



**American Eel**  
*Anguilla rostrata*

**Common Names:** elver, silver eel, yellow eel, freshwater eel

**Interesting Facts:**

- \* Aristotle did the first known research on eel.
- \* Leptocephali were originally thought to be a different species.
- \* American eel were once thought to be the same species as the European eel (*Anguilla anguilla*).

**Special Uses:**

- \* Bait for both commercial and recreational fisheries.
- \* Eaten fresh or smoked.
- \* Elvers are often exported to Asian markets for aquaculture purposes.

**Largest Recorded:** 25", 8 lbs., 2 oz.

**Oldest Recorded:** 20 years

**Stock Status:** Depleted

## Species Profile: American Eel

### **American Eel Stock Determined to be Depleted**

#### Introduction

The 2012 benchmark stock assessment and peer review have concluded that the American eel population is depleted in U.S. waters. The stock is at or near historically low levels due to a combination of historical overfishing, habitat loss, food web alterations, predation, turbine mortality, environmental changes, toxins and contaminants, and disease. Although fisheries are a fraction of what they were historically, eel support valuable commercial, recreational, and subsistence fisheries.

American eel are a particularly challenging species to conserve and manage on a coastwide basis for a number of reasons. Throughout its life-span, from multiple juvenile life stages through adulthood, American eel will have inhabited and traversed a wide range of habitats from the Sargasso Sea to estuaries and inland riverine systems. During this journey, they will have moved through myriad jurisdictions and management authorities from the high seas to federal government and on to state governments. The life history of the species, such as late age at maturity and a tendency of certain life stages to aggregate can make American eels particularly vulnerable to overharvest.

Over the last two years, there has been a significant increase in the demand for young eels (called glass eels) due to tighter restrictions on the exportation of European eels and decreased ability to harvest Japanese eels. Currently, harvest of elvers is only allowed in Maine and South Carolina. Law enforcement agencies in all states along the East Coast have been working continuously to monitor and prevent illegal harvest of glass eels.

#### Life History

From a biological perspective, American eel are a very mysterious and illusive species. Information about abundance and status at all life stages, as well as habitat requirements, is very limited. American eels are catadromous, spending most of their life in freshwater or estuarine environments, then traveling to the ocean as adults to reproduce and die. Sexually maturing eels migrate up to 3,000 miles to spawning grounds located in the Sargasso Sea, an area of the western Atlantic Ocean east of the Bahamas and south of Bermuda. Spawning events have never been observed. Because all mature adult fish from the entire range come together in one place and reproduce, the American eel population is considered a panmictic (single) stock. American eels found along the eastern coast of Mexico are from the same population as eels found in the St. Lawrence River in Canada.

American eels have a multitude of life stages: leptocephali, glass eel, elvers,



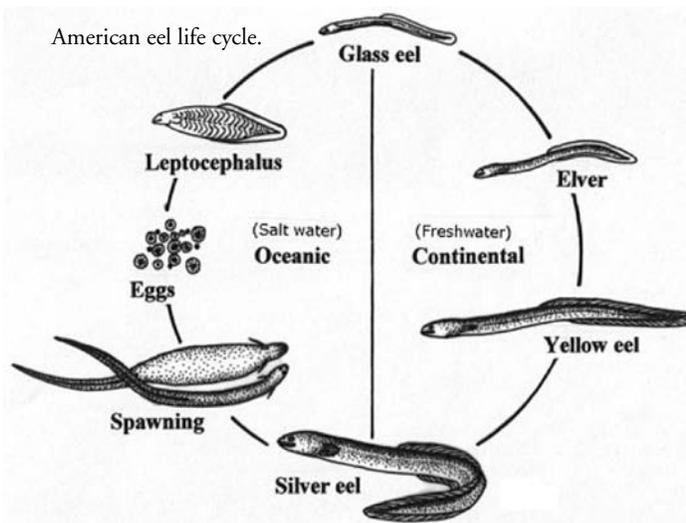
Student with glass eels and elvers as part of NYSDEC's American eel project. Photo by Chris Bowser, NYSDEC.

yellow eel, and silver eel. For up to a year and a half the Gulf Stream transports and disperses larval eels, called leptocephali, along the eastern coast of Central and North America. At this stage, the eels are transparent and no bigger than a stick of gum. Leptocephali metamorphose into glass eels as they migrate toward land. The elver stage occurs when glass eels turn a brown color and move into brackish or freshwater. Usually by age two, elvers make the transition into the yellow eel stage. Yellow eels will typically establish a very small home range, and have even been known to return to their place of capture if they are displaced. They inhabit fresh, brackish, and saltwater habitats where they will feed primarily on invertebrates and smaller fishes and grow until they reach sexual maturity.

Sexual maturity can occur any time between eight and 24 years of age. Females will grow larger and reach maturity at a later age than males, particularly in the northern regions. When yellow eels start to sexually mature, they begin a downstream migration toward the Sargasso Sea spawning grounds. During this migration, yellow eels metamorphose into the adult silver eel phase, undergoing several physiological changes. Adult silver eels are believed to spawn in the Sargasso Sea during winter and early spring. It is assumed they die after spawning.

### Commercial & Recreational Fisheries

Commercial landings fluctuate depending on the market price for eel. The American eel fishery primarily targets yellow eels. Eel pots are the most typical gear used; however, weirs, fyke nets, and other fishing methods are also employed. At the silver eel stage, eels are completely focused on migrating and typically do not respond to baited traps. Glass eel fisheries along the Atlantic coast are prohibited in all states except Maine and South Carolina. In recent years, Maine is



the only state reporting significant glass eel harvest. Harvest has increased the last few years as the market price has risen to over \$2,000 per pound. Although yellow eels were harvested for food historically, today's fishery sells yellow eels primarily as bait for recreational fisheries. Glass eels are exported to Asia to serve as seed stock for aquaculture facilities. Little information is available on targeted recreational fisheries for American eel.

From 1950 to 2010, U.S. Atlantic coast landings ranged from approximately 664,000 pounds in 1962 to 3.67 million pounds in 1979. After an initial decline in the 1950s, landings increased to a peak in the 1970s and 1980s before declining again in the 2000s. The value of U.S. commercial fishery has varied from less than a \$100,000 (prior to the 1980s) to a peak of \$6.4 million in 1997. Total value increased through the 1980s and 1990s,

dropped in the late 1990s, and increased again in the 2000s.

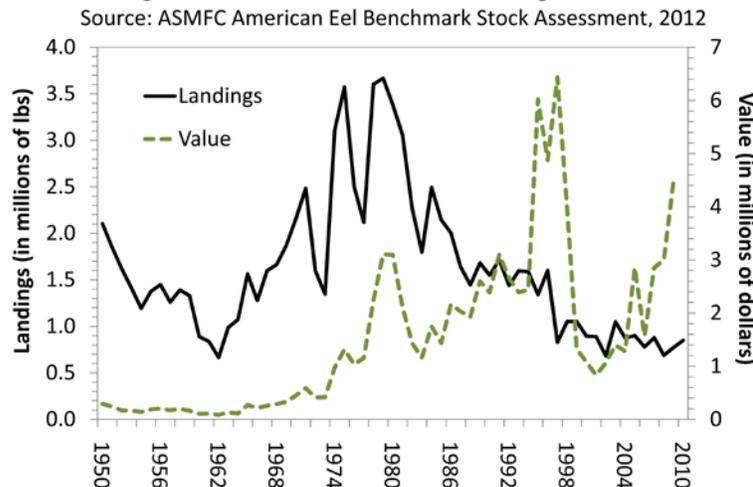
### Stock Status

The Commission conducted a benchmark stock assessment for American eel in 2012. Despite the large number of surveys and studies available for use in this assessment, the American eel stock is still considered data-poor because very few

surveys target eels and collect information on length, age, and sex of the animals caught. Also, eels have an extremely complex life history that is difficult to describe using traditional stock assessment models. Therefore, two data-poor methods were used to assess the American eel resource: trend analyses and model analysis.

Trend analyses found evidence of declining or, at least, stable abundance of American eels in the U.S in recent decades. Regional trend analyses identified decreasing populations in the Hudson River and South Atlantic regions, while analysis from the Chesapeake Bay and Delaware Bay/Mid-Atlantic Coastal Bays regions showed no consistent increasing or decreasing trends. Coastwide model analysis estimated biomass to be at a reduced level (see American Eel Stock Assessment Q & A Sidebar on page 9 for more information).

Figure 1. American Eel Commercial Landings and Value



Both trend and model analyses indicate that the American eel stock has declined in recent decades and the prevalence of significant downward trends in multiple surveys across the coast is cause for concern. Significant levels of harvest in the 1970s is considered a major factor contributing to the current low biomass levels, but other factors such as

habitat loss, predation, and disease have also played a role. Stock status is depleted and no overfishing determination can be made at this time based solely on the trend analyses performed. The ASMFC American Eel Technical Committee and Stock Assessment Subcommittee caution that although commercial fishery landings and effort in recent times have declined in most regions (with the possible exception of the glass eel fishery), current levels of fishing effort may still be too high given the additional stressors affecting the stock such as habitat loss, passage mortality, and disease as well as potentially shifting oceanographic conditions. Fishing on all life stages of eels, particularly young-of-the-year and in-river silver eels migrating to the spawning grounds, could be particularly detrimental to the stock, especially if other sources of mortality (e.g., turbine

mortality, changing oceanographic conditions) cannot be readily controlled. Management efforts to reduce mortality on American eels in the U.S. are warranted.

In 2010, Canada Department of Fisheries and Oceans (DFO) conducted a stock assessment on American eels in Canadian waters and found that region-specific status indices show abundance relative to the 1980s is very low for Lake Ontario and upper St. Lawrence River stock, and either unchanged or increasing in the Atlantic Provinces. A joint stock assessment by both Canada DFO and the Commission was recommended by the American Eel Stock Assessment Subcommittee as an approach for the next assessment.

### Atlantic Coast Management

American eels are managed by the Commission in territorial seas and inland waters along the Atlantic coast from Maine to Florida. Increasing demand for eel by Asian markets and domestic bait fisheries, coupled with concern about declining eel abundance and limited assessment data, spurred development of the first Interstate Fishery Management Plan for American Eel in the mid-1990s. The plan, approved in 1999, provided several reasons why heavy harvest pressure may adversely affect American eel populations: (1) American eel have a slow rate

## American Eel Assessment Q&A

### What Data Were Used?

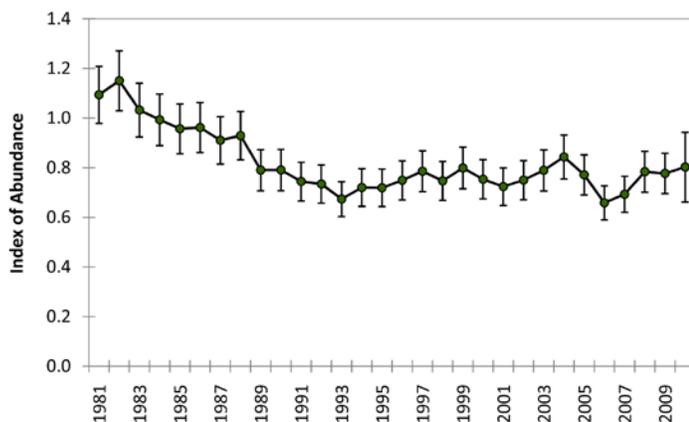
The American eel assessment used two types of data. The first was fishery-dependent data, which includes commercial landings, recreational landings, and effort data provided by the states, NOAA Fisheries and ACCSP. The second was fishery-independent data, which includes data collected through state, federal, and academic research programs. While over 100 fishery-independent surveys and studies were initially reviewed, the American Eel Stock Assessment Subcommittee ultimately selected 19 young-of-year surveys and 15 yellow eel surveys to use as indices of abundance based on the number of years surveyed, survey design, appropriateness of gear used for catching eel, and frequency of eel catches.

### How Were The Data Analyzed?

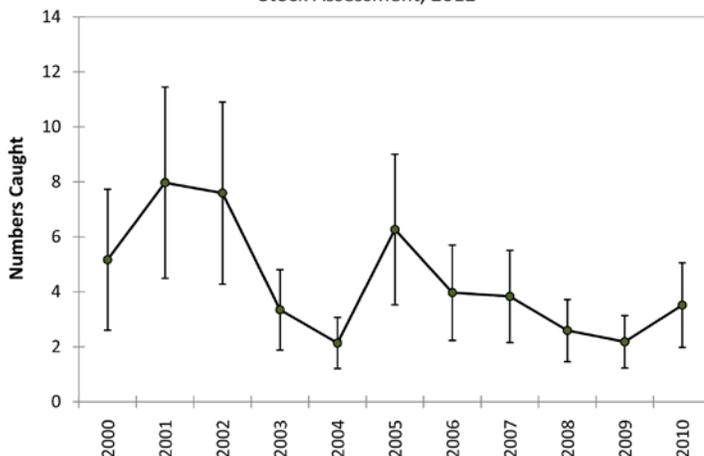
Despite the large number of surveys and studies available for use in this assessment, the American eel stock is still considered data-poor because very few surveys target eels and collect information on length, age, and sex of the animals caught. Also, eels have an extremely complex life history that is difficult to describe using traditional stock assessment models. Therefore, several data-poor methods were used to assess the American eel resource. The first set of analyses (trend analyses) aimed at determining if there was a statistically significant trend in the fishery-independent survey data at the river, regional and coastwide scales. Indices of regional abundance for YOY and yellow-stage American eel were developed for six regions along the Atlantic Coast. The regional indices were developed by first splitting up all the datasets by regions, then standardizing each of the datasets that within the region, and lastly combining the standardized surveys within the region.

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**Figure 2. Index of Abundance for Yellow-phase American Eels along the Atlantic Coast (30-year index). The error bars represent the standard errors about the estimates. Source: ASMFC American Eel Benchmark Stock Assessment, 2012**



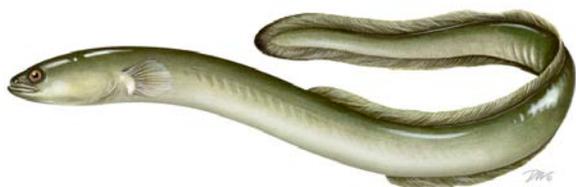
**Figure 3. 10-year Index of Abundance for Young-of-the-Year American Eels along the Atlantic Coast. The error bars represent the standard errors about the estimates. Source: ASMFC American Eel Benchmark Stock Assessment, 2012**



of maturation, requiring eight to 24+ years to attain sexual maturity; (2) glass eel tend to aggregate seasonally during migration, making them vulnerable to directed harvest; (3) harvest of yellow eel is a cumulative stress, over multiple years, on the same yearclass; and (4) all fishing mortality occurs prior to spawning.

Each state is responsible for implementing management measures within its jurisdiction to ensure the sustainability of the American eel population that resides within state boundaries. The FMP required that all states and jurisdictions implement an annual young-of-year abundance survey by 2001 in order to monitor annual recruitment. In addition, the FMP required all states and jurisdictions to establish a minimum recreational size limit of six inches and a recreational possession limit of no more than 50 eels per person per day. Recreational fishermen are not allowed to sell eels without a state license. Commercial regulations vary by state but also include a six-inch minimum size limit with the exception of Maine and South Carolina which maintain glass eel fisheries. Management measures stipulate that states and jurisdictions shall maintain existing (as of 2000) or more conservative fisheries regulations for all life stages, unless otherwise approved by the American Eel Management Board.

The greatest hindrance to the development and implementation of an effective management program for American eel is the panmictic nature of the stock. Local, regional, and ocean-wide actions have the ability to affect the entire stock because there is random mating within the breeding population—all of the American eel found from Canada to Central America. While different agencies have authority over eel in their jurisdictions, they do not have the ability to alter the population beyond their management boundaries. The Commission has begun a working relationship with the Great Lakes Fishery Commission, which is founded by a bi-national agreement between the U.S. and Canada, to facilitate participation and data sharing. In response to the 2012 American Eel Stock Assessment, the American Eel Management Board tasked the Technical Committee to develop management options based on the recommendations and results in the assessment. The Management Board will review these options at the ASMFC Summer Meeting.



## American Eel Assessment Q&A (continued from page 3)

The second approach involved a model called Depletion-Based Stock Reduction Analysis (DB-SRA) which uses trends in historical catch to estimate biomass trends and maximum sustainable yield. DB-SRA requires a long time series of historical catch records extending back to the beginning of the modern fishery, information about the life history of the species (e.g., age at maturity), and a set of assumptions about the stock and current biomass relative to unfished biomass. The DB-SRA provided estimates of historical and current biomass levels to illustrate relative trends to in population size and abundance. However, the Peer Review Panel suggested improvements be made to the model before biomass estimates and reference points are used for management.

### What Is The Status Of The Stock?

Both trend analyses and DB-SRA results indicate that the American eel stock has declined in recent decades and the prevalence of significant downward trends in multiple surveys across the coast is cause for concern. Therefore, the stock status is depleted. No overfishing determination can be made at this time based solely on the trend analyses performed.

### What Data Are Needed?

Direct and detailed monitoring of the American eel population and fisheries trends is needed to improve the stock assessment. The stock assessment report specifically identified the following areas that are critical for improved understanding and management of American eel:

1. Improved accuracy of commercial catch and effort data through better compliance with landings and effort reporting requirements
2. Targeted fishery-independent surveys for yellow and silver eels. Alternatively, the collection of length, age, and sex information for yellow and silver eels caught in already existing surveys is recommended, especially in the South Atlantic where few surveys are conducted that catch American eels.
3. Collection of age structure data outside the range of the fishery to assess the contribution of these animals to overall stock productivity
4. Quantification of mortality rates due to dam turbines, disease, and other environmental stressors
5. A comprehensive map of coastwide habitat loss to aid in quantifying the potential magnitude of reduced productivity
6. Given the panmictic nature of the American eel stock, the next assessment should be a cooperative effort between U.S. and Canada.

### How Will This Guide Management?

The American Eel Board accepted the assessment for management use in May 2012. The Board tasked the American Eel Technical Committee (TC) with developing management recommendations based on the results of the assessment; its recommendations will be presented to the Board in August. Additionally, the Board will be providing a copy of the assessment to the U.S. Fish and Wildlife Service (USFWS) for its use in determining whether American eel should be listed as threatened under the Endangered Species Act.