



New Hampshire  
**FISH AND GAME**  
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## Anadromous Fisheries in NH

By Matthew Carpenter



*Pictured: Doug Smithwood of the USFWS stocks river herring in the Nashua River.*

In pre-colonial times, anadromous fish (fish that spend their early years in freshwater, migrate to the ocean for a time, and then return to freshwater to spawn), most notably Atlantic salmon, American shad, and river herring (blueback herring and alewives) populated the Merrimack and Connecticut River basins. Historic records indicate that Atlantic salmon ascended the mainstem Connecticut River 400 miles to Beechers Falls, Vermont, while Atlantic salmon in the Merrimack River migrated 180 miles to its headwaters at Profile Lake in Franconia, New Hampshire. Although actual numbers of Atlantic salmon in the Merrimack and Connecticut's historical spawning runs are unknown, historical records indicate that they were abundant.

The American shad and river herring resources were much larger than those of Atlantic salmon. American shad historically migrated to Bellows Falls, Vermont on the Connecticut River and in the Merrimack River, traveled as far north as the Winnepesaukee River, Franklin, New Hampshire. These species reached incredible numbers, likely measuring in the millions, before the dams blocked access to their spawning habitat in the upper rivers. Each year, juvenile river herring and shad would pour out of the rivers along the coast, providing an incredible abundance for marine

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species from cod to humpback whales. Today river herring and shad reaching New Hampshire number in the 10's of thousands, but fisheries biologists at NH Fish and Game and U.S. Fish and Wildlife are working hard to restore their populations to some semblance of their former abundance.

The sea lamprey is a fascinating eel-like primitive fish with a disc shaped mouth lined with teeth designed for sucking the blood of larger host fish in the ocean. Reaching lengths of up to 3 feet, sea lampreys once migrated far up rivers to spawn in gravel nests, called redds, in habitat very similar to the spawning areas used by Atlantic salmon. Before dams were built, sea lamprey were recorded as far north as the Baker River in Wentworth, NH. Some biologists believe that sea lamprey helped improve the gravel nesting areas of other species, such as salmon, by stirring up and loosening the gravel substrate during spawning. Sea lampreys were once sought out as a food source by colonists and were sometimes referred to as "Derryfield beef". Juvenile sea lamprey, called ammocoetes, are nonparasitic and actually burrow into the sediment and filter feed on organic matter for about 5 years before they are ready to complete their migration downstream to the ocean. While sea lamprey can still be found migrating in a number of New Hampshire Rivers each spring, their numbers have been greatly reduced.

The American eel is another migratory fish species found in New Hampshire. Unlike the other migratory species, the American eel is catadromous, which means that it lives most of its life in freshwater and spawns in the oceans. The whole group of migratory fish species are often referred to as diadromous, meaning that they migrate between marine and freshwater habitats for some phase of their life cycles. All American eels spawn at some unknown location in the Sargasso Sea. Each spring, eel larvae travel by the billions on ocean currents and into freshwater rivers all along the Atlantic coast. Juvenile eels, known as elvers, work their way upstream into freshwater rivers, lakes, and ponds, where they may live for over 20 years before they complete their migration back to the Sargasso Sea. Once one of the most abundant fish in New Hampshire waters, American eel numbers have been greatly reduced due to restricted access upstream of dams. Perhaps more importantly, adult eels migrating downstream, known as silver eels, are often killed by hydropower turbines. As of December 2014, the American eel is under review as a candidate species for listing under the federal threatened and endangered species act. Biologists with the NH Fish and Game Fish Conservation Program are working to better understand the distribution and abundance of American eels in New Hampshire waters and also to ensure safe and effective upstream and downstream passage at dams throughout the state.

A New Hampshire Fish and Game report from 1857 lists a number of causes for the decline and final elimination of some of these diadromous fish: the inability to regulate commercial fisheries, unregulated harvest of adult shad and salmon on their spawning grounds, destruction of juvenile fish by the numerous mill dams, and the construction of impassable dams.

The first dam on the Connecticut River, constructed in 1798 at Turners Falls, Massachusetts, and the Essex dam in Lawrence, Massachusetts on the Merrimack River denied anadromous fish access to their critical spawning habitat in the upper watersheds. Shad, river herring, and sea lamprey maintained remnant populations below the dams, but the Atlantic salmon population in both rivers was extirpated.

### **Restoring a Valued Resource**

Efforts to restore migratory fish in New Hampshire have been going on for many years. In 1864, the New Hampshire State Legislature adopted the first fisheries commission from Massachusetts and New Hampshire to investigate the restoration of migratory fish to the Merrimack and Connecticut Rivers. During 1870-1896, the fisheries commissioners were successful in providing fish ways, securing salmon and shad egg sources, and restoring limited numbers of anadromous fish to the Connecticut and Merrimack Rivers. These early restoration efforts, even though successful, were short lived as the continued construction of dams without effective fish passage facilities and the unregulated harvest of salmon finally ended these early restoration efforts.

### **Current Restoration Program**

The current anadromous fish restoration efforts commenced on a formal basis in the 1960s, when the New England state fishery agencies, the U.S. Fish and Wildlife Service and the National Marine Fisheries Service mutually agreed to support anadromous fish restoration programs for the Connecticut and Merrimack Rivers. The main objectives of the programs were to develop the full potential of the anadromous and resident fishery resources of the rivers for public benefit and to provide high quality sport fishing opportunities. In addition to working on the restoration of Atlantic salmon, American shad and river herring, these efforts have benefited resident fish (such as walleye and smallmouth bass) and other migratory fish, including American eel and sea lamprey.



Atlantic salmon restoration efforts in the Merrimack and Connecticut Rivers have been discontinued due to poor returns, a lack of resources, and shifting priorities within the U. S. Fish and Wildlife Service, which was the primary funding agency.

### **Restoration Activities**

Although the salmon restoration program has ended, the NH Fish and Game Department continues to work on restoring American shad, river herring, American eel. Following are just a few of the tasks that the NH Fish and Game Department is currently involved in to support the restoration of these and other migratory fish.

1. Capture and transport adult shad and river herring from within river and other out-of-basin sources to increase their populations.
2. Working with dam owners to improve upstream and downstream fish passage for all migratory fish species.
3. Monitor counts of migratory fish runs and conduct surveys for evidence of successful reproduction.
4. Conduct surveys to monitor the abundance and distribution of American eels to help evaluate and inform fish passage improvements.
5. Identify important sea lamprey spawning areas.
6. Provide the public with outreach programs relative to anadromous fish restoration programs.