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2014 Review of the Chesapeake Bay American Eel Fishery Management Plan

October 2014

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Fisheries Service
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MARYLAND
DEPARTMENT OF
NATURAL RESOURCES

2014 Review of the
Chesapeake Bay American Eel Fishery Management Plan

October 2014

Plan Review Team

Fishery Management Plans Program Staff
Chesapeake Finfish Program Staff
Fisheries Service Management Team
Sport Fisheries Advisory Commission
Tidal Fisheries Advisory Commission

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List of Acronyms

AE – American Eel
ASMFC – Atlantic States Marine Fisheries Commission
COMAR – Code of Maryland Regulations
CPUE – Catch-Per-Unit-Effort
DNR – Department of Natural Resources
ESA – Endangered Species Act
FMP – Fishery Management Plan
FS – Fisheries Service
NMFS – National Marine Fisheries Service
PRT – Plan Review Team
SFAC – Sport Fisheries Advisory Commission
TC – Technical Committee
TFAC –Tidal Fisheries Advisory Commission
USFWS – United States Fish and Wildlife Service

Summary

The Maryland Department of Natural Resources Fisheries Service's Plan Review Team evaluated the 1991 Chesapeake Bay American Eel Fishery Management Plan in 2014 to determine if the management framework remains appropriate, needs to be amended, or should be completely revised. The goal, objectives, and implementation table from the 1991 Chesapeake Bay American Eel Fishery Management Plan and the Department of Natural Resources' Fisheries Allocation Review Policy were used to guide the review.

The Atlantic States Marine Fisheries Commission conducted an American eel (*Anguilla rostrata*) stock assessment in 2012. The stock assessment determined that the American eel stock is depleted. Stock reduction was attributed to the synergistic effect of harvest pressure, reduced habitat availability (blockages), increased habitat impairment (pollution), introduction of a swim bladder parasite, and climate change. Atlantic States Marine Fisheries Commission implemented Addendum III to increase restrictions on harvest of pigmented eels, increase the minimum size, reduce the daily creel, and prevent small mesh eel pots. Addendum IV is currently being developed to specify harvest reduction frameworks for glass, yellow, and silver phase American eel.

The Fisheries Service's Plan Review Team determined that the goal, objectives, strategies, and actions established in the American Eel Fishery Management Plan address the management needs for this species. However, the American Eel Fishery Management Plan does not include a provision for the adoption of current and future management requirements established by the Atlantic States Marine Fisheries Commission. The Fisheries Service's Plan Review Team concluded that the 1991 Chesapeake Bay American Eel Fishery Management Plan should be amended to ensure management flexibility when Atlantic States Marine Fisheries Commission's regulatory requirements change.

Status of the Fishery Management Plan

Date of FMP Approval: 1991

Amendments: none

FMP Review Dates: 1992, 1993, 1994, 2000, 2001, 2002-2004, 2010, 2014

FMP Updates: 2007 - 2014

Fishery management plans provide a framework for how a fishery resource will be managed based on a species life history, habitat, ecosystem considerations, and fishery utilization. Over time, the status of a resource can change and new issues arise. Strategies and actions within a plan need to be periodically reviewed and evaluated to ensure the management framework is still appropriate or amended/revised to address significant changes. For specific details on the process for reviewing plans and developing or amending plans, see Appendices 1 - 3.

The Chesapeake Bay American Eel Fishery Management Plan (AE FMP) was developed in 1991. Progress towards implementation of the AE FMP's strategies and actions has been updated annually since 2007. The Maryland Department of Natural Resources (DNR) has authority to regulate American eel (*Anguilla rostrata*) through the Code of Maryland Regulations (COMAR 08.02.01.01).

During 2014, a DNR Fisheries Service Plan Review Team (FS PRT) was convened to review the AE FMP. The FS PRT was comprised of staff from the FMP program (Marek Topolski, Nancy Butowski) and Chesapeake Finfish program (Keith Whiteford). Additional staff from Fisheries Service participated in the AE FMP review as well as members of the Sport Fisheries Advisory Commission (SFAC) and the Tidal Fisheries Advisory Commission (TFAC) (*Note: This draft does not yet incorporate input from SFAC or TFAC as their review is occurring now.*).

The goal of the 1991 AE FMP 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. With this goal, optimum biological, economic, and social benefits will be attained.

In order to meet the goal, several objectives were defined:

1) Promote protection of the resource by maintaining a clear distinction between conservation goals and harvest regulations.

2) Restore self-sustaining populations of American eels to their historic ranges.

3) Implement appropriate monitoring programs necessary for collecting stock assessment data.

4) Provide for fair allocation of allowable harvest, consistent with traditional uses, among the various components of the fishery.

5) Promote studies to improve the understanding of economic, social, and biological aspects of the fishery.

6) Continue to pursue and enforce standards of environmental quality and habitat protection necessary to protect the American eel population within the Bay and its tributaries.

The AE FMP strategies can be broadly defined under four categories:

1) Stock Status: The jurisdictions will adopt a conservative approach to managing American eels in the Bay until stock assessment analyses have been completed by reducing the possibility of growth overfishing and by preventing the waste of small eels. A minimum size of 6 inches will be adopted to protect elvers. A baywide minimum mesh size for eel pots will be implemented.

2) American Eel Bait Fishery: Catch and effort information from the American eel crab bait fishery will be obtained and monitored. Catch and effort statistics will be improved by reporting the number of eels used as crab bait on the mandatory finfish reporting forms.

3) Research Needs: In order to increase the knowledge and understanding of the American eel resource in the Chesapeake Bay, research projects will be promoted to address the deficiencies in biological and socioeconomic data.

4) Habitat and Water Quality Issues: The Bay jurisdictions will continue to set specific objectives for water quality goals and review management programs established under the Chesapeake Bay Agreement. Efforts include identifying and controlling nutrients, toxic materials, conventional pollutants, and atmospheric inputs; protecting wetlands and submerged aquatic vegetation; and managing population growth. In addition, the jurisdictions have committed to providing upstream access for migratory fishes.

The AE FMP was adopted in 1991 and was previously reviewed in 2010. The Fisheries Service Plan Review Team (FS PRT) concluded that the AE FMP management framework remains suitable for American eel management, but a provision should be included that will ensure the adoption of current and future management requirements established by the Atlantic States Marine Fisheries Commission (ASMFC).

The ASMFC adopted a coastal FMP for American Eel in 1999. This FMP's goal is:

… to conserve and protect the American eel resource to ensure its continued role in the ecosystems while providing the opportunity for its commercial, recreational, scientific, and educational use.

ASMFC developed this FMP in response to data and other information which indicated that some segments of the American eel population were in decline. Jurisdictions were required to implement a young-of-the-year abundance survey, implement a 50 eel per person per day for eel ≥ 6", and a commercial licensing and reporting system. Three addenda have been added to the ASMFC FMP. Addendum I (2006) mandated improvements to commercial catch and effort data. Improved reporting could be implemented through harvest permits or dealer permits. Addendum II (2008) recommended inclusion of upstream and downstream passage requirements for American eel during the Federal Energy Regulatory Commission's relicensing of hydroelectric dams. For other dams, removal is recommended but if not feasible then eel passage should be provided. The ASMFC implemented Addendum III (2013) which required a minimum mesh size of ½"x1/2" by 2017 (prohibition of smaller mesh with escape panels), a reduction of the recreational creel limit to 25 eels per person per day, a limit on pigmented eel bycatch in the glass eel fishery (Maine and South Carolina), and an increase in the yellow eel minimum size from 6" to 9" beginning in 2014. Addendum IV is being developed which will specify the mechanisms to reduce overall fishing mortality of glass, yellow, and silver eel. The ASMFC Management Board will continue deliberations on Addendum IV during the October 2014 meeting. Each jurisdiction is required to complete an ASMFC annual compliance report.

The FS PRT agreed that the AE FMP's goal and objectives continue to be appropriate for managing the American eel resource within the Chesapeake Bay watershed. Furthermore, the goal and objectives align with those of the ASMFC's American eel FMP. Jurisdictions have and continue to align management measures to be in compliance with ASMFC requirements. However, the AE FMP does not provide an explicit objective that states that the jurisdictions will follow ASMFC guidelines and modify strategies and actions as necessary to comply with current and future ASMFC requirements.

Status of the Stock

American eel are broadly distributed among estuarine and freshwater habitats along the east coast of the Americas. All American eel are considered to be from a single stock, however, ASMFC only has authority to manage American eel inhabiting waters from Florida to Maine. The ASMFC conducted an American eel stock assessment in 2012. Yellow eel abundance index trends vary along the coast. For example, Hudson River and south Atlantic indices indicate decreasing abundance, no trends are evident in the Delaware Bay/mid-Atlantic Coastal Bay indices, and there is increasing abundance in the Chesapeake Bay. As a whole, the stock assessment models identified declines in abundance for young-of-year and yellow-phase American eel. The prevalence of declining indices resulted in a determination that the American eel stock was depleted. Stock reduction was attributed to the synergistic effect of harvest pressure, reduced habitat availability (blockages), increased habitat impairment (pollution), introduction of a swim bladder parasite, and climate change. Additional data and model development are required before reference points and maximum sustainable yield can be determined.

Status of the Fishery

In Maryland, ninety-nine percent of commercially harvested yellow phase American eel were caught using eel pots (Whiteford, 2014). Maryland's commercial fishery reported a peak in landings in 2011 followed by a decrease in landings. There were 568,000 pounds of American eel harvested during 2012 (Whiteford, 2014) and the harvest continued to decline 2013. However, both years were well above the long-term average landings (Figure 1). Commercial crabbers reported catching 30,000 pounds of American eel for use as bait in 2013 (Whiteford, 2014). The average combined American eel harvest from 1994-2013 was 370,000 pounds. Prior to 1994, annual harvest data from the National Marine Fisheries Service (NMFS) is used for the analyses (NMFS; National Marine Fisheries Service, Fisheries Statistics Division, personal communication, n.d.; Figure 1). Eel landings reported on crab harvester forms are not included in NMFS commercial landings data (Whiteford, 2014).

Recreational harvest data for American eel is not available from the Marine Recreational Information Program (National Marine Fisheries Service, Fisheries Statistics Division, personal communication, n.d.; Whiteford, 2014). Maryland recreational fishermen are allowed to harvest 25 eels per person per day. Because of the data deficiency, the recreational harvest of American eel is unknown.

Status of Management Strategies and Actions

ASMFC specifies minimum management criteria that all jurisdictions must meet. Maryland has implemented a number of regulations to be compliant with ASMFC requirements (Atlantic States Marine Fisheries Commission, 2013). Glass eel and elver fisheries are prohibited in Maryland. Commercial and recreational fisheries have a 9" minimum size limit. There is no harvest limit for the commercial fishery, but there is a recreational creel limit of 25 eels per person per day. Both fisheries are open all year. Eel pots are required to have a minimum mesh size of ½" x ½". Eel pots that have smaller mesh sizes with escape panels will be prohibited starting in 2017.

Compliance with ASMFC requirements includes a minimum set of data collection programs. Maryland conducts both fishery dependent and independent annual surveys. The commercial eel pot fishery is monitored from the Chester and Susquehanna Rivers. Fishery independent monitoring includes a yellow eel pot survey in the Sassafras River, a silver eel trap survey in a first order stream of the Corsica River, and young-of-year abundance in the coastal bays (Whiteford, 2014). Yellow and silver eel are subsampled for ageing and the prevalence of the swim bladder parasite *Anquillicolla crassus* (Whiteford, 2014).

The Maryland Department of Natural Resources' Fish Passage Program has included eels on its list of targeted species. Blockage removal projects consider whether or not eels would benefit from implementing a proposed project. The ASMFC published the Proceedings of a Workshop on American Eel Passage Technologies (July 2013). The workshop participants agreed that traditional fish passage structures (fishways and fish lifts) are ineffective at passing juvenile eels and that specialized eel passage structures are necessary.

Fisheries Allocation Policy - The Department of Natural Resources Fisheries Allocation Policy went into effect in September 2012. The policy provides guidelines for reviewing allocation, provides the basis/background for allocation, and outlines procedures for review and stakeholder input. The overarching factors in allocation decisions are linked to the FMP goals and objectives and include:

- Conservation;
- Management goal for the species;
- Social and cultural importance of maintaining fisheries and dependent industries;
- Environmental impact;
- Economic value of dependent fisheries;
- Economic viability of activity supported by the fisheries;
- Management resources;
- Historical trends and values; and
- Potential for new fisheries to develop.

Among the Allocation Policy procedures are triggers for allocation review. In accordance with policy, a pre-assessment of triggers was conducted internally by DNR FS. Triggers listed by the policy and the pre-assessment summary are as follows:

- Initial development or revision of a FMP

The Chesapeake Bay American Eel Management Plan was developed in 1991 and there have been periodic reviews and updates of the plan. The review schedule for Chesapeake Bay FMPs had American eel scheduled for 2014. There were no public requests for a change in allocation during the FMP review.

- Significant shift in fisheries harvest

Since 1954, American eel harvest has fluctuated cyclically approximately every 12 years (Whiteford, 2014; MD DNR, unpublished data; personal communication National Marine Fisheries Service, Fisheries Statistics Division; Figure 1). Harvest data from NMFS does not include crab bait harvest, but based on MD DNR data, bait harvest would have little effect on overall harvest levels. Inter-annual variability of eel harvest has become more common since the early 1990s making the cyclic harvest pattern less obvious. From 2010 - 2013 a notable increase in American eel harvest occurred.

- Population shift of target or non-target species

No population assessment of American eel in Maryland's portion of the Chesapeake Bay watershed or coastal bay watersheds has been done. As a surrogate, commercial fishing effort can provide some insight (Whiteford, 2014; MD DNR, unpublished data; Figure 2). Both the number of eel pots fished (effort) and the number of active licenses decreased in the 2000s then returned to 1990s levels by 2010. Catch-per-unit-effort (CPUE) averaged 0.4 eel per pot from 1992 – 2002. During the time of reduced effort, the CPUE steadily increased to a high of one eel per pot in 2006 and has since averaged 0.8 eel per pot. The increase and subsequent stabilization of CPUE suggests that American eel abundance has improved since the 1990s.

- Threatened and endangered species issues

U.S. Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration Fisheries were petitioned in 2004 to list the American eel as endangered under the Endangered Species Act (ESA). USFWS determined that "there is substantial scientific and commercial information indicating that listing the American eel may be warranted". The main threats to the species presented by the petitioner and supported by the information they provided appear to be commercial harvest, habitat loss and degradation due to loss of wetlands and upper tributary habitat, hydropower turbine mortality, changes in oceanic conditions, and inadequacy of existing regulatory mechanisms" (Department of the Interior, Fish and Wildlife Service, 2005). After a 12-month review, the USFWS determined that American eel distribution and abundance remains sufficient such that a listing of threatened or endangered was not warranted (Department of the Interior, Fish and Wildlife Service, 2007). In 2010, the Center for Environmental Science, Accuracy, and Reliability (formerly Council for Endangered Species Act Reliability) petitioned the USFWS to list American eel as threatened under the Endangered Species Act. Again, USFWS determined that further status review was warranted (Department of the Interior, Fish and Wildlife Service, 2011). The Center for Environmental Science, Accuracy, and Reliability filed a lawsuit against USFWS in 2012 for failure to complete a 12-month review within the specified time required by the ESA. The USFWS is required to publish a review of American eel status by September 30, 2015 (ASMFC American Eel Plan Review Team, 2013).

- Changing social patterns and values

Little has been written about the societal valuation and historic usage of American eel. It is known that American eel have been used both as a food source (personal and market) and a bait for use in various other fisheries, however, little data is available for the recreational sector (Limburg, Oliveira, Wiedenmann, & O'Boyle, 2012). The recognition that American eel serve a variety of important ecosystem services may lead to increased public conservation awareness (see section Ecosystem Needs). Corburn (2003) demonstrated how a Brooklyn, New York neighborhood's valuation and activism for important natural resources, such as American eel, can impact broader community environmental policy. In this case, the members of a local community gathered information on fish consumption and presented it to the Environmental Protection Agency (EPA). As a result, the EPA revised their consumption advisories for subsistence fisheries.

- Ecosystem needs

American eel are integrally linked to the abundance and distribution of freshwater mussels, in particular the mussel *Elliptio complanata* (Ashton, Harbold, Killian, & Stranko, n.d.; Chesapeake Bay Foundation, 2014; Galbraith, 2014; Lellis et al., 2013). Larval mussel (glochidia) require a host fish to attach to the gills where they are then able to transition to a juvenile stage and then release from the host fish. Movement of American eel during glochidia attachment and development enables distribution of freshwater mussels throughout the watershed. Freshwater mussels are capable of filtering large volumes of water. Restoration of American eel, therefore, has the potential to facilitate water quality improvement of river systems that have blockages such as the Susquehanna River.

Access to freshwater tributary habitats has been impaired by construction of hydroelectric and flood control dams on rivers such as the Susquehanna, Potomac, and Patuxent. American eel were a significant component of freshwater stream ecosystems comprising up to 50% of fish biomass (Susquehanna River Anadromous Fish Restoration Cooperative, 2013). Consequently, re-establishment of American eel in freshwater ecosystems will restore predator-prey relationships that were disrupted (Susquehanna River Anadromous Fish Restoration Cooperative, 2013). Removing large dams is an effective strategy to re-establish American eel to headwater streams (Hitt, Eyler, & Wofford, 2012).

The Sargasso Sea is an oceanic gyre that is defined by four Atlantic Ocean currents: Gulf Stream, Canary Current, North Atlantic Drift, and Antilles Current (Pendleton, Krowicki, Strosser, & Hallett-Murdoch, 2014). American and European eel are reliant upon an intact Sargasso Sea gyre for successful spawning. Friedland, Miller, & Knights (2007) detected a northward shift of the northern eel spawning isotherm (22.5°C). The isotherm shift was attributed to ocean warming – a result of climate change. Climate change induced ocean warming has been implicated as one cause of declining European eel recruitment (Bonhommeau, Chassot, & Rivot, 2008; Friedland et al., 2007; Pendleton et al., 2014) and may be affecting American eel recruitment as well (Friedland et al., 2007).

- Market dynamics

Dockside value of American eel has undergone a dramatic shift since the 1950s (National Marine Fisheries Service, Fisheries Statistics Division, personal communication). Dockside value data was not available prior to 1950. Per pound, American eel was below $0.15 from 1950 until 1973

when dockside value steadily increased to $0.85 per pound in 1980 (Figure 3). Prior to 1973 the value of American eel remained stable regardless of harvest variability. Value then decreased to $0.35 per pound in 1973 before rebounding, exceeding $1.00 in 1988, and peaking in 1991 at $1.82 per pound. The trends in American eel value, dockside and price per pound, has generally mirrored the harvest trend from 1974 to 2011; although the value trends have periodically exaggerated the harvest trends (Figure 3). Maximum dockside price per pound was $2.18 in 2006. American eel harvested in Maryland are either exported to foreign live markets in Europe and Asia or used by the bait industry. Increased demand by the live market may be responsible for price increases since the 1970s.

- Management resources

The ASMFC requires states to monitor the commercial catch of yellow eel, commercial harvest of eel, and the relative abundance of young-of-year eels. DNR FS has a limited budget for implementation of monitoring and management of American eel. Funds allocated to the American eel project are at best sufficient to accomplish the minimum ASMFC compliance requirements (K. Whiteford, MD DNR, personal communication). Non-compliance would result in closure of Maryland American eel fisheries.

- New data

The next American eel stock assessment is scheduled for 2017. Three near term research needs were identified by the ASMFC's American eel Technical Committee (TC) and recommended to the ASMFC Management Board (American Eel Technical Committee, 2014). 1) Continuation of efforts to develop a standardized survey design to monitor life history stages. 2) Develop a standardized methodology for the use of oxytetracycline to mark eel otoliths. 3) Hold an ageing workshop to validate the methods and techniques used to determine eel age. A detailed list of prioritized research needs, developed by the TC and American Eel Stock Assessment Committee, is included in the 2012 American eel stock assessment report (Limburg, Oliveira, Wiedenmann, & O'Boyle, 2012, pp. 21-30).

Conclusion

The FS PRT concluded that the current Chesapeake Bay American Eel Fishery Management Plan goal, strategies, and actions remain adequate. Current and future management of the American eel resource will be required to work within the framework established by ASMFC. To this end, the AE FMP does not explicitly adopt ASMFC compliance requirements as they evolve over time. This is particularly important as the ASMFC Management Board considers which of a variety of options to implement to reduce commercial harvest of American eel. The FS PRT concluded that the 1991 Chesapeake Bay American Eel Fishery Management Plan should be amended to ensure management flexibility when ASMFC's regulatory requirements change.

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Figure 1. Commercial landings of American eel in Maryland from 1950 - 2013 (Whiteford, 2014; MD DNR, unpublished data; personal communication National Marine Fisheries Service, Fisheries Statistics Division). Beginning in 1994, total American eel harvest was separated into landings from finfish and crab harvester reports.

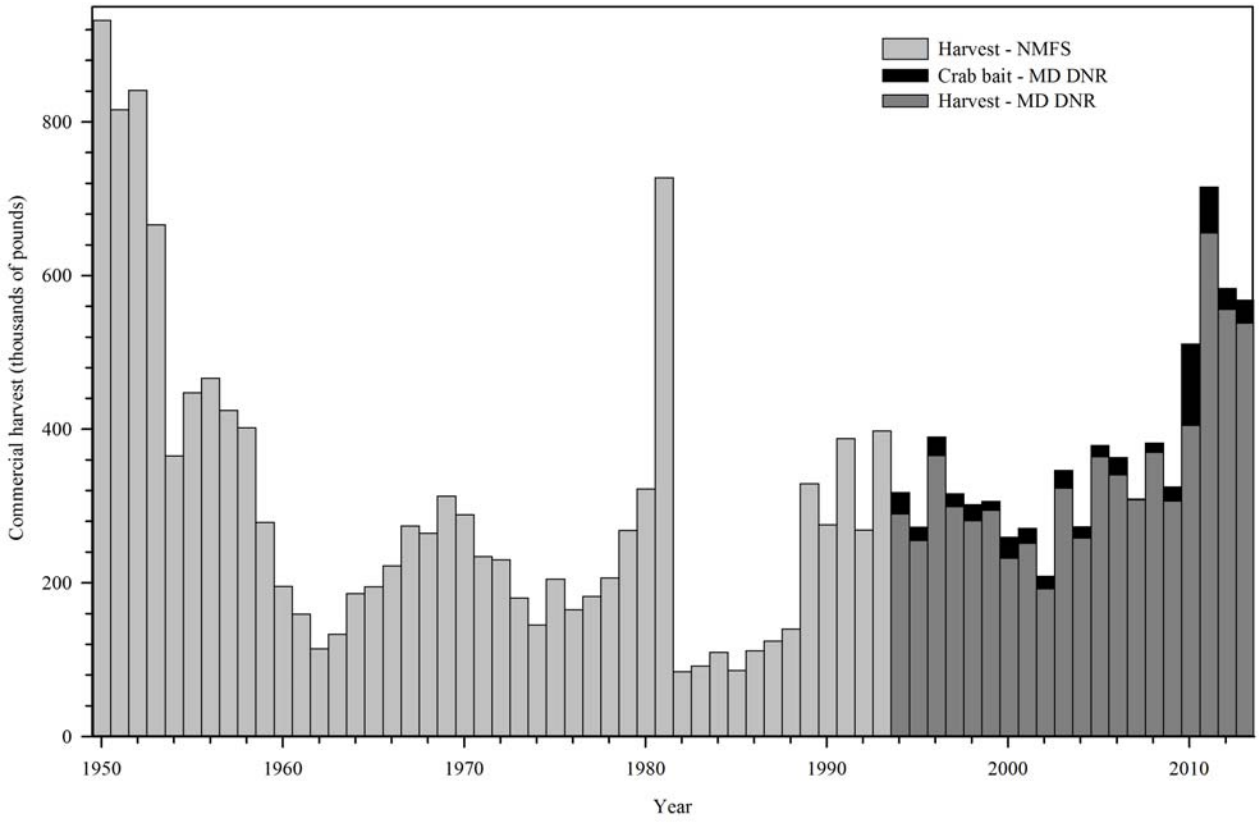


Figure 2. American eel commercial harvest effort, participation, and catch per unit effort (CPUE) in Maryland from 1992 - 2013 (MD DNR, unpublished data).

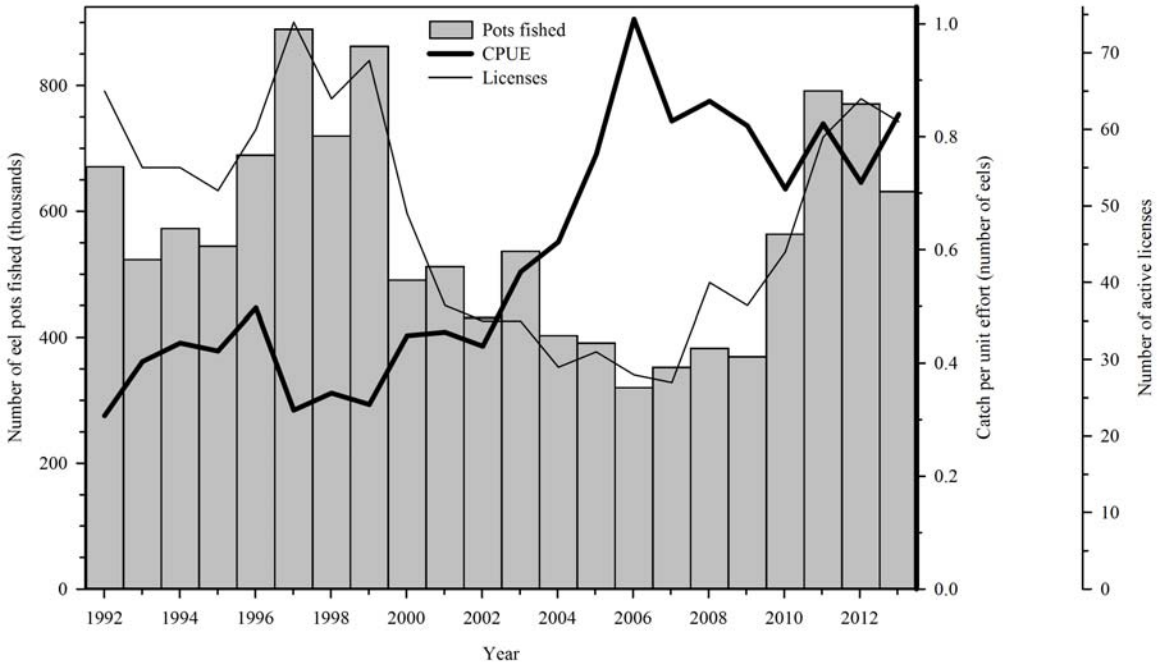
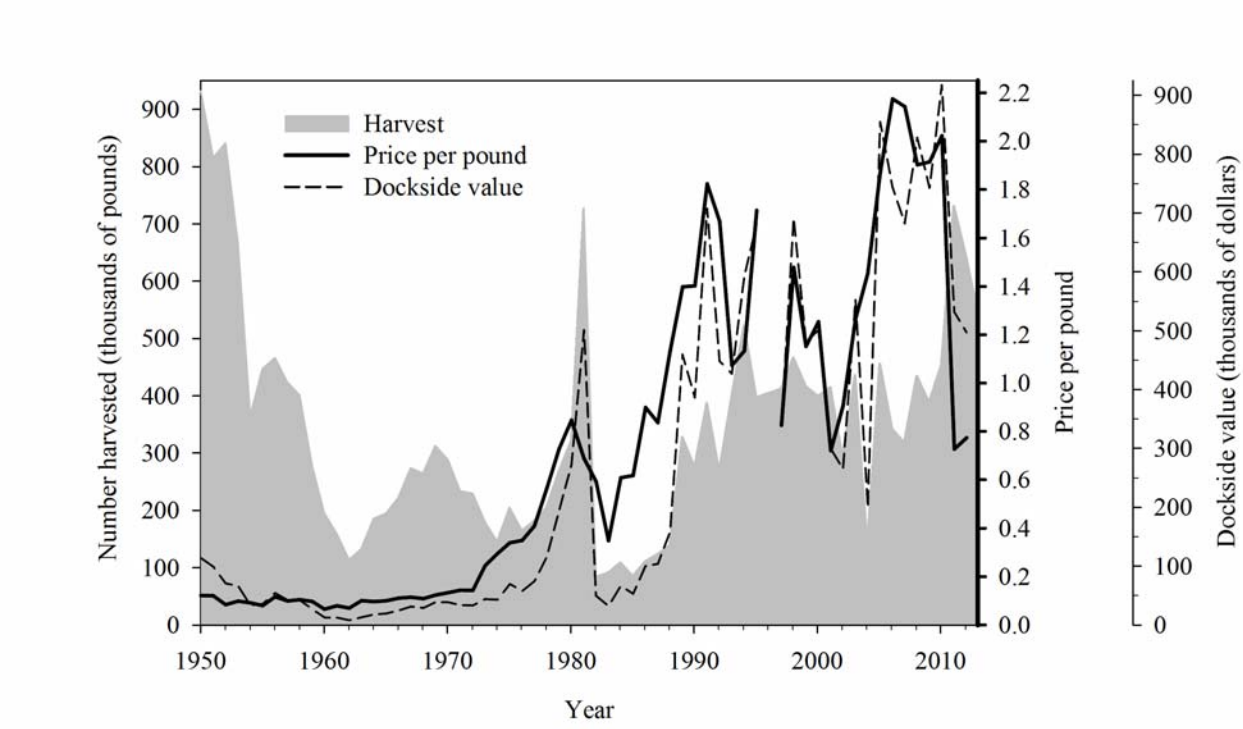


Figure 3. American eel dockside value and harvester price per pound compared to total harvest from 1950 – 2013 (Whiteford, 2014; MD DNR, unpublished data; personal communication National Marine Fisheries Service, Fisheries Statistics Division).



Chesapeake Bay American Eel Fishery Management Plan Implementation Table

1991 Chesapeake Bay American Eel Management Plan Implementation Table (updated 09/14)			
Strategy	**Action**	**Date**	**Comments**
1.1 The jurisdictions will adopt a conservative management approach until stock assessment analyses have been completed for American eels in the Bay.	1.1A) Maryland and the Potomac River Fisheries Commission will adopt a minimum size limit of 6 inches for American eels in the Bay. B) Virginia will continue its prohibition on the taking of elvers and will adjust its definition to correspond to a 6" minimum size limit.	1992 1993 Continue	Glass eel and elver fisheries are prohibited. No commercial harvest limit. Commercial season open all year for pots and traps. VA restricts other gear to January 1 to August 31. MD, PRFC, VA recreational limit is 25 eels/person/day. Limit for charter/head boat captain or crew is 50 eels/day. There are no harvest regulations in District of Columbia and PA.
		2005/2006	A coastal stock assessment was conducted in 2005 but the peer review panel determined that the terms of reference were either partially or insufficiently met.
		2012	A benchmark coastal stock assessment was completed in 2012 and concluded that eels are depleted along the coast.
		2013	Per Addendum III to the Interstate Eel FMP, minimum size was increased from 6" to 9" for all fisheries. Starting in 2014 harvest of eels will be prohibited from 9/1-12/31 by any gear other than a baited eel pot or spear. i.e., no harvest of eels with fyke or pound nets.
		2014	**Draft Addendum IV was released for public comment during summer 2014. ASMFC Management Board will evaluate management options in October 2014.**
		2017	**A stock assessment is scheduled for 2017.**
	1.2A) Maryland will implement a ½ x ½" minimum mesh size for eel pots. B) Virginia and the Potomac River Fisheries Commission will continue to enforce a ½ x ½" minimum mesh size for eel pots. Virginia will continue to enforce the escape panel requirements in ½ x ½" mesh pots.	1993 Continue 2013	MD, VA and PRFC currently enforce the ½" x ½" minimum mesh size for eel pots**.** Eel pots in MD with undersize mesh require a 16 in^2 escape panel of ½" x ½" mesh. In MD, pots with mesh size <½" require escape panels. Per Addendum III to the Interstate Eel FMP, as of January 1, 2017 the entire pot must be ½" x ½" mesh.

1991 Chesapeake Bay American Eel Management Plan Implementation Table (updated 09/14)			
Strategy	**Action**	**Date**	**Comments**
			Virginia ½" x 1" escape panels in ½" x ½" mesh pots.
	1.3 Upon restoration of American eels to the Susquehanna River basin, the Pennsylvania Fish Commission (PFC) will adopt regulations to prevent the overharvest of small eels.	On-going 2010 2013	CBP fish passage goal of 2,807 miles opened by 2014 is 92% complete The 2010 SRAFRC restoration plan did not have specific restoration goals for eel. Draft addendum (2013) to the plan specifies eel restoration goals http://www.srbc.net/pubinfo/docs/SRAFRC_American_Eel_Restoration_Plan_20140527_220124v1.pdf There are no harvest regulations in PA.
2.1 Catch and effort statistics for the American eel crab bait fishery will be obtained.	2.1 Maryland will require the reporting of American eels used for the crab bait fishery on their mandatory finfish reporting forms.	1993 2007 Continue	Information gathered from the Crab Reporting Forms indicated that previous bait estimates were probably too high. ASMFC required coastal states/jurisdictions to collect eel catch and effort data from all eel fisheries. MD commercial crabbers are required to report their harvest and effort of eels used for bait. These forms were changed in 2010 and may have increased reporting. Commercial crabbers can use up to 50 eel pots with no catch limit.
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.	3.1A) Maryland and Virginia will continue to collect catch and effort data from the live-eel fishery and begin monitoring the bait eel fishery. B) PRFC will continue to collect catch and effort data from their commercial fishery.	1997 2000 2006 Continue	MD conducts an annual population study. ASMFC implemented mandatory commercial reporting by life stage. ASMFC adopted Addendum I to the Coastal Eel FMP to improve data collection and subsequent stock assessments.
	3.2 Maryland, the Potomac River Fisheries Commission, and Virginia will encourage research to collect basic biological and socioeconomic information.	Continue 2000 2007 2010 On-going 2006	The ASMFC coastal eel FMP required states/jurisdictions to conduct an annual young of year survey. USFWS determined there was no need to list eels as endangered or threatened. USFWS was petitioned a second time for an eel status review. **The published status review is due in September, 2015.** MD initiated an annual fishery independent eel pot survey and silver eel survey. Eel are also sampled for disease

1991 Chesapeake Bay American Eel Management Plan Implementation Table (updated 09/14)			
Strategy	**Action**	**Date**	**Comments**
			(swimbladder parasite *Anquillicolla crassus*) prevalence. CB long term average (2004-2012) was 50%.
4.1 The District of Columbia, Environmental Protection Agency, Maryland, Pennsylvania, the Potmac 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. In addition, the jurisdictions have committed to providing upstream passage for migratory fishes.	4.1 The jurisdictions will continue to provide for fish passage at dams, and to remove stream blockages wherever necessary.	2005 2009 On-going **2014** 2008 2012	CBP fish passage goal was to open an additional 1,000 miles of tributary from 2005 to 2014. Another goal was to open 2,807 miles by 2014. **This goal is 92% complete. The 2014 CB Watershed Agreement (prompted by Executive Order 13508) included an outcome for opening 1,000 miles of migratory fish passage by 2025 (baseline mileage 2,041). American eel was identified as one of the focal species.** ASMFC approved Addendum II to the Coastal eel FMP which placed an emphasis on improving upstream and downstream passage. USFWS conducted a study to determine the timing & cues for out-migrating eels in the Shenandoah River. Results of the study indicate that outmigration is variable and sometimes protracted [13]. Study of the Embry Dam removal on the Rappahannock River indicated that the restoration resulted in increased numbers of eels as far as 100 miles upstream [14].
	4.2 The 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	Continue	Chesapeake Bay Program develops, revises, and monitors goals and strategies for restoration. The 2014 CBP Watershed Agreement revised the goals and outcomes. For more information: http://www.chesapeakebay.net/issues/issue/menhaden http://www.chesapeakebay.net/issues/issue/shad http://www.chesapeakebay.net/issues/issue/striped_bass http://www.chesapeakebay.net/issues/issue/nutrients http://www.chesapeakebay.net/issues/issue/chemical_contaminants http://www.chesapeakebay.net/issues/issue/wastewater http://www.chesapeakebay.net/issues/issue/agriculture http://www.chesapeakebay.net/issues/issue/sediment http://www.chesapeakebay.net/issues/issue/stormwater_ru

1991 Chesapeake Bay American Eel Management Plan Implementation Table (updated 09/14)			
Strategy	**Action**	**Date**	**Comments**
	the reduction and control of toxic substances. D) Developing and adopting basinwide management measures for conventional pollutants entering the Bay from point and nonpoint 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. G) Managing population growth to minimize adverse impacts to the Bay environment.	2005 2009 On-going **2014**	noff http://www.chesapeakebay.net/issues/issue/development http://www.chesapeakebay.net/issues/issue/air_pollution http://www.chesapeakebay.net/issues/issue/wetlands http://www.chesapeakebay.net/issues/issue/bay_grasses CBP fish passage goal was to open an additional 1,000 miles of tributary from 2005 to 2014. Another goal was to open 2,807 miles by 2014. **This goal is 92% complete. The 2014 CB Watershed Agreement (prompted by Executive Order 13508) included an outcome for opening 1,000 miles of migratory fish passage by 2025 (baseline mileage 2,041). American eel was identified as one of the focal species.**

Acronyms

ASMFC – Atlantic States Marine Fisheries Commission
CB – Chesapeake Bay
CBP – Chesapeake Bay Program
FMP – Fishery Management Plan
PFC – Pennsylvania Fish Commission
PRFC – Potomac River Fisheries Commission
SRAFRC – Susquehanna River Anadromous Fish Restoration Cooperative
USFWS – United States Fish & Wildlife Service

Appendix 1

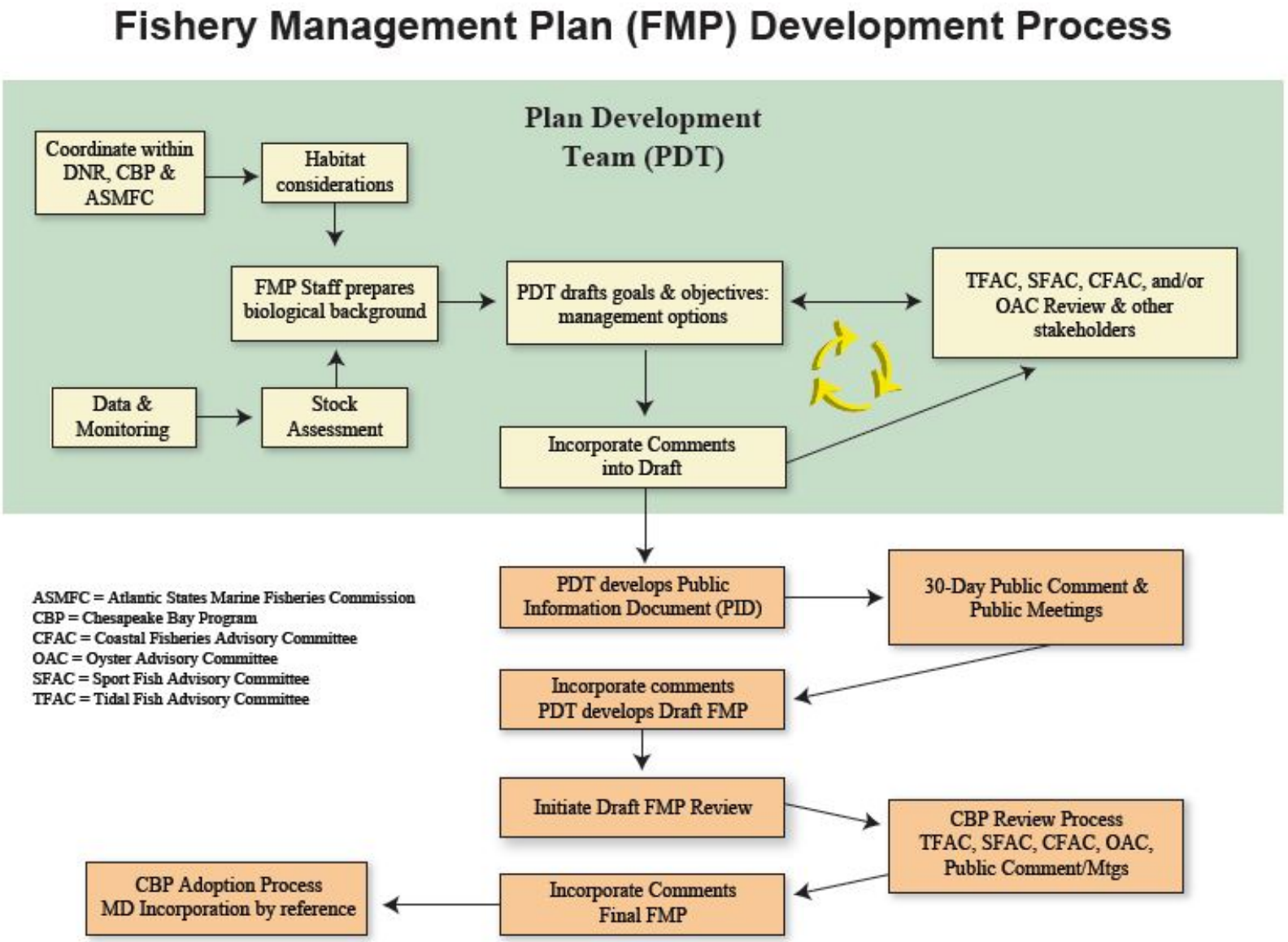
Fishery management plans (FMPs) provide a framework for how a fishery resource will be managed based on a species life history, habitat, and fishery utilization over time. Maryland law (Natural Resources Article §4-215) contains a statutory mandate for the development of FMPs for a given list of species. Legislation enacted in 2010 expanded MD Department of Natural Resources' (MDNR) authority to prepare FMPs for additional fish species. MDNR no longer needs to go to the General Assembly to justify adding new species to the list. FMPs can be prepared for species based on specific concerns about the status of a species and after consultation with the Tidal Fisheries Advisory Commission (TFAC) and the Sport Fisheries Advisory Commission (SFAC).

A Maryland Task Force on Fishery Management (Task Force) was convened in 2008 to review the current fishery management planning process and recommend improvements to the process that would increase stakeholder input and transparency during all stages of the FMP development and review process (Appendices 4 and 5 for flowcharts of the FMP Development Process and the FMP Review Process). The FMP staff developed a time line to review FMPs for 26 species. It is used to delineate an annual work plan.

FMP review begins with the designation of a Plan Review Team (PRT) by the Fisheries Service (FS) Director. The FS PRT evaluates the FMP goal, objectives, management strategies, and actions for their implementation status and applicability to current management needs. Depending on the particular species, the FMP review could also include the Chesapeake Bay Program and/or coordination with the Atlantic States Marine Fisheries Commission (ASMFC). After reviewing the components of the FMP and providing comments on the status of the management actions, the FS PRT recommends one of three pathways: 1) continue implementing the plan; 2) develop an amendment to significantly change or add to the FMP; or 3) revision of the FMP. The FS PRT drafts a FMP review report for review by the Fisheries Service Senior Management Team. The draft is also sent to the TFAC and SFAC for their review and input. The final, revised FMP review report is submitted to the Fisheries Service Director who makes the final decision regarding which of the three options to pursue: status quo, amendment, or revision.

In 2008, the Task Force emphasized the need for ecosystem-based management for all state managed fish species, including ASMFC managed species such as striped bass. The Task Force recommended MDNR continue research on the influence of habitat on fish populations, factors that impair fish habitat, participation in the environmental revue process, updating regulations, transparent management framework, and outreach to County, local, and public entities. Chesapeake Bay jurisdictions are developing quantitative ecosystem-based management tools that will supplement traditional management tools currently in use. Ecosystem-based tools will address habitat, food web, stock assessment, and socioeconomic issues.

Appendix 2. Schematic of the fishery management plan development process in Maryland.



Appendix 3. Schematic of the fishery management plan review process in Maryland.