

American eel

Anguilla rostrata

The American eel is the only species of freshwater eel found in North America. People have fished and farmed eels for thousands of years, but until recent times, little was known about the eel's complex life history.

The species has survived multiple ice ages and seems to be equipped to withstand the cycles and fluctuations inherent in ocean dynamics. Some scientists consider the highly adaptive American eel to have the broadest diversity of habitats of any fish species in the world.

Eel Migration and Life Cycle

During its lifetime, the American eel changes habitats and undergoes several physical phases, known as metamorphoses. Each winter, mature American eels return to spawn in the Sargasso Sea, 2 million square miles of warm water in the North Atlantic between the West Indies and the Azores.

Millions of eels gather here from across the species' range, such that individuals could breed with American eels from any part of its range. This mating behavior perpetuates a single breeding population, preventing the genetic, behavior or physical changes that develop when different stocks of a species live in and rely on different geographic areas.

The larvae of this snake-like fish passively use ocean currents to leave the Sargasso Sea for homes throughout its fresh- and brackish water range from Greenland south to Venezuela. Eels do not necessarily return to the same areas where their parents grew up; rather, they are randomly deposited into areas out of the ocean currents and then swim to coastal habitats.

In the United States, they are ubiquitous on the eastern seaboard from Maine to Florida, common in the Gulf States, and widely distributed



Eels can absorb oxygen through their skin and gills, allowing them to travel over land, particularly wet grass or mud.



Eels can cover their entire bodies with a mucous layer, making them nearly impossible to capture by hand—making “slippery as an eel” more than just a figure of speech.

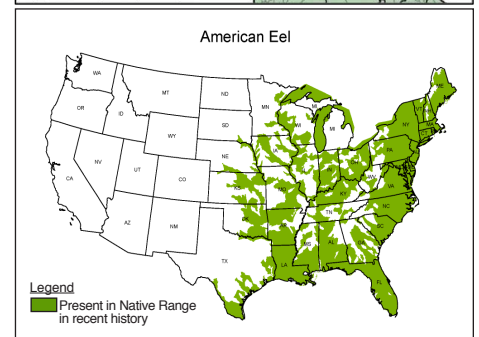
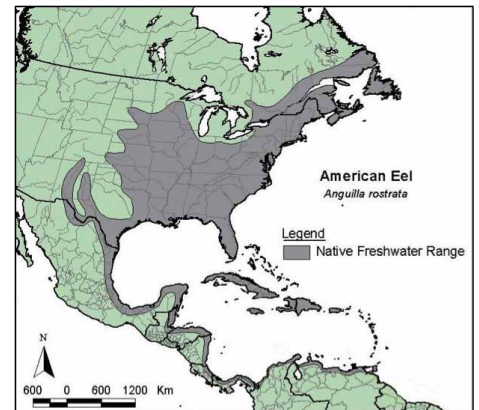
inland in suitable habitat of the Mississippi River, becoming less common with greater distance from the ocean.

Leptocephali: Eel eggs hatch on the ocean surface into small, transparent, willow-shaped larvae that drift with the Gulf Stream and other currents, taking about a year to reach the Atlantic coast.

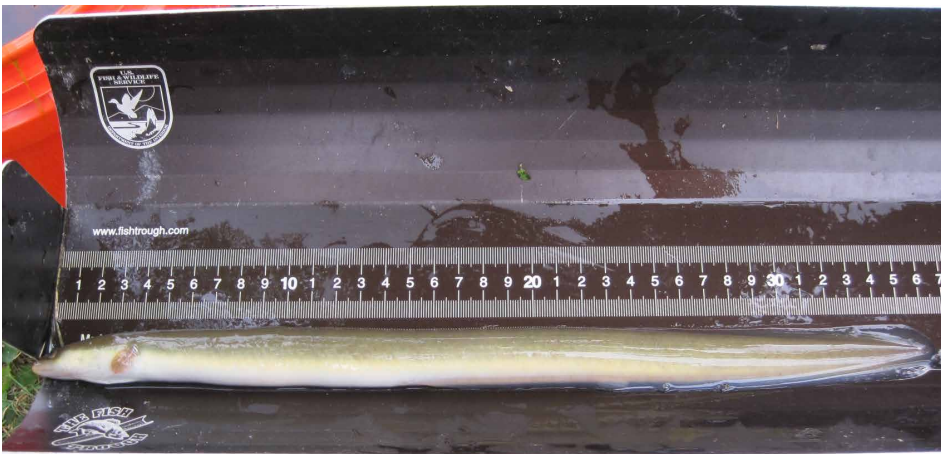
Glass eels: By the time they reach the coast, the transparent larvae have developed fins, grown to about 2-3 inches long and are the shape of adult eels.

Elvers: Elvers develop gray to green-brown pigmentation and are more than 4 inches in length. They can be found in estuaries, marine or tidal rivers.

Yellow eels: Yellow eels are sexually immature adults that are yellow-green to olive-brown. They swim and feed at night. After a few years in marine or brackish waters, or up to 40 or more years of living in freshwater, yellow eels begin to sexually mature. Eels that remain in estuarine and marine waters undergo these changes but mature earlier than those in freshwater due to more food and a faster growth rate.



The top map shows the native freshwater range of the American eel. The bottom map shows the distribution of the American eel in freshwaters of 36 U.S. states. American eel distribution data were provided to the Service through state fish surveys, eel fishway monitoring, current records of eel stocking and 2013 data from NatureServe.



Female eels can grow to 5 feet in length, and males usually reach about 2 feet.

Silver eels: Depending on a variety of factors, which can include eel density, growth rate and water salinity, silver eels sexually differentiate at about 8-10 inches in length and become male or female silver eels with dark coloring, bronze-black backs and silver undersides.

Silver eels undergo amazing physical changes enabling their return to the Sargasso Sea, transforming the eels from shallow water, bottom dwellers to ocean travelers. They cease to feed during ocean migration, and their gut begins to degenerate. To fuel the long ocean swim, their fat reserves increase. Eyes double in size and become more sensitive to blue, enhancing vision in deep water. Blood vessels feeding their swim bladders increase in number, allowing increased gas deposition and reduced loss of gas, both critical for buoyancy.

Upon return to the Sargasso Sea, females release 20-30 million eggs that are fertilized by males. Once they spawn, it is assumed that adult eels die, but researchers have never witnessed eels spawning in the wild.

Stressors and Conservation Efforts

American eels remain widely distributed throughout much of their historical range, despite reduced numbers over the past century and habitat loss from dams and other obstructions. In some large coastal rivers, eels are the most commonly found fish, occupying more aquatic habitats than any other species.

The Service continues to work with partners across the range on conservation efforts to ensure long-term stability for the American eel and other migratory fish species.

Mechanisms restoring fish passage have reduced local mortality from hydroelectric facilities. Dam removals, culvert replacements, night-time hydroelectric facility shutdowns, and updated fishways have restored habitat access in many areas.

The agency's Northeast fisheries program alone has removed or improved more than 200 barriers to fish passage since 2009, opening more than 1,200 miles and 12,000 acres of rivers for aquatic wildlife including the American eel. The Service has also secured \$10.4 million in Hurricane Sandy resilience funding to restore fish passage through removal of 13 dams in Connecticut, Maryland, New Jersey and Rhode Island.

Harvest quotas have alleviated fishing pressure on the American eel. Glass eels cyclically fetch a high price on the Asian market, and this young life phase of American eels was heavily harvested in the U.S. in the 1970s, which may have contributed to regionally recognizable declines at that time.

Why conserve eels?

In all its life stages, the American eel serves as an important prey species for many fish, aquatic mammals, and fish-eating birds. For example, new information indicates that porbeagle sharks eat some American eels migrating to the Sargasso Sea.

Restoring eels to freshwater habitats restores the historical ecosystem balance. In some rivers, eels are an important host species for successful reproduction of freshwater mussels. Eels serve as prey for predatory fish when they are small and become predators themselves as they grow in freshwater systems.

In the last two decades, an *Asian parasite* (*Anguillicoloides crassus*) has become well established in continental waters of the western North Atlantic. Although the parasite does not appear to cause mortality in the wild, further research is needed to assess the potential to impair silver eel swimming ability during the spawning migration.

The American eel has evolved with changes in its freshwater, estuarine, and marine habitats since it diverged from other species of eel about two million years ago. *Climate change* may affect future ocean conditions, such as water temperature, current patterns and food sources, that may have implications for the eel's breeding success. However, high levels of uncertainty in the precise mechanism and timing of such changes make it difficult for scientists to accurately predict how, or to what extent, any changes will affect eel migration, aggregation for reproduction, and ultimately abundance.



U.S. Fish and Wildlife Service biologist holds an American eel.



Close-up of a juvenile American eel. This smooth and snake-like fish feeds on worms, small fish, mollusks and crustaceans.

Addressing threats to the American eel and its conservation has taken several forms, including increasing eel access to former habitat, improving downstream passage past hydroelectric facilities, and monitoring to improve our understanding of the species. Where fish and eelways have been built or structurally improved, the number of eels moving up-and downstream has increased.

Anglers should follow applicable American eel fishing regulations, including minimum size and possession limits.

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What is the eel's status?

An in-depth status review completed September 2015 found that the eel's single population is overall stable and not in danger of extinction (endangered) or likely to become endangered within the foreseeable future (threatened).

The review was largely based on a biological species report peer reviewed by the National Oceanic and Atmospheric Administration-Fisheries, U.S. Geological Survey, U.S. Forest Service, the Atlantic States Marine Fisheries Commission's Eel Technical Committee and academia.

The best scientific and commercial information available shows that the species remains widely distributed and locally abundant throughout its native range, as demonstrated by fishery landings, fishway counts of juvenile eels, and genetic estimates of spawning abundance. While sources of individual eel mortality still exist from harvest and hydroelectric facilities, these and other stressors do not threaten the overall species.

The consequences of being a panmictic species means there are no subpopulations of American eel. All individuals are genetically, behaviorally, and physically representative of the entire worldwide population. For example, an eel that grew up in Maine may mate with an eel that grew up in Mexico and produce offspring that have the same random chance of ending up in Greenland or Missouri. Therefore, the American eel is considered to be one worldwide population.

There are no comprehensive population estimates for the American eel, but genetic information suggests the spawning abundance of mature eels from 1997 to 2008 has varied from 4.7 to 109 million eels. The best available information indicates that millions of adult American eels migrate to the Sargasso Sea to spawn, and likely hundreds of millions of American eel larvae return from the spawning grounds to estuary and freshwater habitats.

The Service completed an earlier status review in 2007, also finding then that ESA listing is not warranted.



Juvenile eels-elvers-in a ramp for passage study at Conowingo Dam.