Massachusetts Wildlife

No. 2, 2022

$3.00

Birding,
Bowhunting,
Aquatic Connectivity

Great Marsh Restoration Continues

Photo by MassWildlife Archives/Bill Byrne

The Great Marsh is a 17,000-acre salt marsh in Essex County that provides many critical functions, from maintaining water quality and providing habitat for numerous species, including the state-listed salt marsh sparrow (*Ammospiza caudacuta*, Special Concern), to supporting recreational opportunities and protecting seven coastal towns from flooding. Unfortunately, along the Atlantic Coast, the loss of salt marsh habitat, like Great Marsh, is occurring at an alarming rate. Historical alteration of hydrology through the development of agriculture embankments, mosquito ditches, and infrastructure (roads) has degraded salt marshes and made them even more vulnerable to sea-level rise and associated impacts from climate change. Within the Great Marsh, it is estimated that up to 15 feet of salt marsh loss is occurring annually along salt marsh creeks. Critical access to coastal areas is being flooded more frequently and marsh plants are drowning, thereby reducing carbon sequestration and habitat for many species.

In 2018, MassWildlife started the Great Marsh Ecosystem Recovery Project with the goal of quickly restoring 5,000 acres of salt marsh using natural techniques. This year, through continued funding provided by the Executive Office of Energy and Environmental Affairs as part of the State Hazard Mitigation and Climate Adaptation Plan, MassWildlife, its sister agencies (Department of Ecological Restoration and Office of Coastal Zone Management), and several conservation partners (The Trustees, Essex County Greenbelt Association, Town of Ipswich, Massachusetts Audubon Society, and the U.S. Fish and Wildlife Service), will commence with Phase III of the project to work towards the fulfillment of mutual salt marsh restoration goals. When fully restored, the functions of the Great Marsh will protect our state's rich biodiversity and contribute to a climate-resilient coastline that will safeguard our communities now and into the future.

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MASSACHUSETTS WILDLIFE

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An outdoorsman recounts his journey to birding and provides advice to anyone who seeks to see, hear, and identify more birds with the support of the birding community at large.

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Twenty seasons of failed archery deer hunts prompted this hunter to set his bow aside and focus on other hunting pursuits. But the nagging desire to accomplish the hitherto impossible got him back in his treestand last season, where he learned that becoming a successful bowhunter is as much about your inner state of being as the intersection of skill and opportunity.

MIGRATING FISH, CHANGING RIVERS **24**
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The history of hydropower and migratory fish in New England is full of struggle and triumph. The region's abundant inland fisheries were significantly challenged early on by industrialization, pollution, and overfishing, but the habitat work being conducted by MassWildlife and its many partners is reconnecting waterways and allowing for passage critical to both fish and their environments.

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On the Cover: An adult male yellow warbler pauses in a shrubby thicket after catching multiple insects during the nesting season. Females are also yellow, but less bright than males, and have mostly unstreaked yellow underparts. The tone of the male's song is thought to be so sweet it is often remembered as *sweet sweet sweet I'm so sweet.* Photo © Dean Cerrati

Photo © Robert S. Michelson/pbmphoto.com

Migrating Fish, Changing Rivers

by Steven Mattocks

Early European settlers must have been in awe of the abundant natural resources they encountered upon their arrival in Massachusetts. From old-growth hardwood forests and towering white pines to bountiful wildlife that included bears, moose, deer, and timber wolves, the land had much to offer. The vast coastal and inland fishery resources were equally impressive. From the offshore ground fisheries to the inshore migratory fish runs, these resources likely seemed limitless. The settlers, as well as Native Americans, observed millions of migratory fish swimming upriver each spring, and early anecdotes describe salmon, American shad, and river herring in astounding abundances and sizes compared to today's standards. In fact, a report from Medford on the Mystic River in 1844 states that fishermen, "encountered more than fifty-eight thousand" (herring) in one seine net haul. In Dorchester on the Neponset River in 1773, a fisherman "made a large haul of shad and caught 4,000 and sent 40 barrels to Boston." In South Hadley on the Connecticut River, an anecdote dating back prior to 1800 states, "Many salmon were taken, 24 are said to have been caught at one haul, weighing 8–40 pounds."

These accounts may leave us both mystified and curious as to what happened to our natural heritage, but it is now widely recognized that the reduction of these fisheries coincided with early industrial development.

Specifically, as early as the 1630s, settlers began constructing mill dams across Massachusetts' waterways to harness the power of rivers. The earliest dams were built along small streams and were used to power saw and grist mills. By the mid-1800s, population growth, demand for goods and services, and improved

construction methods brought about modern dams that spanned the largest rivers in New England: it was then that the mighty Connecticut and Merrimack rivers were tamed. This was an astounding feat for energy production, industry, and civil life. Mill complexes built alongside rivers became the lifeblood of cities, providing thousands of jobs and producing an array of goods.

While the societal gains of these mill complexes were clear, the ecological impacts were not. One major challenge was that the dams blocked migratory fish

Photo by Troy Gipps/MassWildlife

(Top) Catching Herring, *drawn by W. P. Bodfish, and published in* Harper's Weekly Journal, *April 16, 1887, depicts a spring herring run on Cape Cod. (Middle) Juvenile shad caught by MassWildlife staff during a survey on the Connecticut River last September. Juvenile shad migrate to the ocean each fall where they spend the following 3–5 years before returning as adults to the Connecticut River to spawn. (Bottom) Fishways like the one constructed on the right side of the A&D Hydro Dam on the Westfield River, in West Springfield, allow diadromous and resident fish to ascend and descend a water-filled ladder to bypass the dam. (Page 24) A school of adult river herring migrating in the Merrimack River.*

Photo by Steven Mattocks/MassWildlife

The diadromous fishes shown above require movement between freshwater and marine habitats to live, feed, spawn, and complete their lifecycle.

from swimming up- and downstream. The impacts of this were soon realized. Iconic migratory fish species that once existed in great abundances and supported the survival of early settlers and Native Americans were almost completely blocked from completing their lifecycles due to dams. In their natal, undisturbed habitats, migratory fish such as salmon, shad, and river herring, along with several other species such as American eel, sea lamprey, rainbow smelt, white perch, striped bass, and sturgeon, are diadromous, meaning they require movement between freshwater and marine habitats to live, feed, spawn, and complete their lifecycle. For most of these species, this migration requires traversing upriver tens to hundreds of miles each spring past many obstacles to where they eventually reach small streams and lakes to spawn.

Salmon, shad, and river herring populations quickly plummeted after dams were constructed. By the 1800s, Atlantic salmon were no longer found in the Connecticut and Merrimack rivers. Today, sea-run Atlantic salmon numbers across the remaining range are extremely low; Massachusetts and New Hampshire no longer have natural runs. Maine has prohibited salmon fishing and the population is federally listed as endangered. With few exceptions, their naturally occurring habitat range is now restricted to Canada, whereas they formerly entered inland waters as far south as the Connecticut River. River herring fishing in Massachusetts is prohibited and they are now federally listed as a species of concern by the National Oceanic and Atmospheric Administration (NOAA). Shad fishermen are limited to three fish per day, which can only be taken from the Merrimack and Connecticut rivers. Salmon, shad, and river herring saw reduced harvests and exports throughout the past several centuries as they simply could not pass the dams in high enough numbers to maintain their previous abundance and populations have since been reduced to remnants of their former glory.

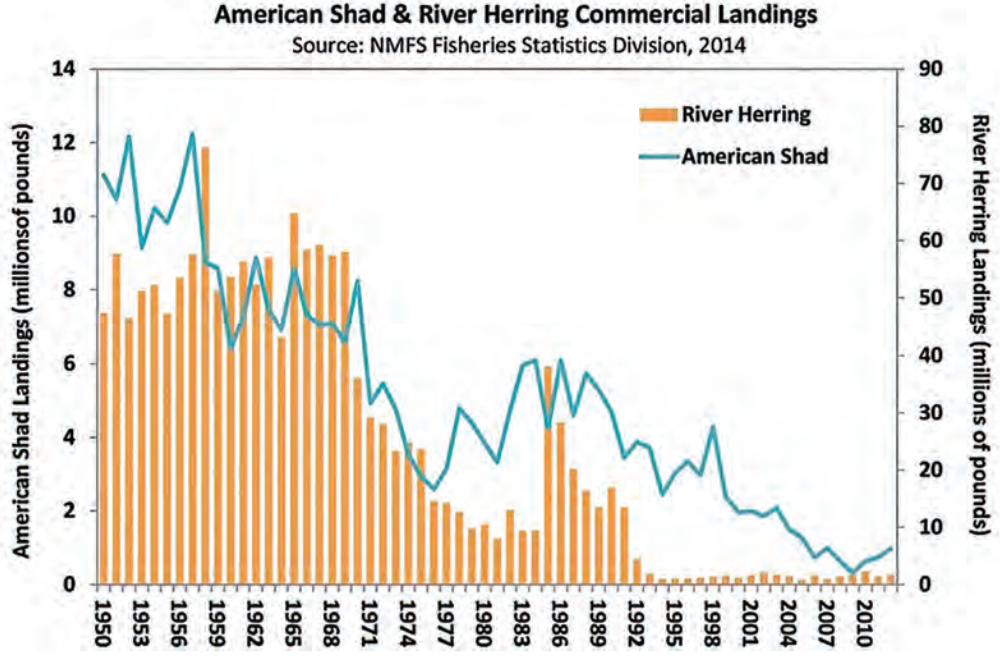
The idea that we would allow such extraordinary resources to become imperiled caught my attention at a young age. After completing my undergraduate degree at East Carolina University and

several field seasons employed by state fish and wildlife agencies in Alaska, Tennessee, North Carolina's Outer Banks, and Colorado, I was fortunate enough to pursue and receive a master's degree at UMass Amherst. Broadly, I was tasked with estimating historical population trends of river herring in New England and quantifying their importance to marine and freshwater food webs. I spent hours in the archives searching for when and where historical dams were constructed, how much river habitat they blocked, and what that meant for river herring populations and aquatic food webs. Using modern and historical data, we surmised, conservatively, that freshwater ecosystems currently operate at about 6.7% of their historical capacity to produce diadromous fish. This consequence of dam construction revealed that it was not the quantity of dams that was such a detriment to fish runs, but the number of major rivers that were blocked by dams. These rivers lie at the center of major migratory fish routes, thus it's the mainstem dams that block the most habitat. By the mid-1800s, there existed at least one dam on every major river in the state. Quantifying the ecological impacts of dams was an important step in realizing the ramifications of past actions and realigning our future goals. Research like this underscores the importance of migratory species to people and freshwater and marine food webs and continues the dialogue for future efforts in management and conservation.

Trickle Effects from Legacy Dams

While the issue of dammed rivers is older than MassWildlife, it is, in fact, the very reason for the agency's inception. Two commissioners on fisheries were appointed in Massachusetts in 1866 to address the loss of Atlantic salmon caused by dams and pollution. The following year, the agency was given authority to manage all inland fish, and then game animals later, in 1886.

Attempts were made to improve fish passage over dams, such as the installation of fishways or fish ladders, but



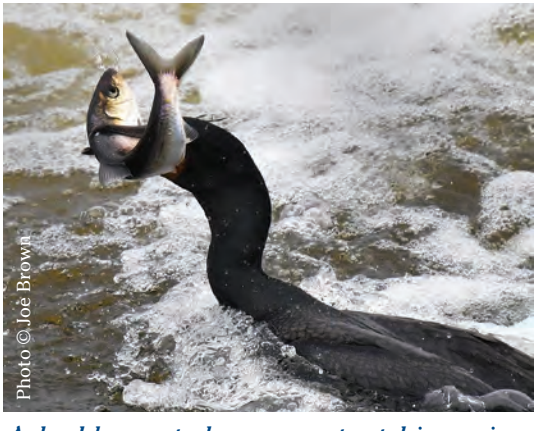
Graphic by NOAA

American shad and river herring landings continued to decline in the 1900s.

An adult white sucker collected, then released, during a MassWildlife fisheries survey, where species, length, and weight are recorded to better understand fish populations.

generally they have not been, and are still not, effective. Practically none of the large-scale fishways used today come close to passing the target number of fish established by state and federal agencies. While dams are a serious issue, they are not the only stressor on the fishery. Pollution, historical overfishing, landscape changes, sedimentation, deforestation, and climate change also contribute to fishery declines.

While diadromous fish make the longest and perhaps most well-known migratory journeys, resident fish that occupy our rivers year-round also require movement up- and downstream to live, feed, and spawn. From large bottom-feeder fish to small shiners and minnows, seasonal fish migrations are essential for fish to access different habitats throughout the year to sustain their lifecycles. Some of our smallest fish species, such as common shiners, creek chubs, and longnose dace, can travel up to 10 miles upriver for spring spawning migrations. Eastern brook trout, our only native trout and a symbol of recreational fishing found on one of several Massachusetts Environmental Trust license plates, undergoes fall spawning migrations upriver towards clear, cold tributary streams. Yet another interesting freshwater species with notable migrations is the white sucker. White suckers are an ecologically important species that, through their migrations, contribute nutrients to upstream waters (spawning activity, feces). Their schooling behavior and migrations upriver can be observed in large rivers or small streams, and these relatively large fish (up to 25 inches and 6 pounds, or larger) have played an important role in the food web since before Europeans arrived.



A double-crested cormorant catching a river herring at Mystic Lakes Dam in Arlington.

Although less understood, centuries of dams have certainly impacted white suckers as well as other freshwater resident fish, with impacts such as isolating populations (upstream from downstream), changing habitat (creating impoundments, altering sediment

patterns, regulating flow), and reducing available spawning habitat. To help address the wide-ranging impacts of dams on resident fish populations, MassWildlife incorporates resident fish needs such as white sucker migrations into fish passage goals and monitoring. One example of this occurs at the A&D Hydro Dam on the Westfield River in West Springfield (pictured on page 25), where white sucker passage numbers, along with other freshwater and diadromous species, are documented each year.

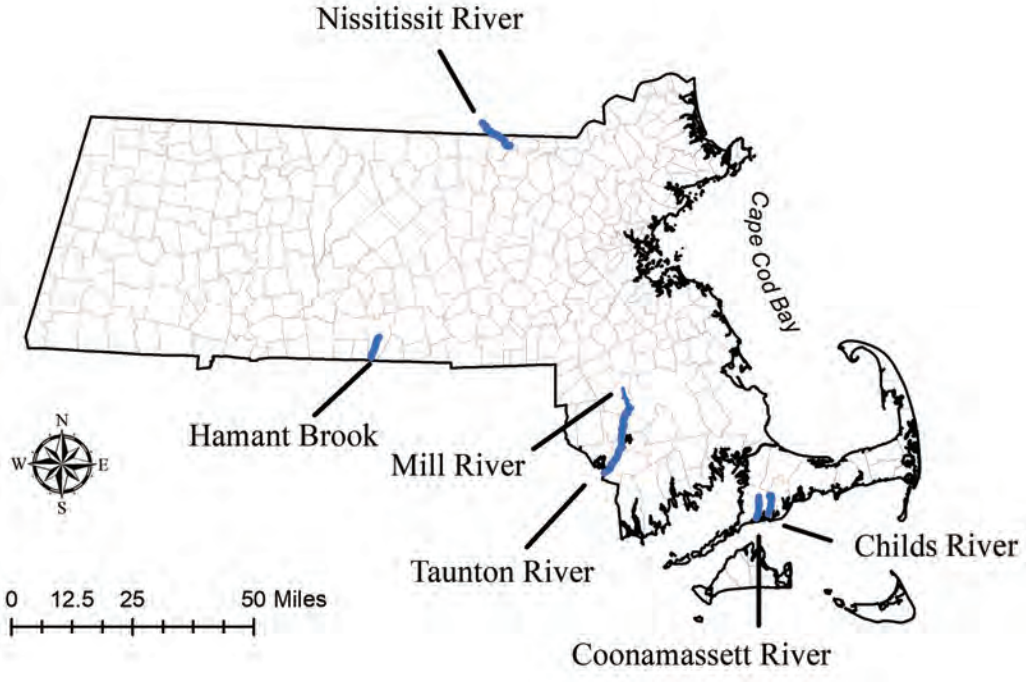
Freshwater resident and migratory fish are important for terrestrial wildlife, aquatic mussels, and even other fish, which have come to rely on the predictable, seasonal movement patterns of these fish. Every spring, striped bass, gulls, terns, and cormorants follow river herring upriver for spring forage. Species such as bear, fox, river otter, and aquatic and terrestrial invertebrates benefit from the arrival of migrating fish in upland habitats through direct consumption or nutrient enrichment of soils and plants.

The importance of these connections has been widely studied and has led to a more holistic approach to research, conservation, and management. It's a shift that affects my work activities each week through interactions with people from a wide variety of federal, state, and local organizations to move conservation and restoration efforts forward. Within MassWildlife, fisheries staff are working with similar goals in mind, and when we collaborate with entities outside of our agency, the impact we have, on others and on natural resources, multiplies. As an agency that serves all people of the Commonwealth and all wildlife, we strive to make positive resource impacts locally and collaboratively in support of regional and national conservation goals.

Restoring the Natural Flow

Many of the 3,000 dams in the Commonwealth's waters are obsolete, no longer serve their original purpose, and have fallen into disrepair. Removing hazardous dams eliminates the infrastructure liability and, in many cases, reduces risk from flooding and climate change impacts. While few would argue that dams have been the greatest detriment to migratory fish runs, road stream crossing structures such as culverts and bridges may provide more practical restoration opportunities today. Undersized, aging, or improperly designed culverts and bridges can be complete barriers to migrating fish and wildlife, and many are hazardous and in need of structural repair or replacement. These smaller yet often significant barriers to fish passage provide local, feasible opportunities to improve river connectivity. Today, these structures are being replaced with new ones that meet enhanced stream-crossing standards and improve aquatic habitat, increase stormwater capacity, and mitigate potential impacts from climate change.

People recognize the impacts relic dams continue to have on our fish and wildlife populations and are removing them at increasing rates. According to American Rivers, 66 dams have been removed in Massachusetts since 1912. Since 2005, the Massachusetts Division of Ecological Restoration (DER) has helped to remove over 40 dams. We are repeatedly seeing that fish are resilient and recolonize former habitats and establish new ones once dams are removed. MassWildlife and numerous federal, state, local, and non-governmental partner agencies and organizations work together across the state to restore aquatic habitats and river connectivity and have done so for decades. Recent projects with successful dam removals, culvert replacements, and channel restorations have led to restored systems where fish are returning and thriving. These projects range from the upland hardwood forests of Sturbridge to the coastal streams of Cape Cod, and involve brook trout and river herring, along with many other resident and migratory species. Recent examples include Hamant Brook and Childs River restoration projects, which demonstrate the value of reconnecting river habitats. Below, I will focus on three important restoration efforts that have reconnected rivers and restored species. To begin, I'll describe a restoration project that



Five examples of river restoration project success stories in Massachusetts.

involves a river and one of its tributaries with deep roots in both herring fisheries and manufacturing. It's a project that is emerging as one of the state's most notable success stories.

Taunton River Watershed

The Taunton River was once an important fishery that teemed with river herring, shad, and other diadromous fish. A record from 1896 states the Taunton River had the third largest herring harvest of all New England rivers, after the Damariscotta River in Maine and the Connecticut River in Massachusetts. And yet, like most rivers, the Taunton was obstructed early on with dams. According to historical records, by 1837 there were three dams on the Taunton River and by 1874 there were six dams on the Mill River, a tributary of the Taunton. The decline in fisheries sparked a state report, in 1921, to declare the re-establishment of the old fishery an 'impossibility' due to manufacturing waste and dams.

But today, the dams on the mainstem Taunton River are gone, and the river is home to the largest river herring run in Massachusetts. It occurs on a tributary of the Taunton, called the Nemasket River. The run has averaged about a half a million herring each spring over the last two decades. This healthy run is largely due to the Nemasket watershed containing the largest natural pond system in Massachusetts, called the Assawampsett Pond Complex, which consists of over 5,000 acres of spawning and nursery habitat.

With the Taunton River unobstructed, a restoration opportunity presented itself to remove three dams on the Mill River, and to add a fish ladder at a fourth dam. The Hopewell Mills Dam, the Whittenton Dam, and the West Britannia Dam, which once helped power mill complexes along the Taunton waterfront, were removed in 2012, 2013, and 2018, respectively. And in 2012, a fish ladder was constructed at Morey's Bridge Dam. DER led federal, state, and local partners in this effort, which improved water quality and restored the natural flow of water, sediment, and organic matter downstream. The removal of the Mill River dams reconnected

Photo by Steven Mattocks/MassWildlife

Juvenile river herring and American shad captured during a MassWildlife survey of the Taunton River in August 2019.

over 50 miles of mainstem and tributary habitat for river herring, American eel, American shad, sea lamprey, and many other species, as well as 560 acres of river herring spawning habitat. In 2013, the first year after the first two dams were removed, the Massachusetts Division of Marine Fisheries (DMF) counted roughly 1,000 river herring that were recolonizing former habitat. In 2021, DMF counted 31,789 river herring at the Morey's Bridge fishway.

The Mill River and Taunton River systems clearly illustrate that when dams are removed, fish come back. The Taunton River was added to the National Wild and Scenic Rivers System in 2009.

Coonamassett River

The Coonamassett River in Falmouth is another example of a successful restoration project for migratory species, with major benefits to both river herring and brook trout. The Coonamassett River once harbored a healthy, wild, reproducing salter (sea-run) brook trout population, but dams, stream channelization, cranberry bogs, and pollution reduced runs to a trickle by the 2000s. Momentum toward restoration finally took hold, and the town of Falmouth, along with 40 partner organizations, including MassWildlife, celebrated the completion of Phase 1 (2018) and Phase 2 (2021) of the Coonamassett River Restoration Project. In total, two dams were removed, three culverts replaced, 4,600 feet of channel was reconstructed, 56 acres of wetlands were restored through removal of former cranberry bogs, and 2.2 miles of free-flowing river was reconnected. With the help of brook trout transplanted from the Mashpee River in 2013 and 2014, MassWildlife surveys in 2015 captured almost 100 brook trout, 25 of which were recaptures. Surveys in 2019 above the lower dam removal found brook trout, indicating immediate passage to the restored habitat. Additionally, young-of-year brook trout were sampled in the lower Coonamassett last fall, which may indicate successful spawning in the restored habitat sections. MassWildlife continues to work with partners to monitor brook trout and the restoration of the Coonamassett River.

Nissitissit River

Another recent success for diadromous and resident species is the Nissitissit River Restoration Project. A private dam owner, the Town of Pepperell, DER, MassWildlife, Trout Unlimited, and other partners removed the Millie Turner Dam in 2015, which restored over 4,000 feet of instream habitat and reconnected over 40 miles of mainstem and tributary waters from the Nashua to the Nissitissit. This removal benefits Eastern brook trout, state-listed brook floater mussel, American eel, and river herring. The Nissitissit and its coldwater tributaries are home to a brook trout stronghold and exemplary natural communities

Photos by Steven Mattocks/MassWildlife

(Above) MassWildlife's Southeast District Fisheries Manager, Steve Hurley, surveys the Coonamassett River in 2019 after the lower dam removal. (Right) A large salter brook trout captured during surveys of the lower Coonamassett River in 2019.

(BioMap Core Habitat). Fish and other aquatic species are now able to access coldwater refugia during warm summer months, and access critical spawning, rearing, and feeding areas. Removing the dam also reduced liability and protects town infrastructure from a catastrophic breach of a high-hazard, poor-condition dam. In 2019, parts of the Nashua, Squannacook, and Nissitissit rivers were designated as National Wild and Scenic Rivers, adding further protections to 53 miles of river habitat.

Partnerships

As illustrated above, projects such as dam removals, which involve multiple jurisdictional entities and interests, are only possible through strong, collaborative partnerships. DER has been integral in this effort by leading and assisting municipalities and organizations with the complex process of removing dams as well as administering grants. The Massachusetts Department of Transportation is another important partner that manages a vast network of roads and leads and implements many structural improvements on streams, such as culvert and bridge replacements. DMF is also a major partner through its similar mandate, management, and monitoring of many coastal and migratory species. Additionally, non-profit organizations such as American Rivers, The Nature Conservancy, the Connecticut River Conservancy, and Trout Unlimited, as well as local municipalities and organizations are invaluable in getting projects off the ground and accomplished. Federal partners such as the U.S. Fish and Wildlife Service, the Army Corps of Engineers, and NOAA also provide substantial support and grant opportunities.

An invaluable research partner to MassWildlife is the U.S. Geological Survey's Massachusetts Cooperative Fish and Wildlife Research Unit at UMass Amherst. The Massachusetts Coop Unit has been leading research on fish and wildlife for decades, including the impacts of dams on fisheries. This research partnership has helped management agencies better

understand the impacts of dams on fish populations and aquatic communities. Today, the Massachusetts Coop Unit is leading a study to better understand the impacts of current and former dams on fish populations and river health by monitoring river conditions before and after removals. These partnerships continue to serve as regional and national examples of successful collaborations.

Hope Swims On

Despite the ecological drawbacks of dams, the fact remains that life would not be what it is today had colonial settlers not constructed dams and the associated mill complexes. The very cities we live in emerged through the ingenuity and drive that the manufacturers helped to foster. Hundreds of years later, many of the mill complexes and dams still stand. The dams have changed the rivers, no doubt, as well as the species that swim in them. Throughout these changes to the landscape and inland waters, MassWildlife has continued to prioritize what it was established to do: ensure the safe passage of fish and protect and manage all wildlife of the Commonwealth. MassWildlife, through partnerships and collaborations, continues to focus on dam removal and river connectivity to recover and strengthen fish populations in our ever-changing rivers. As dam removal and river restoration work continues across the Commonwealth, our rivers reconnect as they once did, inching us closer, perhaps, to restoring the awe-inspiring fish runs of our past.

(Above) This larval sea lamprey lives buried in river sediment for five years before metamorphosing into a juvenile and migrating to the sea. Adults live in the ocean for one or more years before returning to rivers to spawn, and then die. Sea lamprey are ecologically important and are native to the Connecticut River. (Below) The recently restored natural flow of Hamant Brook in Sturbridge.

Photo by Steven Mattocks/MassWildlife

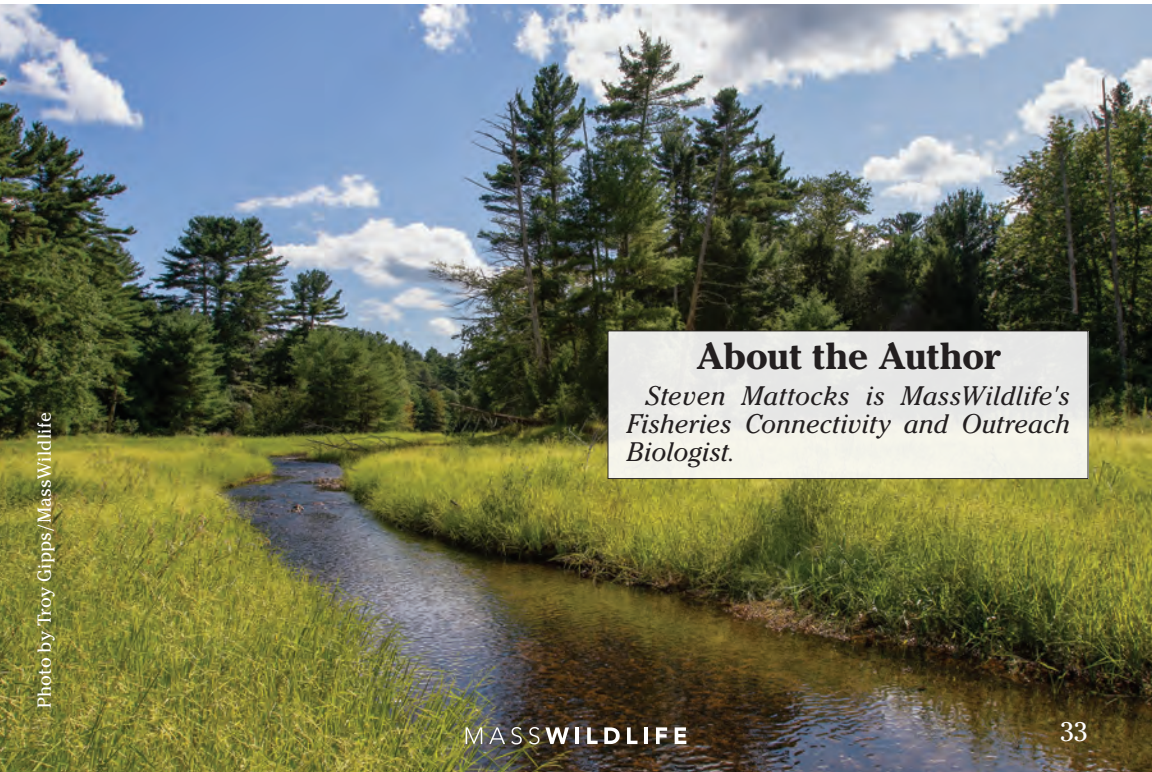


Photo by Troy Gipps/MassWildlife

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The Northern short-tailed shrew (*Blarina brevicauda*) is one of the rarest types of life forms: a venomous mammal. Their neurotoxic venom enters prey by way of a salivary gland at the base of the shrew's lower incisors. While this shrew poses no threat to humans, it is a formidable predator, even though adults measure only four to five inches long and weigh a mere ounce. Their high metabolic rate, which is tied to being a small, warm-blooded carnivore, requires them to hunt constantly and consume the equivalent of their own body weight each day. Typical prey items include grubs, earthworms, snails, and beetles, but they are capable of killing prey much larger than themselves, such as mice, snakes, and ground-nesting bird chicks. Their tiny eyes can do little more than distinguish light from dark, which is indicative of a life spent mostly underground. They navigate using a form of echolocation: emitting twittering vocalizations and analyzing the reverberations to sonically examine their surroundings and chart the best path forward. They rely on their long, highly-sensitive whiskers to find prey. Photo © Troy Gipps