



2010 Fishery Management Plans

Report to the Legislative Committees



Prepared by

Maryland Department of Natural Resources
Fisheries Service
Fishery Management Plan Program

July 2011



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2010 Fishery Management Plan (FMP) Updates (July 2011)

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. 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.

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 Committees 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 Hard Clams, Brook Trout; and a technical report for catfish. During 2010, work began on developing an FMP for black bass. 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 reviewed by the Sport Fish Advisory Committee and the Tidal Fish Advisory Committee for additional input. If an amendment or revision is recommended by the review team, the process for developing FMPs begins.

2010 Maryland FMP Report (July 2011) American Eel (*Anguilla rostrata*)

American eel comprise one single breeding population along the entire Atlantic coast. 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. Given their range of habitats and their complex life history, the current status of the stock is unknown.

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 2010 and the plan review team concluded that the 1991 management framework is still appropriate for managing the population in Chesapeake Bay.

The ASMFC adopted a coastal FMP for American Eel in 1999 with addenda I (2006) and II (2008). 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. YOY surveys have been completed in Maryland since 1998. Each jurisdiction is required to complete an ASMFC annual compliance report

Stock Status

The status of the American eel stock is poorly understood along the Atlantic coast and in the Chesapeake Bay. There are limited data to determine reliable indices of abundance. It is difficult to make correlations between landings data and population abundance because the fishery is market driven and fluctuates from year to year. In 2005, a peer reviewed coastal stock assessment was completed. Biological reference points were not established during the stock assessment due to the inability to calculate coastwide exploitation rates and provide an estimate of stock size because of relatively poor geographic data coverage. The coastal states will continue monitoring and collecting data in order to develop biological reference points in the future. An ASMFC stock assessment is in progress and slated for completion fall 2011.

An age- and sex-structured assessment model for American eels in the Potomac River was completed (Fenske et al. 2011). Model results indicate that between 1980 and 2008 estimated recruitment, biomass and abundance decreased. Exploitation during this same time period exceeded $F_{50\%}$. A decline in recruitment has also been reported from other places along the Atlantic coast.

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

Habitat loss due to stream/river blockages has contributed to reductions in American eel. The Maryland Fish Passage Program has added eels to its list of targeted species. Blockage removal projects now consider whether or not eels would benefit from implementing a proposed project.

Current Management Measures/The Fishery

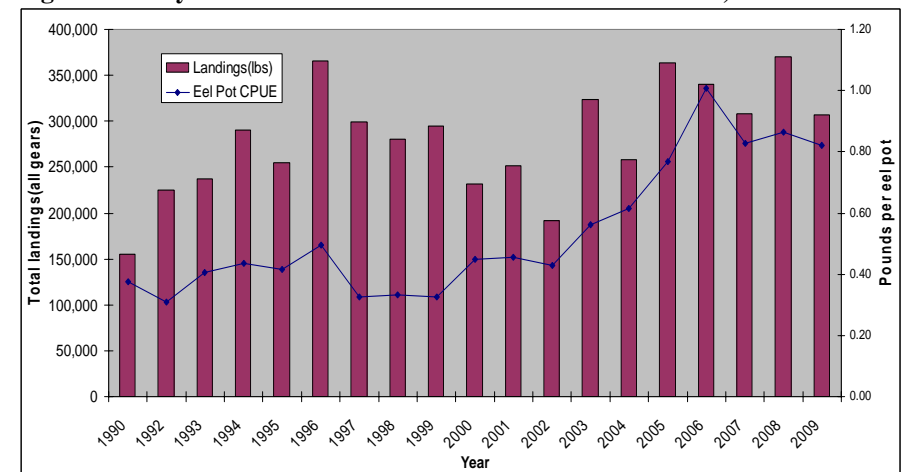
In 2009, total reported commercial eel landings for Maryland were 302,878 pounds. This amount was higher than the mean annual landings of 248,401 (1983-2009). Since a license was required to harvest eel in Maryland in 1983, a steady increase in landings occurred to 1997 and has reached a plateau around 300,000 pounds. Current data suggests that Chesapeake Bay catch per unit effort (CPUE) over the last three years is relatively stable after steadily increasing from 1999 to a time series high in 2007. Eels are also harvested for crab bait. Over the last 16 years, about 18,000 pounds of eels per year have been used as crab bait.

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 1/2 x 1/2" 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 and a fishery independent pot survey, both 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

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. Maryland commercial eel harvest and annual CPUE, 1990-2009



(From Whiteford 2010)

1991 Chesapeake Bay American Eel Management Plan Implementation Table (updated 06/11)

Problem Area	Action	Date	Comments
<p>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.</p>	<p>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</p>	<p>1992 1993 Continue</p>	<p>Stock status of eels is poorly understood but there are indications that abundance on a coast-wide basis has declined & the stock is at low levels. A coastal stock assessment was conducted in 2005/2006 but failed some of the terms of reference. A new coastal stock assessment is in progress and scheduled for completion in fall 2011. MD data from fishery independent pot survey (1999-present) indicate a positive trend and 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.</p>
	<p>1.2 MD will implement a ½ by ½" mesh size for eel pots. Eel pots in MD with undersize mesh require a 16 in² 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</p>	<p>1993 Continue</p>	<p>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. Commercial landings during 2009 were 302,878 lbs and 179,563 lbs from MD & VA, respectively.</p>
	<p>1.3 Upon restoration of eels to the Susquehanna River basin PRFC will adopt regulations to prevent over fishing of small eels.</p>	<p>On-going</p>	<p>Fish passage goals have been adopted for the Bay and Tributaries. Eels have been added to the 2010 SRAFRFC plan with specific actions for eel passage on the Susquehanna River.</p>
<p>2. Bait Fishery Strategy 2.1 Catch and effort statistics for the American eel crab bait fishery will be obtained.</p>	<p>2.1 MD will require the reporting of eels used for crab bait on crab reporting forms</p>	<p>1993 2007 Continue</p>	<p>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. Currently, commercial crabbers can use up to 50 eel pots with no catch limit.</p>

1991 Chesapeake Bay American Eel Management Plan Implementation Table (updated 06/11)			
Problem Area	Action	Date	Comments
3. Research Needs Strategy 3.1 The 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.	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 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). 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.
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.	4.1 Continue to provide stream passage	2000 2005 2009 On-going	A new CBP fish passage goal was adopted in 2005 to open additional 1,000 miles of tributary by 2014. The 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 is conducting a study to determine the timing & cues for out-migrating eels in the Shenandoah River. Results of the study will assist hydroelectric companies to manage power generation to minimize impacts on out-migrating silver eels.

1991 Chesapeake Bay American Eel Management Plan Implementation Table (updated 06/11)			
Problem Area	Action	Date	Comments
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)	4.2 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.

ASMFC= Atlantic States Marine Fisheries Commission C2K= Chesapeake 2000 agreement
 CBP = Chesapeake Bay Program DO = Dissolved oxygen
 FMP= Fishery Management Plan PRFC= Potomac River Fisheries Commission

2010 Maryland FMP Report (July 2011)

Section 2. American shad (*Alosa sapidissima*) and Hickory shad (*Alosa mediocris*)

Chesapeake Bay FMP

American shad abundance remains low despite having a moratorium since the 1980s and increased access to optimal spawning habitat. Bycatch mortality from the offshore Atlantic herring fishery may account for limited restoration success. In contrast, wild hickory shad abundance continues to increase in systems being restored. Hickory shad restoration in the Patuxent River appears successful and stocking has been discontinued.

The Atlantic States Marine Fisheries Commission (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 continue the American shad moratorium, to remove stream blockages and reopen historic habitat, and to continue stocking hatchery-raised fish. Amendment 1, developed in 1998, continued the ASMFC shad moratorium, initiated review of criteria to reopen a shad fishery, and the 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. Amendment 3 (2010) established an instantaneous total mortality (fishing and natural) benchmark of Z_{30} , the juvenile recruitment failure definition was made more conservative, states were mandated to monitor American shad bycatch and discards, and states having commercial and/or recreational (excluding catch and release) fisheries needed an approved sustainability plan. In early 2011, a Plan Review Team (PRT) reviewed 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 recommended development of a second amendment due to substantial changes in American shad and river herring stock status.

In 2006, the National Oceanic and Atmospheric Administration (NOAA) Chesapeake Bay Fisheries Ecosystem Advisory Panel adopted a Fisheries Ecosystem Plan for Chesapeake Bay. Maryland Sea Grant facilitated development of the plan. The goal was to develop an ecosystem-based fisheries management plan (EBFMP) for five keystone species. American shad, hickory shad, alewife herring, and

blueback herring are grouped together as one of the keystone species. State, federal, and academic representatives met in 2009 to develop an *Alosa* biological background document detailing current and future stressors. An issues document was completed in 2011 that 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). The issue briefs document was then sent to a Quantitative Ecosystem Team to develop measurable targets and reference points. For more information on the EBFM process and issue briefs go to <http://www.mdsg.umd.edu/programs/policy/ebfm>.

Stock Status

American shad stocks began to decline in the 1960s and reached all time lows in the 1970s. American shad fisheries were closed in 1980. Based on Conowingo Dam passage¹ (Figure 1) and Maryland Department of Natural Resources tagging² data (Figure 2), shad abundance increased from 1998 to 2001, decreased after 2001, and has increased since 2006. The 2009 population estimate for the Susquehanna River below Conowingo Dam was 188 thousand shad (Figure 1). In contrast, American shad abundance in the Potomac River has steadily increased since 2000 to early 1950s levels^{3,4}.

Wild (non-hatchery) spawning American shad abundance varies among river systems. Wild shad in the Conowingo Dam tailrace comprised 62% of the stock in 2009. Nineteen percent of American shad in the tailrace were repeat spawners⁵ (spawned in previous years). Most American shad juveniles were hatchery reared: 99% in the Patuxent River, 93% in the Choptank River, and 92% in the Nanticoke River⁵. Juvenile abundance has been variable without trend in the Upper Chesapeake Bay, Nanticoke River, and Patuxent River since 1995^{5,6} (Figure 3). Potomac River juvenile shad increased in abundance through 2004 but has since declined.

For hickory shad, age structure has remained consistent. Proportions of wild and repeat spawning adults has been increasing. Repeat spawning in Deer Creek increased from 83% male and 86% female in 2008 to 96% male and 87% female in 2009⁵. DNR data is insufficient to estimate hickory shad adult and juvenile abundance. NOAA's marine recreational fisheries statistics survey stopped collection of American and hickory shad data in 2009 due to inadequate samples.

Current Management Measures

Chesapeake Bay American shad harvest has been prohibited by Maryland since 1980, Potomac River Fisheries Commission since 1982, and Virginia since 1994. Maryland closed their ocean intercept fishery in 2005. Pennsylvania and New York

have also prohibited harvest of American shad in the Susquehanna River basin. Maryland enacted a hickory shad moratorium in 1981. A limited commercial bycatch is allowed. A recreational catch and release shad fishery takes place below Conowingo Dam. Hickory shad are also caught in Deer and Octoraro Creeks.

Issues/Concerns

American shad abundance in Maryland increased from 1998 to 2001, decreased after 2001, and increased some in 2009 and 2010. The effect of multiple mortality sources² such as bycatch, discard, dam turbines, pollution, and predation on abundance trends is unknown. Additional data are required to estimate total mortality and develop appropriate target and threshold biological benchmarks.

River and stream blockages, including dams, prevent shad from reaching suitable spawning habitat. Poor spawning habitat has negatively affected shad abundance. Fish passage structures (rather than dam removal) were installed at some dams to varying success. Shad responses to the design and operation of Conowingo Dam including the east fish elevator have not been adequately studied. Exelon Generation Company, LLC, Conowingo Dam operator, has initiated several studies as part of the Federal Energy Regulatory Commission relicensing process. Studies include radio telemetry, fish passage effectiveness, east fish lift attraction flows, passage impediments below the dam, and plant operation impact on fish reproduction.

A research study was initiated to investigate possible American shad population effects from the parasite *Ichthyophonus* sp. The parasite is ubiquitous throughout the Atlantic and Pacific oceans.

References

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- ² Maryland Department of Natural Resources. 2010. Chesapeake Bay Finfish / Habitat Investigations. US FWS Federal Aid Project F-61-R-5 2008 – 2009. Annapolis, Maryland.
- ³ Carpenter, AC. pers. comm.. 2007 – 2009. Potomac River Fisheries Commission.
- ⁴ Cosby, Ellen. pers. comm. 2010 – 2011. Potomac River Fisheries Commission.
- ⁵ Sadzinski, B. and T. Jarzynski. 2010. Maryland's 2009 American Shad (*Alosa sapidissima*), Hickory Shad (*Alosa mediocris*), Alewife Herring (*Alosa pseudoharengus*) and Blueback Herring (*Alosa aestivalis*) Compliance Report. Maryland Department of Natural Resources, Stevensville, Maryland.

⁶ Durell, E.Q., and Weedon, C. 2010. Striped Bass Seine Survey Juvenile Index Web Page. <http://www.dnr.state.md.us/fisheries/juvinindex/index.html>. Maryland Department of Natural Resources, Fisheries Service.

The Fisheries

Figure 1. American shad passed at Conowingo Dam and the estimated population in the dam's tailrace: 1997-2010⁵.

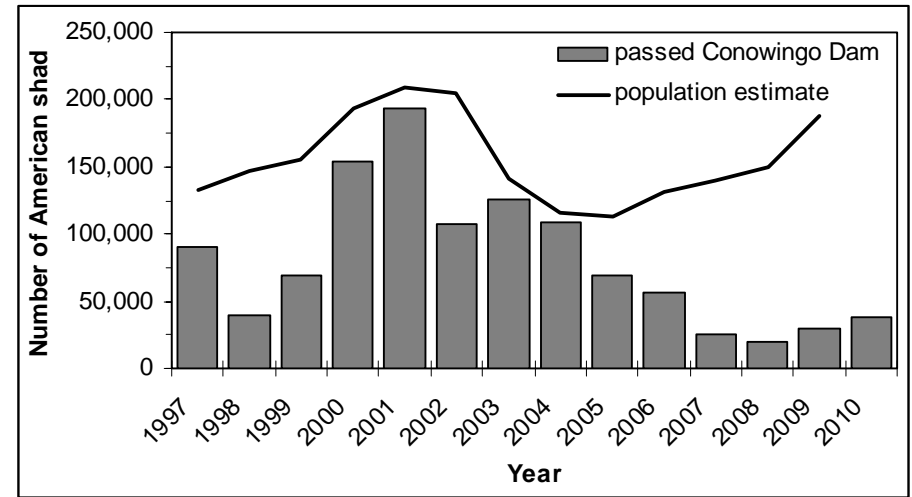


Figure 2. Maryland recreational catch and release spring hickory shad (Deer Creek) and American shad (Conowingo Dam and Deer Creek) log book and creel data⁵.

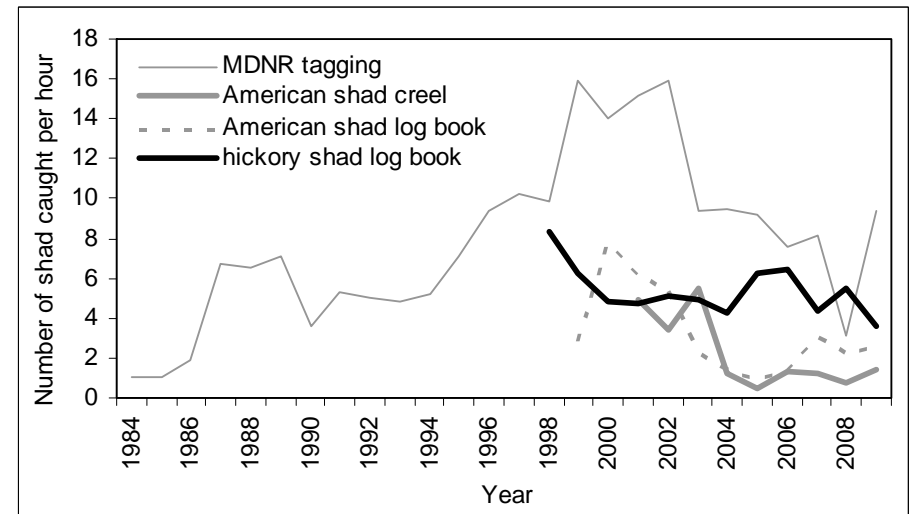
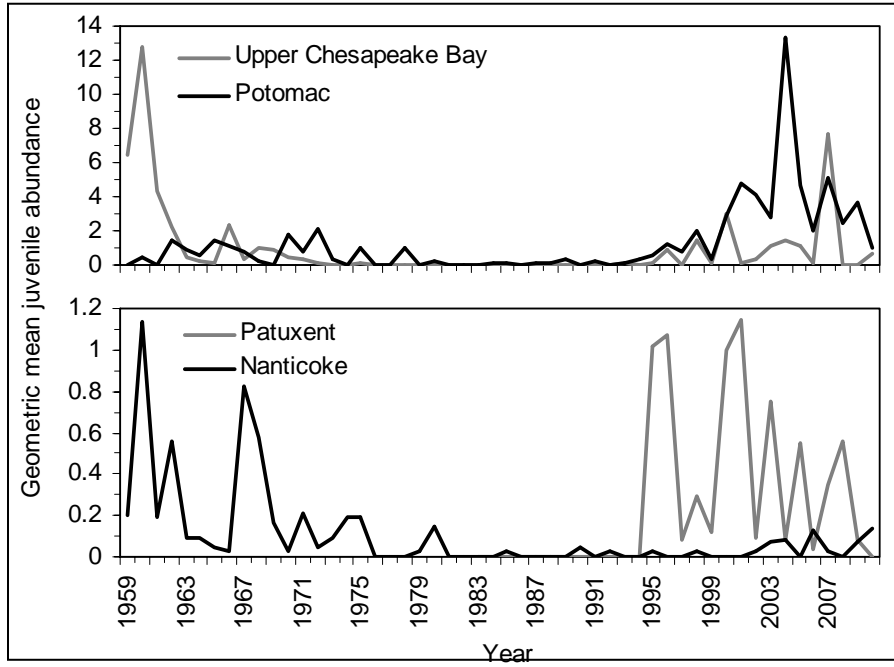


Figure 3. Juvenile American shad abundance in the Upper Chesapeake Bay, Patuxent River, Nanticoke River, and Potomac River⁵.



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

Chesapeake Bay FMP

River herring commercial harvest has remained at historic lows for 35 years. The lowest commercial landings have occurred since 2006. ASMFC will close all commercial and recreational river herring (alewife and blueback) fisheries on January 1, 2012 unless a sustainability plan has been approved. Maryland DNR did not develop and implement an ASMFC approved river herring sustainability plan.

The Atlantic States Marine Fisheries Commission (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 herring fishing mortality and remove impediments to accessing historic habitat. Amendment 1 (1998) to the CBFMP did not address any issues related to river herring. ASMFC enacted Amendment 2 to their FMP to address coastwide declines in alewife and blueback herring stocks.

ASMFC approved a second amendment to their FMP in 2009. Amendment 2 requires States to have an ASMFC Board approved river herring sustainability plan by 2012 or their river herring fisheries will be closed. A sustainability plan requires States to develop a river herring juvenile index to monitor spawning adults, collect commercial and recreational fisheries statistics, and collect bycatch data. River herring stocking programs are encouraged. As required by ASMFC, Maryland submits an annual compliance report. In early 2011 a Plan Review Team (PRT) assessed the adequacy of the CBFMP, including Amendment 1, to address recent management changes by ASMFC. The PRT recommended development of a second amendment due to continued declines of the river herring stock and the substantial management actions specified in Amendment 2 to the ASMFC FMP.

In 2006, the National Oceanic and Atmospheric Administration (NOAA) Chesapeake Bay Fisheries Ecosystem Advisory Panel adopted a Fisheries Ecosystem Plan for Chesapeake Bay. Maryland Sea Grant was contracted to facilitate implementation of the plan. The goal was to develop an ecosystem-based fisheries management (EBFM) plan for five keystone species. The Alosines American shad, hickory shad, alewife herring, and blueback herring are grouped together as one of the keystone species. During fall 2008, state, federal, and academic representatives met to develop an *Alosa* biological background document detailing current and future stressors. An issues document was completed in 2011 that examined four types of stressors: 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). This issues briefs document has been sent to a Quantitative Ecosystem Team to develop measurable targets and reference points. For more information on the EBFM process, go to <http://www.mdsg.umd.edu/programs/policy/ebfm>.

Stock Status

Preliminary stock assessment results indicate coastwide historic low commercial landings and a decline in mean length and age¹. Maryland Department of Natural Resources monitors river herring in the Nanticoke River. Commercial landings cycled from high to low approximately every 20 years between 1929 and 1969 (Figure 1). However, a trend of decreased landings was evident. River herring landings have failed to rebound since 1976. Adult river herring stocks in Maryland are projected to remain at low abundance levels for the near future.

Alewife and blueback herring juvenile abundance has been monitored in the Nanticoke River and baywide since 1980. Each abundance index has varied from year to year without trend^{2,3} (Figures 2 and 3). Initial analyses indicate that a river herring JAI is a predictor of future year class strength⁴.

Beginning in 2009 alewife and blueback herring recreational data were no longer available from the Marine Recreational Fisheries Statistics Survey (MRFSS). The recreational river herring fishery in Maryland is considered minimal and is not adequately sampled by the MRFSS. The next river herring stock assessment is scheduled for completion in 2011.

Current Management Measures

There are no harvest restrictions for herring in Maryland other than a commercial closure from June 6 to December 31. The summer and fall harvest closure has little impact since most river herring have left Chesapeake Bay waters prior to June². Amendment 2 to the ASMFC FMP requires states to have a river herring management plan that ensures stock sustainability. State's having FMPs that ASMFC deems unsustainable will have their commercial and recreational fisheries closed on January 1, 2012. The CBFMP has not been approved as sustainable by ASMFC.

Issues/Concerns

River herring mortality sources include harvest, bycatch, discard, dam turbines, pollution, and predation. Ocean trawl bycatch is of particular concern. Insufficient data exist to develop management benchmarks. Additional data collection will likely be needed to comply with future ASMFC management requirements.

Adult access to suitable spawning habitat is critical for larval and juvenile survival. Blockages, such as dams, prevent adult river herring from reaching suitable spawning habitat. Blockage removal (preferred), fishway, and bypass channel efficiency data is insufficient to determine restoration effectiveness.

References

- ¹ Shad & River Herring Plan Review Team. 2010. Review of the Atlantic States Marine Fisheries Commission fishery management plan for shad and river herring (*Alosa* spp.) 2010. Atlantic States Marine Fisheries Commission. Arlington, Virginia.
- ² Sadzinski, B. and T. Jarzynski. 2010. Maryland's 2009 American Shad (*Alosa sapidissima*), Hickory Shad (*Alosa mediocris*), Alewife Herring (*Alosa pseudoharengus*) and Blueback Herring (*Alosa aestivalis*) Compliance Report. Maryland Department of Natural Resources, Stevensville, Maryland.
- ³ Durell, E.Q., and Weedon, C. 2010. Striped Bass Seine Survey Juvenile Index Web Page. <http://www.dnr.state.md.us/fisheries/juvinindex/index.html>. Maryland Department of Natural Resources, Fisheries Service.
- ⁴ Linda Barker. pers. comm. 2011. Maryland Department of Natural Resources.

The Fisheries

Figure 1. Commercial river herring landings for Maryland Chesapeake Bay waters².

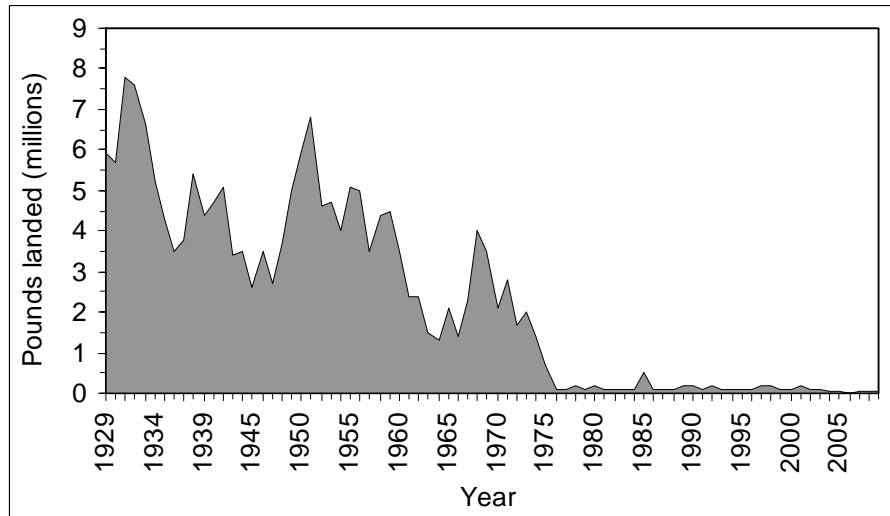


Figure 2. Juvenile alewife herring abundance in the Nanticoke River and Baywide³.

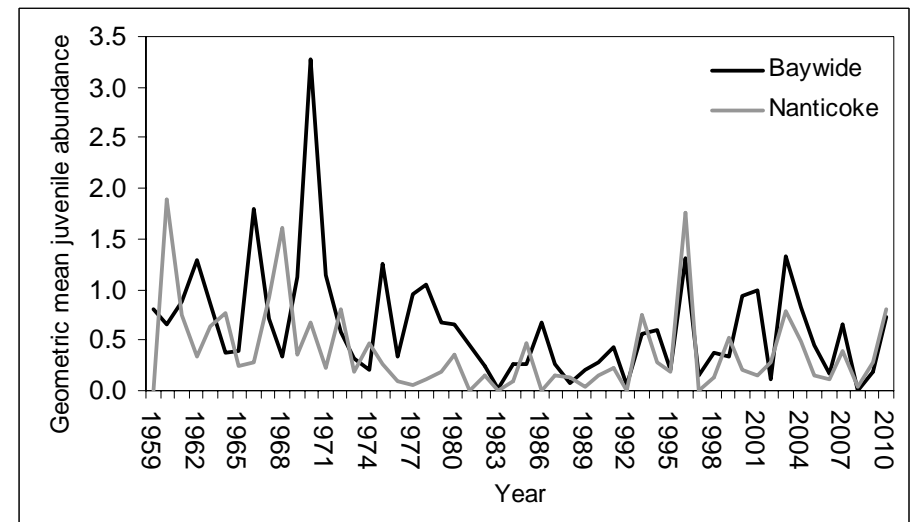
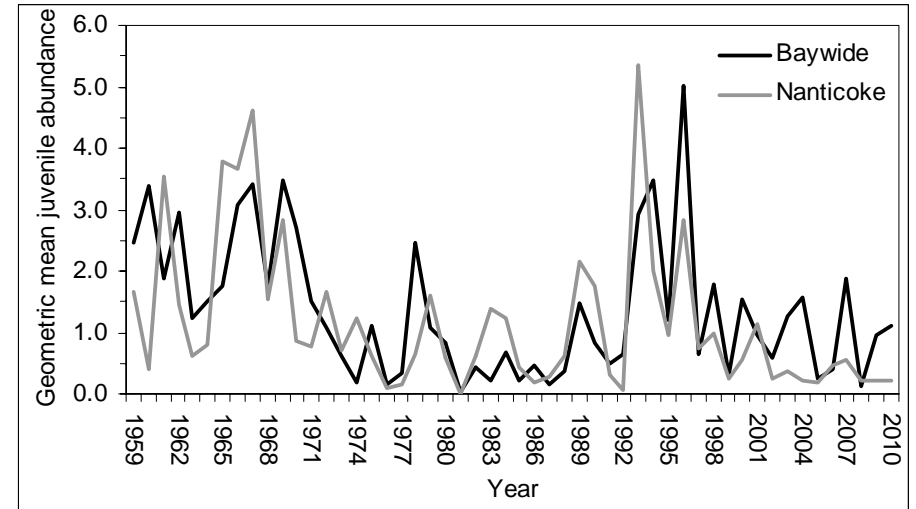


Figure 3. Juvenile blueback herring abundance in the Nanticoke River and Baywide³.



1998 Amendment 1 to the 1989 Chesapeake Bay Alosid Management Plan Implementation Table (updated 6/7/2011)

Strategy	Action	Date	Comments
<p>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.</p>	<p>1.1 The Bay jurisdictions will continue the moratorium on American shad in Chesapeake Bay.</p>	<p>1989 Continue</p> <p>2009</p> <p>Continue</p> <p>Ongoing</p>	<p>The Bay jurisdiction will reevaluate the criteria for reopening a fishery in Chesapeake Bay during the Alosine FMP revision process.</p> <ul style="list-style-type: none"> - Until new criteria are determined, the moratorium will remain in place for American and hickory shad in Chesapeake Bay. - Coastal fishery scheduled for closure December 2004. <p>Development of a Chesapeake Bay EBFMP coordinated by MD Sea Grant began in 2009 and will continue through 2011.</p> <p>Chesapeake Bay jurisdictions will continue to follow ASMFC requirements.</p>
<p>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.</p>	<p>1.2 The bay jurisdictions will incorporate the shad restoration targets into the revised Alosine FMP</p>	<p>1999 Continue</p> <p>2007</p> <p>Ongoing</p> <p>2010</p>	<p>River specific targets were proposed in 1997, but need to reevaluate.</p> <ul style="list-style-type: none"> - STAC conducted a workshop on Alosine targets during 2001. - Recommendations from the workshop will be considered. - A target-setting white paper is under development. <p>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 on the Potomac River, and gill net on the York River.</p> <p>No relationship exists between adult and juvenile shad abundance preventing development of a JAI. Any relationship that may exist is masked by at sea mortality.</p>

1989 Chesapeake Bay Alosid Management Plan Implementation Table (updated 6/7/2011)

Strategy	Action	Date	Comments
<p>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.</p>	<p>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.</p>	<p>Continue</p>	<p>Shad stocks in the upper Bay have increased since the moratorium in 1980. The 2004 population estimate for adult American shad in the Conowingo Dam tailrace exceeded 1,000,000 fish.</p> <p>Upper Bay shad estimates are no longer possible with the loss of a commercial pound net in the Susquehanna Flats.</p> <p>DCFM implemented a moratorium on shad during 1992.</p> <p>PRFC has a moratorium on directed shad harvest since 1982.</p> <p>ASMFC allows a limited Hickory and American shad in Potomac pound net and gill net.</p>
<p>1.1.2 Virginia will follow ASMFC recommendations for a 25% exploitation rate for alosids.</p>	<p>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 exploitation is above the 25% rate, Virginia will take the appropriate steps to limit fishing effort.</p>	<p>1994</p> <p>2005 continue</p> <p>continue</p> <p>2010</p>	<p>VA implemented a moratorium in harvest of American shad from the Bay in 1994.</p> <p>No harvest restrictions on hickory shad and river herring.</p> <p>ASMFC allows a limited American shad commercial bycatch 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).</p> <p>PRFC adopted a moratorium on directed harvest of river herring.</p>
<p>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</p>	<p>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: <u>Harvest</u> – Quotas would be a reasonable regulation if the size of the spawning stock in a given year was predictable <u>Seasons</u> – Setting a season during a segment of the “average” spawning period to regulate exploitation <u>Areal closures</u> – Restrict exploitation in those areas where the potential for harvest is greatest such as restricted portions of migratory routes or at</p>	<p>1990</p> <p>2012</p>	<p>No restrictions have been implemented for river herring.</p> <p>Commercial harvest has been declining due to low market demands and questionable stock status.</p> <p>Commercial and recreational river herring fisheries without an ASMFC approved sustainable fishery plan will be closed January 1, 2012.</p>

1989 Chesapeake Bay Alosid Management Plan Implementation Table (updated 6/7/2011)

Strategy	Action	Date	Comments
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.	migration barriers <u>Gear restrictions</u> – Restrict large-volume harvesting by pound nets and/or haul seines		
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.	Continue 2011, continue	MD (1981) and DC (1992) and PRFC (1995) will 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. Only the Choptank River will be stocked beginning in 2011.
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 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	Continue 2009	PA prohibits the harvest of shad. The recreational catch and release fishery below Conowingo Dam will continue. No Alosa MRFSS data is available after 2008.
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.	2.1 Maryland, Pennsylvania and Virginia will participate in the ongoing ASMFC alosid 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.	Continue 2010	MD, VA, and PRFC participate in the ASMFC shad management board and technical committee. ASMFC conducted a stock assessment in 1997. In 1999, Amendment 1 to the ASMFC coastal shad plan adopted a strategy to keep fishing mortality below F_{30} . The next stock assessment update to be peer-reviewed is scheduled for 2005. ASMFC Amendment 3 changed the American shad mortality threshold to Z_{30} (total mortality). American shad and river herring mortality rates have been increasing. Alosa bycatch in Atlantic ocean fisheries are contributors, but data is limited.
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 indicate that the coastal fishery is mixed and highly variable from year to year.

1989 Chesapeake Bay Alosid Management Plan Implementation Table (updated 6/7/2011)

Strategy	Action	Date	Comments
	2.2 B) Control the coastal intercept fishery through a combination of gear restrictions, seasonal and area closures, and harvest limits	1993 2005	ASMFC Amendment #1 requires a closure of the coastal intercept fishery by December 2004. - Moratorium on the harvest of shad from coastal waters as of January 1, 2005.
	2.2 C) Continue to monitor and document its territorial sea intercept fishery for American shad	1993 2004	MD and VA are 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	The harvest of river herring has declined for a number of reasons.
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	River herring bycatch is being monitored under the MAFMC Squid, Mackerel and Butterfish FMP.
	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	River herring bycatch is being monitored under the MAFMC Squid, Mackerel and Butterfish FMP.
	2.3.2 c) Intercept fisheries will be discouraged.		
3.1 The jurisdictions will collect specific data on alosid species to improve stock assessment databases.	3.1 A) Maryland will continue the alosid 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 2011	On-going VIMS, MD DNR and DCFM alosine juvenile surveys. - The last several years indicate an increase in juvenile Alosines. ASMFC Amendment 2 requires river herring JAI surveys. -VA & MD continue to provide important data to coastal stock assessment MD is developing alewife and blueback herring JAIs. 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 2009 Continue	Adult shad project on the Nanticoke River was discontinued 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.

1989 Chesapeake Bay Alosid Management Plan Implementation Table (updated 6/7/2011)

Strategy	Action	Date	Comments
		Continue	<p>- MD DNR is planning to continue a comparable survey through the 2012 moratorium. Development of survey methods has not been discussed.</p>
	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)	Continue	<p>Commercial landing data has been improved on a coastwide basis with the establishment of ACCSP. - Shad still caught as bycatch.</p>
	3.1 D) The VMRC Stock Assessment Program will provide additional fishery dependent data collection for Virginia's shad fisheries (on-going)	Continue	
	3.1 E) Virginia will initiate an ocean intercept tagging program to determine stock composition in the coastal shad fishery (1990)	1991-1992	<p>Tagging work completed in 1992. - Results indicated coastal catch is mixed and highly variable. - Other tagging work has been discussed</p>
	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)	Continue	<p>Mortality rates have been calculated for herring on the Nanticoke River. Exploitation rates for river herring have not been a priority.</p>
	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)	2009	<p>A map of historic shad and herring spawning areas has been completed. Tributary-specific targets are being considered. - The FMPC and ad hoc Fish Passage workgroups have met to discuss how to address the development of targets. - CBSAC sponsored a workshop to evaluate different methodologies and recommended a multi-metric approach. A 'white paper' to address the C2K is being drafted and scheduled for completion by December 2004. ASMFC Amendment 2 requires adult river herring spawning/population assessment.</p>
	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)	Continue	<p>DCFM has been sampling the upper Potomac for shad and river herring since 1991. A juvenile survey on the Potomac indicates shad are increasing in abundance. - The 2003 JAI was 2.73 (GM)</p>

1989 Chesapeake Bay Alosid Management Plan Implementation Table (updated 6/7/2011)

Strategy	Action	Date	Comments
<p>4.1 The Chesapeake Bay Program’s Fish Passage Workgroup has analyzed the problem of impediments to alosid 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 SRAFRFC and continue to promote fish passage at structures on the Susquehanna River tributaries having the potential for alosid 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.</p>		<p>2011</p>	<p>There is no relationship between American shad JAI and spawning adult abundance.</p>
	<p>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:</p> <p>A) Permanent fish passage facilities are being designed and will be constructed at Conowingo Dam at a cost of \$12.5 million. (1989)</p>	<p>Variable</p> <p>2009</p>	<p>Completed</p> <p>The last significant blockage in MD for spawning American shad passage is the Conowingo Dam.</p> <p>Many blockages to river herring spawning habitat remain.</p>
	<p>4.1 B) Design planning and implementation of fishways at Holtwood, Safe Harbor and York Haven dams on the Susquehanna River. (In progress)</p>	<p>1986</p> <p>continue</p>	
	<p>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)</p>	<p>1990</p>	
	<p>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)</p>	<p>Continue</p> <p>2009</p>	<p>1,838 miles of Chesapeake Bay stream habitat was reopened in PA, VA, and MD for anadromous fish from 1988 through 2005.</p> <p>The revised fish passage goal is now 2,807 miles of steam opened by 2025.</p> <p>Between 1986 and 2003, more than 340 million American shad fry and fingerlings were cultured</p>

1989 Chesapeake Bay Alosid Management Plan Implementation Table (updated 6/7/2011)

Strategy	Action	Date	Comments
		<p>2010, continue</p> <p>2010, continue</p> <p>2012</p>	<p>and released in Susquehanna, James, Pamunky, Mattaponi, Rappahannock, Potomac & Choptank rivers.</p> <p>Stocking began on the Rappahannock River in 2003.</p> <p>Hickory shad abundance has increased in the Patuxent River and stocked will be discontinued in 2011. Stocking will only continue in the Choptank River as of 2011.</p> <p>MD is only stocking American shad in the Choptank River as of 2011. Patuxent River and Marshyhope Creek are no longer being stocked due to a loss of wild spawning adults.</p> <p>Experimental stocking of American shad, hickory shad, and river herring in the Patapsco River will begin in 2012</p>
	<p>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)</p>	<p>Completed</p>	<p>Elkton dam fishway was built in 1993. Since then, thousands of herring and resident fish have used the fishway to access 12 miles of upstream habitat for spawning, forage, and cover.</p> <p>Fish Passage staff have documented over 7,000 alewife and blueback herring using the fishway (1999).</p> <p>The number of herring using the fishway has significantly decreased since 2005. This is the same time frame for the coast wide decline of both shad and herring.</p> <p>The stream area around the ladder was dredged in 2005 to increase its effectiveness.</p>
	<p>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)</p>	<p>2009-2013</p> <p>2010</p>	<p>Under consideration during the FERC relicensing for Conowingo and Holtwood dams.</p> <p>Holtwood Dam is being renovated to improve upstream passage of Alosa.</p>
	<p>4.1 G) Fish passage facilities on the James and</p>	<p>1999</p>	<p>Vertical slot fishway completed at Boshers Dam on</p>

1989 Chesapeake Bay Alosid Management Plan Implementation Table (updated 6/7/2011)

Strategy	Action	Date	Comments
	Rappahannock Rivers will be established. (Currently being implemented)	2005	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 tributaries. 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	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.	2002 Completed	A hydraulic model study of Little Falls Dam fish passage was completed.
	4.1 In addition to the strategies detailed in the Fish Passage Plan, several aspects must be coordinated with the Fishery Management Plan: J) Sources of adult fish used for restocking areas will be coordinated with other states and agencies. (1990)	Continue	Standardized hatchery-rearing methods in practice. All American shad broodstock used by MD, VA, PA, and USFWS are from the Potomac River.
	4.1 K) The reintroduction of alosid stocks will require specific regulatory measures to protect the newly-introduced fish until populations have been established.	Continue 2012	Moratorium in place for American and hickory shad. Regulations to protect reintroduced herring have not been implemented. - Moratorium goes into effect Jan 1, 2012.
	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. Boshers Dam vertical slot fishway is monitored for passage each spring. American shad plus 23 other species are known to use the passage. Fishways are monitored on a limited basis as new ladders are constructed. A new 10 year fish passage goal will require all

1989 Chesapeake Bay Alosid Management Plan Implementation Table (updated 6/7/2011)

Strategy	Action	Date	Comments
			new fish passage projects be monitored to ensure they are passing fish. Fishway efficiency has been difficult to measure.
<p>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.</p>	<p>4.2.1) Maryland and Pennsylvania will continue to work within SRAFRFC'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.</p>	<p>Continue 2002</p> <p>2010</p>	<p>SRAFRFC adopted a new Alosine Management and Restoration Plan for the Susquehanna River Basin in 2002.</p> <p>A revised SRAFRFC Management and Restoration Plan has been completed.</p>
	<p>4.2.2 A) Maryland, Pennsylvania, and Virginia working within SRAFRFC, will promote using Susquehanna River brood stock for hatchery production.</p>	<p>Continue 2002</p>	<p>PA broodstock are being collected from the Susquehanna River.</p> <p>MD, VA, PA, and USFWS use American shad brood stock collected from the Potomac River. MD discontinued using Susquehanna River brood stock in 2002. USFWS recently discontinued their use. Susquehanna River American shad spawned at MD hatcheries have had poor fertilization rates. The cause has not been determined. Normandeau Associates, Inc. spawns Susquehanna River American shad for stocking in PA.</p>
	<p>4.2.2 B) Virginia will expand funding to the recently constructed Pamunky/Mattaponi Indian Reservation shad hatcheries.</p>	<p>1993</p>	<p>CBP provided limited funds for hatchery work</p>
<p>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.</p>	<p>4.3.1 The following technical issues have been accepted.</p> <p>A) Adoption of Maryland water quality standard for dissolved oxygen of 5.0 mg/liter in the Susquehanna River below Conowingo Dam (1989)</p>	<p>Continue</p>	<p>Standards were implemented in 1989 and have been monitored ever since. New water quality criteria for living resources have been adopted. During the present FERC relicensing of Conowingo Dam on the Susquehanna River, Maryland is insisting on establishing sampling protocols for water quality.</p>
	<p>B) Installation of turbine venting systems and intake air injection capabilities (1991)</p>		
	<p>C) Operation of turbines as necessary to meet the D.O. standard (1989)</p>		
	<p>D) Monitored spills as necessary (1989)</p>		
	<p>E) A schedule of minimum and continuous flows</p>		

1989 Chesapeake Bay Alosid Management Plan Implementation Table (updated 6/7/2011)

Strategy	Action	Date	Comments
	(1989)		
<p>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.</p>	<p>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).</p>	<p>2007 2011</p>	<p>Maps delineating particular habitats of concern have been utilized for developing water quality standards. Revised habitat prioritization maps have been completed by CBP.</p>
<p>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 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.</p>	<p>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.</p> <p>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.</p>	<p>Variable May 12, 2009 2010</p>	<p>New commitments were established in the new Chesapeake 2000 Agreement. Of particular importance to Alosines will be the assessment of priority migratory species populations and the development of tributary-specific target. STAC sponsored a workshop during 2001 to address targeting efforts. A document to address the targets is under development.</p> <p>An executive order by President Barack Obama required federal agencies to increase cooperation and leadership, coordinate with state and local government, and enforcement of the clean water act by EPA.</p> <p>EPA is mandating restoration criteria and actions for Chesapeake Bay States. - EPA has developed a Chesapeake Bay watershed TMDL. - States must have plans approved by EPA of face possible fines or other sanctions.</p>
	<p>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</p>		

1989 Chesapeake Bay Alosid Management Plan Implementation Table (updated 6/7/2011)

Strategy	Action	Date	Comments
	<p>in urban and agriculture runoff. 4) Reduce chlorine discharges to critical finfish areas.</p>		
	<p>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.</p>	<p>2011</p>	<p>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.</p> <p>MD DNR Fisheries Service is researching spawning and hatch success with associated habitat and watershed conditions.</p>
	<p>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 Marylands 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 noncontrol mitigative techniques that are feasible to control acid deposition into the Bay.</p>		

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 – Distric of Columbia Fisheries Management
 EBFMP – Ecosystem Based Fisheries Management

FERC – Federal Energy Regulatory Commission
FMP - Fishery Management Plan
FMPC – Fisheries Management Planning and Coordination
GM – Geometric Mean
JAI – Juvenile Abundance Index
MAFMC – Mid-Atlantic Fisheries Management Council
MD DNR – Maryland Department of Natural Resources
PRFC – Potomac River Fisheries Commission
SRAFRC – Susquehanna River Anadromous Fish Restoration Committee
STAC= Chesapeake Bay Program, Scientific and Technical Advisory Committee
VIMS – Virginia Institute of Marine Science
VMRC – Virginia Marine Resource Commission

2010 Maryland FMP Report (July 2011)

Section 3. Atlantic croaker (*Micropogonias undulatus*) and Spot (*Leiostomus xanthurus*)

Chesapeake Bay FMP

Croaker and spot are the most sought after species by bottom-fishing anglers in the mid to lower portions of the Chesapeake Bay. The Chesapeake Bay Atlantic Croaker and Spot Fishery Management Plan (FMP) was adopted in 1991. The FMP 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, 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 and have successfully reduced the number of small fish caught in the trawl fishery.

Atlantic croaker - Biological reference points (BRPs) for croaker was established for the mid-Atlantic region in 2005 (ASMFC Amendment 1). The BRPs were revised in 2011 (Addendum 1) following the 2010 ASMFC stock assessment and apply to the entire Atlantic coastal stock. The BRPs define overfishing and set targets for female spawning stock biomass and fishing mortality. If $F/F_{MSY} > 1$, overfishing is occurring; if $SSB / (0.70 * SSB_{MSY}) < 1$, the coastal stock is overfished.

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 estimates¹. Juvenile indices (seine and trawl) have been calculated for every year since 1959.

Spot - Maryland is part of the Spot Plan Review Team (PRT) and has prepared a status report to the PRT². The ASMFC South Atlantic State-Federal Fisheries Management Board voted in March 2011 to schedule hearings on a draft omnibus amendment for spot, spotted seatrout and Spanish mackerel. Commercial and recreational management measures or recommendations, adaptive management, and monitoring recommendations are available for public comment³. A management trigger for spot is included in the draft omnibus amendment and will help the ASMFC Management Board in monitoring the status of the stock until a full coastwide stock assessment can be completed.

Stock Status

Atlantic croaker – According to the 2010 benchmark assessment⁴, overfishing is not occurring but the overfished status could not be determined due to data limitations. Monitoring data from Maryland's portion of the Chesapeake Bay indicate a broadening size and age structure. Atlantic croaker is; now considered a single stock along the entire Atlantic Coast.

Spot – 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 MD. For the Chesapeake Bay, a JI is calculated for spot from the MD DNR Blue Crab Trawl Survey (BCS) and another from the Striped Bass Juvenile Seine Survey (JSS). In addition to the Chesapeake Bay JIs, two coastal bay JIs are derived from trawl and seine data. The indices showed a sharp decline in 2009², but both Chesapeake Bay juvenile indices indicated a very strong 2010 year class.

Management Measures

There are currently no management measures required by ASMFC to restrict the commercial or recreational fisheries for either croaker or spot. 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 and a 9 inch minimum size limit. There are no harvest restrictions for spot.

The Fisheries

Figure 1. Maryland commercial landings of Atlantic croaker, 1929-2010, with mean line (2010 landings preliminary; NMFS and Maryland DNR)

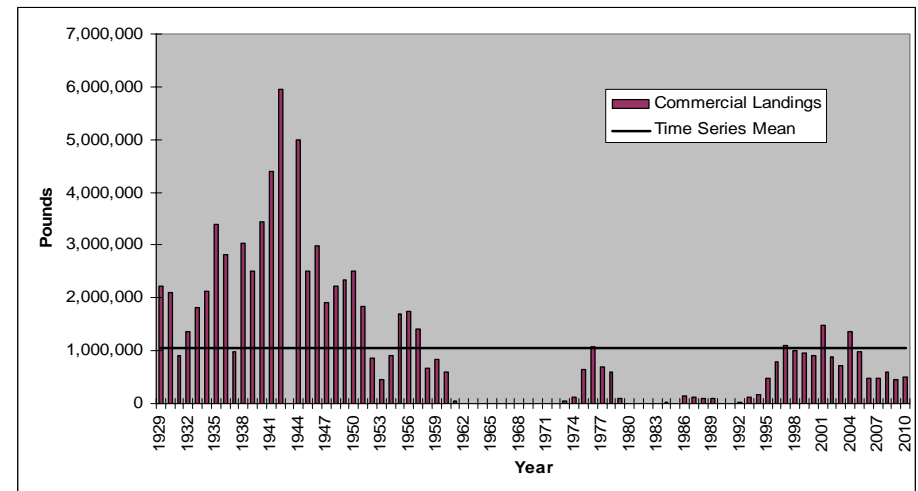


Figure 2. Maryland recreational MRFSS Atlantic croaker harvest and release estimates with mean line, 1981-2010 (NMFS).

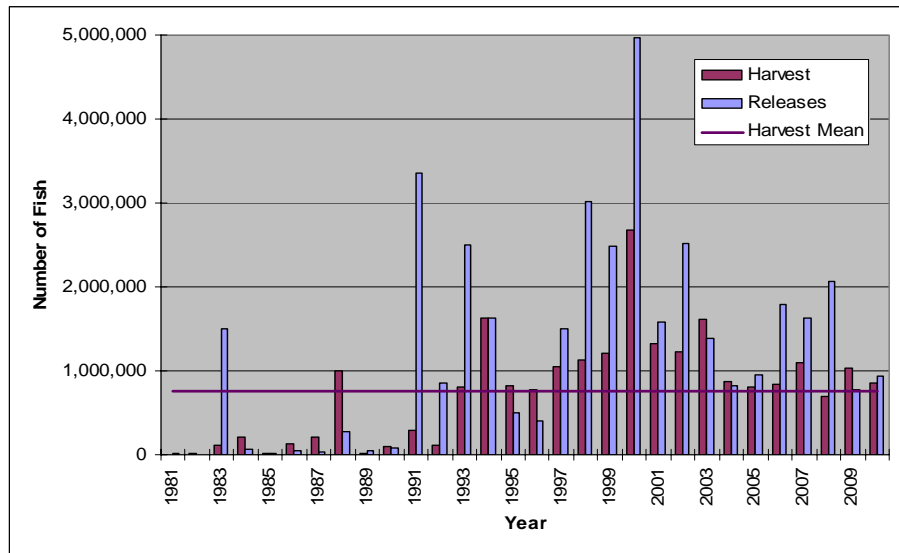
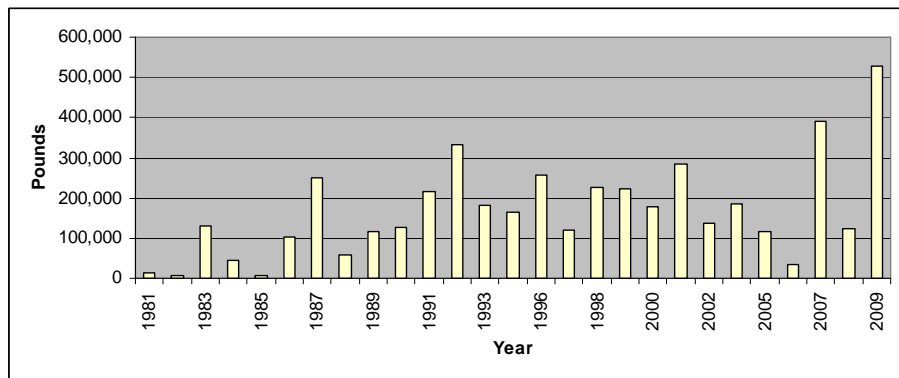


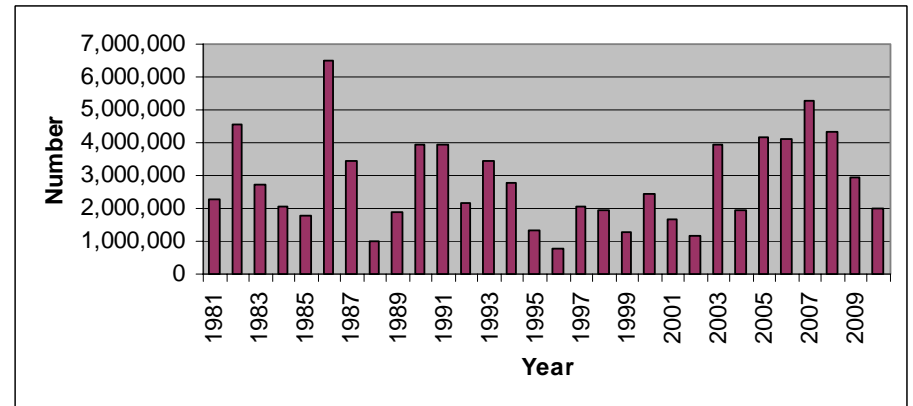
Figure 3. Maryland commercial landings of spot, 1981-2009. (NMFS and Maryland DNR)



References:

¹ Rickabaugh, H. 2011. Maryland Atlantic Croaker (*Micropogonias undulatus*) Compliance Report to the Atlantic States Marine Fisheries Commission – 2010. Maryland Department of Natural Resources Fisheries Service June 2011

Figure 4. Maryland recreational MRFSS spot harvest estimates, 1981-2010. (NMFS).



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 stock. Both species are caught indirectly and together during other fishing activities and 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 area⁵

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. With increasing temperatures due to climate change, croaker are predicted to expand their distribution northward.

References (cont'd)

² Rickabaugh, H. and K. Capossela. 2011. Evaluation of the Status of Spot in Maryland – 2010. Maryland DNR Fisheries Service doc. 6-23-2011.

³ ASMFC. 2011. Draft Omnibus Amendment to the Interstate Fishery Management Plans for Spanish Mackerel, Spot, and Spotted Seatrout. Fishery Management Report of the Atlantic States Marine Fisheries Commission. Arlington VA.

⁴ ASMFC. 2010. Atlantic Croaker 2010 Benchmark Stock Assessment. Washington DC.

⁵ Peuser, R (editor). 1996. Estimates of finfish bycatch in the south Atlantic shrimp fishery. Final Report of the SEAMAP-South Atlantic Committee: Shrimp Bycatch Work Group. Washington DC: Atlantic States Marine Fisheries Commission.

1991 Chesapeake Bay Program Atlantic Croaker and Spot Fishery Management Plan Implementation (updated 06/11)

Problem Area	Action	Date	Comments
<p>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.</p>	<p>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.</p>	<p>2005 2009 Continue</p>	<p>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. Current estimates of F and SSB indicate that the croaker stock is healthy and overfishing is not occurring (ASMFC 2009). 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 Chesapeake Bay Seine Survey is one of several state and regional reports considered for proposing management triggers. MD commercial landings for croaker during 2009 were 597K lbs, down from 872K in 2008. VA commercial landings of croaker dropped from 11.3 million pounds in 2008 to 8.6 million pounds in 2009. Estimated MD recreational harvest of croakers was 1.8 million fish in 2009 and 1.7 million in 2010. VA has far greater recreational harvest with 12 million fish in 2009 and 9.4 million in 2010. Commercial landings for spot during 2008 were 124K lbs & 2 million lbs for MD & VA, respectively and 529K and 3.9 million in 2009. Estimated spot recreational harvest for 2009 from MD & VA were 3 million and 4.5 million and 2 million and 3.3 million in 2010.</p>
	<p>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.</p>	<p>Continue 1993</p>	<p>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 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.</p>
	<p>Action 1.2.2 CBP jurisdictions will evaluate the need to implement a minimum size limit for spot.</p>	<p>1992 2009</p>	<p>No recommendations have been made. There is some concern over declining juvenile abundance. Georgia is the only coastal state with a size limit (8"). The ASMFC has proposed the development of an amendment to the coastal spot FMP by 2011.</p>

1991 Chesapeake Bay Program Atlantic Croaker and Spot Fishery Management Plan Implementation (updated 06/11)				
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. The 2004 Croaker Stock Assessment indicated that the coastal states have been 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. The shrimp bycatch will be considered as part of the next benchmark assessment (ASMFC 2010). Spot up to age 3 are regularly represented in the commercial fishery. Spot age 4 to 6 years are not seen every year and when present, only account for a small percentage of 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. 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
	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. Recommendations for spot include: monitoring data; improving catch and effort statistics; and developing stock assessment analyses.	

1991 Chesapeake Bay Program Atlantic Croaker and Spot Fishery Management Plan Implementation (updated 06/11)			
Problem Area	Action	Date	Comments
<p>Habitat and Water Quality Issues Habitat alteration and water quality impact the distribution of finfish species in the Chesapeake Bay</p>	<p>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</p>	<p>Continue 2000 on-going</p>	<p>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.</p>

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

2010 Maryland FMP Report (July 2011) Atlantic Menhaden (*Brevoortia tyrannus*)

Due to an error in the 2009 coastal stock assessment model for Atlantic menhaden, the status of the coastal stock was corrected in 2010. Currently, the stock is not overfished but overfishing occurred in 2008 (the last year of data in the 2009 stock assessment). This is the first time since 1998 that the stock has experienced overfishing. However, the stock has been overfished in 32 of the last 54 years (Figure 1).

A coastal Atlantic menhaden fishery management plan (FMP) was developed by the Atlantic States Marine Fisheries Commission (ASMFC) in 1981. Subsequently, the plan was revised in 1992 and the stock is currently managed under Amendment I (2001) and several addendums (2004, 2005, 2006, 2009). Since the 2009 coastal stock assessment was updated and revised in 2010, new biological reference points to increase abundance and spawning stock biomass have been proposed (ASMFC draft addendum V). A high priority has also been placed on developing ecosystem-based reference points to address the forage needs of predator species. However, this is 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. However, menhaden is one of the species slated for the development of an ecosystem-based fishery management plan (EBFMP). Maryland Sea Grant is facilitating the EBFM process and biological briefs on key ecosystem topics for menhaden in Chesapeake Bay have been completed. More information on the EBFM process 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. The BRPs are based on fecundity and fishing mortality; and are used to assess the status of the stock. A recent benchmark assessment was conducted during 2009, peer reviewed, and released in 2010. The assessment included data only through 2008 and two new components were added: a factor for aging error and natural mortality rates that varied with age and time of year. After the release of the stock assessment results, an error was found and corrected in one of the codes of the stock assessment model. The revised results indicated that overfishing was not occurring but that the stock was overfished in 2008. Other indicators of stock status especially recruitment indices (Figure 2) suggest that the current BRPs need to be reevaluated. The ASMFC menhaden technical committee will be developing a range of new alternative BRPs and a range of management strategies to achieve the BRPs by late fall 2011. The new BRPs will include a greater degree of protection for the spawning stock and account for predation.

Management Measures

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 metric tons) for the reduction fishery in Chesapeake Bay. If harvest is less than the cap, there is the flexibility to capture additional fish the following year but not over 122,740 metric tons. The cap was originally in place until 2010 but has been extended to 2013. The development of new BRPs may affect the harvest cap.

The Fishery

Maryland commercial fishermen harvested 6.89 million pounds of menhaden in 2010 (Figure 3). Virginia commercial fishermen harvested 351.40 million pounds in 2009 (Figure 4). Although there is a cap on the purse seine harvest from the Chesapeake Bay, the cap has not been reached since it was implemented in 2006.

Issues/Concerns

Menhaden have a unique role in the Chesapeake Bay ecosystem as both a primary filter-feeder and an important forage species for top predators. Menhaden also support a major fishery and are the Bay's largest fishery by weight.

Figure 1.

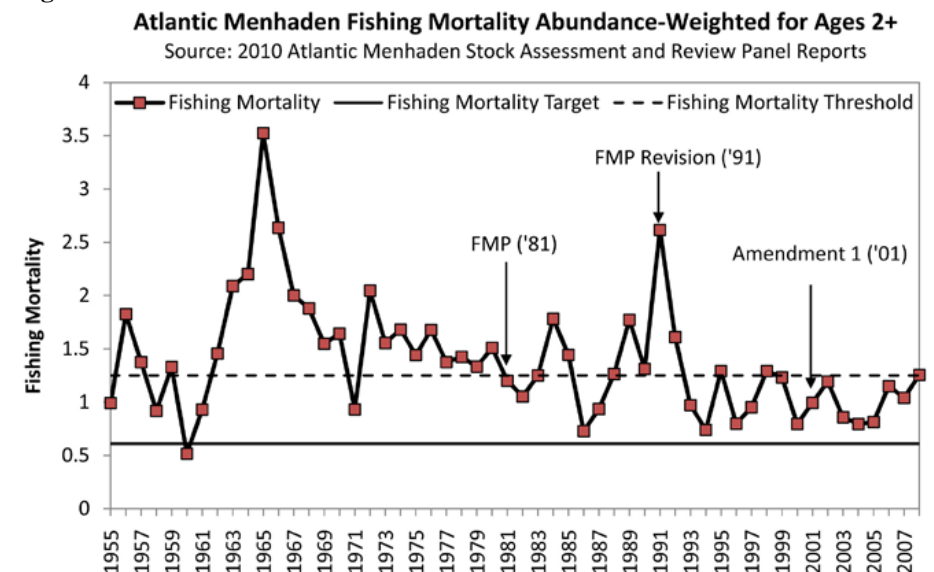
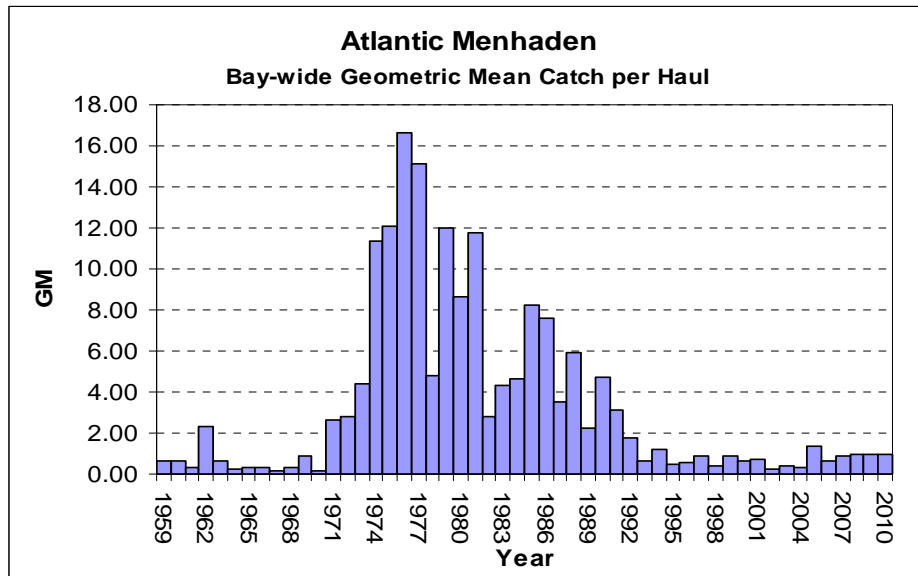
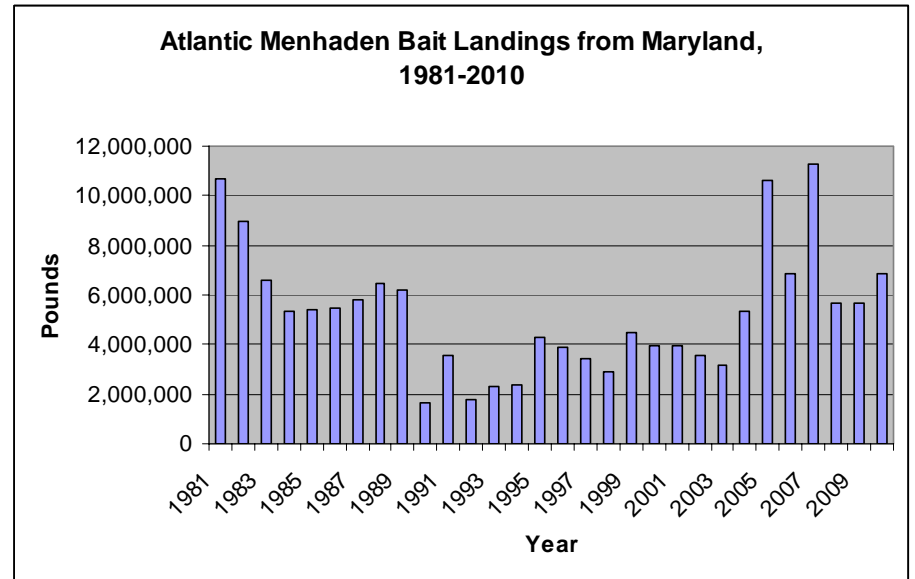


Figure 2. Geometric mean catch per haul of menhaden juveniles in the Maryland portion of the Chesapeake Bay.



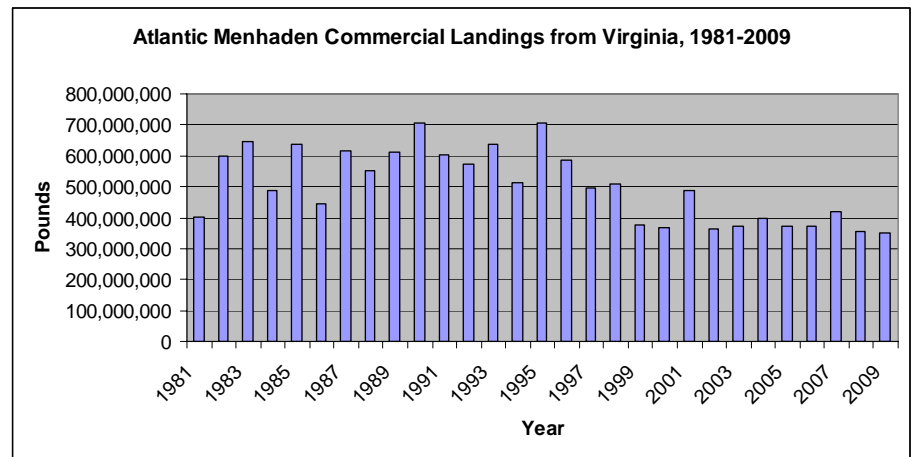
(from Durell et al. 2010)

Figure 3. Atlantic Menhaden Bait Landings from Maryland



(MDNR data)

Figure 4. Atlantic Menhaden Landings from Virginia



(NMFS data)

2010 Maryland FMP Report (July 2011)
Section 5. Black Drum (*Pogonias cromis*)

Chesapeake Bay FMP

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. The CBFMP is currently the only regional FMP for black drum on the Atlantic Coast. Delaware and New Jersey have discussed the development of a joint DE-NJ black drum FMP. The ASMFC Interstate Fisheries Management Program Policy Board has discussed the potential for developing a coastal black drum FMP. If an FMP is pursued it would serve as a framework for precautionary measures since data is most likely insufficient for a formal stock assessment. The 2010 ASMFC Action Plan goal is to “strengthen cooperative research capabilities, data collection, and the scientific basis for stock assessments to support fisheries management actions”. Strategies listed to achieve this goal include evaluating the extent of fishery-independent and dependent data collections for black drum, evaluating the status of the coastal black drum stock, and determining whether or not coastal management is warranted.

Stock Status

There is no formal stock assessment of black drum from the Chesapeake Bay or the Atlantic Coast and the stock status is unknown. Tagging data suggest there is one Atlantic coastal stock. Maryland has some data from 1999 but very little since that time. Virginia indicated that black drum did not appear to be overharvested (2005), but they cautioned that “many unknowns surround the stock and its harvest”. Some biological information is available from Gulf of Mexico black drum but evidence suggests that this is a separate stock.

Current Management Measures

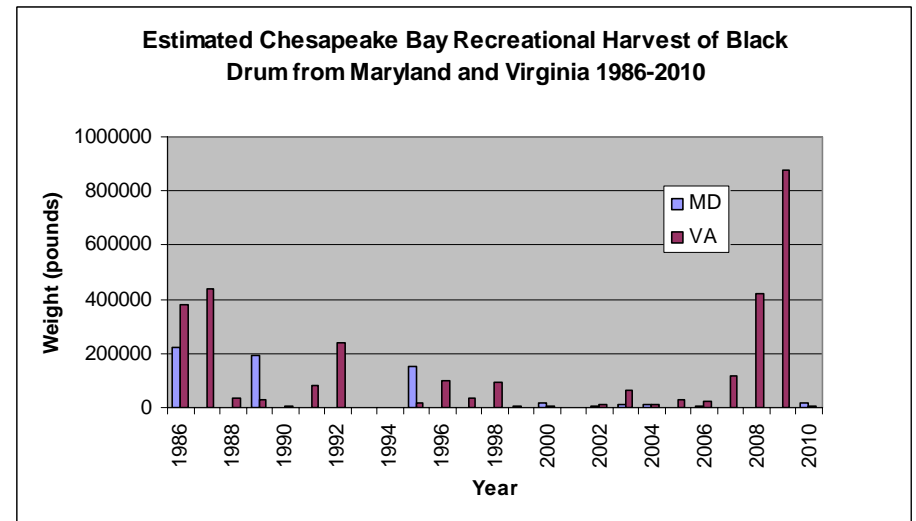
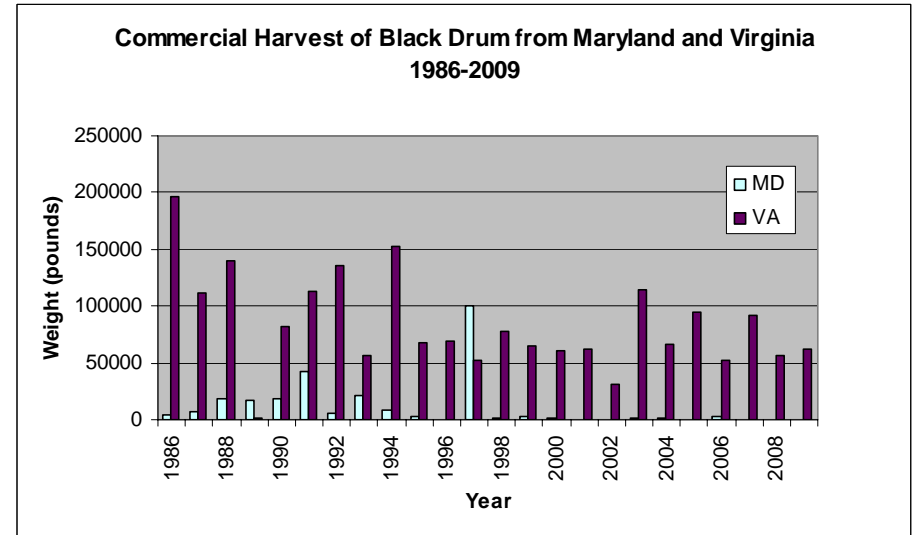
Maryland closed its Chesapeake Bay commercial black drum fishery in 1999. Virginia manages its commercial fishery through limited entry and a quota. Size limits and catch reporting are also required. Virginia established a management zone in the southeast portion of the Chesapeake Bay for black drum, further restricting some commercial gear. Both states limit recreational harvest to one fish over 16”.

Issues/Concerns

Age-growth studies by ODU 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 addition, the 16” minimum size limit does not protect mature females.

The Fisheries



(data from NMFS and MRFSS; 2010 landings preliminary)

1993 Chesapeake Bay Program Black Drum Implementation (updated 12/09)

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	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 plans to conduct a data workshop to discuss state black drum data for possible inclusion in a future ASMFC FMP.
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
	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 is 1500 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. Juveniles utilize shallow water. MD records juvenile black drum collected in seine and trawl surveys of the Coastal Bays. Black drum feed on crabs, oysters, mussels and clams within the Bay.

2011 Maryland FMP Report (July 2011)

Section 6. Black Sea Bass (*Centropristis striata*)

Chesapeake Bay FMP

Black sea bass support important recreational and commercial fisheries on Maryland's coast. The majority of black sea bass are caught in federal waters (>3 nautical miles offshore) where natural hard bottom and cold water corals can be found. The coastwide stock was declared rebuilt in 2010. However, data suggest that a regional management program may be more appropriate for black sea bass.

The Chesapeake Bay and Atlantic Coast Black Sea Bass Fishery Management Plan (CB FMP) was adopted in 1996. At that time, the black sea bass stock was overfished. The CB FMP was developed to reduce fishing mortality particularly on juvenile black sea bass. The Chesapeake Bay is a nursery area 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 under a joint ASMFC and MAFMC multispecies FMP that was approved in 1996. Black sea bass are one component of the 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 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 were developed to designate special management zones around artificial reefs. A progressive implementation schedule was instituted to increase minimum size, 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 threshold and target exploitation rate. 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

The ASMFC's Technical Committee for black sea bass concluded in 2010 that the black sea bass stock has been rebuilt. This determination was made based on revised biological reference points (BRP). The new fishing mortality (F) target is $F_{40\%} = 0.42$ and the spawning stock biomass (SSB) target is $SSB_{40\%} = 27.6$ million pounds. A spawning stock biomass threshold was established to determine if black sea bass are overfished. The $SSB_{\text{threshold}}$ is $\frac{1}{2}SSB_{40\%}$ or 13.8 million pounds. Currently $F = 0.26$ and $SSB = 28.6$ million pounds. Black sea bass are not overfished since SSB is well above $SSB_{\text{threshold}}$, and overfishing is not occurring since the fishing mortality rate is below $F_{40\%}$. Consequently, the technical committee determined the black sea bass stock to be rebuilt. The next assessment update will be completed in 2011.

Black sea bass are protogynous hermaphrodites. They begin life as a female but between ages 2 to 5 they change sex becoming male. A new stock assessment methodology was used in 2009 because of black sea bass' unusual life cycle. Managing a protogynous species increases the amount of uncertainty associated with stock assessments so the reference points and current stock status should be viewed with caution².

Trawl and beach seine surveys 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.

Current Management Measures

The coastwide recreational sector is allocated 51% of the total allowable catch and the commercial fishery is allocated the remaining 49%. Maryland receives 11% of the coastwide quota. Within a given fishing season, excess quota in one state can be transferred to another state that has not exceeded its quota. Black sea bass coastwide harvest exceeded the target harvest by 1.15 million pounds (Figure 1). Exceeding the recreational harvest target in 2010 will result in more conservative coastwide management measures for 2011. However, the ASMFC Management Board approved state-by-state [catch] shares and regulations. Maryland's harvest, combined with Delaware's and Virginia's, is less than 3% of the coastwide harvest. Maryland DNR will continue its 2010 regulations as no harvest reduction measures are necessary for 2011.

Recreational anglers are limited by a 12½" minimum size and 25 fish per person per day. The recreational fishing season is from May 22 to December 31. An October 12 to 31 seasonal closure was implemented in 2010 and will continue in 2011.

The Maryland commercial black sea bass fishery is bound by limited entry. A finite number of permits exist, which requires an individual to arrange for a permit transfer prior to entering the fishery. 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's proportion of the prior year's total harvest in Maryland. A vessel is not allowed to land black sea bass in excess of a permit's allotted quota. Quota is allocated among four commercial sectors: 87% pots, 11% trawl, 1% hook and line, and 1% for all other fishing gear. Persons 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.

The Fisheries

ASMFC does not allocate recreational quota to the states, instead, a coastwide total allowable landings (TAL) quota is assigned (Figure 1). The 2010 recreational TAL was 1.83 million pounds and the TAL for 2011 is 1.78 million pounds. Maryland's recreational anglers harvested 23,131 pounds in 2010 (Figure 1). The average fish caught was approximately 13 inches total length. ASMFC set the 2010 coastwide commercial quota at 1.76 million pounds and at 1.71 million pounds for 2011. The 2010 quota for commercial harvest was 193,447 pounds and 149,438 pounds were harvested (Figure 2). The 2011 commercial quota for Maryland was set at 188,219 pounds.

Figure 1. Black sea bass harvested by the recreational fishery in Maryland: 1981-2010 (ASMFC, NMFS). ASMFC began implementing a coastwide total allowable landings (TAL) limit in 1998.

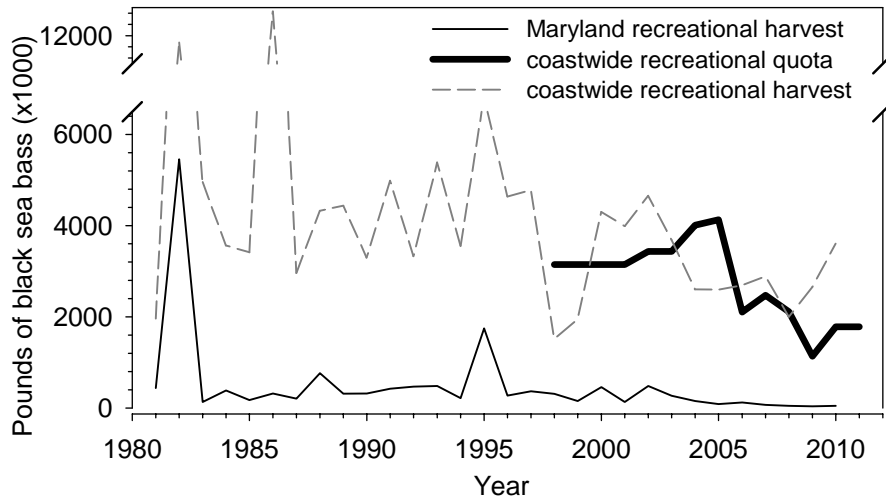
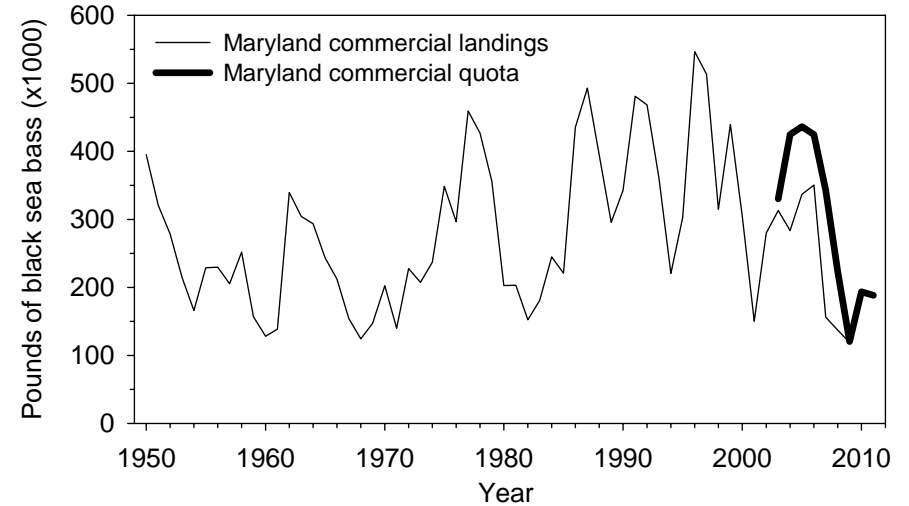


Figure 2. Black sea bass harvested by the commercial black sea bass fishery in Maryland: 1950 - 2009. Quota for 2010 and 2011 are included. (ASMFC, NMFS)



Issues/Concerns

Tagging results indicate that black sea bass migration is limited to regional scales. The current stock assessment does not consider regional differences that may exist in the black sea bass stock. An age-based model that uses tagging data can accommodate regional variability and should be evaluated.

Maryland DNR is exploring mechanisms to improve regulatory consistency among the black sea bass, summer flounder and horseshoe crab commercial fisheries to streamline the coastal commercial permit process while allowing for some flexibility.

References

- ¹ Personal communication from the National Marine Fisheries Service, Fisheries Statistics Division. June 2011.
- ² Shepherd GR. 2009. Black sea bass 2009 stock assessment update. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 09-16; 30 p.

1996 Chesapeake Bay and Atlantic Coast Black Sea Bass Fishery Management Plan Implementation Table (updated 7/2011)

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 2003 2004 2009 Continue	BSB have exceeded the survey index since 2003 and are not considered overfished. 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. In MD, individual commercial BSB quota and limit are identified on a BSB card. Non permitted individuals are limited to landing ≤50 lbs. MD & VA have a 11" minimum size limit for the commercial fishery. MD recreational minimum BSB size limit increased to 12.5" with a creel limit of 25/person/day VA recreational minimum BSB size limit increased to 12.5" with a creel limit of 25/person/day. No changes in size or creel limits during 2010.
	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 2003 2010 2011	Amendment 13 of the MAFMC and ASMFC's Summer Flounder, Scup and 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. 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. MD & VA implemented recreational closures from January 1 to May 21 and October 12 to October 31. A new stock assessment will begin in 2011.
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.	Continue	PRFC has tested plastic escape panels for pound nets.
	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.	Continuing	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	1996	Mesh size requirements for the commercial fishery are appropriate for the minimum size requirements.

1996 Chesapeake Bay and Atlantic Coast Black Sea Bass Fishery Management Plan Implementation Table (updated 7/2011)

Strategy	Action	Date	Comments
	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.	1980 1981 1992 2004	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. Smaller nets must have a minimum mesh size of 4 ½” throughout; smaller nets must have 4.5” 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 dimensions. 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 in diameter; b) Magnesium alloy, timed float releases (pop-up devices), or similar magnesium alloy fasteners; or c) ungalvanized or uncoated iron wire of 0.09” or less in diameter.
	1.2e) The jurisdictions will define a BSB pot for enforcement requirements as recommended by the MAFMC.	2002 2008	Has not been implemented 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 device, without associated wings or leads, consisting of: (a) An enclosure of various shapes covered with 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 in diameter; b) Magnesium alloy, timed float releases (pop-up devices), or similar magnesium alloy fasteners; or c) ungalvanized or uncoated iron wire of 0.09” or less in diameter. Pots and traps having wooden slats will remove one set of 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	2.1a) Research on effects of hermaphroditism 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	Continuing 2009	Although the stock has been rebuilt, management measures have been kept conservative because of unknown population dynamics due to hermaphroditism. A new stock assessment methodology was used to address the increased uncertainty because black sea bass are protogynous.


1996 Chesapeake Bay and Atlantic Coast Black Sea Bass Fishery Management Plan Implementation Table (updated 7/2011)

Strategy	Action	Date	Comments
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.	for BSB in this region.		
	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 major 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 male, ranging from ages 0 to 2. From 2002 to 2006 >75% were female, except in 2005 (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 net fishery as part of a two year pound net study funded by the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA).	Continuing	
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 underfished, but the stock is not overfished. ASMFC Technical Committee declared stock rebuilt. Revised BRPs are 0.42 and $SSB_{40\%} = 27.6$ million pounds. Overfished threshold is $SSB_{threshold} = 13.8$ million pounds ($\frac{1}{2}SSB_{40\%}$). In 2010 $F = 0.26$ and $SSB = 28.6$ 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	The MRFFS program is in the process of being revamped.
	2.3c) MD will require mandatory reporting for all black sea bass landed in Maryland, wherever harvested.	Continuing	Data is included in the 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	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

1996 Chesapeake Bay and Atlantic Coast Black Sea Bass Fishery Management Plan Implementation Table (updated 7/2011)

Strategy	Action	Date	Comments
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.		2008	<i>Crasostrea virginica</i> (native oyster) and not <i>Crasostrea ariakensis</i> (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.
	3.1aB) MD and VA will continue the implementation of the Aquatic Reef Habitat Plan.	2010	MD completed Amendment 1 to the OMP in 2010. The oyster restoration through the enhanced sanctuary strategies increased the amount of protected oyster habitat from 9% to 25%.
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	Artificial Reef Committee, Maryland Artificial Reef Initiative, and Maryland Artificial Reef Management Plan were developed and several reefs have been created in Bay and the Atlantic Ocean. In VA, artificial reefs are being funded through Recreational Advisory Board. artificial reefs created by funds from recreational license revenues adhere to 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) 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.
	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 dredging in VA) in or near SAV beds.
	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. <ul style="list-style-type: none"> • 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. • 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 	Continue 2003	MD implemented a living shorelines program in 1970 to encourage vegetative shoreline stabilization. Regulations are in place to prohibit dredging through SAV beds. Tiered design 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. 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. MD legislated that shoreline stabilization projects must use living shoreline

1996 Chesapeake Bay and Atlantic Coast Black Sea Bass Fishery Management Plan Implementation Table (updated 7/2011)

Strategy	Action	Date	Comments
	impacts on SAV from activities that significantly increase turbidity. <ul style="list-style-type: none"> • 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. 	2008	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.	Continuing	A bay wide SAV restoration goal was set. The new SAV goal is 185,000 acres restored by 2010 and 1,000 acres planted by 2008. In 2008, there were approximately 76,900 acres of bay grasses, about 42% of the goal. In 2009, there were 85,899 acres of bay grasses throughout the Bay, which was 46% of the goal.
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. <ul style="list-style-type: none"> • Define the resource through inventory and mapping activities. • Protect existing wetlands. • Rehabilitation, restoring and creating wetlands. • Improving education. • Further research. 	Continuing 2006 Continuing	Programs have been expanded to the tributaries. GIS mapping activities are underway to target protection and restoration efforts on wetland habitat resources, but habitats are not targeted for a single, specific species' habitat. MD is developing a Blue Infrastructure that includes mapping of BSB habitat as structural habitat and  .
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: <ul style="list-style-type: none"> • 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	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=19 President Obama executive order recommitting federal agencies to Bay restoration and regulatory enforcement.
	3.4b) Based on the 1994 Chesapeake Bay Toxics Reduction Strategy Reevaluation Report, the jurisdictions will emphasize the following four areas:	Continue	See Chesapeake Bay Program website for updates on nutrient reduction. http://www.chesapeakebay.net/status_reducingpollution.aspx?menuitem=19

1996 Chesapeake Bay and Atlantic Coast Black Sea Bass Fishery Management Plan Implementation Table (updated 7/2011)

Strategy	Action	Date	Comments
	<ul style="list-style-type: none"> • 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. • Directed Toxics Assessment: Identify areas of low level contamination, improve tracking and control of non-point sources. 		Chesapeake Bay Program is monitoring levels of mercury, PCBs, PAHs, organophosphate and organochloride pesticides.
	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

MFS – National Marine Fisheries Service

PAH – Polycyclic Aromatic Hydrocarbon

PCB – Polychlorinated Biphenyl

PRFC – Potomac River Fisheries Commission

SAV – Submerged Aquatic Vegetation

SSB – Spawning Stock Biomass

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

2010 Maryland FMP Report (July 2011)

Section 7. Blue Crab (*Callinectes sapidus*)

During 2010, the Chesapeake Bay blue crab population was at its second highest level since 1997 and well above the management target for a third year in a row. The results of the 2010/2011 Winter Dredge Survey indicated that the management measures put in place starting in 2008 have been successful at improving the blue crab stock.

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. Following the completion of the 2011 blue crab stock assessment, a new amendment is likely to be developed in 2012.

Stock Status

In 2006, the Baywide winter dredge survey (WDS) was adopted as 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 spawning age crabs (age 1+) is used to determine if the population is overfished. The results of the 2010-2011 WDS indicated that there were 223 million age 1+ blue crabs (Figure 1). Although there was a decrease in the number of spawning-age crabs because of a high over-wintering mortality, the number of adult crabs remained above the target level. The blue crab stock is not overfished and overfishing is not occurring.

A new stock assessment was completed and peer reviewed in 2011. A final report is scheduled for late summer/early fall 2011. The 2011 stock assessment will provide a new integrated estimate of management reference points and stock status. Previous stock assessments did not directly link the two parameters. Preliminary recommendations from the stock assessment include re-evaluating the reference points based on estimates of age 0+ female crabs or the exploitable stock and the abundance of age 1+ female crabs or an index of the spawning stock. Re-evaluating the reference points will likely result in refining the management control rule. Redefining the reference points currently in use with the targets and thresholds recommended in the 2011 assessment is not expected to change the current status of the stock. However, new reference points are likely to change the historical perspective of the stock. Under the current threshold abundance reference point, the

stock was not overfished from 1990-2010. Under the proposed threshold, the female spawning stock would be considered overfished from 2001-2003

Management Measures

In 2001, the Bi-State Blue Crab Advisory Committee adopted a control rule for managing the blue crab fishery which was incorporated into the 2003 Amendment #1 to the 1997 CBP Blue Crab FMP. The control rule was subsequently updated in the 2005 stock assessment and is the foundation for sustainable management. It is based on the relationship between the number of spawning-age crabs, the fraction of crabs removed by fishing (exploitation) and the reference points. The control rule sets forth an overfishing definition or exploitation threshold of 53% and a target exploitation of 46%.

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

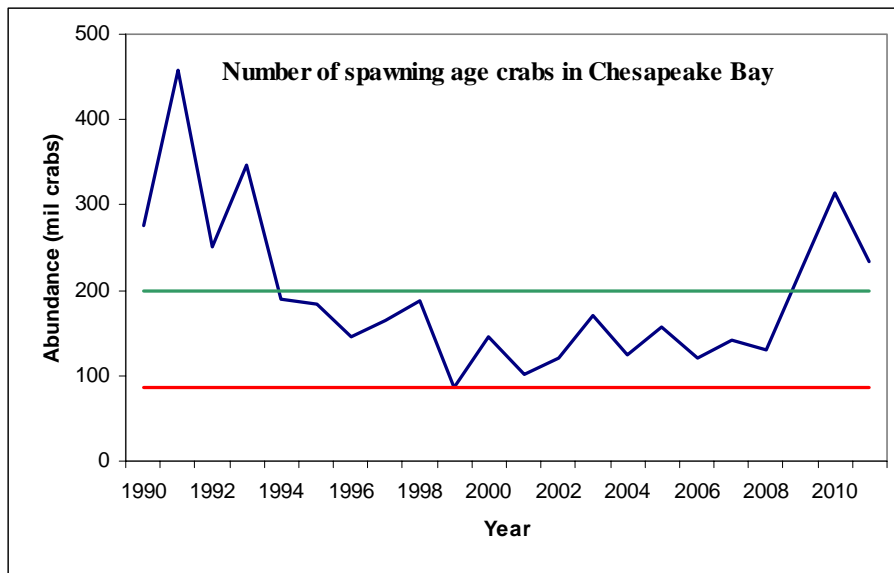
As the population level increases, maintaining the exploitation target results in an increase in harvest. The 2010 baywide (Maryland & Virginia) commercial harvest was approximately 89 million pounds (Figure 2) which resulted in a 43% exploitation rate. The 2010 baywide harvest was the highest since 1993. Recreational harvest is assumed to be approximately 8% of the total harvest or an estimated 7.12 million pounds (Ashford and Jones, ODU 2001,2002). The 2010 total exploitation rate continued to be below the target of 46%.

Issues/Concerns

Although management measures have successfully allowed the blue crab population to increase over the last three years, conservation measures need to continue to ensure that the population remains robust and at target levels. The blue crab population is subject to high variability from year to year. 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 (number of crabs that survive to become juveniles) is strongly influenced by environmental factors and can affect the number of juveniles that enter into the population. Therefore, there needs to be an appropriate margin of conservation to account for environmental variability.

Another concern is 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. Maryland and Virginia have been implementing a license buy-back program. In Maryland, the number of Limited Crab Catcher (LCC) licenses has been reduced by about 700 resulting in a reduction of effort by about 35,000 pots. However, more needs to be done to reduce latent effort. New methods for calculating recreational catch and effort is also needed to fully characterize total removals by the fishery.

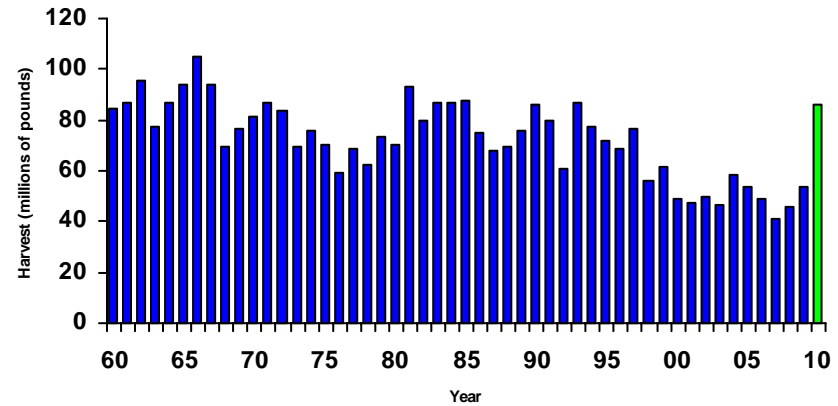
Figure 1.



MDNR/VIMS Data

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.

Figure 2. Chesapeake Bay Commercial Blue Crab Harvest, 2010 (MDNR & VMRC data)



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.

In addition, Maryland has begun 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.

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. The completion of the 2011 stock assessment will necessitate further examination and possible changes to the management targets and thresholds. Any changes will include a transparent stakeholder process.

2003 Chesapeake Bay Program Blue Crab Fishery Management Plan Amendment (updated 06/2011)			
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 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 overfishing threshold is 53%. 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, the overfishing threshold will be reevaluated.
	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 exploitation target will be reevaluated.
	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.)	2003 2005 2006 2008	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. The control rule will be reevaluated based on 2011 stock assessment results.

2003 Chesapeake Bay Program Blue Crab Fishery Management Plan Amendment (updated 06/2011)

Problem Area	Action	Date	Comments
	<p>Action 4 CBP jurisdictions will utilize the results of fishery-independent surveys to determine stock status.</p>	<p>On going</p>	<p>Results of the 2010-2011 Winter Dredge Survey (WDS) indicated the abundance of age 1+ crabs was 223 million crabs. Spawning-age crab abundance remained above the interim target for the 3rd consecutive year.</p>
<p>Fishing Effort Strategy CBP jurisdictions will adjust fishing effort to achieve the adopted BRPs.</p>	<p>Action 5 CBP jurisdictions will reduce the exploitation rate of legal-sized blue crabs to meet the target BRPs.</p>	<p>Began in 2001; continue 2008</p>	<p>The Bay jurisdictions implemented new regulations in 2008 & 2009 to reduce exploitation on female crabs. The 2008 baywide harvest was approximately 48.6 million lbs (average = 74 million lbs.). The 2009 baywide harvest was 53.9 million lbs. The 2010 baywide harvest was 89 million lbs.</p> <p>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. To date, MD has 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.</p>
<p>Monitoring Strategy CBP jurisdictions will collect fishery - dependent and fishery-independent data on blue crab resources.</p>	<p>Action 6 CBP jurisdictions will continue to monitor blue crab resources in the bay and work towards developing a baywide monitoring approach</p>	<p>On going</p>	<p>Recruitment, as measured by the abundance of age 0 crabs in the WDS, remained low and was below the average recruitment of 258 million crabs. Although the number of juveniles has declined, it remains one of the largest juvenile abundance indices since 1998.</p>

2003 Chesapeake Bay Program Blue Crab Fishery Management Plan Amendment (updated 06/2011)

Problem Area	Action	Date	Comments
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.
	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.

2003 Chesapeake Bay Program Blue Crab Fishery Management Plan Amendment (updated 06/2011)

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 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 has completed biological briefs on important blue crab issues. This information is available at http://www.mdsg.umd.edu/programs/policy/ebfm/
	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

MSG = Maryland Sea Grant

EBFM = Ecosystem based fisheries management

QET = Quantitative Ecosystem Team

2010 Maryland FMP Report (July 2011) Section 8. Bluefish (*Pomatomus saltatrix*)

Chesapeake Bay FMP

Bluefish are highly migratory pelagic fish that utilize estuarine and nearshore habitats as juveniles. They are ferocious fighters which make them popular among hook and line anglers. In addition to their high recreational value, bluefish are harvested commercially. The commercial fishery is relatively minor because the food value is lower than most other commercial fish species, since the less firm flesh degrades quickly in warm weather and does not freeze well.

The Chesapeake Bay Bluefish Fishery Management Plan (CBFMP) was adopted in 1990. The CBFMP was developed in response to the Atlantic coastal FMP for bluefish and provides the framework for management within the Chesapeake Bay. Amendment #1 to the CBFMP, developed in 2003, adopted the Mid-Atlantic Fisheries Management Council (MAFMC) and the Atlantic States Marine Fisheries Commission (ASMFC) coastal overfishing definition and rebuilding schedule. Furthermore, the amendment introduced ecosystem based management through two new objectives: 1) water quality and habitat goals and 2) multi-species interactions.

The coastal bluefish stock is jointly managed under the MAFMC/ASMFC FMP. The coastal FMP was 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. 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 actions¹.

Stock Status

There is no formal stock assessment for bluefish from the Chesapeake Bay. The status of the bluefish stock is derived from the Atlantic coast stock assessment. The last stock assessment update occurred in 2010 (with data through 2009). In the 1990s, the coastal bluefish stock was overfished and management measures were implemented to reduce fishing mortality (F) and rebuild the stock. The stock was declared rebuilt in 2009. The 2010 stock assessment² concluded that the bluefish stock is not overfished and overfishing is not occurring. Biological reference points for biomass and fishing mortality were developed using the stock assessment results and are used to set the annual total allowable landings (TAL). Fishing mortality in 2009 was 0.10, below the target biological reference point (F_{MSY}) of 0.19².

Current Management Measures

The commercial fishery has been managed under a coastal quota system since 2000. The MAFMC/ASMFC uses the process in the coastal Amendment 1 to set the state quotas. Maryland receives approximately 3% of the commercial coastwide quota and Virginia receives about 12%. Allocations between fisheries and among coastal jurisdictions are based on historic landings data (1981-1989). Approximately 83% of the quota is allocated to the recreational fishery and 17% to the commercial fishery. The 2011 Atlantic coast TAL was 27.29 million pounds: 22.65 million pounds for the recreational fishery and 4.64 million pounds for the commercial fishery. Maryland has an 8" minimum size limit for both the recreational and commercial fisheries. The recreational fishery has a daily creel limit of 10 fish per person and the commercial fishery is under an annual quota. There is no closed season.

The Fisheries

Commercial landings from Maryland for 2010 were 143,688 (Figure 1) The recreational fishery harvested an estimated 334,856 fish in 2009 and 301,279 fish in 2010 (Figure 2. MRFSS data).

Figure 1. Maryland Commercial bluefish landings, 1981-2010 (MDNR)

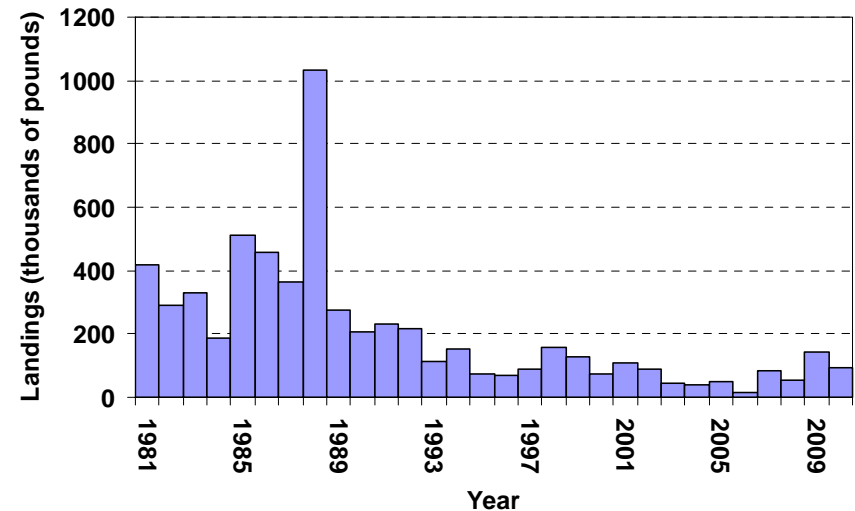
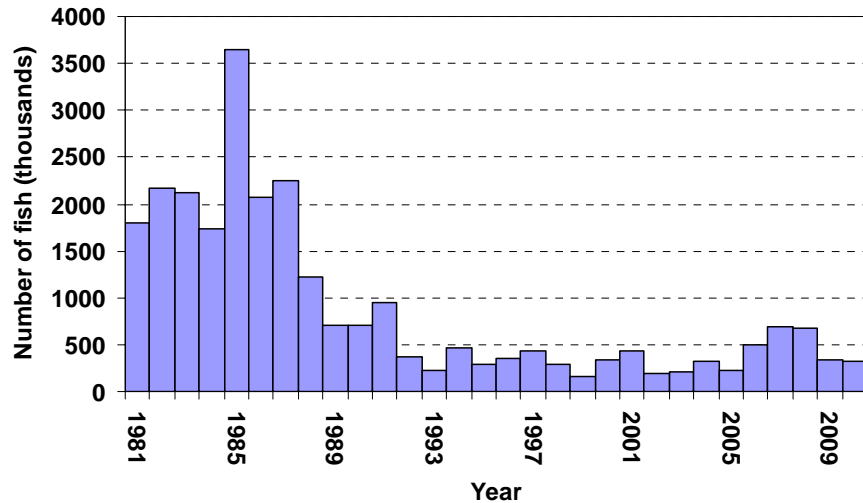


Figure 2. Maryland recreational bluefish harvest, 1981 to 2010. (MRFSS)



Issues/Concerns

The coastal bluefish stock was declared fully rebuilt in 2009, one year ahead of the nine-year rebuilding schedule. However, the 2010 coastal stock assessment update has projected a declining biomass through 2012 under a range of fishing scenarios. The Atlantic coast states are developing a cooperative plan to collect more age/length data to address shortcomings in the stock assessment model. A bluefish ageing workshop was held in Norfolk, VA in May, 2011 and best ageing practices were described³. Additional uncertainty in the stock assessment data is due to changes in NMFS survey methodology and bluefish discard data². The highly migratory nature of bluefish populations and their bi-modal recruitment pattern creates a uniquely complex scenario to model and assess. Maryland will continue its fishery dependent and independent surveys to monitor stock status.

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 Shepherd, G.R. and J. Nieland 2010. Bluefish stock assessment update. US Dept Commerce, Northeast Fish Sci Cent Ref. Doc 10-15.

2003 Amendment I to the 1990 Chesapeake Bay Program (CBP) Bluefish Fishery Management Plan (FMP) (updated 06/11)			
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 drafted in 2003. BRPs based on the 2005 coastal stock assessment were $F_{msy} = 0.19$ and $B_{msy} = 147,052$ mt. The model that calculates population abundance has been annually updated since 2005. The output from the model is used to set the annual Total Allowable Catch (TAC). The stock was declared rebuilt in 2009. Current mortality estimates indicate an F (which is below the threshold F (0.4) and target F (0.19)). Therefore, the stock is not overfished and overfishing is not occurring.
	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	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 update (2010), the bluefish stock is considered rebuilt.
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 TAL for 2011 has been set at 27.29 million pounds.
	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 recreational harvest limit (RHL). The proposed RHL for 2011 is 22.65 million lbs. 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 29 th , 1991)

2003 Amendment I to the 1990 Chesapeake Bay Program (CBP) Bluefish Fishery Management Plan (FMP) (updated 06/11)			
Problem Area	Action	Date	Comments
Research and Monitoring Strategy Data collected from multiple independent fishery surveys contribute to coastal research and monitoring efforts of bluefish.	Action 3.0 CBP jurisdictions will continue to 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.	Continue	Mandatory reporting is in effect in all CBP jurisdictions. MAFMC created a research set aside (RSA) program which allows up to 3% of the TAL to be sold to fund 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	MD requires logbooks for charter boats. Beginning in 2004, coastal species managed by quota are electronically reported in real time. The Marine Recreational Information Program (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.
	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	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.	Continue	Bluefish habitat was identified in Amendment I to the Chesapeake Bay Bluefish FMP.
	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.
	Action 4.2 CBP jurisdictions will monitor activities that may negatively	Continue	CBP monitors SAVs in the Chesapeake Bay by

2003 Amendment I to the 1990 Chesapeake Bay Program (CBP) Bluefish Fishery Management Plan (FMP) (updated 06/11)			
Problem Area	Action	Date	Comments
also become possible with the establishment of CHESFIMS in 2001 and ChesMAPP in 2002 and the utilization of coastal multispecies models of Atlantic menhaden, striped bass, weakfish and bluefish.	impact SAV types where bluefish have demonstrated a significant degree of association.		annual aerial survey. The 2010 survey estimated ~80,000 acres of SAVs or 43% of the 185,000 acre goal.
	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 forage species, such as Atlantic menhaden, Atlantic croaker, spot and/or blue crab, additional management measures may be necessary.	In progress	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
	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	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.

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
MRFSS – Marine Recreational Fisheries Statistics Survey
NMFS – National Marine Fisheries Service
PRFC – Potomac River Fisheries Commission
SAV – Submerged Aquatic Vegetation
TAL – Total Allowable Landings

2010 Maryland FMP Report (July 2011)

Section 9. Maryland Catfish Species

Introduction

Past stocking programs and unauthorized introductions have established non-native blue (*Ictalurus furcatus*) and flathead (*Pylodictis olivaris*) catfish populations in tributaries of the Chesapeake Bay. The 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. Removing blue and flathead catfish from established areas is not considered possible with current available methods. 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 other areas probably through angler transport. There are conflicting concerns between supporting recreational/commercial fishing opportunities and curtailing an “invasive” species.

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 to be naturalized. Blue catfish were also introduced to the Potomac River in the 1970s and were found in high numbers in 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. A technical report was written in 1998. This technical report summarized catfish knowledge to that date 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 (Piavis and Webb, 2010). It uses a surplus production model for the Head of Bay (HOB), Choptank River, and the Potomac River 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 River 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. Since 2000, the model has shown a population increase (Fig. 1). Harvests have been under maximum sustainable yield (MSY) since 1999. The HOB catfish harvests have also responded to fishing mortality rates best when using the fishing mortality (F) ratio of F:Fmsy (Fig. 2). Recruitment indices from the seine survey do not always agree with the results of the surplus production models (Fig. 3). Since the EJFS seine survey was designed for striped bass, the sample sites or methodology may not be as appropriate to describe channel catfish young of year (YOY) abundance in the Upper Bay. Results from the winter trawl survey suggest strong year class strength for 2004, 2006 and 2008 cohorts, while the seine survey did not collect any channel catfish YOY from the first two years and a trivial number from 2008 (Fig 3). Bay-wide YOY channel catfish relative abundance mirrors head-of-Bay results. More channel catfish juveniles were collected in 2010, but the quantity collected was still below the long-term series average (Piavis and Webb, 2011). Relative stock density data from fyke nets sampled in the Choptank and Nanticoke Rivers show annual variation between these river systems. In 2010, more quality (>460mm), preferred (>510mm) and memorable (>710mm) channel catfish were collected from the Nanticoke River fyke nets.

Data continue to be collected on white catfish which can be used to calculate relative stock densities and length frequencies (Piavis and Webb, 2011).

Management

A 10 inch minimum size limit applies to both commercial and recreational fisheries. There are no creel limits or closed seasons. Area and gear restrictions apply to commercial fishermen.

Fishery Statistics

The channel catfish commercial fishery is important in the Chesapeake Bay region (Fig.4). When harvest peaked in 1996, catfish were the second highest landed species by weight. In 2008, catfish landings were third highest by weight. In the last few years, flathead catfish have entered the commercial fishery and an active market exists for this 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 (Weinrich et al. 1986), although MRFSS estimates have large proportional standard errors (PSE). The recreational fishery for catfish is substantial. In some western shore tributaries of Chesapeake Bay, guided trophy fisheries exist and utilize catch-and-release activity. Recreational catfish size records are frequently broken.

Issues of Concern

Introduced non-native catfish species are considered to be invasive. Both blue and flathead catfish compete with native species for forage. Fishermen 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 (Piavis and Webb, 2010). Blue catfish inter-specific competition and predation may hinder channel catfish population recovery (Piavis and Webb, 2010). The native white catfish have declined in many areas and circumstantial evidence suggests their decline may be correlated to the expansion of non-native and 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 (Viverette et al. 2007). During 2010, the Sustainable Fisheries Goal Implementation Team (GIT) of the Chesapeake Bay Program put together an ad hoc committee to examine the issue of invasive catfish species. They concluded that blue catfish and flathead catfish exhibit 9 out of 15 predictors of invasiveness (Morris & Whitefield, 2009). The ad hoc committee has drafted an Invasive Catfish Policy that agrees to develop and implement management strategies to reduce invasive catfish populations and mitigate their spread. The policy is currently under consideration. The ASMFC drafted a Resolution on Non-Native Invasive Catfish 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. The resolution is expected to be adopted at the summer 2011 meeting.

Catfish do not make 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 (Pinkney et al. 2002).

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- Weinrich, D., E. Franklin, S. Minkinen, and A. Jarzynski. 1986. Investigation of American shad in the upper Chesapeake Bay. Maryland Department of Natural Resources. Tidewater Administration. Annapolis, Maryland.

Figure 1. Biomass estimates of Head-of-Bay channel catfish from a surplus production model with 80 % confidence intervals, 1980 – 2008.

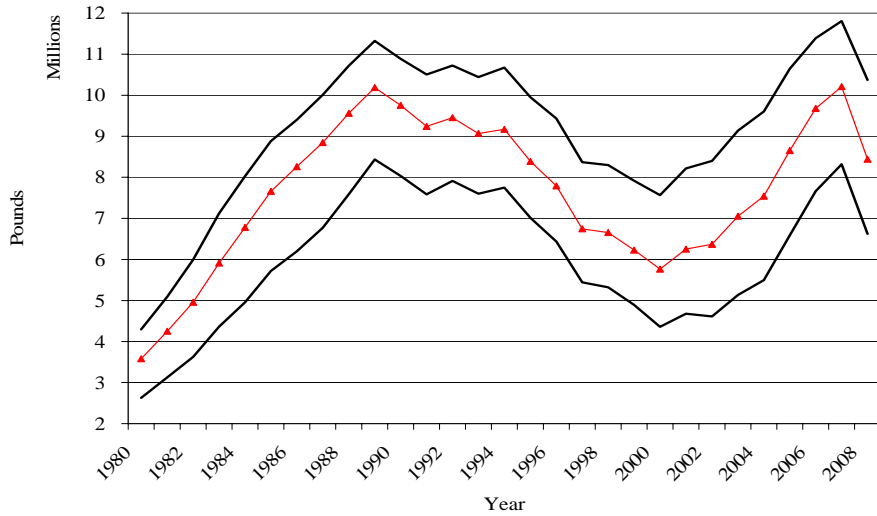


Figure 2. Biomass:Biomass at maximum sustainable yield ($B:B_{MSY}$) and $F:F_{MSY}$ at maximum sustainable yield ($F:F_{MSY}$) ratios for Head-of-Bay channel catfish from a surplus production model, 1980 – 2008.

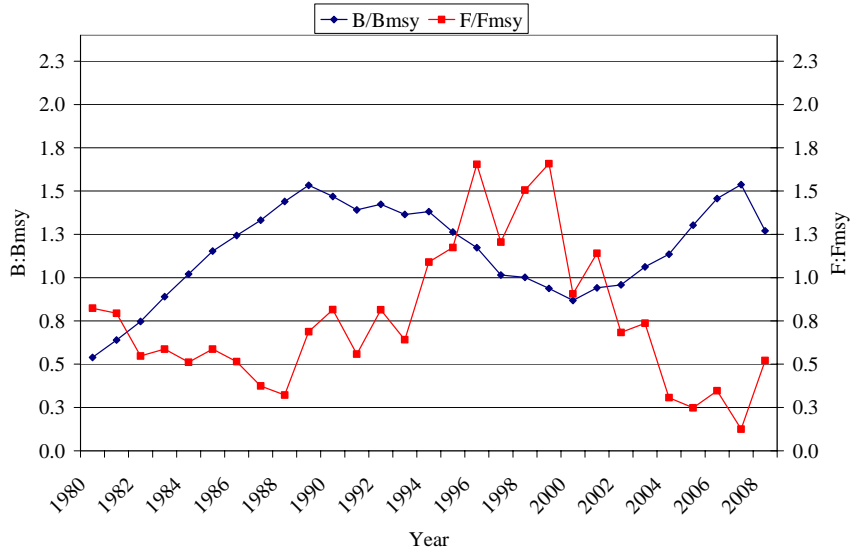


Figure 3. Head-of-Bay channel catfish fishery independent young-of-the-year seine index.

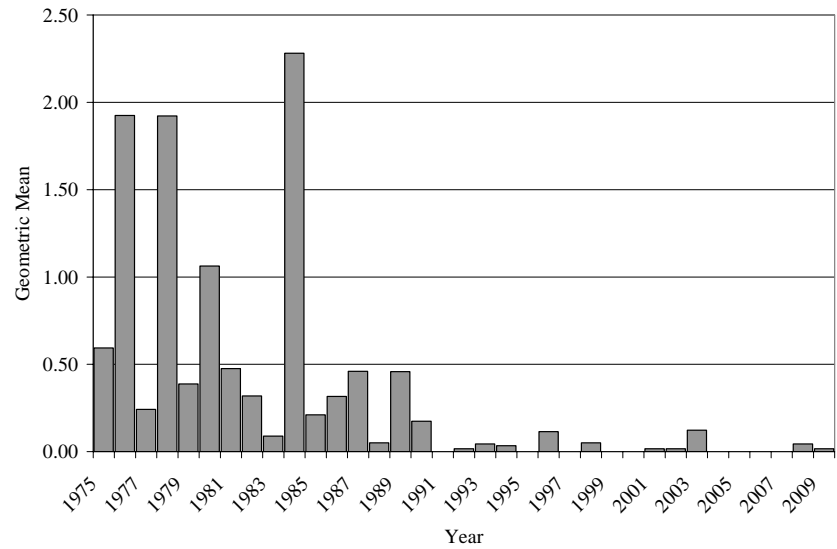
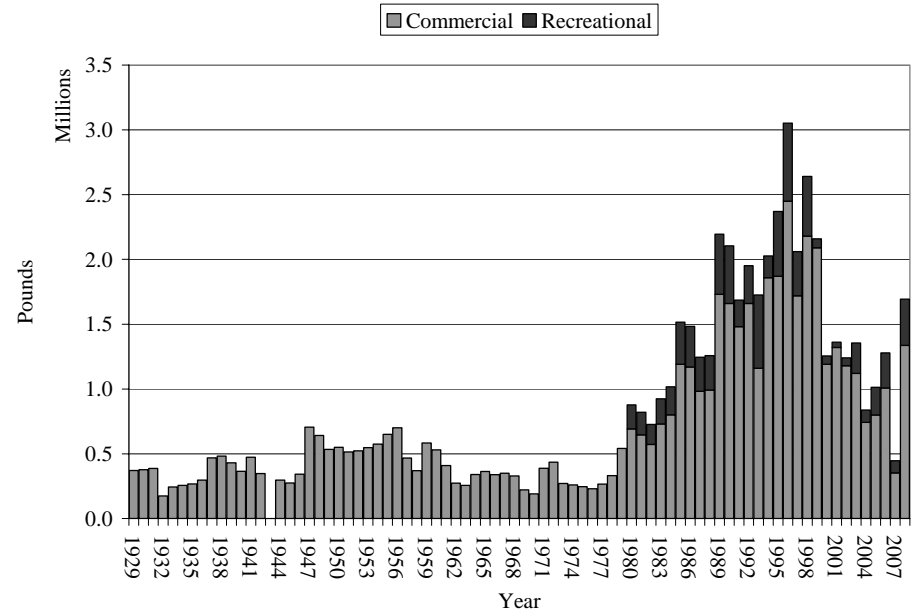


Figure 4. Chesapeake Bay channel catfish landings from the commercial and recreational fisheries, 1929-2008. (All Figures from Piavis and Webb, 2010).



2010 Maryland FMP Report (July 2011)

Section 10. Maryland Coastal Bays Blue Crab (*Callinectes sapidus*)

The 2001 Coastal Bay Blue Crab Fishery Management Plan (FMP) was reviewed during 2010. The Plan Review Team determined that the plan was still an appropriate framework for managing the resource. The 2001 Coastal Bays Blue Crab Fishery Management Plan (FMP) 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 development of an FMP was triggered by the Comprehensive and Conservation Management Plan (CCMP) adopted for Maryland's Coastal Bays in 1999. 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 address fishery issues specific to Maryland's Coastal Bays. The CCMP is reviewed and updated on an annual basis.

Stock Status

Analysis of the Coastal Bays Finfish Investigation (CBFI) Trawl Survey data (Figure 1) indicates that blue crab relative abundance in the Coastal Bays fluctuates without trend and represents a relatively stable population. Additional fishery independent data collected by the CBFI Trawl Survey indicates 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.

Fishery Statistics

Maryland's Coastal Bays support both a commercial and recreational blue crab fishery. The 2010 harvest of hard, soft and peeler crabs from the Coastal Bays was the highest since 1994. 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 (Figure 2). 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

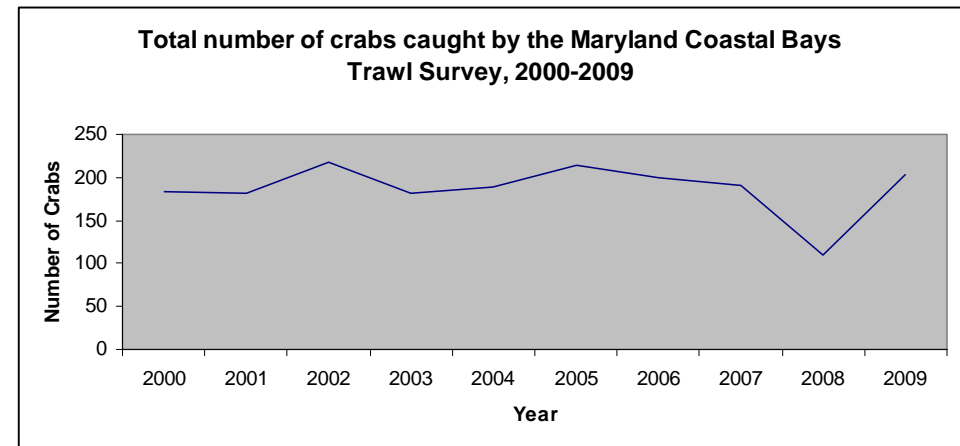
DNR manages the Coastal Bays commercial blue crab fishery through daily catch limits (25 bushels/boat/day), seasons (closed between Dec 31 & Apr 1), gear restrictions (no scrapes or dredges), size limits (minimum 5" for hard crabs and 3 1/2" for soft crabs), limited entry, and other management strategies 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

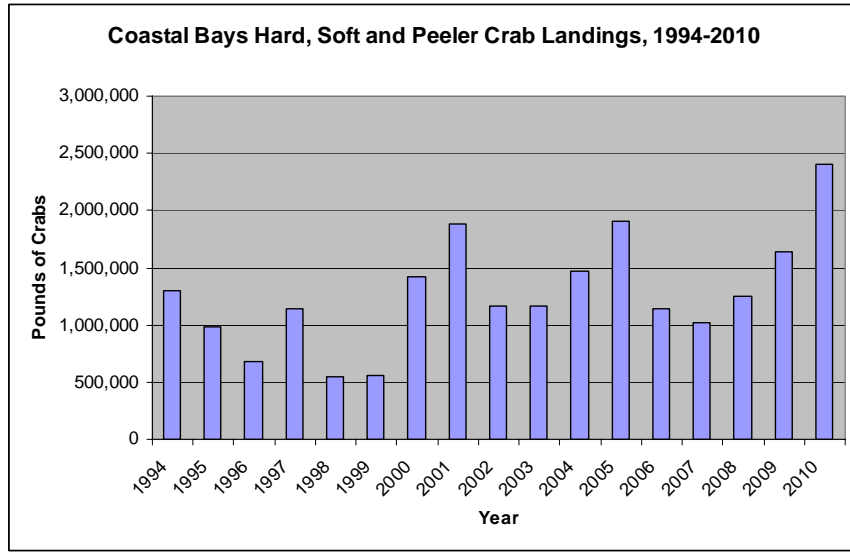
A parasitic dinoflagellate, *Hematodinium* sp., has been found to cause mortality in blue crabs from the Coastal Bays. Studies conducted in 2005 and 2006 indicated that the number of infected crabs follows a seasonal pattern increasing from late summer through December. Results indicated that salinity 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.

Figure 1



(data from MDNR)

Figure 2



(MDNR data)

2001 Coastal Bays Blue Crab Fishery Management Plan Implementation (last update 1/11)		
Objective/Problem	Action	Implementation
Obj. 1. Improve our understanding of how <i>Hematodinium</i> 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 <i>Hematodinium</i> in the coastal bays blue crab population (i.e. identify what intensity of <i>Hematodinium</i> infection causes mortality, and identify other factors, environmental and/or biological, that may influence blue crab mortality from <i>Hematodinium</i>). b) Identify factors which influence <i>Hematodinium</i> 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 <i>Hematodinium</i> .	Current research includes monitoring prevalence in MD coastal bays. Research is ongoing with the NOAA Oxford Cooperative Lab and the University of Maryland Biotechnology Institute Center of Marine Biotechnology.
	1.4.2 DNR will define the criteria under which a Marine Protected Area can be effective in assessing the impacts of <i>Hematodinium</i> 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 2.4 million lbs (2010). Average landings have been approximately 1.3 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.
	2.1.4: DNR and MCBP will encourage research that examines the stock - recruitment	Not yet initiated.

2001 Coastal Bays Blue Crab Fishery Management Plan Implementation (last update 1/11)		
Objective/Problem	Action	Implementation
	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).	
	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.
	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. 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.	Not yet initiated. .
Prob. 2.4: Invasive,	2.4.1: DNR will continue to monitor the abundance and impact of green crabs and other	Ongoing but limited due to lack of

2001 Coastal Bays Blue Crab Fishery Management Plan Implementation (last update 1/11)		
Objective/Problem	Action	Implementation
Non-indigenous Species	invasive, non-indigenous crab species.	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 be 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 <u>Shifting Sands</u> (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.	Not yet initiated
Obj.3. Maintain an economically stable and sustainable commercial blue crab fishery.	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.
	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	Completed. Prohibition of scrapes & dredges has been enacted. (COMAR.08.02.03.06E)

2001 Coastal Bays Blue Crab Fishery Management Plan Implementation (last update 1/11)		
Objective/Problem	Action	Implementation
	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.	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 36 th and 50 th Street; and 2) The Thorofare 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 dredging in areas where female crabs are concentrated).	Hydraulic Clam Dredging is currently prohibited in Maryland's 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	Ongoing.

2001 Coastal Bays Blue Crab Fishery Management Plan Implementation (last update 1/11)		
Objective/Problem	Action	Implementation
	derelict pots.	
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.	Not yet initiated.
	4.1.2: DNR will examine the effects of habitat quality on the success rates of recreational crabbing in the coastal bays.	Not yet initiated.
	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
	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.	Md & VA's SAVs in the Coastal Bays increased by over 25% since

2001 Coastal Bays Blue Crab Fishery Management Plan Implementation (last update 1/11)		
Objective/Problem	Action	Implementation
		2005.
	<p>5.1.5: DNR and Natural Resources Conservation Service (NRCS) will develop habitat requirements for the growth of seagrasses in the coastal bays by:</p> <p>a) DNR will develop water quality requirements for seagrasses;</p> <p>b) DNR will identify areas that meet water quality requirements for restoration purposes;</p> <p>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</p> <p>d) NRCS will complete soil mapping effort for entire coastal bays</p>	<p>a) Completed (Maryland Department of Natural Resources 2004).</p> <p>b) Ongoing.</p> <p>c) Completed by MGS & DNR.</p> <p>d) Not yet initiated.</p>
Prob. 5.2: Overwintering Habitat.	<p>5.2.1: DNR will identify and protect blue crab overwintering areas in the coastal bays by:</p> <p>a) Delineating and mapping overwintering areas; and</p> <p>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)).</p> <p>c) DNR will define the criteria under which a Marine Protected Area can be effective in protecting blue crab overwintering areas.</p>	No mapping has occurred. Hydraulic clam dredging is prohibited (2007).
Prob. 5.3: Shallow Water and Shoreline Habitats.	<p>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.</p>	Ongoing.
Prob. 5.4: Dissolved Oxygen.	<p>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 the CCMP for more specific information on these actions.</p>	Ongoing. (Maryland Department of Natural Resources 2004).
	<p>5.4.2: DNR will identify areas which have unsuitable levels of dissolved oxygen (i.e. < 3 mg/L) for blue crabs.</p>	Ongoing. (Maryland Department of Natural Resources 2004).
Prob. 5.5: Nutrient, Sediment and Chemical Inputs.	<p>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.</p>	Ongoing. (Maryland Department of Natural Resources 2004).
Obj. 6. Improve enforcement of crabbing restrictions. Prob. 6.1: Enforcement	<p>6.1.1: DNR will consider increasing the number of enforcement personnel in the coastal bays, specifically during the crabbing season.</p>	NRP hires seasonal staff to increase patrols during summer months. Penalties for violating regulations and enforcement

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Objective/Problem	Action	Implementation
of Conservation Measures.		procedures have been enhanced over the past year.
	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

2010 Maryland FMP Report (July 2011)

Section 11. Maryland Coastal Bays Hard Clam (*Mercenaria mercenaria*)

Coastal Bays FMP

The hard clam, or quahog, is found in some higher salinity areas of the Chesapeake Bay, but it is most frequently encountered in 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 that the plan should be revised because the majority of actions are no longer valid due to the ban on dredging.

Stock Status

There have been no recent stock updates. The exclusion of hydraulic escalator dredges from the Coastal Bays removed a gear that was used in conducting fishery-dependent stock assessments. In the absence of stock assessment data, the impact of this legislation on the hard clam population is difficult to determine. In 2008, hard clam densities were low in all regions of the Coastal Bays (Fig.1). The causes of these poor density conditions have not been determined. Low density could result from unfavorable water quality conditions for hard clam survival¹ and possible increased predation by blue crabs².

Current Management Measures

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 Fishery

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.

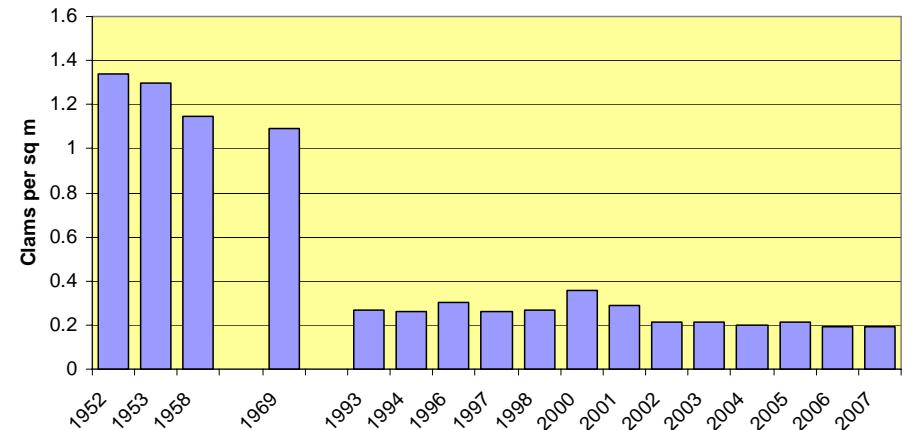
Commercial effort and harvest has varied over the years. Since the prohibition of hydraulic dredging, commercial fishery landings have been negligible. Information from the recreational fishery is largely unknown. The minimum size for hard clams is 1" (transverse measurement) with a 250/person/day limit.

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.

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 considered to be established in the Coastal Bays and they may not be collected and used as bait in areas where they are not established. The green crab is listed as a "species prohibited from transport" in MD (COMAR 08.02.19.04) Green crabs are known clam predators and their impact on the hard clam population is not known.

Chincoteague Bay Hard Clam Densities



(figure from M.Tarnowski, MDNR)

References

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

2002 Coastal Bays Hard Clam Fishery Management Plan (updated 07/11)		
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 3 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 3 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 has been no commercial harvesting during the past 3 seasons. Commercial clam harvesters will be required to report their catch by late 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 Partnership. Three aquaculture open houses were held in 2010.

2002 Coastal Bays Hard Clam Fishery Management Plan (updated 07/11)		
Objective/Problem	Action	Implementation
		<p>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.</p> <p>MD DNR will launch a commercial shellfish tagging program in 2011 to meet FDA national public safety requirements.</p>
	3.1.2 Identify problems with the permitting process, and make recommendations to specific agencies to solve those problems.	<p>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.</p>
	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.	<p>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.</p> <p>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 and staff the Aquaculture Coordinating Council and Aquaculture Review Board.</p> <p>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.</p>
	3.1.4 DNR will evaluate the feasibility of hard clam aquaculture in Maryland's coastal	a) This was not meant to designate where

2002 Coastal Bays Hard Clam Fishery Management Plan (updated 07/11)		
Objective/Problem	Action	Implementation
	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	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 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	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.

2002 Coastal Bays Hard Clam Fishery Management Plan (updated 07/11)		
Objective/Problem	Action	Implementation
Clamming Opportunities in Maryland's Coastal Bays		
	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.
	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. Prob. 5.1: Conflict Between Recreational Fishermen and Commercial Clammers.	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.
	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 this 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	5.2.2 DNR will increase the shoreline setback distance for which a person may not catch	Effected in 2002.

2002 Coastal Bays Hard Clam Fishery Management Plan (updated 07/11)		
Objective/Problem	Action	Implementation
harvesting now prohibited.	hard clams with a hydraulic dredge in front of federal or state-owned property from 150 to 300 feet	
	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.
	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 this 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.

2002 Coastal Bays Hard Clam Fishery Management Plan (updated 07/11)		
Objective/Problem	Action	Implementation
	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 clambers 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 3 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) <i>Determining the significance or contribution of these overwintering crabs to the coastal bays blue crab population;</i> c) Determining the magnitude of overwintering blue crab bycatch in the hydraulic clam dredge fishery; and d) <u>Assessing the impact of dredging activity on overwintering female blue crabs.</u>	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: a) Planting materials and sources; b) Enhancement areas; and c) Funding sources.	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.
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	9.1.1 DNR will continue to survey the hard clam resource on annual basis in Maryland’s	Ongoing. This action will be included in

2002 Coastal Bays Hard Clam Fishery Management Plan (updated 07/11)		
Objective/Problem	Action	Implementation
fisheries dependent and independent monitoring programs to obtain sufficient and accurate data for managing hard clams Prob. 9.1: Stock Assessment	coastal bays to facilitate management decisions.	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 3 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:

DNR = Department of Natural Resources

IFQs = Individual Fishing Quotas

MIPS = Maryland Industrial Partnerships

NRP = Natural Resource Police

STAC = Scientific & Technical Advisory Committee

UMES = University of Maryland Eastern Shore

VIMS = Virginia Institute of Marine Science

2010 Maryland FMP Report (July 2011)

Section 12. Horseshoe Crab (*Limulus polyphemus*)

Chesapeake Bay FMP

Significant progress has been made in modeling the ecological interactions between the Delaware Bay horseshoe crab population and the migratory red knot (*Calidris canutus*) population. The Atlantic States Marine Fisheries Commission (ASMFC) released the progress report “A Framework for Adaptive Management of Horseshoe Crab Harvest in the Delaware Bay Constrained by Red Knot Conservation” in 2010. Data suggest that exploitation of the Delaware Bay horseshoe crab population has decreased due to ongoing management actions. Red knot abundance remains depressed causing some bird conservation groups to advocate for a moratorium on horseshoe crab harvest.

The Chesapeake Bay and Atlantic Coast Horseshoe Crab Fishery Management Plan (CBFMP) was adopted in 1994. The CBFMP prohibits the harvest of horseshoe crabs during a specific season to protect loggerhead turtles and shorebirds that rely on horseshoe crabs and their eggs for food. The plan established a spawning stock census of horseshoe crabs, stricter harvest reporting standards, and a program to delineate important spawning areas. The CBFMP is scheduled for review in 2011.

ASMFC’s Interstate Fishery Management Plan for Horseshoe Crab and Addendum I established state-by-state quotas on bait landings. The quotas were set at 25% below reference period landings. Addendum II allowed quota transfer between states. The US Fish and Wildlife Service determined that a portion of horseshoe crabs landed in Maryland and Virginia are of Delaware Bay origin, the epicenter of horseshoe crab spawning. Addendum III reduced Maryland commercial harvest and added seasonal closures. This action was taken to increase the abundance of horseshoe crab eggs, which are a major dietary component for migratory shorebirds including the red knot. The red knot population has decreased since the 1980s, which may be related to horseshoe crab egg abundance. Addendum IV required a harvest closure in Maryland and a prohibition on landing crabs in Virginia caught in federal waters from January 1 to June 7 for two years. These harvest restrictions apply to the bait fishery but not the biomedical industry. Addendum V extended these restrictions to October 31, 2010. Addendum VI continues the Addendum IV restrictions for Maryland and Virginia. In addition, no more than 40% of Virginia’s quota may be harvested from a specific area and must have a minimum male to female ratio of 2:1 if landed in Virginia. Addendum VI expires April 30, 2013.

In 2007, the ASMFC Horseshoe Crab and Shorebird Technical Committees created an adaptive resource management (ARM) working group to develop an integrated horseshoe crab and red knot adaptive management framework. ARM’s objective was to “Manage harvest of horseshoe crabs in the Delaware Bay to maximize harvest but

also to maintain ecosystem integrity and provide adequate stopover habitat for migrating shorebirds.”

A series of abundance scenarios were examined for both species. Five management alternatives were presented:¹ 1) a full 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. The ARM analysis revealed two direct relationships 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 in the breeding grounds. The importance of body weight versus Arctic snow conditions appears to vary annually. It is likely that genetic variability in body mass thresholds is an important factor for annual red knot survival. The migratory red knot population has shown no evidence of recovery despite a four-fold reduction in horseshoe crab harvest (ASMFC). The next horseshoe crab stock assessment is planned for 2014.

Stock Status

Horseshoe crabs caught in Maryland waters belong to the stock that spawns in Maryland, Virginia, and Delaware Bay. Recent spawning survey results from Delaware Bay detected a significant increase in male spawning activity, but did not detect any trend in female spawning activity. The 2009 stock assessment determined that relative biomass had increased to the 1991 level (Figure 1) and relative fishing mortality has decreased to the 1991 level (Figure 2)². The Delaware Bay stock is undergoing positive population growth and recovery. Juvenile and adult male horseshoe crab abundance increased significantly from 1998-2009. However, immature horseshoe crab abundance may have declined in Delaware Bay. Adult female abundance appears stable.

Egg surveys indicate a 3-fold density increase at several beaches from 2009 to 2010. Egg density peaked as shorebird migration peaked indicating improved prey availability for birds. Horseshoe crabs are harvested for biomedical purposes and a biomedical mortality threshold was developed in the 1998 ASMFC FMP. Since biomedical use exceeded the threshold in 2010, the ASMFC Plan Review Team recommended considering actions to decrease the biomedical use. Current population data is insufficient for the development of biological reference points to determine overfishing and overfished conditions.

Current Management Measures

Maryland does not have any harvest restrictions for the recreational sector. Commercial harvest of horseshoe crabs in Maryland is closely monitored due to its importance as a bait fishery, biomedical use, and food source for migratory shorebirds. Horseshoe crab harvest is not allowed in Maryland from May 1 to June 7

and on weekends. Male horseshoe crab harvest is allowed for the biomedical industry during the May 1 to June 7 closure because the crabs must be released after their use. Harvest is allowed at least one mile offshore from June 8 to July 10. One-hundred horseshoe crabs per person per day can be caught with a valid permit. Horseshoe crab harvest is open in all waters from July 13 to November 30. A permit is not required during this time period for personal use (25 crabs/person/day). Permit holders are issued a catch quota based on their proportion of 1996 landings applied to the current year's allowable landings. A ratio of two or more male crabs to every one female is part of the harvest requirement. No bycatch harvest is allowed.

Horseshoe crab blood is used to produce Limulus Amebocyte Lysate (LAL), a substance to screen injectable drugs, biologics, medical devices, and raw materials for the presence of endotoxins. Horseshoe crabs are used for research in an increasing variety of applications including advanced eye research, surgical suture wound dressing development, and cancer research. All crabs collected for the biomedical production of LAL must be released alive where they were caught within 48 hours. If purchased, the crabs can be transferred back to the harvester and counted against the harvester's quota. Mortality is low during the bleeding process but increases to roughly 15% when release mortality is included. The total mortality threshold for crabs bled by the biomedical industry is 57,500.

The Fisheries

Maryland's harvest quota has remained at 170,653 horseshoe crabs since 2004. Commercial landings in 2010 were 161,545 horseshoe crabs or 27% of the coastwide landings (Figure 3). Maryland commercial landings have remained relatively stable since 1998 either at or below the quota except in 2002. Coastwide, commercial horseshoe crab landings decreased significantly between 1998 and 2004, and have begun to stabilize (Figure 3). The number of crabs landed from coastal waters for biomedical bleeding (not bait) has increased since 2004 from 292,760 to 482,704 in 2010 (Figure 3). Crab mortality has varied between 14.7% and 15.9% during this time. Increasing biomedical crab landings is resulting in increased numbers of dead crabs. Horseshoe crab mortality has exceeded the threshold number of crabs (57,500) in each of the past four years (2007 to 2010; Figure 4)

ASMFC's horseshoe crab Plan Review Team (PRT) has recommended that Virginia implement area-specific quota reductions in 2011 to reduce their quota by at least 21,562 crabs. The reduction would compensate for quota overages in 2009 and 2010. Late reporting of additional overages was also of concern.

Figure 1. Horseshoe crab relative biomass (B/BMSY) with 50% and 80% confidence intervals (CI) for 1991 to 2009 from the surplus production model. (ASMFC²)

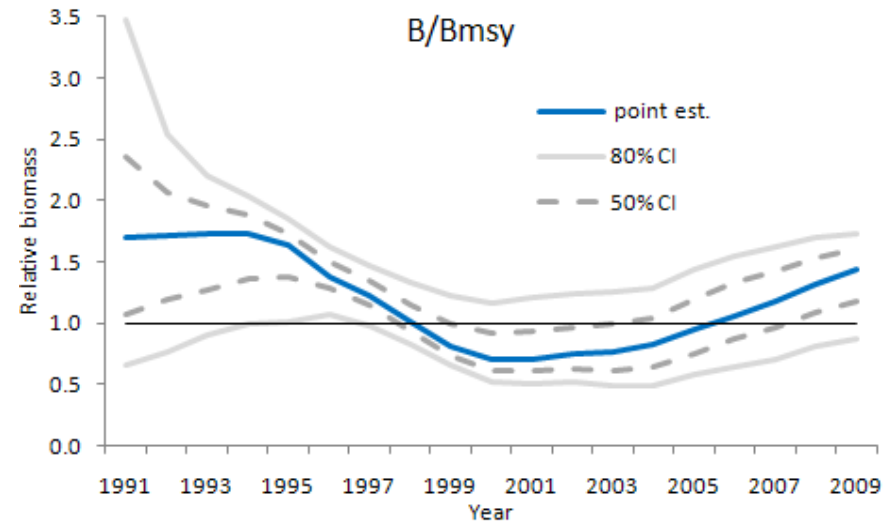


Figure 2. The horseshoe crab fishing mortality (F/FMSY) plot includes 50% and 80% confidence intervals (CI) to from the surplus production model for the years 1991 to 2008 . (ASMFC²)

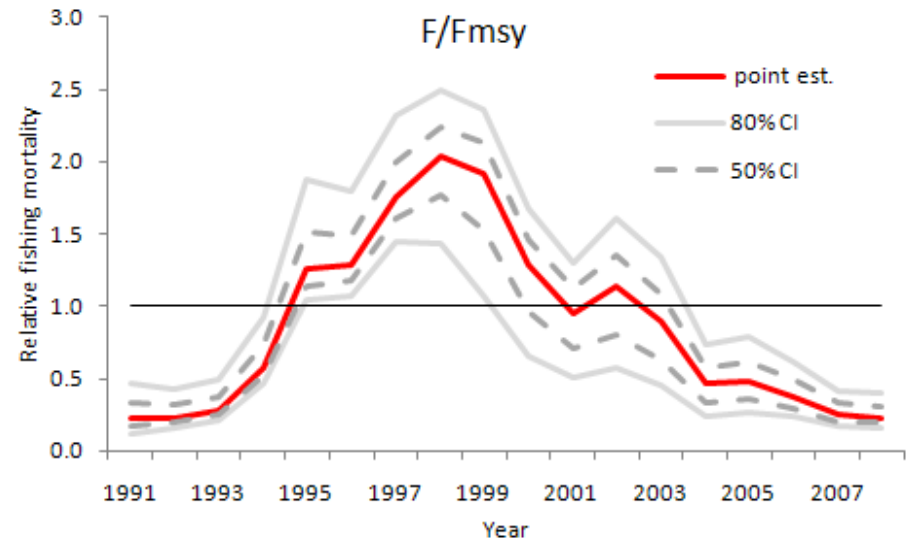


Figure 3. Maryland and coastwide horseshoe crab commercial landings reported for 1998 to 2010. Horseshoe crabs supplied to the biomedical industry for bleeding excluding crabs those supplied for bait (2004 to 2010). The solid line is Maryland's commercial harvest quota. (DNR & ASMFC)

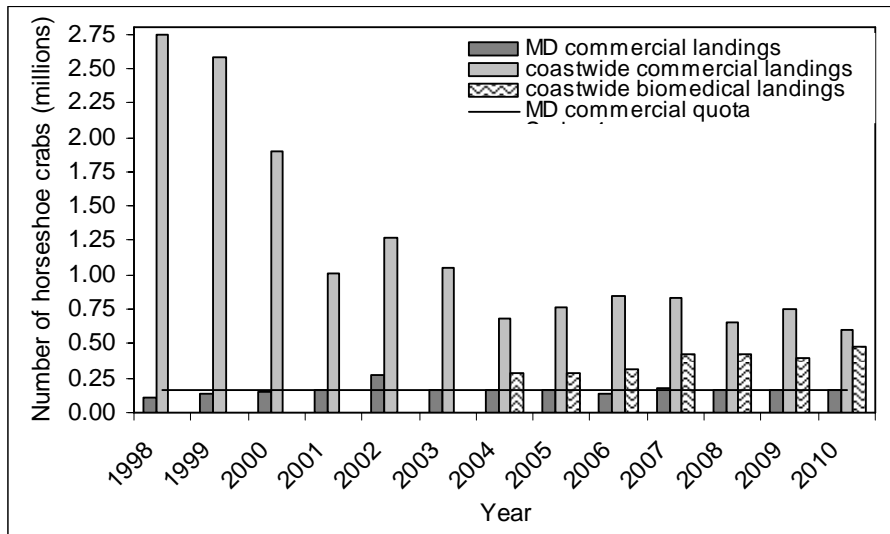
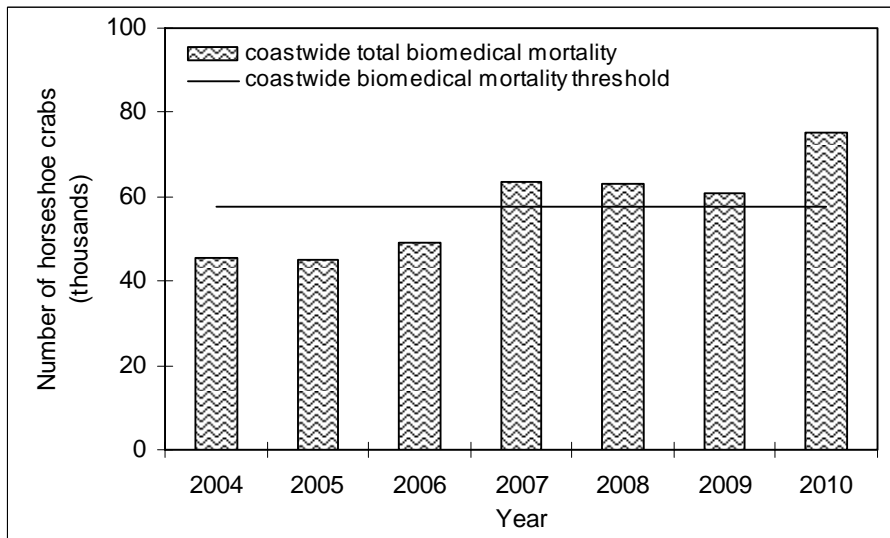


Figure 4. Horseshoe crab total mortality coastwide for the biomedical industry from 2004 to 2010. The solid line is the horseshoe crab mortality threshold for the biomedical industry. (ASMFC)



Issues/Concerns

Horseshoe crab spawning stock and egg production are being monitored to ensure sufficient egg production to support migratory shorebird feeding (esp. red knot *Calidris canutus*). ASMFC is requiring Atlantic coast states to continue current monitoring programs. Congressional funding for current monitoring and stock assessment programs is unlikely to continue.³ The biomedical industry may fund a portion of the monitoring cost. Population data for the Delaware Bay stock is necessary for development of a stock assessment. The Virginia Tech benthic trawl survey provides critical information for the stock assessment and ARM model. The survey is relatively inexpensive and provides reliable estimates of horseshoe crab abundance.

Biomedical landings in 2010 increased 24% over the five-year average. The 1998 FMP implemented a biomedical mortality threshold of 57,500 crabs. Estimated mortality from the biomedical bleeding process has exceeded this threshold the past four years (2007 to 2010; Figure 4). Additional data collection for the biomedical industry may be necessary. The ASMFC Management Board may implement restrictions on the number of crabs the industry is allowed to land.

Conservation

The USFWS received petitions in 2004 and 2005 to emergency list the red knot under the Endangered Species Act (ESA). In 2007, USFWS determined that the red knot (*Calidris canutus rufa*) is a candidate for ESA protection, but emergency listing was not warranted at the time. Since the 2005 determination, ASMFC continues to pursue developing an integrated horseshoe crab and red knot adaptive management framework. Some conservation groups have begun to advocate for a moratorium on the harvest of horseshoe crabs. The state of New Jersey issued a notice of a proposed rule to upgrade the current state listing of the red knot from threatened to endangered on January 18, 2011. Comments on the proposed rule were due March 18, 2011. Maryland DNR is exploring mechanisms to improve regulatory consistency among the black sea bass, summer flounder and horseshoe crab commercial fisheries to streamline the coastal commercial permit process while allowing for some flexibility.

References

- ASMFC. 2009. A Framework for Adaptive Management of Horseshoe Crab Harvest in the Delaware Bay Constrained by Red Knot Conservation, 2009. Stock Assessment Report No. 09-02 (Supplement B). Atlantic States Marine Fisheries Commission, Washington, DC.
- ASMFC. 2009. Horseshoe Crab Stock Assessment for Peer Review. Stock Assessment Report No. 09-02 (Supplement A). Atlantic States Marine Fisheries Commission, Washington, DC.
- ASMFC. 2011. 2011 review of the fishery management plan in 2010 for Horseshoe crab (*Limulus polyphemus*). Atlantic States Marine Fisheries Commission, Alexandria, VA.

1994 Chesapeake Bay and Atlantic Coast Horseshoe Crab Management Plan Implementation Table (updated 7/2011)

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 (Action to prohibit hand collection of HSCs between May 1 and June 7 was changed based on MD spawning survey data. In January 1996, MD adopted measures to restrict the hand collection of HSC between April 1 and June 30 to 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.
		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.
		Open 2006 2011	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. VA prevents HSC harvest within 1,000 ft of mean low water May 1 through June 7. 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
		Continue 2009	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 the May 1 to June 7 closure. HSC collection for scientific purposes is allowed during the fishery closure so long as crabs are released alive within 48 hours to waters where they were caught. Scientific collection permits continue to be issued for biomedical bleeding of male crabs. Both male and female crabs can be used for the education outreach program entitled "Green Eggs and Sand."
		2010	The open harvest season was delayed from July 1 to July 13.

1994 Chesapeake Bay and Atlantic Coast Horseshoe Crab Management Plan Implementation Table (updated 7/2011)			
Problem Area	Action	Date	Comments
	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.
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	<p>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.</p> <p>Maryland Coastal Bays program began a volunteer spawning survey. Public reports of HSC spawning in Chesapeake Bay are kept on file.</p> <p>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.</p> <p>Biomedical industry is collaborating with USFWS Coast wide Tagging Program for HSC.</p>
		2002 Continue	
	2007		
		2008 Continue	
	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	<p>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.</p> <p>ASMFC coastal management actions include a mandatory monitoring program, tagging studies, spawning surveys, and egg surveys.</p>
		On-going	

1994 Chesapeake Bay and Atlantic Coast Horseshoe Crab Management Plan Implementation Table (updated 7/2011)

Problem Area	Action	Date	Comments
3.1 Maryland and Virginia will monitor the commercial and medical harvest of horseshoe crabs to improve the quality of data obtained from the commercial fishery.	3.1a Maryland will require horseshoe crab harvesters to provide monthly reports on the size of harvest, area of collection, gear usage, and any other information the Department of Natural Resources deems necessary.	1995 Continue	Reporting was implemented on January 29 th , 1996. Permit system currently required and used to monitor commercial harvest. 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.
		2010	
		2000	ASMFC instituted a 25% reduction in horseshoe crab bait landings using 1995-1997 as the reference period.
		2004	MD has implemented additional restrictions based on ASMFC Addendum III. MD landings limited to 170,653 lbs annually based on 2001 landings.
		2005	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.
		2006	ASMFC Addendum IV changed start of harvest closure from May 1 to January 1. This provision expires in 2008; it was continued through 2009. All HSC supplied to the bait fishery will be included in that states allowable harvest. Biomedical industry will make available all HSC that expire prior to live release to the bait fishery.
		2004 Continue	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 was allowed >1 mile offshore during April 1 – 30 & June 8 - 30. Harvest was allowed from July 1 – Nov 30 in all MD tidal waters.
		2008	MD changed the HSC harvest ratio to 2:1 male:female ratio (issued by public notice).
		2009 Continue	Biomedical industry is allowed to land male HSCs for bleeding during the May 1 to June7 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.
		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	
2001	ASMFC allows state-to-state transfer of quotas.		

1994 Chesapeake Bay and Atlantic Coast Horseshoe Crab Management Plan Implementation Table (updated 7/2011)			
Problem Area	Action	Date	Comments
	monthly reports		
	3.2 Virginia will continue their mandatory reporting procedures implemented in January 1993.	Continue 2000 2006	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 to 1997 as the reference period. 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 an ASMFC coastal FMP.
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 DNR 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	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.

Acronyms

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

2010 Maryland FMP Report (July 2011)

Section 13. King Mackerel (*Scomberomorus cavalla*) and Spanish Mackerel (*Scomberomorus maculatus*)

Chesapeake Bay FMP

Spanish mackerel and King mackerel are seasonal visitors to Maryland waters and typically provide anglers with an exciting fishing experience in late summer. A Chesapeake Bay and Atlantic Coast King and Spanish Mackerel Fishery Management Plan was adopted in 1994. The plan follows the Atlantic States Marine Fisheries Commission (ASMFC) 1983 FMP for Coastal Migratory Pelagic Resources which includes Spanish mackerel. These two species are also managed jointly under the federal Coastal Migratory Pelagics FMP adopted in 1982 by the South Atlantic Fishery Management Council (SAFMC) and the Gulf of Mexico Fisheries Management Council (GMFMC).

Stock Status

There is no formal stock assessment for either species for the Chesapeake Bay or the mid-Atlantic coast. Coastal overfishing occurred in the 1970's and early 1980's and led to regulations to control harvest and rebuild depleted stocks. Stock assessments are performed by the Mackerel Stock Assessment Panel (MSAP) of the joint GMFMC and SAFMC. Based on the 2008 South Atlantic and Gulf of Mexico King mackerel Southeast Data, Assessment, and Review (SEDAR), the king mackerel stock is not experiencing overfishing. At this time, the data are insufficient to determine biomass estimates or size of the stock. Spanish mackerel population levels are high but whether or not overfishing is occurring is unknown. Fishing mortality estimates are currently not available. Management measures have been successful at rebuilding the stock. The overfishing ratio (B/Bmsy) has been increasing.

Current Management Measures

The annual coastal total allowable catch (TAC) for Spanish mackerel is set at 7.04 million pounds. Fifty five percent of the TAC is allocated to the commercial fishery and 45% to the recreational fishery.

The Chesapeake Bay states manage Spanish mackerel through size and creel limits and closures consistent with actions taken by Federal mandates and the SAFMC. Maryland and Virginia require a 14" minimum size limit with a creel limit of 15 fish. 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. Escape panels are used to reduce bycatch from pound nets.

Public hearings were held in 2011 on a draft omnibus amendment for spot, spotted seatrout and Spanish mackerel. ASMFC is expected to approve the amendment in August, 2011. The amendment includes an update to the coastal plan and includes

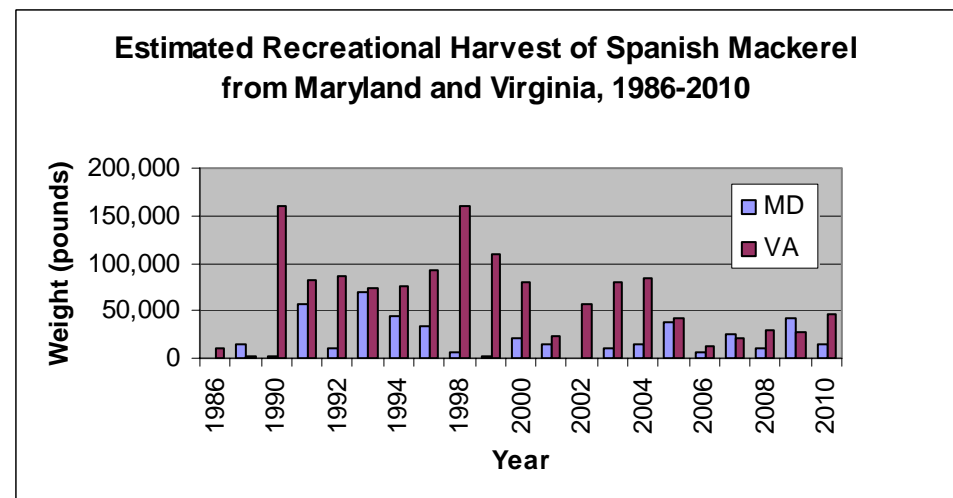
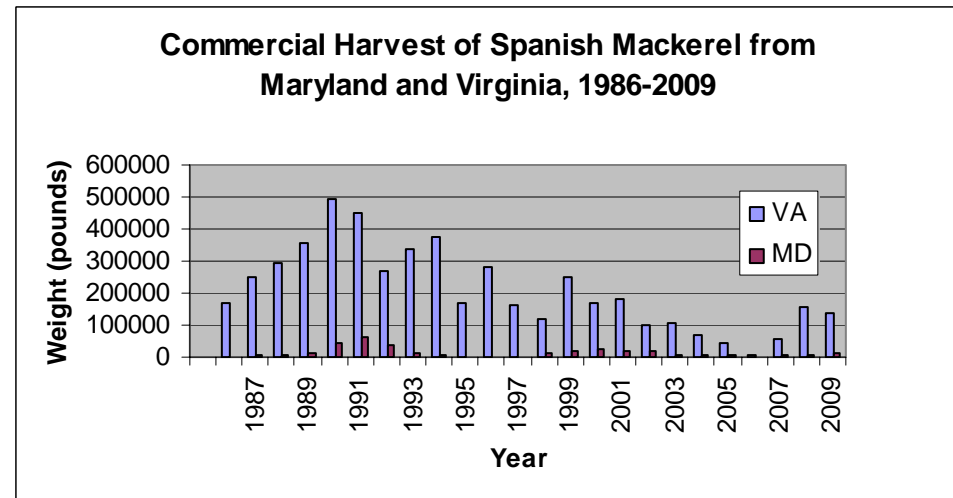
commercial and recreational management measures and recommendations, adaptive management options, *de minimis* thresholds and exemptions, and monitoring recommendations.

Issues/Concerns

The 2010 Review of the ASMFC FMP for Spanish mackerel repeated its recommendations for 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

There were no commercial landings reported for king mackerel in Maryland during 2010.



1994 Chesapeake and Atlantic Coast King and Spanish Mackerel Management Plan Implementation Table (update 07/11)			
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
	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 increased to 27".
	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	Completed.
	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.
	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, to be implemented July 1, 2012, includes monitoring and management recommendations and possible state regulatory changes.
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.

1994 Chesapeake and Atlantic Coast King and Spanish Mackerel Management Plan Implementation Table (update 07/11)			
Section	Action	Date	Comments
	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:

CBP = Chesapeake Bay Program

EEZ = Exclusive Economic Zone

UMCES = University of Maryland Center for Environmental Studies

2010 Maryland FMP Report (July 2011)

Section 14. Eastern Oyster (*Crassostrea virginica*)

Chesapeake Bay Oyster Management

The 2010 oyster spatfall index (number of larval oysters that have settled and developed a thin shell) was approximately 80 spat per bushel and the highest spatfall count since 1997 (Figure 1). This was about a five fold increase over the 25 year median of 16 spat per bushel. The 2010 spat set is not a response to power dredging activities. No significant differences were observed from spat sets within or outside the power dredging areas. The survival rate of young and adult oysters was also higher than previous years. Increased survival was due in part to a lower frequency and intensity of diseases caused by oyster parasites. Given the recent expansion in the Maryland oyster sanctuary program, these two factors, high spatfall and high survival, are particularly advantageous to increasing oyster abundance.

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. Consequently, the PRT recommended a complete revision of the plan.

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 new 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 drafted a science-driven consensus document describing a minimum suite of goals and metrics. The draft document is currently under review.

Stock Status

The oyster stock in the Chesapeake Bay is currently estimated at less than 1% of its historic abundance. Estimates of small and market oysters in the Maryland portion of the Bay have been around 1.2 million oysters over the last few years (2006 to present). Approximately 450 million hatchery-raised oysters were planted in the Bay in 2010 to augment natural reproduction. In addition, approximately 60,000 bushels of oyster shells were spread over 316 acres of bottom (Oyster Recovery Partnership & Chesapeake Bay Program website).

Pre-stock assessment studies were conducted over the last two years. 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 periods¹. Recommendations have been made to improve data collection from the fishery and the fall survey.

Current Management Measures

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). Both harvest seasons and catch limits by gear type are enforced for the public fishery. The average number of annual license holders is 550 (2002-2010) and there are fewer than 18 oyster processing companies in operation. The new sanctuary expansion allows 167,720 acres of natural oyster bars for the wild oyster fishery. Maryland DNR will begin implementing a new procedure for tagging each container (bushel) of oysters during the 2011-2012 oyster season. The new procedure will follow requirements by the National Shellfish Sanitation Program.

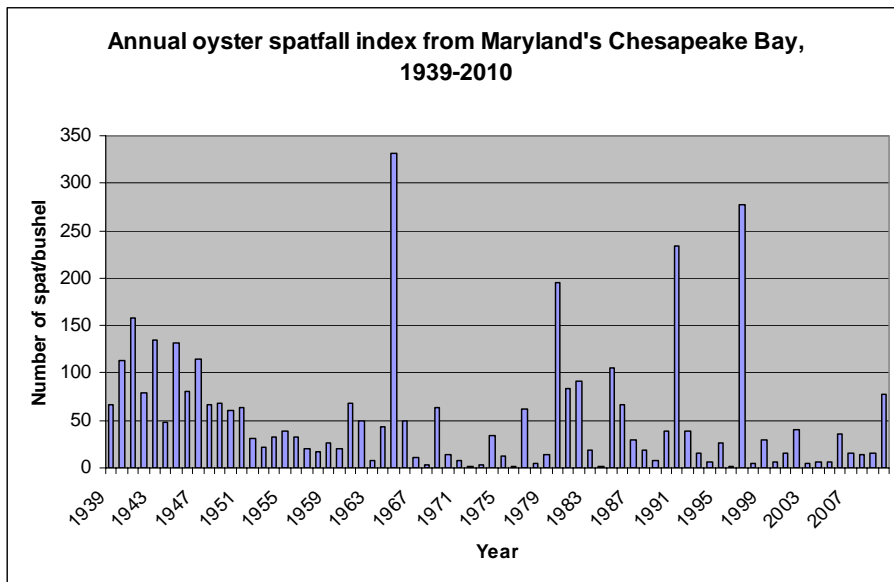
Aquaculture

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. Through a partnership with the Oyster Recovery Partnership, DNR provides field support for in-the-water activities of oyster aquaculture production.

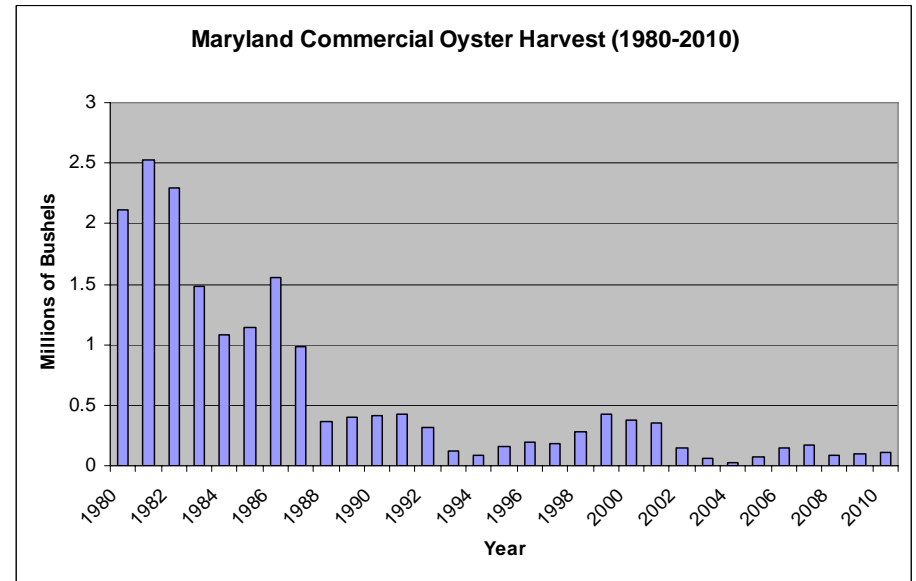
Marylanders Grow Oysters (MGO), a program under Governor O'Malley's Smart, Green & Growing Initiative, grew approximately 1.9 million oysters that were planted in sanctuaries. Since 2008 the program has grown from nearly 900 oyster cages to about 8,000 oyster cages. This volunteer program involves about 2000 people and 18 tributaries. The program is expected to expand to 24 tributaries and an additional 600+ cages during 2011. For more details on the program, go to the website <http://www.oysters.maryland.gov>.

Figure 1.



(MDNR data)

Figure 2.



(MDNR data)

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 years¹. 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 increase in sanctuary areas and aquaculture activities require additional law enforcement. Although new measures have been adopted to deter and issue citations for oyster poaching, more effort needs to be taken.

References

¹ 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 6/2011)

Section	Action	Date/ Responsible agencies	Comments
<p>Disease Strategy 3.1A. Utilize disease management in all aspects of restoration & harvest to minimize spreading disease</p> <p>3.1B. Develop & implement disease strategies within each of the 3 designated salinity zones.</p>	<p>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?</p>	<p>Continue Univ. of MD, VIMS, MDNR, and VMRC.</p>	<p>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.</p>
	<p>3.2 Increase hatchery production to supplement natural recruitment and mitigate the prevalence of <i>P.marinus</i> (refer to Chapter VI Hatchery Production for additional details)</p>	<p>Continue Univ. of MD, VIMS, MDNR, aquaculture industry</p>	<p>Additional State and Federal funding has resulted in an increase in hatchery production from 38 million spat in 2000 to over 300 million in 2006. There was a record production of 750 million in 2009. In MD during 2010, ~450 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. During 2008 VA hatcheries produced more than 498 million larvae and seed. ORP has supported UMCES hatchery infrastructure and capacity (MDNR/NOAA funding).</p>
	<p>3.3 Establish broodstock sanctuaries in heavily infected areas to possibly produce disease resistant seed. (see Chapter IV Sanctuaries for more details).</p>	<p>Open MDNR, VMRC, ORP, VA Corps</p>	<p>Sanctuaries have been established in a variety of areas throughout the Bay to produce self-sustaining populations of oysters.</p>
	<p>3.4 Develop, implement and maintain a seed policy to reduce and minimize disease impacts.</p>	<p>2004 2007 Continuing</p>	<p>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. 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.</p>

	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	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.
Strategy 4.2. Utilize the steps outlined in the OMP for establishing oyster sanctuaries throughout the bay.	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	Protocols have been developed to delineate and mark sanctuary areas.
	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. To date, alternate materials to replace natural oyster shell cannot be economically manufactured in large quantities. The current approach is to clean exposed shell on natural bars and extract previously planted and shallow buried shells.
	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.
	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.

	<p>4.2.6 Monitor areas to evaluate oyster population status and measure progress towards the commitment to increase oyster biomass by 10-fold.</p>	<p>On-going MNDR, VIMS</p>	<p>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.</p>
<p>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</p>	<p>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</p> <p>Action 4.3.A.1 Identify priority areas in Zone 1 that would have the most success at reaching the defined project objectives</p> <p>Action 4.3.A.2 Rehabilitate and maintain oyster bottom habitat to provide planting substrate for seed oysters and optimal conditions for larval settlement</p> <p>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</p> <hr/> <p>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.</p> <p>Action 4.3.B.1 Critically examine long-term environmental conditions and develop relevant project objectives for sanctuaries in Zone 2.</p> <p>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.</p>	<p>2005 On-going</p>	<p>MD is implementing a new 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.</p>

	<p>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</p> <p>Action 4.3.C.1 Reestablish and maintain bottom habitat for oyster spat settlement and growth of disease resistant adults</p> <p>Action 4.3.C.2 Monitor Zone 3 sanctuaries to determine the effects of disease mortality</p> <p>Action 4.3.C.3 Utilize Zone 3 as an area to test laboratory strains of disease resistant oysters</p> <p>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.</p>		
Sanctuaries (cont'd)	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 new sanctuaries based on protecting 25% of the state's most productive areas as identified by an analysis of the annual fall survey data.
Strategy 4.4 The jurisdictions will establish oyster sanctuaries to promote maximum ecological value			
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	<p>Action 4.5.1 Utilize only SPF hatchery seed in sanctuaries designated for oyster biomass accumulation, Zone 1 and Zone 2.</p> <p>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</p> <p>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</p>	<p>On-going</p> <p>On-going</p>	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.
Sanctuaries (cont'd)	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
Strategy 4.6 To facilitate the enforcement of closed areas, especially	Action 4.6.2 Sanctuaries will be buoyed and marked		

sanctuaries, implement the following actions:	Action 4.6.3 The public and judiciary will be notified about sanctuary areas through educational initiatives, public announcements and stakeholder meetings		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.
	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 new 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 new 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 indicates that exploitation rates have been around 25%.
	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. When 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 new 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 Committees 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 new 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 MNDNR, 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, Univ. of MD	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, Univ. of MD	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	This action will be addressed as part of the Native Oyster Master Plan by the ACOE. The plan is expected to be available for public review in the fall 2011.
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.

<p>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.</p>	<p>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.</p>	<p>2007</p>	<p>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.</p>
	<p>Action 6.3.2 Monitor restoration activities to clarify the interaction between selectively bred strains and wild stocks of oysters.</p>	<p>2005 UnMD, ORP, VMRC</p>	<p>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.</p>
<p>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</p>	<p>Action 6.4.1 Amend the OMP as necessary to incorporate new strategies and actions regarding aquaculture.</p>	<p>2009 2010</p>	<p>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.</p>

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 will be taking 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

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

PRT= Plan Review Team

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

2010 Maryland FMP Report (July 2011)
Section 15. Red Drum (*Sciaenops ocellatus*)

Chesapeake Bay FMP

The Red drum resource supports an important recreational fishery in the South Atlantic. Two fishery management areas are defined: the northern (NC to NJ) and the southern stock (FL to SC). 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

The status of the red drum stock is derived from the Atlantic coast stock assessment. In the 1980s and 1990's the coastal red drum stock was overfished and management measures were implemented to reduce fishing mortality (F) and to rebuild the stock. The 2009 peer reviewed ASMFC stock assessment results indicated the stock was relatively stable and overfishing is not occurring. The fishing mortality threshold is 30% of a static spawning potential ratio (SPR) and the fishing mortality target is 40% of a static SPR. An FMP rebuilding schedule has not been developed.

There is no formal stock assessment for the Chesapeake Bay. Red drum are not frequent visitors to Maryland's portion of the Chesapeake Bay. More red drum are reported from Virginia waters and when the salinity is high in Maryland. Schools of red drum larger than the maximum size limit may be seen in years of low freshwater flow.

Current Management Measures

Red drum are managed through size limits and creel limits in compliance with ASMFC compliance measures. Management guidelines are implemented under the 1984 coastal FMP and amendments 1 (1991) and 2 (2002). Maryland allows recreational fishermen to take 1 fish per day between 18 and 27". Commercial fishermen in Maryland are allowed 5 fish per day with a slot limit of 18-25". Virginia allows a possession limit of 3 fish per day and a slot limit of 18-26" for both commercial and recreational fishermen. The Potomac River Fisheries Commission (PRFC) has a possession limit of 5 fish per day and a slot limit of 18-25" for recreational and commercial fishermen. There are no closed seasons for either the recreational or commercial fisheries.

Issues/Concerns

SAV beds are important red drum habitat and state jurisdictions continue to work towards meeting the Chesapeake Bay Program's SAV restoration and water clarity goals. Maryland will continue to monitor commercial pound nets and fish houses and

measure red drum when they are encountered. Coastal states are developing a cooperative plan to collect more age/length data to improve stock assessment results.

The Fisheries

Figure 1. Commercial red drum landings from Maryland DNR, 1988-2009.

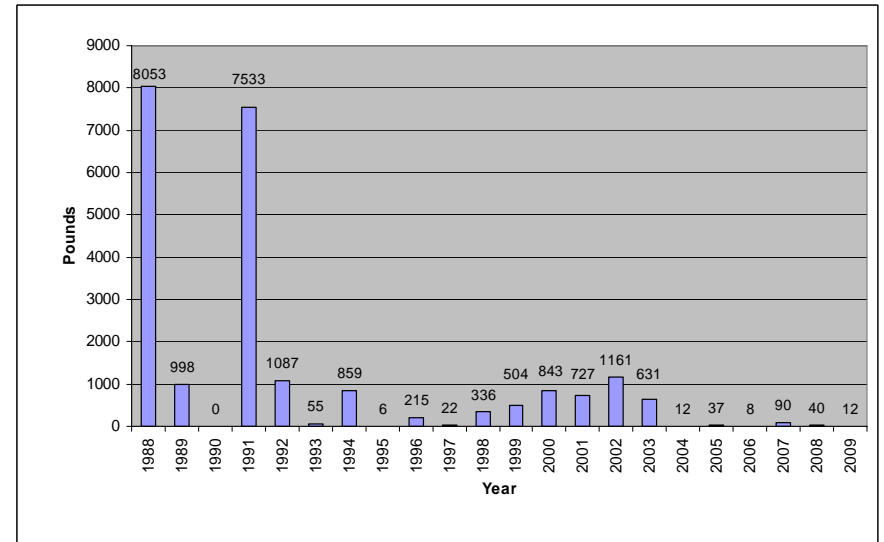
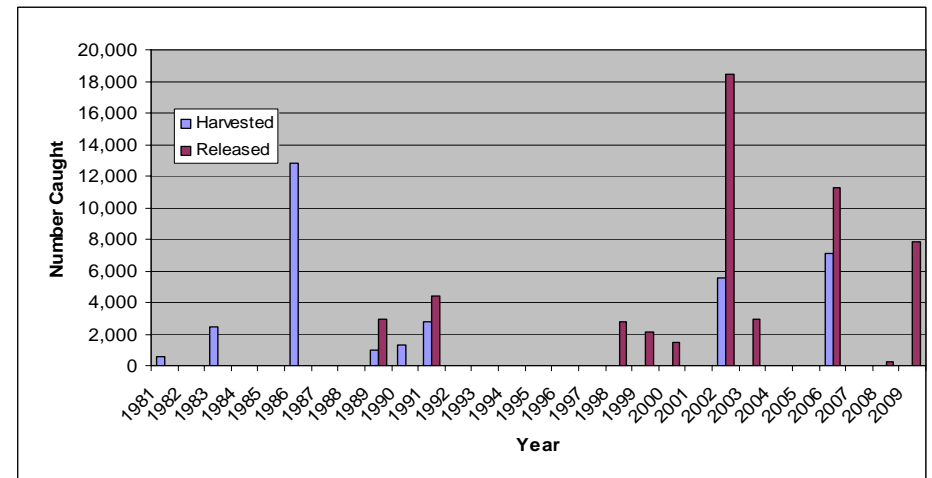


Figure 2. MRFSS harvest and release estimates for red drum in Maryland, 1981-2009



(Figures by Rickabaugh, 2009)

1993 Chesapeake Bay and Atlantic Coast Red Drum Management Plan Implementation Table (updated 5/11)			
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 decreased its size limit and now allows fishing 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.
	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 used should indirectly 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 5/11)			
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 (ChesMMAAP) continues but red drum are infrequently encountered. There is not sufficient data 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.
	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 9746 pounds in 2009, up from 6372 in 2008 and 2607 in 2007.
	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.
	2.3c Virginia and Maryland will continue to supplement the Marine Recreational Statistics Program	Continue	Maryland has changed its recreational citation tournament award program to make the awards searchable online starting in early 2011. The Marine Recreational Information Program (MRIP) is replacing MRFSS. In 2010, VA anglers caught and released 717 red drum over 46" in length.

1993 Chesapeake Bay and Atlantic Coast Red Drum Management Plan Implementation Table (updated 5/11)			
Section	Action	Date	Comments
	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.
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 less than 80,000 acres in 2010 due to warmer water temperatures.

Acronyms:

PFRC= Potomac River Fisheries Commission

SAV= Submerged Aquatic Vegetation

VIMS= Virginia Institute of Marine Science

2010 Maryland FMP Report (July 2011)

Section 16. Scup (*Stenotomus chrysops*)

Chesapeake Bay FMP

After a stock collapse in the 1990s, the Atlantic coast scup stock has rebounded and is no longer at low levels. No Chesapeake Bay Program fishery management plan (FMP) has been developed for scup. Maryland has authority to manage scup as a species in need of conservation established in 1994. 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. Scup were incorporated into the summer flounder FMP 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. Addendum XIX (2007) maintained the 1999 Amendment XII'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 XIV and implemented a standardized bycatch reporting and monitoring system with Amendment XVI.

Stock Status

Based on the 2009 assessment, the scup stock was determined to be rebuilt and not undergoing overfishing. The stock assessment methods and biological reference points (BRPs) were revised in 2009. The revised BRPs are a threshold fishing mortality ($F_{40\%}$) of 0.177 and a target spawning stock biomass ($SSB_{40\%}$) of 202.92 million pounds. Coastwide in 2010, $F_{40\%}$ was 0.043 and $SSB_{40\%}$ was 341.7 million pounds. The next scup stock assessment is scheduled for 2011.

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" and all commercial harvesters must have a federal permit. 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 landings³. Regulations for commercial fishing gear mesh size and escape panels have been enacted.

Recreational harvest regulations differ between state and federal waters. In Maryland, scup are managed with an 8" minimum size. In federal waters, a slot limit

of 7 to 10 inches is used to regulate harvest⁴. Both jurisdictions have established a 50 fish per person per day limit.

The Fisheries

Scup harvest in Maryland is generally low and varies from year to year (Figures 1 and 2). The 2010 commercial scup harvest was 19,141 pounds; 18,669 pounds during the Winter I season and 472 pounds during the Winter II season². These scup were harvested in the winter mixed black sea bass/scup/summer flounder trawl fishery. Twenty-five scup were harvested in Maryland by recreational anglers during the 2010 season⁵.

Figure 1. Pounds of scup commercially harvested in Maryland for the years 1950 to 2010^{2,5}. (MDNR and NMFS)

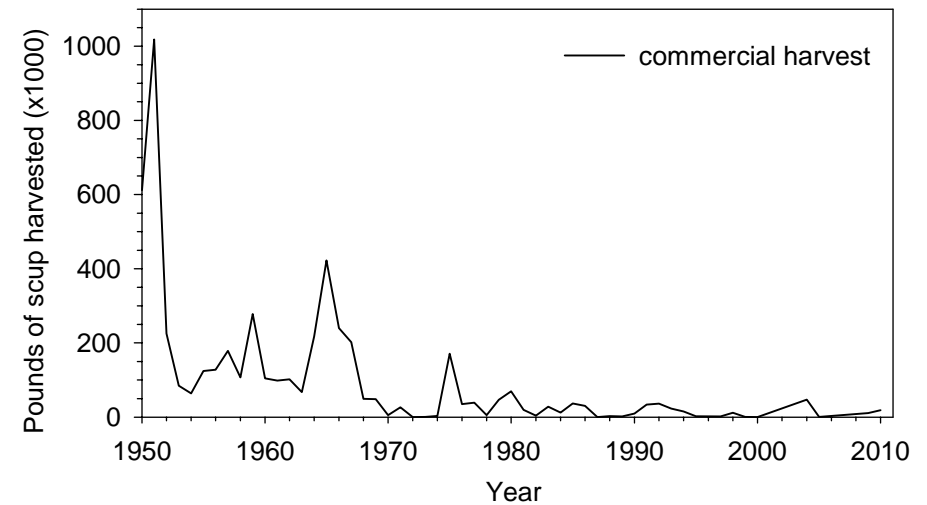
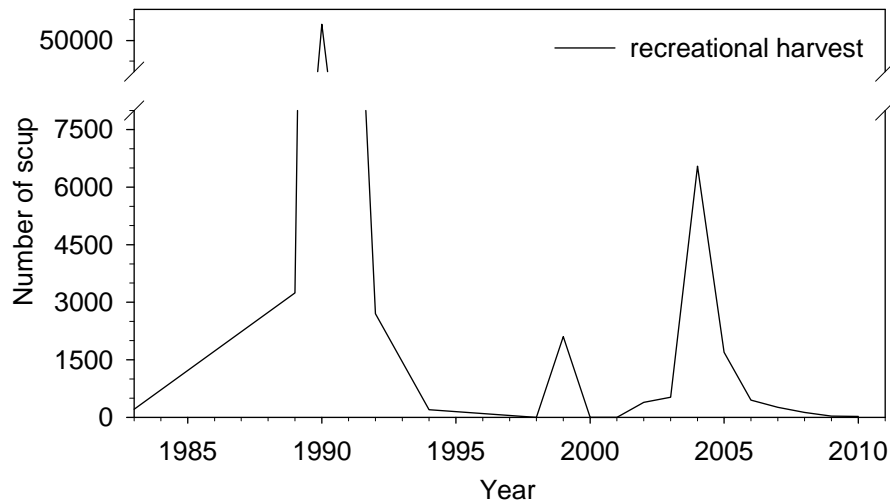


Figure 2. The number of scup harvested in Maryland by recreational anglers from 1983 to 2008⁵. (NMFS)



⁵ Personal communication from the National Marine Fisheries Service, Fisheries Statistics Division. May 25, 2011.

Issues/Concerns

Differences exist between state and federal management measures. 1) The MAFMC's FMP no longer specifies state-by-state quota distribution for the summer commercial fishery. In contrast, under ASMFC the summer coastwide quota continues to be allocated to states based on historical landings. 2) There are different recreational size limits for state and federal waters. Maryland regulations specify an 8" minimum size, while the federal regulation specifies a 7 to 10 inch slot limit.

References

- ¹ Maryland Office of the Secretary of the State. COMAR 08.02.12.03. Retrieved July 25, 2011: <http://www.dsd.state.md.us/comar/comarhtml/08/08.02.12.03.htm>
- ² Doctor, S. 2011. Maryland's 2010 annual compliance report for scup. Maryland Department of Natural Resources. Stevensville, MD.
- ³ Kerns, T., P. Caruso, and J. Coakley. 2010. 2010 review of the Atlantic States Marine Fisheries Commission fishery management plan for the 2009 scup fishing year scup (*Stenotomus chrysops*). Atlantic States Marine Fisheries Commission.
- ⁴ Electronic Code of Federal Regulations. Title 50: Wildlife and Fisheries Part 648—Fisheries of the Northeastern United States subpart H—Management measures for the scup fishery. Retrieved July 28, 2011: <http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=67e5cdb6e436238c13567432a2224de&rgn=div6&view=text&no-de=50:8.0.1.1.6.8&idno=50.Washington, DC>.

2010 Maryland FMP Report (July 2011)

Section 17. Striped Bass (*Morone saxatilis*)

Chesapeake Bay FMP

Maryland Department of Natural Resources (DNR) initiated a review of the 1989 Chesapeake Bay Striped Bass Management Plan (CB FMP) in 2010. The goal of the review is to determine the adequacy of the CB FMP's management framework. Issues being reviewed include harvest and quota enforcement, fishing sector allocation, regulatory decision rules, and the integration of habitat management reference points.

The Atlantic States Marine Fisheries Commission (ASMFC) developed the Interstate Fisheries Management Plan for Striped Bass in 1981 (ASMFC FMP). The Chesapeake Bay Program (CBP) developed the CB FMP in 1989 to coordinate management among jurisdictions to comply with ASMFC FMP requirements. Amendment 1 to the CB FMP formally adopted ASMFC's management framework for the Chesapeake Bay. A new CB FMP amendment will be needed to reflect the significant changes to ASMFC's FMP since 1998. Amendment V to the ASMFC FMP required an annual juvenile abundance index (JAI) survey in Maryland and Virginia. Maryland's JAI began in 1954 and VA's in 1955. Juvenile survival varies annually so the acceptable JAI variation used to define recruitment failure was changed from 90% to 75% (Amendment VI). Several ASMFC addenda have been adopted to make adjustments to management measures (www.asmfc.org/stripedBass.htm). A second addendum to Amendment VI is being considered by ASMFC.

A NOAA Chesapeake Bay Fisheries Ecosystem Advisory Panel agreed to develop a Fisheries Ecosystem Plan (FEP) for Chesapeake Bay in 2006. Maryland Sea Grant was contracted by CBP to facilitate implementation of the FEP. The goal was an ecosystem-based fishery management plan for five keystone Chesapeake Bay species, which includes striped bass. State, federal, and academic representatives met in 2008 to develop a striped bass biological background that included current and future ecosystem stressors. Issue briefs were developed for four categories of 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 completed in 2009 (www.mdsg.umd.edu/programs/policy/ebfm/).

Stock Status

The striped bass stock is not overfished and is not undergoing overfishing. Striped bass are managed with biological reference points (BRPs) for female spawning stock biomass (SSB) and fishing mortality (F). Current BRPs are defined in ASMFC's 2009 Stock Assessment Report for Atlantic Striped Bass: $SSB_{target}=82,672,500$ lbs and $SSB_{threshold}=66,138,000$ lbs. Target F for striped bass in coastal waters is 0.30 and the

$F_{threshold}$ is 0.34. The F_{target} is slightly lower for the Chesapeake Bay ($F=0.27$) because a smaller minimum size (18") is used to regulate the fishery. The next benchmark stock assessment will be in June 2013.

Chesapeake Bay F for striped bass 18-28" in 2008 was 0.08-0.10^{1,3} and 0.13 for fish ≥ 28 "³. The juvenile abundance index (JAI), a predictor of year class strength, measured as a geometric mean of age-0 fish declined from 2009 (3.92) to 2010 (2.54). The JAI has been below the JAI_{target} (4.32) four of the last five years (Figure 2). However, the stock has not experienced recruitment failure based on the management trigger. Recruitment failure is defined by Addendum II as three consecutive years of JAI falling below the 25th percentile value (1.6).

Current Management Measures

Management measures for striped bass can change annually based on ASMFC requirements and stakeholder concerns. Commercial fisheries are managed using quotas and time restrictions for each gear type. Maryland's 2010 and 2011 Chesapeake Bay commercial fisheries (pound net, haul seine, hook and line, and drift gill net) had an 18"-36" slot limit. The Atlantic Ocean drift gill net and trawl fisheries had a 24" minimum size limit during the same years.

The 2010 and 2011 recreational fisheries are managed with minimum size limits, creel limits, tackle and bait restrictions, season closures, and area closures. The Upper Bay spring catch-and-release trophy fishery (March 1st to May 3rd) is restricted to the mainstem Upper Bay and requires circle hooks or J-hooks (< 0.5" gap) if using bait. The spring hook and line trophy fishery (April 16th to May 15th) restricts anglers to the mainstem Chesapeake Bay and 1 fish/person/day ≥ 28 " in length. An 18"-28" slot limit is imposed from May 16th to December 15th. During this time, anglers can keep 2 fish within the slot, or 1 fish within the slot and 1 fish >28 ". Anglers fishing from May 16th to 31st are restricted to the mainstem Chesapeake Bay and portions of the Susquehanna, Northeast, Chester, Choptank, and Patuxent Rivers. This fishery is managed with an 18"-26" slot limit. Anglers fishing from June 1st to December 15th do not have any area restrictions. The Maryland coastal recreational fishery is year round allowing 2 fish/person/day and a minimum size of 28".

The Fisheries

Maryland's 2010 striped bass quota was 5.1 million lbs. and was distributed among three fishing sectors: commercial (42.5%), recreational (42.5%), and charter (15%). The Maryland Chesapeake Bay commercial quota was 2.25 million lbs in 2009, 2.10 million lbs in 2010, and 1.96 million lbs for 2011. Commercial quota is allocated among three sectors. Drift gill net was allocated 934,742 lbs in 2010 and 884,000 lbs in 2011. Hook and line was allocated 519,117 lbs in 2010 and 439,000 lbs in 2011. The pound net/haul seine fishery was allocated 645,004 lbs in 2010 and 641,000 lbs in 2011. The 2010 coastal commercial quota was 125,465 lbs. The Maryland commercial fishery landed

2.15 million lbs in 2010 (Figure 1), or 29.4%⁴ of the coastwide commercial catch. The harvest distribution was 127,327 lbs from the coast; 934,742 lbs from gill nets; 936,030 lbs from pound nets; and 519,117 lbs by Hook and Line^{1,2}. Discard mortality was estimated to be 8.8%². Maryland's Atlantic coast fishery landed 44,802 lbs.

The 2010 Chesapeake Bay recreational quota (including charters) was 2,857,099 lbs¹. Maryland anglers harvested 68,533 lbs from the Atlantic coast and 2.79 million lbs from Chesapeake Bay¹ (Figure 1), or 13.4%⁴ of coastwide recreational landings². Seventy-five percent of fish were released with an estimated 8% mortality.

Issues/Concerns

Commercial harvest reporting has been streamlined. Reporting rates and compliance have improved. Several instances of illegal commercial harvest have occurred since 2009. Illegal anchored gill nets were found prior to the 2011 drift gill net season (13 tons of striped bass) and after the season (3 tons of striped bass). This was 3.6% of the drift gill net quota. New penalty legislation and regulations were adopted in 2011. DNR is reviewing enforcement options and available resources. Commercial and recreational poaching data is limited. Some recreational angler advocates have requested review of the 1989 allocation formula.

DNR is reviewing the CB FMP and Amendment 1 strategies and actions. A new amendment is being considered. Allocation will be included in the review.

Striped bass natural mortality has increased in Chesapeake Bay. Research is needed to understand how mycobacteriosis, diet composition, spawning stock sex ratio, juvenile production, and recruitment success affect natural mortality.

Recreational anglers and catch and release practices have increased. Roughly 8-9% of fish released do not survive. Coastwide, this equals ≥ 2 million striped bass. Education and outreach programs to teach best-fishing practices need to continue.

Maryland commercial watermen and the DNR are exploring implementation of a catch-share management system. Environmental Defense Fund (EDF) is coordinating the meetings and discussions.

References

¹ MDNR. 2011. Maryland Striped Bass (*Morone saxatilis*) Compliance Report to the Atlantic States Marine Fisheries Commission 2010. MDNR, Annapolis, MD

² ASMFC. 2010. 2010 review of the Atlantic States Marine Fisheries Commission fishery management plan for Atlantic striped bass (*Morone saxatilis*) 2009 fishing year. Atlantic States Marine Fisheries Commission, Washington, DC.

³ ASMFC. 2009. 2009 stock assessment report for Atlantic striped bass. Atlantic States Marine Fisheries Commission, Washington, DC.

⁴ Personal communication from the National Marine Fisheries Service, Fisheries Statistics Division. May 10, 2011.

Figure 1. Maryland commercial and recreational (including charters) striped bass landings² and quotas¹ since 1982.

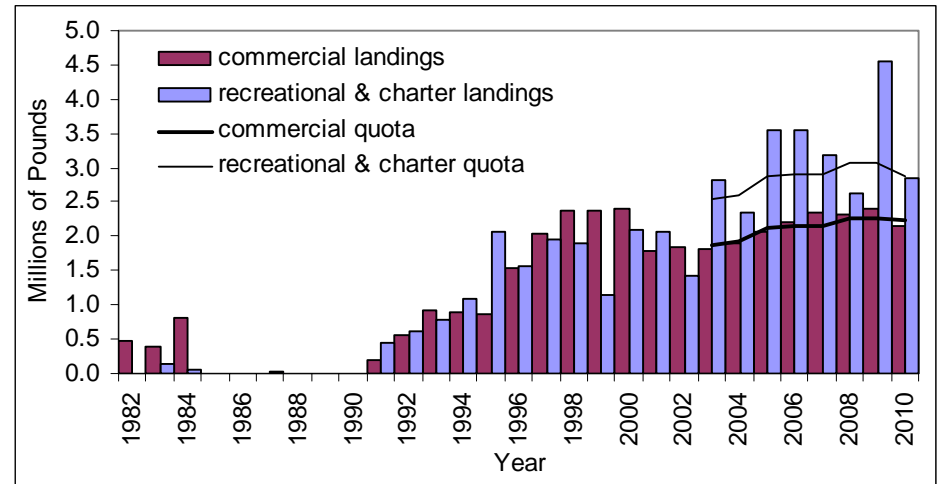
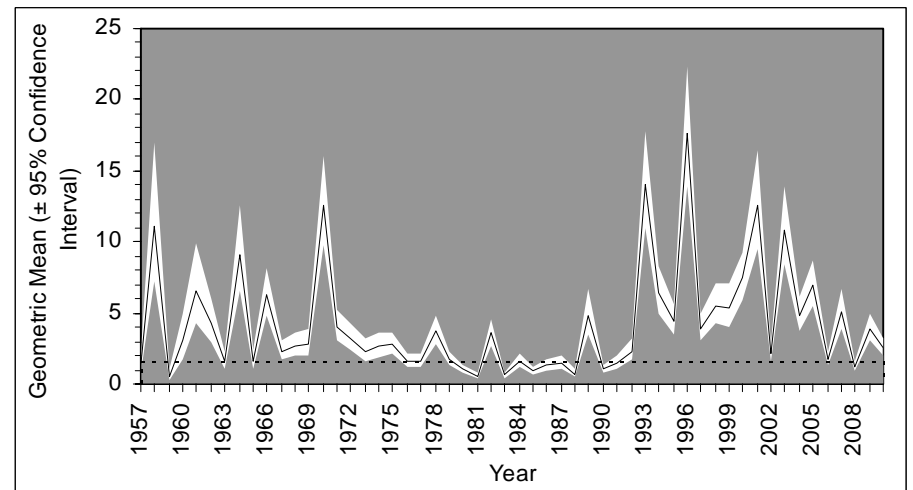


Figure 2. Striped bass Juvenile Abundance Index trend with confidence intervals since 1957¹. The dashed line represents ASMFC's recruitment failure definition.



1989 Chesapeake Bay Striped Bass Management Plan Implementation Table (updated 6/1/2011)

Amendment 1 to the 1989 FMP adopts current and future ASMFC management scenarios for Chesapeake Bay.

Strategy	Action	Date	Comments
<p>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.</p> <p>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.</p>		<p>Continue</p> <p>1995</p> <p>1995</p> <p>Ongoing</p> <p>2003</p> <p>2009</p> <p>2010</p>	<p>Targeted 1990 for a transition fishery.</p> <p>The coastal stock was declared restored.</p> <p>Juvenile abundance data is used by ASMFC to estimate coastal SSB and VPA of coastal stock</p> <p>Amendment VI changed the JAI recruitment failure definition from 90% to 75% of the index for three consecutive years.</p> <p>Strong recruitment of 1993, 1996, 2001, and 2003 year classes. The MD 2009 juvenile index was 3.92, slightly lower than the average 4.32. The MD 2010 juvenile index was 2.54.</p>
<p>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 <u>transition</u> fishery and a rate of 0.5 (equivalent to about 32% of the legal sized fish being harvested) during a <u>recovered</u> 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.</p>	<p>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.</p> <p>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 reported for the period 1972-1979. No commercial fishing is permitted in the District</p>	<p>February 2003</p> <p>Continue</p> <p>2000</p> <p>Continue</p> <p>Since the fishery reopened</p> <p>2009</p>	<p>CBP jurisdictions have option to implement stricter regulations than required under ASMFC Amendment VI.</p> <p>All CB jurisdictions have implemented regulations to prevent exceeding F_{target}.</p> <p>CB F has remained below the coastal F_{target} of 0.30 and CB F_{target} of 0.27 since 1997. The overfishing definition is $F_{msy}=0.34$. If coastwide estimated mortality rates exceed the target rate for 2 consecutive years, the ASMFC Management Board will recommend harvest reductions.</p>

1989 Chesapeake Bay Striped Bass Management Plan Implementation Table (updated 6/1/2011)

Amendment 1 to the 1989 FMP adopts current and future ASMFC management scenarios for Chesapeake Bay.

Strategy	Action	Date	Comments
	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.	Ongoing	<p>2009 MD commercial landings were 2.39 million lbs (Figure 1, ASMFC), and recreational landings were 4.56 million lbs (Figure 1, ASMFC). The Maryland commercial fishery landed 2.15 million lbs in 2010. Recreational landings were 2.79 million lbs. in 2010. Mortality of released fish is estimated to be 8.8% for commercial and 8% for recreational.</p> <p>2009 PRFC commercial landings were 727,197 lbs and VA commercial landings were 1.55 million lbs. 2009 VA recreational landings were 1.26 million lbs.</p>
	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.		
	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.		
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.		
	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 the female spawning stock.	Ongoing	MD and VA provide data to ASMFC to estimate SSB using a VPA.
		2008	SSB is estimated using a statistical catch at age (SCA) model. The VPA model is no longer used. As of 2008, $SSB_{threshold} = 30,000$ mt and $SSB_{target} = 37,500$ mt.
		2010	SSB has remained above 1995 SSB_{target} from 1996-2009.
	1.3.3 Maryland and Virginia will continue	1993 VA	MD and VA discontinued stocking striped

1989 Chesapeake Bay Striped Bass Management Plan Implementation Table (updated 6/1/2011)

Amendment 1 to the 1989 FMP adopts current and future ASMFC management scenarios for Chesapeake Bay.

Strategy	Action	Date	Comments
	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.	1995 MD	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.
<p>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.</p> <p>2.1 The striped bass harvest will be equitably allocated among user groups on a yearly basis.</p>	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.		
	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.	2011	The MD striped bass commercial fishery has applied for sustainable fishing certification.
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 negligible levels.		CB jurisdictions are in compliance.
	2.2.2 Maryland and Virginia will require that gill nets be marked, tended, and recovered		CB jurisdictions are in compliance.

1989 Chesapeake Bay Striped Bass Management Plan Implementation Table (updated 6/1/2011)

Amendment 1 to the 1989 FMP adopts current and future ASMFC management scenarios for Chesapeake Bay.

Strategy	Action	Date	Comments
	(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.		
	2.2.4 Maryland and Virginia will establish annual quotas for their commercial fisheries.		CB jurisdictions are in compliance.
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.		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.		CB jurisdictions are in compliance.
	2.3.1 C) The sale of striped bass caught by recreational or charter boat fishermen will be prohibited.		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.	2010	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 of a license if a harvest report is not received within 50 days after the due date. Two of more reporting violations may result in license suspension.
	2011	MD Senate Bill 655 and House Bill 1225 increase 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.	
2011	MD House Bill 1252, passed the General Assembly, established a misdemeanor charge and up to two years imprisonment for the unlawful capture of >\$20,000 of striped bass (based on sale proceeds).		
2.4.1 Fishing seasons will be established for the	2.4.1 A) The District of Columbia will		

1989 Chesapeake Bay Striped Bass Management Plan Implementation Table (updated 6/1/2011)

Amendment 1 to the 1989 FMP adopts current and future ASMFC management scenarios for Chesapeake Bay.

Strategy	Action	Date	Comments
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.	establish a recreational fishing season within the period June through December.		
	2.4.1 B) Maryland will establish fishing seasons within the following periods: <ul style="list-style-type: none"> 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. 	2011	MD Senate Bill 635 (Senator Frosh) and House Bill 1154 (Delegate Jim Gilchrist), require the revocation of an individual's commercial fishing license if found by an Administrative Law Judge to have knowingly committed an egregious 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.
	2.4.1 C) Virginia will establish fishing seasons within the following periods: <ul style="list-style-type: none"> 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. 		
	2.4.1 D) The Potomac River Fisheries Commission will establish fishing seasons within the following periods: <ul style="list-style-type: none"> 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. 		
	2.4.1 E) Maryland, the Potomac River Fisheries Commission and Virginia will annually review the need for a Bay spawning		

1989 Chesapeake Bay Striped Bass Management Plan Implementation Table (updated 6/1/2011)

Amendment 1 to the 1989 FMP adopts current and future ASMFC management scenarios for Chesapeake Bay.

Strategy	Action	Date	Comments
	season fishery in relationship to the issue of parity with the coastal states.		
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.		
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.		
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.		
	2.4.4.2 Maryland may allow one trophy fish per boat during a May trophy season.		
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: <ul style="list-style-type: none"> 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 recreational effort. o Conduct port and onboard sampling of 	1995 - 2003 Ongoing	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 juvenile striped bass seine survey (JAI); 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.
		2007	Data collected from Federal waters is

1989 Chesapeake Bay Striped Bass Management Plan Implementation Table (updated 6/1/2011)

Amendment 1 to the 1989 FMP adopts current and future ASMFC management scenarios for Chesapeake Bay.

Strategy	Action	Date	Comments
	policies for the striped bass fishery throughout the Chesapeake Bay. Strategies to address enforcement needs will be developed.		
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.		2008 - 2010	MD and VA have instituted tagging programs to estimate migration and mortality rates. SARC determined stock is not overfished is not undergoing overfishing.
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	
3.2 Efforts will be made to improve our understanding of factors that affect reproduction and recruitment to the fishery.	3.2 The District of Columbia, Maryland and Virginia, in cooperation with federal 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.	2007 Continue 2009	Addendum 1 to Amendment 6 of the ASMFC FMP requires states to implement angler education about catch and release best practices. Tagging data indicates striped bass M <u>may</u> be increasing unless CB emigration has increased. Increased M may reflect an increased incidence of mycobacteriosis. Decreased prey availability and poor water quality may also be increasing M.
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	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		Water quality issues are also addressed in the Chesapeake 2000 Agreement and most recently in the 2009 Executive Order.

1989 Chesapeake Bay Striped Bass Management Plan Implementation Table (updated 6/1/2011)

Amendment 1 to the 1989 FMP adopts current and future ASMFC management scenarios for Chesapeake Bay.

Strategy	Action	Date	Comments
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.	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.		
	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 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.	1991 2001 2007 Continue	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 has been facilitated through MD Sea Grant. Habitat issues/stressors have been defined for 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		

1989 Chesapeake Bay Striped Bass Management Plan Implementation Table (updated 6/1/2011)

Amendment 1 to the 1989 FMP adopts current and future ASMFC management scenarios for Chesapeake Bay.

Strategy	Action	Date	Comments
	<p>inadequately treated sewage.</p> <p>c) Establish and enforce nutrient and conventional pollutant limitations in regulated discharges.</p> <p>d) Reduce levels of nutrients and other conventional pollutants in runoff from agricultural and forested lands.</p> <p>e) Reduce levels of nutrients and other conventional pollutants in urban runoff.</p>		
	<p>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:</p> <p>a) Reduce discharge of metals and organic compounds from sewage treatment plants receiving industrial wastewater.</p> <p>b) Reduce the discharge of metals and organic compounds from industrial sources.</p> <p>c) Reduce levels of metals and organic compounds in urban and agricultural runoff. Reduce chlorine discharges to critical finfish areas.</p>		
	<p>4.1 4 – Development and adoption of a basinwide plan for the management of conventional pollutants entering the Chesapeake Bay from point and nonpoint sources:</p> <p>a) Manage sewage sludge, dredge spoil and hazardous wastes.</p> <p>b) Improve dissolved oxygen concentrations in the Chesapeake Bay through the reduction of nutrients from both point and nonpoint sources.</p> <p>c) Continue study of the impacts of acidic conditions on water quality.</p> <p>d) Manage groundwater to protect the water quality of the Chesapeake Bay.</p> <p>e) Continue research to refine strategies to reduce point and nonpoint sources of nutrient, toxic and conventional pollutants in the Chesapeake Bay.</p>		

1989 Chesapeake Bay Striped Bass Management Plan Implementation Table (updated 6/1/2011)

Amendment 1 to the 1989 FMP adopts current and future ASMFC management scenarios for Chesapeake Bay.

Strategy	Action	Date	Comments
	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.		

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

F – Fishing Mortality

FMP – Fishery Management Plan

JAI – Juvenile Abundance Index

M – Natural Mortality

MD – Maryland

MDNR – Maryland Department of Natural Resources

MSY – Maximum Sustainable Yield

NOAA – National Oceanic and Atmospheric Administration

NRP – Maryland Natural Resources Police

PA – Pennsylvania

PRFC – Potomac River Fisheries Commission

SARC – Stock Assessment Review Committee

SCA – Statistical Catch at Age

SSB – Spawning Stock Biomass (females)

USFWS – U.S. Fish and Wildlife Service

VA – Virginia

VMRC – Virginia Marine Resources Commission

VPA – Virtual Population Assessment

2010 Maryland FMP Report (July 2011)

Section 18. Summer Flounder (*Paralichthys dentatus*)

Chesapeake Bay FMP

Coastwide, the summer flounder stock continues to improve as the 2013 stock rebuilding target approaches. By the late 1980s the Atlantic coast summer flounder stock had been overfished and was depleted. In 1991, Chesapeake Bay jurisdictions adopted a regional summer flounder management framework: the Chesapeake Bay Summer Flounder Fishery Management Plan (CB FMP). The 1991 CB FMP implemented management measures that reduced fishing mortality (F) and increased the stock's spawning biomass. CB FMP strategies and actions were based on guidelines established by the Atlantic States Marine Fisheries Commission (ASMFC) and the Mid-Atlantic Fisheries Management Council (MAFMC). In 1997 as the stock improved, the Chesapeake Bay jurisdictions adopted Amendment # 1 to the CB FMP. This amendment adopted all future reference points and quota determined by the ASMFC and MAFMC. Jurisdictions agreed to implement commercial and recreational management measures as needed to meet these requirements. Amendment #1 also included a provision to implement a commercial permit system to maintain traditional Chesapeake Bay and coastal fisheries.

Summer flounder, scup and black sea bass are managed under a joint AMFSC and MAFMC fisheries management plan. ASMFC first developed the Fishery Management Plan for Summer Flounder in 1982 to establish a 14" minimum size and specify trawl net mesh size for fishing in state waters (≤ 3 miles from shore). 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 fishers to abide by the more conservative state or federal requirements. 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 (3, 4, 8, and 15 to 19) 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. Maryland submits an annual compliance report to ASMFC.

Stock Status

Summer flounder are managed as a single stock in US Atlantic coast waters from the North Carolina/South Carolina border north to the US/Canadian border. Stock status was last reviewed in 2010. The stock is not being overfished and overfishing is not occurring. However, the summer flounder stock has not been rebuilt to target levels. The ASMFC/MAFMC FMP rebuilding schedule extends to the year 2013.

Current biological reference points (BRP) for summer flounder are a target F of 0.255, a threshold F of 0.310, a target spawning stock biomass (SSB) of 132.4 million pounds, and a threshold SSB of 66.2 million pounds. Fishing mortality has declined since the 1990s. It was estimated at 0.237 in 2009. Summer flounder SSB began increasing in the 1990s. In 2009, the SSB estimate was 117.9 million pounds. For both BRPs, the 2009 estimates are between the target and threshold values. On average, 42 million summer flounder juveniles have annually recruited to the spawning population since 1982. Furthermore, the number of larger and older fish in the coastal population has improved.

Management Measures

National Marine Fisheries Service (NMFS), in conjunction with MAFMC, annually determine the coastwide total allowable catch (TAC). Sixty percent of the TAC is allocated to the commercial fishery and 40% is allocated for recreational harvest. Commercial coastwide quota is allocated among states based on their historic proportion of landings. The recreational fishery is managed with a single coastwide quota through a process referred to as conservation equivalency. NMFS allows states, in cooperation with ASMFC and MAFMC, to set their own management measures to meet the TAC. Commercial and recreational quota overages are deducted from the following year's quota.

Maryland is allocated 2.04% of the coastwide commercial TAC. A portion of Maryland's commercial quota is allocated to the Potomac River Fisheries Commission (PRFC). The majority of Maryland's quota is allocated to the coastal commercial fishery. The remaining quota is set aside for Chesapeake Bay commercial harvest, which is primarily a bycatch fishery. Catch shares are used to equitably allocate Maryland's commercial quota in Atlantic coastal waters and Coastal Bays including their tributaries. The catch share system assigns a specific individual fishing quota (IFQ) for each fisherman. The catch share permitting system allows each fisherman to plan and manage their fishing business for best economic yield. Permits are managed with an 18" minimum length for the commercial hook and line fishery and a 14" minimum length for other gears. Individuals without an IFQ permit are restricted to 100 lbs per individual per day for Atlantic and coastal waters, and for Chesapeake Bay waters a ≥ 18 " total length and 3 fish per person per day. Chesapeake Bay commercial harvest without hook and line is limited to a 14" minimum size and 50 lbs per day. PRFC manages the Potomac River with a 14" minimum size and no catch limit. Jurisdictions also regulate net design and mesh size.

Maryland's 2010 recreational TAC target was 75,000 fish. The estimated recreational harvest in 2010 was 38,000 fish. The 37,000 fish underage was combined with Maryland's initial 2011 harvest target. Maryland's total summer flounder recreational TAC for 2011 is 101,000 fish. Maryland recreational summer

flounder harvest is only allowed from April 16 to November 30. All fish are subject to an 18" or greater total length and 3 fish per person per day. Summer flounder recreational harvest from the Potomac River is allowed year round and managed with a $\geq 17\frac{1}{2}$ " total length and 4 fish per person per day.

Maryland annually monitors summer flounder abundance, size, and age through a Coastal Bays trawl survey, beach seine survey, and from fish caught by commercial trawlers fishing near-shore Atlantic waters. The Maryland Department of Natural Resources (MDNR) and the Maryland Saltwater Sportsmen's Association (MSSA) Atlantic Coast Chapter initiated the Maryland Volunteer Angler Summer Flounder Survey (MVASFS) in 2011. This survey is designed to test NMFS's assumptions when estimating the overall recreational summer flounder catch. The MVASFS is innovative because it is a public/private venture with Coastal Bay recreational anglers to collect summer flounder harvest data from private docks, ramps, and marinas. NMFS only interviews recreational anglers at public boat launches. The MVASFS harvest data will be used when developing management measures.

The Fisheries

The coastwide TAC in 2010 was 22.13 million pounds. In 2010, Maryland's commercial fishery harvested 209,358 pounds; 89 thousand pounds less than the quota (Figure 1). The prior year's harvest had exceeded the quota by 110 thousand pounds. Recreational landings were 39,243 fish, approximately 140,750 pounds, in 2010 (Figure 2).

Figure 1. Commercial harvest (1940 to 2010) and quota (1994 to 2010) of summer flounder in Maryland. (MDNR, NMFS, and Northeast Fisheries Science Center)

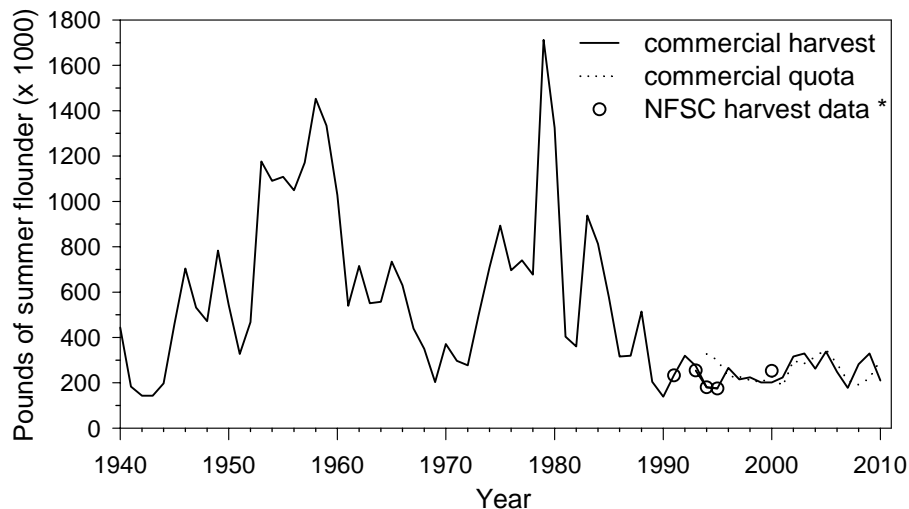
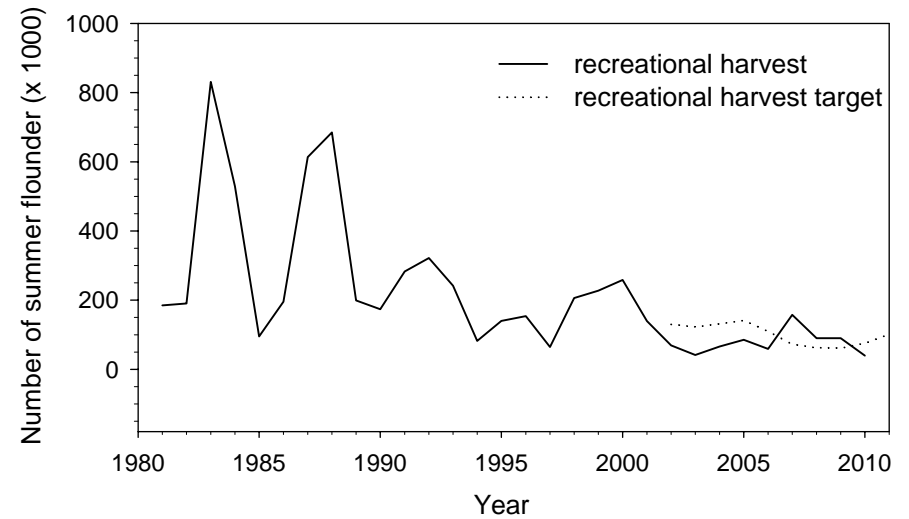


Figure 2. Recreational summer flounder harvest and target in Maryland from 1981 to 2010. (MDNR, NMFS)



Issues/Concerns

The summer flounder stock is continuing to rebuild with a rebuilding target date of 2013. MDNR will continue to monitor commercial and recreational summer flounder harvest and fishing effort to ensure necessary management measures are implemented.

Maryland DNR is exploring mechanisms to improve regulatory consistency among the black sea bass, summer flounder and horseshoe crab commercial fisheries to streamline the coastal commercial permit process while allowing for some flexibility.

Amendment 1 to the 1991 Chesapeake Bay Summer Flounder Fishery Management Plan Implementation Table (updated 7/2011)			
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. Atlantic, Coastal Bays, and Chesapeake Bay: 18" minimum for hook and line, 14" minimum for other gear. 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/. PRFC annual commercial quota is determined by NMFS/ASMFC and deducted from MD's total annual quota: 14" minimum, January 1 to December 31. VA annual commercial quota is determined by NMFS/ASMFC. 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

Amendment 1 to the 1991 Chesapeake Bay Summer Flounder Fishery Management Plan Implementation Table (updated 7/2011)

Strategy	Action	Date	Comments
			<p>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. Minimum size is 14".</p>
	<p>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.</p>	<p>2001 2003 2005 2009 2011</p>	<p>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 April 15 to September 13: Atlantic & Coastal Bays have ≥18" total length and 3 fish per person per day, and Chesapeake Bay has ≥16½" total length and 1 fish per person per day. PRFC April 15 to September 13: ≥16½" total length and 1 fish per person per day. VA open all year: ≥19" total length and 5 fish per person per day. MD April 16 to November 30: Atlantic, Coastal Bays, and Chesapeake Bay have ≥18" total length and 3 fish per person per day, PRFC: ≥17½" total length and 4 fish per person per day. VA open all year: ≥17½" total length and 4 fish per person per day.</p>
	<p>1.1c) Maryland and Virginia will maintain the traditional commercial fishery by requiring a</p>	<p>1998, 2003 Continue</p>	<p>A summer flounder permit system has been determined and is being implemented.</p>

Amendment 1 to the 1991 Chesapeake Bay Summer Flounder Fishery Management Plan Implementation Table (updated 7/2011)			
Strategy	Action	Date	Comments
	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.	2005 2010	VA issues permits for vessels and dealers.

1991 Chesapeake Bay Summer Flounder Fishery Management Plan Implementation Table (updated 7/2011)				
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	Initiated increasing minimum size 13" to 14" ASMFC revised overfishing definition.	
	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	1998	See Amendment #1, Strategy 1.1, Action 1.1b See Amendment #1, Strategy 1.1, Action 1.1b
	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		See Amendment #1, Strategy 1.1, Action 1.1a
	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.	1993 1995		ASMFC State allocations changed. ASMFC capped coastwide quota & adjusted stock rebuilding schedule.

1991 Chesapeake Bay Summer Flounder Fishery Management Plan Implementation Table (updated 7/2011)			
Strategy	Action	Date	Comments
	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 with MAFMC quota closures.	1998	ASMFC revised overfishing definition. See Amendment #1, Strategy 1.1, Action 1.1a
1.2) Management agencies will 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.	1.2a) Virginia and Maryland will implement a 5.5 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.		
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.	Continue	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.		
	1.3c) Maryland, PRFC, and Virginia will work through the Mid-Atlantic Fisheries Management Council and the Atlantic States Marine Fisheries		

1991 Chesapeake Bay Summer Flounder Fishery Management Plan Implementation Table (updated 7/2011)			
Strategy	Action	Date	Comments
	Commission to encourage protection of immature flounder.		
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.		
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.		
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.	Continue	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.		

1991 Chesapeake Bay Summer Flounder Fishery Management Plan Implementation Table (updated 7/2011)			
Strategy	Action	Date	Comments
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.		
	3.1 2) Developing and adopting basinwide nutrient reduction strategies.		
	3.1 3) Developing and adopting basinwide plans for the reduction and control of toxic substances.		
	3.1 4) Developing and adopting basinwide management measures for conventional pollutants entering the Bay from point and nonpoint sources.		
	3.1 5) Quantifying the impacts and identifying the sources of atmospheric inputs on the Bay system.		
	3.1 6) Developing management strategies to protect and restore wetlands and submerged aquatic vegetation.		
	3.1 7) Managing population growth to minimize adverse impacts to the Bay.		

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
- NMFS – National Marine Fisheries Service
- PRFC – Potomac River Fisheries Commission
- VAC – Code of Virginia
- VMRC – Virginia Marine Resource Commission

2010 Maryland FMP Report (July 2011)
Section 19. Tautog (*Tautoga onitis*)

Chesapeake Bay FMP

In spring of 2011, the Atlantic States Marine Fisheries Commission (ASMFC) determined that the tautog stock was overfished and that overfishing is occurring. The ASMFC Management Board has implemented a sixth addendum to the fishery management plan (FMP) to reduce fishing mortality (F) by 53%. Necessary regulations to achieve the reduction must be implemented by the start of 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 is scheduled for review in 2011. The review will evaluate the current goals, objectives, strategies and actions within the 1998 FMP to determine whether the current management framework is appropriate or whether an addendum or amendment is necessary.

Tautog harvest in Maryland is primarily recreational (90%). 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 0.21 and 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. State tautog regulations must also prohibit the possession of tautog caught in Federal waters. Amendment VI provisions must be implemented by January 1, 2012. 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, the ASMFC determined that coastwide tautog are overfished at $SSB_{2009} = 23.3$ million lbs ($SSB_{target} = 59$ million lbs) and overfishing continues to occur ($F_{2007-2009} = 0.38$ versus $F_{target} = 0.20$)^{1,2,3}. Tautog SSB has remained below the threshold value since 1989^{1,3}. Recruitment of age 1 fish has remained at apparent low levels since the early 1990s². A paucity of data continues to challenge the tautog stock assessment committee and has resulted in a coastwide assessment rather than regional assessments. Stock assessment estimates have tended to overestimate F and both over- and underestimate SSB². The status of tautog in Maryland is largely

unknown. Limited data suggests that the tautog population is stable but not at target levels.

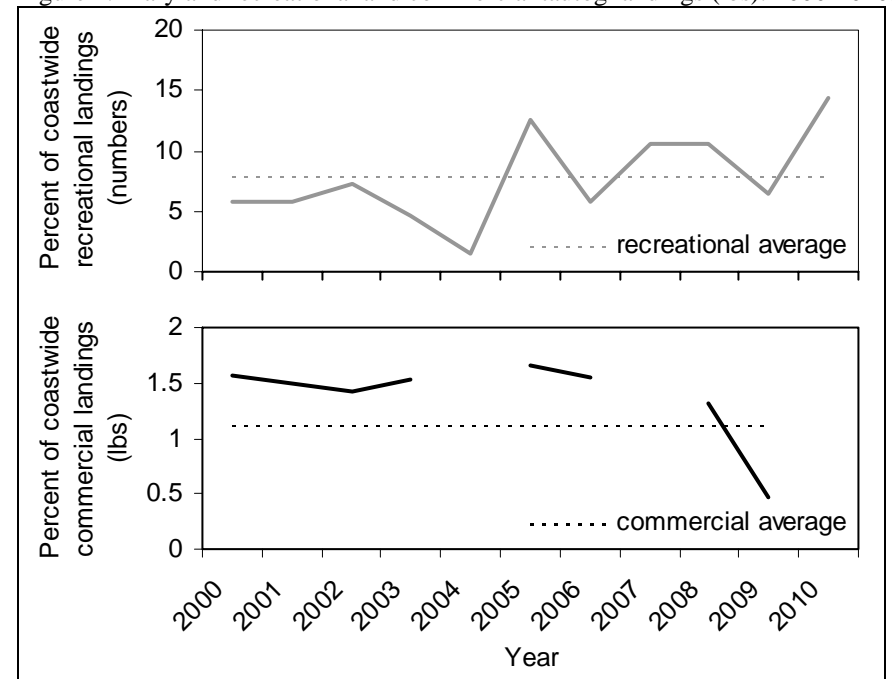
Current Management Measures

As of June 2011, the Maryland tautog regulations are as follows. Recreational regulations allow 4 fish per person per day from January 1 – May 15 and November 1 – 30. Two fish per person per day are allowed from May 16 – October 31. The fishery is closed in December. The minimum size limit is 14". The commercial fishing season, minimum size, and allowable harvest are the same as for the recreational fishery. One panel on pots and traps must be attached with degrading fasteners to prevent ghost fishing if lost.

The Fisheries

Coastwide, Maryland's average recreational landings from 2000-2010 varied between 1.4% and 14% of tautog landed⁴ (Figure 1). Commercial landings varied between 1.3% and 1.6% of pounds landed coastwide from 2000-2009 (excluding 2004 and 2007, Figure 1)⁴. Maryland's tautog harvest is a minor component of coastwide landings. However, Maryland is not eligible for *de minimis* status since it requires '...commercial landings in the most recent year for which data are available did not exceed *the greater of 10,000 lbs or 1% of the coastwide commercial landings*⁵.'

Figure 1. Maryland recreational and commercial tautog landings (lbs): 2000-2010.



Issues/Concerns

All states with a tautog fishery are required to implement regulations to reduce F by 53%. Maryland's tautog fisheries are a minimal component of the total coastwide harvest and a 53% reduction in landings may not be equitable.

Tautog are dependent on bottom structure, but managed as a single Atlantic coast stock. Larval dispersal and juvenile/adult migration among reef areas coastwide is poorly understood. It is conceivable that source and sink populations exist. If so, then regional management options will be necessary.

Oyster reef and submerged aquatic vegetation 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.

References

- ¹ Atlantic States Marine Fisheries Commission. 2011. Addendum VI to the interstate fishery management plan for tautog. Atlantic States Marine Fisheries Commission. Arlington, Virginia.
- ² Atlantic States Marine Fisheries Commission. 2011. 2011 Tautog Assessment Update Summary. Atlantic States Marine Fisheries Commission. Arlington, Virginia.
- ³ 2008 Review of the Atlantic States Marine Fisheries Commission fishery management plan for tautog (*Tautoga onitis*)
- ⁴ Personal communication from the National Marine Fisheries Service, Fisheries Statistics Division. June 2011.
- ⁵ Carmichael, J. 1997. Fishery management plan for tautog addendum I. Atlantic States Marine Fisheries Commission. Washington, DC.

1998 Chesapeake and Atlantic Coast Tautog Fishery Management Plan Implementation Table (updated 6/21/2011)

Strategy	Action	Date	Comments
<p>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.</p>	<p>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.</p>	<p>1998 2003 2005 Continue</p>	<p>The 14" minimum size limit is in effect for MD, VA and PRFC. MD commercial and recreational creel is 4 fish/person/day during January 1- May 15 and November 1-30, 2 fish/person/day during May 16 - October 31, and a December closure. VA has a closed commercial season from May 1 – November 12. No commercial catch limit is listed in the VA regulation. VA recreational fishery is closed from May 1 – June 24..</p>
	<p>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.</p>	<p>1998 2000 2003 2005 Continue</p> <p align="center">Continue</p> <p align="center">2011</p>	<p>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.</p> <p>MD 2009 commercial landings were 1,132 lbs; recreational landings were 304,045 lbs; recreational releases (discards) were 7,601 fish (NMFS). VA 2009 commercial landings were 10,897 lbs; recreational landings were 506,154 lbs; recreational releases (discards) were 12,654 fish (NMFS).</p> <p>Tautog continue to be overfished and are now 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. MD has not yet determined what management measures are necessary to reduce exploitation.</p>
	<p>1.3) VA and MD waters will continue to require degradable fasteners in tautog pots and traps utilizing either:</p> <ul style="list-style-type: none"> • 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" (2.39 mm) or smaller. 	<p>1997 Continue</p>	<p>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.</p>
<p>2.1) VA and MD will work with Virginia</p>	<p>2.1) The management agencies will gather data on</p>	<p>Continue</p>	<p>Annual fecundity estimates are much higher than</p>

1998 Chesapeake and Atlantic Coast Tautog Fishery Management Plan Implementation Table (updated 6/21/2011)

Strategy	Action	Date	Comments
<p>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.</p>	<p>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.</p>	<p>1989-1999 Continue</p>	<p>previously thought. All states are required to collect data to support the coastwide stock assessment.</p>
	<p>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.</p>	<p>Continue</p>	<p>Data from the trawl survey is used in the ASMFC stock assessment. However, very little data is collected on tautog.</p>
	<p>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.</p>	<p>Continue</p>	<p>Commercial reporting has been improved through more stringent penalties for not reporting and for late reporting.</p>
	<p>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.</p>	<p>Continue</p> <p>2009 Continue</p> <p>2011 Continue</p>	<p>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.</p> <p>MD contracted to have supplemental MRFSS recreational data collected.</p> <p>MD implemented a coastal recreational saltwater license requirement.</p>
	<p>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.</p>	<p>1972 Continue</p> <p>1999 Continue</p>	<p>Juvenile tautog are sampled during the summer and fall coastal bays trawl and seine survey (not designed to target tautog).</p> <p>MD Coastal Bays Fisheries Investigation annually collects age, length and sex data for tautog purchased from several commercial fishermen.</p>
<p>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 available shelter and food sources should likewise be encourages.</p>	<p>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.</p>	<p>Continue</p> <p>2007</p>	<p>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).</p> <p>VA initiated Marine Sportfish Collection Project where freezers are set up for recreational anglers to donate whole fish or carcasses to be processed for sex, length, and age.</p> <p>VA initiated VA Saltwater Fisherman's Journal where</p>

1998 Chesapeake and Atlantic Coast Tautog Fishery Management Plan Implementation Table (updated 6/21/2011)			
Strategy	Action	Date	Comments
			anglers can keep track of their fishing experience and provide 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	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 commercial fish species are expected to benefit from improved/protected oyster bar habitat.
	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 (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,	Continue 2006	Building artificial reefs have waxed and waned over the years. As materials and sites become available, artificial reef structures may be built. Emphasis has been on rebuilding oyster reefs and oyster habitat. Over 19 areas have been designated as special management areas for oysters in the Chesapeake Bay. MD DNR & CCA MD acquired Woodrow Wilson bridge

1998 Chesapeake and Atlantic Coast Tautog Fishery Management Plan Implementation Table (updated 6/21/2011)

Strategy	Action	Date	Comments
	<p>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.).</p>	<p>2007</p> <p>2008 Continue</p>	<p>concrete debris deploying it at the Point No Point reef.</p> <p>MD ARC and MARI were established to develop reefs in cooperation with the OCRF. Both MARI and OCRF accept private donations while MD contributes funds when available.</p> <p>44 NY subway cars were deployed off Ocean City. USN Destroyer <i>Radford</i> is being prepared for reefing. Ship material 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.</p>
	<p>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.</p>	<p>Continue</p>	<p>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.</p>
<p>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”.</p>	<p>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.</p>	<p>Continue 2003 On-going</p>	<p>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. VIMS annually surveys SAV distribution in Chesapeake Bay. The 2009 acreage was 85,899 (46% goal). The 2010 acreage was 79,675 (43% goal).</p>
	<p>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 when making decisions that impact SAV, with special emphasis on SAV that falls within the salinity range of juvenile.</p> <ol style="list-style-type: none"> 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 	<p>Continue</p> <p>2003</p>	<p>MD implemented a living shorelines program in 1970 to encourage vegetative shoreline stabilization.</p> <p>Regulations are in place to prohibit dredging through SAV beds. Tiered designation and prioritization of SAV beds has not been implemented.</p> <p>Avoidance of dredging, filling and construction impacts to SAV is strictly enforced by MDE and USACE with input from DNR, USFWS, and NMFS.</p> <p>MD has not established undisturbed buffers. VA has established buffer criteria.</p> <p>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.</p>

1998 Chesapeake and Atlantic Coast Tautog Fishery Management Plan Implementation Table (updated 6/21/2011)

Strategy	Action	Date	Comments
	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.	2008	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 3.2.1)
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.
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 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.”	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 d) improve education e) further research.	Continue 2006 Continue 2009 Continue	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 is developing a Blue Infrastructure that includes mapping structural habitat and SAV. Wetland mosquito ditches from the 1930s-1940s are being plugged to reduce tidal flow and restore wetland hydrology and function.
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,	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	Continue	Maps that indicate regions of concerns for living resources have been developed. See Chesapeake Bay Program website for updates on nutrient reduction.

1998 Chesapeake and Atlantic Coast Tautog Fishery Management Plan Implementation Table (updated 6/21/2011)

Strategy	Action	Date	Comments
<p>based on recent program reevaluations, to strengthen deficient areas.</p>	<p>c) improve on current point and nonpoint source control technologies.</p>	<p>2009</p>	<p>http://www.chesapeakebay.net/status_reducingpollution.aspx?menuitem=19859.</p> <p>President Barack Obama’s executive order recommitted federal agencies to Bay restoration and regulatory enforcement.</p>
	<p>3.4.1B) Based on the 1994 Chesapeake Bay Program Toxics Reduction Strategy Reevaluation Report, the jurisdictions will emphasize the following 4 areas:</p> <p>a) pollution prevention: target “regions of concern” & “areas of emphasis”</p> <p>b) regulatory program implementation: insure that revised strategies are consistent with and supplement pre-existing regulatory mandates</p> <p>c) regional focus: identify and classify regions according to the level of contaminants</p> <p>d) directed toxics assessment: identify areas of low level contamination, improve tracking and control nonpoint sources.</p>	<p>Continue</p>	<p>See Chesapeake Bay Program website for updates on nutrient reduction.</p> <p>http://www.chesapeakebay.net/status_reducingpollution.aspx?menuitem=19859</p> <p>Chesapeake Bay Program is monitoring levels of mercury, PCBs, PAHs, organophosphate and organochloride pesticides.</p>
	<p>3.4.1C) The jurisdictions will continue to develop, implement, and monitor their tributary strategies designed to improve bay water quality.</p>	<p>Continue April 2003</p>	<p>Ambient water quality criteria of DO, water clarity, and chlorophyll-a have been adopted for the Chesapeake Bay.</p>
<p>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.</p>	<p>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:</p> <p>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.</p> <p>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.</p> <p>3) Foster resource protection and land stewardship. Cooperation and linkages among local watershed protection planning efforts should be increased to</p>	<p>Continue</p>	<p>See Chesapeake Bay Program website for updates on land stewardship.</p> <p>http://www.chesapeakebay.net/status_protectingwatersheds.aspx?menuitem=19876</p> <p>MD developed curriculum “Where Do We Grow from Here?” about population growth and its impacts on the Bay.</p>

1998 Chesapeake and Atlantic Coast Tautog Fishery Management Plan Implementation Table (updated 6/21/2011)			
Strategy	Action	Date	Comments
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.	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.		

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

2010 Maryland FMP Report (July 2011)
Section 20. Weakfish (*Cynoscion regalis*)

Chesapeake Bay FMP

Although fishing mortality has been successfully reduced on the coastwide stock of weakfish, 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 change in the status of the weakfish stock from overfished to fully exploited and included new biological data pertinent to the Chesapeake Bay. The CBP plan 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 an annual compliance report to ASMFC.

Stock Status

At present, the weakfish stock is considered depleted but overfishing is not occurring. 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 in 2008 showed both a decrease in mean adult age and the lowest juvenile abundance since the survey was standardized in 1989. The ASMFC Weakfish Management Board revised and 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%.

Current Management Measures

Management measures to reduce commercial and recreational exploitation by over 50% are 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..

Issues/Concerns

Factors such as predation, competition, and changes in the environment have increased natural mortality and appear to have a stronger influence on weakfish stock dynamics than fishing. The ASMFC Weakfish Management Board “received a significant amount of public comment supporting a coastwide moratorium”. The

Board chose to implement restrictions that would allow for limited directed fishing and allow sampling programs to continue.

The Fisheries

Figure 1. Maryland’s recreational weakfish harvest and releases in numbers, 1981-2010.

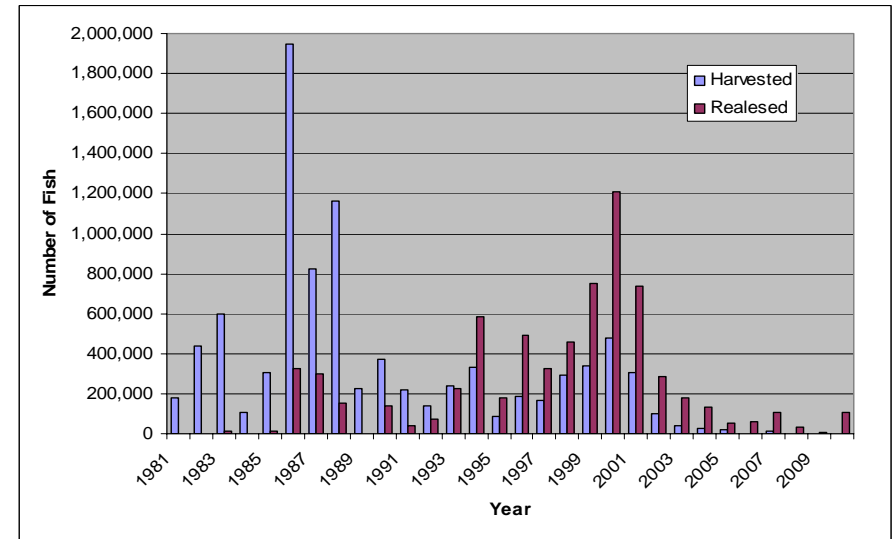
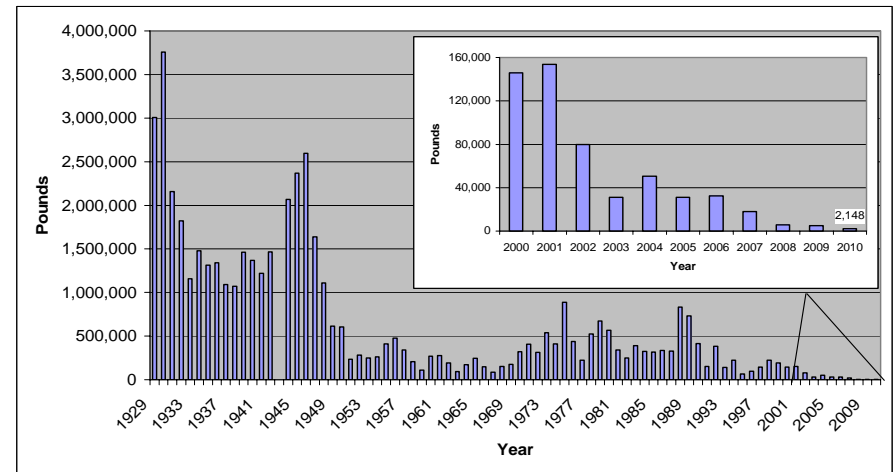


Figure 2. Maryland’s total commercial weakfish landings, 1929-2010.



(Figures from Rickabaugh 2011)

2003 Chesapeake Bay Program Weakfish Fishery Management Plan Implementation (updated 6/11)			
Section	Action	Implementation	Comments
<p>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.</p>	<p><u>Action 1.1</u> 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</p>	<p>Annually reviewed and adjusted if necessary</p>	<p>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.</p>
	<p><u>Action 1.2</u> 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.</p>	<p>Annually</p>	<p>Addendum IV to Amendment 4 of the weakfish FMP requires that the recreational creel does not exceed 1 fish in the management unit including CBP jurisdictions. 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 complied with these requirements in 2010; all met the recreational harvest restrictions and met or exceeded the commercial harvest restrictions.</p>

2003 Chesapeake Bay Program Weakfish Fishery Management Plan Implementation (updated 6/11)			
Section	Action	Implementation	Comments
<p>The Fishery Management 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.</p>	<p><u>Action 2.1</u> The CBP jurisdictions will consider regional differences when determining state allocation issues and regulations.</p>	As necessary	The Maryland Sport Fish Advisory Commission recommended a weakfish moratorium. Fishing mortality has been decreased over the years but there remains a significant amount of non-fishing mortality
	<p><u>Action 2.2</u> 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.</p>	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 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.
	<p><u>Action 2.3</u> 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.</p>	Annually	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.

2003 Chesapeake Bay Program Weakfish Fishery Management Plan Implementation (updated 6/11)			
Section	Action	Implementation	Comments
<p>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.</p>	<p><u>Action 3.1</u> The CBP jurisdictions will continue fishery dependent sampling and improve catch data. Economic information from the recreational and commercial fisheries will also be reviewed.</p>	Continue	Monitoring data provides information on abundance; age structure and Y-O-Y recruitment. Total commercial landings in MD fell to a low of 2148 pounds in 2010, the lowest harvest in the 1929-2010 time series (Fig.2). The preliminary MD 2010 recreational harvest estimate is 2833 weakfish, weighing 1810 pounds. Only 47 weakfish were sampled in MD Chesapeake Bay pound nets in 2010 and the mean length declined for the second consecutive year.
	<p><u>Action 3.2</u> The CBP jurisdictions will conduct fishery independent sampling and collect data on abundance, age structure and recruitment.</p>	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 Addendum 1 to Amendment 4. In addition, the MD calculated geometric mean juvenile catch per hectare in coastal bays increased from 1.33 in 2009 to 2.16 in 2010. The Chesapeake Bay juvenile geometric mean increased from 1.42 in 2009 to 1.68 in 2010.
	<p><u>Action 3.3</u> CBP jurisdictions will continue to coordinate state activities with the Atlantic Coast Cooperative Statistics Program (ACCSP).</p>	Continue	Since 2003, data requirements have been based on a 2 year average.
	<p><u>Action 3.4</u> The CBP jurisdictions will begin to collect and examine stomach contents data and examine the effects of environmental variables upon weakfish growth rates.</p>	On-going	Data from the ChesMMAF Survey, CHESFIMS project and the MD Winter Trawl Survey will be used to delineate species interactions and predator/prey 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 6/11)			
Section	Action	Implementation	Comments
<p>Habitat</p> <p>Management Strategy: CBP jurisdictions will monitor and regulate activities which may be harmful to weakfish habitat.</p>	<p>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.</p>	<p>On-going</p>	<p>CBP jurisdictions support the commitments of 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 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.</p>
	<p><u>Action 4.1</u></p> <p>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.</p>	<p>Continue</p>	<p>The MD DNR water quality protection database focuses on watershed lands that are most important for improving water quality.</p>
	<p><u>Action 4.2</u></p> <p>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.</p>	<p>Continue</p>	<p>Data from the ChesMMAP, CHESFIMS, and the MD Winter Trawl Surveys will provide data on important forage species for weakfish. The CHESFIMS survey was discontinued after 2005 due to lack of funding.</p>
	<p><u>Action 4.3</u></p> <p>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.</p>	<p>Continue</p>	<p>The MD Juvenile Striped Bass 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.</p>

2003 Chesapeake Bay Program Weakfish Fishery Management Plan Implementation (updated 6/11)			
Section	Action	Implementation	Comments
Ecosystem Interactions Management Strategy:	<u>Action 4.4</u> 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 inter- and intra-species weakfish competition and predator/prey interactions. ASMFC weakfish TC has incorporated a striped bass predator function into the 2006 weakfish stock assessment to model the weakfish stock decline since 1998.

Acronyms:

ASMFC = Atlantic States Marine Fisheries Commission
 CHESFIMS = Chesapeake Bay Fishery Independent Multispecies Fisheries Survey Program
 F = mortality due to fishing
 PRFC = Potomac River Fisheries Commission
 SSB = spawning stock biomass
 VIMS = Virginia Institute of Marine Science

BRPs = biological reference points
 ChesMMAP = Chesapeake Bay Multispecies Monitoring and Assessment
 CBP = Chesapeake Bay Program
 FMP = fishery management plan
 SAFMC = South Atlantic Fishery Management Council
 TC = technical committee
 Y-O-Y = young of the year fish

Spotted Seatrout Notes:

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 to include weakfish only in 2003. Since that time, there has been no new management plan for spotted seatrout. 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 is expected to approve the omnibus amendment for spot, spotted seatrout and Spanish mackerel in August, 2011. The omnibus amendment includes recommended measures to protect the spotted seatrout spawning stock and requires a coastal minimum length limit. The ASFMC adopted the spotted seatrout FMP in 1984 for states from Maryland to Florida.

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 state assessments have been performed (NC, SC, GA, FL) on local stocks, there have been some data limitations. Stock status varies by state. The MD recreational harvest has been approximately 10,000 pounds or less for the past 10 years. The VA recreational fishery has harvested up to 761,067 pounds (2010). 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.

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 12” minimum total length is recommended 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.

2010 Maryland FMP Report (July 2011) Section 21. White Perch (*Morone americana*)

Maryland FMP

Although interest in the species is high, 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 direction of this draft plan. The biological 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

A new Maryland assessment is under development and is expected to be completed in late 2011. The previous 2009 assessment indicated that the estimated biomass was above minimal stock levels and fishing mortality was lower than necessary to maintain stock abundance. That 2009 assessment cautiously noted that some indices of commercial CPUE were trending lower while recreational CPUE trended higher. The upper bay winter trawl survey showed slightly lower CPUE in 2010, with older individuals represented in the samples (Piavis and Webb, 2011). Relative stock densities for all areas sampled in 2010 indicated an increase in quality (8 inch minimum) and preferred (10 inch minimum) fish. The Choptank River assessment exhibited a 6-fold increase in the population from 1989 to 2007. The 2010 Choptank River fyke net CPUE was the highest seen since 2007 and the second highest of any year in the 11 year time series. Fishing mortality has increased since the last stock assessment. In 2010, calculated instantaneous fishing mortality rates were 0.99 for the Choptank, 0.66 for the Nanticoke, and 0.76 for Upper Bay data. Both Maryland and Virginia calculate juvenile indices for white perch and recent years have shown average to below average juvenile abundance. There was a slight increase in the 2010 Baywide white perch JI, although it was still below the long-term average. Biological reference points (BRP) have not been formally established although a fishing target was suggested as $F=0.65$.

Current Management Measures

White perch are managed in coordination with striped bass because they overlap in habitat and have some commercial gear types in common, such as drift gill nets. The management unit is the white perch stock throughout its range in Maryland's portion of the Chesapeake Bay. The commercial fishery is regulated with gear and area restrictions with an 8" minimum size limit. There is no recreational size or creel limit for fish caught by hook & line. When caught by methods other than hook & line, such as cast net and seine, the minimum size is 8". 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. In the years since 2002, there have been three relatively poor year-classes, three average year-classes, and only one very good year-class. Declines in abundance are expected as a result of recent low recruitment and higher fishing mortality.

The Fisheries

Preliminary 2009 commercial landings from Maryland are 1,167,828 lbs.

Figure 1. Maryland commercial landings of white perch, 1981-2009.

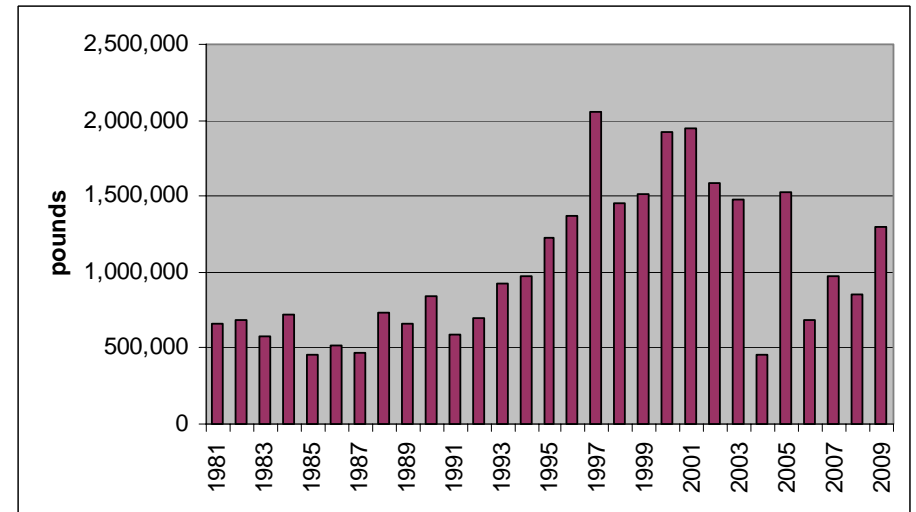
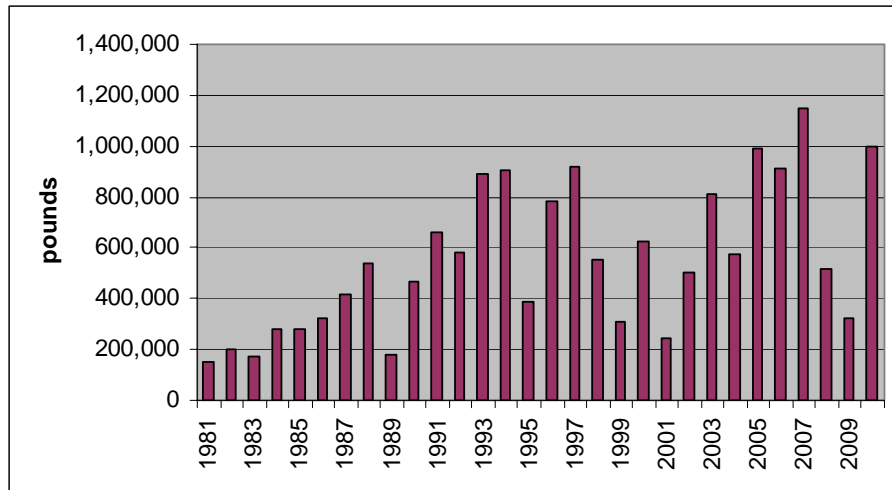


Figure 2. Maryland recreational MRFSS white perch harvest estimates, 1981-2010



References:

Piavis, P.G. and E. Webb III. 2011. 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.

Draft 1990 White Perch Fishery Management Plan Implementation Table (updated 6/11)			
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	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	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	Juvenile index was high from 1994-2001. Since 2002, 3 poor year-classes, 5 average and 1 very good year-class. The Choptank River assessment indicated an increase from 1 million white perch in 1989 to 6 million in 2007 with a low fishing mortality rate of 0.20 in 2007. Fishing mortality of white perch has increased and this increased mortality will be addressed in the upcoming white perch stock assessment report due in late 2011. Commercial CPUE indices have been trending lower. Recreational landings have shown an increasing trend for the same period. Recreational CPUE has increased recently. White perch stocks are not overfished and overfishing is not occurring. 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 indicators 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.

Acronyms:

BRPs = Biological Reference Points
DNR = Department of Natural Resources

CPUE = Catch per Unit Effort
H & L = Hook and Line

2010 Maryland FMP Report (July 2011)

Section 22. Yellow Perch (*Perca flavescens*)

Maryland FMP

Maryland's yellow perch fisheries have responded well to new 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. During 2008, stakeholder meetings were conducted to develop objectives for the commercial and recreational fisheries. An amendment to the plan is under development.

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 uses conservative estimates of natural mortality. The yellow perch assessment model was modified in 2009 and 2010. The updated population estimate remained stable and the modified model has been fine-tuned using weighting parameters. Recruitment to the population increased from an estimated 87,800 in 2009 to 356,000 in 2010.

Current Management Measures

After considerable public input during 2008, the fisheries are now managed on the basis of 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 ($F=0.48$). Fishing mortality in 2010 was calculated at 0.24. Three management areas have been established the Upper Bay, the Chester River and the Patuxent River. When the TAC is reached in early March, the commercial season is closed for that area. 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 has no closed season or areas, a minimum size limit of 9 inches and a creel limit of 10.

Issues/Concerns

Despite controlled low fishing mortality, recruitment is expected to decrease in 2011-2012 due to poor juvenile year-classes in 2008 and 2009. Yellow perch

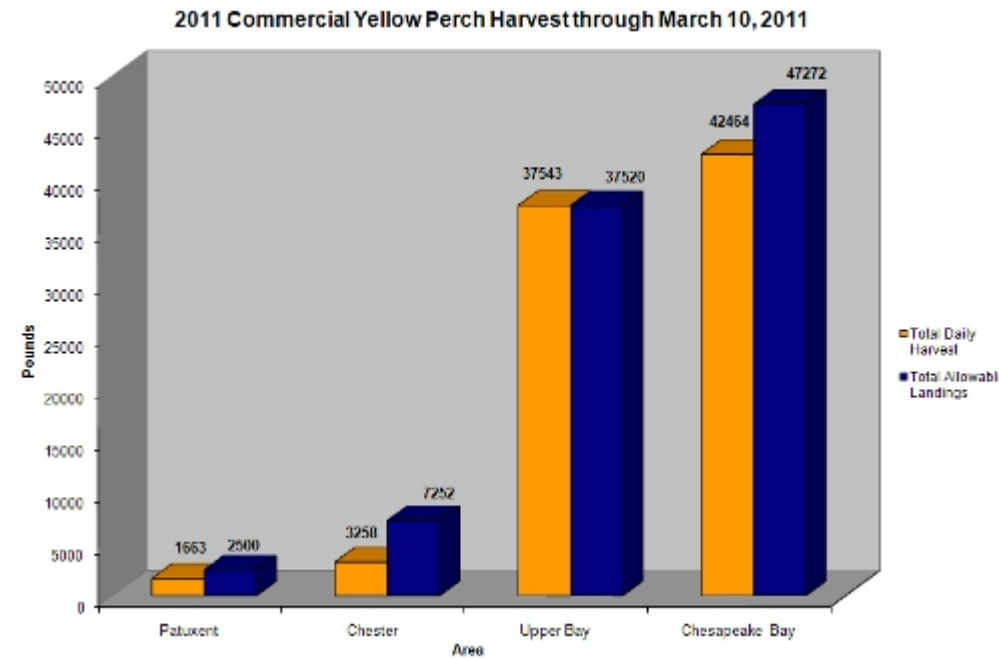
numbers are projected to fall from 920,000 in 2010 to 665,000 in 2012. Biomass is projected to decrease from 410,000 pounds in 2010 to 305,000 pounds in 2011. Commercial seasonal closures presently require a minimum 48 hour notice at a time when catches are highest (see figures). Authority for a 24 hour closure notice or daily harvest limits are options for meeting but not exceeding area TACs. There may be local conflicts where recreational fishing and commercial activity overlap temporally and spatially.

The Fisheries

The 2010 TAC of 39,949 pounds for the Upper Bay management area was exceeded by 9680 pounds before the season could be closed. The Chester River TAC of 7800 was exceeded by 948 pounds. The Patuxent River TAC of 2500 pounds was not reached and harvest was only 1455 pounds.

The 2011 TACs were adjusted by the overages incurred during the 2010 season. Final TACs for 2011 were 37,520 pounds for the Upper Bay, 7252 pounds for the Chester River and 2500 pounds for the Patuxent River. The Upper Bay TAC was exceeded by only 23 pounds while the TACs for the other management areas were not reached (Figure 1).

Figure 1.



2002 Maryland Tidewater Yellow Perch Fishery Management Plan Implementation Table (updated 06/11)

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) plans 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 plans ended in 2006. DNR, OOS has developed the "blue infrastructure". This GIS based analysis identifies 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 06/11)

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 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.
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 has been 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 and compare the results with historical yellow perch ichthyoplankton data, as additional information useful in assessment of fish passage projects and the importance of future blockage removals.
	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 IS data and development projections to identify potential 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 but will not be available until 2009 at the earliest. 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.

2002 Maryland Tidewater Yellow Perch Fishery Management Plan Implementation Table (updated 06/11)

Section	Action	Date	Comments
	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 and evaluate five watersheds annually.	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.
	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 to be viable. 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.
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	Presented to YP Ad hoc group for discussion and adopted. Based on a target fishing mortality rate ($F=0.48$) a 2011 TAC (adjusted for prior overage) of 47272 pounds was calculated. This was an increase from the previous year's TAC. The calculated 2011TAC for the Upper Bay commercial fishery was 37,520 pounds. The Chester River TAC was 7252 pounds and the Patuxent River TAC was 2500 pounds. Improved catch reporting included daily call-ins, verified by tagging. These measures were implemented in 2009 to improve accountability.
	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. Updated table (2006). Need to reexamine the table's usefulness in guiding management strategies. Starting with the 2009 seasons, 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.

2002 Maryland Tidewater Yellow Perch Fishery Management Plan Implementation Table (updated 06/11)

Section	Action	Date	Comments
	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.
	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 06/11)

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 continued through 2011. The information provided by anglers in 2010 showed a high perception of success (64%). Larger yellow perch were caught in 2010 than in 2009. The Chester River and Susquehanna River produced the highest catch rates of approximately 6 fish per hour.
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. Future needs are to better define fyke nets.
	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) has been calculated based on the latest stock assessment starting in 2009. Allocation of the TAC between commercial fishing and recreational fishing is determined after considering input from stakeholders.
	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 makes 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.

2002 Maryland Tidewater Yellow Perch Fishery Management Plan Implementation Table (updated 06/11)

Section	Action	Date	Comments
<p>Stock Status</p> <p>MD DNR will monitor yellow perch stocks in representative areas of the</p>	<p>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 stocks and require additional management measures.</p>	<p>On-going</p>	<p>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. Choptank River and upper Chesapeake Bay populations have increased based on latest assessments (2009) but recruitment is expected to decrease in the future (2011-2012).</p>
<p>Chesapeake Bay in order to assess yellow perch stock status. Assessment and</p>	<p>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.</p>	<p>2003</p>	<p>Yellow perch recruitment has been monitored on the Severn River but 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.</p>
<p>management efforts will be focused on areas already under special management measures, i.e., closed areas.</p>	<p>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.</p>	<p>2001 2005</p>	<p>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).</p>
	<p>22) Evaluate additional fishery-independent indicators of stock status, such as the trawl survey in the upper Bay.</p>	<p>On going</p>	<p>Implementation of this action is dependent on manpower and funding</p>
	<p>23) Review and evaluate yellow perch monitoring efforts biannually. Recommend changes in monitoring and protocol necessary to implement the yellow perch FMP.</p>	<p>2002 and even years thereafter</p>	<p>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.</p>

2002 Maryland Tidewater Yellow Perch Fishery Management Plan Implementation Table (updated 06/11)

Section	Action	Date	Comments
<p>Yellow Perch Outreach</p> <p>MD will continue outreach efforts to engage fishing and non-fishing communities in stewardship of the yellow perch resource in tributary basins.</p>	<p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>	<p>Open</p> <p>Open</p> <p>2004</p> <p>On-going</p>	<p>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 will be implemented in 2008. CCA, MSSA will be asked to promote angler participation.</p> <p>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.</p> <p>Focus has changed to American eel as an educational tool. Experience in Severn River (Arlington Echo) indicated too low viability of local eggs for successful program.</p> <p>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.</p>

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