

Species Profile: American Eel



Fishery Scientists and Managers Seek to Sustainably Manage this Ecologically and Economically Valuable Species

Introduction

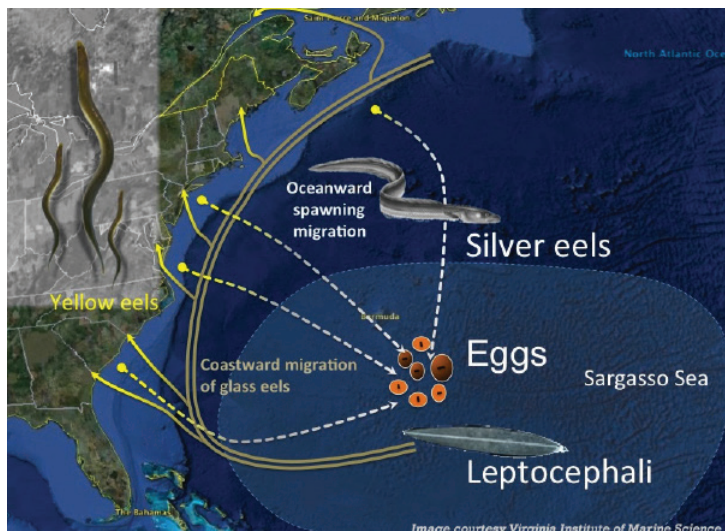
With winter fast approaching, snow is on a lot of our minds. It's also on the minds of marine scientists although the snow they are thinking of is marine snow. This material, which is made up of a combination of decaying plants and animals, soot, and other inorganic matter, falls through the water column before settling on the ocean floor. It has been recently identified as a common food source for the larval stage of the Japanese eel and it may also be important in the diet for American eel larvae as well. This insight is another piece in the puzzle that is being used by scientists to improve techniques for reproducing eels in captivity via aquaculture.

Since 2011, there has been a growing demand for glass eels for aquaculture purposes, increasing landings and the price per pound of glass eels. This demand, coupled with scientific advice that American eel is depleted throughout its US range, has prompted new management measures for several eel life cycles along the Atlantic coast as well as a renewed effort to sustainably raise eels through aquaculture methods.

Life History

From a biological perspective, American eel are a very mysterious species. Once thought to be a freshwater species, American eel are actually a catadromous species – the only one found in North America. This illusive species begins its life in the Sargasso Sea, an area of the western Atlantic Ocean east of the Bahamas and south of Bermuda. 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 are 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. As they grow into yellow eels they will feed mainly at night on insect larvae, crayfish, smaller benthic fish, and even smaller elvers when available.

Yellow eel will typically establish a very small home range and have even been known to return to their home range if they are displaced. Another unique characteristic about American eel is when they are densely concentrated in habitat, they are more likely to be males, while eel living in less dense populations are more likely to be females. Females will also grow larger and reach maturity at a later age than males, particularly in the northern regions. Males grow to two feet long and females can reach up to four feet long, although growth rates are dependent on the habitat latitude and distance from the Atlantic Ocean.



Sexually maturing eel, called silver eel, migrate up to 3,000 miles back to where they were born in the Sargasso Sea. They will spawn once and presumably die. The spawning events have yet to be observed and the exact location remains unknown. Because all mature adult eel from the entire range come together in one place and reproduce, the American eel population is considered a panmictic (single) stock. So the eel you see in your local rivers and streams are the same as the ones found in the St. Lawrence River in Canada or rivers in South America!

Commercial & Recreational Fisheries

Commercial landings fluctuate depending on the market price for eel at their various life stages: glass, yellow, and silver. The majority of commercial landings come from the yellow eel fishery. After an initial decline in the 1950s, commercial yellow eel landings increased to a peak of 3.67 million pounds in 1979,

Species Snapshot

American Eel
Anguilla rostrata

Common Names:

Elver, silver eel, yellow eel, freshwater eel

Interesting Facts:

- Eel can travel over land! This fascinating creature can absorb oxygen through its skin so it is possible for them to travel over land for short distances, such as through mud or wet grass.
- Eel have poor eyesight and likely depend on a keen sense of smell to locate food.
- Aristotle did the first known research on eel.
- Leptocephali (eel larval stage) were originally thought to be a different species.
- American eel were once thought to be the same species as the European eel (*Anguilla anguilla*).

Christmas Eel!

- Eel are considered an important component of the traditional Italian-American "Feast of Seven Fishes" dinner celebrated on Christmas Eve.

East Coast Record: 44.5 inches/8 pounds, caught in New Hampshire in 1975

Oldest Recorded: 20 years

Stock Status:

Depleted throughout its US range

declined again in the 2000s, and have exceeded one million pounds only twice since 2004. Eel pots are the most typical gear used in the commercial yellow eel fishery; however, weirs, fyke nets, and other fishing methods are also employed. Although yellow eel were harvested for food historically, today's fishery sells yellow eel primarily as bait for recreational fisheries. At the silver eel stage the eel are completely focused on migrating and typically do not respond to baited traps. With the approval of Addendum IV, silver eel fisheries are only permitted on a limited basis in the Delaware River (NY). Glass eel fisheries along the Atlantic coast are prohibited in all states except Maine and South Carolina. Over the last three years, there has been a significant increase in the demand for glass eel due to tighter restrictions on the exportation of European eel and decreased ability to harvest Japanese eel. Harvest, by dip net or fyke net, has increased as the market price has risen to over \$2,000 per pound. In 2013, the glass eel fishery was the second most valuable fishery in Maine, behind American lobster. Glass eel are exported to Asia to serve as seed stock for aquaculture facilities. Little information is available on targeted recreational fisheries for American eel.

Stock Status

The 2012 benchmark stock assessment concluded American eel is depleted in US waters due to a combination of historical overfishing, habitat loss, food web alterations, predation, turbine mortality, environmental changes, toxins and contaminants, and disease. 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 eel and collect information on length, age, and sex of the animals caught. Also, given the extremely complex life history of eel it 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 eel in the US in recent decades. Regional trend analyses identified decreasing populations in the Hudson River and South Atlantic regions, while no consistent trends were found for the Chesapeake Bay and Delaware Bay/Mid-Atlantic Coastal Bays regions. The coastwide model analysis estimated biomass to be at a reduced level. 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.

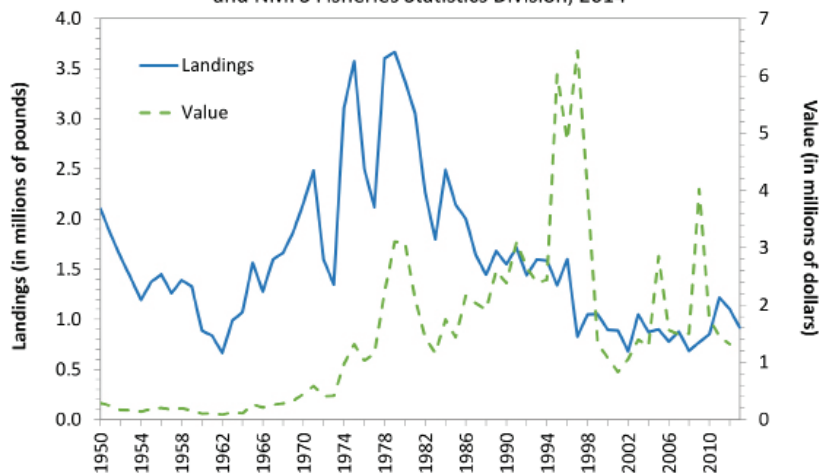
American eel were petitioned for listing as threatened under the Endangered Species Act (ESA) in 2010. At that same time, the Canada Department of Fisheries and Oceans conducted a stock assessment on American eel in Canadian waters and found that region-specific status indices show abundance relative to the 1980s is very low for Lake Ontario and upper St. Lawrence River stock, and either unchanged or increasing in the Atlantic Provinces. Furthermore, in 2014 the International Union for Conservation of Nature (IUCN) listed American eel as endangered on the IUCN Red List. It is anticipated that the US Fish and Wildlife Service will make a determination on the ESA listing by September 2015.

Atlantic Coastal Management

American eel are a particularly challenging species to conserve and manage on a coastwide basis as they are a slow growing, late maturing, semelparous species (meaning they spawn once and then die) that migrate between the high seas and inland estuaries and riverine systems, as well as through international, federal, state, and local jurisdictions. Through the Commission, Atlantic coastal states from Maine through Florida manage American eel in their territorial seas and inland waters. Each state is responsible for

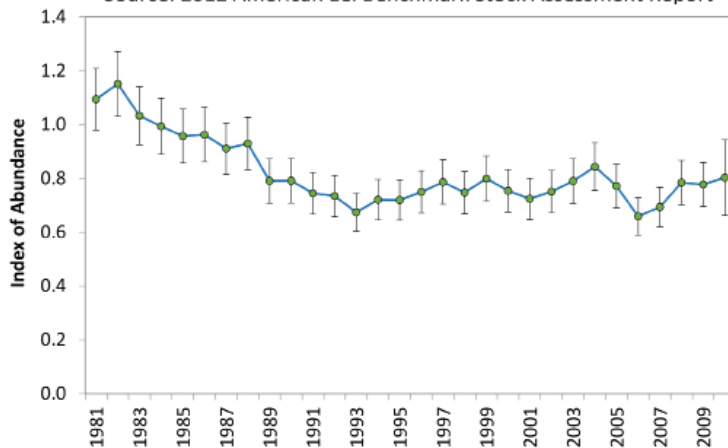
Yellow-Phase American Eel Commercial Landings and Value

Source: 2012 American Eel Benchmark Stock Assessment Report and NMFS Fisheries Statistics Division, 2014



30-Year Index of Abundance for Yellow-phase American Eel along the Atlantic Coast (error bars represent standard errors about the estimates)

Source: 2012 American Eel Benchmark Stock Assessment Report



implementing management measures within its jurisdiction to ensure the sustainability of the American eel population residing within state boundaries. 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 in the mid-1990s.

Through Addenda III and IV, the Commission and the states seek to reduce mortality and increase conservation of American eel stocks across all life stages. Addendum III, approved in 2013, increased the commercial yellow eel minimum size to 9 inches, reduced the recreational bag limit to 25 fish/day, prohibited silver eel fisheries except in the Delaware River (NY), and implemented fishery-independent and fishery-dependent monitoring requirements. Addendum IV, approved in 2014, established the first ever coastwide quota for yellow eel fisheries, set at 907,671 pounds, along with specific management action if the quota is exceeded. Specifically, the Addendum establishes two management triggers: (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 either one of the triggers are met then states would implement state-specific allocation based on average landings from 2011-2013. Addendum IV also sets Maine's glass eel quota at 9,688 pounds (a 17.5% reduction from the 2014 quota). Maine will maintain its daily trip level reporting and require a pound-for-pound payback in the event of quota overages in its glass eel fishery. Additionally, the state will implement a fishery-independent life cycle survey covering glass, yellow and silver eels within at least one river system. The Addendum specifies these requirements would also be required for any jurisdiction with a commercial glass eel fishery harvesting more than 750 pounds.

Addendum IV provides states/jurisdictions the ability to request limited participation in the glass eel fishery based on conservation programs enacted after January 1, 2011, and given there is an overall benefit to American eel populations. Examples of conservation programs include, but are not limited to, habitat restoration projects, fish passage improvements, or fish passage construction. The Addendum also provides opportunities for a limited glass eel harvest for domestic aquaculture purposes and allows the continuation of New York's Delaware River silver eel weir fishery under a transferable license cap, limited to nine permits annually. For more information, please contact Mike Waine, FMP Coordinator, at mwaine@asmfc.org.

