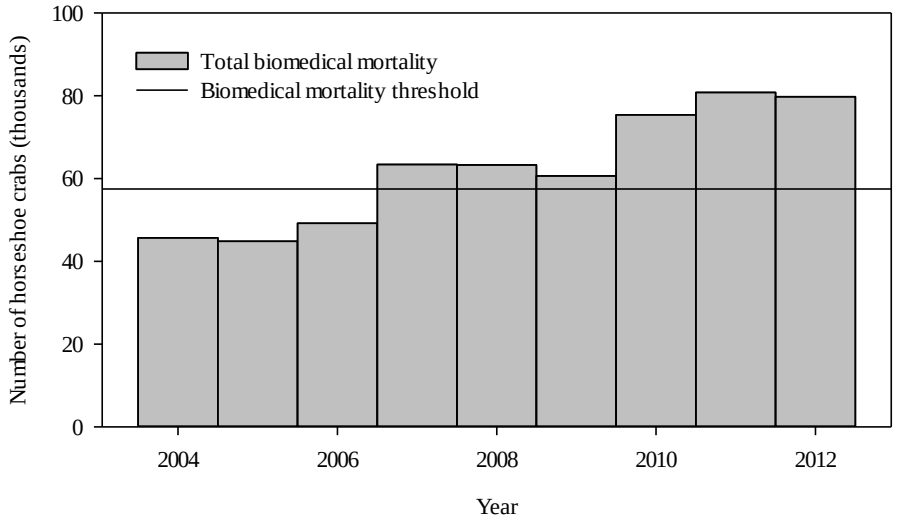


Figure 2. Actual and threshold mortalities of horseshoe crabs bled for the biomedical industry [2,10]. Mortality does not include crabs returned to the bait industry.



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[8] Doctor, S. 2011. Maryland's 2010 horseshoe crab (*Limulus polyphemus*) compliance report to the Atlantic States Marine Fisheries Commission. Maryland Department of Natural Resources Fisheries Service, Annapolis, MD.

[9] Personal communication from the National Marine Fisheries Service, Fisheries Statistics Division. July 23, 2013: http://www.st.nmfs.noaa.gov/index.

[10] ASMFC. 2007. 2007 review of the fishery management plan in 2006 for horseshoe crab (*Limulus polyphemus*). Atlantic States Marine Fisheries Commission, Washington, DC.

1994 Chesapeake Bay and Atlantic Coast Horseshoe Crab Management Plan Implementation Table (updated 7/2013)			
Problem Area	**Action**	**Date**	**Comments**
Strategy 1.1 Maryland and Virginia will protect the ecological role of horseshoe crabs by protecting horseshoe crab spawning areas and monitoring harvest.	1.1 Maryland and Virginia will prohibit the hand collection of horseshoe crabs from beaches during the peak time of shorebird migration, May 1-June 7.	1995	MD prohibited hand collection of HSCs between May 1 and June 7.
		1996	Based on spawning data, MD modified the restriction on hand collection of HSC to between April 1 and June 30 on Monday and Thursday only.
		1998	Since the CBP Horseshoe Crab FMP was adopted in 1994, coastal ASMFC requirements were adopted in 1998. Jurisdictions comply with all ASMFC HSC harvest restrictions.
		2001	NMFS established a HSC reserve in federal waters having a 30 mile radius from the mouth of Delaware Bay.
		2009 Open	MD COMAR 08.02.10.01.01 states that all persons are prohibited from catching or landing HSCs in state waters from December 1 to June 7, and catching or landing HSCs from the Chesapeake Bay and its tidal tributaries, or within 1 mile of the Atlantic coast or its coastal bays shoreline from June 8 to July 12. Person's can collect crabs Monday thru Friday from July 13 to November 30. There are no recreational catch limits but they must abide by the seasonal closures and the 25 crab/person/day for a non-permitted person.
		Open	VA Chapter 4 VAC 20-900- restricts hand collection unless a person has a hand harvester license. 5 HSCs/person/day may be harvested for personal use without a license.
		2006	VA prevents HSC harvest within 1,000 ft of mean low water May 1 through June 7.
		2011	VA implemented a license and permit moratorium. Only commercial fishermen who held a HSC harvest permit prior to May 1, 2011 are eligible to purchase a permit after May 1, 2011.
	1.2a Maryland will prohibit the scraping, trawling or dredging of horseshoe crabs between May 1 and June 7 within the Chesapeake Bay, coastal bay areas, and 1 mile of the Atlantic Coast.	1995	The time period recommended to prohibit the scraping, trawling, and dredging of HSCs within the Chesapeake Bay, coastal bays, and within 1 mile of the Atlantic coast was changed from May 1 and June 7 to April 1 and June 30 based upon MD spawning survey data .
		2004	Crabs harvested from the bait industry can by bled by the biomedical industry. These crabs must be returned to the bait harvester after being bled.
		2009 Continue	April catch or harvest restriction was added to the spring fishery. MD COMAR 08.02.10.01.01 states that HSCs cannot be caught or landed in MD state waters from December 1 to June 7. This restriction includes a May 1 to June7 closure. Scientific collection permits (including biomedical bleeding) allow HSC collection during the fishery closure so long as crabs are released alive within

1994 Chesapeake Bay and Atlantic Coast Horseshoe Crab Management Plan Implementation Table (updated 7/2013)			
Problem Area	**Action**	**Date**	**Comments**
			48 hours to waters where they were caught. HSCs are collected and reared as part of the education outreach program entitled "Green Eggs and Sand."
		On-going	June 8 to July 10 harvest is allowed 1 mile off Maryland's Atlantic coast. Harvest is allowed in all tidal waters from July 13 to November 30. Harvest is Monday through Friday. Female harvest is prohibited.
	1.2b Virginia will continue its ban on trawling within state waters.	1995	Virginia prohibits the use of trawls in Virginia's portion of the Territorial Sea.
	1.3 Virginia will prohibit a directed horseshoe crab fishery between May 1 and June 7, continue mandatory reporting in the conch dredge fishery and monitor bycatch of horseshoe crabs.	1995	An ASMFC HSC FMP was adopted in 1998. Since then, additional harvest restrictions have been implemented as needed.
Strategy 2.1 Maryland and Virginia will coordinate with Delaware and begin to develop a spawning stock census of horseshoe crabs that will serve as the basis for determining management recommendations as appropriate.	2.1 Maryland and Virginia will coordinate and implement a horseshoe crab spawning stock census in Chesapeake Bay, coastal bays, and along the Atlantic coast.	1995	An annual spawning stock survey was initiated from 1994 to 2000 in MD. The Delaware spawning survey provides data on assessing the status of the spawning population. MD's spawning survey is only in the coastal bays (not the Chesapeake Bay). MD Coastal Bays HSC trawl survey has been conducted since 1990.
		2002 Continue	Maryland Coastal Bays program began a volunteer spawning survey. Public reports of HSC spawning in Chesapeake Bay are kept on file.
		2007 Continue	Adaptive Resource Management Modeling (ARM) is being used to determine the ecological interaction between HSCs and shorebirds, and the economic and biological value of HSCs to the commercial fishery and the biomedical industry.
		2008 Continue	Biomedical industry is collaborating with USFWS Coast wide Tagging Program for HSC.
	2.2 Maryland and Virginia will promote and encourage research on horseshoe crab estimates of population abundance, age and size composition, mortality estimates and migration.	Open	Continue to participate in the annual HSC meeting of regional biologists and managers. A University of Maryland Eastern Shore project to determine if a spawning stock survey could be used to provide a statistically significant index of abundance was partially funded. CPUE data is collected from MD's offshore and coastal bay trawl survey, and blue crab summer trawl survey within the Chesapeake Bay. Sex data is collected from MD's spawning beach survey. A tagging program was initiated in 1995 to determine migratory patterns, identify stocks, and increase our understanding of the HSCs spawning behavior. USFWS currently directs the effort.
		On-going	ASMFC coastal management actions include a mandatory monitoring program, tagging studies, spawning surveys, and egg surveys.
3.1 Maryland and Virginia will	3.1a Maryland will require horseshoe crab harvesters to provide monthly reports on the size of harvest, area of	1995 Continue	Reporting was implemented on January 29th, 1996. Permit system currently required and used to monitor commercial harvest.

1994 Chesapeake Bay and Atlantic Coast Horseshoe Crab Management Plan Implementation Table (updated 7/2013)			
Problem Area	**Action**	**Date**	**Comments**
monitor the commercial and medical harvest of horseshoe crabs to improve the quality of data obtained from the commercial fishery.	collection, gear usage, and any other information the Department of Natural Resources deems necessary.	2000 2004 On-going 2005 2006 2004 Continue 2008 2009 Continue 2010 On-going	ASMFC instituted a 25% reduction in horseshoe crab bait landings using 1995-1997 as the reference period. MD has implemented additional restrictions based on ASMFC Addendum III. MD landings limited to 170,653 lbs annually based on 2001 landings. MD began implementing a 1:1 male:female harvest ratio issued by public notice. Saturday and Sunday harvest closure. Limit of 100/person/day with permit 1 mile off Atlantic Coast from Jun 8 to Jul 10. From Jul 13 thru Nov 30 in all waters, harvest is quota on permit or 25/person/day without permit. Permittee's catch limit based on ratio of reported 1996 landings applied to total annual allowable landings for the present year. ASMFC Addendum IV changed start of harvest closure from May 1 to January 1. This provision was to expire in 2008 but was continued through 2009. All HSC supplied to the bait fishery is included in that states allowable harvest. Biomedical industry will make available all HSC that die prior to live release to the bait fishery. HSC annual bait fishery quota has been 170,653 HSCs since 2004**.** Harvest closure was Dec 1 – March 31 and May 1 - June 7. Harvest is allowed >1 mile offshore during April 1 – 30 & June 8 - 30. Harvest is allowed from July 1 – Nov 30 in all MD tidal waters. MD changed the HSC harvest ratio to 2:1 male:female ratio (issued by public notice**)**. Biomedical industry is allowed to land male HSCs for bleeding during the May 1 to June 7 harvest closure so long as the crabs are released within 48 hours. Spring harvest closure was extended to include April 30. A "chain of custody" must be documented for every batch of HSCs received. Harvesters are required to submit monthly catch logs. Commercial harvest reports must be submitted to MDNR Fisheries Service within 10 days after the end of the month being reported after which the report is late.
	3.1b Maryland will determine if a special permit to harvest horseshoe crabs is necessary after evaluating the new federal reporting system and the results of the monthly reports	1995 2001 On-going	MD requires a special HSC permit to land HSCs. ASMFC allows state-to-state transfer of quotas.
	3.2 Virginia will continue their mandatory reporting procedures implemented in January 1993.	1993 Continue 2000	Reporting was implemented in January of 1993. VA has a commercial quota based on coastal reference period. ASMFC instituted a 25% reduction in horseshoe crab bait landings using 1995

1994 Chesapeake Bay and Atlantic Coast Horseshoe Crab Management Plan Implementation Table (updated 7/2013)			
Problem Area	**Action**	**Date**	**Comments**
			to 1997 as the reference period.
		2006	ASMFC Addendum IV changed the start of harvest closure from May 1 to January 1 through 2008. It required that Virginia trawl harvest not exceed a certain percentage from a specified area and must maintain at least a 2:1 male:female harvest ratio to protect the Delaware stock. Commercial quota is 152,495 HSCs. Quota can be transferred from other jurisdictions with a combined cap.
	3.3 Maryland and Virginia will survey American eel harvesters and their use of horseshoe crabs by sex for bait.	1995 2000	No longer an issue. Both eels and horseshoe crabs are managed through ASMFC coastal FMPs.
4.1.1 The jurisdictions will define and protect horseshoe crab spawning areas that are used by migrating shorebirds.	4.1 Maryland and Virginia will initiate a study to delineate the geographic distribution of horseshoe crab spawning habitat in the Chesapeake Bay and coastal bays if funding is available.	Open Continue	A HSC hotline and spawning beach survey was developed in 1994 to delineate spawning habitat in Maryland. The survey is available through the MDNR website. VA has also established a hotline. MD DNR Coastal Bays Program and Worcester County staff have cooperative projects that display shoreline stabilization using soft shoreline designs to create or protect HSC spawning habitat.
	4.2 The jurisdictions will promote research to define the water quality requirements for horseshoe crabs.	2010 Continue	Maryland Coastal Bay volunteer spawning survey began recording temperatures to understand the horseshoe crab spawning behavior in the Maryland Coastal Bays.
	4.3 The jurisdictions will continue to work with the Chesapeake Bay Program, the Coastal Bay Initiative, and water quality improvement goals for the Bay and coastal areas.	Continue	The Chesapeake 2000 agreement commits to improving habitat and water quality for living resources in the Bay. The Comprehensive Coastal Management Plan (CCMP) includes strategies and actions to improve Coastal Bays water quality and habitat conditions.

Acronyms

ASMFC- Atlantic States Marine Fisheries Commission
CBP - Chesapeake Bay Program
COMAR - Code of Maryland Regulations
CPUE - Catch per Unit Effort
FMP - Fishery Management Plan
HSC - Horseshoe Crab
MDNR – Maryland Department of Natural Resources
NMFS – National Marine Fisheries Service
USFWS - US Fish and Wildlife Service
VAC - Code of Virginia

2012 Maryland FMP Report (August 2013)
Section 13. King Mackerel (*Scomberomorus cavalla*) and Spanish Mackerel (*Scomberomorus maculatus*)

Chesapeake Bay FMP

Spanish mackerel are caught by both recreational and commercial fishermen in Chesapeake Bay [1,2]. They prefer warm water and are usually available for six- to eight-weeks (July-August) and are increasingly important to recreational fishermen. King mackerel are less common visitors to Maryland's coastal waters.

The Chesapeake Bay and Atlantic Coast King and Spanish Mackerel Fishery Management Plan (FMP) was adopted in 1994. The plan follows the Atlantic States Marine Fisheries Commission's (ASMFC) 1990 FMP for Coastal Migratory Pelagic Resources which includes Spanish mackerel. These two species are managed jointly under the federal Coastal Migratory Pelagics FMP adopted in 1983 by the South Atlantic Fishery Management Council (SAFMC) and the Gulf of Mexico Fisheries Management Council (GMFMC). Since 1985, eighteen amendments have been adopted. For specific details on each of the amendments, go to: http://www.safmc.net/Library/FisheryManagementPlansAmendments/tabid/395/Default.aspx. Atlantic coastal states comply with the provisions of the 1990 Spanish mackerel ASMFC FMP by implementing creel limits, size limits and seasonal closures. The ASMFC Omnibus Amendment 1 (2011) and Addendum I to the Omnibus Amendment (2013) provide additional authority to manage Spanish mackerel in state and federal waters.

Stock Status

There is no formal stock assessment for either mackerel species in the Chesapeake Bay or along the mid-Atlantic coast. A stock assessment conducted by the Southeast Data, Assessment, and Review Process (SEDAR) in 2012 concluded that Spanish mackerel are not overfished and overfishing is not occurring [3]. Coastal overfishing had occurred in the 1970's and early 1980's, which led to harvest control regulations and a rebuilding of the depleted stocks. Stock assessments are performed by the Mackerel Stock Assessment Panel (MSAP) of the joint GMFMC and SAFMC. Management measures have been successful at rebuilding the Spanish mackerel stock. The ratio of biomass to Bmsy has been increasing. Based on the 2008 SEDAR stock assessment, the king mackerel stock is not experiencing overfishing. At this time, the data are insufficient to determine biomass estimates or size of the king mackerel stock. Biological reference points have not been established.

Current Management Measures

The coastal annual catch limit (ACL) for Spanish mackerel was set at 5.69 million pounds under Amendment 18 to the federal FMP (2011). Fifty-five percent of the TAC is allocated to the coastal commercial fishery and 45% to the coastal recreational fishery.

The Chesapeake Bay states manage Spanish mackerel through size and creel limits as well as closures consistent with federal management measures. All states from New York to Florida implemented the requirements of the 2011 Omnibus Amendment for Spot, Spotted Seatrout and Spanish mackerel. Maryland and Virginia require a 14" minimum total length limit with a creel limit of 15 Spanish mackerel. The king mackerel size limit is 27" in both states with a creel limit of 3 fish in Virginia. Maryland has not developed creel regulations for king mackerel because they are rarely encountered in Maryland state waters. Commercial reporting is required. Cull panels are used to reduce bycatch from pound nets set in the Potomac River by the Potomac River Fisheries Commission (PRFC).

Following public hearings, ASMFC approved an omnibus amendment for spot, seatrout and Spanish mackerel in August, 2011. The amendment includes an update to the coastal plan and includes commercial and recreational management measures and recommendations, adaptive management options, *de minimis* thresholds and exemptions, and monitoring recommendations. Maryland changed its regulations in 2012 to comply with the omnibus amendment[4]. The states require that recreational fishermen land their catch with the head and fins intact. The MD and VA commercial fisheries will have a limit of 3500 pounds per vessel/day/trip. ASMFC Addendum I establishes a 2 year pilot program to reduce the commercial pound net minimum size limit from 12" to 11.5"during July through September. The reduced size limit minimizes waste from the fishery. It allows already dead fish to be landed instead of discarded.

Issues/Concerns

The 2010 Review of the ASMFC FMP for Spanish mackerel recommends additional research and monitoring. High priority recommendations included collecting basic fisheries data for better stock assessment accuracy; developing methods for fishery-independent monitoring; determining better estimates of recruitment, natural and fishing mortality rates and stock size; and implementing ecosystem-based management.

The Fisheries

In most years, the estimated recreational harvest of Spanish mackerel is greater in Virginia than in Maryland (Fig. 1). Catch estimates in the recreational fishery are imprecise with proportional standard errors in excess of 50 for most years in both Maryland and Virginia. In all years, commercial landings of Spanish mackerel from Virginia waters greatly exceed those from Maryland (Fig.2). There have been few reports of commercial landings of king mackerel from Maryland since 1993 and from Virginia since 2000.

Figure 1

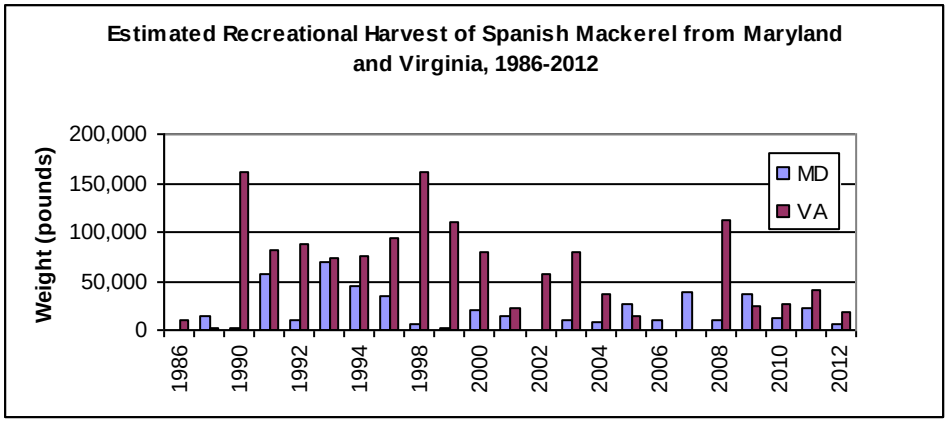
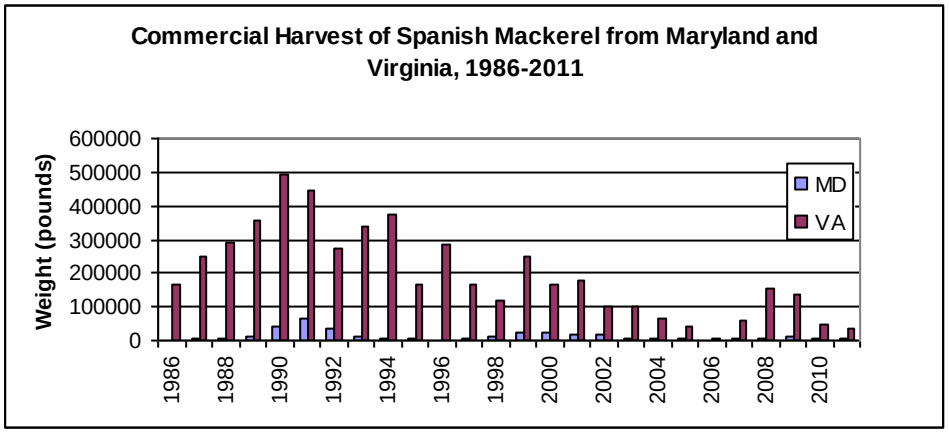


Figure 2.



Commercial harvest reports from 2011 are preliminary.[2]

References

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1994 Chesapeake and Atlantic Coast King and Spanish Mackerel Management Plan Implementation Table (update 08/13)			
Section	**Action**	**Date**	**Comments**
Stock Status	Action 1.1.1 A) Virginia will enforce a 14" TL minimum size limit and a 10 fish/person/day bag limit for Spanish mackerel.	1991 Continue	Minimum size and creel limits in place. Creel limit increased to 15 fish/person/day.
	Action 1.1.1 B) Maryland will enforce a 14" TL minimum size limit for both the recreational and commercial fisheries and a 10 fish/person/day bag limit for Spanish mackerel.	1993 Continue	Minimum size and creel limits in place. Creel limit increased to 15 fish/person/day. VA has a commercial limit of 3500 pounds Spanish mackerel per vessel per day. **MD implemented a 3500 pound commercial limit in 2012**.
	Action 1.1.2 A) Virginia will enforce a 5 fish/person/day bag limit for king mackerel.	1991 Continue	Minimum size and creel limits in place. Creel limit reduced to 3 fish/person/day.
	Action 1.1.2 B) Maryland will enforce a 5 fish/person/day bag limit for king mackerel.		MD has not developed regulations for king mackerel since most of the catch is outside state waters. Fishermen must abide by the limits imposed in the EEZ.
	Action 1.1.3. Virginia and Maryland will enforce a 20" FL or 23" TL minimum size limit for king mackerel.		Minimum size limit of 27" established.
	Action 1.1.4. Virginia and Maryland will close their respective commercial and recreational fisheries for king and Spanish mackerel when such closures are in effect in Federal waters.	1995	Closures will be in compliance with South Atlantic Fishery Management Council (SAFMC) recommendations.
Monitoring catch and quotas, and research needs.	Action 2.1.1. Virginia and Maryland will require mandatory reporting of commercial landings	Continue	Both states are in compliance with reporting requirements.
	Action 2.1.2. Virginia and Maryland will supplement the Marine Recreational Statistics Program. MD will require charter boat logbooks.	Continue	Coastal charter boat logbook system was improved in 1994. Improvements in estimating recreational harvest are in progress under the NOAA Marine Recreational Information Program (MRIP)

1994 Chesapeake and Atlantic Coast King and Spanish Mackerel Management Plan Implementation Table (update 08/13)			
Section	**Action**	**Date**	**Comments**
	Action 2.1.3. Jurisdictions will support stock assessment research for mackerel stocks.	Continue	VA samples Spanish mackerel for length and weight. A new King Mackerel Stock Assessment Report was completed in March 2009 for South Atlantic and Gulf of Mexico. The ASMFC omnibus amendment was approved in 2011 and was implemented July 1, 2012. The amendment includes monitoring and management recommendations and requires state regulatory changes now in progress. **Maryland submitted its plan to implement the requirements of the omnibus amendment to ASMFC in March, 2012. Addendum I was adopted in 2013 to establish a 2 yr. pilot program to reduce waste n the commercial fishery.**
Waste/sublegal bycatch and hook and release mortalities	Action 3.1.1. Virginia will evaluate the use of escape panels as a means of reducing undersized bycatch. VA will enforce a 2 7/8" minimum mesh size for gill nets.	Continue	VA conducted studies on escape panels in pound nets and found they were successful at reducing bycatch.
	Action 3.1.2. Jurisdictions will support angler educational programs.	Continue	In 2008, Project FishSmart was organized by UMCES to develop a process for developing a consensus position on fisheries management options by a stakeholder group comprised of biologists, environmental organizations, tackle shop owners, charter boat operators, anglers, commercial fishermen, and tournament organizers. The pilot project species was King Mackerel and the goal of the project was to prevent overfishing and preserve a year-round fishery. A consensus goal that the fishery should be managed to prevent overfishing from occurring and recommendations were adopted Nov 7, 2008. A report was submitted to the South Atlantic Fishery Management Council that recommended three options for consideration (UMCES, 2008). The Council included the three management recommendations in its public scoping document.
	Action 3.1.3. Virginia will monitor bycatch sold as crab bait from the pound net and haul seine fisheries.	1995	
Habitat Issues	Action 4.1.1. Jurisdictions will continue to work with the Chesapeake Bay Programs, the Coastal Bays initiative, and water quality improvement goals for the Bay and coastal areas.	Continue	The CBP has adopted new water quality goals and are working towards attaining the goals. Status of the water quality indices can be found on their website at www.chesapeakebay.net

Acronyms:
ACL = Annual Catch Limit
ASMFC = Atlantic States Marine Fisheries Commission
CBP = Chesapeake Bay Program
EEZ = Exclusive Economic Zone
UMCES = University of Maryland Center for Environmental Studies
PRFC = Potomac River Fisheries Commission

2012 Maryland FMP Report (August 2013)
Section 14. Eastern Oyster (*Crassostrea virginica*)

The oyster population in the Maryland portion of the Chesapeake Bay improved during 2012. The Maryland oyster biomass index was at its highest value since 1999, spatfall was above the average recruitment, and mortality was at its lowest levels since 1985[1]. Oyster disease prevalence during 2012 was below the long-term average but the intensity of disease infection was greater.

Chesapeake Bay Oyster Management

The Chesapeake Bay Oyster Management Plan (OMP) was adopted in 1989 and revised in 1994 and 2004. The 2004 OMP provides both a general framework and specific guidance for implementing a strategic, coordinated, multipartner management effort for oysters in the Bay. The *OMP* defines several strategies for rebuilding and managing native oyster populations: evaluating the use of sanctuaries and harvest reserves to obtain optimum ecological and economic benefits; rebuilding habitat; managing harvest; increasing hatchery production; evaluating the impediments to aquaculture; improving coordination among the oyster partners; and developing a baywide database to track restoration projects. Amendment #1 to the OMP was adopted in 2010. The amendment allows aquaculture and clamming activities within the larger, expanded sanctuary (areas closed to shellfish harvest and focused restoration activities) program; the use of new enforcement measures to protect sanctuary areas; and the implementation of sanitation guidelines. The 2004 OMP was reviewed during 2010. The Plan Review Team (PRT) concluded that the framework for managing oysters was still appropriate but that the strategies and actions had changed considerably because of the Maryland 10-point plan. The PRT recommended a complete revision of the plan. However, a timeline for revising the plan has not been developed.

A Maryland Oyster Advisory Commission (OAC) was established in 2007 to provide advice on new strategies for rebuilding and managing the oyster population and fishery. As a result of the OAC recommendations, Maryland is implementing a 10-point Oyster Restoration and Aquaculture Development Plan. The new plan increases the network of oyster sanctuaries from 9% of available habitat to 25%; identifies areas for oyster aquaculture with a streamlined permitting process; and allows a more targeted, scientifically managed, sustainable public fishery.

In 2009, Executive Order 13508 Strategy for Protecting and Restoring the Chesapeake Bay Watershed established a goal of restoring oyster populations in 20 tributaries by 2025. This order required the development of restoration goals and methodologies to quantify and assess progress toward the goals. The Sustainable Fisheries Goal Implementation Team (GIT) established a workgroup to develop quantitative oyster restoration metrics; to define sampling protocols and provide assessment techniques for sanctuary reefs. The group completed a science-driven consensus document describing a minimum suite of goals and metrics. The document was formally adopted by the Executive Committee of the GIT in December 2011. A restored oyster reef should have a minimum of 15 oysters and 15 grams of biomass per square meter covering at least 30% of the reef, with at least two year classes of oysters on each reef.[2]

Stock Status

The oyster stock in the Chesapeake Bay is currently estimated at less than 1% of its historic abundance. However, the oyster population has improved over the last two years. The 2012 Maryland oyster biomass index was at its highest value since 1999. The 2012 spatfall intensity index was 59.9 spat/bushel, over the long-term (28 yr) median index of 19.4 spat/bushel. The spatfall index is a measure of reproductive success and an index of potential population increase[1]. Over 800 million hatchery-raised oyster larvae and close to 4 billion eyed-larvae were planted in the Bay in 2012 to augment natural reproduction. To date, 70 oyster reefs have been re-established on 1300 acres of bottom (Oyster Recovery Partnership & Chesapeake Bay Program website).

Two oyster parasites, *Perkinsus marinus* (Dermo) and *Haplosporidium nelsoni* (MSX) are major factors that impact oyster survival and population growth. The distribution and abundance of both diseases are influenced by environmental factors, especially temperature and salinity, and can vary from year to year. During 2012, Dermo disease was below the long-term average but the mean infection prevalence (percentage of oysters with the disease) increased. MSX was at its lowest level since 1990. As a result, total oyster mortality was at it lowest level, 7%, since 1985[1].

Pre-stock assessment studies were conducted in 2009-2010. The studies included a spatial analysis to determine the appropriate scale for oyster population processes and the development of two oyster stock assessment models. The models were fitted to harvest data from the fishery and relative density data from the fall dredge survey. The models estimated abundance and mortality rates. Both approaches found a substantial decrease in oyster abundance during the study periods[3]. Recommendations were made to improve data collection from the fishery and the fall survey.

Current Management Measures

There are three approaches to managing oysters in the Chesapeake Bay: ecological restoration; a sustainable public fishery; and aquaculture. Ecological restoration will meet the goal of the Executive Order to restore tributaries. The US Army Corps of Engineers (USACE) and partners evaluated 63 tributaries and sub-regions for their potential to support large-scale restoration efforts. As a result, 19 tier I tributaries were identified with 11 sites in Maryland and 8 sites in Virginia. Harris Creek was selected as the primary restoration area. The target for Harris Creek is to restore 360

acres. To date, 110 acres have been restored and 524 million oysters have been placed in Harris Creek. It is projected to take 2 to 5 years to complete the restoration effort if funding is kept at current levels. The Little Choptank River has been selected as the next priority area for targeted oyster restoration in Maryland. The governor has proposed a $7.5 million capital investment in oyster restoration in Harris Creek (Talbot County) and the Little Choptank (Dorchester County) with additional money for aquaculture infrastructure improvements.

Maryland's oyster harvest has been around 100,000 bushels annually since 2002. Historically, the annual harvest averaged 2.5 million bushels (1920-1969) and 1.3 million bushels (1970-2002) (Figure 2). Preliminary harvest data for the 2012-2013 season is 340,000 bushels. Both harvest seasons and catch limits by gear type are enforced for the public fishery. The sanctuary expansion allows 167,720 acres of natural oyster bars for the wild oyster fishery. Maryland DNR began implementing a new procedure for tagging each container (bushel) of oysters during the 2011-2012 oyster season. The new procedure follows the requirements by the National Shellfish Sanitation Program.

Aquaculture

New shellfish legislation was passed in 2011 and included expanding leasing areas; giving DNR the authority to revoke commercial licenses for poaching violations; transferring the Seafood Marketing and Aquaculture Program from the Department of Agriculture to the Department of Natural Resources; and requiring the Department of Environment to use the most reliable data to determine whether shellfish production areas pose risks to consumer health. A $2.2 million financial assistance program was established to aid watermen in aquaculture endeavors. An aquaculture training and education program is also underway. The program includes a series of training publications and the sponsorship of two statewide aquaculture conferences. To date, 84 new leases have been issued since 2010. Maryland DNR has implemented an aquaculture electronic notification system for leaseholders. Beginning in 2013, leaseholders are required to submit monthly harvest reports. Through a partnership with the Oyster Recovery Partnership, DNR provides field support for in-the-water activities of oyster aquaculture production.

Marylanders Grow Oysters (MGO), a program under Governor O'Malley's Smart, Green & Growing Initiative, grew over 2 million oysters that were planted in sanctuaries. Since 2008 the program has grown from nearly 900 oyster cages to about 8,000 oyster cages. This volunteer program involves about 2000 people and has expanded to 30 tributaries. For more details on the program, go to the website http://www.oysters.maryland.gov .

Figure 1.

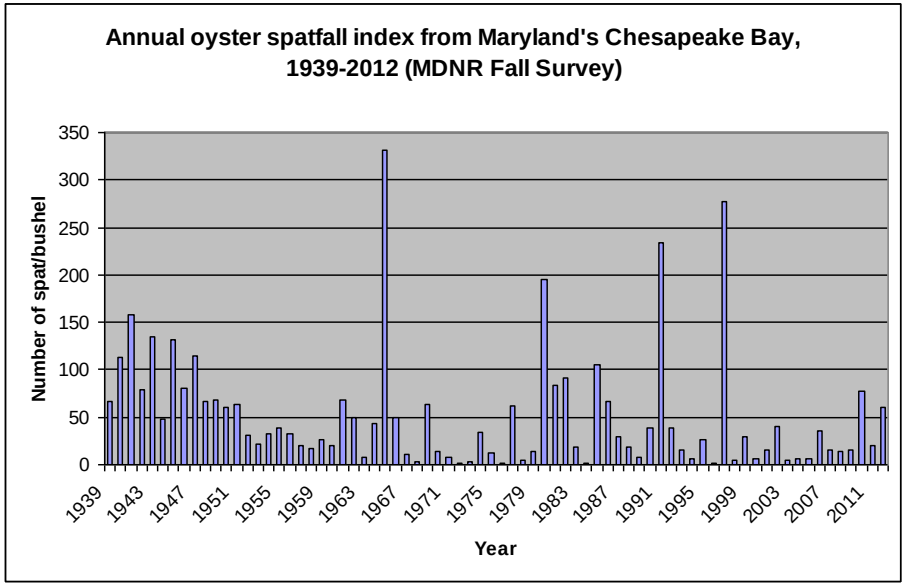
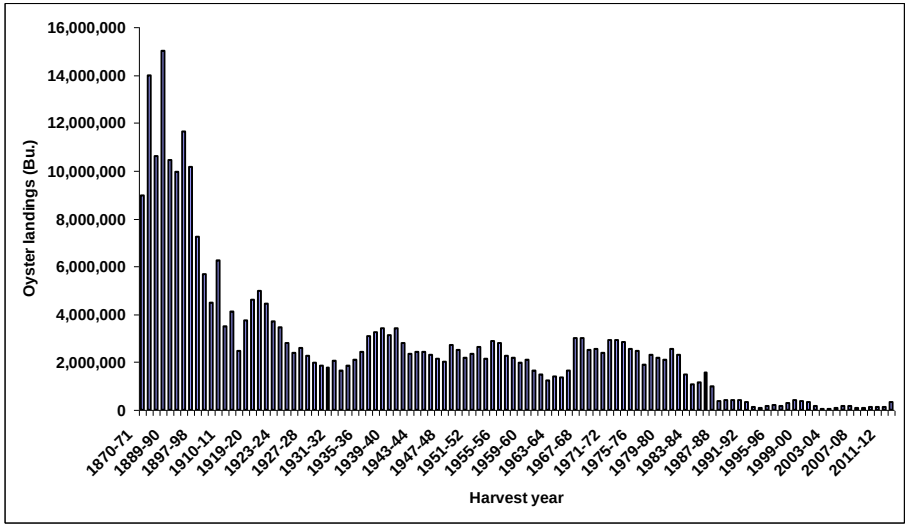


Figure 2. Maryland commercial oyster harvest, 1939-2012.



(MDNR Shellfish Program)

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Issues/Concerns

A major issue for oyster recovery is the continued degradation and loss of habitat. Approximately 80% of oyster habitat has been lost over the last 25 years[2]. Maryland DNR believes at least 10,000 acres of habitat need to be rehabilitated for oyster recovery. In addition, a healthy and robust oyster resource in the Bay relies on appropriate substrate for the setting of young oysters. Although dredging for buried shell and shell reclamation activities are underway, the availability of suitable habitat is limited. The Oyster Recovery Partnership has developed the Shell Recycling Alliance, a group of over 150 restaurant owners, caterers, seafood distributors and citizens, as a mechanism for collecting shells for habitat and seed. Starting in July, 2013, residents and businesses will be able to receive a tax credit per bushel of recycled oyster shell up to $750 per year. Over 15,000 buhels of shell were collected in 2012.

The Chesapeake Bay Program is in the process of developing a new Watershed Agreement. The proposed oyster outcome is: *Restore native oyster habitat and population in ten tributaries by 2025 to recover the benefits of fish habitat and water quality improvements provided by healthy oyster reefs.*The proposed outcome reduces the originial restoration of 25 tributaries to 10 tributaries. Given the funding restraints and the amount of shell and oyster seed needed, the restoration of 10 tributaries was more reasonable.

The increase in sanctuary areas and aquaculture activities require additional law enforcement. New measures have been adopted to deter and issue citations for oyster poaching. Enforcement requires a continued dedicated effort. The new penalty system has resulted in license suspensions and revocations.

References

[1]Tarnowski, M. 2013. Maryland Oyster Population Status Report 2012 Fall Survery. Maryland Department of Natural Resources Shellfish Division & Cooperative Oxford Laboratory, MDNR Publ. No. 17-62013-661

[2] Report of the Oyster Metrics Workgroup. 2011. Restoration Goals, Quantitative Metrics and Assessment Protocols for Evaluating Success on Restored Oyster Reef Sanctuaries. Submitted to the Sustainable Fisheries Goal Implementation Team of the NOAA Chesapeake Bay Program, Annapolis, Maryland. http://www.chesapeakebay.net/channel_files/17932/oyster_restoration_success_metrics_final.pdf

[3] Wilberg, M. and T. Miller. 2010. Developing Spatially-Explicit Assessment Tools for Eastern Oyster in Chesapeake Bay. Technical Report No. TS-599-10 of the University of Maryland Center for Environmental Science.

2004 Oyster Management Plan (OMP) Implementation Table (updated 8/2013)			
Section	**Action**	**Date/ Responsible agencies**	**Comments**
Disease Strategy 3.1A. Utilize disease management in all aspects of restoration & harvest to minimize spreading disease 3.1B. Develop & implement disease strategies within each of the 3 designated salinity zones.	3.1 Conduct an analysis of how disease management might affect overall survival and productivity. Answer the following question: What management strategies will help increase biomass over a large scale and in the long-term?	Continue Univ. of MD, VIMS, MDNR, and VMRC.	Modeling and assessment frameworks were utilized through the EIS process to evaluate the benefits of disease management strategies. They included developing and testing of disease tolerant strains for aquaculture; implementing geographically distinct, large-scale oyster restoration (VIMS/NOAA funding); and producing disease-free spat on shell (ORP/UMCES). Scientific research results indicate the need for a cautionary approach to using disease resistant strains for restoration (see Action 6.3.1). Maryland has adopted a new approach for managing against oyster disease. Maryland will use a targeted restoration approach to facilitate the evolution of natural disease resistance, while managing against the spread of disease. Sanctuaries located in areas with salinities >14 ppt will encourage the development of disease resistance through natural selection.
	3.2 Increase hatchery production to supplement natural recruitment and mitigate the prevalence of *P.marinus* (refer to Chapter VI Hatchery Production for additional details)	Continue Univ. of MD, VIMS, MDNR, aquaculture industry	Additional State and Federal funding has resulted in an increase in hatchery production from 38 million spat in 2000 to over 800 million in 2012.There were 750 million spat produced in 2009. During 2010, ~450 million spat were produced and in 2011 over 600 million spat. I**n 2012, over 800 million spat were produced**. Production is dependent on spawning success in the hatcheries, availability of cultch, and long-term funding to operate the hatcheries at full capacity**.** VIMS started an Oyster Aquaculture Training program to provide skilled technicians in oyster husbandry for both hatchery and field operations. ORP has supported UMCES hatchery infrastructure and capacity (MDNR/NOAA funding).
	3.3 Establish broodstock sanctuaries in heavily infected areas to possibly produce disease resistant seed. (see Chapter IV Sanctuaries for more details).	Open MDNR, VMRC, ORP, VA Corps	Sanctuaries have been established in a variety of areas throughout the Bay to produce self-sustaining populations of oysters.
	3.4 Develop, implement and maintain a seed policy to reduce and minimize disease impacts.	2004 2007 Continuing	MDNR developed a new policy with additional restrictions, however**,** beginning in 2007 no seed was available to move and very little was moved in 2008 & 2009 to the present. VIMS has a long standing advisory to the state (VMRC) against moving diseased seed. Both MD & VA have oyster advisory committees to provide advice on seed policy issues as they arise.
	3.5 Implement oyster surveys as necessary to obtain the best estimates of oyster population data: a) Increase the frequency & spatial intensity of sampling; b) Seek additional funding.	On-going	MDNR funded a project (UMCEES) to develop spatially-explicit assessment tools for the oyster stock in Chesapeake Bay. The project develop a framework for stock assessment, evaluated current data collection, recommended improvements to data collections and evaluated the feasibility of including environmental factors into assessment models. A final report was completed in 2010 and available at **http://www.dnr.state.md.us/irc/docs/00016171.pdf .** DNR/ MGS & NOAA are continuing to coordinate field operations to characterize benthic habitat.

Sanctuaries Strategy 4.1 A network of clearly marked oyster sanctuaries will be established throughout the Chesapeake Bay and its tributaries Strategy 4.2. Utilize the steps outlined in the OMP for establishing oyster sanctuaries throughout the bay.	4.2.1 Decisions on where to locate sanctuaries will be guided by the Virginia Oyster Restoration Plan developed by VIMS and VMRC and Maryland's Priority Restoration Areas developed by MDNR and the Maryland Oyster Roundtable Steering Committee. The maps will be used as a preliminary tool to focus restoration activities (The MD Oyster Roundtable has been replaced by the Oyster Advisory Committee)	2004 2009 On-going	MDNR supported a study to determine the best productive oyster bars within Maryland and used the results to develop a 10 point Oyster Restoration and Aquaculture Development Plan. Based on this study, new sanctuaries areas have been established. USACOE conducted a study to evaluate 63 tributaries and sub-regions for the purpose of supporting restoration. Nineteen Tier I tributaries were delineated: 11 sites in MD and 8 sites in VA. **Five priority tributaries have been identified (Maryland: Harris Creek and Little Choptank; Virginia: Lynnhaven River, Lafayette River, and the Elizabeth River).Initial efforts have been focused on Harris Creek in Maryland and the Lafayette River in Virginia.**
	4.2.2 Utilize existing protocols & standard operating procedures for recording or charting GPS coordinates for oyster sanctuaries in order to verify locations and track restoration progress.	Beginning in 2005 2008/2009 On-going	Protocols have been developed to delineate and mark sanctuary areas**.** Bay jurisdictions continue to track restoration progress.
	4.2.3 Evaluate the use of alternative cultch material because all restoration efforts depend on the availability of suitable habitat and traditional shell dredging cannot support the scale of the current & future sanctuary initiative.	On-going	A study in MD was conducted in various salinities & the report is on file with DNR. VIMS and the ACOE released a report on the effectiveness of alternative materials (2006). The function of alternative substrates is to provide a firm base for a constructed oyster bar. Alternate materials to replace natural oyster shell can be expensive. MDNR Shellfish Program will spend $2 million on transporting shell from FL during 2013. They also will be considering buried shell deposits within the Bay.
	4.2.4 Develop and implement techniques to locate and recover buried shell or shell with layers of sedimentation using vacuuming, bar cleaning or other innovative methods.	2005 2009 On-going	MD has obtained a permit for a reclamation program that will provide up to 25 million bushels of shell. The MDNR/MGS and NCBO bottom survey program will provide information to prioritize areas and facilitate decisions on shell reclamation techniques. **ORP started a Shell Recycling Alliance and collected approximately 15,000 bushels of shell in 2012.**
	4.2.5 Increase hatchery production to support restoration needs. Current seed levels are too low to effectively stock sanctuaries (see Chapter VI Hatchery and Aquaculture).	2005	See comment for Action 3.2. The question of what is an effective quantity of hatchery seed in sanctuaries is unknown.
	4.2.6 Monitor areas to evaluate oyster population status and measure progress towards the commitment to increase oyster biomass by 10-fold.	On-going MDNR, VIMS	Utilize the 1994 value as the baseline for measuring the increase in biomass. Provide annual updates. Documentation for MD's methodology for calculating biomass estimates is available in the PEIS. Maryland's biomass is based on the annual fall survey data and an estimate of available oyster habitat. There is a need to improve the data, especially the habitat estimates, that supports the biomass calculations. Criteria for determining a restored oyster reef were adopted in 2011. Jurisdictions are focusing on restoring two targeted tributaries, Harris Creek (MD) and Lafayette River (VA).

Sanctuaries (cont'd) Strategy 4.3 Management actions within sanctuaries are primarily based on salinity zones and focus on three key factors: growth, reproduction and disease. The zonal approach to management provides general guidelines for selecting project objectives and anticipating project results in each area	Strategy 4.3.A: Zone 1 (5ppt to <12ppt) Increase biomass & enhance reef habitat. Enhance reef/ bottom habitat to increase oyster biomass and promote the development of living oyster reefs with broad size/age class structure that supports a diverse reef community Action 4.3.A.1 Identify priority areas in Zone 1 that would have the most success at reaching the defined project objectives Action 4.3.A.2 Rehabilitate and maintain oyster bottom habitat to provide planting substrate for seed oysters and optimal conditions for larval settlement Action 4.3.A.3 Plant hatchery produced SPF seed, if necessary, over several years to establish an oyster population with a diverse age class structure	2005 **On-going**	MD is implementing a 10-Point Oyster Restoration Plan that focuses on targeted restoration strategies, expands the sanctuary program, rehabilitates oyster habitat, manages against disease, increases hatchery production, and enhances law enforcement.
	Strategy 4.3.B: Zone 2 (12-14ppt) Transition Area: The boundaries of Zone 2 shift because of variations in rainfall and resulting salinity. Consequently, Zone 2 will exhibit fluctuations in spat settlement and disease mortality. Projects in this zone must utilize current environmental data during planning. Action 4.3.B.1 Critically examine long-term environmental conditions and develop relevant project objectives for sanctuaries in Zone 2. Action 4.3.B.2 In the areas that have predominantly Zone 1 characteristics, utilize Zone 1 guidelines and in areas that have predominantly Zone 3 characteristics, utilize Zone 3 guidelines.		
	Strategy 4.3.C (>14ppt) Develop Disease Tolerance: It is not certain that disease resistance can develop via a management approach in Zone 3. The strategy will be to promote the development of disease resistance where disease mortality is high Action 4.3.C.1 Reestablish and maintain bottom habitat for oyster spat settlement and growth of disease resistant adults Action 4.3.C.2 Monitor Zone 3 sanctuaries to determine the effects of disease mortality Action 4.3.C.3 Utilize Zone 3 as an area to test laboratory strains of disease resistant oysters Action 4.3.C.4 Limit the use of natural seed to sanctuaries in Zone 3. The use of natural seed in repletion areas is allowed as long as disease protocols are followed.		

Sanctuaries (cont'd) Strategy 4.4 The jurisdictions will establish oyster sanctuaries to promote maximum ecological value	Action 4.4.1 Identify areas of special interest throughout the Bay, especially areas that may retain larvae (maybe auto-recruiting), and protect them using the sanctuary status	**On-going**	The Great Wicomico and Lynnhaven Rivers have been identified as areas of special interest**.** MD has established sanctuaries based on protecting 25% of the state's most productive areas as identified by an analysis of the annual fall survey data. **Harris Creek is Maryland's priority restoration area. To date, it has received 524 million oysters on 110 acres.**
Strategy 4.5 Implement the actions described in chapter III to address disease problems. In addition, the jurisdictions will take further action to minimize the spread of disease	Action 4.5.1 Utilize only SPF hatchery seed in sanctuaries designated for oyster biomass accumulation, Zone 1 and Zone 2.	On-going	Two workshops held in 2007 provided guidance on the role of hatchery-based oysters used for restoration. Using domesticated strains has not improved survival or resulted in higher recruitment. Preserving local wild stocks is preferred since data suggests some level of natural disease resistance is occurring. **Recent monitoring results provide more evidence of disease resistance. However, Dermo disease was below the long-term average and MSX was at its lowest level since 1990. It is difficult to separate the effects of environmental conditions especially temperature and salinity from improved survival due to disease resistance.**
	Action 4.5.2 Place hatchery seed on newly created sanctuary bottom and not on top of infected oyster populations in order to prevent rapid infection of the disease-free seed	On-going	
	Action 4.5.3 Continue to prohibit the movement of infected oysters from higher salinity waters onto newly or previously created sanctuaries in Zone 1		
Sanctuaries (cont'd) Strategy 4.6 To facilitate the enforcement of closed areas, especially sanctuaries, implement the following actions:	Action 4.6.1 Sanctuaries will be placed in geographically distinct areas with enough space to create a buffer zone between harvest and sanctuary areas to enable enforcement	Began in 2003 and continue	State agencies are responsible for marking sanctuary areas but sanctuaries continue to experience enforcement problems. New enforcement strategies have been developed to address this issue. See strategy 5.4. During 2009, MDNR provided educational materials to the court system and implemented a pilot program in Anne Arundel County to establish a Natural Resource Day in court. This program is expected to be expanded to other counties. MDNR also provided in-service training to NRP officers on all fishery issues especially regarding oysters. The new penalty system has resulted in license suspensions and revocations.
	Action 4.6.2 Sanctuaries will be buoyed and marked		
	Action 4.6.3 The public and judiciary will be notified about sanctuary areas through educational initiatives, public announcements and stakeholder meetings		
	Action 4.6.4 New enforcement measures will be identified and implemented. Additional manpower will be recommended if necessary		
Managing Harvest Strategy 5.1 Establish sanctuaries & special management areas thereby reducing F & develop appropriate biological reference pts.	Action 5.1.1 Establish a network of sanctuaries (refer to Section 1.IV for details) and special management areas throughout the Bay to limit harvest and increase oyster production	Continue	The MD 10-pt Plan increased the total area designated as oyster sanctuaries from 9% of quality habitat in 2009 to approximately 25% in 2010. The plan allows approximately 167,720 acres of natural oyster bars for the wild oyster fishery. In 2009, MD added 3 new sanctuaries that more than doubled the area of protected bottom from 1475 to 2581 acres. VA has a combination of 3-dimensional oyster reefs and acreage set aside as sanctuary areas. More than a 100 reefs have been constructed throughout VA's portion of the Chesapeake Bay.
	Action 5.1.2 Define appropriate biological reference points for the oyster resource based on the results of the bay wide stock assessment	2007/2008 2010	BRPs have not been developed but the 2010 assessment study indicated that exploitation rates have been around 25%. Assessments of oyster populations on specific bars are being conducted but a baywide assessment is not planned.
	Action 5.1.3 Utilize the disease guidelines and actions presented in Section 1.III in all aspects of special management areas and the fishery	2005	Continuing

	Action 5.1.4 Control oyster harvest to reach an appropriate F determined by the Oyster Scientific Committee.	2007/2008	Oyster harvest is controlled through a number of regulations by MDNR & VMRC. If BRPs are determined, a target and threshold F will be defined.
Strategy 5.2. Develop guidelines for managing fishing effort and monitoring oysters in open and closed areas.	Action 5.2.1 a) Determine the criteria for opening and closing areas; b) Monitor population; c) Determine level of acceptable exploitation; d) Regulate harvest and gear type; e) Develop additional monitoring if necessary; f) Close area when harvest criteria are met.	2005 On-going	Criteria for opening/closing harvest reserves have been developed. The managed reserves are opened to harvest only upon approval by the State and when 50% or more of the oysters are 4" in size. The 4" size limit allows the oysters an additional year to provide ecological services.
	Action 5.2.2 Utilize the site selection criteria set forth in the OMP to select special management areas (see Section 2 for details).	2005 Continuing	All oyster partners are managing oysters according to the salinity zones specified in section 2. Zone 1 (5-12 ppt) management involves the enhancement of populations by the planting of shell and seed. Zone 3 (>15 ppt) management involves the development of disease-resistant natural populations as well as the maintenance of hard substrate for spat settlement. Zone 2 (12-14 ppt) involves a mixture of these approaches.
	Action 5.2.3 a) MDNR will utilize the ORT STAC to review & make recommendations on where to locate harvest reserve areas; b) VA will utilize their current system to review and make recommendations on open & closed areas.	Continue 2007	The ORT STAC is no longer active. In 2007, MD established an Oyster Advisory Committee (OAC) to develop new strategies for rebuilding and managing the oyster resource. The OAC's recommendations resulted in MD's 10 point oyster management. The plan includes increasing the area and number of sanctuaries, encouraging aquaculture, and the support of a more targeted, sustainable, scientifically-managed oyster fishery.
	Action 5.2.4 Identify and implement regulatory & legislative changes needed for managing open & closed harvest areas.	2006	MDNR opens and closes areas via public notice. VMRC utilizes the Commission process.
	Action 5.2.5 a) Evaluate how rotating open & closed areas contributes to reproduction, oyster biomass & harvest; b) Based on the harvest reserve biological data, reevaluate the criteria (Action 5.2.1) for opening & closing areas & modify actions as necessary.	2005 On-going	Monitoring is underway and evaluation is on-going.
Strategy 5.3 a) Follow project guidance criteria specified in section 2 when developing repletion program work plans; b) Maintain the MDNR work plan review process	Action 5.3.1 Modify the MD repletion program through the established ORT Steering & Scientific Committee**s** to reduce and minimize disease impacts: a) Establish criteria to limit and/or restrict seed movement to certain regions depending on environmental conditions & disease levels; b) Avoid transplanting older year classes that have higher levels of disease than young spat; c) Rotate and/or clean seed areas; d) Allow old seed areas to lie fallow and/or be harvested; e) Utilize the disease results from the Fall survey; f) Transplant wild seed as soon as possible.	2004 On-going	MDNR no longer implements a repletion program but puts all of its resources into the 10-point plan.
	Action 5.3.2 MD will evaluate the effects of the repletion program on oyster population dynamics and habitat; and document how it contributes to an increase in oyster biomass & habitat.	2006	No repletion effort currently in progress.
Strategy 5.4 Strengthen the enforcement of oyster closures in sanctuaries & special management areas.	Action 5.4.1 Evaluate and implement the appropriate enforcement measures.	2005 MNDR, VMRC 2010	The MD Natural Resources Police (NRP) is beginning to implement radar and camera vessel monitoring technology. The system, Maritime Law Enforcement Information Network (MLEIN), is largely a national security tool that will be adapted to aide enforcement.
	Action 5.4.2 Prohibit the culling of oysters while underway to minimize the movement of infected oysters.	On-going MDNR, VMRC	

Hatchery and Aquaculture Considerations Strategy 6.1 Utilize hatchery-produced seed to augment natural reproduction reduce disease effects & increase biomass.	Action 6.1.1 Develop an interlab certification program for oyster diseases. Utilize the molecular diagnostic protocols for certifying SPF oyster seed developed by the VIMS Shellfish Pathology Laboratory.	2005	VIMS, Univ. of MD, MDNR
	Action 6.1.2 MD will increase hatchery production of SPF seed to support the 10-fold increase in oyster biomass: a) Increase & maintain as necessary the operating funds for each MD hatchery facility; b) Evaluate & optimize the efficiency of each facility in order to ensure maximum production of spat.	On- going MDNR, ORP, UMD	See comments for Action 3.2
	Action 6.1.3 Continue the protocol for certifying and using SPF seed: a) establish standards & refine criteria; b) use only SPF seed in sanctuaries located in Zone 1 (< 12ppt).	Continue VIMS, MDNR, UMD	Implemented and continuing.
	Action 6.1.4 The U.S. Army Corps of Engineers (COE) will conduct an analysis of hatchery project production in relationship to environmental benefits as part of its long-term restoration planning, and determine whether augmenting or building new hatchery (ies) is warranted	2008 ACOE	The master plan examines and evaluates the problems and opportunities related to oyster restoration and formulates plans for implementing large-scale Baywide restoration. This action was expected to be addressed as part of the Native Oyster Master Plan by the ACOE. However, the plan establishes guidelines for restoration and not specific actions.
Hatchery and Aquaculture Considerations (cont'd)	Action 6.1.5 Virginia will increase hatchery production of disease resistant seed to support the 10-fold increase in oyster production: a) Increase and maintain as necessary, the operating funds for oyster breeding in Virginia; b)Evaluate the feasibility of a public or a public-private hatchery	On going VMRC, VIMS	VIMS/VMRC conducted a pilot project to promote capacity building of private hatchery and grow-out infrastructures in order to provide oyster spat-on-shell for restoration (NOAA funding FY04 continued in FY06). VIMS is currently training oyster technicians for aquaculture work both in the hatchery and in the field.
	Action 6.1.6 Virginia will develop strategies for effective seeding of reefs and their effects on recruitment, especially in relation to the spread of disease resistance in the wild population.	2005 VMRC, VIMS	VIMS is conducting research on these questions through NOAA funding.
Strategy 6.2 Continue to track the genetic background of broodstocks used in hatcheries for restoration or replenishment activities	No specific actions recommended at this time.	To be determined MDNR, VMRC	There is some concern about reduced genetic variability of selectively bred oysters compared to wild oysters. In 2007, oyster disease experts recommended to discontinue transplanting infected natural seed; to discontinue bar cleaning for disease; to use hatchery-produced seed for augmenting natural stocks; to create sanctuaries and enforce a harvest moratorium; and consider larval dispersal mechanisms when creating oyster sanctuaries.
Strategy 6.3 Develop recommendations for using disease resistant strains of native oysters for restoration. Selectively bred oyster strains should be used for restoration only in areas where native oysters are locally depleted.	Action 6.3.1 Assess and evaluate the use of disease resistant stocks as a tool for increasing disease resistance in the native oyster population in the Bay.	2007	The participants at the 2007 OMP Workshop concluded that the development of alternative strains for use in restoration should not be pursued thereby preserving the natural ability of oysters to develop disease resistance. There was also consensus that domesticated disease-resistant strains were acceptable for aquaculture endeavors.

	Action 6.3.2 Monitor restoration activities to clarify the interaction between selectively bred strains and wild stocks of oysters.	2005 UMD, ORP, VMRC	Carlsson et al (2008) evaluated the contribution of a selectively bred, domesticated oyster strain to recruitment in the Great Wicomico, Lynnhaven, York, and Elizabeth Rivers from 2002 to 2006. They were unable to detect a significant contribution of the domestic strain to wild-produced spat.
Strategy 6.4 The members of the OMP drafting team will review the MD task force report & recommend changes to the OMP as appropriate regarding aquaculture strategies & actions	Action 6.4.1 Amend the OMP as necessary to incorporate new strategies and actions regarding aquaculture.	2009 2010	The vision of the new Maryland 10-Point Oyster Plan is "to establish a private aquaculture industry that emerges as a major economic contributor to the State of Maryland while maintaining a more targeted and scientifically managed wild oyster fishery that is sustainable." Chapter 173 of the Legislative Acts of 2009 passed new aquaculture leasing statutes that completely changes how Maryland regulates, administers, and manages aquaculture and leasing of shellfish. Grants have been secured to help watermen with start-up and operational costs for new oyster farms. The first Aquaculture Enterprise Zone (AEZ) was established by regulation in October 2009 in the Patuxent River near Broomes Island. Amendment #1 to the OMP was adopted in 2010. The amendment allows aquaculture and clamming activities within the larger, expanded sanctuary (areas closed to shellfish harvest and focused restoration activities) program; the use of new enforcement measures to protect sanctuary areas; and the implementation of sanitation guidelines. During 2010, the OMP was reviewed. The PRT recommended that the plan be revised. The OMP is scheduled for a management meeting in early 2014 to determine how to address the PRT recommendation.
Monitoring and Information Management Strategy 7.1 A) Utilize the results of the oyster stock assessment as an estimate of oyster abundance in the Bay; B) Use the 1994 biomass value as a baseline to track progress towards the 10-fold objective.	Action 7.1.1 Conduct monitoring programs that are consistent in terms of sampling procedure, timing of sampling, types of data collected, and analysis and provide the results to a central database or databases.	Continue	Monitoring programs have been reviewed. UMCEES has provided recommendations on how to improve existing fishery-independent and fishery-dependent data collection methodology. MDNR Shellfish Program has taken the recommendations under consideration.
	Action 7.1.2 Establish a Technical Committee to develop data management guidelines for handling oyster data.	2005	Original committee meeting did not result in specific guidelines.
	Action 7.1.3 Develop and maintain a database to track oyster restoration projects and provide web-based access.	open MDNR, VMRC, NOAA	NOAA compiled an inventory of all oyster restoration project implemented in recent years in both states (2007). NOAA also established a full database of implementation and monitoring data for all oyster restoration projects completed with federal funding, beginning in FY07 and ongoing.
	Action 7.1.4 The Chesapeake Bay Program will conduct an annual oyster symposium		An Oyster Workshop was convened in December 2007.
	Action 7.1.5 Promote the research recommendations listed in Section 2.	2005 2009	All oyster partners. Research recommendations will be developed during the OMP revision process.

Acronyms:
ACOE = Army Corps of Engineers PRT= Plan Review Team

BRPs = Biological Reference Points
MGS = Maryland Geologic Society
MDNR = Maryland Department of Natural Resources
NCBO = NOAA Chesapeake Bay Office
NOAA = National Oceanographic and Atmospheric Administration
OMP = Oyster Management Plan
ORP = Oyster Recovery Partnership
PEIS = Programmatic Environmental Impact Statement
SPF = Specific Pathogen Free
UMCEES = University of Maryland Center for Environmental & Estuarine Studies
UMCES = University of Maryland Center for Environmental Studies
VIMS = Virginia Institute of Marine Science
VMRC = Virginia Marine Resources Commission

2012 Maryland FMP Report (July 2013)
Section 15. Red Drum (*Sciaenops ocellatus*)

Chesapeake Bay FMP

In 2012, red drum were more abundant than usual and provided unexpected catches to fishermen in both Maryland and Virginia. The Atlantic States Marine Fisheries Commission (ASMFC) adopted a Fishery Management Plan (FMP) in 1984 to protect the red drum spawning stock. The coastal FMP included states from Florida to Maryland. ASMFC Amendment 1 (1991) to the FMP extended regulations to all states from Florida to Maine with the goal to attain optimum yield from the fishery over time. Amendment 2 was adopted in 2002 to require states to comply with recreational limits to meet the target fishing mortality. The Chesapeake Bay Red Drum Fishery Management Plan was adopted in 1993 to address overfishing and follow the ASMFC guidelines. Management measures since 2000 have resulted in reduced fishing mortality.

Stock Status

Status of the red drum stock is derived from the Atlantic coast stock assessment. In the 1980s and 1990s the coastal red drum stock was overfished and management measures were implemented to reduce fishing mortality (F) and rebuild the stock. Two management areas were defined: the northern stock (NC to NJ) and the southern stock (FL to SC). The 2009 peer reviewed ASMFC stock assessment found the stock to be relatively stable. However, due to data limitations for adult red drum, a conservative conclusion by ASMFC is that overfishing is likely not occurring. The fishing mortality threshold is 30% of a static spawning potential ratio (sSPR) and the fishing mortality target is 40% of a static SPR. The average sSPR has been above the overfishing threshold (F30%) since 1994 with the exception of 2002 and has been above the target (F40%) since 1996. Fishing pressure and mortality appear to be stable and it is likely that the stock is not subject to overfishing [1]. The next benchmark assessment is scheduled for 2015.

There is no formal red drum stock assessment for Chesapeake Bay. In most years, red drum are not frequent visitors to Maryland's portion of the Chesapeake Bay due to lower salinities. More red drum are reported from Virginia waters where salinities are higher. Schools of red drum below the minimum and over the maximum size limit may be seen in years of low freshwater flow such as 2012, a year of unusually high catches.

Current Management Measures

Red drum are managed through size limits and creel limits in compliance with all current ASMFC FMP requirements Maryland allows recreational fishermen to take 1 fish per day between 18" and 27". Charter boat logs show that anglers in Maryland release most of the red drum they catch[2]. Commercial fishermen in Maryland are allowed 5 fish per day with a slot limit of 18"-25". Virginia allows a slot limit of 18"-26" and a possession limit of 3 fish per day for both commercial and recreational fishermen. The Potomac River Fisheries Commission (PRFC) has a slot limit of 18"-25" and a possession limit of 5 fish per day for recreational and commercial fishermen. There are no closed seasons for the recreational or commercial fisheries.

Issues/Concerns

Red drum has been identified by ASMFC as a priority species in need of research. Coastal states are developing a cooperative plan to collect more age/length data to improve stock assessment modeling results. Maryland will continue to monitor commercial pound nets and fish houses and measure red drum when they are encountered.

Submerged aquatic vegetation (SAV) beds are important red drum habitat. Efforts to achieve SAV restoration and water clarity goals will continue. ASMFC has produced a draft Addendum I to Amendment 2 to the red drum fishery management plan: Habitat Needs & Concerns [3] for public comment (through June 30, 2013). The draft addendum describes the habitats for red drum spawning, egg and larvae, juveniles, subadults, and adults

The Fisheries

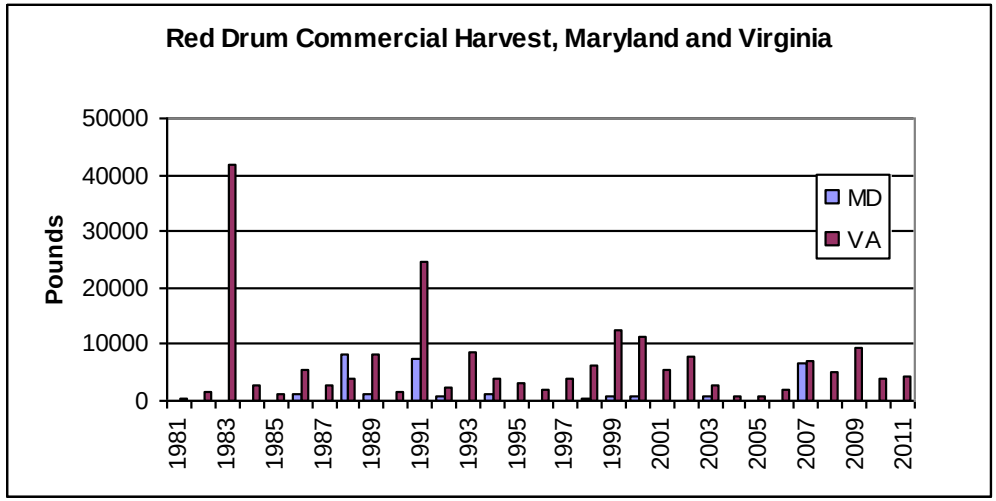

Figure 1. Commercial red drum landings reported to NMFS by Maryland and Virginia: 1981-2011[4].

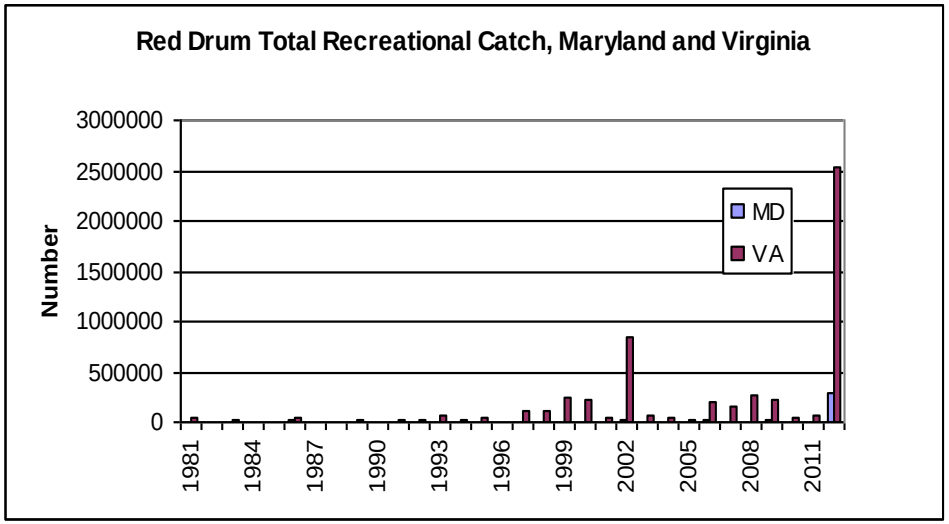

Figure 2. Total recreational red drum MRIP catch estimate for Maryland and Virginia , all modes combined, 1981-2012[5] .(Includes fish caught and released)

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[3] Draft addendum 1 to amendment 2 to the red drum fishery management plan: *Habitat Needs & Concerns*. May 2013. 24p.

[4] Personal communication from the National Marine Fisheries Service, Fisheries Statistics Division. July 25, 2013. http://www.st.nmfs.noaa.gov/st1/commercial/.

[5] Personal communication from the National Marine Fisheries Service, Fisheries Statistics Division. July 25, 2013. http://www.st.nmfs.noaa.gov/st1/recreational/index.html.

[6] SAV in Chesapeake Bay and Coastal Bays. VIMS William & Mary Virginia Institute of Marine Sciences. http://web.vims.edu/bio/sav/sav12/exec_summary.html

1993 Chesapeake Bay and Atlantic Coast Red Drum Management Plan Implementation Table (updated 7/13)			
Section	**Action**	**Date**	**Comments**
1. Overfishing	1.1.1 Virginia will continue to enforce a 5 fish creel limit and an 18 inch minimum size limit with one fish over 27in in the recreational fishery.	1992 Modified in 2003 Continue	In compliance with coastal recommendations. VA has adopted a slot limit and now allows harvest of 18-26" red drum. A new possession limit of 3 fish has been adopted for both recreational and commercial harvest. The 2009 peer reviewed ASMFC stock assessment found the resource to be relatively stable with overfishing not occurring. **Next coastal stock assessment is scheduled for 2015.**
	1.1.2 Maryland and the PFRC will implement a 5 fish creel limit and an 18 in minimum size limit with one fish over 27in in the recreational fishery	1994 Modified in 2003 Continue	In compliance with coastal recommendations. MD has a recreational size limit for red drum of 18-27" and a commercial size limit of 18-25". The possession limit is 1 fish/day for the recreational fishery and 5 fish/day for the commercial fishery. PRFC has a size limit of 18-25" and a possession limit of 5 fish for both recreational and commercial harvest.
	1.2a Jurisdictions will investigate the potential for using bycatch reduction devices in nonselective fisheries	1992 Continue	The bycatch of immature red drum has not been a problem in Chesapeake Bay fisheries because small fish are infrequently encountered. Bycatch reduction devices that are currently in place should increase the escapement of juvenile red drum.
	1.2b Virginia and Maryland will work with the South Atlantic Fishery Management Council (SAFMC) and ASMFC to develop and require more efficient gear to reduce bycatch and/or discards.	1992 Continue	MD and VA appointed representatives to the ASMFC/SAFMC Red Drum Advisory Panel.

1993 Chesapeake Bay and Atlantic Coast Red Drum Management Plan Implementation Table (updated 7/13)			
Section	**Action**	**Date**	**Comments**
2. Stock Assessment and Research Needs	2.1 Jurisdictions will support fecundity research and tagging studies to determine movements of juvenile red drum and develop juvenile indices. Maryland and Virginia will continue the Baywide trawl survey of estuarine finfish species and crabs.	1993 Continue	The VA red drum tagging program is ongoing. The tagging program includes a fishery independent study and a volunteer recreational study. Tag recapture data indicates a southward, late fall migration of juvenile red drum out of the Bay and along the Virginia coast. Future tag returns should provide information about the movements of these fish upon reaching sexual maturity. The Chesapeake Bay Multispecies Monitoring and Assessment Program (ChesMMAP) continues but the collection of red drum is not sufficient to guide any stock assessment. The Maryland Shoal Water (blue crab) Trawl Survey continues (data for fish and crabs). ASMFC has recommended that all states implement a tagging program for red drum. ASMFC has continued to facilitate standardized ageing protocols and consistency among laboratories.
	2.2 VMRC Stock Assessment Program will continue to collect biological data from commercial catches of red drum	1993 Ongoing	There is little fishery dependent information on larger, reproductive red drum and limited fishery-independent information (ASMFC). The large adults are primarily found offshore where fishing for red drum is prohibited.
	2.3a Jurisdictions will continue collecting commercial fisheries statistics.	Continue	Maryland's Chesapeake Bay red drum harvest remains insignificant. Virginia commercial reports were **4400 pounds in 2011, about 10% higher than the 2010 harvest**.
	2.3b Virginia will implement a limited and/or delayed entry program and a mandatory reporting system for commercial licenses.	1993 Continue	Implemented in January 1993.

1993 Chesapeake Bay and Atlantic Coast Red Drum Management Plan Implementation Table (updated 7/13)			
Section	**Action**	**Date**	**Comments**
	2.3c Virginia and Maryland will continue to supplement the Marine Recreational Statistics Program	Continue	**Maryland awarded 209 citations for red drum up to 54" in length that were caught and released in 2012, up from only 10 in 2011. In 2011, VA anglers caught and released 755 red drum over 46" in length in 2011, compared to 717 for 2010. The Marine Recreational Information Program (MRIP) has replaced MRFSS with refined estimates of recreational harvest and total catch. Proportional standard errors (PSE) were in excess of 50 for every year except one, indicating that recreational harvest estimates were imprecise for red drum. MRIP estimated that recreational fishermen in MD in 2012 harvested 17,869 red drum and released 280,000 while VA angler harvest was estimated at 28,159 and over 2.5 million released.**
	2.3d Maryland will continue a sampling program using pound nets and trawls.	Continue	Maryland conducts fishery dependent sampling from pound nets in the Chesapeake Bay. Twenty-one red drum were sampled in 2008 (mean 361mm TL, range 237-541mm TL). None were collected in 2009 and 2010 and only two were collected and released in 2011[3]. **In 2012, biologists sampled 458 red drum from pound nets; of this total, 455 were under the 18" minimum TL and 3 were over the 25" maximum TL size limit. Accordingly, no legal-sized red drum would have been available to commercial or recreational fishermen.**

1993 Chesapeake Bay and Atlantic Coast Red Drum Management Plan Implementation Table (updated 7/13)			
Section	**Action**	**Date**	**Comments**
3. Habitat Issues	3.1 Jurisdictions will continue to set specific objectives for water quality goals and review management programs established under the Chesapeake 2000 agreement	Continue	SAV beds are important red drum habitat. Water clarity and water quality goals were adopted by the Chesapeake Bay Program signatory states in 2003 that will help in achieving a SAV restoration goal of 185,000 acres by 2010. In 2008, there were nearly 77,000 acres of bay grasses, or 42% of the goal. By 2009, this had grown to nearly 86,000 acres but decreased to just under 80,000 acres in 2010 due to warmer water temperatures**.** Bay grasses decreased 21% in 2011 to 63,074 acres after high spring flows, Hurricane Irene and Tropical Storm Lee. Grasses in the coastal bays of Maryland decreased by 35% in 2011. **Another 21% overall decrease was calculated in 2012 from areas mapped in both 2011 and 2012. The largest SAV declines were noted for upper and middle Chesapeake Bay. Among Chesapeake Bay sites, only the Potomac River and middle James River locations showed any increases from 2011 to 2012. The Delmarva Peninsula Coastal Bays (Assawoman, Isle of Wight, Sinepuxent, Chicoteague and Southern VA Coastal Bays declined 8% from 13,455 acres in 2011 to 12,326 acres in 2012[6].**

Acronyms:
ASMFC = Atlantic States Marine Fisheries Commission
MRFSS = Marine Recreational Fisheries Statistics Survey
PFRC= Potomac River Fisheries Commission
SAV= Submerged Aquatic Vegetation
VIMS= Virginia Institute of Marine Science
VMRC = Virginia Marine Resource Commission

2012 Maryland FMP Report (July 2013)
Section 16. Scup (*Stenotomus chrysops*)

Chesapeake Bay FMP

Harvest of scup in Maryland is variable among years and compared to other Atlantic Coast states, is minimal in Maryland. Commercial landings have been relatively low since the 1970s and minimal data is available from 2000-2009. Although recreational harvest data is not available for significant portions of the 1980s and 1990s, harvest appeared to surge in 1990 and 1991 but is less frequently targeted. In 2010, the Atlantic coast scup stock was declared rebuilt. The stock has rebounded and is no longer at low levels. No Chesapeake Bay Program fishery management plan (FMP) has been developed for scup. Maryland Department of Natural Resources' authority to manage scup as a species in need of conservation was established in 1994.[1]

Scup are jointly managed by the Atlantic States Marine Fisheries Commission (ASMFC) and the Mid-Atlantic Fishery Management Council (MAFMC). The ASMFC manages scup fisheries in state waters (out to three miles) while the MAFMC manages scup fisheries in federal waters (3-200 miles offshore). Scup were incorporated into the ASMFC and MAFMC summer flounder FMPs in 1996. Since then, a series of amendments and addenda have been implemented to modify management measures. Addenda III (2001), VII (2002), IX (2003), and XI (2004) implemented a 50-fish per person per day catch limit and 8-inch minimum size limit for recreational fisheries. Addendum XIX (2007) maintained the 1999 Amendment 12's fishing mortality (F_{max}) of 0.26 and a spring spawning stock survey index of 2.77kg per tow. In 2007, the MAFMC established a seven year rebuilding plan with Amendment 14 and implemented a standardized bycatch reporting and monitoring system with Addendum XVI.

Stock Status

The scup stock assessment was updated in 2011 using the ASMFC peer-reviewed methodology developed in 2009. The revised biological reference points (BRPs) are a threshold fishing mortality ($F_{40\%}$) of 0.177 and a target spawning stock biomass ($SSB_{40\%}$) of 203 million pounds. Scup are not overfished and overfishing is not occurring (based on the 2011 stock assessment).[2] Median F increased over the past few years and exceeded $F_{threshold}$. Fishing mortality in 2010 was estimated at 0.040; however F projections showed an increasing trend of 0.097 in 2011 and 0.188 in 2012.[2] Spawning stock biomass was estimated to be 410 million lbs in 2010; projected SSB for 2011 and 2012 are comparable and remain above $SSB_{40\%}$.[2] Recent rise in F coupled with recruitment uncertainty require precautionary management measures if quota increases are to be considered.[3]

Current Management Measures

The majority of coastwide scup harvest is allocated to the commercial fishery (78%). The remaining 22% of harvest is allocated to the recreational fishery. Maryland manages commercial harvest with a three season system. The commercial minimum size limit is 9" in Maryland state waters and 10" in Federal waters. All commercial harvesters must have a federal permit.[4,5] The annual coastwide commercial quota is divided among three fishing seasons: January through April (Winter I = 45%), May-Oct (Summer = 39%), and November through December (Winter II = 16%). Winter fisheries are also managed with trip limits (Winter I is 1,000 pounds per trip and Winter II is 2,000 pounds per trip). The summer fishery is managed with state-by-state quotas based on historical landings.[6] Regulations for commercial fishing gear mesh size and escape panels have been enacted.

Recreational harvest regulations differ between state and federal waters. In Maryland waters the minimum size limit is 8" with a possession limit of 50 fish per person per day. In federal waters, the minimum size is 10.5".[5] The 10.5" minimum size limit requirement also applies to the Party and Charter boat fisheries. The federal creel limit is 20 fish per person per day.

The Fisheries

Scup harvest is generally low but can be highly variable among years. (Figures 1 and 2). It must be noted that there is little harvest data available during the 2000s. Scup are harvested in winter as part of the mixed black sea bass/scup/summer flounder trawl fishery. Estimated commercial scup harvest was 54,200 pounds in 2011, 8,260 pounds in 2012, and 313,000 pounds by May, 21, 2013 (Figure 1).[7,8]

Recreational catch estimates have been revised as a part of the Marine Recreational Information Program (MRIP). Catch estimates have been recalculated for 2004-2011 to provide more accurate estimates and replace those previously made by the Marine Recreational Fisheries Statistics Survey (MRFSS). Landings data is not available for the mid-1980s and mid-1990s. Recreational anglers harvested 18 scup in 2010, 11 scup in 2011[7], and 0 scup in 2012[4] (Figure 2). Proportional standard errors (PSE) for recreational scup harvest are typically with a running average of 71%. The PSEs for 2009, 2010, and 2011 were 96, 88, and 101 percent, respectively. A PSE value greater than 50 indicates a very imprecise estimate.

Figure 1. The commercial harvest of scup in Maryland since 1950.[7, 8] Landings for 2012 and 2013 are as of December 2012 and May 2013, respectively.[8] Harvest data is not available for the years 1996, 2001-2003, and 2006-2008.

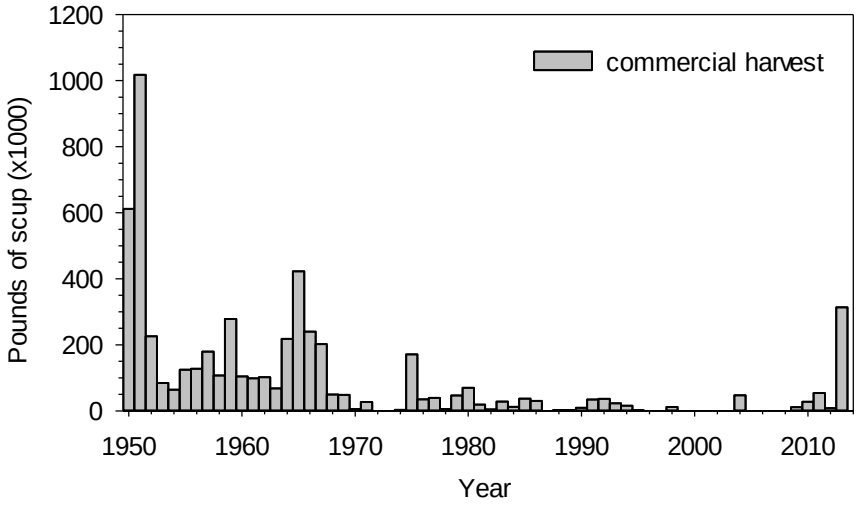
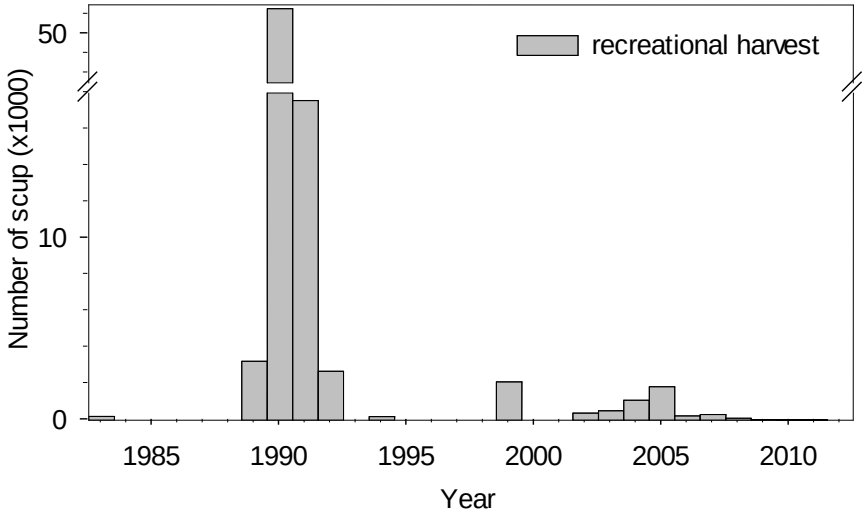


Figure 2. The recreational scup harvest in Maryland since 1983.[7] Landings data is not available for the years 1984-1988, 1993, and 1995-1997.



Issues/Concerns

The MAFMC's FMP designates a coastwide commercial quota in federal waters rather than state-by-state quota allocation. In contrast, ASMFC's FMP allocates the coastwide quota for state waters on a state-by-state basis according to historical landings.

The MAFMC funded an economic analysis of the scup fishery to explore two concerns: the existing allocation between the recreational and commercial fisheries and the allocation among the three fishing seasons[3]. Current regulations and quota do not constrain either fishery; the consequence is no increase in participants' willingness to pay for additional allocation. Current commercial quota allocation between winter and summer fisheries is not efficient. A quota shift, up to 9%, from the winter to summer fisheries would increase commercial economic efficiency. Liberalized recreational limits from the current 9" minimum and 50 fish per day would likely have positive economic effects with minimal (< 1%) increase in harvest or impact on the commercial sector.[9]

Scup population data collected by MDNR does not support the Northeast Data Poor Stocks Working Group's conclusion that the scup population has recovered.[4] Larger sized scup are uncommon in commercial and recreational harvests.

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[7] Personal communication from the National Marine Fisheries Service, Fisheries Statistics Division. May 21, 2013: http://www.st.nmfs.noaa.gov/recreational-fisheries/index.

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[9] Dancy, Keily. 2012. Scup allocation analysis report summary. Mid-Atlantic Fishery Management Council. Memorandum. Retrieved from http://static.squarespace.com/static/511cdc7fe4b00307a2628ac6/t/5165737ee4b0d3f496679b32/1365603198112/Tab%2005_Scup_Allocation_Report.pdf

2012 Maryland FMP Report (July 2013)
Section 17. Striped Bass (*Morone saxatilis)*

Chesapeake Bay FMP

Age diversity for Atlantic coast striped bass continues to broaden despite a 26% decline in the female spawning stock since 2003. The declines are attributed to several years of below average juvenile year classes. The 2012 Maryland juvenile striped bass index (JAI) was below both the long term average and the Atlantic States Marine Fisheries Commission (ASMFC) recruitment failure value (Figure 1). While the index was low, juvenile abundance or year class strength is sensitive to spring weather conditions and can fluctuate widely from year to year. Annual variation can be illustrated by comparing the above average 2011 year-class with the 2012 value. Three consecutive years of recruitment failure must occur in order to trigger a management response.

The Fisheries Service Plan Review Team reviewed the 1989 Chesapeake Bay Striped Bass Management Plan (CBSB FMP) and Amendment #1 in May 2013. The review included an examination of the harvest allocations specified in the FMP. The review process has not been completed but findings are expected by the end of 2013.

The ASMFC developed the Interstate Fisheries Management Plan for Striped Bass in 1981 (ASMFC FMP). In 1989 the Chesapeake Bay Program developed the CBSB FMP to coordinate management among jurisdictions and to comply with ASMFC FMP requirements. Several amendments and addenda to the ASMFC FMP have been adopted to make adjustments to management measures (www.asmfc.org/strippedBass.htm). Amendment 5 (1995) to the ASMFC FMP required an annual juvenile abundance survey in Maryland and Virginia to monitor for recruitment failure. Maryland's JAI began in 1954 and Virginia's in 1955. Amendment #1 to the CBSB FMP formally adopted ASMFC's Amendment 5 management framework within the Chesapeake Bay. Amendment 6 (2003) replaced all previous ASMFC management documents for striped bass. It includes provisions for target and threshold control rules to effectively manage mortality, spawning potential, and age diversity. Addendum I (2007) implemented additional data collection requirements to improve discard estimates. Addendum II (2010) revised the recruitment failure threshold from an annually variable value (1957 – present) to a set value (1957 – 2009) of 1.60. Addendum III, approved in 2012, standardized the use of commercial harvest tags coastwide to reduce illegal harvest.

A NOAA Chesapeake Bay Fisheries Ecosystem Advisory Panel agreed to develop a Fisheries Ecosystem Plan (FEP) for CB in 2006. Maryland Sea Grant was contracted to facilitate FEP development for five keystone Chesapeake Bay species, which includes striped bass. State, federal, and academic representatives completed a series of issue briefs in 2009 that identified current and future ecosystem stressors: habitat (warming, flow, eutrophication/ hypoxia, pollution/contamination, and watershed development), food web (forage and predation), stock assessment (recruitment variability, exploitation, disease, and connectivity), and socioeconomic (livelihoods, recreation, and consumption). The briefs were forwarded to a Quantitative Ecosystem Team (QET) tasked with development of measurable targets and reference points. No targets or reference points have been developed to date. For more information on the EBFM process, go to (www.mdsg.umd.edu/programs/policy/ebfm/).

Stock Status

The striped bass stock is not overfished and overfishing is not occuring. Striped bass are managed with biological reference points (BRPs) for fishing mortality (F) and female spawning stock biomass (SSB). Current BRPs are defined in ASMFC's 2009 Stock Assessment Report for Atlantic Striped Bass: Target F for striped bass in coastal waters is 0.30 and the $F_{threshold}$ is 0.34. Chesapeake Bay has a slightly lower F_{target} (0.27) because of the smaller minimum size (18") used to manage the fishery. Coastwide, current levels of F remain low at 0.23 [1]. In Chesapeake Bay, F for striped bass (>18") during 2010 was 0.16 [1]. Target SSB is 82.7 million pounds and $SSB_{threshold}$=66.2 million pounds. Coastwide SSB was 111 million pounds, a 26% decline from the 2003 high of 140 million pounds [1]. Spawning stock biomass is forecast to decline during the years 2012 – 2017 [1]. The next benchmark stock assessment is currently under development. A draft for public comment is scheduled for 2013.

MD DNR has conducted the Maryland JAI for striped bass since 1954. The JAI is a predictor of year class strength and used to monitor recruitment success. If the JAI for age-0 striped bass falls below a value of 1.60 for three consecutive years, it would trigger management action by the ASMFC [2]. The 2012 Maryland JAI was at a historic low of 0.49 [3] (Figure 1). Although it was below the recruitment failure threshold, it did not trigger a management action at this time. The Maryland JAI is one of six JAIs that are calculated for different regions along the Atlantic coast. The six regions include Maine, New York, New Jersey, Virginia, and North Carolina. Recruitment failure for three consecutive years in any one of these six regions would trigger an ASMFC management action [2].

Current Management Measures

Maryland's 2012 striped bass quota was 4.7 million lbs. and was distributed among two fishing sectors: commercial (42.5%) and recreational/charter (57.5%) [4]. The Maryland Chesapeake Bay commercial quota remained at 1.96 million lbs for 2012 [4]. A new precautionary management measure was implemented in 2012. Five percent of the quota was set aside to account for errors in harvest reporting, thereby leaving 1.87 million lbs available for harvest. The 2012 commercial quota was allocated among three sectors: drift gill net (802,000 lbs), hook and line (447,000 lbs), and pound net/haul seine (616,000 lbs). The 2012 quota for recreational and charter fisheries in Chesapeake Bay was 2.66 million lbs [4]. The 2012 Maryland Atlantic Coast commercial quota remained at 126,000 lbs [4]. The Maryland Atlantic Coast recreational harvest is managed under a coastwide F. Striped bass regulations may be adjusted annually based on ASMFC requirements and stakeholder concerns.

Commercial fisheries are managed using quotas and time restrictions for all four fishing sectors: pound net, haul seine, hook and line, and drift gill net. Maryland's 2012

Chesapeake Bay commercial fisheries operated with an 18"-36" total length slot limit. Chesapeake Bay seasons varied among sectors. The pound net fishery was open Monday – Saturday from June 1 – November 30. The haul seine fishery was open on Monday – Friday from June 7 – November 30. The hook and line fishery was open on Monday – Thursday from June 7 – November 30. The drift gill net fishery was open on Monday – Friday from January 1 – February 28 and December 3 – 31. The Atlantic Ocean drift gill net and otter trawl fisheries had a 24" total length minimum size limit. Atlantic coast fisheries were open on Monday – Friday from January 1 – April 30 and November 1 – December 31.

Watermen and the Maryland Department of Natural Resources (MD DNR) will begin implementing a catch shares management system for the 2014 commercial season. Each watermen will be given the option to remain in the current common pool management framework or switch to an individual transferable quota (ITQ) management framework. The common pool fishery has a single quota assigned to all participants. An ITQ guarantees each participating waterman a portion of the commercial quota. Watermen will have the ability to temporarily transfer quota to other waterman with an ITQ. Quota allocation is based on a waterman's historical landings. February 29, 2012 was the cut-off date for quota calculation as requested by the commercial fishing industry.

Striped bass caught by the commercial fishery must be individually tagged and landed at a certified check station prior to sale [2]. Each fish is counted and weighed. Check stations verify each fisherman's daily harvest record on the fisherman's harvest permit. Fishermen submit monthly harvest reports to MD DNR. Check stations call in daily harvest numbers and submit a weekly report. Fishermen and check stations have the option to submit harvest data electronically. Check stations are randomly sampled by MD DNR to collect age and length data as well as validate reporting.

The recreational fishery is managed with minimum size limits, creel limits, tackle and bait restrictions, seasonal closures, and area closures [2]. Regulations to control catch and release effort during the pre-spawn period (March 1 - the third Friday in April) were implemented in 2010. Anglers are prohibited from using stinger hooks, required to use barbless hooks when trolling, required to use circle hooks or J hooks with a gap < ½" when using bait, and allowed up to six lines per boat when trolling.

The upper Chesapeake Bay (Susquehanna Flats) catch and release season was from March 1 – May 3 and the catch and keep season was from May 16 – 31. During catch and keep, anglers were restricted to one fish per person per day that was 18" – 26". The spring trophy season (April 21 – May 15) was restricted to the Chesapeake Bay mainstem south of Brewerton Channel (Baltimore) down to the MD/VA line, Pocomoke Sound, and Tangier Sound. Anglers were allowed one fish per person per day that was ≥28". Eels were prohibited as bait during the upper Chesapeake Bay and spring trophy seasons to prevent deep hooking which increases mortality. The summer – fall recreational/charter boat season had a two fish per person per day slot limit of 18" – 28"; or one fish per person per day that was between 18" - 28" and one fish per person per day that was >28". This fishery was split into two seasons. The first was May 16 – 31 and was limited to the Chesapeake Bay mainstem from Hart-Miller Island (Baltimore) to the MD/VA border; the lower five miles of the Chester, Choptank, and Patuxent rivers; Pocomoke Sound, and Tangier Sound. Use of eels as bait was prohibited. The second season was open from June 1 – December 15 in all tidal waters. The Atlantic Coast recreational fishery is year-round with a limit of two fish per person per day at ≥28".

The US Secretary of Commerce enacted a moratorium on striped bass harvest in federal waters (Exclusive Economic Zone or EEZ) in 1990. The moratorium remains in effect.

The Fisheries

The Maryland commercial fishery quota was estimated at 2.09 million lbs in 2012 with 1.96 million for Chesapeake Bay and 126,000 for the Atlantic coast (Figure 2) [4]. Five percent of the Chesapeake Bay quota was withheld to account for management uncertainties. Chesapeake Bay harvest was estimated at 1.85 million lbs; 861,000 lbs from gill net, 425,000 lbs from hook and line, and 566,000 lbs from pound net/haul seine [2,4]. Atlantic coast landings were 78,000 lbs [2,4].

Recreational anglers in Maryland harvested an estimated 1.09 million lbs [5] from Chesapeake Bay and the Atlantic Coast (Figure 3). Spring trophy fish are not accounted for in MD's quota and so an adjusted harvest estimate (excludes trophy fish) is provided in Figure 3. An estimated 2.14 million fish were released with an estimated 9% mortality. Recreational catch estimates, from 2004 – 2011, were revised as a part of the transition from the Marine Recreational Fisheries Statistics Survey (MRFSS) to the Marine Recreational Information Program (MRIP; http://www.st.nmfs.noaa.gov/recreational-fisheries/index).

Figure 1. Striped bass juvenile abundance index trend: 1957 – 2012 [3]. The red dashed line represents the recruitment failure definition and the vertical dotted lines demarcate the 1985 – 1989 harvest moratorium.

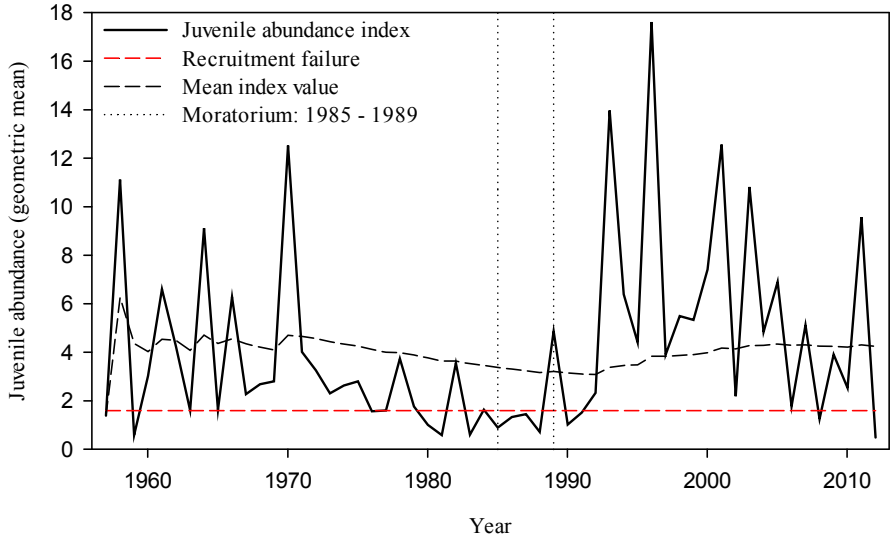


Figure 2. Maryland commercial striped bass landings and quotas: 1950 – 2012 [4,5]. Maryland's 1985 – 1989 striped bass moratorium is indicated with vertical dotted lines.

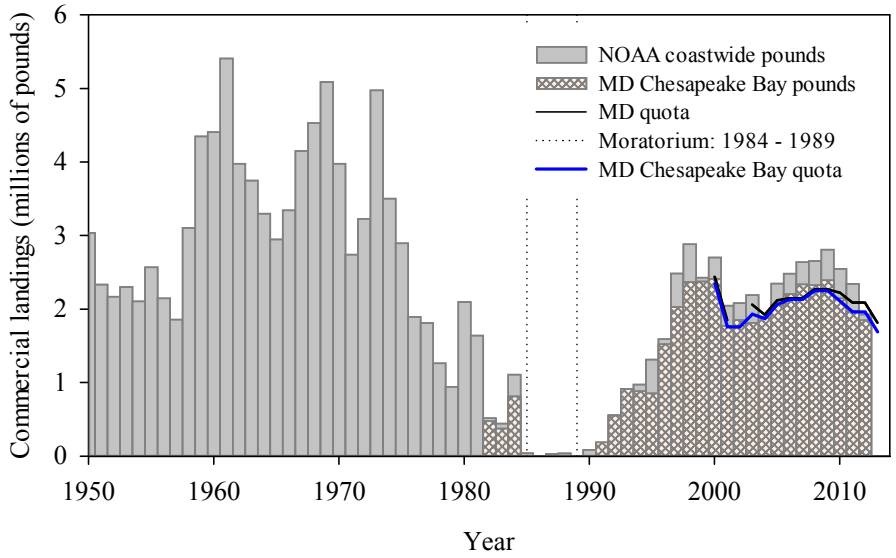
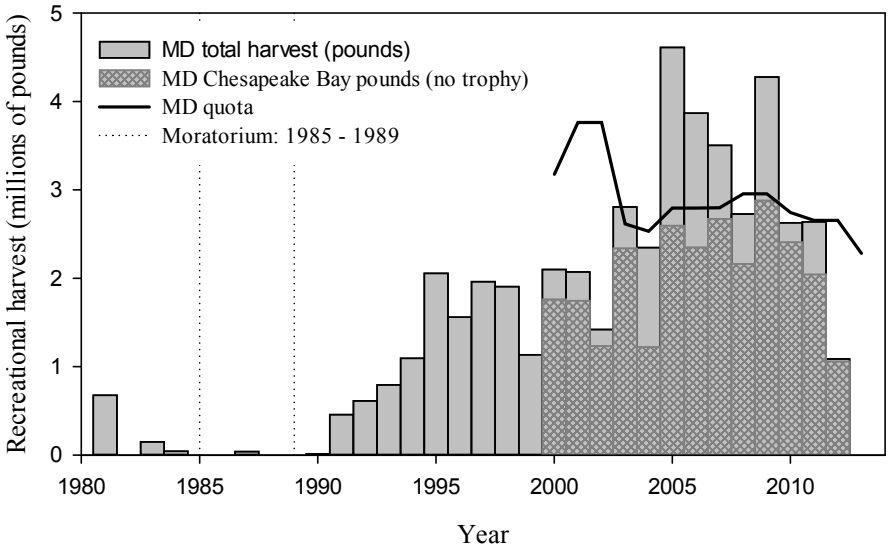


Figure 3. Maryland recreational (including charters) striped bass landings and quotas: 1981 – 2012 [4,5]. Landings for 2012 are an estimate as of July, 2012 [4]. Maryland's 1985 – 1989 striped bass moratorium is indicated with vertical dotted lines.



Issues/Concerns

Tagging data indicate that natural mortality (M) has been increasing, particularly in Chesapeake Bay, and is above the assumed value. Increased M in Chesapeake Bay may be linked to the increased prevalence of mycobacteriosis [1]. Nutritional status of striped bass has been proposed as a means to develop a health index. Nutrition-based reference points were recently proposed by Jacobs et al. (2013) [6]. Further study of mycobacteriosis infections in striped bass and its relation to M is needed.

A constant M was used during the catch-at-age based stock assessment process. Recent tagging-based estimates that indicated a low F in Chesapeake Bay are not consistent with harvest data. These results also call into question the tagging analysis assumption that all 18" -28" males are resident to Chesapeake Bay, as well as patterns of emigration.

Recreational anglers and catch and release practices have increased. Estimated mortality of fish released by recreational anglers was increased from 8% to 9% in 2011 [7]. Education and outreach programs promote best-fishing practices.

References

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[2] ASMFC. 2010. Addendum 2 to Amendment 6 to the Atlantic striped bass interstate fishery management plan. Atlantic States Marine Fisheries Commission. Washington DC.

[3] Maryland Department of Natural Resources Fisheries Service. 2013. Striped bass seine survey juvenile index: striped bass (YOY) [Data file]. Retrieved from http://www.dnr.maryland.gov/fisheries/juvindex/index.asp

[4] MDNR. 2013. Maryland Striped Bass (*Morone saxatilis*) Compliance Report to the Atlantic States Marine Fisheries Commission 2012. MDNR, Annapolis, MD

[5] Personal communication from the National Marine Fisheries Service, Fisheries Statistics Division. June 12, 2013.

[6] Jacobs, J. M., R. M. Harrell, J. Uphoff, H. Townsend, and K. Hartman. 2013. Biological reference points for the nutritional status of Chesapeake Bay striped bass. North American Journal of Fisheries Management. 33: 468-481.

[7] ASMFC. 2012. 2012 review of the Atlantic States Marine Fisheries Commission fishery management plan for Atlantic striped bass (*Morone saxatilis*) 2011 fishing year. Atlantic States Marine Fisheries Commission, Washington, DC.

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1 - Overharvesting, Reduced Spawning Stock and Poor Recruitment: Controlling fishing mortality will be the primary method of maintaining adequate striped bass stocks. Optimum yield per fish will be more closely approached by establishing minimum sizes greater than historic limits. Long term fishery maintenance must be based on a management objective commensurate with reproductive success. The number of eggs per striped bass is directly related to fish size and age. Females will be protected so that more can reach their spawning potential. As reproductive potential is protected and spawning stock increases, more young striped bass should enter the fishery. Two types of fisheries have been defined by the ASMFC: 1) A conservative transitional fishery, which would go into effect after the Maryland striped bass juvenile index has reached a 3-year-average of 8.0; and (2) A more robust recovered fishery, to be considered when a certain percentage of the female spawning stock is composed of striped bass females equal to or greater than age VIII. The percentage will be determined by the ASMFC.		Completed 1995 1995 On-going 2003 2010 Continue	Target is 1990 for a transition fishery. The stock was deemed restored in 1995. Juvenile abundance data is used by ASMFC to estimate coastal SSB and SCA of coastal stock. Amendment VI changed the JAI recruitment failure definition from 90% to 75% of the index for three consecutive years. Addendum 2 to Amendment 6 established a fixed recruitment failure value of 1.60. Strong recruitment of 1993, 1996, 2001, 2003, and 2011 year classes. **In 2012, the JAI was the lowest since 1990s.** Overharvesting is not an issue at this time.
1.1 Fishing mortality will be controlled by several means to protect striped bass stocks. Harvest restrictions will be set to provide a fishing mortality rate of 0.25 (equivalent to about 18% of the legal sized fish being harvested) during a transition fishery and a rate of 0.5 (equivalent to about 32% of the legal sized fish being harvested) during a recovered fishery, in accordance with ASMFC guidelines (these percentages may change slightly as additional calculations are made by the ASMFC). Adult stock levels, stock composition, and the Maryland striped bass young-of-the-year index (or other juvenile indices as approved by ASMFC) will be used in determining needed restrictions.	1.1.1 The District of Columbia, Maryland, Virginia, and the Potomac River Fisheries Commission will utilize a combination of harvest restrictions to meet target fishing mortality rates. Controls may include seasonal quotas, daily bag limits, minimum size limits, seasons, time restrictions, gear restrictions, license requirements, and other actions. Maryland's annual quota will be presented as total sport and commercial landings.	2000 Continue February 2003 Continue 2009 On-going	All CB jurisdictions have implemented regulations to prevent exceeding F_{target}. CBP jurisdictions have the option to implement stricter regulations than required under ASMFC Amendment 6. The overfishing definition is F_{msy}=0.34. If coastwide estimated mortality rates exceed the target rate for 2 consecutive years, the ASMFC will develop management measures. Bay jurisdictions are in compliance with ASMFC guidelines. CB F remains below the target of 0.27. See Strategy 1.2 comments for size limits and Strategy 2.4.1 comments for seasons and time restrictions.
	1.1.2 Maryland, the Potomac River Fisheries Commission and Virginia will cap commercial harvest during the transitional fishery with a quota not to exceed 20% of the average annual commercial harvest as	1990 1995	Implemented. The stock was deemed restored.

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	reported for the period 1972-1979. No commercial fishing is permitted in the District of Columbia.		
1.2 Size limits and fishing mortality rates will be set to allow sufficient recruitment to the spawning stock.	1.2.1 The District of Columbia, Maryland, Virginia and the Potomac River Fisheries Commission will establish a minimum size limit of 18 inches total length in the Chesapeake Bay and tributaries during the transition fishery. Maryland may establish a larger minimum legal size during a May trophy fishery beginning in 1991.	On-going	ASMFC requires that the recreational minimum size limit for striped bass in Chesapeake Bay is 18" except for the spring trophy season. The minimum size limit for striped bass during the spring trophy season in MD is 28".
	1.2.2 Maryland, Virginia and the Potomac River Fisheries Commission will prohibit the keeping and sale of sublegal (fish smaller than the minimum size) striped bass by-catch.	On-going 2012	ASMFC prohibits the sale of sub-legal striped bass (<28"). All striped bass are individually weighed, measured, and tagged at certified check-in stations. Harvest tag criteria were standardized, coastwide, with Addendum III to Amendment 6.
	1.2.3 As a conservation measure, the District of Columbia, Maryland, Virginia and the Potomac River Fisheries Commission will establish a consistent maximum legal size for striped bass in the Chesapeake Bay and its tributaries.	On-going	DC, MD, PRFC, and VA recreational fisheries are managed with a combination of the 18" – 28" slot limit and a 28" minimum size limit: 2 fish 18" - 28", or 1 fish 18" - 28" and 1 fish ≥28". Spring trophy season size limits for MD and PRFC are 1 fish ≥28" and VA allows 1 fish ≥32". There is not a spring trophy season in DC. Commercial fishery size limits: MD is 18" – 36" for all gear and seasons; PRFC is 18" – 36" from February 15 – March25 and ≥ 18" from June 1 – December 15, and for gill net ≥ 18" from November 12 – February 14; VA minimum size is 18" all season with a 28" maximum from March 26 – June 15. Commercial fishing is prohibited in DC.
1.3 Fishing mortality rates will be set to ensure a viable female spawning stock of age VIII and older females, and stocks will continue to be enhanced with hatchery production.	1.3.1 During a transition fishery, mortality will be controlled to protect age VIII or older females until they comprise at least a certain percentage (as determined by the ASMFC) of the female spawning population.	2011	Female fish ages 8+ have increased in abundance. Minimum percent of age 8+ females has not been specified by ASMFC.
	1.3.2 A fishery on a recovered stock will be controlled so that females age VIII or older continue to comprise at least a certain percentage (as determined by the ASMFC) of	Discontinued Ongoing - Adjusted during	ASMFC uses a VPA to estimate SSB. A statistical catch at age (SCA) model is used to estimate SSB. Since 2008, $SSB_{threshold}$ =

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	the female spawning stock.	stock assessment	66.2 million lbs and SSB_{target} = 82.7 million lbs. Minimum percent of age 8+ females has not been specified by ASMFC.
	1.3.3 Maryland and Virginia will continue hatchery production to enhance striped bass spawning stocks in areas that are still depleted. The District of Columbia will work with the Maryland and Virginia hatchery programs to enhance striped bass spawning stocks.	1993 VA 1995 MD	MD and VA discontinued stocking striped bass.
	1.3.4 Hybrid striped bass stocking and the introduction of non-native stocks will be restricted in the Chesapeake Bay and its tributaries in accordance with ASMFC guidelines. The Maryland Department of Natural Resources, the Pennsylvania Fish and Boat Commission and the U.S. Fish & Wildlife Service will discuss stocking issues regarding the Susquehanna River.	Magothy - 1982 Patuxent - 1984 Pennsylvania – 1990	MD, PA, and USFWS discontinued stocking hybrid striped bass.
2 - Regulatory and Enforcement Issues: In order to control fishing effort and fishing mortality rates, harvest and sale regulations will be developed and implemented. Guidelines will be set for monitoring the resource and harvest restrictions. The individual jurisdictions will comply with ASMFC goals and criteria for the striped bass fishery and, where possible, have compatible fishing regulations. Areas of harvest pressure and times when harvesting pressure will be heaviest will be defined in order to facilitate adequate enforcement. 2.1 The striped bass harvest will be equitably allocated among user groups on a yearly basis.	2.1.1 The Maryland quota will be allocated as follows – 42.5% commercial; 42.5% recreational; 15% charter. Virginia and the Potomac River Fisheries Commission will use various restrictions in fishing seasons and bag limits to equitably allocate and restrict harvest among the commercial, recreational and charter boat fisheries.	On-going **2013**	Quota allocation is periodically reviewed. Recreational and charter allocations have since been combined to be 57.5%. **Quota allocation was reviewed in 2013 by an FMP plan review team (PRT). Recommendation from DNR Fisheries Service is pending.**
	2.1.2 Maryland will terminate the fishing season for each of its three component fisheries when their individual quota is reached, regardless of time during the season. Virginia will terminate its commercial fishing component when its harvest quota is reached, regardless of time during the season. The Potomac River Fisheries Commission will terminate its fishing seasons when the allowable harvest under ASMFC's Striped Bass Plan is reached, regardless of the time during that season.	On-going	MD Department of Natural Resources, VA Marine Resources Commission, and PRFC have authority to close their fisheries when quotas are projected to be reached.
2.2 Maryland, Potomac River Fisheries Commission and Virginia will establish commercial gear restrictions to limit fishing effort and sublegal by-catch, and to facilitate enforcement.	2.2.1 Maryland, the Potomac River Fisheries Commission and Virginia will establish a minimum gill net mesh size designed to reduce sublegal by-catch mortality to	On-going	CB jurisdictions are in compliance.

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	negligible levels.		
	2.2.2 Maryland and Virginia will require that gill nets be marked, tended, and recovered (except for Virginia's stake nets) daily. The Potomac River Fisheries Commission will continue a fixed location for each gill net licensed in the Potomac.	On-going	CB jurisdictions are in compliance.
	2.2.4 Maryland and Virginia will establish annual quotas for their commercial fisheries.	On-going	State quotas are determined by ASMFC. CB FMP includes provisions for how jurisdictions allocate among sectors. MD adopted an allocation policy in 2011.
2.3 Selling and buying procedures and timely reporting requirements will be established to monitor and regulate harvest.	2.3.1 A) Maryland will establish check-in stations for the commercial sale of striped bass.	On-going	CB jurisdictions are in compliance.
	2.3.1 B) Virginia dealers and commercial watermen that harvest striped bass will be required to have a special permit to sell striped bass.	On-going	CB jurisdictions are in compliance.
	2.3.1 C) The sale of striped bass caught by recreational or charter boat fishermen will be prohibited.	On-going	CB jurisdictions are in compliance.
	2.3.2 Maryland and Virginia will establish a weekly reporting system for licensed commercial fishermen and a daily reporting system for buyers during the commercial season. Maryland and Virginia will provide the Potomac River Fisheries Commission with information obtained through their mandatory buyer reporting provisions. The Potomac River Fisheries Commission will reduce the time period required for the finfish reporting system from monthly to weekly.	2006 2009 2010 2011 2011	Electronic reporting was established for check stations and fishermen. Commercial Harvest Reports must be submitted to MDNR Fisheries Service within 10 days after the end of the month being reported. After 10 days the report is late. Watermen having late reports will be identified on the MDNR commercial webpage and in the Maryland Watermen's Gazette. Official violations are recorded for a license if a harvest report is not received within 50 days after the due date. Two or more reporting violations may result in license suspension. MD Senate Bill 655 and House Bill 1225 increased the penalty for commercial fishing with a suspended license, a revoked license, or without a license. The fine is up to $25,000 and imprisonment for up to one year. MD House Bill 1252, established a misdemeanor charge and up to two years imprisonment for the unlawful capture of

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			>$20,000 worth of striped bass (based on sale proceeds).
2.4.1 Fishing seasons will be established for the recreational, charter boat and commercial fisheries. The length of the season may be adjusted as needed, including when quotas are reached (see Action 2.1.2), by opening and closing areas to fishing, or with other actions as appropriate. Seasons will be consistent among jurisdictions to the extent possible.	2.4.1 A) The District of Columbia will establish a recreational fishing season within the period June through December.	Completed	The season opens in May and concludes at the end of December.
	2.4.1 B) Maryland will establish fishing seasons within the following periods: o The commercial gill net season will be within the period November through March 15. o The commercial pound net/haul seine/fyke net/hook and line seasons will be within the period June through November. o The recreational and charter boat seasons will be within the period June through November. o There may be a May trophy fishery for recreational and charter boat fishing, effective May 1991, limited to a single trophy fish per boat per day.	On-going Dates modified & subject to change Dates modified & subject to change	Fishing season dates are annually reviewed by ASMFC. Pound net: Monday – Saturday from June 1 – November 30. Haul seine: Monday – Friday from June 7 – November 30. Hook and line: Monday – Thursday from June 7 – November 30. Drift gill net: Monday – Friday from January 1 – February 28 and December **3** – 31. Atlantic coast: Monday – Friday from January 1 – April 30 and November 1 – December 31. Upper Chesapeake Bay (Susquehanna Flats) catch and release: March 1 – May 3, and the catch and keep: May 16 – 31. Spring trophy: 3rd Saturday in April – May 15. Summer – fall recreational/charter boat: May 16 – 31 and June 1 – December 15.
	2.4.1 C) Virginia will establish fishing seasons within the following periods: o The commercial netting season will be within the period September through February. o The recreational and charter boat seasons will be within the period June through December.	Dates modified & subject to change Dates modified & subject to change	Commercial season is **January 16** – December 31 (≥ 18") and March 26 – June 15 (≤ 28"). Recreational Chesapeake Bay spring trophy fishery: May 1 - June 15. Spring/summer fishery: May 16 - June 15. Fall fishery: October 4 - December 31
	2.4.1 D) The Potomac River Fisheries Commission will establish fishing seasons within the following periods: o The commercial gill net season will be within the period November through March. o The commercial pound net/haul seine/hook and line seasons will be within the period June through December. o The recreational and charter season will be within the period June through December.	Dates modified & subject to change	Pound net, Haul Seine, and miscellaneous gear: February 15 – March 25 (18" – 36") and June 1 – December 15 (≥ 18"). Hook and line: February 15 – March 25 (18" – 36") and June 1 – December 31 (≥ 18"). Gill net: November **12** – February 14 (≥18") and February 15 – March 25 (18" – 36"). Recreational seasons differ by size, possession, and bait limits. Spring season: April **20** – May 15. Fall season: May 16 – December 31.

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	2.4.1 E) Maryland, the Potomac River Fisheries Commission and Virginia will annually review the need for a Bay spawning season fishery in relationship to the issue of parity with the coastal states.	Continue	Addressed by ASMFC.
2.4.2 Establish time periods when fishing is allowed to aid law enforcement and monitoring.	2.4.2 Maryland will prohibit commercial fishing on weekends and at night during the transitional fishery.	Completed	Weekend and evening/night fishing have been prohibited.
2.4.3 Maryland, the Potomac River Fisheries Commission and Virginia will maintain appropriate striped bass fishing areas.	2.4.3 Maryland will continue to restrict fishing for striped bass in spawning areas and rivers, and spawning reaches as defined in COMAR 08.02.05.02. Virginia will continue to restrict fishing within the spawning reaches defined in VMRC Regulation 450-01-0034. The Potomac River Fisheries Commission will continue its prohibition on gill netting or striped bass fishing during April and May throughout the entire Potomac River during the transitional fishery.	Completed On-going	Area closures are regulated. Jurisdictions follow ASMFC harvest restrictions.
2.4.4 The District of Columbia, Maryland, the Potomac River Fisheries Commission and Virginia will establish recreational and charter boat creel limits consistent with ASMFC guidelines and dependent on length of season.	2.4.4.1 The District of Columbia, Maryland, the Potomac River Fisheries Commission and Virginia will establish creel limits for the recreational and charter boat fisheries of up to five (5) fish per person per day within the established season.	On-going	Jurisdictions are in compliance with ASMFC harvest restrictions. See Strategy 1.2 for creel limits.
	2.4.4.2 Maryland may allow one trophy fish per boat during a May trophy season.	On-going	Jurisdictions are in compliance with ASMFC harvest restrictions. See Strategy 1.2 for creel limits.
2.5 Maryland, Virginia and the Potomac River Fisheries Commission will establish monitoring programs to provide timely knowledge of harvest and effort data.	2.5.1 Maryland, the Potomac River Fisheries Commission and Virginia will monitor harvest for the striped bass fishery by one or a combination of the following: o Utilize daily trip tickets for commercial and charter fishermen. o Conduct port sampling of commercial vessels. o Conduct onboard sampling of commercial catches. o Utilize check-in station sampling to characterize exploited stocks. o Require dealer logs o Maintain Natural Resource Police activity reports. o Utilize aerial overflights to estimate	1995 - 2003 On-going On-going	Amendment V of the ASMFC FMP requires MD and VA to conduct annual juvenile abundance (JAI) surveys. CB jurisdictions are required to compile and submit commercial and recreational fisheries data. Monitoring programs include the Maryland Estuarine Juvenile Finfish Survey; spring spawning stock survey; spring tagging; commercial pound net, haul seine, hook and line, and drift gill net; and recreational Susquehanna Flats catch and release, spring trophy, spring-early summer and summer-fall recreational/charter boat seasons. Monitoring requirements may be changed as necessary.

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	recreational effort. o Conduct port and onboard sampling of recreational vessels. o Conduct telephone surveys to estimate recreational participation. o Utilize mail surveys to estimate recreational catch and effort. o Utilize an enhanced National Marine Fisheries Service survey and/or Chesapeake Bay Stock Assessment Committee recreational monitoring data.	2007 2008 2011	Data collected from Federal waters is coordinated with NOAA Fisheries. Addendum I to Amendment 6 of the ASMFC FMP requires commercial and recreational catch, bycatch, discard, and mortality data. Discard mortality data gaps will be identified. Coastal stock data was used in a VPA model, but is now used in an SCA model. Addendum 1 to Amendment 6 of ASMFC FMP requires states to address bycatch and angler education. States are required to collect commercial and recreational catch and bycatch data that is consistent with ACCSP standards, coordinate data collection from Federal waters with NOAA Fisheries, and review discard mortality studies for information gaps. States are to implement angler education about best practices for catch and release fishing. MD Senate Bill 414 and House Bill 396 authorize NRP officers to inspect licensed commercial vessels, vehicles, and premises where MD fishery resources may be stored. NRP officers are authorized to issue electronic citations. The law allows MDNR to suspend or revoke a license after providing the opportunity for a hearing.
	2.5.2 The District of Columbia will conduct an angler survey to determine striped bass fishing effort and harvest.	On-going	District Department of the Environment conducts monthly angler surveys.
2.6.1 The District of Columbia, Maryland and Virginia will establish regulatory procedures that allow for: 1) recognition of and incorporation of ASMFC requirements into state management, and 2) a periodic cycle of public review of management options. The Potomac River Fisheries Commission will promulgate regulations necessary to comply with the ASMFC and Chesapeake Bay Striped Bass Management Plans.	2.6.1 Maryland will propose legislation to authorize timely management actions and will develop guidelines for regulations. Virginia will promulgate regulations for timely management and seek legislation to correct any deficiencies if noted.	1990 On-going	Jurisdictions are in compliance with ASMFC and are coordinating through the Chesapeake Bay Program.
	2.6.2 The District of Columbia, Maryland, the Potomac River Fisheries Commission and Virginia will adopt consistent enforcement policies for the striped bass fishery throughout the Chesapeake Bay. Strategies to address enforcement needs will be developed.	On-going 2011	ASMFC's Law Enforcement Committee develops minimum enforcement policies. Additional enforcement resources have been made available. Resources include additional officers, equipment, access to state of the art surveillance tools, legislation and regulation,

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			increased penalty system, and a streamlined judicial framework.
		2011	MD Senate Bill 635 and House Bill 1154, require the revocation of an individual's commercial fishing license if found by an Administrative Law Judge to have knowingly committed an egregious violation or repeat violation against striped bass including: using illegal gear; harvesting during closed seasons; harvesting from a closed area; violating established harvest, catch or size limits; or violating tagging and reporting requirements.
3 - Stock Assessment and Research Needs: The Chesapeake Bay Stock Assessment Committee (CBSAC) will continue to improve the coordination of stock assessment pursuant to the Chesapeake Bay Stock Assessment Plan. Stock identification studies should be expanded, especially for the Chesapeake & Delaware Canal and along the coast, to provide information on stock mixing. The contribution of hybrids and hatchery produced fish to the wild population needs to be determined. A review of hooking mortality and other by-catch mortality rates would allow greater precision in establishing fishing mortality controls. Studies on larval survival and growth in relation to environmental variables would provide a better understanding of the factors affecting year class strength.			MD and VA have instituted tagging programs to estimate migration and mortality rates.
		On-going	Gillnet survey is used to collect population data.
		Completed	Studies demonstrating the effectiveness of circle hooks for reduced gut hooking and release mortality have been completed.
		2009	Research has linked striped bass recruitment with climate cycles. Wood & Austin, 2009, Synchronous multidecal fish recruitment patterns in Chesapeake Bay, USA.
		2008 – 2011	SARC determined stock is not overfished is not undergoing overfishing.
		2012-2013	**A benchmark stock assessment (one that adds new data & must be peer reviewed) is scheduled for completion in fall 2013.**
3.1 The jurisdictions will continue to obtain stock information on striped bass in Chesapeake Bay.	3.1 The District of Columbia will continue monitoring aspects of striped bass population dynamics. Maryland will continue surveys of the spawning and premigratory striped bass stock in the Chesapeake Bay. Virginia will initiate surveys on its spawning stock of striped bass. Collection of tissue and scale samples to augment tagging information and stock identification will be considered.	On-going	MD has a gill net survey to monitor the spring spawning stock.
		On-going	MD and VA tag fish for the USFWS Cooperative Coastal Striped Bass Tagging Program to monitor migratory and resident striped bass population dynamics. ASMFC does not require DC to tag fish.
3.2 Efforts will be made to improve our understanding of factors that affect reproduction and recruitment to the	3.2 The District of Columbia, Maryland and Virginia, in cooperation with federal	2007 Continue	Addendum I to Amendment 6 of the ASMFC FMP requires states to implement angler

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Strategy	**Action**	**Date**	**Comments**
fishery.	agencies, will review and update existing data, and initiate new studies that target: striped bass reproduction and early life history, especially in relation to environmental parameters; natural mortality; and catch-release mortality induced by various fishing methods.	2009 Continue On-going	education about catch and release best practices**.** Tagging data indicates striped bass natural mortality (M) may be increasing unless CB emigration has increased. Increased M may reflect an increased incidence of mycobacteriosis, decreased prey availability, or poor water quality. Tagging study design and implementation requirements are coordinated with ASMFC.
4 – Declining Water Quality: Adequate spawning and nursery areas with good water quality are critical for striped bass survival. Although causes for the decline in reproduction may differ between years and between spawning areas, several water quality aspects are identified as reducing survival of young. State and Federal studies will continue to examine the effects of environmental contaminants on striped bass. 4.1 Identify those water quality factors, both natural and man-induced, which affect striped bass reproduction and survival, and focus on the control of those factors.	4.1 The first four action items are commitments under the 1987 Chesapeake Bay Agreement. The DCFM, MDNR, PRFC and VMRC are not the agencies responsible for carrying out the actual commitments, but are involved in setting the objectives of the programs to fulfill the commitments. The achievement of these commitments will lead to improved water quality and enhanced biological production that can only benefit striped bass populations. The DCFM, MDNR, PRFC and VRMC fully support these commitments.	1990 On-going 2010 2012 - 2013	Water quality issues are also addressed in the Chesapeake 2000 Agreement and most recently in the 2009 Executive Order. US EPA established a Chesapeake Bay TMDL "pollution diet" mandating nutrient and sediment reductions for compliance with the Clean Water Act. **The Chesapeake Bay Program has developed a draft Chesapeake Bay Watershed Agreement, which outlines new goals and outcomes for protecting and restorating the Bay. The draft document is open for public input until August 15, 2013 .http://www.chesapeakebay.net/chesapeakebaywatershedagreement/page**
	1 - The first commitment adopted under the 1987 Chesapeake Bay Agreement was a report titled, "Habitat Requirements for Chesapeake Bay Living Resources". This document listed the habitat requirements for selected target species including striped bass. The report is being revised and updated by a workgroup of the Living Resources Subcommittee. When complete in May, 1990, the habitat requirements contained in the report will be used to aid managers in improving water quality: a) Assist in the revision of water quality standards and criteria as needed, b) Develop a Habitat Requirements Use Report which will detail resource needs by	1991 2001 2007 Completed 1990 On-going	Document published. CB jurisdictions have implemented management strategies to protect striped bass habitat. MD spawning areas are protected from harvest March through May. An ecosystem-based fishery management process was facilitated by MD Sea Grant. Habitat issues/stressors were defined for striped bass. Chesapeake Bay Program develops, revises, and monitors goals and strategies for living resources (blue crab, menhaden, oyster, shad, and striped bass. For more information:

1989 Chesapeake Bay Striped Bass Management Plan Implementation Table (updated 7/2013)			
Strategy	**Action**	**Date**	**Comments**
	river segment, c) Assist in the 1991 Nutrient Re-evaluation by providing living resource habitat requirement for use in the 3-D Model (The model will compare existing water quality with the habitat requirements and project whether the requirements would be met under various nutrient removal scenarios), and d) Assist in the implementation of the nutrient, toxics and conventional pollutant control strategies by identifying critical habitat needs.		http://www.chesapeakebay.net/issues/issue/blue_crabs http://www.chesapeakebay.net/issues/issue/menhaden http://www.chesapeakebay.net/issues/issue/oysters http://www.chesapeakebay.net/issues/issue/shad http://www.chesapeakebay.net/issues/issue/striped_bass
	4.1 2 –Development and adoption of a basinwide plan that will achieve a reduction of nutrients entering the Chesapeake Bay: a) Construct public and private sewage facilities. b) Reduce the discharge of untreated or inadequately treated sewage. c) Establish and enforce nutrient and conventional pollutant limitations in regulated discharges. d) Reduce levels of nutrients and other conventional pollutants in runoff from agricultural and forested lands. e) Reduce levels of nutrients and other conventional pollutants in urban runoff.	1990 On-going	Currently addressed through the Chesapeake Bay Program's 2 year milestones towards reaching the 2025 water quality goals. Chesapeake Bay Program develops, revises, and monitors goals and strategies for nutrient reduction. For more information: http://www.chesapeakebay.net/issues/issue/nutrients
	4.1 3 – Development and adoption of a basinwide plan for the reduction and control of toxic materials entering the Chesapeake Bay system from point and nonpoint sources and from bottom sediments: a) Reduce discharge of metals and organic compounds from sewage treatment plants receiving industrial wastewater. b) Reduce the discharge of metals and organic compounds from industrial sources. c) Reduce levels of metals and organic compounds in urban and agricultural runoff. Reduce chlorine discharges to critical finfish areas.	1990 On-going	Chesapeake Bay Program develops, revises, and monitors goals and strategies for chemical contaminants. For more information: http://www.chesapeakebay.net/issues/issue/chemical_contaminants
	4.1 4 – Development and adoption of a basinwide plan for the management of conventional pollutants entering the Chesapeake Bay from point and nonpoint	1990 On-going	Chesapeake Bay Program develops, revises, and monitors goals and strategies for sediment, wastewater, stormwater runoff, and agriculture. For more information:

1989 Chesapeake Bay Striped Bass Management Plan Implementation Table (updated 7/2013)			
Strategy	**Action**	**Date**	**Comments**
	sources: a) Manage sewage sludge, dredge spoil and hazardous wastes. b) Improve dissolved oxygen concentrations in the Chesapeake Bay through the reduction of nutrients from both point and nonpoint sources. c) Continue study of the impacts of acidic conditions on water quality. d) Manage groundwater to protect the water quality of the Chesapeake Bay. e) Continue research to refine strategies to reduce point and nonpoint sources of nutrient, toxic and conventional pollutants in the Chesapeake Bay.		http://www.chesapeakebay.net/issues/issue/sediment http://www.chesapeakebay.net/issues/issue/wastewater http://www.chesapeakebay.net/issues/issue/sediment http://www.chesapeakebay.net/issues/issue/stormwater_runoff
	4.1 5 – The development and adoption of a plan for continued research and monitoring of the impacts and causes of acidic atmospheric deposition into the Chesapeake Bay and its tributaries. This plan is complemented by Maryland's research and monitoring program on the sources, effects, and control of acid deposition as defined by Natural Resources Article Title 3, Subtitle 3A, (Acid Deposition: Sections 3-3A-01 through 3-3A-04): a) Determine the relative contributions to acid deposition from various sources of acid deposition precursor emissions and identify any regional variability. b) Assess the consequences of the environmental impacts of acid deposition on water quality. c) Identify and evaluate the effectiveness and economic costs of technologies and mitigative techniques that are feasible to control acid deposition into the Chesapeake Bay.	1990 On-going	Chesapeake Bay Program develops, revises, and monitors goals and strategies for air pollution. For more information: http://www.chesapeakebay.net/issues/issue/air_pollution

Acronyms

ACCSP – Atlantic Coastal Cooperative Statistics Program
ASMFC – Atlantic States Marine Fisheries Commission
CB – Chesapeake Bay
CBP – Chesapeake Bay Program
COMAR – Code of Maryland Regulations
DCFM – District of Columbia Department of Consumer and Regulatory Affairs, Fisheries Management Section
EPA – Environmental Protection Agency
F – Fishing Mortality
FMP – Fishery Management Plan
JAI – Juvenile Abundance Index
M – Natural Mortality
MDNR – Maryland Department of Natural Resources
MSY – Maximum Sustainable Yield
NOAA – National Oceanic and Atmospheric Administration
NRP – Maryland Natural Resources Police
PRFC – Potomac River Fisheries Commission
SARC – Stock Assessment Review Committee
SCA – Statistical Catch at Age
SSB – Spawning Stock Biomass (females)
TMDL – Total Maximum Daily Load
USFWS – U.S. Fish and Wildlife Service
VMRC – Virginia Marine Resources Commission
VPA – Virtual Population Assessment

2012 Maryland FMP Report (August 2013)
Section 18. Summer Flounder (*Paralichthys dentatus)*

Chesapeake Bay FMP

States were granted greater management flexibility for the recreational summer flounder fishery in 2013. Modifications included state-to-state transfer of unused recreational quota and suspension of recreational seasonal closures for some states including Maryland. Fishing mortality (F) has remained below the target and spawning stock biomass (SSB) has remained at or below the target since 2010. While there has been recent stability in F and SSB, caution is still the approach when setting harvest specifications so as to maintain the stock's rebuilt status (2010).

In the late 1980s, the Atlantic coast summer flounder stock was overfished and depleted. A coastal Fishery Management Plan for Summer Flounder was developed in 1982 by the Atlantic States Marine Fisheries Commission (ASMFC). This coastwide plan established a 14" minimum size and specified trawl net mesh size for fishing in state waters (≤ 3 miles from shore). The MAFMC developed a complementary Fishery Management Plan for the Summer Flounder Fishery in 1988 to govern the federal waters (> 3 miles from shore). The MAFMC's FMP required fishermen to abide by the more conservative state or federal requirements. Summer flounder management was consolidated into a joint ASMFC and MAFMC fisheries management plan.

In 1991, the Chesapeake Bay jurisdictions adopted the Chesapeake Bay Summer Flounder Fishery Management Plan (CBFMP). The CBFMP implemented management measures that reduced fishing mortality (F) and increased the spawning stock biomass (SSB). CBFMP strategies and actions were based on guidelines established by the ASMFC and MAFMC. As the summer flounder stock improved, the Chesapeake Bay jurisdictions developed Amendment # 1 to the CBFMP in 1997. This amendment adopted all future reference points and quota determined by the ASMFC and MAFMC. Jurisdictions continue to implement commercial and recreational management measures as needed to meet these requirements. The CBFMP Amendment #1 also implemented a system of individual quota permits for the commercial fishery.

From 1991 to 1995, MAFMC adopted seven amendments to adjust summer flounder management actions. ASMFC and MAFMC adopted amendments 8 and 9 to incorporate scup and black sea bass, respectively, into the summer flounder FMP. Between 1997 and 2007 ASMFC adopted three amendments (10, 12, and 13) and 8 addenda (III, IV, VIII, and XV to XVIV) to modify summer flounder management. In that same time period, MAFMC adopted five amendments (10 to 13 and 16) and five frameworks (1, 2, and 5 to 7) to modify summer flounder management.

ASMFC adopted Amendment XXIV in 2013 to increase flexibility in recreational quota management. Maryland submits an annual compliance report to ASMFC.

Stock Status

Summer flounder inhabit coastal waters from the North Carolina/South Carolina border north to the US/Canadian border and are managed as a single stock. Stock status was last reviewed in 2011 by the National Marine Fisheries Service. The review committee determined that the summer flounder stock was rebuilt in 2010, is not overfished, and overfishing is not occurring. However, the stock assessment [1] indicated that F may exceed F_{target} in 2011 and if the established catch level approaches the catch specifications then an overfishing determination could be made[2].
Current biological reference points (BRP) for summer flounder are F_{target} = 0.255, $F_{threshold}$ = 0.310, SSB_{target} = 132 million pounds, and $SSB_{threshold}$ = 66.2 million pounds. Fishing mortality has declined since the 1990s and was estimated at 0.241 in 2011, which was below F_{target}. SSB began increasing in the 1990s. The 2011 SSB estimate was 126 million pounds, which was between the SSB_{target} and $SSB_{threshold}$ values. A coastwide benchmark stock assessment is scheduled for completion in 2014.

Management Measures

National Marine Fisheries Service (NMFS), in conjunction with MAFMC, determine coastwide annual catch limits (ACL), commercial quota, and recreational harvest limit (RHL). Commercial coastwide quota is allocated among states based on their historic proportion of landings. In Maryland, 60% of the ACL is allocated to the commercial fishery and 40% to the recreational fishery. Commercial and recreational quota overages are deducted from the following year's quota. Maryland was allocated 2.04% (233,000 pounds) of the 2013 coastwide commercial quota [3]. Maryland was allocated 2.9% (221,000 pounds) of the RHL [3]. States can implement conservation equivalency that can result in different regulatory combinations from state-to-state as long as they stay within the ACL. ASMFC adopted Amendment XXIV in 2013 that allows states to adjust recreational regulations in order to access the portion of RHL projected to be unused [4].

Maryland implements catch share management to equitably distribute the quota among harvesters in Atlantic coastal waters, coastal bays and tributaries, Chesapeake Bay (primarily bycatch) and the Potomac River. The catch share system assigns a specific individual fishing quota (IFQ) for each fisherman which allows them to manage their business for best economic yield. Commercial hook and line harvest is managed with a 16" minimum length and all other gears have a 14" minimum length. Commercial fishermen without an IFQ are restricted to 100 lbs per person per day in coastal waters and 50 lbs per person per day in tidal waters (Chesapeake Bay). The

commercial season is year round. PRFC manages the Potomac River with a 14" minimum size. Net design and mesh size are also regulated.

The Maryland recreational summer flounder fishery was opened year round beginning in 2013. Fish must have a minimum length of 16". Harvest is limited to 4 fish per person per day. Maryland suspended seasonal restrictions on the recreational fishery in 2013. PRFC manages the Potomac River recreational harvest with 16" minimum size limit and 4 fish per person per day limits.

Maryland monitors summer flounder abundance, size, and age with an annual Coastal Bays trawl survey, beach seine survey, and commercial trawl landings from near-shore Atlantic waters. The Maryland Department of Natural Resources (MDNR) initiated the Maryland Volunteer Angler Summer Flounder Survey (MVASFS) in 2005. The results from these four surveys are used by ASMFC, MAFMC, and Maryland to develop regulations for the following year's summer flounder fisheries.

The Fisheries

Maryland's 2012 commercial fishery harvested 140,000 pounds of summer flounder. As of August , 2013, 55,000 pounds of the 233,000 pound quota had been harvested (Figure 1).

Recreational landings of summer flounder should be viewed with caution due to high proportional standard error (PSE). Sixty-two thousand pounds (PSE = 33.1) were harvested by recreational anglers in 2012 (Figure 2).

Figure 1. Maryland's commercial summer flounder harvest (1940 to August of 2013) and quota allocation (1994 to 2013).[1,5,6,7,8] Prior to the vertical line, all flounder species were combined.

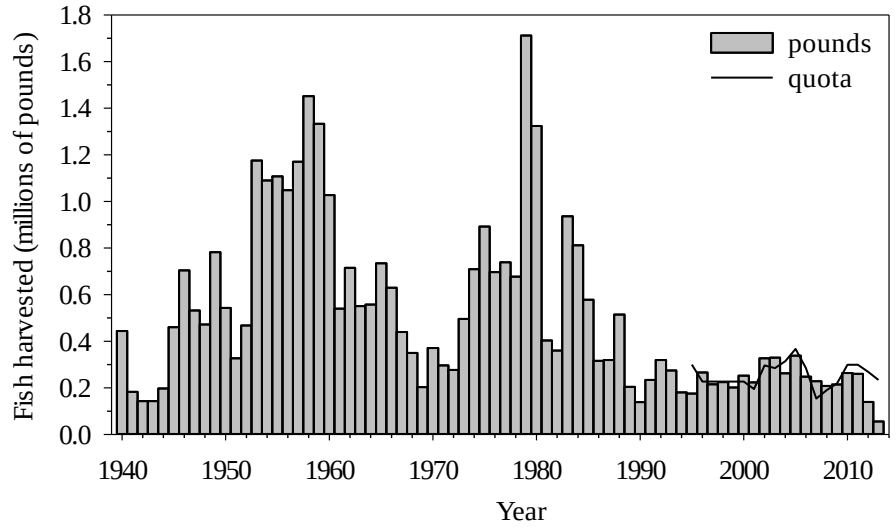
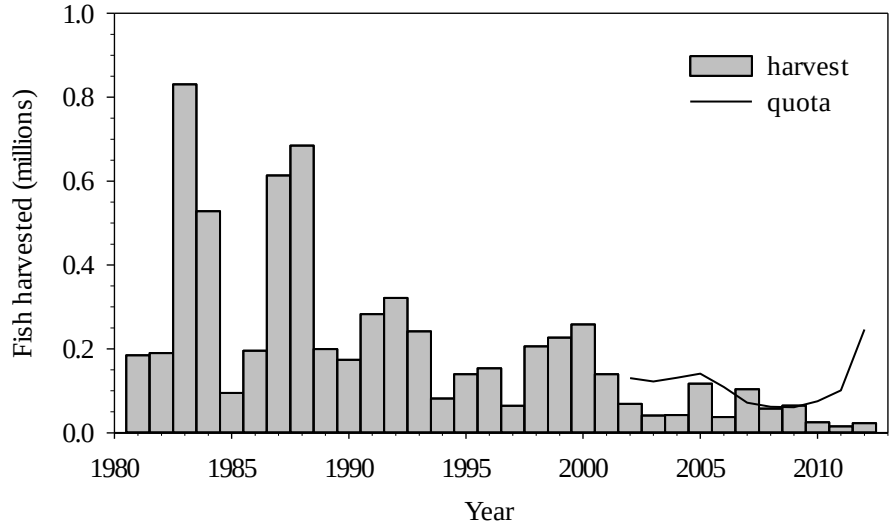


Figure 2. Estimated recreational summer flounder harvest and quota in Maryland from 1981 to 2012.[5]



Issues/Concerns

There is sufficient error in the estimation of recreational summer flounder harvest to exercise caution when making management decisions. Average PSE of the Marine Recreational Information Program (MRIP) harvest estimates during the past decade has been 34.

The rate of summer flounder natural mortality is uncertain. Stock assessment results are influenced by natural mortality. Factors that are affected include F, SSB, and recruitment. These values are critical foe determination of stock status.

References

[1] Terceiro M. 2011. Stock Assessment of Summer Flounder for 2011. US Dept Commerce, Northeast Fish Sci Cent Ref Doc. 11-20; 141 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://www.nefsc.noaa.gov/nefsc/publications/

[2] Collins, K. 2011, October 31. New report forces Council to reconsider summer flounder recommendations: 2012 stock size lower than previously estimated. Mid-Atlantic Fishery Management Council. Dover, DE. http://www.mafmc.org/press/2011/pr11_17_2012_Fluke_Recommendation.pdf

[3] Federal Register /Vol. 77, No. 222 / Friday, November 16, 2012 / Proposed Rules 68723-68730 (http://www.gpo.gov/fdsys/pkg/FR-2012-11-16/pdf/2012-27973.pdf)

[4] ASMFC. April 18, 2013. News release. ASMFC Summer Flounder, Scup and Black Sea Bass Board approves Addendum XXIIV: New York & New Jersey may modify regulations to access additional fish. Press Contact: Tina Berger

[5] Personal communication from the National Marine Fisheries Service, Fisheries Statistics Division. May 23, 2012: http://www.st.nmfs.noaa.gov/index

[6] ASMFC. 2006. 2006 Review of the Atlantic States Marine Fisheries Commission fishery management plan for summer flounder (*Paralichthys dentatus*). Atlantic States Marine Fisheries Commission. Washington, DC

[7] Doctor, S. 2013. Maryland's 2012 summer flounder (*Paralichthys dentatus*) compliance report to the Atlantic States Marine Fisheries Commission. Maryland Department of Natural Resources. Annapolis, Maryland.

8 Personal communication from the NOAA Fisheries Service, Northeast Regional Office, Fisheries Statistics Office. May 2, 2012: http://www.nero.noaa.gov/ro/fso/reports/reports_frame.htm

Amendment 1 to the 1991 Chesapeake Bay Summer Flounder Fishery Management Plan Implementation Table (updated 8/2013)			
Strategy	**Action**	**Date**	**Comments**
1.1) The Bay jurisdictions will continue to implement management measures which reduce fishing mortality on the summer flounder stock and equitably allocate the harvest of summer flounder.	1.1a) The jurisdictions will implement annual quotas, individual quotas and/or possession limits in addition to seasonal restrictions, minimum mesh size requirements, minimum size limits, limited entry and license requirements to meet the coastwide commercial quota. The traditional balance of harvest between the Chesapeake Bay and the Atlantic coast will be maintained.	1998, 2004 Continue	ASMFC revised overfishing definition. Coastwide and state quotas are determined annually. ASFMC allowed a change in allocation. FMP actions are annually evaluated and adjusted to meet ASMFC coastal stock rebuilding targets.
		2008 2009	The ASMFC's Summer Flounder, Scup, and Black Sea Bass Board set the 2009 total allowable landings for summer flounder at 18.45 million pounds, up 2.68 millions pounds from 2008. Officials determined from the 2008 June Stock Assessment Workshop (SAW) and Peer Review that summer flounder is no longer overfished, is not experiencing overfishing, but has not been rebuilt to target levels.
		2011	MD annual commercial quota is determined by NMFS/ASMFC. Commercial IFQ permits are issued. Limit without permit in Ocean and Coastal Bays is 100 lbs/individual/day. Limit without permit in Chesapeake Bay is 50 lbs/individual/day. PRFC annual commercial quota is determined by NMFS/ASMFC and deducted from MD's total annual quota. VA annual commercial quota is determined by NMFS/ASMFC and is 21.3% of the coastwide quota. Of the annual quota, 300,000 lbs is set aside for tidal waters; 142,114 lbs is set aside for the Chesapeake Bay waters and the remaining quota is allocated to harvest from non-Virginia waters (typically beyond 3 miles offshore). For the non-VA waters, harvest from 1st Monday in January to the day prior to last Monday in November is allotted 70.7% of this quota. The remaining 29.3% of the quota is allotted to the last Monday of November to December 31. Allocation limits are adjusted for over and under harvest. A series of combined pound/day and pound/species (Atlantic croaker, black sea bass, scup, squid, scallop, and Atlantic mackerel) restrictions have been implemented.
		2013	**MD's commercial hook and line minimum size was reduced to 16". Minimum size for other gear types is 14". PRFC and VA minimum size is 14". A coastwide benchmark stock**

Amendment 1 to the 1991 Chesapeake Bay Summer Flounder Fishery Management Plan Implementation Table (updated 8/2013)			
Strategy	**Action**	**Date**	**Comments**
			assessment is scheduled for completion in 2014.
	1.1b) The jurisdictions will implement recreational seasons, creel limits and minimum size limits to meet the annual coastal recreational harvest limits recommended by the MAFMC/ASMFC.	2001 2003 2005 **2013**	ASMFC implements coastwide system for conservation equivalency. ASMFC sets State-specific recreational harvest targets. ASMFC established a program to allow the recreational summer flounder coastwide allocations to be subdivided into regions. **MD suspended seasonal closure**: **Atlantic & Coastal Bays have ≥16" total length and 4 fish/person/day, and Chesapeake Bay has ≥16" total length and 4 fish/person/day. PRFC and VA have the same size, creel, and season limits**.
	1.1c) Maryland and Virginia will maintain the traditional commercial fishery by requiring a special landings permit for the Atlantic commercial summer flounder fishery. The jurisdictions will develop, define and adopt criteria to determine eligibility for participation in the fishery.	1998 2003 Continue 2005 On-going	MD has implemented a summer flounder catch share system. The catch share allocation equitably distributes the quota among harvesters based on past harvest. Individual fishing quotas (IFQ) allow fishermen to manage harvest for best economic yield. VA issues permits for vessels and dealers.

1991 Chesapeake Bay Summer Flounder Fishery Management Plan Implementation Table (updated 8/2013)			
Strategy	**Action**	**Date**	**Comments**
1.1) Maryland, Virginia and the PRFC will propose changes in the minimum size regulations, creel limits and seasons in the recreational fishery to conform to guidelines set by MAFMC. Maryland and Virginia will comply with commercial quotas, mesh sizes and other commercial restrictions enacted by MAFMC. These recommendations are intended to provide greater spawning stock biomass from each flounder year-class and provide a greater yield-per-recruit.	1.1a) Maryland, the PRFC and Virginia will propose an increase in their minimum size limit for recreationally caught flounder from 13 inches to 14 inches.	1992 1998 **2013**	Initiated increasing minimum size 13" to 14" ASMFC revised overfishing definition. See Amendment #1, Strategy 1.1, Action 1.1b **MD, PRFC, and VA: 16"**
	1.1b) Maryland, Virginia and the PRFC will propose creel limits and seasonal restrictions in compliance with MAFMC recommendations. A six fish creel limit will be proposed as one measure to meet these recommendations. A recreational fishing season extending from May 15 – Sept. 30 may also be required to reduce fishing mortality. Virginia will continue to enforce its ten fish per day limit until such time as MAFMC recommendations can be implemented.	1998 **2013**	See Amendment #1, Strategy 1.1, Action 1.1b **MD, PRFC, and VA: 4 fish per person per day. Seasonal closure suspended.**
	1.1c) Commercial size limits will remain at 13" for Virginia and Maryland in conformance with MAFMC recommendations. The PRFC will propose a 14" minimum commercial size limit for its commercial flounder fisheries to provide parity with the recreational fishery. A 5.5 inch diamond or 6 inch square minimum cod end mesh size will be implemented in all directed flounder trawl fisheries.	1998 **2012**	See Amendment #1, Strategy 1.1, Action 1.1a **MD's commercial hook and line minimum size was reduced to 16". Minimum size for other gear types is 14". PRFC's minimum size is 14".**
	1.1d) Commercial fisheries will be subject to quotas set by MAFMC and administered by the states. All flounder landed by a vessel registered in a state will be counted towards that state's quota, without regard to the actual fishing location. Commercial fisheries in each state will be closed when that state's quota is reached. The PRFC will propose a moratorium on its commercial flounder fisheries from January through June, inclusive, to compliment the seasonal closure proposed for the recreational fishery, in addition to conforming to MAFMC quota closures.	1993 1995 1998 2012	ASMFC State allocations changed. ASMFC capped coastwide quota & adjusted stock rebuilding schedule. ASMFC revised overfishing definition. See Amendment #1, Strategy 1.1, Action 1.1a MD receives 2.04% of the coastwide commercial TAL. A portion of MD's TAL is allocated to PRFC. VA is allocated 21.3% of the coastwide quota.
1.2) Management agencies will	1.2a) Virginia and Maryland will implement a 5.5	On-going	Mesh size restrictions have been implemented.

1991 Chesapeake Bay Summer Flounder Fishery Management Plan Implementation Table (updated 8/2013)			
Strategy	**Action**	**Date**	**Comments**
continue to promote the implementation of minimum mesh size in the directed flounder trawl fisheries sufficient to allow escapement of immature female flounder. Management agencies will urge the Mid-Atlantic Fisheries Management Council to enact a mesh size compatible with these management goals in the directed flounder trawl fisheries to complement the mesh size requirements enacted through the Baywide Plan.	inch diamond or 6 inch square minimum cod end mesh size in all directed flounder trawl fisheries to allow escapement of immature female flounder. Virginia and the PRFC will continue their bans on trawling in state waters.		
	1.2b) Virginia and Maryland will work with the Mid-Atlantic Fisheries Management Council to adopt a 5.5 inch diamond or 6 inch square minimum cod end mesh size for the EEZ flounder trawl fishery consistent with the objectives of the Baywide Plan and MAFMC's recommendations for conservation of the resource.	On-going	Mesh size restrictions have been implemented.
1.3) Virginia, Maryland and the Potomac River Fisheries Commission will investigate the incidental bycatch of small flounder in non-directed fisheries and participate in coastal deliberations to protect small flounder in other coastal states.	1.3a) Maryland will collect information from its pound net and ocean trawl fisheries to develop management strategies for reducing the non-directed bycatch of small flounder and other species. Options for consideration include minimum mesh sizes, season and area restrictions, culling practices, escape panels and fishing efficiency devices.	On-going	MD collects summer flounder abundance, size, and age data from commercial trawlers fishing near-shore Atlantic waters.
	1.3b) Virginia will continue to monitor the species composition and biological characteristics of bait harvested in its pound net fishery. The VMRC will take action, as needed, to reduce the incidental bycatch of small flounder in the bait fishery.		Monitoring of pound net bait fish harvest is not required.
	1.3c) Maryland, PRFC, and Virginia will work through the Mid-Atlantic Fisheries Management Council and the Atlantic States Marine Fisheries Commission to encourage protection of immature flounder.	On-going	Immature flounder are conserved via gear and harvest restrictions.
2.1) Maryland, Virginia and the Potomac River Fisheries Commission will continue to support stock identification research to determine the extent of stock mixing in the Chesapeake Bay flounder population.	2.1) The jurisdictions will continue to support stock identification research, particularly stock composition tagging studies being conducted at Virginia's Institute of Marine Science (VIMS) and the University of Maryland. Coordinated studies on the relative contribution of various estuaries, including the Chesapeake Bay, to the coastal flounder stock will be initiated.	1995 On-going	VIMS and the VMRC cooperatively support the Virginia Game Fish Tagging Program. The tagging program trains and maintains an experienced group of volunteer recreational anglers who tag and release the fish they catch. More information is available at: http://www.vims.edu/research/units/centerspartners/map/recfish/index.php MD does not have a summer flounder tagging program.

1991 Chesapeake Bay Summer Flounder Fishery Management Plan Implementation Table (updated 8/2013)			
Strategy	**Action**	**Date**	**Comments**
2.2) Virginia will continue to support stock assessment work conducted by the VMRC and index of abundance research performed by Virginia Institute of Marine Science (VIMS).	2.2) VMRC's Stock Assessment Program will continue to collect biological data (age, size, sex) from commercial catches of summer flounder. VIMS will continue to monitor abundance of juvenile flounder through its young-of-the-year and juvenile flounder survey trawl indices.	On-going	Data collection is required by ASMFC and MAFMC.
2.3) Maryland, Virginia and the Potomac River Fisheries Commission will continue to support interjurisdictional efforts to maintain a comprehensive data base on coastwide level.	2.3) Maryland, Virginia and the PRFC will continue to collect fisheries landings data on summer flounder as part of ongoing commercial fisheries statistics programs. Virginia will continue to pursue adoption and implementation of a limited and/or delayed entry program and a mandatory reporting system for commercial licensees. Maryland and Virginia will continue to supplement the Marine Recreational Fisheries Statistics Survey to obtain more detailed catch statistics at the state level. Through FISHMAP, Maryland will begin a pound net sampling project to collect information on summer flounder and other species.	On-going	Data collection is required by ASMFC and MAFMC.
2.4) Maryland and Virginia will continue their joint and individual efforts in providing the information needed to determine the relationship between abundances of adult and juvenile flounder.	2.4) Maryland and Virginia will continue the Baywide trawl survey of estuarine finfish species and crabs to measure size, age, sex distribution, abundance and CPUE. Maryland will continue seaside juvenile summer flounder studies utilizing bottom trawls, beach seines and their cooperative sampling of trawl fisheries.	1977 On-going 1989 On-going 2001 – 2005 2002	MD DNR conducts a summer blue crab trawl survey. VIMS and MD DNR collaboratively conduct a winter dredge survey of blue crabs. University of Maryland Center for Environmental Science Chesapeake Biological Laboratory, University of Maryland - College Park, and the Maryland Department of Natural Resources co-operatively conduct the Chesapeake Bay Fishery-Independent Multispecies Survey (CHESFIMS). More information is available at: http://hjort.cbl.umces.edu/chesfims.html VIMS conducts the Chesapeake Bay Multispecies Monitoring and Assessment Program (ChesMMAP) with funding from the VMRC. The trawl survey samples juvenile and adult fishes from the upper Chesapeake Bay to the mouth of the Bay. More information is available at: http://www.vims.edu/research/departments/fisheries/programs/

1991 Chesapeake Bay Summer Flounder Fishery Management Plan Implementation Table (updated 8/2013)			
Strategy	**Action**	**Date**	**Comments**
			multispecies_fisheries_research/chesmmap/index.php
		2006 On-going	The scope of the CHESFIMS program was reduced to a subset of sites.
		On-going	Summer flounder juvenile surveys are required by ASMFC.
3.1) The District of Columbia, Environmental Protection Agency, Maryland, Pennsylvania, the Potomac River Fisheries Commission, and Virginia will continue to promote the commitments of the 1987 Chesapeake Bay Agreement. The achievement of the Bay commitments will lead to improved water quality and enhanced biological production.	3.1) The District of Columbia, Environmental Protection Agency, Maryland, Pennsylvania, the Potomac River Fisheries Commission, and Virginia will continue to set specific objectives for water quality goals and review management programs established under the 1987 Chesapeake Bay Agreement. The Agreement and documents developed pursuant to the Agreement call for: 1) Developing habitat requirements and water quality goals for various finfish species.	1990 On-going	Chesapeake Bay Program (CBP) develops, revises, and monitors goals and strategies for agriculture, air pollution, bay grasses, blue crabs, chemical contaminants, climate change, development, education, forests, groundwater, invasive species, menhaden, nutrients, oysters, population growth, rivers and streams, sediment, shad, stormwater runoff, striped bass, wastewater, weather, and wetlands. For more information: http://www.chesapeakebay.net/issues Chesapeake Bay Program develops, revises, and monitors goals and strategies for living resources (blue crab, menhaden, oyster, shad, and striped bass. For more information: http://www.chesapeakebay.net/issues/issue/blue_crabs http://www.chesapeakebay.net/issues/issue/menhaden http://www.chesapeakebay.net/issues/issue/oysters http://www.chesapeakebay.net/issues/issue/shad http://www.chesapeakebay.net/issues/issue/striped_bass The CBP has developed a new draft Watershed Agreement with fisheries and habitat outcomes.
	3.1 2) Developing and adopting basinwide nutrient reduction strategies.	1990 On-going	Chesapeake Bay Program develops, revises, and monitors goals and strategies for nutrient reduction. For more information: http://www.chesapeakebay.net/issues/issue/nutrients
	3.1 3) Developing and adopting basinwide plans for the reduction and control of toxic substances.	1990 On-going	Chesapeake Bay Program develops, revises, and monitors goals and strategies for chemical contaminants. For more information: http://www.chesapeakebay.net/issues/issue/chemical_contaminants
	3.1 4) Developing and adopting basinwide management measures for conventional pollutants entering the Bay from point and nonpoint sources.	1990 On-going	Chesapeake Bay Program develops, revises, and monitors goals and strategies for sediment, wastewater, stormwater runoff, and agriculture. For more information: http://www.chesapeakebay.net/issues/issue/ sediment http://www.chesapeakebay.net/issues/issue/wastewater http://www.chesapeakebay.net/issues/issue/ sediment http://www.chesapeakebay.net/issues/issue/stormwater_runoff
	3.1 5) Quantifying the impacts and identifying the	1990	Chesapeake Bay Program develops, revises, and monitors goals

1991 Chesapeake Bay Summer Flounder Fishery Management Plan Implementation Table (updated 8/2013)			
Strategy	**Action**	**Date**	**Comments**
	sources of atmospheric inputs on the Bay system.	On-going	and strategies for air pollution. For more information: http://www.chesapeakebay.net/issues/issue/air_pollution
	3.1 6) Developing management strategies to protect and restore wetlands and submerged aquatic vegetation.	1990 On-going	Chesapeake Bay Program develops, revises, and monitors goals and strategies for wetland and submerged aquatic vegetation restoration. For more information: http://www.chesapeakebay.net/issues/issue/wetlands http://www.chesapeakebay.net/issues/issue/bay_grasses
	3.1 7) Managing population growth to minimize adverse impacts to the Bay.	1990 On-going	Chesapeake Bay Program develops, revises, and monitors goals and strategies for land development. For more information: http://www.chesapeakebay.net/issues/issue/development

Acronyms

ASMFC – Atlantic States Marine Fisheries Commission
CPUE – Catch per Unit Effort
EEZ – Exclusive Economic Zone
FISHMAP – Fishery Independent Sampling and Habitat Mapping
IFQ – Individual Fishing Quota
MAFMC – Mid-Atlantic Fishery Management Council
MD DNR – Maryland Department of Natural Resources
NMFS – National Marine Fisheries Service
PRFC – Potomac River Fisheries Commission
TAL – Total Allowable Landings
VAC – Code of Virginia
VMRC – Virginia Marine Resource Commission

2012 Maryland FMP Report (May 2013)
Section 19. Tautog (*Tautoga onitis*)

Chesapeake Bay FMP

Atlantic coast tautog continue to be overfished and overfishing continues. All states, including Maryland, were required to reduce harvest by 39%. The Atlantic States Marine Fisheries Commission (ASMFC) is developing a stock assessment update to be completed in 2014. Since Tautog do not migrate coastwide, regional stock management will be one consideration during the stock assessment update.

The ASMFC Management Board implemented Addendum VI to the fishery management plan (FMP) to reduce fishing mortality (F) by 53%. The percentage was later changed to a 39% reduction, coastwide[1,2] because F had been over-estimated. Regulations to achieve the reduction were implemented in 2012. The Chesapeake Bay and Atlantic Coast Tautog Fishery Management Plan (FMP) was adopted in 1998 by the Chesapeake Bay Program (CBP) to perpetuate the stock and maintain existing fisheries. The CBP FMP adopts ASMFC guidelines and requirements. The CBP FMP was reviewed in 2011. The review evaluated the goals, objectives, strategies and actions within the 1998 FMP and concluded that the current management framework is appropriate for managing the stock.

Tautog harvest in Maryland is primarily recreational (90%)[3]. The 1996 ASMFC Tautog FMP established an interim F of 0.24, a final target F = 0.15, and a minimum size of 14". Addenda I and II successively extended the implementation timeframe for F_{target}. Addendum III revised the F_{target} reference point to 0.21and a biological reference point of 40% spawning stock biomass (SSB, 0.29). Overfishing was defined as $F_{threshold} = 0.29$. Addendum IV established biological reference points to determine if tautog are overfished: $SSB_{target} = 59$ million lbs and $SSB_{threshold} = 44$ million lbs. Tautog biomass was below average for 8 years and a rebuilding F_{target} of 0.20 was implemented. The addendum stipulated that only recreational regulations could be implemented to reduce F. Addendum V removed the provision that restricted regulations to the recreational fishery. Addendum VI (2011) requires reducing F_{target} to 0.15, a 53% coastwide reduction in harvest. Amendment VI provisions were to be implemented by January 1, 2012. Following Technical Committee recommendations, the 53% coastwide harvest reduction was revised downward to 39% in early 2012[1]. Maryland is required to submit an annual compliance report to ASMFC.

Stock Status

Tautog are managed as a single coastwide stock. During the 2011 stock assessment update and subsequent corrections, the ASMFC determined that coastwide tautog are overfished at $SSB_{2009} = 23.5$ million lbs ($SSB_{target} = 59.1$ million pounds and $SSB_{threshold} = 44.3$ million pounds) and overfishing continues to occur with F = 0.26 ($F_{target} = 0.15$)[1, 4, 5]. Tautog SSB has remained below the threshold value since 1989[4]. Recruitment of age 1 fish has remained at low levels since the early 1990s[5]. Currently, tautog are assessed as a single coastwide stock rather than regional stocks. The next stock assessment update is scheduled for peer review in summer 2014. All available data were reviewed in March during a data workshop. An assessment workshop is scheduled for fall 2013 to develop the assessment models.

Current Management Measures

Maryland's 2012 tautog regulations were modified to accommodate the ASMFC required 39% harvest reduction[2,6]. Commercial and recreational fisheries in Maryland are subject to the same regulations. Tthe minimum size limit is 16". Fisheries in tidal and coastal waters are limited to 4 fish per person per day during January 1 – May 15 and during November 1 – 26. Harvest is reduced to 2 fish per person per day from May 16 – October 31. Tautog harvest is prohibited from November 27 – December 31. Commercial harvesters are allowed to use hook and line, net, pot, trap, trot line, and seine. One panel on pots and traps must be attached with degradable fasteners to prevent ghost fishing if lost. Recreational anglers are restricted to hook and line.

The Fisheries

Maryland's commercial and recreational tautog harvest are minor components of the total coastwidelandings. Commercial landings have remained at or below one thousand pounds since 2007 and have averaged ~1% of coastwide landings (Figure 1)[7,8]. Estimated landings for 2012 were one thousand pounds. Reported recreational landings in 2012 were 5,000 fish. However, percent standard error of this estimate was 70%[7]. Maryland's recreational landings have averaged ~3% of coastwide landings since 1981 (Figure 1)[6,7]. Recreational catch estimates have been revised as a part of the Marine Recreational Information Program (MRIP). Catch estimates have been recalculated for 2004-2011 to provide more accurate estimates and replace those previously made by the Marine Recreational Fisheries Statistics Survey (MRFSS) (For more details go to the FMP Introduction).

Issues/Concerns

Tautog minimum size regulations were increased from 14" to 16" to reduce harvest during the 2012 season by 39%. However, tautog data indicate an 82% decline in harvest. Maryland has requested that ASMFC review and consider a proposal to reduce the minimum size to 15".

Tautog are dependent on bottom structure, but managed as a single Atlantic coast stock. Egg and larval dispersal is believed to be coastwide. Juvenile and adult migration is limited and would best be managed as regional stocks.[9] Regional stocks and management options will be examined during the 2014 stock assessment update process.

Oyster reefs and submerged aquatic vegetation (SAV) are important tautog habitat. Restoration of these habitats in Chesapeake Bay is important for juveniles, especially in the lower bay. Hard bottom and deep water coral habitats in ocean waters are important and in need of conservation. The location and extent of these habitats are poorly documented.

Opercular bones are used to age tautog, but in 2001 Old Dominion University began using otoliths. The ASMFC held an ageing workshop[10] to compare the two methods. States exchanged and read otoliths and opercular bones to compare results. No significant biases were observed. The ASMFC Tautog Technical Committee determined the methods to be comparable. States are advised to re-read past samples for training prior to reading new samples.

Figure 1. Maryland and coastwide commercial tautog landings (lbs): 1950-2011[7,8]. Discrepancies between commercial landings reported by NMFS and ACCSP are due to differences in data confidentiality requirements.

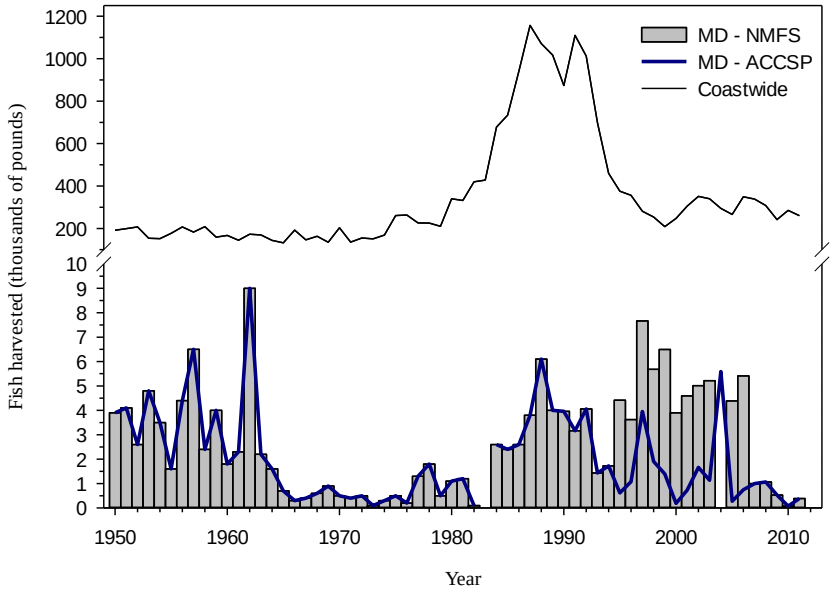
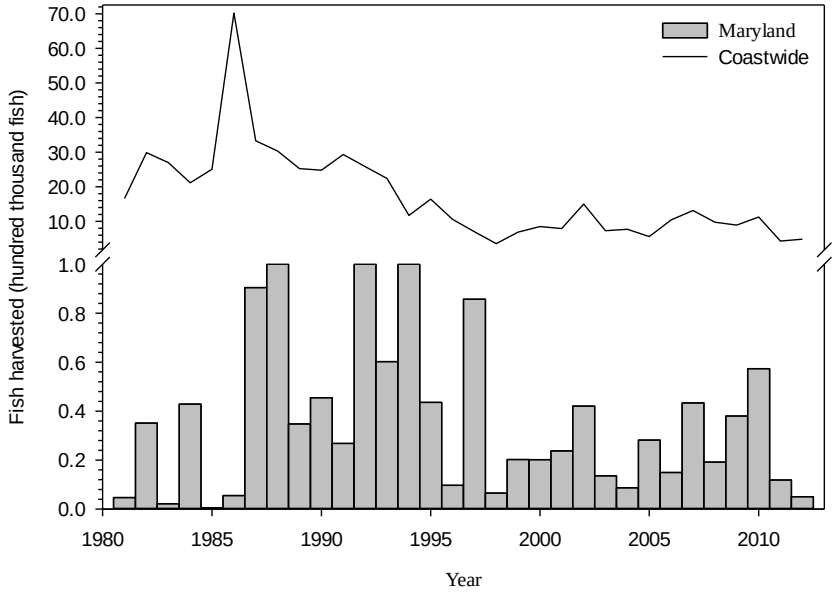


Figure 2. Maryland and coastwide recreational tautog harvest (number of fish): 1981-2011[7].



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[8] Atlantic Coastal Cooperative Statistics Program. (1950 - 2011) Commercial Landings (Dealer Reports) - Non-Confidential - Landings by State by Species; generated by Marek Topolski; using ACCSP Data Warehouse [online application], Arlington, VA: Available at http://www.accsp.org --> Data Center --> Data Warehouse --> Login; accessed May 15, 2013.

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1998 Chesapeake and Atlantic Coast Tautog Fishery Management Plan Implementation Table (updated 5/15/2013)			
Strategy	**Action**	**Date**	**Comments**
1) Implement minimum size and possession limits applicable to the commercial and recreational fisheries to prevent overexploitation. Monitor size composition of landings in the recreational fishery to prevent compression of age structure in the population. Use size composition of fish in the recreational fishery and total landings in the commercial fishery as triggers to implement further management of the fishery, should statistically significant compression of the age structure occur. This plan recommends that the Secretary of Commerce implement minimum size and possession regulations for tautog in the EEZ that are in accordance with state minimum size requirements contained in the plan. It is the intention under the Atlantic Coastal Fisheries Conservation and Management Act to have EEZ fisheries regulated consistent with state possession and landing laws, and that the more stringent of state or federal law will apply regardless of whether fish are caught in the EEZ or in state waters.	1.1) VA, MD and PRFC will implement a minimum size limit of 14" in the recreational and commercial tautog fisheries. Minimum size limits may be changed as more data becomes available on stock condition and biological reference points are re-evaluated.	1998 2003 2005 Continue	MD commercial and recreational fisheries have a 16" minimum size, 4 fish/person/day from January 1 – May 15, 2 fish/person/day from May 16 – October 31, 4 fish/person/day from **November 1 – 26**, and is **closed from November 27 – December 31**. VA has a 16" minimum size, **3** fish/person/day creel, and a recreational closure from **May 1 – Sept 19**. **VA commercial fishery has a 15" minimum size, no catch limit, and seasonal closures from January 22 – last day of February and May 1 - October 31.** PRFC has a 14" minimum size limit and no harvest restrictions for both commercial and recreational fisheries.
	1.2) VA, MD and PRFC will reduce fishing mortality to interim and target rates, as defined by ASMFC, through a combination of possession limits, gear, seasons, and/or other restrictions. Target rates may be changed and management measures adjusted as more data becomes available to manage the stock. Due to differences in F between MD and VA, different management strategies may be necessary to reach the target F set by ASFMFC. The jurisdictions will continue to work towards a unified, Baywide management strategy.	1998 2000 2003 2005 2011 Continue 2011 2012	A benchmark coastal stock assessment was completed in 2005 (using data from 1981-2004). Results indicate that F declined from 0.71 to 0.299. Overfishing was redefined as $F_{40\%SSB}$=0.29. Since the 2003 rate and the most recent 3-year average (F=0.389) exceed the ASMFC rebuilding target (F=0.2), tautog are considered overfished. Abundance indices indicate a slight increase in biomass & recruitment. The stock is believed to be at a stable level. ASMFC stock assessment was updated in 2011. MD **2012** commercial landings are estimated to be **1 thousand lbs** and recreational landings were **5 thousand fish** (NMFS). VA **2011** commercial landings were **14.6 thousand lbs** and **2012** recreational landings were **14 thousand fish** (NMFS). Tautog continue to be overfished and are undergoing overfishing. ASMFC Addendum VI was implemented to reduce F to 0.15, a 53% reduction, and prohibit possession of tautog caught in federal waters. The next ASMFC stock assessment is scheduled for 2014. MD's 2012 harvest reduction was decreased from 48% to 39%.
	1.3) VA and MD waters will continue to require degradable fasteners in tautog pots and traps utilizing either: • Untreated hemp, jute, or cotton string of 3/16" (0.48 mm) or smaller • Magnesium alloy, timed float releases (pop-up devices) or similar magnesium alloy fasteners • Ungalvanized or uncoated iron wire of 0.09"	1997 Continue	A pot and trap shall have hinges on one panel/door made of untreated hemp or jute string 3/16" (4.8 mm) diameter or smaller, magnesium alloy fasteners or ungalvanized/uncoated iron wire of 0.094" (2.39 mm) diameter.

1998 Chesapeake and Atlantic Coast Tautog Fishery Management Plan Implementation Table (updated 5/15/2013)			
Strategy	**Action**	**Date**	**Comments**
	(2.39 mm) or smaller.		
2.1) VA and MD will work with Virginia Institute of Marine Science, Old Dominion University, University of Maryland, Smithsonian Institute and National Marine Fisheries Service's Marine Recreational Fisheries Statistics Survey to conduct research into the size, age and sex composition of tautog in the Chesapeake Bay. The agencies' stock assessment departments will continue to collect information on size composition to monitor the status of tautog stocks. This stock assessment data will be used to determine a baseline of age and sex distribution for the local stock, significant deviation from which will be used as a trigger mechanism to determine the need for future management measures.	2.1) The management agencies will gather data on age, size and sex distribution to be used as a baseline measurement of a healthy population and will encourage research into the possibility of sex-reversal in the tautog population.	Continue 1989-1999 Continue	Annual fecundity estimates are much higher than previously thought. All states are required to collect data to support the coastwide stock assessment.
	2.1 A) VA will continue the Baywide trawl survey of estuarine finfish species and crabs to measure size, age, sex, distribution, abundance and CPUE.	Continue	Data from the trawl survey is used in the ASMFC stock assessment. However, very little data is collected on tautog.
	2.1 B) VA implemented a mandatory reporting system for commercial licensees beginning January 1, 1993. Maryland's mandatory reporting system has been in effect since 1944 (excluding eel). Improved reporting of commercial landings, along with more detailed information on catch location and effort are some of the expected benefits of these programs.	Continue	Commercial reporting has been improved through more stringent penalties for not reporting and for late reporting.
	2.1 C) VA will continue to supplement the Marine Recreational Fisheries Statistics Survey to obtain more detailed catch statistics at the state level. VA's new recreational saltwater fishing license may provide funding for more extensive surveys of the state's recreational fishery.	Continue 2009 Continue 2011 Continue 2012	The MRFSS survey is being improved through the MRIP program. NMFS is requiring that all states register recreational fishermen to create a more robust data base to estimates recreational harvest. MD contracted to have supplemental MRFSS recreational data collected. MD implemented a coastal recreational saltwater license requirement. MRIP was implemented.
	2.1 D) MD's Coastal Bays Fisheries Investigation will be expanded by conducting a creel survey from recreational headboats. The survey will collect biological data on tautog such as sex, length, age and information on recreational fishing effort.	1972 Continue 1999 Continue	Juvenile tautog are sampled during the summer and fall coastal bays trawl and seine survey (not designed to target tautog). MD Coastal Bays Fisheries Investigation annually collects age, length and sex data for tautog purchased from several commercial fishermen.
2.2) The jurisdictions will promote research to determine the extent of migration and mortality in localized tautog populations. As reliance of this species on structure for both food and shelter may limit populations in the Chesapeake Bay area, studies designed to determine the relationship between population size and	2.2) Research on migration of tautog between areas is encouraged. Tagging experiments to provide data on tautog migration may be funded from sales of saltwater fishing licenses. The Virginia Game Fish Tagging Program will be continued.	Continue 2007	A study on the seasonal occurrence of tautog in the lower CB indicates that most fish tagged and released in inshore waters remain inshore for the winter rather than move offshore (Arendt, Lucy and Munroe, 2001). VA initiated Marine Sportfish Collection Project to collect sex, length, and age data. Freezers were set up for

1998 Chesapeake and Atlantic Coast Tautog Fishery Management Plan Implementation Table (updated 5/15/2013)			
Strategy	**Action**	**Date**	**Comments**
available shelter and food sources should likewise be encourages.			recreational anglers to donate whole fish or carcasses. VA initiated Saltwater Fisherman's Journal where anglers log their fishing experiences and anecdotal information.
3.1.1) Restoration of aquatic reefs could lead to increased habitat for tautog. Jurisdictions will continue to expand and improve their current oyster restoration programs with periodic program evaluations to ensure maximum success.	3.1.1A) MD and VA will continue the implementation of the 1994 Oyster FMP which combines the recommendations of both the Virginia Holton Plan and the Maryland Roundtable Action Plan. Strategies in both VA & MD have taken a new focus as the programs intensify efforts to manage around the devastating oyster diseases, Dermo and MSX, currently infecting Chesapeake Bay oysters.	Continue 2003 2004 2008 2009 - 2010 **2012** **Continue**	The 1994 Oyster FMP has been revised. A new Oyster Management Plan was adopted in 2004 and has incorporated concepts from the old FMP and the Aquatic Reef Habitat Plan. Sanctuary and special management areas are being protected from harvest and oyster habitat is being restored. *Crassostrea virginica* (native oyster) and not *Crassostrea ariakensis* (Asian oyster) will be used for reef development following the Environmental Impact Statement for Oyster Restoration in Chesapeake Bay Including the Use of a Native and/or Nonnative Oyster. MDNR has expanded the oyster sanctuary network from 9% to 25% (app. 9,000 acres) of the available oyster habitat. Both recreational and commerical fish species will benefit from improved/protected oyster bar habitat. Oyster aquaculture is increasing. **1,163 acres** of aquaculture have been permitted since 9/7/2011. **Several thousand acres are in application review.**
	3.1.1B) MD and VA will continue the implementation of the Aquatic Reef Habitat Plan. "The purpose of the Aquatic Reef Habitat Plan is to guide the development and implementation of a regional program to rebuild and restore reefs as habitat for oysters and other ecologically valuable aquatic species."	Continue 2003 2004 2007 Continue Continue 2010	Habitat concerns for oysters and other ecologically valuable species are addressed in the 2004 Oyster Management Plan. MD ARC, MARI, and Maryland's Artificial Reef Management Plan were created and several reefs have been built in the Bay. Reefs are qualitatively monitored with underwater video. ARC and MARI have begun support for shallow water (<20 ft.) reef projects.
3.1.2) The creation of new artificial reefs and the expansion and improvement of preexisting reefs will provide additional habitat for the tautog population.	3.1.2A) Jurisdictions will continue to maintain, expand, and improve their artificial reef programs. Since 1995, VA has developed 3 new reef sites within the Bay and expanded several existing sites, deploying more than 6,000 designed structures	1996-2006	MD terminated its program in 1996. Artificial reef development was administered in the Chesapeake Bay by MD Environmental Service and in the Atlantic Ocean by the Ocean City Reef Foundation (OCRF).

1998 Chesapeake and Atlantic Coast Tautog Fishery Management Plan Implementation Table (updated 5/15/2013)			
Strategy	**Action**	**Date**	**Comments**
	(concrete tetrahedrons) and over 5,000 tons of concrete rubble. MD has designated 3 sites as oyster sanctuaries where harvest is not allowed: Plum Point, lower Severn River and Cambridge. MD will also be examining the efficacy of small hill sanctuaries at 3 sites: Tangier, Choptank and Strong Bay (Chester R.).	Continue Continue 2008 2011 On-going	MD Artificial Reef Committee and the MD Artificial Reef Initiative (MARI) were established to develop reefs in cooperation with OCRF. Both MARI and OCRF accept private donations while MD contributes funds when available for reef development projects. In VA, artificial reefs are being funded through Recreational Advisory Board. All artificial reefs are created with funds from recreational license revenues adhere to the gear type prohibition. 44 NY subway cars were deployed off Ocean City. USN Destroyer *Radford* was reefed on August 10, 2011. The vessel has since broken into 3 pieces but remains upright. MARI and OCRC continue to develop existing and new artificial reefs as funding and materials become available. For the most up-to-date information on the artificial reef program go to: http://www.dnr.maryland.gov/fisheries/reefs/
	3.1.2B) VA has recently prohibited the use of all gear except recreational rod and reel, hand-line, spear, or gig on four artificial reefs in state waters. The result of this regulation is similar to the MAFMC/ASMFC Special Management Zones that protect vital tautog habitat.	Continue	MD and VA both adopted legislation that prohibits hydraulic clamming (and crab dredging in VA) in or near SAV beds. MD has a prohibition on hydraulic dredging in coastal bays. It is allowed in MD Chesapeake Bay waters, but not within a delineated SAV bed. There is no required setback from the bed.
3.2.1) Jurisdictions will continue efforts to: "achieve a net gain in SAV distribution, abundance, and species diversity in the Chesapeake Bay and its tributaries over current populations".	3.2.1.1A) Protect existing SAV beds from further losses due to increased degradation of water quality, physical damage to the plants, or disruption to the local sedimentary environment as recommended by the Chesapeake Bay Submerged Aquatic Vegetation Policy Implementation Plan.	2003 Continue	The revised SAV goal adopted by Chesapeake Bay Program is planting 1,000 acres of SAV by 2008 and restoration of 185,000 acres of SAV by 2010. **170 acres have been planted to date (0.02 in 2011).** VIMS annually surveys SAV distribution in Chesapeake Bay. **2012 SAV acreage was 45.7 thousand (25% goal).**
	3.2.1.1B) The Guidance for Protecting Submerged Aquatic Vegetation in Chesapeake Bay from Physical Disruption was developed in response to the above action and should be used by agencies making decisions that influence SAV survival in Chesapeake Bay. The following recommendations from the guidance document should be strongly considered	Continue	MD implemented a living shorelines program in 1970 to encourage vegetative shoreline stabilization. Regulations are in place to prohibit dredging through SAV beds. Tiered designation and prioritization of SAV beds has not been implemented. Avoidance of dredging, filling and construction impacts to SAV is strictly

1998 Chesapeake and Atlantic Coast Tautog Fishery Management Plan Implementation Table (updated 5/15/2013)			
Strategy	**Action**	**Date**	**Comments**
	when making decisions that impact SAV, with special emphasis on SAV that falls within the salinity range of juvenile. 1. Protect SAV and potential SAV habitat from physical disruption. Implement a tiered approach to SAV protection, giving highest priority to protecting Tier I and Tier II areas but also protecting Tier III areas from physical disruption. 2. Avoid dredging, filling or construction activities that create turbidity sufficient to impact nearby SAV beds during SAV growing season. 3. Establish an appropriate undisturbed buffer around SAV beds to minimize the direct and indirect impacts on SAV from activities that significantly increase turbidity.	 2003 2008	enforced by MDE and USACE with input from DNR, USFWS, and NMFS. MD has not established undisturbed buffers. VA has established buffer criteria. The revised SAV goal adopted by Chesapeake Bay Program is restoration of 185,000 acres of SAV by 2010 and planting 1,000 acres of SAV by 2008. (see 3.2.1A) MD legislated that shoreline stabilization projects must use living shoreline techniques unless demonstrated to be infeasible.
	3.2.1.2) Set and achieve regional water and habitat quality objectives that will result in restoration of SAVs through natural revegetation as recommended by the Chesapeake Bay SAV Policy Implementation Plan.	Continue	Water quality criteria have been adopted **http://www.chesapeakebay.net/restoringwaterquality.aspx?menuitem=14728**.
	3.2.1.3) Set regional SAV restoration goals in terms of acreage, abundance, and species diversity considering historical distribution records and estimates of potential habitat as recommended by the Chesapeake Bay SAV Policy Implementation Plan.	Continue	The new SAV goal is 185,000 acres restored by 2010 and 1,000 acres planted by 2008. (see 3.2.1A)
3.2.2) The jurisdictions will use The Submerged Aquatic Vegetation Habitat Requirements and Restoration Targets: A Technical Synthesis as a guide to set quantitative levels of relevant water quality parameters necessary to support continued survival, propagation and restoration of SAV, as well as established the regional SAV restoration target goals defined earlier in this section.	3.2.2) When choices must be made in selecting SAV restoration projects, to fund and support under the Chesapeake Bay SAV Policy Implementation Plan, specific attention should be given to action items that lead to the protection and restoration of SAV found within the juvenile tautog habitat range.	Continue	More emphasis is being placed on multispecies benefits when considering restoration projects. Only 15% of restoration target was met by 2008. Long-term survival of SAV plantings has been limited. STAC reviewed the SAV restoration projects and concluded they were operationally successful but functionally unsuccessful. Currently reviewing next steps.
3.3)In 1998, the Chesapeake Executive Council adopted the Chesapeake Bay Wetlands Policy in recognition of the ecological and economic importance that wetlands play in the Chesapeake Bay. The Wetlands Policy establishes an immediate goal of no net loss with a long-term goal of a net resource gain for	3.3) The jurisdictions should strive towards achieving the following, especially in the salinity range of tautog. a) define the resource through inventory and mapping activities b) protect existing wetlands c) rehabilitate, restore and create wetlands	Continue 2006 Continue	GIS mapping activities are underway to target protection and restoration of habitat resources. Habitats are not targeted to benefit a specific species. MD is developed a Blue Infrastructure that includes mapping structural habitat and SAV.

1998 Chesapeake and Atlantic Coast Tautog Fishery Management Plan Implementation Table (updated 5/15/2013)			
Strategy	**Action**	**Date**	**Comments**
tidal and nontidal wetlands. It identifies specific actions necessary to achieve both the short term goal of the Policy, "no net loss" and the long term goal of "a net resource gain for tidal and nontidal wetlands."	d) improve education e) further research.	2009 Continue 2011	Wetland mosquito ditches from the 1930s-1940s are being plugged to reduce tidal flow and restore wetland hydrology and function. Between 2010 and 2011, 3,775 acres of wetlands were established or re-established and 107,239 acres were enhanced or rehabilitated.
3.4.1) Jurisdictions will continue efforts to improve Baywide water quality through the efforts of programs established under the 1987 Chesapeake Bay Agreement. In addition, the jurisdictions will implement new strategies, based on recent program reevaluations, to strengthen deficient areas.	3.4.1A) Based on 1992 baywide nutrient reduction plan reevaluation, the jurisdictions will: a) expand program efforts to include the tributaries b) intensify efforts to control nonpoint sources of pollution from agriculture and developed areas c) improve on current point and nonpoint source control technologies.	Continue 2009 2009 2010 2012 **2013**	Maps that indicate regions of concern for living resources have been developed. See Chesapeake Bay Program website for updates on nutrient reduction. http://www.chesapeakebay.net/status_reducingpollution.aspx?menuitem=19859. President Barack Obama's executive order recommitted federal agencies to Bay restoration and regulatory enforcement. EPA established a Bay wide TMDL (aka: pollution diet). Each jurisdiction must establish 2 year milestones for progress towards meeting its TMDL. Legislation has been passed for restrictions on new developments using septic systems. **Legislation for a stormwater fee based on impervious surface coverage was enacted.**
	3.4.1B) Based on the 1994 Chesapeake Bay Program Toxics Reduction Strategy Reevaluation Report, the jurisdictions will emphasize the following 4 areas: a) pollution prevention: target "regions of concern" & "areas of emphasis" b) regulatory program implementation: insure that revised strategies are consistent with and supplement pre-existing regulatory mandates c) regional focus: identify and classify regions according to the level of contaminants d) directed toxics assessment: identify areas of low level contamination, improve tracking and control nonpoint sources.	Continue	See Chesapeake Bay Program website for updates on nutrient reduction. http://www.chesapeakebay.net/status_reducingpollution.aspx?menuitem=19859 Chesapeake Bay Program is monitoring levels of mercury, PCBs, PAHs, organophosphate and organochloride pesticides.
	3.4.1C) The jurisdictions will continue to develop, implement, and monitor their tributary strategies	Continue April 2003	Ambient water quality criteria of DO, water clarity, and chlorophyll-a have been adopted for the Chesapeake Bay.

1998 Chesapeake and Atlantic Coast Tautog Fishery Management Plan Implementation Table (updated 5/15/2013)			
Strategy	**Action**	**Date**	**Comments**
	designed to improve bay water quality.		
3.4.2 The Chesapeake Bay Program partners will "Plan for and manage the adverse environmental effects of human population growth and land development in the Chesapeake Bay watershed." In 1996, the Chesapeake Bay Program accepted the Priorities for Action for Land, Growth and Stewardship in the Chesapeake Bay Region as a framework to address land use and development pressures in the Chesapeake Bay. This approach recognizes that communities are the basic unit for addressing growth, land-use and long-term stewardship of the natural environment. These priorities are voluntary actions which are expected to be accomplished through a variety of public and private partners, including but not limited to the Chesapeake Bay Program. Jurisdictions will forward the goals of the Priorities for Action, which encourage sustainable development patterns. Given the fact that tautog are particularly vulnerable to suspended solids which abrade epithelial tissues and to decreasing SAV and shellfish beds which serve as habitat and feeding areas, the goals of the Priorities for Action which are germane to nutrient and sediment load reduction will be promoted.	3.4.2) Encourage efficient development patterns which reduce nutrient and sediment loads to the Chesapeake Bay and promote responsible land management practices and decisions regarding present and future development by pursuing the following: 1) Revitalize existing communities. Revitalization efforts can assist existing communities and help reduce sprawl by encouraging the use of state-of-the-art storm water management and pollution prevention strategies. 2) Encourage efficient development patterns. Ecologically sound, efficient development patterns encourage higher population density; compact and contiguous development. Benefits to the Bay include reduced impervious surfaces; conservation of farms, forests, and wetlands. 3) Foster resource protection and land stewardship. Cooperation and linkages among local watershed protection planning efforts should be increased to foster a regional sense of stewardship toward the bay's natural resources. The development of new policies that integrate natural and community infrastructure in public and private planning, development and protection efforts will further this goal.	Continue	See Chesapeake Bay Program website for updates on land stewardship. http://www.chesapeakebay.net/status_protectingwatersheds.aspx?menuitem=19876 MD developed curriculum "Where Do We Grow from Here?" about population growth and its impacts on the Bay.

Acronyms

ARC - Artificial Reef Committee
ASMFC – Atlantic States Marine Fisheries Commission
CB – Chesapeake Bay
CCA MD – Coastal Conservation Association of Maryland
CPUE – Catch per Unit Effort
DO – Dissolved Oxygen
EEZ – Exclusive Economic Zone
F – Fishing Mortality
FMP – Fishery Management Plan
GIS – Geographic Information System
MAFMC – Mid-Atlantic Fishery Management Council
MARI - Maryland Artificial Reef Initiative
MD DNR – Maryland Department of Natural Resources
NMFS – National Marine Fisheries Service
OCRF - Ocean City Reef Foundation
PAH – Polycyclic Aromatic Hydrocarbon
PCB – Polychlorinated Biphenyl
PRFC –Potomac River Fishery Commission
SAV – Submerged Aquatic Vegetation
USACE – United States Army Corps of Engineer
USFWS – United States Fish and Wildlife Service
USN – United States Navy
VIMS – Virginia Institute of Marine Science

2012 Maryland FMP Report (September 2013)
Section 20. Weakfish (*Cynoscion regalis*)

Chesapeake Bay FMP

The depleted condition of weakfish stocks coastwide continues and they have not responded to reductions in fishing mortality. Total mortality remains high and non-fishing mortality has increased. The Chesapeake Bay Weakfish and Spotted Seatrout Fishery Management Plan (CBFMP) was adopted in 1990 to enhance and perpetuate the Chesapeake Bay's weakfish and spotted seatrout stocks. Since then, the plan was revised in 2003 and only addresses weakfish. The revised plan was developed in response to the improvement in the status of the weakfish stock from overfished (below a threshold) to fully exploited (fished at MSY) and included new biological data pertinent to the Chesapeake Bay. The CBFMP follows the compliance requirements set forth in the ASMFC Amendment IV to the Interstate Weakfish Management Plan (2003) and several addenda (2006-2009). Maryland is required to submit annual compliance reports to ASMFC for each species

The CBP plan was reviewed by the Maryland DNR Fisheries Service (FS) weakfish and spotted seatrout plan review team (PRT) in 2012/2013. A draft report was presented to the Tidal Fisheries Advisory Committee and Sport Fisheries Advisory Committee as part of the plan review process. The PRT recommended no changes to spotted seatrout allocation and a need for additional socioeconomic data. More information can be found in the draft document at: http://dnr.maryland.gov/fisheries/calendar/events/473/h_weakfish_spotted_sea_trout_weakfish_fmp_review_may_6_%202013.pdf).

Stock Status

Since 2009, the Atlantic coastwide weakfish stock has been considered depleted rather than overfished. The term "depleted" is used when causes other than fishing mortality have resulted in a biomass decline. If the low biomass level was caused by fishing mortality the stock would be considered overfished. The most recent peer-reviewed stock assessment was completed for the Atlantic coastal stock in 2009. The stock spawning potential was estimated at 3% of an unfished stock. Since 1995, the decline in biomass has been due to a sustained increase in natural mortality and not from an increase in fishing mortality. The increased natural mortality was exacerbated by continued removals by commercial and recreational fisheries. Maryland's fishery dependent and independent monitoring has shown both a decrease in mean adult age and low juvenile abundance. The ASMFC Weakfish Management Board adopted new percentage-based spawning stock biomass biological reference points (BRPs) in November 2009. The spawning potential threshold was set at 20% and the spawning potential target was set at 30%. Despite changes to reference points, the depleted weakfish stock is unlikely to recover quickly [1].

Current Management Measures

Management measures to reduce commercial and recreational exploitation by over 60% were required by ASMFC's Addendum IV. It resulted in requiring states to implement a 1 fish recreational creel limit and a 100 pound commercial trip and bycatch limit. Chesapeake Bay Program jurisdictions implemented new restrictions in 2010 to meet or exceed the ASMFC requirements on harvest and bycatch. These restrictions continued during 2012 and no new management actions have been taken.

Fisheries

Both recreational and commercial harvests of weakfish have significantly decreased over the last few years (Figure 1 & 2). The recreational harvest was estimated to be 11,401 fish in 2012, but the high proportional standard error (PSE) indicates imprecision in this estimate. The recreational fishery is largely catch-and-release. An estimated 24,898 individuals were estimated to have been released in 2012, although the PSE also suggests imprecision. Since 2002, Maryland commercial weakfish landings have been below 100,000 pounds and decreased to less than 1,000 pounds in 2011. Preliminary Maryland commercial landings data indicate 1,227 pounds of weakfish for 2012. A similar decreasing trend has been seen in other states along the Atlantic coast.

Issues/Concerns

Factors such as predation, competition, and changes in the environment, such as rapid temperature changes, have increased natural mortality and appear to have a stronger influence on weakfish stock dynamics then harvest. Production of weakfish juveniles is not leading to high adult biomass [1]. The ASMFC Weakfish Management Board "received a significant amount of public comment supporting a coastwide moratorium". The ASMFC Board chose to implement restrictions that would allow for limited directed fishing and allow sampling programs to continue.

The ASMFC weakfish plan review team (PRT) has reported its recommendations for management, biological research, social and economic research and habitat studies[1]. Biological research recommendations were listed under high, medium and low priorities. High priority recommendations include catch and effort data, discard mortality rates, age validation, stock identification and movements, spatial and temporal analysis of the fishery, and analysis of the spawner- recruit relationship and environmental influences on year-class strength [1].

Figure 1. Maryland's estimated recreational weakfish harvest and releases in numbers, 1981-2012.[2]

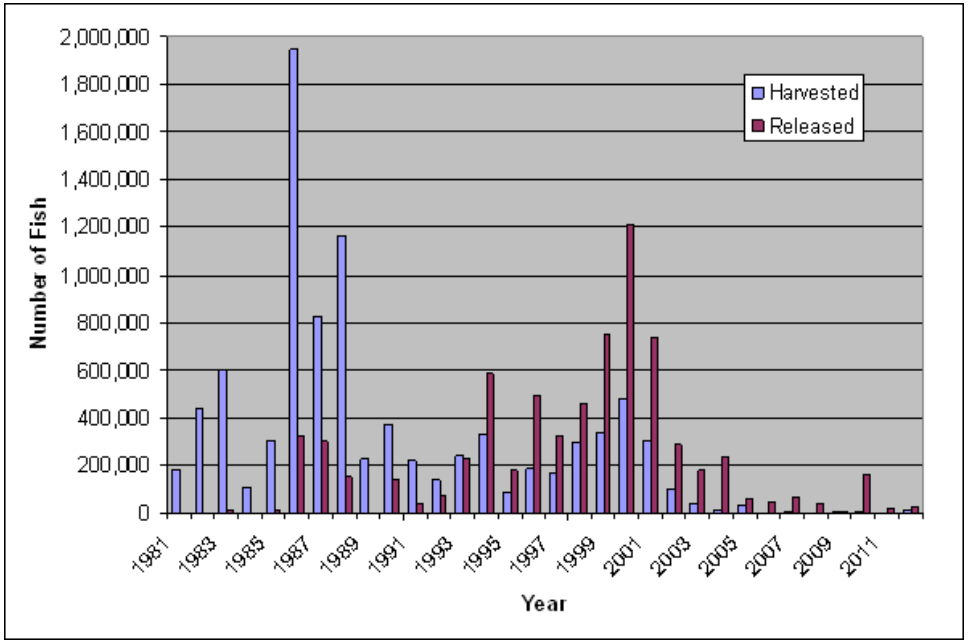
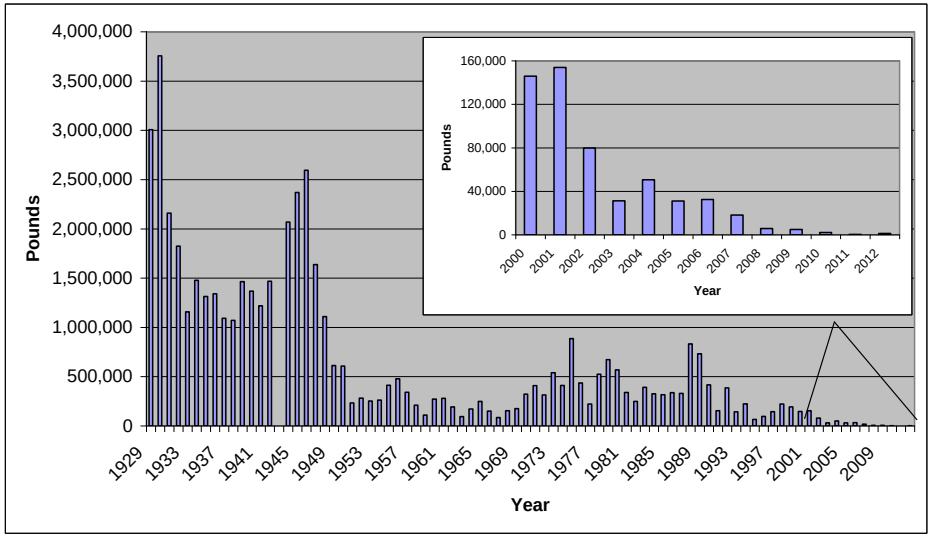


Figure 2. Maryland's total commercial weakfish landings, 1929-2012[2]. Inset provides detail of landings since 2000.



References

[1] ASMFC. 2012. 2012 Review of the Atlantic States Marine Fisheries Commission Fishery Management Plan for Weakfish (*Cynoscion regalis*) 2011 Fishing Year. ASMFC Board Approved October 23, 2012. 25p

[2] Rickabaugh, H.W. Jr. 2013. Maryland Weakfish (*Cynoscion regalis*) Compliance Report to The Atlantic States Marine Fisheries Commission – 2012. Fisheries Service, Maryland Department of Natural Resources. 13p.

2003 Chesapeake Bay Program Weakfish Fishery Management Plan Implementation (updated 9/13)			
Section	**Action**	**Implementation**	**Comments**
Stock Status Management Strategy: CBP jurisdictions will adopt biological reference points (BRPs) that reflect the most current status of the weakfish stock. As data becomes available on multi-species interactions and ecological considerations such as species interactions, food webs, bycatch, biodiversity and habitat, the BRPs should be modified accordingly.	Action 1.1 MD, PRFC (Potomac River Fisheries Commission) and VA will adopt the Atlantic States Marine Fisheries Commission's (ASMFC) recommendations for the coast wide management of weakfish	Annually reviewed and adjusted if necessary	The 2009 assessment results indicated that the weakfish stock is depleted, with SSB estimated at 3% of an unfished stock well below the BRPs adopted in Addendum IV. The biomass decline is the result of increasing natural mortality while F remains low. Size and age structure of the stock has decreased. The ASMFC review team (2010) recommended the development of additional methods to analyze the stock in the next assessment. **The 2013 ASMFC Action Plan calls for a review of stock assessment modeling efforts.**
	Action 1.2 In order to achieve the fishing target rates defined by the adopted BRPs, CBP jurisdictions will utilize a combination of size limits and possession limits, and/or seasons or areas to manage the commercial and recreational fishery in state waters.	Annually	ASMFC Addendum IV to Amendment 4 of the weakfish FMP requires that the recreational creel does not exceed 1 fish in the CBP jurisdictions management unit. Commercial landings must be limited to 100 pounds and bycatch must be limited to 100 pounds per vessel, per day or trip. The finfish trawl fishery allowance for undersized fish must be reduced to 100 fish. The CBP jurisdictions are in compliance; All met the recreational harvest restrictions and met or exceeded the commercial harvest restrictions. The same requirements have remained in effect since 2010.
The FisheryManagement Strategy: The CBP jurisdictions will regulate the commercial and recreational fishery based on the most recent status of the stock and the established fishing targets.	Action 2.1 The CBP jurisdictions will consider regional differences when determining state allocation issues and regulations.	As necessary	The Maryland Sport Fish Advisory Commission recommended a weakfish moratorium but no action was taken. Fishing mortality has been decreased over the years but there remains a significant amount of non-fishing mortality
	Action 2.2 The CBP jurisdictions will consider the economic impacts of management measures on the fishery and promote the utilization of economic data in the management decision process.	Dependent on the availability of economic data	Collection of economic data for the commercial fishery should include dockside values, the number of commercial vessels, the number of commercial fishermen and the economic returns from the commercial fishery. Data collection for the recreational fishery should include the

2003 Chesapeake Bay Program Weakfish Fishery Management Plan Implementation (updated 9/13)			
Section	**Action**	**Implementation**	**Comments**
			number of anglers, the number of directed trips and angler expenditures. Detailed data collection will enable the development of bio-economic models that can estimate costs or benefits to consumers resulting from fishery regulations.
	Action 2.3 The CBP jurisdictions continue to support the use of BRDs in non-directed fisheries and the appropriate mesh sizes in directed fisheries, to reduce the fishing mortality on small weakfish.	Annually	ASMFC Addendum III to Amendment 4 of the weakfish FMP aligns BRD certification requirements between state and federal waters along with the SAFMC shrimp bycatch reduction device requirements.
The Fishery Research and Monitoring: The CBP jurisdictions will continue to monitor the biological characteristics of the weakfish stock in the Chesapeake Bay and coordinate monitoring activities within the Bay and the Atlantic coast.	Action 3.1 The CBP jurisdictions will continue fishery dependent sampling and improve catch data. Economic information from the recreational and commercial fisheries will also be reviewed.	Continue	Monitoring data provides information on abundance; age structure and Y-O-Y recruitment. **Total commercial landings in MD increased from 1,000 to 1,227 pounds in 2012, continuing the trend of low harvests. Commercial landings in VA are higher than those in MD, but are also at the lowest level in at least the past 30 years. Landings declined from 65,000 pounds in 2009 and 61,000 in 2010 to less than 31,000 pounds in 2011. The MD 2012 recreational harvest estimate was 11,000 weakfish, but the PSE indicated imprecision. More weakfish were caught by VA recreational fishermen, with a more precise estimate of nearly 22,000 fish in 2012, an increase to the total 4,000 individuals caught in 2010 and 2011(the fewest in 30 years). More weakfish (93) were sampled in MD Chesapeake Bay pound nets in 2012. Mean length increased to 284mm, the highest mean length since 2006.**
	Action 3.2 The CBP jurisdictions will conduct fishery independent sampling and collect data on abundance, age structure and recruitment.	Continue	Amendment 4 to ASMFC's Weakfish FMP stipulates that states, which harvest 150,000 lbs. or more of weakfish, must submit otoliths and fish lengths as data for the coastal stock assessment. The extent of otolith and length data required was revised in ASMFC Addendum I to

2003 Chesapeake Bay Program Weakfish Fishery Management Plan Implementation (updated 9/13)			
Section	**Action**	**Implementation**	**Comments**
			Amendment 4. **Otoliths were removed from 71 of 93 fish from MD pound net samples. Of the 71, three were age 3, 30 were age 2 and 38 were age 1.** The m**ean juvenile index from fishery independent sampling in the coastal bays in 2012 decreased from 1.90 in 2011 to 0.46 juveniles per hectare, the second lowest value of the time series. The Chesapeake Bay juvenile geometric mean per tow decreased to 0.46 weakfish/tow following three consecutive years of slightly improving numbers. This was the second lowest value of the time series, and far below the time series mean of 3.2 juveniles/tow.**
	Action 3.3 CBP jurisdictions will continue to coordinate state activities with the Atlantic Coast Cooperative Statistics Program (ACCSP).	Continue	**The ACCSP Coordinating Council approved the Atlantic States Fisheries Data Collection Standards document in May, 2012. This document will be used to direct partner data collection.**
	Action 3.4 The CBP jurisdictions will begin to collect and examine stomach contents data and examine the effects of environmental variables upon weakfish growth rates.	On-going	Data from the ChesMMAP Survey, CHESFIMS project, and the MD Winter Trawl Survey may be used to evaluate species interactions and relationships. Results and trends can then be incorporated into CBP fishery management plans. ASMFC weakfish stock assessment (2006) incorporated a striped bass predator function allowing weakfish stock decline to be modeled.

2003 Chesapeake Bay Program Weakfish Fishery Management Plan Implementation (updated 9/13)			
Section	**Action**	**Implementation**	**Comments**
Habitat Management Strategy: CBP jurisdictions will monitor and regulate activities which may be harmful to weakfish habitat.	Activities, which contribute to the degradation and or loss of habitat types that weakfish utilize throughout their life history stages will be monitored and regulated by CBP jurisdictions.	On-going	CBP jurisdictions support the commitments of the Chesapeake Bay 2000 Agreement. These activities include reducing the discharge of toxic pollutants or excessive nutrients into the Chesapeake Bay and its tributaries, interruption or changes in water discharge patterns, deposition of solid waste, sewage sludge or industrial waste into Bay (which may lead to anoxic conditions), rapid coastal development, unregulated agricultural practices, net coastal wetland loss or the dredging of contaminated sub-aqueous soils. The CBP developed a new draft Watershed Agreement with new and updated habitat outcomes. For more information see http://www.chesapeakebay.net/
	Action 4.1 The CBP jurisdictions will monitor and regulate land-based activities and water-based activities that may negatively impact Chesapeake Bay water quality and weakfish spawning, rearing and foraging areas.	Continue	The MD DNR water quality protection database focuses on watershed lands that are most important for improving water quality.
	Action 4.2 The CBP jurisdictions will monitor important weakfish forage species to insure that activities, such as directed fisheries or incidental bycatch in non-directed fisheries, do not adversely affect abundance. These managed species, which serve as forage for weakfish include Atlantic croaker, spot, Atlantic menhaden, and blue crab. If fishing activities are contributing to higher F's on forage species, additional management measures may be necessary.	Continue	Data from the ChesMMAP, CHESFIMS, and the MD Winter Trawl Survey will provide data on important forage species for weakfish. The CHESFIMS survey was discontinued after 2005 due to lack of funding.
	Action 4.3 The CBP jurisdictions will monitor the abundance of weakfish forage species that are not managed under CBP FMPs, such as bay anchovies, and Atlantic silversides, using on-going monitoring and surveys.	Continue	The MD Estuarine Juvenile Finfish Survey and VIMS Juvenile Abundance Monitoring Surveys (formerly known as the VIMS Trawl Survey and the VIMS Juvenile Seine Survey) will continue to monitor the abundance of important, non-managed forage species in the Chesapeake Bay.

2003 Chesapeake Bay Program Weakfish Fishery Management Plan Implementation (updated 9/13)			
Section	**Action**	**Implementation**	**Comments**
Ecosystem Interactions Management Strategy:	Action 4.4 The CBP jurisdictions will continue to identify predator/prey interactions, both inter- and intraspecies competition and other interactions that might affect the management of weakfish. As multispecies interactions are evaluated and quantified, biological reference points and management strategies may be adjusted.	On-going	Data from the ChesMMAP, CHESFIMS, and the MD Winter Trawl Survey will be collected and analyzed by CBP jurisdictions to identify possible inter-and intra-species relationships. ASMFC weakfish TC has incorporated a striped bass predator function into the 2006 weakfish stock assessment to model the weakfish stock decline since 1998. No new recommendations have been developed.

Acronyms:
ASMFC = Atlantic States Marine Fisheries Commission
BRPs = biological reference points
CHESFIMS = Chesapeake Bay Fishery Independent Multispecies Fisheries Survey Program
ChesMMAP = Chesapeake Bay Multispecies Monitoring and Assessment
CBP = Chesapeake Bay Program
F = mortality due to fishing
FMP = fishery management plan
PRFC = Potomac River Fisheries Commission
SAFMC = South Atlantic Fishery Management Council
SSB = spawning stock biomass
TC = technical committee
VIMS = Virginia Institute of Marine Science
Y-O-Y = young of the year fish

Spotted Seatrout Notes:

The ASFMC adopted the spotted seatrout FMP in 1984 for states from Maryland to Florida. A Public Information Document (PID) was issued in November, 2009 by the ASMFC for an amendment to the interstate FMP for Spanish mackerel, spot, and spotted seatrout. The ASFMC approved the omnibus amendment for Spanish mackerel, Spot, and Spotted Seatrout August 4, 2011and a corrected version with Technical Addendum 1a on February 9, 2012 [1]. The omnibus amendment includes recommended measures to protect the spotted seatrout spawning stock and requires a coastal minimum length limit.

The spotted seatrout was included in the original Bay Program Chesapeake Bay *Weakfish and Spotted Seatrout Fishery Management Plan* in 1990. The management plan was revised in 2003 to include only weakfish. Since 1990, there has been no new management plan for spotted seatrout but updates have been completed on a regular basis. The 1990 FMP was reviewed by the Maryland DNR Fisheries Service (FS) weakfish and spotted seatrout FMP PRT in 2012/2013. The draft report of the FS PRT was presented to the Sportfishing and Tidal Fisheries Advisory Commissions. The Tidal Fisheries Advisory Commission recommended no action but the Sport Fisheries Advisory Commission recommended that the Maryland DNR FS consider raising the minimum size limit and decreasing the creel limit. These recommendations will go through the public scoping process.

Stock Status:

A coast-wide stock assessment of spotted seatrout has not been done because this species is considered to be largely non-migratory. Where assessments have been completed (NC, SC, GA, FL) on local stocks, there have been data limitations. Stock status varies by state. The estimated MD recreational harvest has been approximately 10,000 pounds or less for the past 10 years. The 2012 MRIP estimated that Maryland harvest increased to 6,032 fish. The fishery has become increasingly catch-and-release, and the estimated number of released spotted seatrout was 55,183. The VA recreational fishery caught an estimated 550,000 spotted seatrout in 2012, of which 430,000 were released. The commercial harvest mirrors this pattern, as MD harvests have been approximately 10% of VA commercial harvests. VA commercial harvest of spotted seatrout has varied from a low of 3,773 pounds in 2001 to 84,903 pounds in 2008. The most recent commercial reports from 2011 indicate that only 557 pounds were harvested from MD while 17,000 pounds were harvested from VA.

Management Objectives and Measures:
The ASFMC FMP includes maintaining a spawning potential ratio of 20% or greater to reduce the opportunities for recruitment failures. A size limit of 12" minimum total length is required and all states have complied with this minimum. Net mesh sizes corresponding to this size limit for directed fisheries, data collection, and state stock assessments were also recommended. MD and VA have 14" recreational size limits with 10 fish creels. The MD commercial size limit is 12" with minimum trawl and gill net meshes. The VA commercial H&L limit is 14" with a 10 fish limit and overall quota of 51,104 pounds.

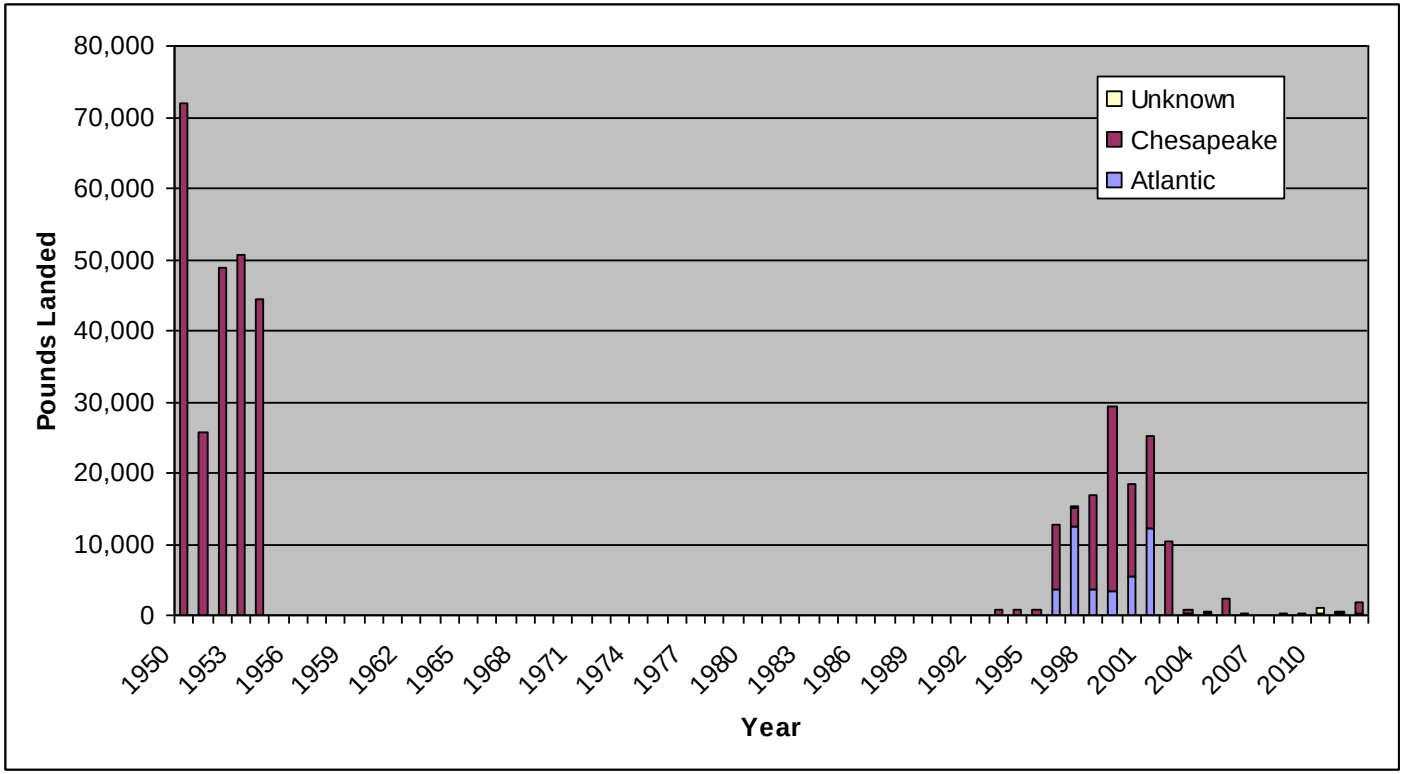


Figure 1. Commercial spotted seatrout landings reported to Maryland DNR, 1950-2012[2].

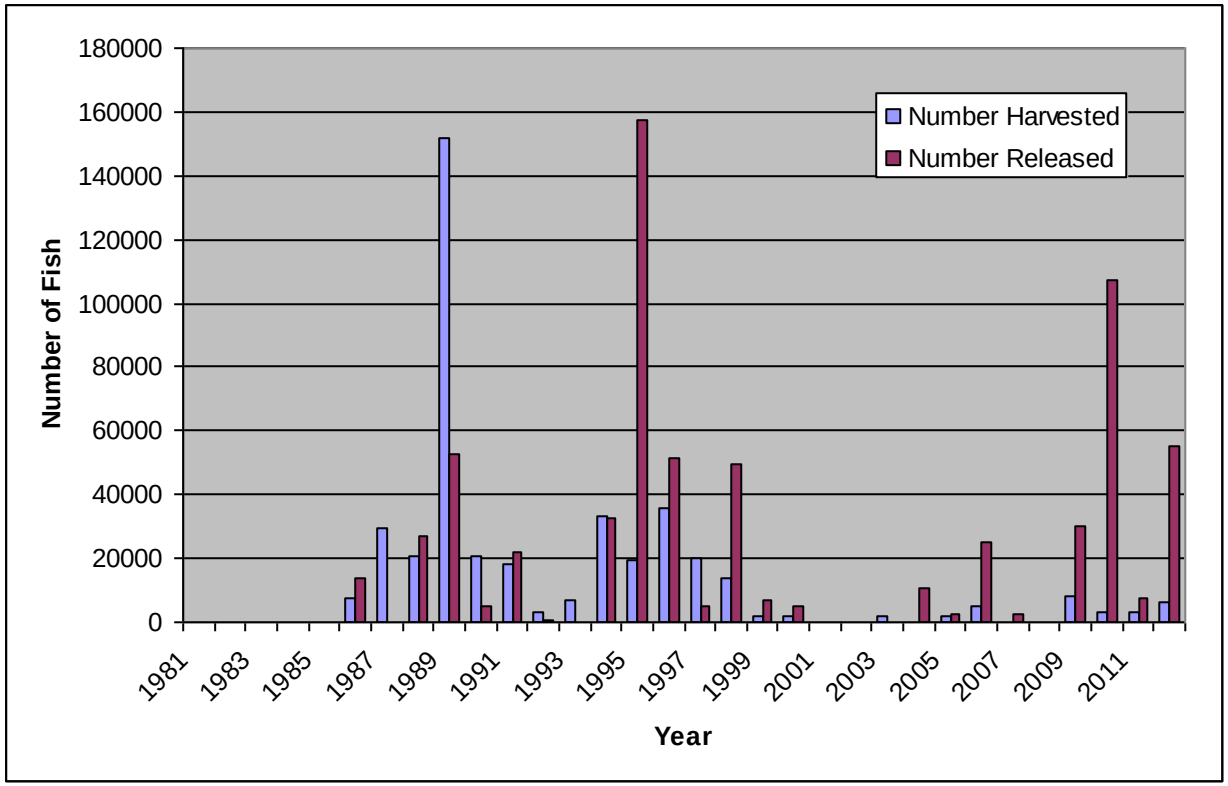


Figure 2. MRIP harvest and release estimates for spotted seatrout in Maryland, 1981-2012[2].

References:

[1] ASMFC. 2012. Fishery Management Report of the Atlantic States Marine Fisheries Commission. Omnibus Amendment to the Interstate Fishery Management Plans for Spanish Mackerel, Spot, and Spotted Seatrout. Approved February 9, 2012. 161 p.

[2] Rickabaugh, H.W. Jr. 2013. Maryland Spotted Seatrout (*Cynoscion nebulosus*) Compliance Report to The Atlantic States Marine Fisheries Commission – 2012. Maryland Department of Natural Resources Fisheries Service. August, 2013. 9p.

2012 Maryland FMP Report (September 2013)
Section 21. White Perch (*Morone americana*)

Maryland FMP

White perch continue to support one of the most important commercial and recreational fisheries in Maryland. In 2011, white perch were the second most commercially valuable finfish in the state ($1.5 million landed), exceeded only by the value of striped bass landings ($5.6 million) [1]. An estimated harvest of 750, 000 pounds were taken by recreational fishermen in 2012 and over 4 million fish were estimated to have been released [2].

Despite its local importance, a Chesapeake Bay Fishery Management Plan (CBFMP) for white perch has not been formally adopted. Maryland drafted a white perch plan in 1990 and has been operating under the framework of this draft plan. The background includes descriptions of the life history, fisheries, economic perspective, resource status, habitat issues, FMP status and management unit, status of traditional fishery management approaches and data needs. The management framework includes goals and objectives, problem areas, and management strategies.

Stock Status

The 2009 Maryland stock assessment noted that biomass was above minimum stock levels and estimated fishing mortality was lower than necessary to maintain stock abundance. The assessment cautiously noted that some indices of commercial catch-per-unit-effort (CPUE) were trending lower while recreational CPUE trended higher. The 2009 stock assessment used a surplus production model for the Maryland portion of the Chesapeake Bay and a Catch Survey Analysis (CSA) in the Choptank River [3]. The most recent 2011 white perch stock assessment used a different modeling approach to better describe the white perch stocks regionally. The CSA model results describe population dynamics in the Upper Bay and Choptank River from 2000 to 2010. There is less available data for Lower Bay white perch stocks. For those areas, both fishery-dependent and fishery-independent indices were examined [4].

Both Maryland and Virginia calculate juvenile indices for white perch and results from recent years have shown average to below average juvenile abundances. In addition to young of the year surveys, an adult white perch index was calculated with data obtained from the Potomac River Striped Bass Spawning Stock Survey.

Biological reference points (BRP) have not been formally established although an F_{limit} was suggested as F=0.60. In the nine years between 2000 and 2010 for which sufficient data was available to estimate F, F did not exceed 0.49 and was well under the F_{limit} of 0.60. Therefore, overfishing is not occurring.

Current Management Measures

White perch are managed in coordination with striped bass because they overlap in habitat. They are also caught using the same commercial gear types such as drift gill nets. The management unit is the white perch stock throughout its range in the Maryland portion of the Chesapeake Bay. The commercial fishery is regulated with gear and area restrictions and an 8" minimum size limit. There is no size or creel limit for fish caught by hook & line. There is no closed season. Virginia has no size limits for recreational or commercial fishing.

Issues/Concerns

White perch populations have recently decreased from a period of high abundance. Fishing mortality has been low except for the most recent years and the species is considered resilient. The juvenile index is variable. High young-of-year CPUE values were found in 2001, 2003 and 2004 and were followed by high gill net catches in 2004 – 2006. Fishery independent sampling after 2007 produced inconclusive results [1].

The Fisheries

Commercial landings from Maryland in 2011, the most recent data available at the time of this update, were 2.04 million pounds with an estimated value of 1.47 million dollars.

Figure 1. Commercial landings of white perch from Maryland, 1981-2011 [1].

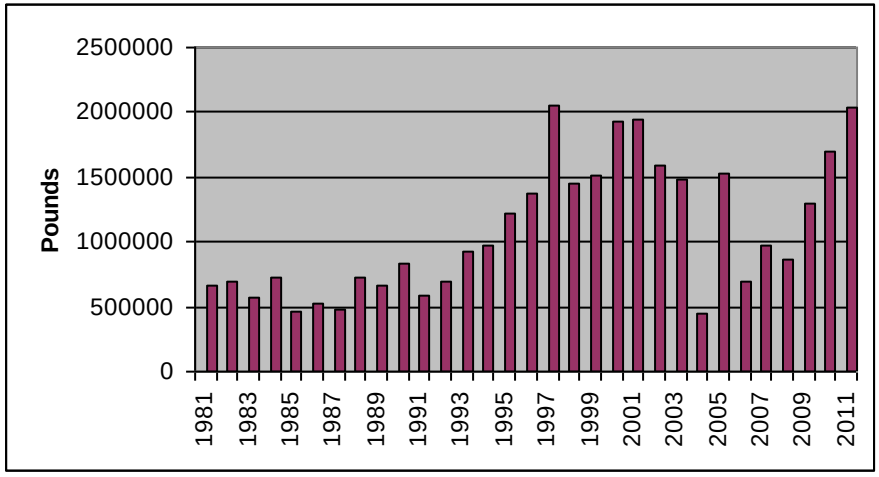
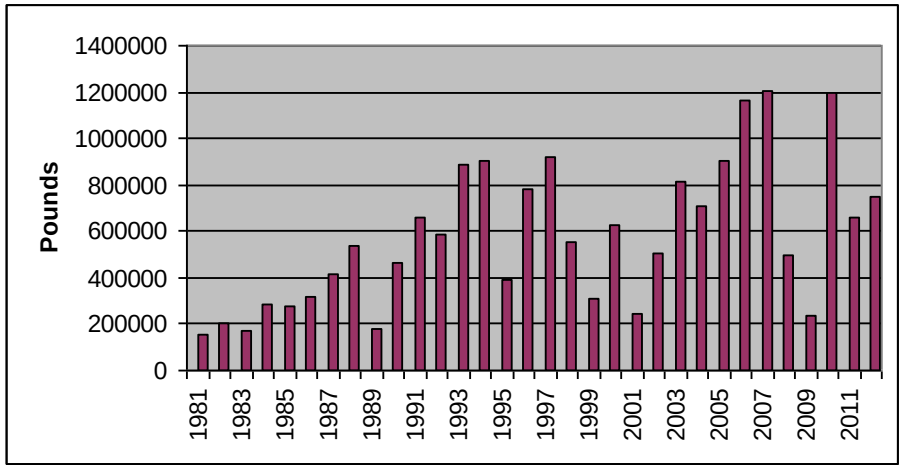


Figure 2. Estimated recreational white perch harvest from Maryland, 1981-2012 [2].



References:

[1] Personal communication from the National Marine Fisheries Service, Fisheries Statistics Division, Commercial Fisheries. September 12, 2013.

[2] Personal communication from the National Marine Fisheries Service, Fisheries Statistics Division, Recreational Fisheries. September 12, 2013.

[3] Piavis, P.G. and E. Webb III. 2012. Population assessment of white perch in Maryland with special emphasis on Choptank River stocks. Maryland Department of Natural Resources, Federal Aid Report F-61-R, Annapolis, Maryland.

[4] Piavis, P.G. and E. Webb III. 2011. Population vital rates of resident finfish in selected tidal areas of Maryland's Chesapeake Bay. Maryland Department of Natural Resources, Federal Aid Report F-61-R, Annapolis, Maryland.

Draft 1990 White Perch Fishery Management Plan Implementation Table (updated 9/13)			
Problem Area	**Action**	**Date**	**Comments**
Mixed Fishery 1.1. Coordinate management with striped bass actions.	1.1. The white perch fishery will abide by striped bass restrictions. Striped bass bycatch will be minimized.	1990 Continue	Commercial gear restrictions and area restrictions and closures apply.
Optimum Harvest 2.1. White perch populations exhibit growth differences.	2.1. Consider eliminating minimum size limits.	1990 Continue	Minimum size limit for commercial and non-H&L recreational set at 8"; no size limit for recreational H&L.
Stock Assessment 3.1. Basic stock information is lacking, including commercial and recreational harvest size and age-composition.	3.1. Stock assessments will be performed periodically.	Periodic	White perch stock assessments are performed every three years. The most recent stock assessment survey was conducted in 2011 and employed a catch survey analysis. This type of analysis has been better than surplus production models for assessing stock size. Young-of year surveys produced high CPUE values from 1994-2001 and 2003-2004. However, fishery independent indices often conflicted and were differed between areas examined. Fishing mortality rates have decreased since 1997. Since 2000, fishing mortality rates have been under F=0.60 and the population has increased. The 2011 Choptank River assessment indicated an increase from 1 million white perch in 1989 to over 6 million in 2011 with a low fishing mortality rate of 0.20 in 2007. White perch stocks are not overfished and overfishing is not occurring, based on the suggested F_{limit} = 0.60. However, formal BRPs have not been adopted.
Habitat Issues 4.1. Water quality impacts distribution and abundance of finfish species in Chesapeake Bay.	4.1. MD will develop objectives for finfish water quality standards under the latest Bay agreements, including, nutrient and toxics reduction strategies on a watershed approach.	Ongoing	Watershed indicators for aquatic systems include water quality as well as components of aquatic systems, biological diversity, hydrologic and terrestrial system. http://www.dnr.state.md.us/watersheds/surf/indic/md/md_indic.html This Maryland Integrated Watershed Data and Information System is a cooperative effort between the DNR and Dept. of Environment and provides a comprehensive database of natural resources and biological information for watershed indicators, profiles, bibliography, planning & strategies and organizations. The Chesapeake Bay Program tools to track water quality improvement can be found at: http://www.chesapeakebay.net/track/tools

Acronyms:

BRPs = Biological Reference Points
CPUE = Catch per Unit Effort
DNR = Department of Natural Resources
F = Fishing Mortality
H & L = Hook and Line

2012 Maryland FMP Report (May 2013)
Section 22. Yellow Perch (*Perca flavescens*)

Maryland FMP

The yellow perch fishery in Maryland is an example of a fishery management success story. It is presently characterized by excellent recreational fishing and a conservatively controlled commercial harvest. Maryland's yellow perch fisheries have responded to management actions taken in 2009. The Maryland Tidewater Yellow Perch Fishery Management Plan (YPFMP) was adopted in 2002 and reviewed in 2006. The 2002 YPFMP improved on the traditional FMP format by including guidelines for ecosystem-based management. Ecosystem based surveys utilizing yellow perch data have been important in developing guidelines for habitat preservation and land use decisions [1]. Stakeholder meetings were conducted during 2008 to develop objectives for the commercial and recreational fisheries. An amendment to the FMP is in preparation and the next review of the FMP is scheduled for 2013.

Stock Status

Yellow perch stocks are not overfished and overfishing is not occurring. Yellow perch stock assessments have been conducted every two years up to 2005 and annually since 2007 for the upper Chesapeake Bay. The biological reference points (targets and thresholds) were updated using the 2007 assessment results. The new reference points take into account uncertainty from the model and use conservative estimates of natural mortality. The yellow perch assessment model was modified in 2009 and 2010 by adding weighted parameters to fine-tune it. The updated Upper Bay population estimate decreased from 714 thousand in 2011 to 632 thousand yellow perch in 2012 (Figure 1). Recruitment to the population at age 2 has increased from an estimated 207 thousand in 2011 to 234 thousand in 2012[2]. Total instantaneous fishing mortality (F=0.28)) remains under the new target instantaneous fishing mortality level (F=0.53).

Current Management Measures

After considerable public input during 2008, yellow perch fisheries are managed under a Total Allowable Catch (TAC). The TAC has been allocated 50:50 between the commercial fishery and the recreational fishery since 2009. The TAC is calculated annually based upon the stock assessment to achieve the target fishing mortality rate (F=0.53). The fishing mortality target is divided in half between the commercial and recreational fishing sectors. Fishing mortality for the commercial fishery in 2012 was calculated at 0.280, down slightly from 0.298 in 2011 (Figure 2). Three management areas have been established: the Upper Bay, the Chester River and the Patuxent River. The commercial season is closed early if a TAC is reached before the scheduled closing date. Any overages are subtracted from the following year's allocation. Commercial fishermen are required to have a special yellow perch permit. Daily reporting is required in the commercial fishery and every fish is tagged for accountability. The commercial fishery has a slot limit of 8.5 to 11 inches and there are areas closed to commercial fishing. The recreational fishery is open year round, has no closed areas, a minimum size limit of 9 inches and a creel limit of 10.

Despite controlled low fishing mortality, recruitment of age 2 yellow perch declined from 2010-2012 due to poor year-classes in 2008 and 2009. Yellow perch numbers and biomass are expected to decrease as a result of poor year-class strength. Some areas have also experienced poor egg survivorship[3].

The Fisheries

The 2011 quota of 37,520 pounds for the Upper Bay management area was exceeded by 23 pounds before the season was closed. The quotas were not reached in the Chester River or the Patuxent River management areas.

The 2012 quotas were not reached in any management area. Final quotas for 2012 were 38,950 pounds for the Upper Bay, 6770 pounds for the Chester River and 2500 pounds for the Patuxent River. The Upper Bay harvest was under its quota by 1757 pounds, while the quotas remaining for the Chester and Patuxent Rivers were 1252 and 1213 pounds respectively. The 2012 season was the first season in which there wasn't any harvest overage for any management region (Figure 3)

In 2013, the yellow perch season was extended for the Upper Bay and Patuxent River management units until March 16. The quotas of 29,800 pounds for the Upper Bay, 5,175 pounds for the Chester River and 2500 pounds for the Patuxent River were not met. For the second straight year, the TAC was not reached for any management unit (Figure 4).

Issues and Concerns

A meeting to discuss commercial tagging alternatives will be conducted in 2013. Options for tagging fish boxes will be discussed with the intended objective being to reduce individual tag cost and labor while maintaining accountability.

References:

[1]Uphoff, J.H., M. McGinty, R. Lukacovic, J. Mowrer and B. Pyle. 2009. Impervious surface target and reference points for Chesapeake Bay subestuaries based on summer dissolved oxygen and fish distribution. Fisheries Technical Report Series Number 55. Maryland Department of Natural Resources, Annapolis, MD 21401.

[2] Piavis, P.G. and E. Webb, III. 2012. Population and vital rates of resident finfish in selected tidal areas of Maryland's Chesapeake Bay. Maryland Department of Natural Resources, Federal Aid Annual Report, F-61-R, Annapolis, Maryland.

[3]Blazer, V., A. Pinkney, J. Jenkins, L. Iwanowicz, S. Minkkinen, R. Draugelis-Dale, and J. Uphoff. 2013. Reproductive health of yellow perch *Perca flavescens* in selected tributaries of the Chesapeake Bay. Science of the Total Environment. 447:198-209.

Figure 1. Yellow Perch Population Abundance from the Upper Bay, 1998-2012

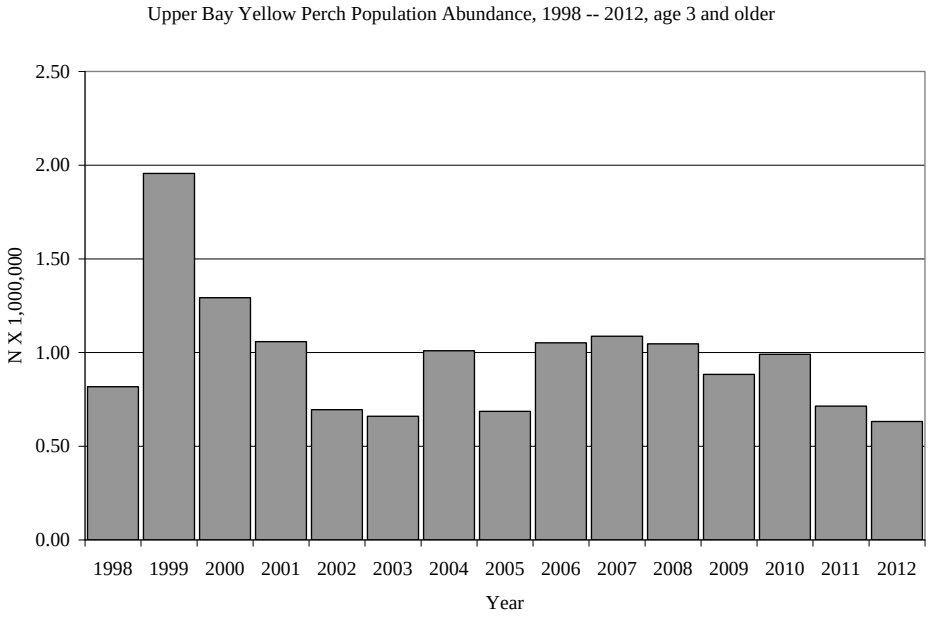


Figure 2. Fishing Mortality Rates (F) and Target (F=0.265) for the Yellow Perch Commercial Fishery, 1998-2012

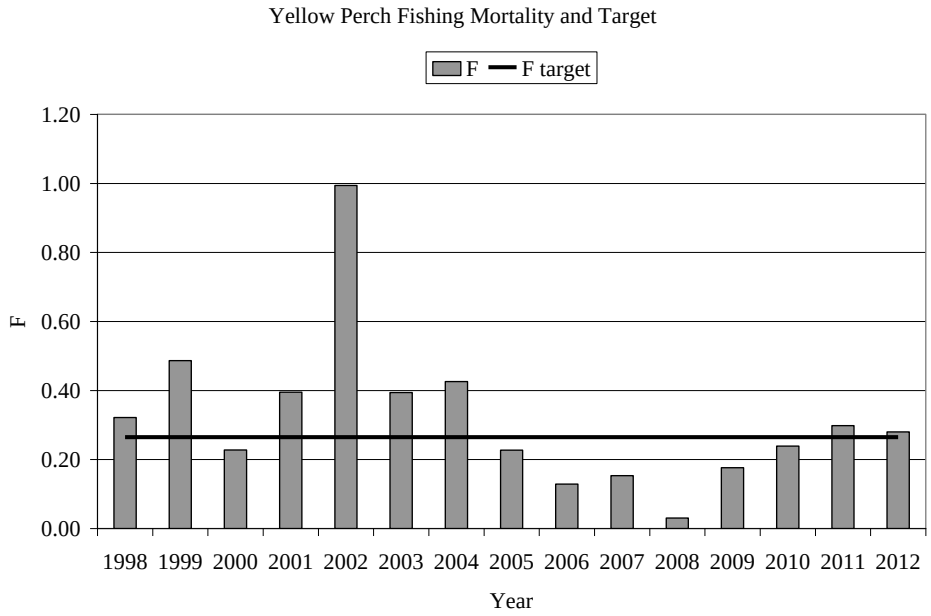


Figure 3. Maryland Commercial Yellow Perch Harvest by Region, 2012

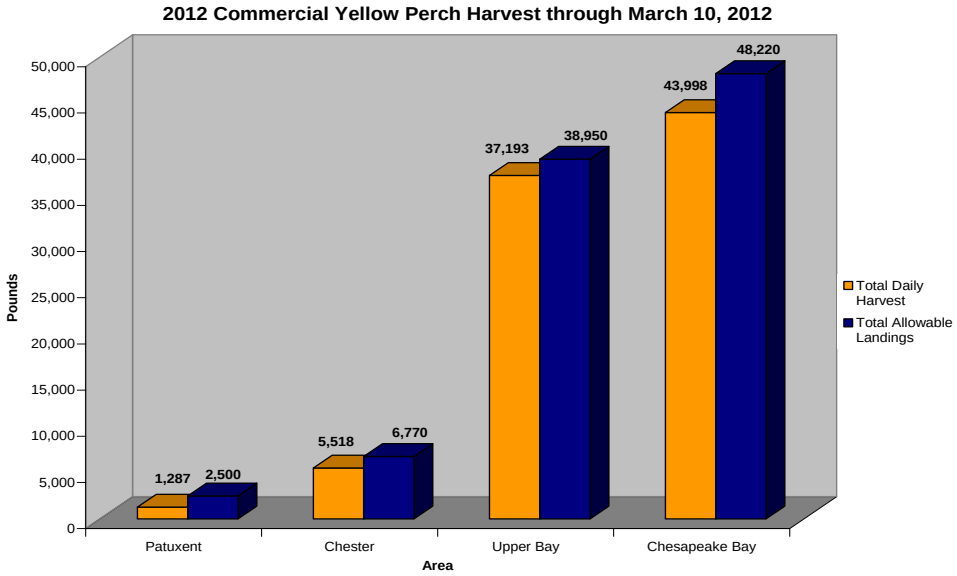
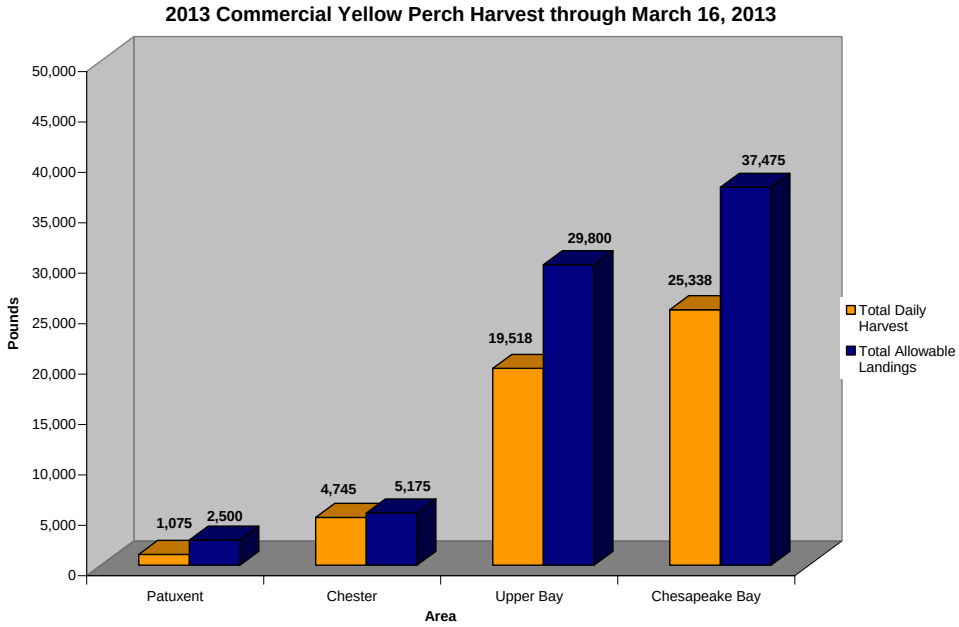


Figure 4. Maryland Commercial Yellow Perch Harvest by Region, 2013



2002 Maryland Tidewater Yellow Perch Fishery Management Plan Implementation Table (updated 05/22/13)			
Section	**Action**	**Date**	**Comments**
Implement Ecosystem Considerations	1) Adopt the following ecosystem guidelines	2001	
	1.1) Participate in forums, which develop federal or state water quality criteria.	Ongoing	Refer to Appendix 1-1 for Chesapeake Bay Program (CBP) efforts. Groups addressing tributary strategies and prioritizing watersheds activities have been made aware of yellow perch. Yellow perch is a focal species for the Corsica River Targeted Watershed project.
	1.2) Cooperate with the MD Department of Natural Resource's (DNR) Chesapeake and Coastal Watershed Services in the development of watershed assessment surveys, watershed restoration plans and in the implementation of restoration and enhancement projects	Ongoing	Watershed & tributary groups use the Anadromous and Estuarine Finfish Spawning Locations in Maryland, Technical Rept. # 42 (Mowrer & McGinty 2002) during discussions of strategies and actions. To date, 25 watershed restoration action strategies (WRAS) have been developed. Each WRAS includes a watershed characterization report, a synoptic survey (water quality & biological) and a stream corridor assessment. Fisheries staff has been involved in reviewing proposals. Funding for developing additional WRAS ended in 2006. DNR, OOS developed the GIS based "blue infrastructure" to identify and prioritizes tidal aquatic habitat and connected watershed features. Yellow perch habitat has been included.
	1.3) Participate in the review of permits for projects, which have the potential for significant impact on fishery resources.	Ongoing	Coordinate with DNR Environmental Review Unit (ERU). The ERU typically reviews 2,500 to 3,000 projects per year. During FY'06 over 800 projects were considered for yellow perch impacts. The ERU has been restructured to include representatives from the major units with DNR. This new structure should aid in improving coordination on restoration and protection projects. As a result of the 2008 Fisheries Task Force recommendations, ERU includes FS staff and fisheries issues are considered in the process.
	1.4) Cooperate with the CBP and the Atlantic States Marine Fisheries Commission (ASMFC) to develop models, collect and exchange data, and support research projects that explore multispecies management.	Ongoing	DNR has provided fishery data for the input parameters of the CBP Ecopath/EcoSim modeling efforts. To date, most of the multispecies initiatives have been focused on migratory species. Yellow perch has not been included in any modeling scenarios but has been recognized as a priority species from a tributary/watershed perspective. Fisheries Ecosystem Project has developed a model of Head-of-Bay yellow perch biomass dynamics that incorporates predation and nutrient management impacts. A cooperative DNR-NMFS CBP effort to develop a Head-of-Bay Ecopath/Ecosim model was initiated for the Yellow Perch Workgroup, but was discontinued.
	1.5) Develop funding sources for habitat restoration.		No new yellow perch habitat projects have been funded. Corsica River Project will provide some info on watershed management in relationship to yellow perch.
	1.6) Develop research proposals to examine habitat fish linkages.		Impervious surface and its impact on aquatic resources (especially fish) are currently under study. There appears to be a 10% IS threshold for fish that also relates to other habitat parameters. Letters of endorsement were supplied for proposals researching habitat and development.

2002 Maryland Tidewater Yellow Perch Fishery Management Plan Implementation Table (updated 05/22/13)			
Section	**Action**	**Date**	**Comments**
	2) Initiate a Severn River Ecosystem study that focuses on life history stage analysis to assess the effects of degraded habitat on stock abundance.	2001 2005	DNR completed field work in 2005. The field results indicated low juvenile survival, low DO and high salinity. Volunteers have been enlisted to monitor yellow perch larvae in the Severn River. These data are incorporated into impervious surface analyses. Severn River habitat has been monitored by the Riverkeeper program (http://www.severnriverkeeper.org/Monitoring07.htm)
	3) Use the Yellow Perch FMP as a model for the application of ecosystem-based fishery management principles and develop new methods of application/implementation.	Ongoing	The Corsica River Project and Mattawoman Watershed Agreement both use the "best management practice" approach. They include a diverse partnership and strive to minimize development as much as possible. Although Smart Growth is charged with minimizing development, it only addresses infrastructure. Fisheries staff continues to work with citizens and county government on the importance of aquatic health and use the Severn River as an example. It is important to identify prime habitat and aquatic resources and encourage/implement good land management decisions for protection. Impervious surface reference points have been proposed that could directly apply to yellow perch management. Priority habitat areas for fish have been mapped.
Restore Yellow Perch Habitat and Enhance Yellow Perch Populations	4) Use the table on Stock Status and Exploitation and the watershed planning process, to designate yellow perch areas for restoration, maintenance or enhancement and develop specific habitat strategies for each area.	Ongoing	The table was updated but a more general watershed management approach is necessary. There should be an emphasis on preserving habitat especially in more pristine areas. Blue infrastructure may aid in determining priority areas for preservation and restoration. The Fish Passage Program continues to collect ichthyoplankton in some historical yellow perch spawning streams. Results are compared with historical yellow perch ichthyoplankton data.
	5) Designate the currently closed rivers as yellow perch areas of particular concern, so if resources and funding become available, they can be directed to these areas.	2002	Before 2009, the Magothy, Nanticoke, Patapsco, Severn, South and West Rivers were identified as yellow perch spawning areas because these areas were already closed to harvest not because they were currently areas of high reproduction. It would be more appropriate to use impervious surface (IS) data and development projections to identify potential habitat areas of particular concern (HAPC). Most of the identified areas above have high IS values and degraded habitat except the Nanticoke. This action needs to be reevaluated. Based on current knowledge, Mattawoman Creek should be designated a HAPC. Blue infrastructure may aid in determining priority areas for preservation and restoration. New management strategies for 2009 opened the previously closed areas to recreational fishing only. Migration of yellow perch from Upper Bay areas into the mid-Western shore rivers is responsible for the yellow perch populations in those areas and removals by recreational fishermen will not reduce recruitment in these rivers. .
	6) Form a MD DNR intra- and inter departmental team to implement habitat restoration strategies for yellow perch in prioritized tributaries of the Bay. Coordinate with the Watershed Restoration Action Plans	2002 Continue	MD FS is working with Tidewater Ecosystem Assessment (TEA) and WRAS to develop habitat recommendations. A Wye Island Yellow Perch Research and Monitoring Coordination Meeting was held in 2003. The meeting resulted in increased participation with state and federal agencies. Currently, the USFWS is conducting research on contaminants in yellow perch from different tributaries when funding is available. MDE is monitoring PCBs and mercury from fish samples and also evaluating disease. The Corsica River Project has been underway since 2005.

2002 Maryland Tidewater Yellow Perch Fishery Management Plan Implementation Table (updated 05/22/13)

Section	Action	Date	Comments
	and evaluate five watersheds annually.		
	7) Identify essential fish habitat (EFH) for utilizing progressively more detailed information.	On-going	Results from the Impervious Surface Project of the Bush River indicate that stream habitat in developed regions is no longer viable, but yellow perch larvae are abundant in the estuary. These results indicate that other spawning locations may be more critical. Maps have been updated to illustrate essential fish habitat at different life stages.
	8) Facilitate the implementation of habitat management and restoration practices identified as important to yellow perch.	On-going	Working with tributary teams and local riverkeepers but the scope of work should be broadened. DNR will continue to coordinate habitat activities.
Control Fishing Mortality by establishing biological reference points (BRPs)	9) Adopt BRPs of $F_{35\%}$ and $F_{25\%}$ as a threshold for the yellow perch resource. As more data becomes available, the BRPs may be changed to reflect the most current status of the resource.	2002 Continue	Continuing analysis indicates current BRPs are appropriate. The Maryland Yellow Perch Stakeholder Committee (YPSC) presented recommendations (2007) to evaluate triggers for yellow perch based on stock biomass or age structure in addition to triggers based on fishing mortality. Triggers were evaluated in 2008. The target fishing mortality rate (F) = 0.53.
that describe the targets and thresholds (limits) for yellow perch stocks.	10) Adopt the decision rules for managing the yellow perch resource based on the target and threshold mortality rates and utilize the decision rules to make recommendations regarding the yellow perch systems currently under assessment.	2002 Continue	Decision rules have been adopted. Based on a target fishing mortality rate (F=0.53) a **2013** Chesapeake Bay TAC of **37,475** pounds was calculated. This was a **decrease** from the **2012** TAC of **48,220** pounds. The calculated **2013 quota** for the Upper Bay commercial fishery was **29,800** pounds. The Chester River quota was **5175** pounds and the Patuxent River quota was 2500 pounds. Improved catch reporting included daily call-ins, verified by tagging. These measures were implemented in 2009 to improve accountability and have continued**.**
	11) Utilize Table 1 of MD Yellow Perch FMP to guide the development of management strategies and actions for selected river systems within the MD portion of the Bay.	On-going Evaluated/ Updated Periodically	Management actions may include size limits, creel limits, closed seasons, area closures, and/or gear restrictions. The table was updated (2006) but needs to be reexamined for its usefulness in guiding management strategies. Starting with the 2009 season, the annual stock assessment will determine the strategies and actions for three management areas – Upper Bay, Chester River, and Patuxent River for commercial fishing. The stock assessment, creel surveys, and public input will help determine strategies and actions for the recreational fishery.
	12) Continue the 8.5 -11inch slot limit for the commercial fishery in all open areas and adjust fishing mortality (F) depending on the most recent stock assessment.	2000 Assessed annually	Slot limit has not changed and is currently in place. Analysis was conducted and evaluated. Slot limit was selected to be the most robust approach. Fishing mortality was below targets in all years. No changes in management recommendations. During stakeholder meetings in 2008, the slot limit was widely supported.

2002 Maryland Tidewater Yellow Perch Fishery Management Plan Implementation Table (updated 05/22/13)			
Section	**Action**	**Date**	**Comments**
	13) Continue the uniform recreational minimum size limit of 9 inches in all open areas. Adjust size and/or creel limits depending on the most recent stock assessment.	2000 Assessed annually	The 9 inch size limit is still in effect. Fishing mortality was below targets in all years. No changes in management recommendations. Based upon recent stock assessments, the creel limit was increased from 5 to 10 yellow perch effective with the 2009 recreational season.

2002 Maryland Tidewater Yellow Perch Fishery Management Plan Implementation Table (updated 05/22/13)

Section	Action	Date	Comments
User Conflicts	14) Establish an ad hoc yellow perch committee comprising stakeholders to provide input into the yellow perch management process.	2001	The ad hoc group will meet as necessary. The Sport Fish & Tidal fish advisory committees will also consider new recommendations. Ad hoc group was empanelled and met during 2006-2007. No progress was made on reducing conflicts. Stakeholder meetings held in 2008 produced compromises that allow both quality recreational fishing and a limited commercial fishery.
Examine the conflict between commercial and recreational uses of yellow perch. Identify	15) Evaluate the utility of a web-based volunteer angler survey to collect data on the recreational fishery and implement the survey if feasible.	2002	A pilot program to utilize angler logbooks was implemented, but the anglers did not return any information. The program was discontinued. A web-based angler survey was implemented in 2008 and continues. **The information provided by anglers in 2012 showed a decrease in the catch per angler hour (CPAH) Shoreline anglers reported the same CPAH as in 2010 and 2011, while boat anglers reported lower catch. Anglers exceeded average reported catches in the Bush, Wye, Northeast, Susquehanna, Patuxent, Chester, and Middle Rivers. The full results can be viewed at: http://www.dnr.maryland.gov/fisheries/survey/yperch/2012.pdf**
any problems and recommend solutions.	16) MD DNR has implemented a system to track the use of pound nets in the Bay. Evaluate the pound net system. For tracking fyke nets and make recommendations for their use.	2003	Fixed gear restrictions are county specific. DNR has done unofficial counts of fyke nets and over the last few years the number of fyke nets has decreased. The number of nets is recorded on reporting forms but it is difficult to get effort data. Regulations to prohibit the use of fyke nets in tributaries upstream of the first 200 ft. channel width during the month of February were implemented for 2008. The width limit was changed in 2009 to a geographic and temporal restriction by area. Fyke nets were legally defined in 2009.
	17) If fishing mortality is too high in relation to the adopted targets, strategies to reduce fishing effort will be explored. Topics to be considered include but are not limited to: capping the number of fyke nets per fishermen, the placement of fyke nets in river systems (i.e., total number per river system; distance between nets); daily harvest restrictions; and seasonal quotas.	As necessary	When targets have been exceeded, these types of management strategies to reduce fishing effort will be evaluated. Total Allowable Catch (TAC) is calculated based on the latest stock assessment. Allocation of the TAC between commercial fishing and recreational fishing is determined after considering input from stakeholders. The public notice required to close the commercial fishery has been reduced from 48 hours to 24 hours.
	18) Evaluate the need for increased enforcement of yellow perch regulations, develop strategies to meet the needs and implement actions accordingly.	To be determined 2001 Continue	NRP make**s** a special effort to enforce yellow perch regulations during spring spawning run. They also conduct a yellow perch creel survey based on random stops and interviews, mostly at road crossings.
Stock Status MD DNR will monitor yellow	19) Continue to sample commercial and recreational harvest of yellow perch and collect basic biological data. Additional biological data may indicate changes in the status of the	On-going	Chesapeake Finfish Program (previously FS Multispecies Project) collects yellow perch data from commercial and experimental fyke nets, seine and trawl surveys and uses data to periodically assess stocks. Upper Chesapeake Bay populations **decreased in 2011 and 2012. Recruitment has decreased and has been under the long-term mean recruitment for the last three years (2010-2012).**

2002 Maryland Tidewater Yellow Perch Fishery Management Plan Implementation Table (updated 05/22/13)

Section	Action	Date	Comments
perch stocks in representative areas of the	stocks and require additional management measures.		
Chesapeake Bay in order to assess yellow perch stock status. Assessment and	20) Develop a method for evaluating yellow perch recruitment and utilize it as one of the parameters for assessing stock status and consequent management actions.	2003	Yellow perch recruitment has been monitored on the Severn River but is no longer a priority. DNR utilizes the EJFS in the upper Bay for information on recruitment. Larval survey methods are being evaluated for use in tributaries. The Nanticoke, Bush, Corsica and Severn rivers were sampled in 2006.
management efforts will be focused on areas already under special management measures, i.e., closed areas.	21) Yellow perch egg strands are easy to collect and important for hatchery and/or aquaculture endeavors. Maryland will prohibit the removal or selling of egg chains that have been stripped by artificial methods, unless a scientific collection permit has been issued.	2001 2005	A person needs a Scientific Collection Permit as described in Natural Resources Article, §08-02.12.02, of the Annotated Code of Maryland, to collect yellow perch eggs. Effective Feb. 2005, a person may not catch or possess yellow perch eggs from any state waters (08.02.05.07F).
	22) Evaluate additional fishery-independent indicators of stock status, such as the trawl survey in the upper Bay.	On going	Implementation of this action is dependent on manpower and funding
	23) Review and evaluate yellow perch monitoring efforts biannually. Recommend changes in monitoring and protocol necessary to implement the yellow perch FMP.	2002 and even years thereafter	Evaluated annually. Added Marshyhope River to fyke net sampling schedule. Contracted with CBL to do a 2008 yellow perch creel survey in Bush River, Mattawoman Creek, Wicomico River (western shore), and Chester River. Additional rivers were surveyed in 2009 – Chester, Bush, Northeast, Patuxent, South, Magothy and 3 tributaries of the Potomac (Mattawoman Ck., Nanjemoy Ck., Wicomico R.). Funding for this creel survey was cut for 2010. DNR Fisheries Service studies fisheries independent and dependent surveys. Fisheries independent efforts include the Upper Bay Winter Bottom Trawl Survey (Sassafras River, Elk River, Upper Bay, Mid Bay, in 2011) and Choptank River Fishery Independent Sampling. Fishery dependent efforts include Upper Chesapeake Bay fyke net surveys (Gunpowder River, Back River and Middle River vicinities) and Nanticoke River fyke and pound net surveys.
Yellow Perch Outreach MD will continue outreach efforts to engage fishing and non-fishing communities in stewardship of the yellow perch	24) Utilize volunteers from the recreational fishing sector, such as the Coastal Conservation Association or watershed community associations, to obtain recreational data in areas not sampled by the MD DNR Multispecies Project. Explore the use of volunteer recreational survey using the web similar to the recreational survey implemented for striped bass.	On-going	Dependent on volunteer recruitment. The volunteer angler survey did not generate any response and was discontinued. A web-based angler survey has been produced and was implemented in 2008. CCA and MSSA will be asked to promote angler participation. The access to the survey and the summary of the 2008-2012 volunteer yellow perch survey can be viewed at: http://www.dnr.maryland.gov/fisheries/survey/index.asp?page=yellow_perch

2002 Maryland Tidewater Yellow Perch Fishery Management Plan Implementation Table (updated 05/22/13)			
Section	**Action**	**Date**	**Comments**
resource in tributary basins.	25) Add yellow perch egg strand sampling in the early spring to river basins with volunteer monitoring programs to obtain data on yellow perch spawning locations.	On-going	CCA conducts stream walks utilizing citizen volunteers. The information is used to indicate spawning presence, although zero egg sightings does not mean there is no spawning in a particular system. Shifts away from "traditional" spawning locations may be indicative of habitat degradation and subsequent shifts by spawning yellow perch to more suitable spawning habitats.
	26) MD DNR will continue to partner with the Yellow Perch Hatch, Raise and Release Project by providing assistance and advice in the collecting, raising, releasing, and stocking of yellow perch in all facets of the project.	2004	**Arlington Echo Outdoor Education Center reported poor viability of Severn River eggs preventing such a program. Focus has changed to bluegill and hybrid sunfish as educational tools.**
	27) MD DNR Fisheries Outreach will explore new avenues to involve the public in yellow perch projects, such as a new exhibit on identifying yellow perch egg strands and collecting information on their occurrence and distribution: cooperative efforts with the Team program; and volunteer monitoring opportunities.	On-going	Volunteer monitoring has occurred in the Bush, Severn and Corsica to monitor eggs, larvae and juveniles and to assess aquatic health (water quality). Fisheries staff has continued to give presentations to fishing clubs, environmental organizations, etc. upon request.

Acronyms:

BRPs= Biological Reference Points
CBP = Chesapeake Bay Program
CCA = Coastal Conservation Association
DNR = Department of Natural Resources
DO = Dissolved Oxygen
EJFS = Estuarine Juvenile Finfish Survey
FMP = Fishery Management Plan
MSSA = Maryland Saltwater Sportfishermen's Association
NRP = Natural Resources Police
OOS = Office of Sustainability
SHA = State Highway Administration
TAC = Total Allowable Catch