

Empty Rivers

The Decline of
River Herring



And The Need to Reduce
Mid-water Trawl Bycatch

A REPORT OF THE HERRING ALLIANCE

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Acknowledgements

The Herring Alliance would like to extend a special thanks to the report author, Amy Schick Kenney, and contributors to the report, Peter Baker, Jake Kritzer, Tom Rudolph, and Lara Slifka. We would also like to thank Jerry Tyson for his invaluable assistance with the publication process and Steve Ganey for his guidance along the way.

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Cover photo of trawlers: www.FishingPix.net





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Photo: Tom Arter

An osprey carries away an alewife. River herring provide an important source of food for many other species.

Introduction

Over the past two decades, populations of river herring along the Atlantic coast have declined by more than 95 percent. At the Holyoke Dam on the Connecticut River, the number of river herring passing each year to spawn declined from 630,000 fish in 1985 to only 21 in 2006. On the St. Croix River, running through Maine and Canada, alewife runs declined from a high of 2,624,700 fish in 1987 to a low of 22 in 2005. To the south, the Susquehanna River in Pennsylvania also saw an alarmingly low return of only four river herring in 2005, down from hundreds of thousands in previous decades.

The dramatic declines of river herring returning to spawn each year is coupled with a crashing fishery, which has declined by 99 percent over the last 50 years. Landings peaked between 1950 and 1970 at 40 to 65 million pounds and hit record low levels in 2005 of under 700,000 pounds.

We are witnessing the disappearance of river herring. Until now, restoration efforts have focused on protecting essential spawning and nursery habitats, removing dams and other structures that impede fish passage, and setting limits for the river herring fisheries.

But these threats have existed for decades without a coast-wide crash. What has changed? The answer appears to be industrial mid-water trawlers, singly or in pairs, dragging large nets through the water to catch Atlantic herring (a different species from the river herring) and mackerel. These vessels probably catch millions of river herring each year, a development that has gone unnoticed by the public and has been ignored by fishery managers.

Unless we act immediately to protect the remaining population, we will lose river herring altogether. Why should we care? The answer is that river herring play a critical role in rivers, estuaries, and ocean waters along the Atlantic coast. They provide food in the spring for hundreds of thousands of animals. Many species of birds, marine mammals and fish, hungry from the winter, depend on the arrival of river herring.

In addition, commercial fishermen, from the time of our founding fathers, have made a living by catching river herring. Recreational fishermen try their luck at luring a fish as they run up the rivers. Towns such as Jamesville, North Carolina, celebrate the annual herring run with a festival that began in 1949. Others simply enjoy standing on the bank of a stream watching the miracle of thousands of river herring make their heroic journey to spawning grounds.

A handful of states—Connecticut, Massachusetts, North Carolina, and Rhode Island—took a leadership role in protecting river herring stocks by implementing a moratorium on harvest in their waters. Unfortunately, the decline of river herring continues.

The time has come to protect what few river herring are left through a coastwide management effort. The Atlantic States Marine Fisheries Commission (ASMFC), an organization designated to coordinate the management of fish species along the East Coast, should act immediately to stop directed fishing on depleted stocks of river herring and limit the incidental take of river herring as bycatch by the mid-water trawl fishery. The National Marine Fisheries Service (NMFS) should improve observer coverage and other monitoring programs, such as port sampling, to adequately account for all river herring taken by the mid-water trawling fleets, and implement limits on river herring bycatch.

The Northeastern United States has already lost one anadromous fish, the Atlantic salmon, which is considered commercially extinct. Without action, we may soon lose two more.

River Herring Life History

The term “river herring” refers to two species of fish: alewife¹ (*Alosa pseudoharengus*) and blueback herring² (*Alosa aestivalis*). Alewife and blueback herring have a similar appearance and life history, making them indistinguishable to the untrained eye. The two species can only be distinguished by measuring the diameter of the eye and body depth, and by observing the color of the abdominal cavity membrane (Collette and Klein-MacPhee, 2002).

1 Other common names include freshwater herring, grayback, gaspereau, sawbelly, kyak, brank herring.

2 Other common names include glut herring, summer herring, black belly, kyack.

River herring are found in rivers, estuaries, and coastal waters of the North Atlantic. They are anadromous fish, spending the majority of their lives in the ocean before returning to natal rivers and streams in the spring and early summer to spawn. Alewives tend to occupy a more northern range, from Newfoundland to North Carolina (ASMFC, 1999). Blueback herring range from Nova Scotia to the St. Johns River in Florida (Hildebrand, 1963). River herring form large schooling aggregations that undertake long seasonal migrations.

Spawning varies from north to south and between the species. Alewives spawn from late March through July, beginning first in the south and moving progressively north during the year. Typically, blueback herring begin spawning three to four weeks after alewives in the same spawning areas (Jones *et al.*, 1978).

At southern latitudes, many river herring exhibit a semelparous life history: they spawn once and then die, similar to the Pacific salmon. This characteristic is more common in southern states because fish travel a greater distance from the Gulf of Maine, where river herring congregate in the winter (Neeves, 1981). The journey, followed by spawning, seems to exhaust them.

Juveniles generally remain in fresh water for several months before emigrating to estuarine nursery areas by the late summer or early fall of their first year. They spend their first winter close to shore (ASMFC, 1999). Little information is available on distribution and migration of adults once they are in the ocean. Tagging studies have shown that both species are capable of migrating over 1,200 miles in ocean waters (VIMS, 2003).

"River herring are a humble but fascinating fish. Their life history is complex, and reversing their drastic decline will require attention to a range of impacts spanning watersheds, rivers, estuaries, and the open ocean. The task will not be easy, but it is within our reach. By bringing back thriving runs of river herring, we will restore a key piece of both coastal ecosystems and our coastal heritage."

—Jake Kritzer, scientist for
Environmental Defense

Importance of River Herring

River herring are culturally and ecologically significant along the Atlantic coast. Humans have revered river herring for centuries as one of the nation's oldest fisheries. Generations have watched the magic of nature as hundreds of thousands of fish migrate up rivers and streams to spawn. And many larger fish, birds, and mammals along the route depend on river herring for food.

Heritage and Non-Consumptive Factors

Many outdoor enthusiasts and naturalists from Maine to Florida regard the annual migration of river herring as a natural wonder. These fish are a key part of the

culture, education, heritage, outdoor recreation, and tourism in these areas. At the Jamesville River Herring Festival in North Carolina, which began in 1949, generations have gathered to witness the traditional fishery activities and savor the delicacy of fried herring.

The river herring fishery connects us to our Nation's past. For example, Native Americans used river herring to fertilize crops, a practice the early settlers in the colonies adopted.

Thomas Jefferson was "always mindful of the

spring migration" of river herring (McPhee, 2002). River herring runs connect us today with America's early history.

River Herring as Forage

River herring play an important role as forage for other species along the Atlantic coast, bringing much-needed food after the winter. A second wave of protein moves downstream later in the year as the young fish migrate to sea.

Studies of predator diets confirm the importance of river herring as a primary food source for fish, birds, and mammals. Ospreys, loons, herons, bald eagles, egrets, kingfishers, harbor seals, river otters, and bluefin tuna, among others, rely on river herring to satisfy a significant portion of their diet.

"I used to take my wife and kids down to the Herring Run in the Spring and Fall. It was great to watch the mature fish migrate upstream and see the fry pile up in the fall preparing to move out to sea. We just don't go anymore, it's too depressing."

—Teddy Ligenza- Commercial Fishermen

- ◆ Along the northeast coast from Maine to New Jersey, up to 33 percent of the diet of striped bass can be river herring during the spring migration (Walter *et al.*, 2003).
- ◆ In the Chesapeake Bay during the herring migration, the diet of striped bass can be nearly 80 percent river herring (Walter and Austin, 2003).
- ◆ In North Carolina, 33 percent of the diet of striped bass can be river herring during winter, rising to 50 percent during the spring migration (Walter *et al.*, 2003).
- ◆ In the Hudson River Estuary, up to 40 percent of the diet of bluefish can be river herring during the summer months (Buckel *et al.*, 1999).
- ◆ In Maine, during late summer and early fall, white perch live entirely on young-of-the-year river herring (Moring and Mink, 2002).
- ◆ Ospreys depend on strong river herring runs to feed their chicks (CT DEP, 2007).
- ◆ In Saint John Harbor, New Brunswick, during the peak of the alewife run, harbor seals are five times more abundant than the yearly average (Brown and Terhune, 2003).

“Besides menhaden, river herring is the number 1 bait for striped bass in the spring. I am currently working with a local group to restore the habitat and water quality of a local run. There are other reasons besides habitat degradation contributing to their decline such as mid-water trawlers and increased water use leading to the fry not being able to migrate to the ocean.”

—Craig Poosikian- Commercial/ Recreational Fisherman

“River herring are an important food source for a variety of birds, including herons and egrets, species that have shown breeding population declines in recent years throughout the northeastern US.”

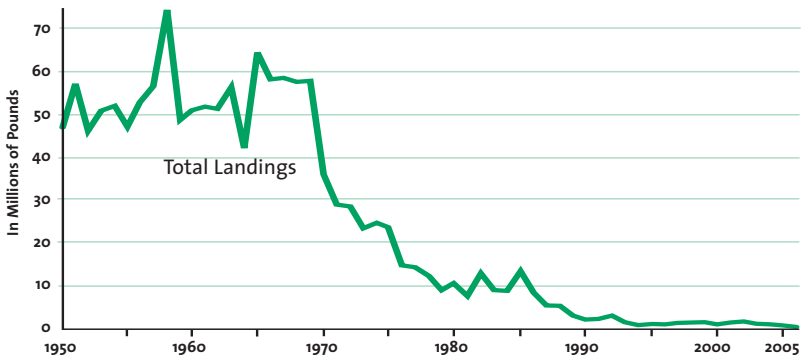
—Rebecca Harris, Massachusetts Audubon Society.

River Herring Fisheries

From the 1800s to the 1960s, fishing for river herring along the Atlantic coast was a thriving industry. During this time, the harvest was exclusively from U.S. fishing boats. In the 1960s, large foreign vessels arrived off the mid-Atlantic coast, scooping up far greater volumes of river herring than the traditional U.S. fishery. The foreign fleet fished in U.S. coastal waters from 1967 to 1972, with a peak foreign harvest of 24 million pounds in 1969. The foreign fleet primarily targeted juvenile fish and probably contributed to the decline in commercial landings in the 1970s (NCDMF, 2007). Commercial landings ranged from a high of 75 million pounds in 1958 to a low of 692,827 pounds in 2005, a 99 percent decline (Figure 1).

Figure 1

Commercial River Herring Landings



Source: Personal communication from The National Marine Fisheries Service, Fisheries Statistics Division, Silver Spring, MD.

In addition to commercial landings of the directed fishery, river herring are caught accidentally—referred to as bycatch—by fisheries for other species. Bycatch, unfortunately, is poorly monitored, reported, and regulated. Inadequate monitoring hides a potentially high level of river herring mortality. The inadequate monitoring of bycatch, especially in the mid-water trawl fleet, stands as a major obstacle to proper management of river herring.

Recreational fishing for river herring also exists in many river systems along the Atlantic coast. Fishermen use various types of gear, from hook and line to dip nets and seines. These recreational landings may be quite large, but it is difficult to know for sure because they are often unreported. This represents another potentially large error in landings data (ASMFC, 1999).

Status of the Stock

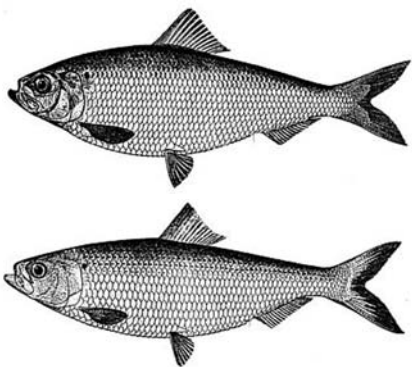
The official status of river herring stock, as reported by the ASMFC, is “unknown.”

This designation is given because no recent, coastwide stock assessment exists. The last assessment was conducted 17 years ago. Despite the “unknown” status, individuals from New England to North Carolina are witnessing a decline in the population of these fish.

The last coastwide stock assessment for river herring was prepared for the ASMFC in 1990. The Commission plans to begin a new assessment in 2008, which will take approximately two years to complete. In 2005, North Carolina conducted a stock assessment for river herring. In addition, other states collect data on fish counts and young-of-the-year surveys. Although this data will not be analyzed collectively until the stock assessment, the individual indicators paint a grim picture of the status of river herring.

Stock Status from the 1990 ASMFC River Herring Stock Assessment

The 1990 coastwide stock assessment for river herring considered the status of 15 river herring stocks between New Brunswick, Canada, and North Carolina. The assessment found that the following one-third of these stocks were or had been overfished: St. John, Damariscotta, Potomac, and Chowan River alewife,



Alewife (top) and blueback herring (bottom) can only be distinguished by measuring the diameter of the eye and body depth, and by the color of the abdominal cavity membrane.

and St. John River blueback herring. The following four stocks had experienced declines, but were not considered overfished: Potomac and Chowan River blueback herring, and Nanticoke and Rappahannock River alewife (Crecco and Gibson, 1990).

The report also suggested benchmarks to define sustainable fishing rates and found that a narrow range of fishing mortality rates is safe before the stock tends toward collapse. Finally, the scientists recommended new conservation measures to rebuild the adult spawning populations and stabilize recruitment in rivers with overfished stocks.

Despite the evidence of serious declines and in disregard of the recommendations of its own scientists, the ASMFC took no action to protect river herring.

Stock Status from the 2005 North Carolina Assessment

In 2005, North Carolina conducted an assessment of river herring populations in its waters (Grist, 2005). The study found that excessive fishing combined with poor recruitment had significantly reduced the abundance of both alewife and blueback herring over the past 20 years, resulting in much lower catches in recent years.

Across the board, the report found evidence of dramatic declines:

- ◆ Both alewife and blueback herring were overfished, and overfishing was ongoing.
- ◆ Recruitment—the amount of fish available to the fishery—had declined more than 95 percent in the last 30 years.
- ◆ The spawning stock biomass—a measure of the adult spawning population that returns to the river—dropped significantly for both species in the 1990s.
- ◆ The juvenile abundance indices for both species were well below the long-term average.
- ◆ Since 1986, blueback herring spawning repetition has been six percent or less per year, and zero repeat spawners were observed for the first time in 2006. Historically, 20 percent of spawners had previously spawned in the river.

Fish Counts

Unfortunately, stock assessments are time and data intensive. A simpler indicator is the annual count of fish returning to their natal streams. Each year, the number of fish passing a fixed point on the river are counted and recorded, providing an estimate of the spawning population.

Coastwide, fish counts indicate that river herring populations have been declining. In most cases, the declines are dramatic and precipitous, ranging between 95 and 99.9 percent (Figure 2) over the past decade. Rivers that once saw hundreds of thousands of fish swimming upstream to spawn are now seeing less than one hundred fish.



Photo: NOAA

Massive runs of herring once signaled the arrival of spring along the East Coast.

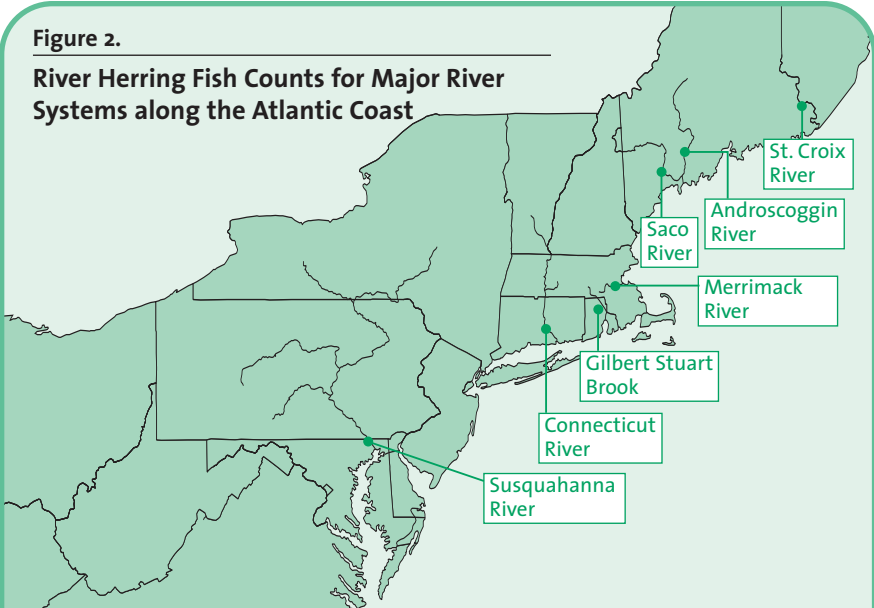
Management of the River Herring Fishery

River herring have fallen through the cracks of fisheries management. These fish cross multiple jurisdictions throughout their lifetime, making it easier for fisheries managers to ignore the problem or pass it on to others. River herring begin life in small headwater creeks and streams that often fall under the jurisdiction of state inland fisheries agencies. By the end of their first year, they have migrated to estuaries and coastal waters managed by state marine fisheries agencies. As juveniles, they move further offshore to school in federal waters controlled by the NMFS. Once they reach maturity, they retrace the spawning route, again crossing multiple jurisdictions.

Only four states—North Carolina, Connecticut, Rhode Island, and Massachusetts—have implemented strong management measures to protect dwindling stocks of river herring. But these plans focus on protecting fish in coastal waters, and do not address the question of vulnerability at sea where

Figure 2.

River Herring Fish Counts for Major River Systems along the Atlantic Coast



Canada: The St. Croix River, running through Canada and Maine, has experienced tremendous declines in its fish counts. Alewife runs declined from a high of 2,624,700 fish in 1987 to a low of 22 in 2005, representing a 99.9 percent decline.

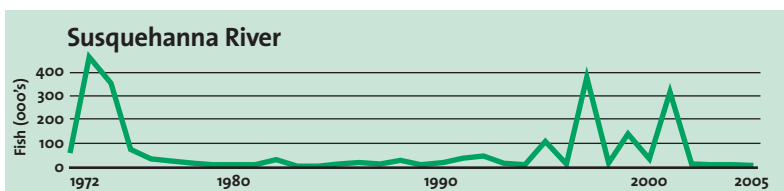
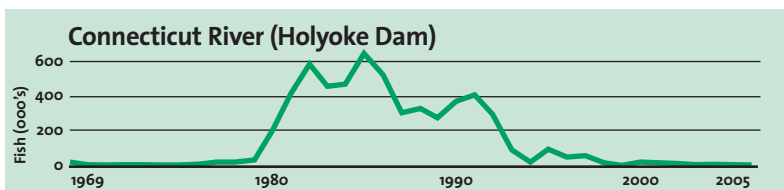
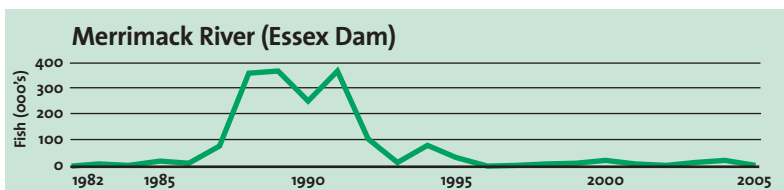
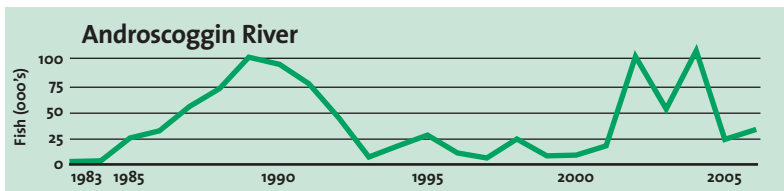
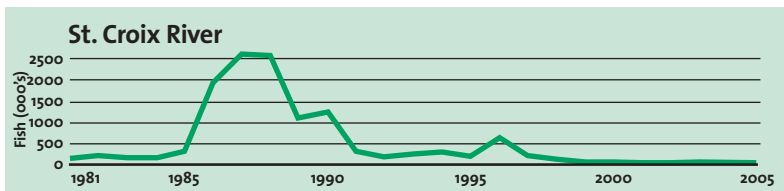
Maine: Of all the fish counts that ASMFC monitors, Maine river systems appear to be doing the best, although results are mixed. The Androscoggin River fish counts have fluctuated over the past 25 years. Fish counts in 2006 were 34,239 fish, 25 percent below the 25-year average. For the Saco River, fish counts in 2006 dropped to 7,994 fish, an 88 percent decline from the recent high in 2001.

Massachusetts: At the Essex Dam on the Merrimack River, fish counts have declined dramatically since the early 1990s from a high of 380,000 fish in 1991 to 98 fish in 2005. This represents a 99.9 percent decline.

Rhode Island: River herring runs are rapidly declining in Rhode Island. Some of the lowest fish counts ever recorded in the state occurred in 2005. The Gilbert Stuart run has historically been the state's highest. It declined from 290,000 fish in 2000 to 17,000 in 2004, representing a 95 percent decline in returning fish.

Connecticut: Since around 1990, river herring populations on the Connecticut River have been declining. At the Holyoke Dam fishway on the Connecticut River, counts went from around 630,000 in 1985 to only 21 in 2006 – a 99.9 percent decline in returning fish.

Pennsylvania: The Susquehanna River has experienced fluctuations in fish counts over the past four decades. However, fish counts reached an alarming low of just four fish in 2005, down from hundreds of thousands seen in the previous decade. This again represents a 99.9 percent decline in returning fish.



Source: ASMFC River Herring Compliance Reports.

these fish spend the majority of their life. Moreover, no action has been taken coastwide to comprehensively address the dramatic decline of river herring.

Fortunately, a management structure exists to address the complex migratory pattern of river herring and the multiple jurisdictions involved. The ASMFC was specifically established to manage fish that cross multiple political boundaries. In 2008, the ASMFC has the opportunity to consider additional management measures to protect river herring.

ASMFC: Amendment 1 to the Interstate Fishery Management Plan for Shad and River Herring (1999)

The Atlantic States Marine Fisheries Commission, an interstate body, enables states from Maine to Florida to develop fishery management plans (FMPs) for more than 20 migratory fish species. The ASMFC established its first fishery management plan for river herring in 1985 in response to rapidly declining stocks of shad and river herring (ASMFC, 1985).

In the mid-1990s, the ASMFC decided to modify the shad and river herring FMP primarily to change the management strategy for shad (ASMFC, 1999). The most significant change to the 1985 plan, articulated in Amendment 1, concerned a phase-out of the ocean intercept fishery for American shad by 2004. This fishery intercepted shad in ocean waters as they migrated along the coast. Unable to tell if shad were coming from healthy or depleted spawning runs, fishery managers shut down the entire fishery. River herring benefited from the closure as they were also caught in the intercept fishery.

In addition to its focus on shad, Amendment 1 included provisions on river herring. It required states to initiate monitoring programs to collect information on the river herring fishery and river herring populations. States were required to maintain existing or more conservative regulations for river herring. Since 1999, however, no additional management measures have been approved for river herring.

In May 2007, North Carolina proposed a coastwide moratorium on the harvest of river herring out of concern for the rapidly declining populations along the East Coast. Three months later, the ASMFC voted to initiate an amendment to the

FMP that would consider various measures to protect river herring, including a moratorium on the fishery.

Moratorium on River Herring Fishing in Massachusetts, Rhode Island, and Connecticut

Currently Massachusetts, Rhode Island, and Connecticut have statewide moratoriums on the harvest of river herring. The decision to close river herring fisheries in some of New England's waters began in Connecticut in 2002 when the commissioner of the Connecticut Department of Environmental Protection declared a moratorium on river herring harvest, which has been extended each year since. The current prohibition extends through March 31, 2008 (CT DEP, 2007).

Massachusetts followed with regulations in 2005, declaring "the harvest, possession or sale of river herring in the Commonwealth or in the waters under the jurisdiction of the Commonwealth by any person is prohibited through 2008." To accommodate the bait harvesting fisheries, up to five percent of the fish caught may be comprised of river herring species (MA DMF, 2005).

Rhode Island took emergency action in 2006 to establish a moratorium on river herring harvest. It implemented regulations two months later stating, "No person shall land, catch, take, or attempt to catch or take any alewives, *Alosa pseudoharengus* or blueback herring *Alosa aestivalis*, from any marine waters of the State of Rhode Island" (RIDEM, 2007a). A similar regulations was issued for alewife and blueback herring taken in fresh water (RIDEM, 2007b).

"Back in 1987, we had a big storm and the access to the bay where the fish started their migration shifted north because of erosion and sedimentation. The fish piled up on the east side of the sand bar looking for a way to get into the bay. In the years following the herring population returning to the river was very low. To protect the stock we placed a local moratorium on the taking of any river herring. We decided to restock and were able to eventually lift the moratorium. A second decline began in 2002. The stocks haven't returned to the same level since."

—Don St.Pierre, Chatham Herring Warden

North Carolina River Herring Fishery Management Plan: Amendment 1 (2007)

In contrast to states with stopgap regulations to protect river herring, North Carolina chose to enact a comprehensive fishery management plan for river herring. Concern over reductions in landings and the declining numbers of juvenile river herring in state waters led to the imposition of seasonal closures and fishing quotas as early as the 1990s. It also prompted the North Carolina Marine Fisheries Commission (NCMFC) to develop a comprehensive management plan for the fishery. In 2000, the NCMFC approved the Albemarle Sound Area River Herring FMP, which established an annual commercial limit of 300,000 pounds and a recreational limit of 25 fish per person per day.

Despite North Carolina's best efforts, river herring continued to decline. The NCMFC authorized the development of interim management measures for the 2006 river herring season as a result of the poor stock condition. The measures reduced the commercial catch to 100,000 pounds and the recreational limit to 12 fish per person per day.

The state evaluated the status of river herring stocks in preparation for the five-year update of the coastwide FMP. The stock assessment indicated poor stock condition, which led the NCMFC to approve strong conservation measures to its river herring FMP in February 2007. North Carolina officials enacted Amendment 1 establishing a variety of management and research programs designed to protect remaining stocks of river herring. Specific provisions included:

- ◆ setting landings of river herring at zero statewide;
- ◆ establishing a monitoring program and stock recovery indicators;
- ◆ surveying spawning and nursery areas and recommending restoration programs;
- ◆ endorsing predation research and considering a multi-species management program; and
- ◆ calling for research programs to collect and assess bycatch data from ocean fisheries.

North Carolina, Connecticut, Massachusetts, and Rhode Island deserve credit for taking action to protect river herring in their waters. Yet despite their efforts, river herring populations continue to decline. The time has come for a coastwide effort to minimize all sources of river herring mortality and prevent further declines.

National Marine Fisheries Service: Species of Concern List

The NMFS listed river herring (both alewife and blueback herring) as a “species of concern” in 2006. NMFS applies this designation to species when there are concerns about the status of the stock and threats to recovery, but not enough information to warrant listing under the Endangered Species Act. Designation as a species of concern is based on factors of demographic and genetic diversity, such as abundance and productivity, distribution, and life history characteristics. River herring met all these criteria and was listed in 2006.

Unfortunately, the NMFS Office of Protected Resources has a limited budget to conduct or support restoration efforts even though river herring are listed as a “species of concern.” Equally troubling, it has no management authority. Rather, states or management authorities may apply for funds from the Proactive Species Conservation Grant Program, which provides money to implement measures to prevent a species from being listed as threatened or endangered. Massachusetts submitted an application for funding, but NMFS had already allocated the \$500,000 appropriated to the program to two existing projects (Damon-Randall, 2007).

Threats to River Herring

Scientific studies have shown a number of factors that lead to the decline of river herring or prevent their recovery:

- ◆ excessive and unsustainable fishing,
- ◆ the construction of dams and other impediments that eliminated access to hundreds of miles of spawning grounds,
- ◆ pollution that degrades water quality and reduced suitable habitat in spawning and nursery areas, and
- ◆ predation on river herring by recovering fish populations, such as striped bass.

Fish Passage

Historically, efforts to restore river herring have focused largely on two major causes of decline: directed fishing and habitat loss. Efforts to control fishing were summarized in the discussion of state efforts to restore river herring. Habitat loss includes obstructions to fish passage (primarily dams), reduced water quality, and the elimination of habitat for spawning and nursery areas.

Concerns about fish passage are not new. In 1824, the residents of Gouldsborough, Maine, petitioned the state legislature to open a mill dam on Prospect Stream, which was “formerly visited, in the proper season, by great quantities of Alewives, which used to go up said stream to a pond at the head thereof, and there cast their spawn. . . .”

The petition asked for “convenient and sufficient passage . . . through or around said dam at a small expence, and without material injury to the Mills situated thereon” (Atlantic Salmon History Project, 2007).

In the 180 years since the Gouldsborough petition, similar concerns have been raised over limited access for diadromous fish to main stem rivers and tributaries for spawning.

When migratory fish encounter a

dam or any system blocking passage, all upstream habitat and spawning areas are eliminated. Dam removal and fish passage projects are necessary to expand the population of river herring by providing access to historical spawning grounds. These projects are vital to the recovery and sustenance of healthy river herring populations and must continue.



Photo: NOAA

Dams prevent millions of river herring from returning to their spawning streams. Fish ladders are often installed to help them migrate upstream.

Restoration Efforts

There are many ongoing restoration programs by towns and local groups to open waterways, create better habitat, and count river herring returning to their spawning grounds. An excellent example can be found on the Connecticut River (see Text Box) where state and federal agencies have made tremendous progress on restoring river herring populations in the Connecticut River basin. Runs that had dwindled to approximately two hundred fish in the early 1970s were restored to 630,000 fish by 1985. Clearly, such a serious commitment to restoration efforts can work.

But despite the best efforts on the Connecticut River, fish counts have once again plummeted to record low levels. The same river is empty again. Why?

Predation

Other observers have attributed the decline of river herring to the resurgence of predatory fish populations—striped bass in particular—resulting from successful fishery management programs. River herring are an important, and in some cases primary, source of food for predatory fish. Striped bass populations increased dramatically in the 1990s in response to strong conservation measures. Some scientists speculate that the resurgence in predatory fish populations has played a role in the poor recovery of river herring and are exploring this hypothesis.

However, the single most important factor contributing to the disappearance of river herring in recent years, and one that has often been overlooked, is bycatch. Large quantities of river herring are being scooped up by industrial mid-water trawlers fishing for Atlantic herring and Atlantic mackerel. Current methods of detecting and reporting bycatch of river herring in the industrial mid-water trawl fisheries are inadequate. If river herring populations are to recover, the problem of bycatch must be addressed.

The Arrival of Mid-Water Trawl Gear: Atlantic Herring and Mackerel Fisheries

In the 1990s, a new threat to river herring populations emerged, which has been largely overlooked by fishery managers. Amidst reports that Atlantic herring and

Restoration Efforts for Diadromous Fish: Connecticut River Basin

The Connecticut River has a long history of restoration efforts for diadromous fish species. Beginning in 1867, four adjacent states (Connecticut, Massachusetts, New Hampshire, and Vermont) agreed to work together to restore fish runs. Problems continued in the early 1900s, including increased water pollution and the construction of dams, which prevented fish from reaching spawning grounds.

Restoration efforts began again in the late 1960s when federal money became available through the Anadromous Fish Conservation Act (Public Law 89-304). The states and federal agencies worked together to restore anadromous fish to the river basin. The Policy Committee for Fisheries Management of the Connecticut River Basin conducted an ecological study of the river basin, assessed habitat for fish species, began negotiations with power companies regarding fish passage, and planned a restoration program. At the same time, water quality began to improve as a result of the Clean Water Act of 1977, allowing even greater opportunity for a successful restoration program.

The Connecticut River Atlantic Salmon Commission (CRASC), established in 1983, replaced the Policy Committee. Although CRASC's primary focus was Atlantic salmon, other diadromous fish—including both alewife and blueback herring—were often considered in management decisions. Today, CRASC has a fishery management plan for river herring.

The early efforts of CRASC were extremely successful for river herring. They identified targeted habitat, opened fish passage, and reintroduced species into habitats. Fish counts at the Holyoke Dam increased from an average of around 50 fish per year between the mid-1950s and mid-1960s, to a high of 630,000 fish in 1985. While returns remained high (in the hundreds of thousands) through the early 1990s, counts began again to decline dramatically after 2000. Only 21 fish returned in 2006, a 99.9 percent decline since 1985.

For a complete discussion of restoration efforts in the Connecticut River, see Gephard, S. and J. McMenemy. 2004.

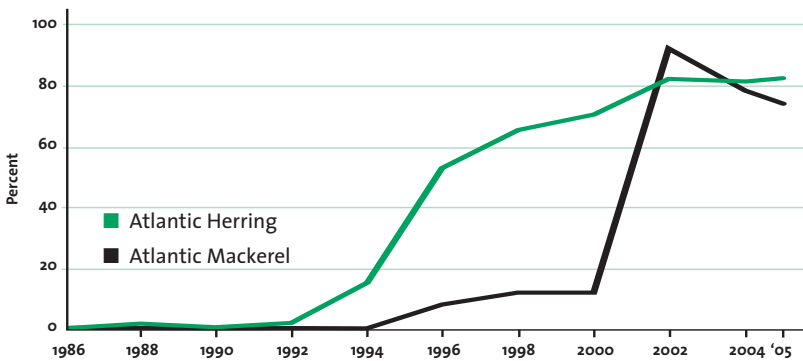
mackerel were plentiful and underutilized, a fleet of industrial mid-water trawl vessels gradually converged on the eastern seaboard. Ranging in length between 90 and 164 feet, these vessels deploy nets the size of a football field, and tow them at high speeds through the water column. This type of fishing gear catches many important marine species, from whales to bluefin tuna to river herring. Each year, the mid-water trawlers captured a greater percentage of the total landings for Atlantic herring (Figure 3). Within a decade, 80 percent of the Atlantic herring catch came from these vessels.

Within the Atlantic mackerel fishery, the percentage of landings taken by this gear remained relatively low until 2001, when more vessels entered the fishery. At that point, it jumped to 92 percent (Figure 3). With the arrival of mid-water trawl gear, the total quantity of mackerel caught increased dramatically. Mackerel landings rose from 12,000 metric tons in 2001 to 54,000 metric tons in 2004. As more mackerel are caught, the opportunity to incidentally catch river herring also increases.

The arrival of the mid-water trawlers in the 1990s appears to coincide with the recent declines of river herring.

Figure 3

Percent of Landings Coming from Mid-water and Mid-water Pair Trawl Gear



Source: NEFMC, 2005, and MAFMC, 2007.

River Herring Bycatch in the Atlantic Herring and Mackerel Fisheries

No one questions the fact that river herring are caught by at-sea fisheries for Atlantic herring and mackerel. The extent of this bycatch, however, and its true impact on river herring populations is unknown because NMFS has scant data on

the problem. The little data available suggest that the number of river herring taken by the mid-water trawl fleet is high—in some cases greatly exceeding the total landings of river herring by the directed fishery.

NMFS relies largely on fishermen to report the details of their catches. Herring species look similar, especially in a catch comprised of thousands of fish. As a result, fishermen often list all herring in a single category using generic terms such as “bait” or “herring species.” Indeed, a recent scientific review found evi-

dence that fishermen’s catch reports, used by NMFS to track the impact of the fishery, may be unreliable (McAllister, 2007).

In an attempt to verify the composition of species caught, NMFS conducts an onboard observer program to document catches. The observer program, however, has low coverage rates and flawed protocols.

The number of fishing trips observed by the program—or coverage rate—has fluctuated from 1 to 17 percent of total fishing trips since the mid-1990s, but are typically between 3 and 6 percent. When observer rates are low, vessels can afford to change their fishing patterns on the few trips where they are required to carry an observer. This is known as the “observer effect” (Babcock *et al.*, 2003). River herring bycatch appears to be episodic; therefore a full assessment to under-



Photo: www.FishingPix.net

Mid-water trawlers target mackerel and Atlantic herring, a completely different species, but they also catch an unknown quantity of river herring.

stand its impact will require higher coverage. A low number of onboard observers can leave uncommon but important bycatch events completely unaccounted for (Babcock *et al.*, 2003).

In addition to low coverage rates, there are problems with the quality of data collected. Even on an observed trip, vessels catch fish that are not sampled by the observer, either because the net is dumped—often on purpose to avoid reporting bycatch—or because some fish are left in the net. In other cases, vessels use sorting mechanisms that dump bycatch fish before they can be examined by the observer. In either case, bycatch goes unreported.

The flaws in the current observer program can be used to misinterpret or even purposefully distort data to demonstrate that the Atlantic herring and mackerel fisheries have little impact on river herring populations. The Atlantic mackerel FMP reports, for example, that river herring bycatch ranged from at least 600 pounds in 1996 to 11,570 pounds in 1997 (MAFMC, 1998). Likewise, the Atlantic herring FMP reports that the total observed take of river herring in the Atlantic herring fishery between 1994 and 2000 was 69,741 pounds for the mid-water trawl fishery and 45,024 pounds for the pair trawl fishery (two vessels pulling a single net) (NEFMC, 2005). These data give the impression that there is minimal impact; however, the numbers only reflect the bycatch witnessed by an observer on board. At best, these are minimum estimates.

In 2004, NMFS introduced a new sampling methodology that required standardized basket sampling. This obliged observers to take samples of fish throughout the net and to identify the catch by individual species (NEFSC, 2004). Prior to this, observers were not required to record a mid-water trawl catch by herring species (NEFSC, 2003). This change improved data on river herring bycatch, although problems still exist.

In 2006, NMFS observed 18 mid-water trawl trips on which 48,000 pounds of river herring were caught, a 2 percent bycatch rate. If this 2 percent rate is applied to all 2006 mid-water trawl landings for Atlantic herring, the data indicates that 700,000 pounds of river herring were taken as bycatch that year. Even more disturbing is the observer data for 2007. Only five mid-water trawl trips

carried observers between January and April. Of this sample, 105,000 pounds of river herring were taken for 297,000 pounds of Atlantic herring landed (NEFMC, 2007), indicating a 35 percent bycatch rate. These large amounts of bycatch could represent a single spawning run of river herring. Thus, a single net could eliminate the entire population of a river system.

Clearly the methodology and data quality for river herring bycatch is seriously flawed. NMFS must improve the program through broader observer coverage and more effective sampling for river herring to adequately account for bycatch in oceanic fisheries.

Wasted Resources: Bycatch and Discards in U.S. Fisheries

A unique study exploring bycatch in U.S. fisheries applied bycatch rates to total landings within a given year (Harrington *et al.*, 2005). Its goal was to produce estimates of discarded bycatch for each fishery. The report includes an analysis of both the Atlantic herring and Atlantic mackerel fisheries on the East Coast, and their impact on river herring.

Data from the observer program were used in the analysis, but instead of reporting the minimum amounts of bycatch observed, the researchers applied the bycatch rates to the entire fishery, thereby giving a closer approximation of the total amount of river herring caught by the Atlantic herring and mackerel fleets.

The analysis for Atlantic herring indicates that 380 metric tons (nearly 1 million pounds) of primarily alewife were caught in the Atlantic herring fishery in 2002 by mid-water and pair trawls.³ The bycatch-to-landings ratio was 0.035 (or 3.5 percent of the Atlantic herring landings). Whereas 3.5 percent bycatch seems low compared to the Atlantic herring landings, this level is significant when compared to river herring landings. A bycatch of one million pounds is equal to the annual coastwide, directed landings of river herring in recent years. It is also possible that the resemblance of river herring to Atlantic herring could conceal the fact that even more river herring were caught but counted as sea herring.

³ This analysis is based on 12 observed trips in 2002. The bycatch ratio is calculated and multiplied by total landings in 2002 to arrive at a bycatch estimate for the fishery during that year. Given the low percentage of observer coverage, the estimates may not be statistically significant.

Likewise, the analysis of 2002 data for Atlantic mackerel suggests that 17,091 metric tons (approximately 40 million pounds) of blueback herring were caught in the mackerel fishery in 2002 by mid-water and pair trawls.⁴ The bycatch-to-landings ratio for this fishery was 1.039 percent. This means that for every mackerel caught, a blueback herring was caught. This catch level is similar to the large river herring catches in the 1970s when foreign ships, were fishing off the Atlantic coast. These landings were blamed for the massive declines in herring in the 1970s and 1980s. To put the 40 million pound bycatch of blueback herring into perspective, consider that the annual harvest of river herring during the last 10 years has been less than two million pounds, and, more recently, under 1 million pounds.

The analysis presented in Harrington *et al.* (2005) suggests that more attention should be focused on the levels of river herring bycatch found in both the Atlantic herring and Atlantic mackerel fisheries. Greater observer coverage is necessary to adequately measure the river herring bycatch. In addition, bycatch limits are necessary to reduce mortality rates of river herring in both fisheries to prevent further declines of the alewife and blueback herring stocks.

Solutions

We are witnessing dramatic declines in river herring. Commercial river herring fisheries along the Atlantic coast have collapsed. The number of spawning fish returning to their natal streams has crashed to historic lows. Five major river systems—the St. Croix, Merrimack, Gilbert Run, Connecticut, and Susquehanna—have experienced a decline in fish counts of between 95 and 99.9 percent from historic highs to the present.

Despite efforts to restore populations, river herring continue to decline. Four states—Connecticut, Massachusetts, Rhode Island, and North Carolina—closed their waters to directed river herring fisheries. Numerous restoration efforts are underway to remove dams, build fish passage, and restock depleted river systems. Yet the trends have only worsened.

⁴ This analysis is based on four observer trips in 2002. The bycatch ratio is calculated and multiplied by total landings for the year. Given the low percentage of observer coverage, the estimates may not be statistically significant.

In the last decade, a new threat to river herring has emerged off the New England and mid-Atlantic coast: mid-water trawlers. These large vessels have tremendous capacity to catch everything in their path. Data suggest that an enormous volume of river herring is accidentally being caught by this gear.

If river herring are to stand any chance of survival, conservation measures must be put in place immediately. The Herring Alliance recommends that management action be taken by states, the Atlantic States Marine Fisheries Commission, and the National Marine Fisheries Service:

Recommendations to States:

- ◆ Increase accessible spawning grounds for river herring by removing dams or providing fish passage.
- ◆ Implement a moratorium on the directed river herring fishery to protect depleted stocks.
- ◆ Support coastwide management measures through the amendment process of the Atlantic States Marine Fisheries Commission.

Recommendations to the Atlantic States Marine Fisheries Commission:

- ◆ Adopt a coastwide management framework for river herring that includes meaningful management measures at the state and federal level.
- ◆ Reduce all sources of mortality on river herring.
 - Implement a moratorium on the directed river herring fishery to protect depleted stocks.
 - Limit the allowable bycatch of river herring by other fisheries.
- ◆ Require data collection programs to accurately document and monitor bycatch of river herring at sea.
- ◆ Support habitat protection and restoration efforts by encouraging dam removal and fish passage projects.

- ◆ Establish indicators of a healthy river herring population, beyond traditional measures of fishing mortality and spawning stock biomass, using the North Carolina Fisheries Management Plan as a guide.
- ◆ Conduct a stock assessment immediately to evaluate the status of river herring populations.

Recommendations to the National Marine Fisheries Service:

- ◆ Increase observer coverage in all mid-water trawl fisheries, especially the Atlantic herring and mackerel fisheries, to adequately account for total river herring losses. Any coverage level that does not allow a statistically significant extrapolation of observed bycatch should be unacceptable.
- ◆ Prohibit the dumping of unsampled catch on observed trips. All catch in the net must be made available to observers for basket sampling to identify the catch by species.
- ◆ Institute a weighmaster system to monitor the offload of Atlantic herring and mackerel vessels. All landed catch should be weighed using flow scales and port-sampled by trained personnel to identify the catch by species so that the data can be extrapolated to obtain an accurate species composition for the total landings by the fishery.
- ◆ Limit river herring bycatch.
- ◆ Report the annual bycatch levels of river herring to the Atlantic States Marine Fisheries Commission.
- ◆ Increase efforts by the Office of Protected Resources to encourage recovery of river herring populations.



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