Species of Concern
NOAA National Marine Fisheries Service

River herring
(Alewife & Blueback herring)
Alosa pseudoharengus and *A. aestivalis*

Alewife. Photo credit: Jim Nagus, TN Wildlife Resources.

Blueback herring. Photo credit: Jim Nagus, TN Wildlife Resources.

KEY INFORMATION

Areas of Concern
Anadromous stocks distributed from Maine through Florida.

Year Identified as "Species of Concern"
2006

Factors for Decline
- Dams and other impediments
- Habitat degradation
- Fishing
- Bycatch
- Striped bass predation

Conservation Designations
IUCN: Not Evaluated

Brief Species Description:
Alewife and blueback herring are collectively referred to as "river herring." Due to difficulties in distinguishing between the two species, they are often harvested and managed together. They are thus both considered Species of Concern. Descriptions of each species follow.

Alewife

Alewife are currently distributed from Newfoundland through North Carolina. Historically, they were found as far south as South Carolina (Figure 1), but they have not been documented that far south in recent years (ASMFC 2005). They may live up to 10 years and reach lengths of between 14 and 15 inches (36–38 cm) (Hildebrand and Schroeder 1928 and Kocik 1998a cited in Collette and Klein-MacPhee 2002).

Alewife are **anadromous** and ascend coastal rivers in the spring to spawn. Spawning migrations begin in the southern portion of the range and move progressively northward and are initiated when water temperatures reach approximately 41to 50°F (5-10°C) (Loesch 1987 cited in Collette and Klein-MacPhee 2002). Alewife spawn over a wide range of substrates such as gravel, sand, detritus, and submerged aquatic vegetation, which are found in large rivers, small streams, ponds, and large lakes. Spawning generally takes place when water temperatures are between 61 and 66°F (16-19°C) (Kocik 2000). Most adults reach sexual maturity by age four, and females are capable of producing between 60,000 and 300,000 eggs annually throughout their range (Kocik 2000).

This is a relatively deep bodied and laterally compressed fish that is grayish green above, darkest on the dorsal surface, and silvery on the ventral surface and sides (Collette and Klein-MacPhee 2002). There is often a dusky spot on adult fish that is located at eye level on either side behind the margin of the gill cover (Collette and Klein-MacPhee 2002).

Alewife are distinguished from Atlantic herring by differences in body depth, origin of the dorsal fin, coloration patterns, and serrations on the midline of the ventral surface (Collette and Klein-MacPhee 2002). They also appear similar to young American shad, although there are differences in jaw length and projection, body shape, and numbers of gill rakers (Collette and Klein-MacPhee 2002).

Alewife feed predominantly on zooplankton (Collette and Klein-MacPhee 2002). While at sea, they also prey on small fishes, such as Atlantic herring, eel, sand lance, cunner and other alewife as well as eating the eggs and larvae of other fish species (Collette and Klein-MacPhee 2002). While at sea, alewife are a highly migratory, **pelagic**, schooling species, and they undertake seasonal migrations, most likely in response to changing water temperatures (Collette and Klein-MacPhee 2002). According to Collette and Klein-MacPhee (2002), they are also light sensitive and are usually found in deeper water during the day. Diel migrations by adults may also be associated with the distribution of zooplankton in the water column (Collette and Klein-MacPhee 2002).

Blueback herring

Blueback herring have a more southerly distribution than alewife (Figure 2) and are distributed from Cape Breton, Nova Scotia to the St. John's River in Florida (Virginia Institute of Marine Sciences 2003; Collette and Klein-MacPhee 2002). They reach a maximum size of approximately 16 inches (40 cm) and are believed to live up to 8 years (Virginia Institute of Marine Sciences 2003).

Blueback herring form schools and are believed to migrate offshore to overwinter near the bottom. Like alewife, they are also anadromous, and in the late spring, adults return to shore, arriving in coastal waters approximately a month later than *A. pseudoharengus* (Virginia Institute of Marine

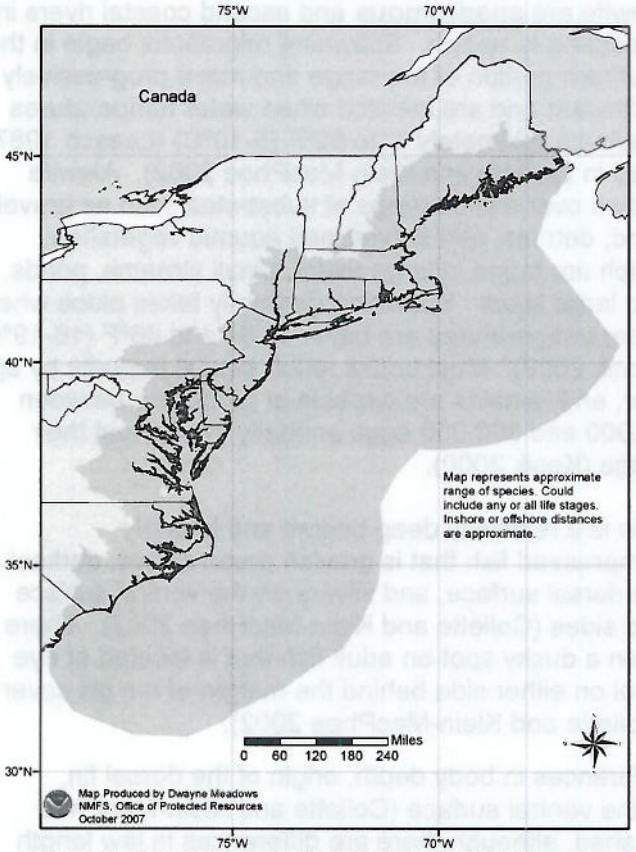


Figure 1. Range of alewife species of concern.

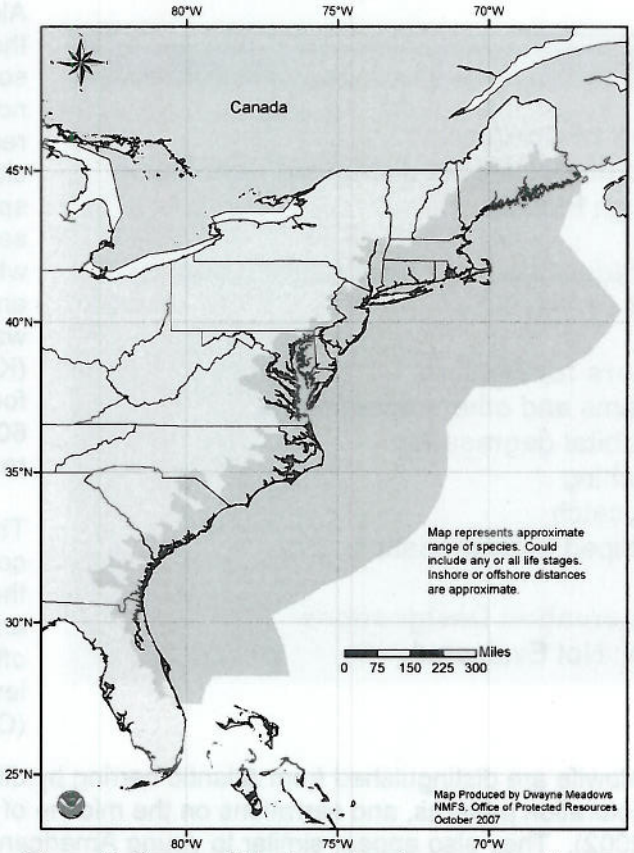


Figure 2. Range of blueback herring species of concern.

Sciences 2003). Blueback herring spawn from late March through mid-May, depending on latitude. They use a greater variety of habitats in areas where they co-occur with *A. pseudoharengus*, and spawning sites include areas with submerged aquatic vegetation, rice fields, swampy areas, and small tributaries upstream from the tidal zone (Virginia Institute of Marine Sciences 2003). Females usually mature by age five and produce between 60,000 and 103,000 eggs. Males generally mature earlier at between 3 and 4 years of age and at a smaller size than the females. According to Collette and Klein-MacPhee (2002), eggs are pelagic or semi-demersal. Young-of-the-year are found in fresh and brackish rivers, and juveniles remain in these nursery areas until they reach about 2 inches (5 cm). For both species, adults migrate quickly downstream after spawning and little is known about their life history while in the marine environment; however, they are believed to be capable of migrating long distances (over 1200 miles or 1930 km) (Virginia Institute of Marine Sciences 2003).

Blueback herring are similar in appearance to alewife. However, they can be distinguished by differences in eye diameter, body depth, and the color of the peritoneum – the abdominal cavity membrane (Collette and Klein-MacPhee 2002). Like alewife, blueback herring are planktivores, preying primarily on ctenophores, calanoid copepods, amphipods, mysids, and other pelagic shrimp and small fish while at sea (Collette and Klein-MacPhee 2002). They too are a pelagic, schooling species and undertake seasonal migrations in the sea response to changing water temperatures and diel vertical migrations in response to prey movement and availability (Collette and Klein-MacPhee 2002).

Rationale for "Species of Concern" Listing:

Demographic and Genetic Diversity Concerns:

River herring populations have exhibited drastic declines throughout much of their range (Figure 3). In Connecticut, river herring populations have been declining since approximately 1990 (Marteka 2004). Dramatic declines have been documented at the fishway at the Holyoke Dam on the Connecticut River, with numbers of river herring dwindling from approximately 600,000 in 1985 to only 1300 in 2003 (Marteka 2004). This declining trend has also been observed in Rhode Island, Massachusetts, and North Carolina. According to representatives of the Rhode Island Department of Environmental Management, runs in the state are rapidly declining, and 2005 had some of the lowest counts ever recorded in the state (Save the Bay – www.savebay.org). According to Save the Bay, the Gilbert Stuart run, which has historically been the state's largest, declined from 290,000 fish in 2000 to 17,000 in 2004, which represents a 95% decline in abundance. According to the North Carolina Wildlife Resources Commission, the herring populations in the lower Cape Fear River are particularly low. In a year-long study conducted by the University of North Carolina at Wilmington's Center for Marine Sciences, researchers sampled nine tributary creeks in

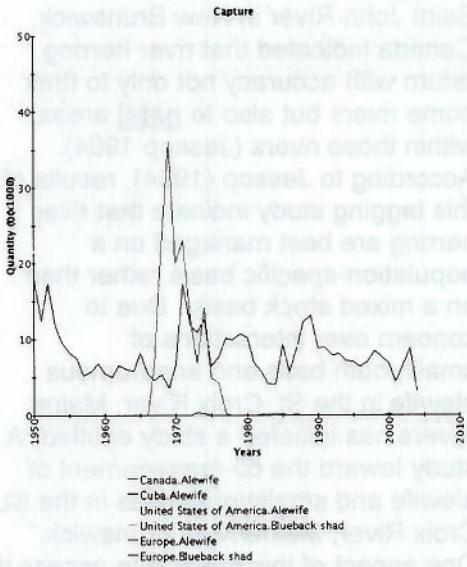


Figure 3. Global Alewife Landings (source: http://www.fao.org/figis/servlet/static?dom=root&xml=tseries/index.xml)

the lower river and only collected 18 river herring. In the St. Croix River, alewife runs declined from a high of 2,624,700 fish in 1987 to a low of 1299 fish in 2004 (Figure 4, St. Croix International Waterway Commission and Fisheries and Oceans Canada 2005). In 2005, spawning escapement increased slightly to 11,632 fish, which is the highest count since 1999. On the ASMFC's river herring message board, there are anecdotal reports of declines of river herring in Connecticut, North Carolina, and the Delaware River (www.asfmc.org).

> "We have had a total closure on the taking of blueback herring and alewife in Connecticut for the last couple of years (CT Department of Environmental Protection order). The recorded numbers of these forage fish entering the rivers seem to be crashing here..."
>
> "We in North Carolina have seen them decrease by 90% over the last decade or so, probably due to overfishing, based on NC Division of
>
> Marine Fisheries statistics...."
>
> "There has been an enormous decline in the Delaware River in the past ten years. I normally fish above the tidal flow. Last year, I caught no herring and about 5 American shad. The past three years have been very poor. In the past seven years, I had two seasons of fair fishing (60 shad per season)."

The Ocean Biogeographic Information System (OBIS) website provides fishery independent data for river herring from a variety of sources. These data also indicate a significant declining trend in river herring populations throughout their range (Figure 5).

A tagging study conducted on the Saint John River in New Brunswick, Canada indicated that river herring return with accuracy not only to their home rivers but also to **natal** areas within those rivers (Jessop 1994). According to Jessop (1994), results of this tagging study indicate that river herring are best managed on a population-specific basis rather than on a mixed stock basis. Due to concern over interactions of smallmouth bass and anadromous alewife in the St. Croix River, Maine Rivers has initiated a study entitled "A study toward the co-management of alewife and smallmouth bass in the St. Croix River, Maine/New Brunswick." One aspect of this study is to assess the genetic diversity and relationships of St. Croix alewife populations and to develop methods to differentiate between anadromous and landlocked alewife

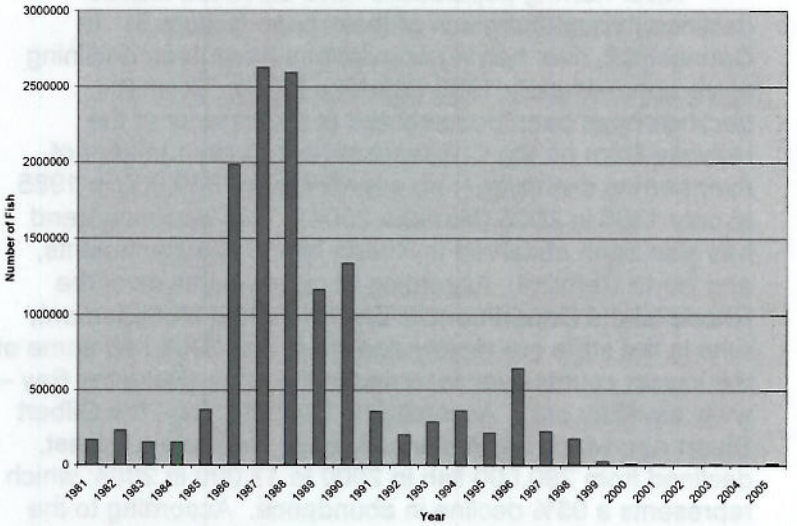


Figure 4. Spawning escapement in the St. Croix River 1981 – 2005.

populations. Bentzen and Paterson (2005) found that anadromous and landlocked populations from the St. Croix are genetically divergent and that there is significant genetic differentiation between anadromous alewife from the St. Croix and anadromous populations in the LaHave and Gaspereau Rivers (Bentzen and Paterson 2005). They also found some genetic differences between two different tributaries to the St. Croix – Dennis Stream and Milltown. These results indicate that alewife do home to their natal streams, and that there is at least partial reproductive isolation between spawning runs, even at the level of tributaries within the St. Croix River (Bentzen and Paterson 2005). The degree of genetic differentiation between the two tributaries to the St. Croix, while significant, was relatively small, and thus, further research needs to be conducted before any definitive conclusions can be drawn regarding whether distinct population segments of alewife exist.

Factors for Decline:

There are several threats to both species that have most likely contributed to their decline. These threats include: loss of habitat due to decreased access to spawning areas from the construction of dams and other impediments to migration; habitat degradation; fishing; and increased predation due to recovering striped bass populations.

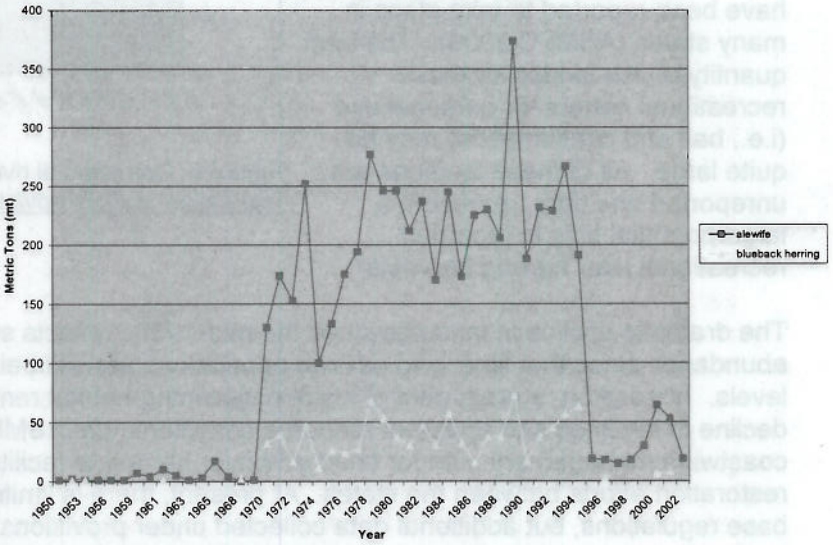


Figure 5. River herring abundance. OBIS.

The river herring fishery is one of the oldest documented fisheries in North America, dating back over 350 years in some areas. Until the late 1960s, it was exclusively a U.S. inshore fishery. However, in the late 1960s, distant-water fleets began fishing for river herring off the Mid-Atlantic coast (Kocik 2000). According to the Food and Agriculture Organization of the United Nations' other countries such as Cuba, Bulgaria, Germany, the Netherlands, Poland, Spain, and the former Union of Soviet Socialist Republics reported landings of river herring from 1966 through about 1977 and again from 1984 through 1989.

Commercial alewife landings in the U.S. peaked in the late 1950s and mid 1970s at over 34,500 mt before declining to minimal levels in the late 1970s (Figure 6) with implementation of the Fisheries Conservation and Management Act (Kocik 2000). Blueback herring landings are only available from 2000-2004, and ranged from a high of 37.2 mt in 2000 to a low of 1.5 mt in 2001. Intensification of the river herring fishery was associated with declining abundance in U.S. river systems (Kocik 2000). According to Kocik (2000), the principal fishing gears used in the river herring fisheries are fish weirs, pound nets, and gill nets. River herring are taken as **bycatch** in other ocean fisheries in various gear types including gillnets, bottom otter trawls, and menhaden purse seines (ASMFC 1999). Along the East Coast, there are extensive recreational fisheries for river herring in many rivers (ASMFC 1999). According to the Atlantic States Marine Fisheries Commission (ASMFC 1999), some are hook and

line fisheries (i.e., Delaware River) while in several states various types of dip nets and seines are permitted. According to NMFS's Marine Recreational Fisheries Statistics Survey, recreational harvest of river herring in 2004 was 378,540 fish, which is a slight increase from 2003 (360,350 fish) (ASMFC 2005). While specific data on the nature of the recreational fishery for river herring are limited, catch and release recreational fisheries have been reported to take place in many states (ASMFC 2005). The total quantity of fish landed by these recreational netters for personal use (i.e., bait and consumption) may be quite large. All of these landings are unreported and thus, represent a large potential bias in recorded recreational river herring harvests.

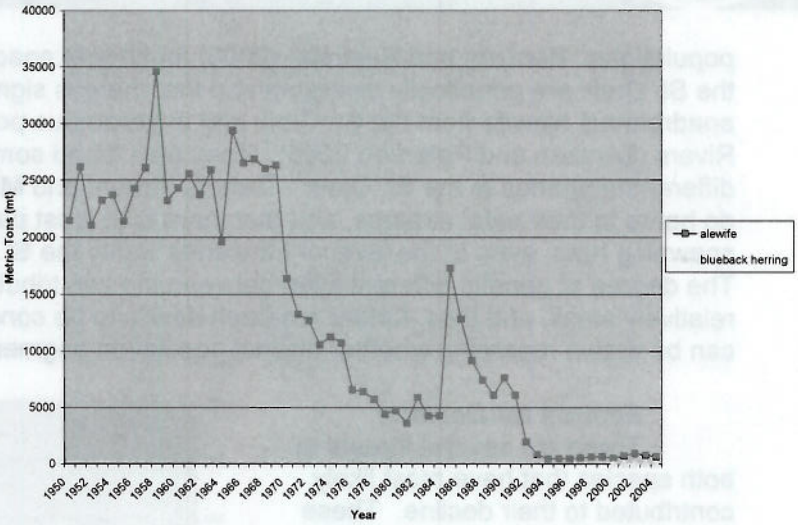


Figure 6. Commercial river herring landings 1950-2004 (source: http://www.st.nmfs.gov/st1/commercial/landings/annual_landings.html)

The dramatic decline in landings since the mid-1960s reflects substantial decreases in resource abundance since that time, and several populations are still being exploited at higher than optimum levels. In addition, a great deal of historic spawning habitat remains unavailable. In response to the decline in landings and apparent resource conditions, the ASMFC has prepared a comprehensive coastwide management plan for shad and river herring to facilitate cooperative management and restoration efforts between the states. At present, there is limited information available on which to base regulations, but additional data collected under provisions of the Plan should provide a better basis for understanding resource status and for regulatory actions.

Status Reviews/Research Underway:

Data Deficiencies:
Accurate population estimates for most river systems in which river herring are present are not available. River herring populations are declining throughout their range and yet, no single factor can be identified as being responsible for this decline. As such, it is necessary to determine the extent to which habitat loss/destruction, alterations in flow and other important habitat characteristics, increased predation by recovering species such as striped bass, bycatch in ocean fisheries such as the Atlantic herring fishery, and climactic changes are affecting these species. Additional genetic analyses are also needed in order to determine if distinct populations exist.

Existing Protections and Conservation Actions:
In response to the declining trend for river herring, the states of Massachusetts, Rhode Island, Connecticut, and North Carolina have instituted moratoriums on taking and possessing river herring. The North Carolina Division of Marine Fisheries developed a River Herring Fisheries Management Plan that details the steps that are necessary to recover North Carolina's river herring populations.

Videos:
History of Alewife fish ladder in Damariscotta, ME (9:43)
http://www.youtube.com/watch?v=zGRc4YZBYkA
Cast netting for alewives (0:51) http://www.youtube.com/watch?v=bvrYwndRnQM
Alewife migration 3:26 http://www.youtube.com/watch?v=yFZaSLOeDcM
Blueback herring catching with a scap net (9:23) http://www.youtube.com/watch?v=V6-x6JkgqWg

References:

ASMFC. 1999. Amendment 1 to the Interstate Fishery Management Plan for Shad & River Herring.

ASMFC Fishery Management Report No. 35. 76 p.

ASMFC. 2005 Review of the Atlantic States Marine Fisheries Commission Fishery Management Plan for Shad and River Herring (*Alosa spp.*).

Bentzen, P. and I.G. Paterson. 2005. Genetic analyses of freshwater and anadromous alewife (*Alosa pseudoharengus*) populations from the St. Croix River, Maine/New Brunswick. Final Report to Maine Rivers, 3 Wade Street, Augusta, ME 04330.

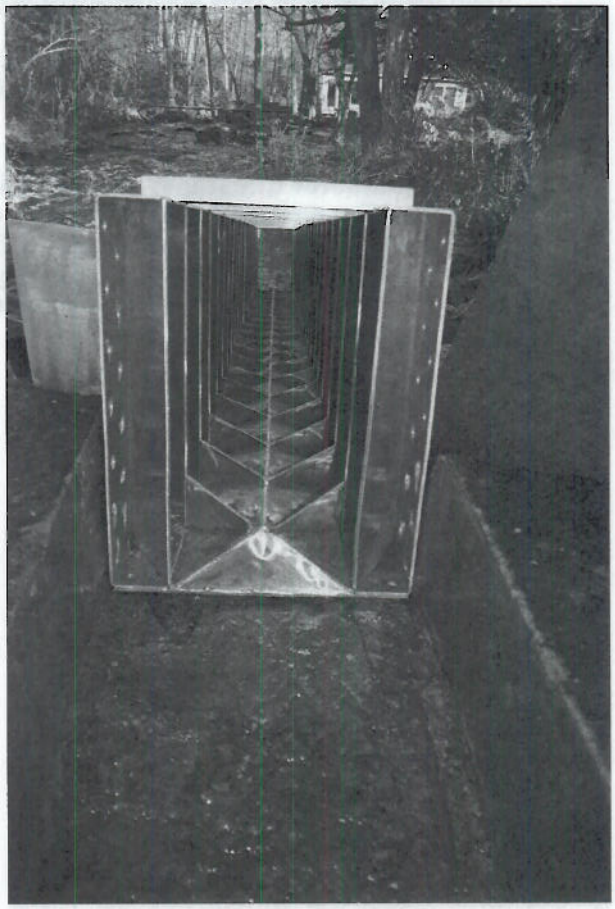
Collette, B.B., and G. Klein-MacPhee. 2002. Atlantic halibut, *Hippoglossus hippoglossus* (Linnaeus 1758). In: B.B. Collette and G. Klein-MacPhee (eds). Bigelow and Schroeder's fishes of the Gulf of Maine. Smithsonian Institution Press, Washington, DC.

Jessop, B.M. 1994. Homing of alewives (*Alosa pseudoharengus*) and blueback herring (*A. aestivalis*) to and within the Saint John River, New Brunswick, as indicated by tagging data. Canadian Tech. Rep. Fish. Aquat. Sci. No. 2015: 22 p.

Kocik, J. Northeast Fisheries Science Center (NEFSC). 2000. Status of Fisheries Resources off Northeastern United States - Alewife. January 2000. http://www.nefsc.noaa.gov/sos/spsyn/af/herring/.

Marteka, Peter. 2004. Fish-population declines are not easily explained. The Hartford Courant. June 14, 2004.

North Carolina Wildlife Resources Commission. 2006. River Herring Moratorium to be Discussed at Public Meeting. http://www.wildlife.state.nc.us/news_stories/pg00_newsrelease/pg00_apr06_2.htm.



Fish bypass ladder installed on Parker River Dam, Byfield, MA, 2000. NOAA Restoration Center Community-based Restoration Project. Photo Credit: NOAA photo library.

Save the Bay. 2006. DEM today files emergency regulations banning the taking of river herring – Save the Bay E-News.

Save the Bay. 2006. River Herring Moratorium Proposed. http://narragansettbaykeeper.blogspot.com/2006/02/river-herring-moratorium-proposed.html.

Virginia Institute of Marine Sciences. 2003. Blueback herring page. http://www.fisheries.vims.edu/femap/fish%20pages/Blueback%20Herring.htm.

Walsh, Harvey J., Lawrence R. Settle, and David S. Peters. 2005. Early life history of blueback herring and alewife in the Lower Roanoke River, North Carolina. Transactions of the American Fisheries Society 134:910-926.

Point(s) of contact for questions or further information:

For further information on this Species of Concern, or on the Species of Concern Program in general, please contact NMFS, Office of Protected Resources, 1315 East West Highway, Silver Spring, MD 20910, (301) 713-1401, soc.list@noaa.gov; http://www.nmfs.noaa.gov/pr/species/concern/, or Kimberly Damon-Randall, NMFS, Northeast Region, One Blackburn Drive, Gloucester, MA 01930-2295, (978) 281-9328, x6535, Kimberly.Damon-Randall@noaa.gov.