# THE AMERICAN EEL AND THE HUDSON RIVER

By Robert E. Schmidt*

Drawings by Kathleen A. Schmidt*

I've spoken about eels to quite a few people in the Hudson Valley and most respond by mentally or physically recoiling. The concept of eels and the realization that they live in the rivers right here seems to disturb many. Others around the world, however, have quite a different attitude towards eels; they avidly pursue them for food. The populations of all freshwater eel species in the world (family Anguillidae) are declining, primarily due to overharvest. This is also true of the American eel (*Anguilla rostrata*).

Due to high levels of PCB contamination, catching and selling American eel from the Hudson River is illegal. Some people still catch Hudson River eels for personal consumption (a dubious practice given the contaminant levels), but those catches have little effect on the eel population each year. The Hudson may be the only place in North America where one can study the eel population without large commercial harvests interfering with the animals.

The American eel spends only part of its life cycle in the Hudson River. The American eel (and anguillid eels in general) are called "catadromous" fishes, which means that they spawn in the ocean and spend most of their juvenile life in freshwater. This life history is opposite to that of some favorite Hudson River game fishes, American shad and striped bass, which are anadromous—they spawn in freshwater and the young migrate to the ocean to mature. Calling the American eel catadromous, however, disguises the almost ridiculous extreme to which eels take this behavior.

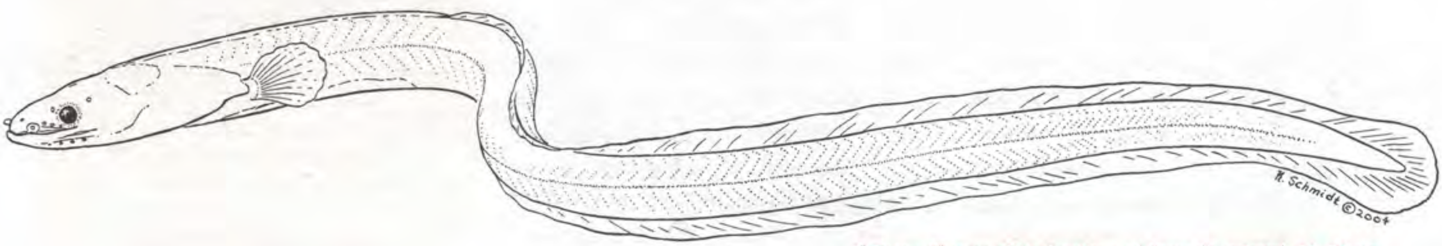
Very small larval American eels are about 5 mm (0.2 in) long and are found near the ocean's surface south and east of Bermuda in the Sargasso Sea. These larvae look quite different from the eels you are used to seeing. They are transparent, elongate, and very flat. Even though they can swim, the larvae drift in the ocean currents and slowly grow to about 80 mm (3 in) long by the time they reach the waters off the New York shore. A study[1] showed that the eel larvae are about 200 days old when they reach the ocean off the shore of Rhode Island, and one suspects that the larval eels near New York would be about the same age.

When they reach our coast, the larval eels begin to transform into the next, "glass eel," stage. Glass eels are 50–70 mm (1.9–2.8 in) long versions of adult eels but they are completely transparent. The glass eels swim along the ocean bottom into the coastal waters and eventually into the Hudson River. That part of their trip probably takes about 50 days. Now the eels become vulnerable to human harvest. A clever commercial fisher can place large very-small-mesh traps called "elver fykes" across the migration route and trap tens to hundreds of thousands of glass eels in a night. (An elver is a young eel and a fyke is a conical fish trap.) There is a market for live glass eels in the Far East, where they are placed in aquaculture facilities and grown to marketable size. Some people eat the glass eels directly, fried and sprinkled over a salad. Elver fykes can be very efficient and many runs of glass eels have been decimated by this practice. Commercial elver fykes are now illegal in New York.

As glass eels slowly move up the Hudson River estuary they seem to segregate by sex, with males staying in the lower estuary and females moving to the upper estuary and into tributaries. During this part of their migration, eels gradually begin to develop dark pigment over their back and sides. When pigmentation begins they are called elvers and when it is complete they are called yellow eels.

This is the stage where a current Hudsonia study begins to look at the eels. The purpose of the study, which is funded by the Hudson River Estuary Program of the New York State Department of Environmental Conservation, is to determine the timing and pattern of immigration of glass eels and elvers into Hudson River tributaries. In 2003 we placed a miniature elver fyke in each of two Hudson River tributaries, Hunters Brook in Wappingers Falls and the Saw Kill in Annandale. The nets were in place from March 15 through June 7 and were checked every day.

We began to catch eels in the first week of April 2003 and caught them fairly consistently through the end of May. Our highest catches began at the new moon and persisted for




"Glass eel" stage of the American eel (*Anguilla rostrata*), 50–70 mm

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three days (May 1–4). We caught about 1200 glass eels and elvers in 2003 (most released alive), and therefore we estimated that each Hudson River tributary can expect an influx of several thousand young eels each spring. This project will continue for two more springs and we are anxious to see whether this pattern is consistent from year to year.

A second Hudsonia project, shared with Karin Limburg of SUNY Syracuse, College of Environmental Science and Forestry, and funded by the Hudson River Foundation, is looking at yellow eels in Hudson River tributaries and the effects of dams on eel populations. We have found some extremely high densities (13,000/ha) of American eel in the mouths of Hudson River tributaries, higher than any reported elsewhere. We have also observed that, even though eels can surmount or circumvent some large barriers, these barriers are significant obstacles for them and the eel densities decline sharply above dams or waterfalls.

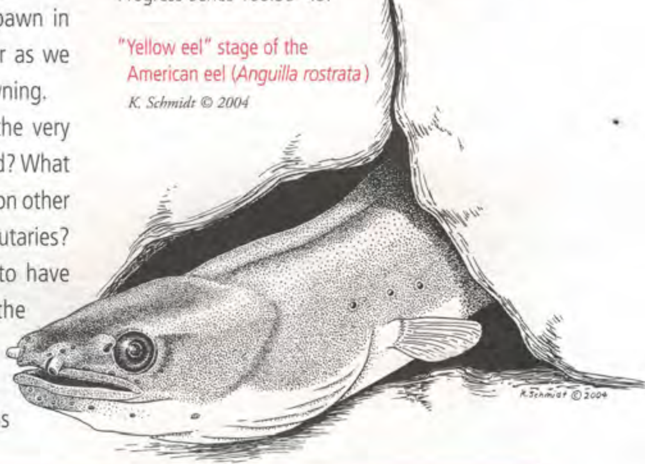
Yellow eels may stay in the Hudson River for 15–25 years. Then they begin the final transformation into a sexually mature adult, called a "silver eel." The eel's color begins to change from yellowish to black and white and the eyes begin to increase in diameter. In 2003 we saw at least two eels in the process of silvering, one a massive 84 cm (33 in) long individual collected near Red Hook. Eventually, the silver eels begin their downstream migration out of the Hudson River estuary and into the ocean. There they disappear from our view but apparently make their way along the sea bottom to the Sargasso Sea, a journey of over 1600 km (1000 mi).

No one has ever observed spawning in this species, partially because the eels spawn in several thousand feet of water. As far as we know, adults do not live beyond spawning.

How can our tributaries support the very high densities of eels that we observed? What effects do dense eel populations have on other fishes that spawn or forage in the tributaries? Glass eels and small elvers appear to have high mortality rates, but what is the source of this mortality? How do eel passage structures (currently there are none in the Hudson Valley) on dams affect eel populations? These are just a few of the questions about American eel ecology that remain unanswered even in the local rivers where we can readily observe the eels. We hope that our current studies are the first of many that will begin to uncover the secrets of this mysterious animal and its role in the Hudson River ecosystem. ■

**REFERENCE**

Wang, C.H., and W.N. Tzeng. 1988. Interpretation of geographic variation in size of American eel, *Anguilla rostrata*, elvers of the Atlantic coast of North America using their life history and otolith aging. Marine Ecology Progress Series 168:35–43.




"Yellow eel" stage of the American eel (*Anguilla rostrata*)
*K. Schmidt © 2004*

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threats that have degraded most of our forests.

Moist, rocky slopes with deep pockets of soil often support large assemblages of spring wildflowers, including trilliums (*Trillium* spp.), bellworts (*Uvularia* spp.), violets (*Viola* spp.), bloodroot (*Sanguinaria canadensis*), trout lily (*Erythronium americanum*), Jack-in-the-pulpit (*Arisaema triphyllum*), and Dutchman's breeches (*Dicentra cucullaria*). Rocky woodlands, especially those on calcareous substrates such as limestone, dolomite, marble, or calcareous shale, are home to sharp-lobed hepatica (*Hepatica nobilis* var. *acuta*), wild columbine (*Aquilegia canadensis*), early saxifrage (*Saxifraga virginica*), and rock cresses (*Arabis* spp.). Springy, braided stream systems of mountain terraces support toothwort (*Cardamine diphylla*), Pennsylvania saxifrage (*Saxifraga pensylvanica*), miterwort (*Mitella diphylla*), and foamflower (*Tiarella cordifolia*). High mountain forests in the Catskills may have northern herbs such as rose twisted-stalk (*Streptopus roseus*), bluebead lily (*Clintonia borealis*), painted trillium (*Trillium undulatum*), and mountain wood-sorrel (*Oxalis montana*). Rich, rocky slopes in the Hudson Highlands support a distinctive array of spring herbs, including small-flowered bittercress (*Cardamine parviflora*), yellow harlequin (*Corydalis flavula*), and two state rarities—small-flowered crowfoot (*Ranunculus micranthus*) and violet wood-sorrel (*Oxalis violacea*).

With spring ephemerals in decline, the need is greater than ever to protect the remaining areas where these herbs still flourish. Protecting lands with good wildflower habitat through acquisition or conservation easements likely will not be enough to stop the decline of spring ephemerals. Research is needed to understand the intricate dynamics of threats such as earthworms, invasive plants, and soil acidification. Understanding these and other ecological factors affecting forest herbs will help to ensure their future. ■

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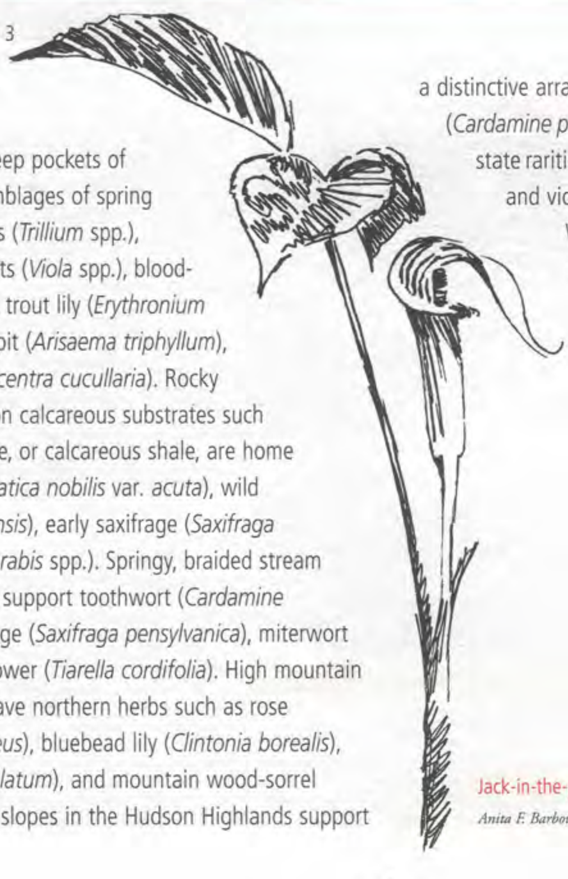

Jack-in-the-pulpit (*Arisaema triphyllum*)
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