

# River Herring in Massachusetts



## The History and Management of an Iconic Natural Resource

by John J. Sheppard & Phillips D. Brady

If asked the question “What animal(s) do you consider most symbolic of the New England fishing tradition?” most Bay Staters would name Atlantic cod, lobster or clams. We, however, would propose another: river herring. While the aforementioned species can be found on the menu of any local seafood shack or restaurant, river herring deserve accolades for many reasons other than just their commercial and table value.

River herring are comprised of two species, the alewife (*Alosa pseudoharengus*), and the blueback herring (*Alosa aestivalis*). Both are anadromous — meaning they live in the ocean but spawn in freshwater — and quite similar in appearance. River herring hatch in freshwater; alewives in the slow-moving waters of lakes and ponds, blueback herring in the flowing waters of rivers and streams. As juveniles, they travel to

the sea and spend the majority of their lives undergoing extensive oceanic migrations where they mature into adults (mainly at three to five years of age). In Massachusetts waters, alewives generally spawn from mid-March to mid-May when water temperatures reach around 51°F. Blueback herring spawn later in the spring (late April through June) when water temperatures reach about 57°F.

The seasonal occurrence of river herring can be linked to the changing of the seasons in New England. Spring marks the return of river herring from their offshore wintering grounds to their natal freshwater streams, thus completing their oceanic migration and propagating future generations. The spawning runs of river herring in Massachusetts’ coastal streams serve as one of the clearest indicators that spring has officially arrived. By the beginning of summer, the adults

have completed spawning and emigrated back to sea. Throughout the summer and autumn months, the young of the year undertake their maiden voyage to the sea, never to return again unless they survive to adulthood. Juvenile emigration generally peaks during the autumn months (September through November), and can last as late as December. Much akin to trees shedding their last leaves, when the last of the juveniles have departed, it marks the end of autumn and the start of the long, cold winter. The cycle repeats itself each year once the first adults are seen entering their natal rivers.

Like their higher profile anadromous counterparts the American shad and Atlantic salmon, river herring are compelled to undergo an annual pilgrimage back to their place of origin once they reach adulthood. It is a perilous journey back to their natal waters, a gauntlet that requires them to swim against fast-flowing currents and negotiate dams, fish ladders and other obstacles of varying difficulty. They are pursued right to (and sometimes into) the streams and rivers by striped bass, bluefish, gulls, cormorants, ospreys and seals; and even when they get into freshwater and strive toward their final

destination, their path becomes no safer as largemouth bass, pickerel, mink and otter get hot on their tails. Many will not survive to reach their spawning grounds, and many that do will display scars and fresh wounds from tooth and talon that attest to their strong constitution and drive to forge onward.

## Historical and Current Importance

River herring was a staple food source for Native Americans prior to colonial settlement. Once the ice melted in early spring, inland tribes moved to coastal areas to harvest the spring runs. Herring were joyously exploited for their flesh and roe which formed a large component of the seasonal diet. John Mendes, a shellfish biologist for the Massachusetts Division of Marine Fisheries (*Marine Fisheries*) and a member of the Mashpee Wampanoag Tribe, provides valuable insight into the importance of river herring from a Native American perspective. In addition to eating them, the natives used river herring for agricultural purposes, or more specifically, to fertilize their crops. A typical use was to bury a whole herring

with corn seeds so the resulting plants would be nourished by the nutrients of the decomposing fish.

River herring were also used in many tribal ceremonies such as marriages, celebratory seasonal rituals, and in religious rites. In fact, every year during the second week of July, the Mashpee Wampanoag host a powwow in which tribes from all across the country gather together to celebrate their heritage. The celebration is open to the public and features dances, handcrafts, demonstrations and food (with river herring a featured item on the menu).

Early colonial records refer to river herring as providing food for the first European settlers of New

*Children trim herring of their heads and tails at a herring cannery in New England, circa 1902 (after a photo by T.W. Smillie).*



England. Since the time when Samoset taught the Pilgrims the method of using river herring to fertilize corn fields, these fish had a considerable influence on the prosperity of the “new world.” In his book **Changes in the Land: Indians, Colonists, and the Ecology of New England** (1983), William Cronon had this to say:

*William Wood described the arrival of the alewives ‘in such multitudes as is almost incredible, pressing up such shallow waters as will scarce permit them to swim.’ So thick did the fish become in some streams that at least one inhabitant fancied he might*

*have walked on their backs without getting his feet wet. John Josselyn had no illusions about crossing streams on the backs of fish, but he was sure he could have walked knee-deep through stranded herring across a quarter-mile of beach. Nothing in their English experience prepared these men for the sight of such prodigious quantities of fish.*

The harvest of river herring by the colonists dates back to the 17<sup>th</sup> century and can be found in the Essex County court records. Daniel Vickers reported that the Puritan settlers at Watertown had constructed a weir on the Charles River as early as 1633, “wherein they take great store of shad and alewives...” Whether colonial weirs were of English design is not clear, but the Algonquians had constructed them of brush woven in among stakes driven into the river bottom for centuries, and the first settlers might well have patterned their early devices on native models.

Fishermen often caught more herring than could be immediately eaten. The



Photo © by Phillips Brady

surplus was preserved and stored for future consumption at home or for export to newly created domestic markets. River herring were packed in barrels and marketed as food or bait. They were sold fresh, or preserved with salt, or simply kept in cold storage. Records also indicate that during the mid-1700s, limited supplies of river herring were exported to foreign markets, namely the West Indies and other Caribbean ports, where they were used primarily as food for slaves.

Historically, the mid-Atlantic states (namely Maryland, Virginia and North Carolina) were the leaders in commercial landings; however, important fisheries existed in several New England coastal states (Maine, Massachusetts, Rhode Island and Connecticut). A U.S. Fish Commission report filed by H.M. Smith in 1898 indicates that Massachusetts had 388 fishermen engaged in the river herring fishery in that year. They harvested almost 4 million pounds of alewives valued at over \$35,000. This accounted for 43% of total landings of river herring for all New England states.



*The historical Jenny Grist Mill at Town Brook in Plymouth (left) and the Sandwich Grist Mill at Mill Creek in Sandwich (above) are popular tourist attractions from which to view river herring during their annual up and downstream migrations.*

During World War I and for a brief period afterwards, an underground industry was established in Massachusetts in which the scales of river herring were utilized in the manufacturing of artificial pearls. Limited information can be found detailing this industry [see Bigelow & Schroeder's **Fishes of the Gulf of Maine**, 1953], but a barrel of alewives could produce up to four pounds of scales (valued between 50¢ and 60¢ per pound). The high value of the scales is evident from Agawam River fishery sales, which rose in value from \$1,255 in 1919 to \$11,000 in 1920.

The commercial fishery for river herring (using mainly weirs, pound nets, and gill nets) in the Gulf of Maine and the mid-Atlantic states was exclusively a U.S. inshore fishery (Maine, North Carolina and Virginia accounting for over 90% of total landings) until the late 1960s when foreign trawling fleets began fish-

ing for river herring off the mid-Atlantic coast. According to the National Marine Fisheries Service, over 448,000 metric tons (mt) of river herring with a value of almost \$28 million were landed coast-wide from 1960 to 2000. Coast-wide landings averaged 25,000 mt annually between 1960 and 1969; declined to an average of 4,000 to 5,000 mt until the mid-1980s; and more recently, to an average of about 500 mt from 1994 through 1998. Massachusetts contributed over 41,000 mt (9% of the total coast-wide landings) valued at over \$1 million over the 40 year period. However, our average annual commercial landings were only 120 mt since the 1970s, and minimal (less than 1 mt/year)

from 1990 to the present.

## **Historical and Current Management Practices**

A river herring run existed in almost every coastal town in Massachusetts during colonial times. Most of these runs were brought under state or town management, although a few were privately owned. Most of these "natural fisheries" were available free to the public and subject to minimal regulations. Colonial legislators granted towns the authority to regulate the harvest of fish as well as the maintenance of their spawning streams under various leasing schemes.

Later legislation also allowed new alewife fisheries to be created in streams or ponds that previously had no existing populations. These artificially created fisheries were initiated by connecting



Photo © by Joe Fascendola

*The two species collectively known as “river herring” are very similar in appearance, but the Blueback Herring (top) spawns in fast flowing rivers and streams, while the Alewife (bottom), spawns in the slower moving waters of ponds and lakes.*

brackish water ponds directly to the ocean. This was accomplished by digging canals and was a common practice on Martha’s Vineyard and Nantucket. New fisheries were also created by connecting inland ponds and streams to coastal rivers, thereby providing the alewives with access to additional spawning habitat. This was a common practice on Cape Cod and southeastern Massachusetts watersheds. The artificial fisheries were managed under the same types of management schemes as the natural ones.

Our forefathers clearly recognized the importance of the river herring resource and the need to protect it. They passed many legislative acts, most of which were specifically tailored to meet the needs of individual fisheries. The first fishery law, known as the Plymouth Colony Fish Law, was enacted in 1623 for the protection of the alewife.

The early laws established designated fishing days, fishing areas, and allowable harvest methods. Laws established by the towns called for the appointment of fish wardens to manage the runs and enforce these laws. In some towns (such as Pembroke) a herring committee was

elected at the annual town meeting to manage the fishery. When several towns were concerned with one fishery, a joint committee comprising members from each of the towns were appointed to discharge these duties. Examples of such a case are the Middleborough-Lakeville Herring Fishery Commission (the Nemaasket River fishery) and the Tri-Town Committee of Marion, Mattapoisett and Rochester (Mattapoisett River and Sippican River) which jointly manage the river herring runs that cross town borders.

Declines in river herring populations were observed even during colonial times, and obstructions in rivers and streams (such as dams) were identified as a significant factor responsible for such declines. By the end of the colonial period, the governing assemblies of Massachusetts (1710), Connecticut (1715), and Rhode Island (1735) had passed 39 acts intended to protect their freshwater fisheries. Daniel Vickers cited two examples of public action [*William and Mary Quarterly*; 61 no. 4, 2004] which led to the formulation of conservation laws for the protection of river herring:

*The colonial records wheeze with continual bickering over what was clearly perceived to be a finite supply of fish. As early as 1645, the town of Sandwich on Cape Cod complained of bass fishermen setting nets in the river, stopping the passage of alewives to the town weir upstream. In 1668, the inhabitants of Topsfield, Rowley, and Will's Hill complained that, because of the milldam at Ipswich, the alewife run had been "hindered for several years," and, as a consequence, "the course of the fish might be wholly diverted from the river."*

As a result of these and related concerns, laws were passed in 1709 and 1727 to prohibit obstructions to fish passage in rivers. This gave rise to the construction of fishways as a means to rectify passage issues at dams and other obstructions. However, the inability to enforce these acts and the increasing number of dams being constructed resulted in an act passed in 1741 which required that a sufficient passageway be made through or around each dam during the spring spawning run, and also provide sufficient water flow for the young to pass down

during their out-migration periods (when they travel out to sea).

This law was repealed in 1745, however, and legislation *allowing* damage to these fisheries began to mount in the following decades as legislators bestowed manufacturing companies with rights to construct dams via eminent domain, and also provided them with immunity to lawsuits from those whose fishing privileges were impacted. In conjunction, the human population of New England was growing rapidly, doubling every 20 years. Much of the new settlement took place along rivers and coastal areas where land practices such as deforestation, farming, irrigation and the construction of dams altered the physical characteristics of the rivers. The increase in population also led to increased commercial and recreational fishing for river herring.

During this time it was discovered that rivers with declining or depleted river herring populations could be restored — and in some areas where no population previously existed, new fisheries could be created — by stocking mature, ripe fish into headwater ponds. A 1921 Fish & Game

Courtesy National Oceanic and Atmospheric Administration / Dept. of Commerce



*Herring processing (including sun drying) at a cannery in Eastport, ME, early 20th century; after a photo by T.W. Smillie.*



Photo © by John Sheppard

*Marine Fisheries staff release river herring (originally from the Agawam River, Wareham) into the Ten Mile River in East Providence. While the technology of herring transport has improved, the practice of restoring historical herring runs or establishing new ones through stocking dates back to the 18th century.*

report by Doctor David L. Belding noted that stocking was especially essential to maintain river herring populations in rivers with impassable dams such as the Back River in Weymouth, Jones River in Kingston, and Town Brook in Plymouth.

The 19<sup>th</sup> century marked the advent of hydroelectric power, an alternative energy source to coal and wood for cities. In 1920, the Federal Power Commission was created which facilitated widespread production of hydroelectric plants and the creation of dams along rivers throughout New England. Given the technology at the time, many of these dams could not be logistically or economically fitted with fishways. The dams prevented migrating fish from reaching spawning grounds, but also damaged essential habitat and degraded water quality to unsuitable or lethal conditions. These compounding effects led to declines and even extirpation of river herring and other anadromous fish stocks in many watersheds.

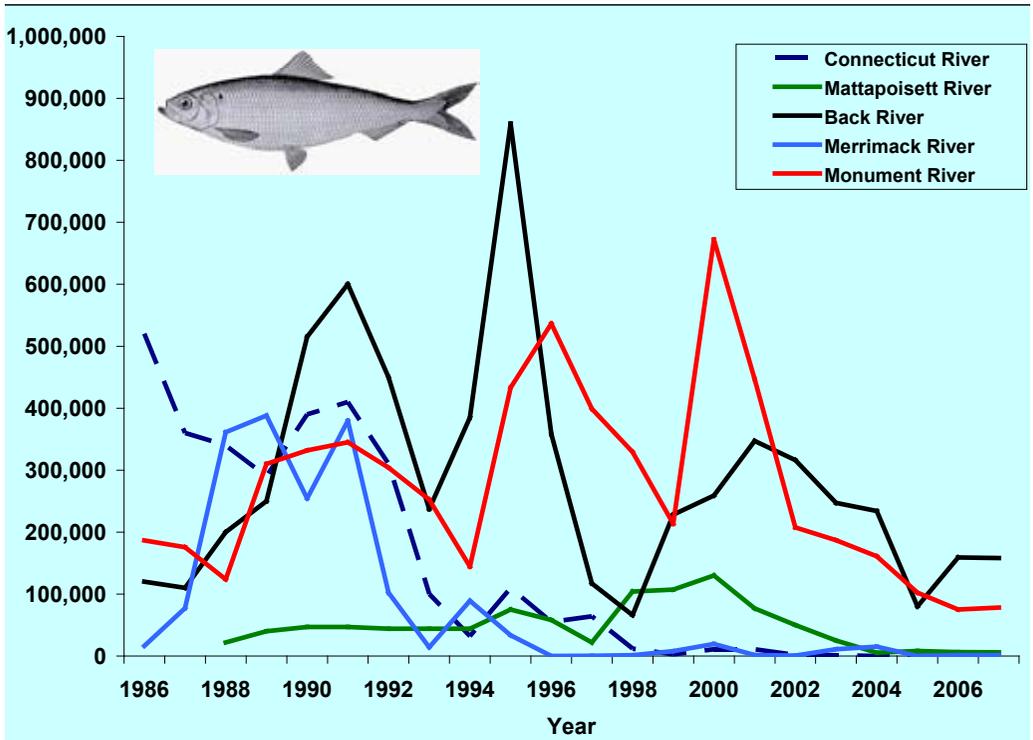
The movement to protect river herring and other anadromous species gained momentum in the 19<sup>th</sup> Century. One person in particular who dedicated considerable effort toward the conservation of river herring fisheries in Massachusetts was Doctor David L. Belding of the Massachusetts Department of Fisheries and Game. Belding's report, published in 1921, provided the first comprehensive survey and assessment of river herring fisheries and fish passage facilities throughout the Commonwealth. Included in this report were management recommendations, many of which are still applicable today. By the time Belding conducted his survey, Massachusetts had lost an estimated 90% of the river herring runs that had existed in colonial times. Through various restoration projects such as the installment and replacement of old fish ladders, Massachusetts today has restored many of its historical runs and identified approximately 100 coastal streams with herring populations.

Despite efforts to conserve river herring stocks, commercial fisheries (both in-river and at sea) were still operating unchecked through much of the 20th century. Fishing effort intensified with the addition of foreign trawling fleets in the 1960s, and was associated with declining herring abundance in U.S. river systems. The dramatic decline in fishery landings and resource abundance led to the implementation of the Fishery Conservation and Management Act (FCMA) of 1976. This established a Fishery Conservation Zone (FCZ), a 200 mile zone contiguous to the territorial sea of the United States that went into effect on March 1, 1977. By Presidential Proclamation on March 10, 1983, this boundary became the Exclusive Economic Zone (EEZ) which prevented foreign fleets from fishing within the U.S. territorial seas.

Years of overharvest and severe reduction in abundance of the resource coupled with the loss of a substantial amount of historic spawning habitat (either through development or pollution) inhibited her-

ring recovery not only in Massachusetts, but in several regions along the east coast. In response to such dire resource conditions, the Atlantic States Marine Fisheries Commission (ASMFC) prepared a comprehensive coast-wide management plan for American shad and river herring in 1985 to facilitate cooperative management and restoration efforts between the states. In 1989, *Marine Fisheries* took conservation efforts a step further by enacting regulations that prohibited directed harvest of river herring by any means other than a dipnet within the territorial waters of the Commonwealth.

At a November 9, 2005 business meeting, the Marine Fisheries Advisory Commission (MFAC) approved a *Marine Fisheries* proposal to implement a three-year moratorium on the harvest, possession, and sale of river herring. Under the terms of this moratorium, the harvest, possession or sale of river herring in the Commonwealth or in the waters under its jurisdiction by any person is prohibited until January 1, 2009.



*Numbers of spawning adult herring returns in various Massachusetts rivers from 1986 to 2007 based on estimates derived from state agencies, town officials and volunteer counting groups.*

## Current Threats to Recovery Efforts

In recent years, Massachusetts has experienced an estimated 80% overall decline in river herring populations (see chart above). These estimations were based on abundance data from resource assessment surveys, catch reports from town wardens and returns from volunteer counting groups. The institution of the moratorium in 2005 serves as another step toward the recovery of river herring stocks in Massachusetts rivers. However, several issues and challenges remain which need to be resolved to further restoration efforts.

Certain natural events — namely unfavorable environmental conditions — can severely impact a river herring population during the fresh water phase of their life cycle. For instance, research indicates that the timing of the spawning runs is temperature dependent (the adults will enter the river when the water reaches a certain temperature). Unseasonably cold temperatures, or the “late onset of spring” can disrupt the spawning run by delaying the arrival of adults to the

spawning grounds. Likewise, droughts in the summertime can cause shallow stream segmentation, trapping young-of-the-year in shallow pools obstructing them from migrating back to sea. This may result in “fish kills” in which hundreds or even thousands of fish are killed by stranding or waters warming to lethal temperatures.

The coastal waters of the Commonwealth have experienced rising populations of striped bass, seals, cormorants and other marine animals in recent years. River herring are important seasonal components of the diets of these predators. River herring populations therefore suffer from increased natural mortality due to increased predation.

There are other sources of declines of an anthropogenic nature. The historical review points to the increase in human population which led to increasing development along rivers and coastal areas. Development has resulted in the degradation of critical habitat through pollution and associated land use. One such problem occurs primarily on Cape Cod where sandy soils, combined with shoreline development and beach nourishment,



Photo © by John Sheppard

*These juvenile herring from the Nemasket River were migrating to sea when drought conditions lowered water levels. The resulting increase in water temperature and decrease in oxygen levels killed these active but delicate fish quite rapidly.*

have contributed to sand deposition in the outlets of many spawning area ponds. During low water years, pond levels may drop below the outlet elevation, trapping juvenile herring in the pond. This delays or prevents downstream migration.

Another concern is the increasing number of requests for water withdrawal permits, either from surface water bodies or from wells close to anadromous fish habitats. As an example, cranberry farming is a large industry that is conducted primarily in the southeast region of Massachusetts (Bristol, Plymouth and Barnstable Counties). During the summer months, cranberry farms draw water from nearby rivers and water bodies to irrigate their bogs. Water withdrawals from streams may create migration barriers within the stream by lowering water levels; can reduce productivity by decreasing available spawning area; and can possibly induce fish kills.

Today, obstructions to fish passage continue to be a problem. There are an estimated 3000 manmade dams in Massachusetts. In 2001 and 2002, *Marine Fisheries* initiated a survey to identify and assess the conditions of all fish passage facilities in Massachusetts coastal streams and rivers. The survey is an update on the work initially conducted by Belding, and the purpose was to provide information on the present state of fish passage, as well as provide guidance for future restoration efforts.

The work surveyed 215 streams, 493 ponds, 380 obstructions, over 100 individual river herring runs, and 175 fishways. The survey documented 150 streams with obstructions that have fish passage structures. Approximately 50% of these fish passage structures are in good condition or function properly, and there are many ongoing efforts to further increase that percentage. If fishways were added to the obstructions presently without them, it would open up approximately 11,000 acres of potential alewife spawning habitat by granting access to 215 ponds.

Prior to the moratorium, evidence of illegal harvesting or "poaching" existed to supply bait to the increasing demand from recreational fishermen and the commercial lobster fishery. In addition, river herring occur as by-catch (incidental catch of non-target species) from ocean

intercept fisheries, namely small-mesh trawl fisheries. The magnitude of river herring removed due to these activities is unknown. Information from poaching is largely anecdotal and the high variance in catch rates and the migratory nature of river herring at sea complicates obtaining accurate estimates of fishing mortality.

## How Can the Public Help?

The public can play a role in the preservation of river herring and other anadromous species by joining a local watershed group or herring counting group. Herring counts, water quality and other data collected by these groups provide valuable information on the status of river herring populations and the health of the rivers they utilize. The public can help by reporting all poaching activities and vandalism to fish ladders to town officials and the Massachusetts Environmental Police (800-632-8075).

River herring have provided one of the oldest documented fisheries in New England and North America. Having played a key role in the survival of Native Americans and the first European colonists, they continue to play an integral role in the food webs of both freshwater and marine ecosystems. Their spawning behavior creates an amazing spectacle that attracts thousands of visitors each year to watch them fight their way past obstacles and ascend fish ladders on their life journey. Next spring, take your family and friends to visit a herring run to witness and appreciate these and other anadromous species. These spawning runs represent what may be the oldest annual historical tradition in New England, and they should be conserved for future generations to appreciate and enjoy.

*John Sheppard, a Marine Fisheries Biologist, has spent the past 3 years working for the Anadromous Fish Dynamics and Management Program. Phillips D. Brady has worked as a Marine Fisheries Biologist for over 30 years and has served as the Project Leader of the Anadromous Fish Management Program for the past 6 years. For more information on anadromous species, visit the Marine Fisheries website ([www.mass.gov/marinefisheries](http://www.mass.gov/marinefisheries)).*



Staff from the Massachusetts Division of Marine Fisheries, Fish & Game Commissioner Mary Griffin (far right), state representatives, and volunteers from the Medford Boat Club and Mystic River Watershed Association all lend a hand in the third annual Mystic River herring bucket brigade in May, 2007. Over 19,000 river herring were collected from Lower Mystic Lake and released into otherwise inaccessible spawning habitat in Upper Mystic Lake. Plans to provide the fish with more natural access into the upper lake are being developed.

Photo by John Sheppard

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