



# American eel

## *Anguilla rostrata*



The American eel is a smooth and snake-like fish that feeds on worms, small fish, mollusks and crustaceans.

There are three species of 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 in the western hemisphere.

People have fished and farmed eels for hundreds of years, but, until recent times, little was known about the eel's complex life history.

### Biological Characteristics

During its lifetime, the American eel undergoes several physical phases, known as metamorphoses, and habitat changes. Some scientists consider the highly adaptive American eel to have the broadest diversity of habitats of any fish species in the world.

Found from Greenland to Brazil, the American eel hatches as a creature of the ocean, using currents to move from its natal waters, perhaps using cues from the currents or salinity to time its metamorphoses. Having survived at least one ice age, the American eel seems to be a flexible species equipped to withstand the short- and long-term cycles and fluctuations inherent in ocean dynamics.

While some American eels swim up freshwater streams to mature, others remain and mature in both estuarine

and marine waters, and some have been known to move between habitats. American eels were long considered the only catadromous fish in North America, since they are thought to spawn in the ocean and mature in freshwater; but the discovery of these marine and estuarine residents leads biologists to revise that description to facultative catadromy, meaning they may be found in freshwater or saltwater during maturation.

American eels in freshwater find homes in a variety of stream habitats, particularly where they can hide under logs and rocks. Female American eels can grow to 5 feet in length, and males usually reach about 3 feet.

American eels can absorb oxygen through their skin, as well as their gills, making it possible for them to travel over land, particularly in wet grass or mud, which may help them move around barriers in streams. 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.

### Life Cycle

After fully maturing, the American eel returns to its birthplace in the Sargasso Sea, 2 million square miles of warm water in the North Atlantic between the West Indies and the Azores. After fertilization, the buoyant eel eggs eventually float to the ocean surface and hatch into small, transparent larvae, shaped like willow leaves called leptocephali. These larvae drift with the Gulf Stream and other currents, taking about a year to reach the Atlantic coast. By this time, the larval eels 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. During the second phase, the juvenile eels migrate to brackish waters and begin to develop gray to green-brown pigmentation. At this stage they are called elvers. Many elvers have been known to move to inland habitats, yet some remain in estuaries or brackish habitats or in marine waters. Before the final maturation stage, they become yellow eels—sexually immature adults that are actually yellow-green to olive-brown. This phase includes eels that have reached more than 4 inches in length.

In their yellow phase, American eels are nocturnal, swimming and feeding at night. Carnivores that feed on insects, fish, fish eggs, crabs, worms, clams and frogs, eels also will eat dead animal matter. Eels move well and forcefully forward and backward, thus giving them the ability to pull, twist and spin to tear apart larger prey.

After 3 to 40 years of living in freshwater streams, 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 fresh water. Size is the defining characteristic. Whether an



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

eel grows slowly (those in freshwater streams) or quickly (those in estuaries), their size at maturation is the same, and both sexes seem to mature at the earliest opportunity.

American eels begin sexual differentiation at a length of about 8 to 10 inches and, depending on eel density, become male or female silver eels. Upon nearing sexual maturity, these silver eels begin their spawning migration toward the Sargasso Sea, completing sexual maturation en route.

American eels undergo amazing physical changes enabling them to return to the ocean. This metamorphosis is a gradual process, transforming the fish from a shallow water, bottom dweller to ocean travelers. In their mature stage, they are called silver eels, where the American eel's coloring is dark, with bronze-black backs and silver undersides. Fat reserves increase to fuel the long ocean swim because eels do not feed during their migration in the open ocean; in fact, their gut begins to degenerate. Eyes double in size and change in sensitivity toward blue, enhancing eels' vision in deep water. The blood vessels feeding their swim bladders increase in number, allowing increased gas deposition and reduced loss of gas, both critical for buoyancy.

Silver eels migrate to the ocean and return to the Sargasso Sea, where females release between 20 and 30 million eggs and the males fertilize them. Once they have spawned, it is assumed that adult eels die, though researchers have never witnessed eels spawning.

## Threats

The potential impacts to American eels vary in scope and severity across the species' range. For example, 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 (*Anguilla crassus*), likely introduced into the range of the American eel through aquaculture practices, infests some eels' swim bladder (an internal gas-filled organ that regulates a fish's buoyancy). While the infestation may not be a problem in shallow water, once the 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 has had regionally recognizable impacts on 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 United States in the 1970s. Climate change may also be impacting American eels and their habitats, but to what extent is not yet known.

## Examples of Improved Eel Habitat in the Northeast Region

### *Eel pass in Westfield, Mass.*

The Connecticut River Watershed Council, U.S. Geological Survey, and Massachusetts Division of Fisheries and Wildlife worked with the Service



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

to restore passage and access for the American eel in the Connecticut River by redesigning, installing and repairing eel passage damaged by ice flows during winter. This project was completed in 2005, and in 2009, this structure, known as an eel pass, successfully facilitated passage for more than 350 eels.

Partial funding came from the Connecticut River Coordinator's Office of the U.S. Fish and Wildlife Service.

### *Eel "Omnibus" in Connecticut*

Many Connecticut towns and the Beardsley Park Zoo in Bridgeport, Conn., worked with the Service to complete the "Omnibus" project, consisting of eight projects that improved eel passage by removing barriers, upgrading existing eel passes and restoring former passage.

Eel passage was improved at Greenville dam and Bunnells Pond dam in Bridgeport. Upstream access of the Hyde Pond in Mystic, Conn., and Rainbow dam in Windsor, Conn., added 76 miles of eel passage. An additional eel pass was managed by the Athol Bird and Nature Club and the Millers River Environmental Center at the New Home dam on the Millers River in Orange, Mass.

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*Elvers climbing to base of Conowingo Dam on the Susquehanna River. Elvers are juvenile eels that migrate to brackish waters and begin to develop gray to greenish-brown pigmentation.*