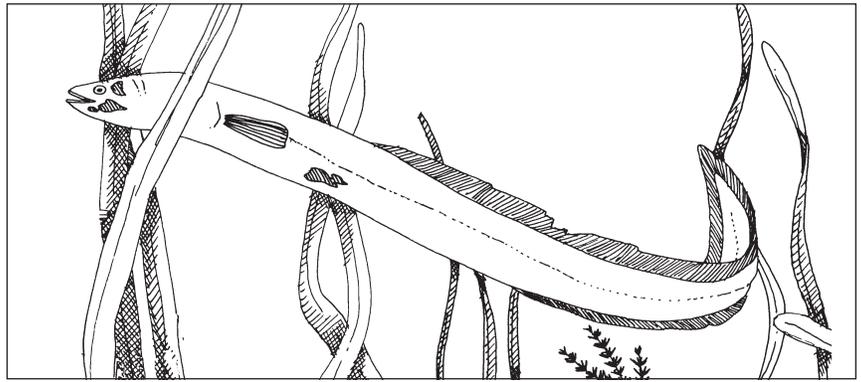


American eel

Anguilla rostrata



There are three species of freshwater eel, the American eel (*Anguilla rostrata*), European eel (*A. anguilla*), and Japanese eel (*A. japonica*), but 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 American eel 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.

The American eel hatches in the ocean waters of the Sargasso Sea, 2 million square miles of warm water in the North Atlantic between the West Indies and the Azores. This snake-like fish uses currents to move from its natal waters to find homes throughout its range, from Greenland south to Brazil.

Eel Migration and Life Cycle

During its lifetime, the American eel changes habitats and undergoes several physical phases, known as metamorphoses.

The life of the American eel is believed to begin and end in the Sargasso Sea. Each winter, mature American eels return to spawn in these natal waters.

Eels gather here from across the species' range, such that individuals could breed with American eels from Greenland down to South America. This behavior perpetuates a single breeding population, preventing the distinctions sometimes found in species that live in different geographic areas.

Leptocephali:

After fertilization, the eel eggs eventually float to the ocean surface and hatch into small, transparent larvae that are shaped like willow leaves. These larvae 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 larvae have developed fins and the shape of adult eels. In this phase, these juveniles, known as glass eels, are still transparent and are about 2 to 3 inches long.

Elvers:

At this stage, eels migrate to brackish waters and begin to develop gray to green-brown pigmentation. Many elvers have been known to move to inland habitats through tidal rivers, yet some remain in estuaries or brackish habitats or in marine waters. This phase includes all eels that reached more than 4 inches in length.

Yellow eels:

Before the final maturation stage, they become yellow eels—sexually immature adults that are actually yellow-green to olive-brown. In their yellow phase, American eels are nocturnal, swimming and feeding at night. In freshwater, they find homes in streams, lakes, ponds and

Classifying the American Eel Migration:

Is it catadromous or anadromous?

American eels were long considered North America's only catadromous fish—meaning born in the ocean, mature in freshwater and return to the ocean to spawn. Anadromous fish, like salmon, are born in freshwater streams, travel to the ocean to mature, and return to freshwater to spawn.

While some American eels swim up freshwater streams to mature, others remain and mature in both estuarine and marine waters. The discovery of eels in both marine and estuarine habitats led biologists to revise that description to facultative catadromy, meaning they may be found in freshwater or saltwater during maturation.

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



The eel is a smooth and snake-like fish that feeds on insects, fish, mollusks, crustaceans and dead animal matter.



Silver eels collected in Shenandoah River to be radio tagged for a tracking study.

ivers, particularly where they can hide under logs and rocks.

After 3 to 40 or more years of living in freshwater, brackish waters, or marine waters, the yellow eels begin to sexually mature. Eels that remain in estuarine and marine waters undergo the same changes but mature earlier than those in freshwater.

Silver eels:

American eels begin sexual differentiation at a length of about 8 to 10 inches. Depending on a variety of factors, which can include population density, eel growth rate, and water salinity, they become male or female silver eels with dark coloring, bronze-black backs and silver undersides. Female American eels can grow to 5 feet in length, and males usually reach about 3 feet.

Silver eels complete sexual maturation as they return to the Sargasso Sea to spawn. They undergo amazing physical changes enabling this return to the ocean, transforming the eels from shallow water, bottom dwellers to ocean travelers.

Eels 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 to 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.

Threats to the American Eel

Potential impacts to American eels vary in scope and severity across the species' range. American eels no longer have access to much of their historical habitat because dams and other obstructions in rivers block and divide habitat and migration corridors. Localized population declines are also attributed to mortality in hydropower plant turbines, degradation of current habitat and overharvest.

An Asian parasite (*Anguillicola crassus*), likely introduced into the range of the American eel through aquaculture practices, infests some eels' swim bladders—an internal gas-filled organ that regulates a fish's buoyancy. Once eels mature and begin their return swim to the Sargasso, a non-functioning or even somewhat impaired swim bladder may result in individual deaths prior to spawning.

Fishing pressure has had some impacts 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. This may have contributed to regionally recognizable declines. Harvest can be especially detrimental because of the eel's slow maturation process.

Climate change may also be impacting American eels and their habitats, but to what extent is not yet known.

Conservation Efforts and Plans

Despite these challenges, American eels remain in much of their vast historic range. In some large coastal rivers, eels are the most commonly found fish, occupying more aquatic habitats than any other species.

Addressing threats to the American eel and its conservation has taken several forms, from research and monitoring to activities increasing eel access to former habitat and spawning grounds. The Atlantic States Marine Fisheries Commission has a fishery management plan for American eels, and the Connecticut River Atlantic Salmon Commission is currently developing a Connecticut River Basin American Eel Management Plan.



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

Conservation organizations have targeted projects removing dams that interrupt historic eel migration routes. In concert with other natural resource agencies, the Service has also worked to mitigate adverse impacts to eels. These measures are specified during the licensing or relicensing of hydropower projects and can include the addition of facilities like eel ladders to safely pass fish and eels upstream. Eel ladders are usually designed to allow eels and other fish to swim over barriers using an ascending ramp.

Eel migration is monitored at various areas both upstream and downstream to help understand and optimize eel passage inland and to the ocean. Where eel passages have been built, eel passage numbers are usually recorded to better understand population status.

Other conservation actions include restrictions on eel harvest by U.S. states and by the federal government in Canada. The Committee on the Status of Endangered Wildlife in Canada designated the American eel a species of special concern, protecting it under the federal Fisheries Act and closing the harvest of eels in the Canadian portion of Lake Ontario.

The U.S. Fish and Wildlife Service continues to work with partners to better understand and conserve this remarkable species.

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Elvers climb Conowingo Dam on the Susquehanna River. These juvenile eels migrate to brackish waters, developing gray to green-brown color.