2015 Maryland FMP Report (June 2016)
Section 1. American Eel ((*Anguilla rostrata)*

In 2015, a yellow eel catch cap of 907,671 pounds was implemented for the Atlantic coastal states. Preliminary Atlantic coast landings of 843,587 pounds were below the cap so state specific allocations for the yellow eel fishery were not initiated. Since the American eel stock was designated as depleted after the results of the 2012 coastal stock assessment, management strategies have been developed to reduce mortality. In addition to the coastal yellow eel quota, a coastal commercial glass eel quota was established, the minimum size limit was increased from 6" to 9", and gear restrictions were enacted for the fall fishery to limit silver eel harvest.

The life history strategy of the American eel is unique. Eels spawn in the Sargasso Sea (east of the Bahamas and south of Bermuda) and their larvae (called leptocephali) are carried by currents for approximately one year along the entire Atlantic coast from South America to Greenland. As the larvae approach the continental shelf, they change into glass eels, which actively swim to coastal areas. After approximately 2 months, the glass eels become pigmented and are referred to as elvers. The elvers either remain in estuaries or continue their migration to rivers and streams. They continue to grow into larger, immature yellow eels and spend most of their life in this stage. Their final life stage occurs when yellow eels become sexually mature and are considered silver eels. Mature silver eels then migrate back to the Sargasso Sea to spawn and die. Silver eels can range in age from 3 to 15 years in Maryland and can live up to 30 years in the northern-most latitudes. American eels comprise one panmictic population, i.e., they are a single-breeding population with random mating. They occur in a broader array of habitats than any other fish species. Their complex life history make American eel difficult to assess and challenging to manage.

Fishery Management

A Chesapeake Bay American Eel Fishery Management Plan (CBAE FMP) was adopted in 1991. The CBAE FMP goal 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 CBAE FMP was reviewed in 2014. The Plan Review Team concluded that the CBAE FMP management framework is still appropriate for managing the population in the Chesapeake and Coastal Bays but recommended the development of an amendment. A draft amendment was developed during 2015 and includes a provision for the adoption of current and future management requirements established by the ASMFC, updates the status of the eel resource, and provides a framework for managing and monitoring the eel fishery in Maryland waters. Amendment 1 is expected to be adopted by reference into MD regulations in the fall 2016.

The ASMFC adopted a coast wide FMP for American Eel in 1999. The goal is to conserve and protect the American eel resource to ensure its continued role in the ecosystem while providing the opportunity for its commercial, recreational, scientific, and educational use. The ASMFC developed the FMP to address data needs and other information which indicated the decline of some segments of the American eel population. Jurisdictions were required to implement fishery-independent young-of-the-year (YOY) monitoring surveys and complete an annual compliance report. Since the coastal FMP was developed, four addenda have been adopted.

Addendum I (2006) to ASMFC's FMP required implementation of a commercial licensing and reporting system for American eel fisheries in order to collect catch and effort data. Addendum II (2008) recommended stronger regulatory language by state and federal agencies to improve upstream and downstream passage at dams, particularly for emigrating silver eels. Addendum III (2013) and Addendum IV (2014) were adopted with the goal of reducing mortality of glass (Maine and South Carolina only), yellow, and silver eels. Addendum III management measures include commercial minimum size, gear restrictions, seasonal closure, and recreational size and creel limits. Addendum IV established a coast wide commercial catch cap for the yellow eel fishery, triggers for the implementation of state-by-state commercial quotas, and a quota for the glass eel fishery.[1]

Stock Status

The 2012 ASMFC benchmark American eel stock assessment concluded that the American eel stock was depleted.[2] Stock depletion is "likely due to a combination of fishing pressure, habitat loss due to river/stream blockages, mortality from passing through hydroelectric turbines, pollution, disease, and unexplained factors at sea.[2] Although the American eel stock was declared depleted, biomass and fishing mortality reference points could not be determined with confidence.[2] A stock assessment update is scheduled for 2017. To date, climate change considerations have not been included in stock assessments. However, updated information suggests that North Atlantic Ocean currents and habitats are changing. Physical oceanographic processes have been linked to the abundance and recruitment of juvenile American eels making them vulnerable to climate change.[3]

Chesapeake Bay biological reference points for American eel have not been established, therefore stock status in the Bay remains unknown. However, based on fishery dependent and independent surveys completed under the Maryland Eel Population Study, all three indices of abundance have indicated positive trends and increases in abundance since the late 1990's. Significant increases in landings since 2010 without notable changes to fishing mortality further supports the increased abundance trends in Maryland's portion of the Chesapeake Bay.[4, 5]

Current Management Measures

Glass eel and elver fisheries are prohibited in Maryland. In 2014, the commercial and recreational minimum size limit was increased from 6" to 9." There is no harvest limit for the commercial fishery but beginning January 1, 2014, there is a seasonal closure from September 1st to December 31st for all gears except spears and baited eel pots. The recreational creel is 25 eels per person per day. Eel pots must have a minimum mesh size of ½" x ½" by January 1, 2017. Till then, eel pots may have smaller mesh sizes provided they have escape panels.

Starting in 2015, a yellow eel catch cap of 907,671 pounds was implemented for the Atlantic coastal states as part of ASMFC Addendum IV. The coastwide catch cap has two management triggers that would result in the implementation of a state-by-state commercial yellow eel quota: if the catch cap is exceeded by more than 10% in a given year (998,438 pounds) or if the catch cap is exceeded for two consecutive years, regardless of the percent. If either of these two management triggers are met then Maryland will need to implement a commercial quota. State-specific allocations are based on average landings from 2011-2013 and Maryland's quota would be 465,968 pounds. Based on preliminary 2015 coastal landings, no management action was required.

Maryland conducts both fishery dependent and independent annual surveys. Landings from the commercial eel pot fishery are monitored and subsampled for biological data. Fishery independent monitoring includes a yellow eel pot survey in the Sassafras River, a silver eel trap survey from Gravel Run (Corsica River), and young-of-the-year survey in the Coastal Bays.[4] Yellow and silver eels are subsampled for sex and age determination and the prevalence of the swim bladder parasite, *Anquillicolla crassus.* Average prevalence rate among Chesapeake Bay eels was 52% from 2004-2014.[4] The effect of the parasite on yellow and silver eel stages is unknown.

The Maryland Department of Natural Resource Fish Passage Program added eels to its list of targeted species many years ago. 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. A specialized eel ladder was built at Daniels Dam (Patapsco River) in 2014 and is passing eels upstream in small quantities. Once the down river Bloede Dam is removed (tentatively in 2017-2018), more eels are expected to use the eel ladder at Daniels Dam.

The Fishery

Ninety-nine percent of commercially harvested American eel were caught using eel pots.[6] Maryland's commercial fishery landed 475,743 pounds of American eel during 2015. From 1989-2009 eel harvest averaged approximately 300,000 pounds with little variability. From 2010-2015, annual harvest has nearly doubled to 577,000 pounds and has comprised 57% of the total coastwide harvest (Figure 1).[7, 8]

Commercial crabbers are allowed to harvest American eel for use as trotline bait. The 2015 reported trotline bait harvest was 3,329 pounds. The 22- year average eel harvest from commercial crabbers is 23,550 pounds. Eel landings reported on crab harvester forms are not included in National Marine Fisheries Service commercial landings data.[6]

Recreational harvest data for American eel is not available from the Marine Recreational Information Program because of lack of data. [7] Consequently, the recreational harvest of eel is considered to be negligible.

Issues/Concerns

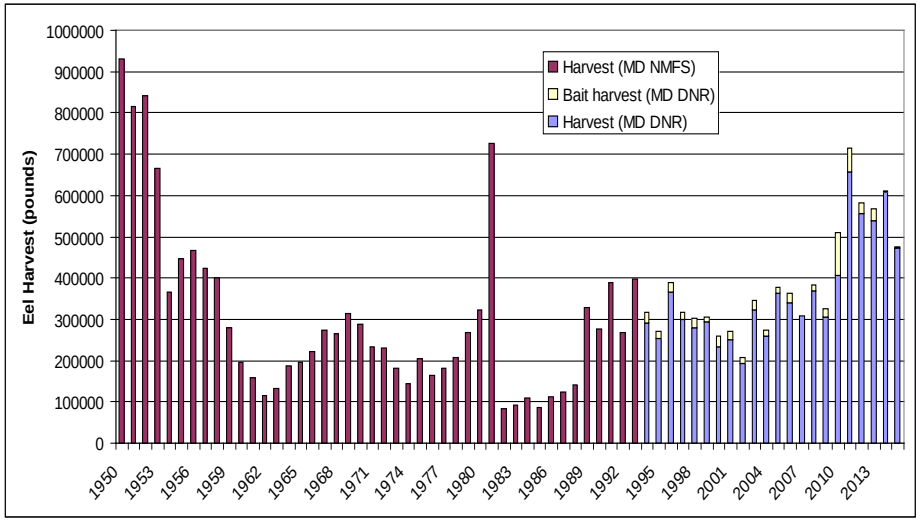
In 2010, the U.S. Fish and Wildlife Service (USFWS) received a petition to list the eel as a threatened species under the Endangered Species Act (ESA) and was followed by a lawsuit in 2012. Since then, the USFWS has conducted an in-depth status review of eels and published a 12-month finding (October 2015). The finding concludes that the American eel resource is stable and does not need protection under the ESA.[9]

The only legal glass eel fisheries along the Atlantic Coast are in the states of Maine and South Carolina.[2] Glass eels are primarily exported to Asian markets. In 2012, the estimated value of the coastal glass eel fishery was $40 million when the price per pound exceeded $2000. Despite prices dropping to $400 - $650 per pound in 2014, prices again reached $2000 per pound in 2015. High economic value for glass eels make them a prime target for poaching and illegal activities.[1] In 2016, ASMFC granted North Carolina an aquaculture harvester permit that would allow the harvest of 200lbs of glass eels. Under Addendum IV, other states may submit proposals to harvest glass eels for aquaculture purposes.

Stream and river blockages continue to reduce American eel access to significant amounts of historic habitat. Downstream movement of yellow and silver eels is particularly problematic at hydropower structures where mortality can be as high as 100%. The USFWS monitors eel abundance at the Conowingo Dam, the first major obstruction to eel passage on the Susquehanna River. Beginning in 2008, a seasonal elver ladder is operated at the dam in order to capture and transport eels upstream. In 2015, over 50,000 elvers were stocked.[10] In addition, federal agencies recently developed a technical memorandum on design guidelines for nature-like fishways.[11] Continued attention to removing blockages and providing passage is necessary.

American eel provide a unique ecosystem service as they are a primary host for freshwater mussel larvae and are the primary means of mussel dispersal within a river/stream.[12] Mussels provide important ecological services as water filters in freshwater. Providing fish passage so American eels have the opportunity to move into freshwater habitat will facilitate the rebuilding of freshwater mussel populations.

Figure 1. American eel commercial landings in Maryland, 1950-2015.
Data for the years 1950-1993 obtained from the National Marine Fisheries Service.[7] Data for years 1994-2015 was provided by Maryland Department of Natural Resources[8]



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[6] Whiteford, K. 2015. State of Maryland American eel (*Anguilla rostrata*) compliance report to the Atlantic States Marine Fisheries Commission calendar year 2012. Maryland Department of Natural Resources, Annapolis, MD.

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[9] Federal Register /Vol. 80, No.195 /Thursday, October 8, 2015 /Endangered and threatened wildlife and plants; 12-month findings on petitions to list 19 species as threatened or endangered. Pp 60834- 60850.

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1991 Chesapeake Bay American Eel Management Plan Implementation Table (updated 6/16)			
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	Glass eel and elver fisheries are prohibited in the Chesapeake Bay. 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	Addendum III to the Interstate Eel FMP required an increase in minimum size from 6" to 9" for all fisheries. Starting in 2014, harvest of eels are 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	Addendum IV was released for public comment during summer 2014 and adopted in October 2014. The addendum establishes a coastwide commercial catch cap for the yellow eel fishery, the implementation of state-by-state commercial quotas if management triggers are met and a quota for the glass eel fishery.
		2015-2016	**Maryland initiated an amendment to the CBAE FMP to adopt current & future ASMFC management requirements, update the status of the eel resource, and provide a framework for managing and monitoring the fishery. Amendment 1 is expected to be adopted by reference into MD regulations in the fall 2016. A quota system will be implemented if one of the management triggers are met: (1) exceeding coastwide quota by more than 10% in a given year, or (2) exceeding the coastwide quota for two consecutive years regardless of the percent overage. If a quota is necessary, Maryland would be allocated 465,968 pounds.**
		TBD	**If state by state quotas are implemented, an eel harvester permit will be required for all commercial eel harvesters, including crab license holders intending to harvest eels for bait. All eel permit holders will be subject to daily reporting requirements. In addition, the Department will be able to modify, open or close the season or adjust catch limits by public notice.**

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			A coastwide stock assessment update 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 **2017**	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. Virginia requires a ½" x 1" escape panels in ½" x ½" mesh pots. Addendum III to the Interstate Eel FMP requires that by January 1, 2017 the entire pot must be ½" x ½" mesh. Escape panels will no longer be allowed in small mesh pots (< ½" mesh).
	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. The 2010 SRAFRC restoration plan did not have specific restoration goals for eel. Addendum III (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 finfish reporting forms.	1993 2007 Continue	Watermen with crab licenses report the amount of eels caught for bait on their crab reporting forms. Information gathered from the Crab Reporting Forms indicate that previous bait estimates were probably too high. ASMFC requires 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	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 2006	The ASMFC coastal eel FMP required states/jurisdictions to conduct an annual young of year survey. MD initiated an annual fishery independent eel pot survey and silver eel survey. Eels are also sampled for disease (swimbladder parasite *Anquillicolla crassus*) prevalence. CB long term average (2004-2015)

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economic aspects affect the eel fishery.		2007 2010 2015	was 52%. USFWS determined there was no need to list eels as endangered or threatened. USFWS was petitioned a second time in 2010 for an eel status review**. The published status review of the second petition was published in October, 2015 and determined that the eel population is stable and does not warrant protection under the ESA.** USFWS completed an American eel biological species report that reviews the best available information on eels in support of the status review.
4.1 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. 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 2014 2008 2010 2012 2015	The CBP fish passage goal was updated to include opening an additional 1,000 miles of tributary from 2005 to 2014 or 2,807 miles by 2014. 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.* 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.** **Through 2015, MD DNR's Fish Passage Program has completed 79 projects and reopened 457 miles of upstream habitat in Maryland.**
	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.	Continue 2014	Chesapeake Bay Program develops, revises, and monitors goals and strategies for restoration. The 2014 CBP Watershed Agreement revised the goals and outcomes for natural resources, water quality and stewardship. For more information: http://www.chesapeakebay.net/chesapeakebaywatershedagreement/page **Results of the 2012-2014 assessment period indicate that 34% of the**

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	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 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.		**water quality standards for dissolved oxygen, water clarity/underwater grasses and chlorophyll a for the Chesapeake Bay were met during this time.** **In 2014, 59% of the Chesapeake Bay met the bottom habitat goal, scoring at least three on the one-to-five Benthic index of Biotic Integrity scale.** **In 2015, there were an estimated 91,621 acres of underwater grasses in the Chesapeake Bay, achieving 49% of the 185,000-acre goal.**

ASMFC – Atlantic States Marine Fisheries Commission
CB – Chesapeake Bay
CBP – Chesapeake Bay Program
ESA – Endangered Species Act
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

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