

SLITHE TO THE SARGASSO

As a college student majoring in wildlife management, I envisioned studying grizzly bears in Alaska, elk in Yellowstone National Park, or climbing cliffs in the Rocky Mountains to check peregrine falcon nests. I never imagined myself working in the marine environment encountering species like long, slimy American eels. It is crazy how life's twists and turns end up opening your eyes to one of nature's hidden wonders. Though not as glamorous as peregrine falcons, American eels have a truly unique and intriguing life history, which makes them fascinating to work with. What these slick, snake-like creatures lack in appearance, they make up with in their drive for survival.

That survival is not certain. Biologists are concerned about the population of American eels declining in the United States. A recent stock assessment by fisheries scientists discovered the abundance of eels is at or near historic low levels along the entire Atlantic coast. The number of eels will continue to decrease unless we can do something to increase young of the year into the population, or stop the mortality of immature eels. Eels are a difficult species to manage, as they know no boundaries and travel through numerous states and federal jurisdictions throughout their complex life cycle. They also take a long time to sexually mature (8-24 years), and if they are harvested or die before they can spawn, it becomes even more difficult for the population to rebound. Biologists are working to monitor and improve passage for this enigmatic species that once darkened the waters of New Hampshire's coastal rivers with its massive spring migrations.

INCREDIBLE JOURNEY

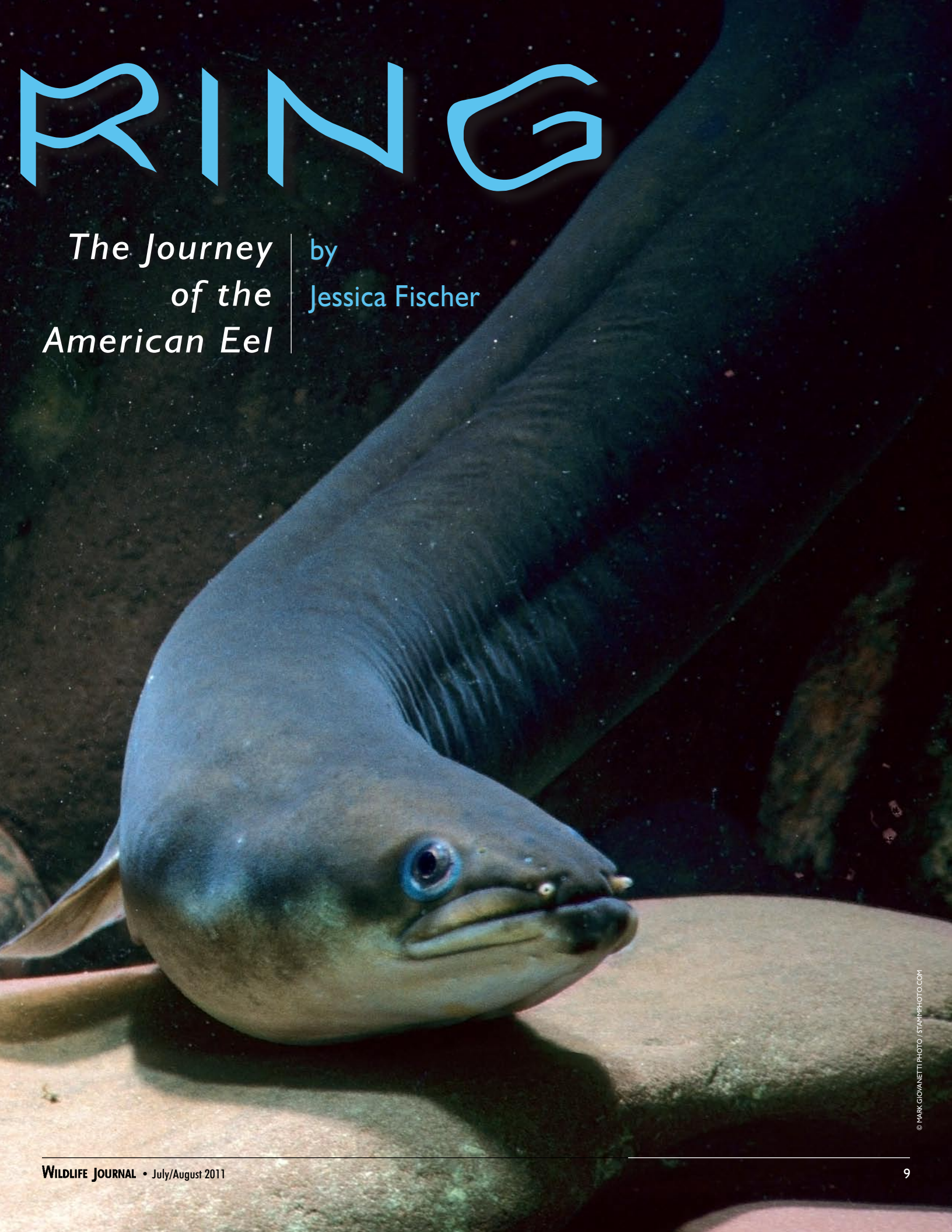
American eels are New Hampshire's only catadromous fish species, which means they live in fresh water for most of their lives, then migrate to the ocean to spawn and die. Adult eels travel all the way to the Sargasso Sea to spawn – far out in the Atlantic Ocean near Bermuda. Once the eel larvae hatch, the Gulf Stream transports them up the East Coast. At this stage, they look like transparent willow leaves and are referred to as *Leptocephali*. These tiny larvae drift in the ocean currents, sometimes for thousands of miles, and may take over a year to reach an estuary.

From the larval stage, they metamorphose into “glass eels” and actively swim towards the coast. Once the transparent glass eels enter the estuary, they begin to develop brown pigmentation that helps to camouflage them. They then are called “elvers” and can remain in this stage for a year as they slowly move up tidal rivers in hopes of reaching fresh water. Elvers travel on high tides, surfing in the current to add more miles onto their upstream migration. When the tide turns and begins ebbing, they burrow in the mud or sand on the bottom to avoid being taken downstream.

Elvers then develop into the “yellow eel” stage. Yellow eels are generally greater than 6 inches in length, and biologists are able to decipher their sex. These eels occupy lakes, rivers, and estuaries throughout New Hampshire, where they can spend up to 30 years or more! Yellow eels provide an important food source for birds, mammals and fish. Throughout their time in inland waters, they feed primarily on insects, but also consume crayfish, snails, fish and amphibians.

RING

*The Journey
of the
American Eel* | by
Jessica Fischer



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American eels in the yellow eel stage need to eat as much as possible, because once they go through their final metamorphosis, becoming “silver eels,” their stomach and intestines actually degenerate and they have only one thing on their minds – getting back to the Sargasso Sea. Silver eels have very large eyes and are a dark, silvery color. They can be quite large; some females can reach up to 50 inches! These large females can carry over ten million eggs, so their success in passing all obstacles to make it downstream is extremely critical. Silver eels migrate downstream mainly at night from September through December.

Once they reach the Sargasso Sea, silver eels spawn and their journey comes to an end. Little is known about the actual spawning grounds in the Sargasso Sea, and biologists have never witnessed eels spawning. All American eels compose one “stock,” meaning every single American eel came from the Sargasso Sea and will try to return there to spawn. In order to

provide eels proper protection, research is needed to broaden our understanding of the spawning area and gain more knowledge of their spawning behavior.

MONITORING THE MIGRATION

As the glass eels make their way upstream in the Lamprey River in Newmarket in mid- to late April, N.H. Fish and Game Marine Fisheries staff are there to monitor their progress. Biologists set up an Irish elver trap, or “eel-evator.” The trap is set up under the fish ladder. Essentially, it is a wooden ramp covered with Enkamat® material (an erosion control product), with a hose positioned at the top to provide a steady, even flow of water down the ramp. During the night high tides, the young eels emerge from the bottom substrate, where they were buried, to continue their journey further upstream. They are attracted to the slow, steady flows of fresh water the eel-evator provides. Once they swim onto the ramp, they encounter

MIGRATING TO FRESH WATER

American eels spawn in the North Atlantic Ocean near Bermuda. Larvae drift with the ocean currents, developing into tiny transparent “glass eels” that head for coastal waters. It can take more than a year for them to reach an estuary. It is not known how the young eels, all born in the same ocean locale, disperse themselves throughout their vast coastal range. Adult eels do not return to fresh waters; they are thought to spawn once and die. European eels are also born in the Sargasso Sea, but migrate east.



BASE MAP © CLOKI / DREAMSTIME.COM

Eels are a food source for many coastal creatures. Below, a great blue heron captures a silver eel; a crayfish stalks a tiny elver.



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Life Cycle of the American Eel

the Enkamat material, which gives them traction to slowly slither their way to the top of the ramp, where they plunge into a five-gallon bucket that hangs from the frame of the trap.

Each day, a biologist collects any eels captured in the bucket and assures the ramp is working properly. Biologists then dose the eels with a mild anesthetic to obtain an accurate length measurement. Eels are extremely slimy and squirmy and without the anesthesia, it would be virtually impossible to take a measurement. They are identified as to which stage they are in: elver or glass eel. More elvers than glass eels tend to show up at this monitoring station, as glass eels will often overwinter in the sediment if they were unable to make it above the dam the year before, transitioning into elvers in the meantime.

After a length measurement is taken, the eel is put into a recovery bucket with river water until it has revived from the anesthesia. Then the eels are released above the dam to continue their voyage upstream. Biologists also collect the temperature of the water and note the moon phase, as eels tend to increase their activity following new and full moons.

N.H. Fish and Game's annual eel survey is funded through license fees and matching federal funds from the Sport Fish Restoration Program, supported by the purchase of fishing equipment and motor boat fuels. This type of monitoring of young-of-the-year glass eels is conducted in numerous states along the Atlantic coast in cooperation with the Atlantic States Marine Fisheries Commission (ASMFC), whose vision is to have "healthy, self-sustaining populations for all Atlantic coast fish species or successful restoration well in progress by the year 2015." ASMFC created a management plan for American eels in 2000, and has led the effort to standardize American eel sampling among states in order to compare trends from year to year and estimate the abundance of American eels in the U.S.

POPULATION CONCERNS

American eels are an important part of the ecosystem, as they increase biodiversity and provide food for other fish and wildlife species, as well as humans. Recreational anglers use eels as bait to catch fish like striped bass. Commercial eel harvest is an important seasonal component in certain communities along the Atlantic coast. In towns that participate in the eel fishery, catching, processing and shipping the eels provides jobs. Commercial fishing for eels has declined dramatically since its peak in the late 1970s; today it is relatively low but stable.

Pressures on the eel population include a high demand for glass eels and elvers from Asian markets, where the aquaculture industry uses them to grow into food-grade product. Unfortunately, there is not

Glass eel: 1.9" to 2.6"



Elver: 2.6" to 3.9"



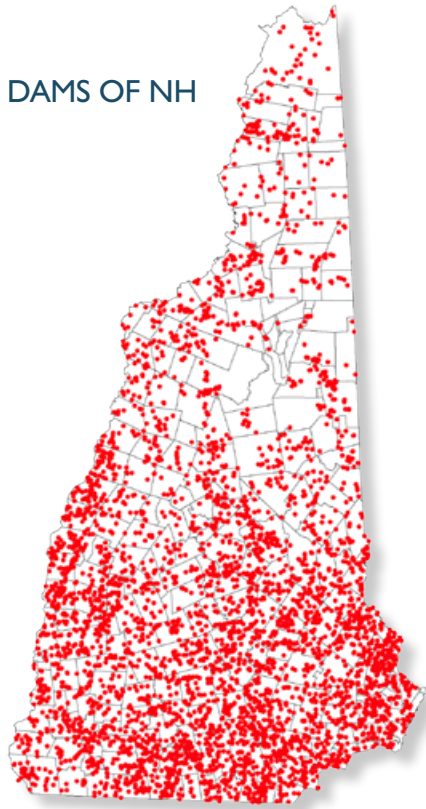
Yellow eel: 4" to 20" (males) or 40" (females)



Silver eel: Up to 50" (4+ feet); females are larger than males



DAMS OF NH



currently a technique to spawn eels for use in aquaculture facilities for food sources, thus the wild population is exploited. Laws have been enacted to protect eels by placing size and bag limits on them. In salt or estuarine waters, eels must be 6 inches or more to take and the bag limit is 50 per day. There are no laws pertaining to harvesting eels once they've reached fresh water.

It is difficult to quantify the effect fishing has had on the eel population, however, it pales in comparison to the impact that thousands of dams have had on the essential migration patterns of eels. The small state of New Hampshire alone has a total of nearly 5,000 dams. The American eel population here has been affected by these dams, just as anadromous fish such as rainbow smelt and river herring (which are spawned in fresh water, mature in the ocean and return to fresh water to spawn) have experienced declines likely caused by limited access to historic spawning grounds.

The full extent of the impact of dams on eels is unclear, as we have limited data on historic populations of American eel. We do know that many young eels are forced to halt their upstream migration when they encounter a dam, and adult (silver) eels that attempt to go over dams on their downstream migration will likely die from the fall. At some dams,

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silver eels must swim through the giant turbines of hydroelectric facilities to make it downstream. Their attempts to make it through typically result in 80-100% injury; with certain types of turbines, more than half of eels die. Fish passage systems are most often designed for salmon or river herring. Eels cannot pass through these because the flows are too high.

Biologists continue to work on developing new technology for both upstream and downstream passage for eels, which is promising to allow eels access into historic habitats that have been off limits for decades.

STAND UP FOR EELS

Now that you know the American eel's remarkable life story and the threats that they face, I hope you can find as warm a place in your heart for these slimy, slithery, interesting creatures as I have. Although they face many threats, they have a tremendous amount of support in their corner, which I hope now includes you, too.



Jessica Fischer is a marine biologist in N.H. Fish and Game's Region 3 office in Durham. She works with American eel, rainbow smelt, northern shrimp, sea-run brown trout and horseshoe crabs.

Fisheries biotechnician Tyson Morrill holds a silver eel killed in a N.H. dam turbine in August 2010. This eel had survived its youthful ocean passage from the Sargasso Sea and up our coastal rivers to live 25 years or more in fresh waters. Finally mature, it was heading downstream to the Atlantic to spawn, but was destroyed before it could complete its journey. At right, tiny glass eels, just inches in length, are measured by biologists.

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