Fish of Yesterday, Fish of Tomorrow

PERRY-WYNNS FISH COMPANY

Written by Jim Wilson

Once a fish of "primitive abundance," populations of river herring have crashed to mere shadows of what they were in the past.

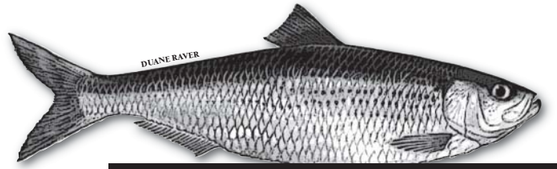
Can the two species be restored, or will they remain simply reminders of what used to be?

"The recent trend of the North Carolina fisheries has not been altogether satisfactory, and the condition of the industry demands the thoughtful consideration of fishermen and lawmakers. . . . Protective measures addressed to diminishing fishes must be radical if they are to accomplish any real benefit."

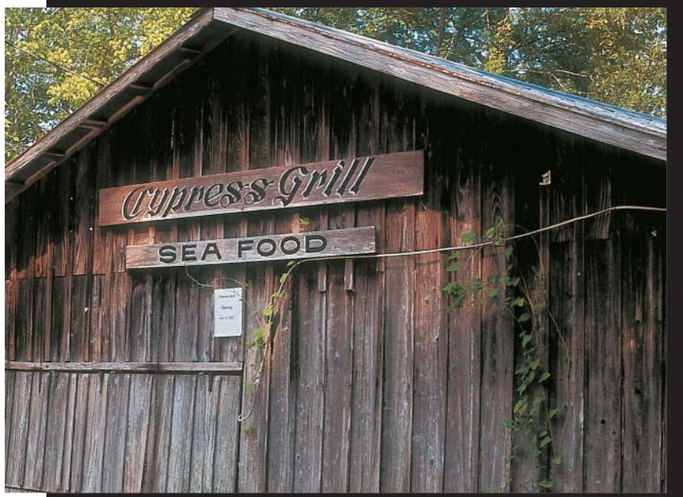
–Hugh M. Smith, "The Fish of North Carolina," 1907

In the coastal rivers of the East Coast, river herring have gone about their business of feeding, spawning and being eaten for untold centuries. Until the final decades of the 20th century, the alewife and the blueback herring, the two species collectively known as river herring, had done very well in their ecological roles.

The fish consumed zooplankton, reproduced by the millions each year, and at some stage of their lives were eaten by humans and other mammals, fish, birds, amphibians and reptiles. "Their abundance and cheapness make them of almost incalculable importance," Deputy U.S. Commissioner of Fisheries Hugh M. Smith wrote of alewives in "The Fish of North Carolina" in 1907.



DUANE RAVER



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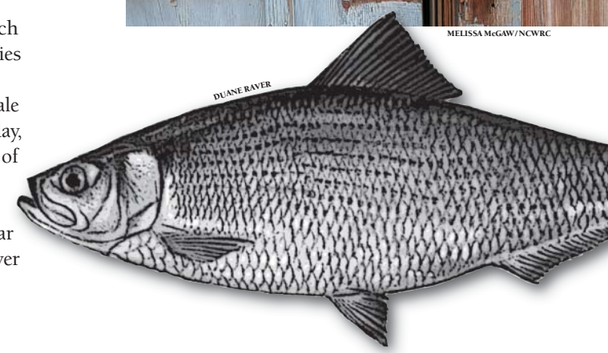
Fishermen once unloaded brimming boatloads of river herring (left) at such fish houses as Perry-Wynns in Colerain on the Chowan River. With river herring stock depleted and a fishing moratorium in place, venerable establishments such as the Cypress Grill in Jamesville face an uncertain future.

One hundred years later, river herring had fallen to such perilously low numbers that N.C. Division of Marine Fisheries director Louis Daniel, speaking to the Marine Fisheries Commission last February, stated that "Every spawning female river herring in the Chowan River is important." Later that day, the commission enacted the radical "protective measures" of which Smith wrote by ending the harvest of river herring.

What had brought a once-thriving fishery, in which North Carolina landings of 10 million pounds or more a year were commonplace, to the point where every fish in the river



DUANE RAVER

NORTH CAROLINA DEPARTMENT OF NATURAL RESOURCES

JOEL C. HOLLAND

Scenes from Sutton Beach (top) in the late 1800s and Chowan Beach in 1941 show the fishing bounty provided by river herring.

had value? The basis for river herring's "almost incalculable importance" had swung 180 degrees, from abundance to paucity, throughout its range, with no definitive reasons for the paucity and no promise that the abundance would ever return.

Fish of History

Aside from inhabitants of the Coastal Plain, most people in North Carolina are unfamiliar with river herring. The two species' lack of publicity belies their importance. Blueback herring and alewives have played significant ecological, historical, cultural and economic roles, particularly in the northeastern counties, dating to the beginnings of our state and nation.

River herring have provided sustenance and income for inhabitants of what has historically been one of the state's poorer regions. The annual return of silvery masses of alewives (*Alosa pseudoharengus*) and bluebacks (*A. aestivalis*) was a fixed and anticipated natural occurrence that signaled the return of spring and sent an influx of protein up the rivers for the profusion of creatures that prey on them.

If the return of river herring was constant, so was some North Carolinians' steadfast dependence upon them. Because the little fish have oily flesh that can be preserved with salt—no ice required—river herring have been exploited since Colonial times. By 1765, Alexander Brownrigg had a sizeable herring and shad fishery operating at his plantation on the Chowan River, which, along with the Albemarle Sound, has traditionally been at the center of the fishery.

Historian Mark T. Taylor wrote in the *North Carolina Historical Review* in 1992 that by 1846, 15 major haul seines were operating in a 30-mile stretch of the sound. Pound nets began to replace the more labor-intensive haul seines in 1870, and by 1896 there were 1,125 of those nets in the sound and its tributaries.

The herring fishery grew to such an extent that by end of the 19th century, as Chowan County native W. Scott Boyce estimated in his 1917 Ph.D. dissertation entitled "Economic and Social History of Chowan County, North Carolina, 1880-1915," fishermen in the Chowan River and Albemarle Sound areas were landing 20 million pounds of river herring most years.

During the period of Boyce's study, herring could be purchased on the riverbanks at the height of the season for as little as $1.00 per thousand. Even at an average price of $2.50 per thousand, the fish, which could be eaten fresh, dried or pickled, were cheap fare. Meals of river herring, cornbread and black yaupon tea three times a day got many families through lean periods of the year, and much of the year for some citizens. Yaupon grew wild, and its leaves were dried for making tea. Corn was priced at 40 cents per bushel. "A dollar a month," Boyce wrote, "would procure for a person the most usual diet of much of the population."

Although long-term historical data for river herring landings in North Carolina are scant, the number of fish pulled from the waters of the area must have been enormous. In 1996, N.C. State University's Joe Hightower, along with co-authors Anton Wicker and Keith Endres, examined historical trends in river herring and American shad abundance in the Albemarle Sound in the *North American Journal of Fisheries Management*. Using data from a haul seine fishery that operated from 1845 to 1907 and the pound net fishery of 1977 to 1993, Hightower wrote that, based on modeling the years 1845 to 1993, the maximum sustainable yield for river herring was 12.6 million pounds, which is very close to the actual average harvest. That, Hightower wrote, was "clearly a sustainable harvest under historical conditions of stock productivity." (Maximum sustainable yield is the maximum number of a fish population that can be removed each year under existing environmental conditions without damaging the stock's ability to grow back.)

In the late 19th century, few people considered that populations of bluebacks and alewives would not always be bountiful. Even such a prominent scientist as Englishman Thomas H. Huxley, president of the Royal Society and an early supporter of Charles Darwin's theory of evolution, thought that some fish species existed in such prodigious numbers that they could never be depleted.

"I believe, then, that the cod fishery, the herring fishery, the pilchard fishery, the mackerel fishery, and probably all the great sea fisheries, are inexhaustible; that is to say, that nothing we do seriously affects the number of the fish," Huxley said in 1883. "And any attempt to regulate these fisheries seems consequently, from the nature of the case, to be useless."

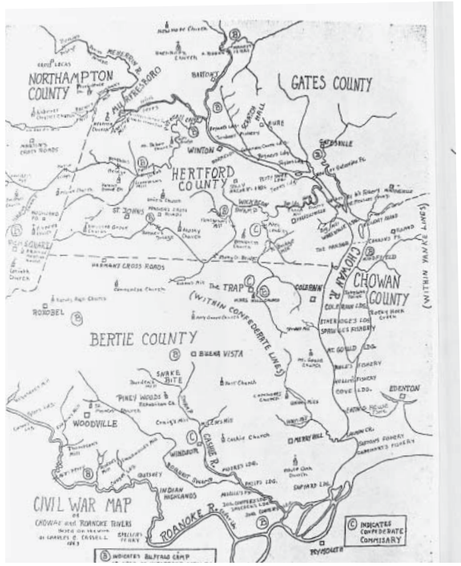
But even as far back as the 1870s, Spencer Baird, a zoologist who was then assistant secretary of the Smithsonian Institution and first commissioner of the new U.S. Commission of Fish and Fisheries, thought that river herring populations were declining. "I am inclined to think, for various reasons, that too little has been done in our waters toward the restoration to their primitive abundance of the Alewife," Baird wrote.

Baird went a step further and speculated that the decline of some important New England fisheries, which in part prompted the birth of the commission he directed, could be directly related to the decline of river herring, rather than Atlantic herring, as many thought at the time. "After a careful consideration of the subject, however, I am strongly inclined to believe that it is due to the diminution of the Alewives," Baird wrote. "[B]efore the construction of dams in the tidal rivers, the Alewife was found in incredible numbers along our coast. … The coincidence, at least in the erection of the dams, and the enormous diminution in the number of the Alewives, and the decadence of the inshore cod fishery, is certainly very remarkable."

Trouble at Home

Fisheries problems were evident in North Carolina, too, though perhaps they were slower to develop in the less-industrialized northeastern Coastal Plain. (Even in the late 19th century, dams and polluted water hurt fish populations, and the northern states seemed to have more of both.) Of particular concern was a decline of American shad, which prompted the state to propagate and stock millions of those fish in the Albemarle Sound from 1877 to 1884. Fishing pressure in the area was substantial. So many pound nets filled Albemarle Sound that in 1905 the N.C. General Assembly passed the Vann Law, which mandated that fishermen must leave a channel in the sound for migrating fish. In 1911, a fisheries convention convened in New Bern to examine the state's fisheries and what one speaker called the "great depletion which has been on the increase among the commercial fisheries."

As the 20th century progressed, the annual catches of river herring began to decline, though not precipitously. Instead of the 20 million pounds annually that Boyce



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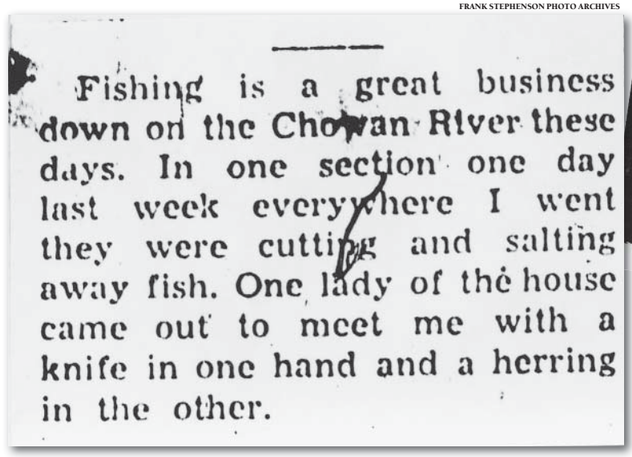
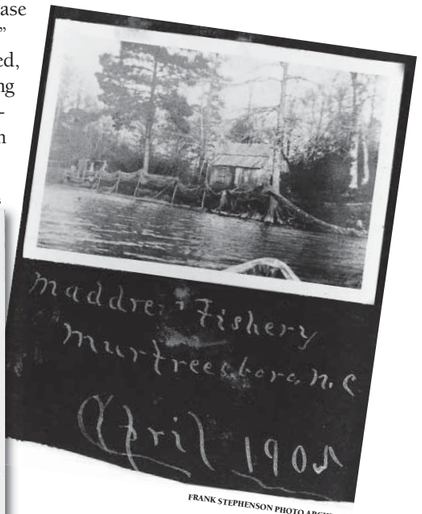
Herring long have been intertwined in northeastern North Carolina culture, as evidenced by this Confederate engineer's 1863 map which indicates fishery locations and a newspaper clipping from 1944. Maddrey's Fishery on the Meherrin River was just one of many operating in 1905.



Fishing is a great business down on the Chowan River these days. In one section one day last week everywhere I went they were cutting and salting away fish. One lady of the house came out to meet me with a knife in one hand and a herring in the other.

FRANK STEPHENSON PHOTO ARCHIVES



FRANK STEPHENSON PHOTO ARCHIVES

MAP ILLUSTRATIONS BY BILL TIPTON

Historically, alewives have ranged from southeastern Canada to South Carolina, with blueback herring extending to northern Florida. Since populations of the two fish have crashed, four states — North Carolina, Massachusetts, Connecticut and Rhode Island — have declared moratoria on fishing. North Carolina has requested that the Atlantic States Marine Fisheries issue a coastwide moratorium.

calculated, North Carolina fishermen by the 1950s were landing 11 million or 12 million pounds. In the early 1970s, the catch sank to about 8 million pounds. The last harvest reminiscent of the flush years of the fishery occurred in 1985, when fishermen landed 11.5 million pounds.

The following year, landings fell by 41 percent to 6.8 million pounds. The slide continued, and this time it was dramatic, as the catch dwindled to fewer than 1 million pounds by 1993. The N.C. Marine Fisheries Commission in 1995 implemented a season extending from Jan. 2 to April 14. The fishery operated under the season in 1995 and 1997. In 1996 and 1998, the rule was suspended and the season extended, with a 250,000-pound total allowable catch (TAC) and a 400,000-pound TAC, respectively. In 1999 the commission amended the rule and allowed a 450,000-pound TAC. From 2000 to 2005, the fishery operated on a 300,000-pound TAC. All TACs were in effect only for the Albemarle Sound Management Area; the remainder of the state operated under the Jan. 2–April 14 season. The TAC dropped to 100,000 pounds in 2006.

This robust fishery had declined to such an abysmal state that the 2006 landings were just over 100,000 pounds, with a value of only $83,182. The combined spawning stock biomass — the total weight of all the sexually mature fish in the population — for alewife and blueback herring in the Chowan River was less than 200,000 pounds. With other biological indicators for river herring also having bottomed out, DMF biologists called for a harvest moratorium. Recognizing that stocks had collapsed, the N.C. Wildlife Resources Commission already had enacted a moratorium on river herring harvest for inland waters.

Clearly, the situation with the stock was, as Marine Fisheries Commission chairman Mac Currin described it, "dire." What was unclear was why. Although DMF staff had determined in the latest N.C. River Herring Fishery Management Plan that the two species were overfished and that overfishing was continuing, other factors — loss of habitat, water quality, predation and oceanic bycatch — likely were affecting or exacerbating the decline.

Those environmental problems and the decline of river herring are not confined to North Carolina. Three other states — Massachusetts, Rhode Island and Connecticut — also have moratoria. DMF director Daniel has asked the Atlantic States Marine Fisheries Commission (ASMFC), a compact of the 15 Atlantic coast states that coordinates management of those states' shared nearshore fisheries, to implement coastwide restrictions for bluebacks and alewives.

In 1965, the Atlantic states harvested 64.3 million pounds of river herring. Forty years later, those states combined for 724,714 pounds, a decline approaching 99 percent.

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The Big Black Box

It's impossible to talk about river herring without acknowledging that as commonplace as the fish have been, much about them is unknown. The two small fish species are similarly sized — reaching a maximum of approximately 12 to 13 inches — and look very much alike. They appear together in Atlantic waters from southeastern Canada to northern South Carolina. Bluebacks are found south to northern Florida.

Bluebacks and alewives are members of the Clupeidae family and are related to American shad, hickory shad, menhaden and sardines. Like shad — and striped bass — river herring are anadromous, meaning they spend most of their lives in salt water but return to fresh water in the spring to spawn. After spawning, the surviving adult fish head back to the Atlantic. The juveniles remain in the rivers and estuaries and then depart for the sea in late autumn or early winter, bound eventually for the continental shelf off New England.

It is when bluebacks and alewives disappear into the sea — what Wildlife Commission Coastal Regional Fishery Supervisor Pete Kornegay calls "the big black box of the Atlantic Ocean" — that our knowledge of them truly diminishes. "A lot of things can happen out there that we don't know about," Kornegay said.

Dick Brame, executive coordinator of the Coastal Conservation Association's Atlantic States Fisheries Committee, thinks there is indeed something happening to river herring while they are at sea. "I've always had a suspicion that they are bycatch in an ocean fishery we aren't aware of," Brame said. "One of the things we saw was when the ASMFC banned ocean netting of shad, lo and behold, those fish have begun to come back."

River herring bycatch in the oceanic Atlantic herring fishery is reported by National Marine Fisheries Service observers to be small, but the fishery for Atlantic herring, a different species of migratory, nonanadromous herring, is huge and growing. The 2005 landings of Atlantic herring totaled nearly 215 million pounds, about 87 percent of which came off Massachusetts and Maine. The days observers spend onboard fishing vessels are few but increasing. Even with an observer onboard, Brame said, it can be difficult for that person to differentiate alewives and bluebacks from Atlantic herring.

"When they empty a big purse seine, you're looking at millions of fish coming onto that ship," Brame said. "You can't see the trees for the forest."

Sara Winslow, Northern District manager for DMF, said that finding out what is

Fishermen haul seine at Capehart's Fishery in 1884 on the Chowan River in Bertie County.

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happening to river herring has become "one of the big issues that all the East Coast states have questions about. Something's happening; nobody really knows where it's happening, so we need to get a handle on where the removal is occurring. It's not occurring in North Carolina. It's on the East Coast, but where, I don't think anybody really knows."

During a 2005 meeting of the ASMFC's Shad and River Herring Management Board, Andy Kahnle of the New York State Department of Environmental Conservation said that on a trip to New York's Fulton Fish Market, he looked inside boxes labeled "Herring." "In those boxes were hickory shad, alewife and American shad, all about 10 to 12 inches long," Kahnle said. "So, there is a harvest that continues for all these species somewhere, and it's making it to the market."

Invasion of the Foreign Fleet

For a brief period beginning in the late 1960s, it was all too clear what was happening to river herring in the ocean. And what was taking place would have far-reaching effects.

In 1969 North Carolina fishermen's nets were flush with bluebacks and alewives. The total landings in our state numbered 19,761,700 pounds, more than in any other year since the National Marine Fisheries Service began keeping landings data in 1950. Following catches of 11.5 million pounds, 12.7 million pounds and 11.2 million pounds through 1972, the landings declined in 1973, and that trend continued.

From 1967 to 1972, a fleet of foreign fishing vessels recorded large catches of river herring in United States coastal waters, with the highest harvest—24 million pounds—occurring in 1969. Most of those river herring were immature fish less than 7 ½ inches in length. "This level of fishing pressure on subadult river herring was probably a major factor contributing to the declines in commercial landings of river herring along the Atlantic coast seen in the mid-1970s," DMF biologists concluded in the Fishery Management Plan.

The Magnuson-Stevens Act ended the directed harvest of river herring within the 200-mile Exclusive Economic Zone of the United States in 1977. Even with that fishery closed, river herring stock failed to show any significant improvement and remained on a downward track.

That's true enough, said Kornegay, but he doesn't believe the large landings at that time are the reason river herring stocks are depressed 35 years later. "Foreign fleets and Russian trawlers were really popular to blame during the Cold War," he said. "Some people still like to believe that was the cause. River herrings' longevity is such that they should have recovered several times since then."

CLUPEIDAE FAMILY

River herring and their cousins are found in many of the same waters off the Atlantic Coast.

BLUEBACK HERRING

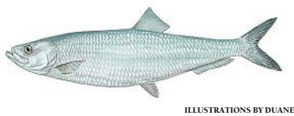
ALEWIFE

ATLANTIC MENHADEN

AMERICAN SHAD

HICKORY SHAD

ATLANTIC HERRING



ILLUSTRATIONS BY DUANE RAVER

For Kornegay, the major factor in the decline of river herring stocks is simple. "They were just totally overfished, decade after decade," Kornegay said. "Once you beat a population to a certain level, it doesn't take much of a perturbation to put them over the edge. The SSB [spawning stock biomass] is so low right now that any fishing pressure will be the final nail in the coffin."

The SSB is one of the statistics biologists look at to determine the health of a stock. According to the latest assessment, in 2003 the SSB for bluebacks was 89,678 pounds and for alewives 92,442 pounds. The figure for alewives has actually increased since 1995, when the SSB bottomed out at 10,862 pounds. Those figures are mere shadows of what they used to be. The blueback SSB averaged 8.3 million pounds between 1972 and 1986. For alewives the SSB from about the same period ranged from 1.1 million pounds to 3.1 million pounds.

At age 3, some river herring begin returning to their natal rivers—presumably—to spawn. But the bulk of the fish do not spawn until age 4, and some are 5 years old before spawning for the first time. Thus all the fish that comprise the 2007 year class will not spawn until 2012.

After their initial attempt, river herring return annually to spawn, and the repeat spawners are more productive than virgin spawners. Biologists can detect repeat spawners in fish samples by marks on their scales, caused probably by erosion on the edges of scales when the herring return to fresh water from the ocean and cease feeding until they have spawned out.

In 2006 DMF failed to find any blueback repeat spawners in its sample. That did not mean there were no repeat spawners in the entire population, but it was the first time DMF could not detect any repeat spawners among either males or females in its annual sampling, which dates back to 1972. Biologists in 2005 had found no male repeat spawners and 3.6 percent repeat females. For alewives in 2006, there also were no male repeat spawners, but 7 percent repeat females.

DMF's goal in its effort to restore river herring is to achieve a combined 10-percent repeat spawner rate among Chowan River blueback herring, which historically have tended to have higher populations than alewives here and are used as the indicator species in the Fishery Management Plan.

Another of the key indicators is the juvenile abundance index. As with the SSB and repeat spawner numbers, juvenile abundance is down. Abundance is measured in catch per unit of effort. The effort in this case is one haul of a 60-foot bag seine. Since the first sampling in 1972, the highest catch per unit of effort for bluebacks was 362.9 juveniles per haul. In 2006, the juvenile abundance index was 0.5. DMF biologists would like to see the bluebacks reach a three-year moving average of 60 fish landed per unit of effort.

The fourth key indicator is recruitment, which is the number of new fish added to the stock each year. One of the problems with river herring today is historical recruitment overfishing. "That is a situation in which fishing mortality rates have significantly reduced annual recruitment," said Kent Nelson, Fisheries Program Manager for the Wildlife Commission. "It is characterized by a greatly reduced spawning stock, loss of older fish in the population and generally low recruitment year after year. Sustained recruitment overfishing can lead to stock collapse, especially if combined with other factors, such as poor environmental conditions."

DMF biologist John Carmichael noted in his 1996 assessment of Chowan River bluebacks that recruitment overfishing has been occurring for decades: "Strong year classes of the late 1960s sustained the stock through the mid-1970s, then poor 1975–1977 cohorts [year classes] contributed to the decline in the late 1970s. Exceptional recruitment of the 1978–1981 cohorts, averaging 30.5 million fish, allowed the stock to rebuild in the early 1980s, but another series of poor cohorts from 1983-1986, combined with sustained high fishing mortality, led to a decline in overall stock abundance."

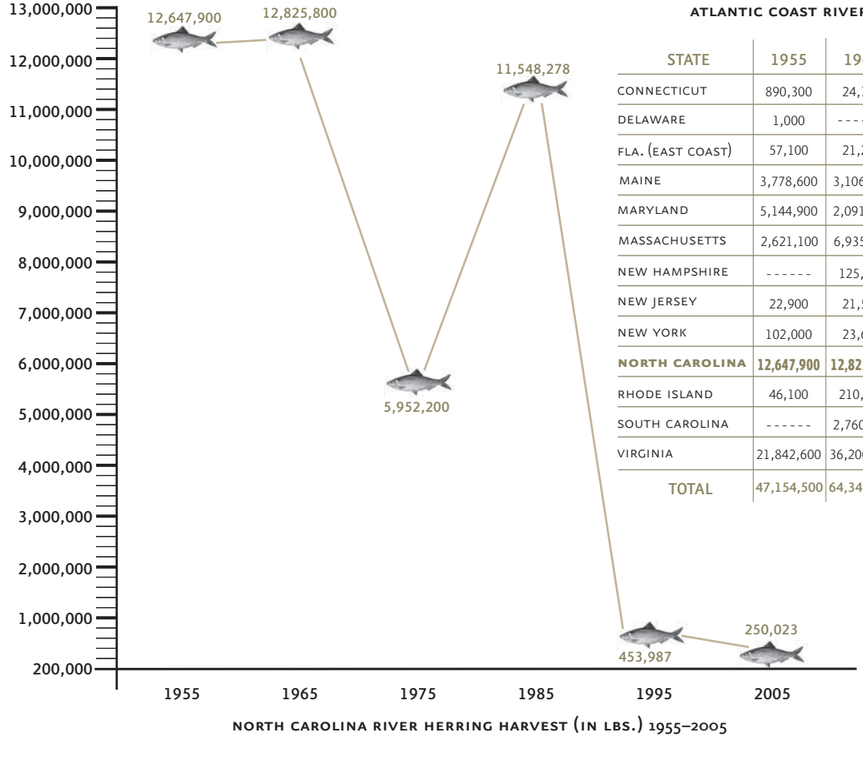
Some of the year classes at the time were truly large. There were 38.9 million recruits in the 1978 cohort, followed by 15.2 million, 38.1 million and 59.7 million. After that bang-up effort in 1981, recruitment spiraled downward. The following year produced only about 8 million. By 1997, the number fell below 1 million for the first time.

Winslow blames the recruitment failure on the low SSB. "I don't think the spawning stock is there to produce the recruitment," she said. "The population is at such low levels now, and you're dealing with only two or three year classes of fish that are contributing. Historically you had fish from 3 to 8 years old, and those repeat spawners had higher fecundity of eggs, more eggs. I think really that was where the recruitment was coming from. These fish that are spawning now are virgin fish; they're spawning for the first time, and then they're out of the system."

During the 1970s and for a few years in the 1980s, annual landings remained high, but the harvest was heavy with age-3 fish that had contributed only a few offspring to the population. Not until surveys began to show fewer and fewer juvenile fish did the problem become apparent. Fishermen had unknowingly harvested the future.

Dipnetters and Stripers

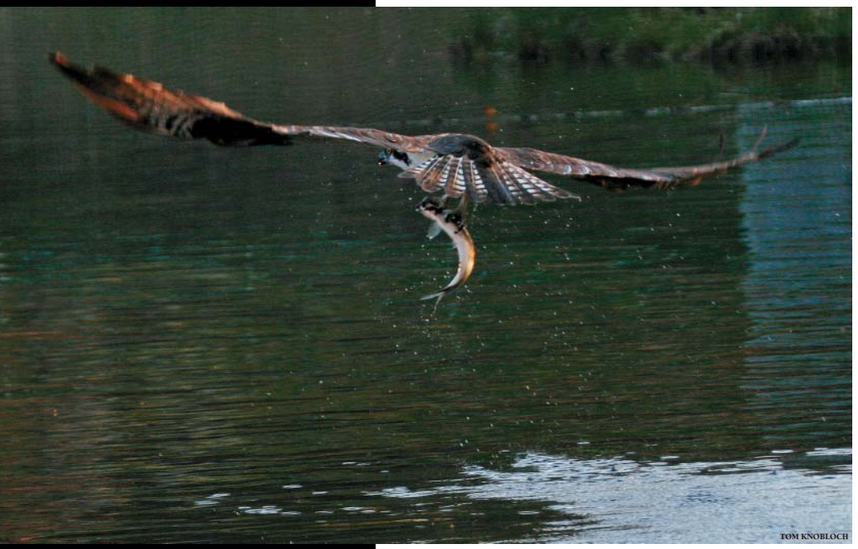
Among the restrictions DMF and the Wildlife Commission placed on the river herring fishery before the moratorium was a daily creel limit for recreational fishermen. Though the commercial harvest is well documented for several decades, the recreational component is all but unknown.



NORTH CAROLINA RIVER HERRING HARVEST (IN LBS.) 1955–2005

ATLANTIC COAST RIVER HERRING HARVEST (IN LBS.) 1955–2005

STATE	1955	1965	1975	1985	1995	2005
CONNECTICUT	890,300	24,100	25,200	38,900	14,044	------
DELAWARE	1,000	------	600	7,600	19,500	3,819
FLA. (EAST COAST)	57,100	21,200	1,800	------	------	------
MAINE	3,778,600	3,106,455	3,768,300	1,344,900	247,170	336,770
MARYLAND	5,144,900	2,091,800	718,400	183,900	34,582	38,368
MASSACHUSETTS	2,621,100	6,935,300	1,716,900	46,600	------	------
NEW HAMPSHIRE	------	125,000	------	61,300	------	------
NEW JERSEY	22,900	21,500	9,300	4,800	795	1,079
NEW YORK	102,000	23,600	15,300	150	------	------
NORTH CAROLINA	**12,647,900**	**12,825,800**	**5,952,200**	**11,548,278**	**453,987**	**250,023**
RHODE ISLAND	46,100	210,000	41,500	400	------	------
SOUTH CAROLINA	------	2,760,000	18,300	------	------	------
VIRGINIA	21,842,600	36,200,300	11,359,900	432,000	240,393	94,655
TOTAL	47,154,500	64,345,055	23,627,700	13,668,828	1,010,874	724,714


TOM KNOBLOCH


FRANK STEPHENSON


MELISSA McGAW/NCWRC

Ospreys are among the birds (top) that prey on river herring. One method of preserving the fish is to dip them in salt water and let them air dry (middle). Pound nets have long been the most popular method of fishing for herring.

There has never been much of a hook-and-line fishery for river herring, although some fish have been landed in recent years on Sabiki rigs — multiple-hook setups with artificial flies used for catching baitfish. Most of the recreational catch has been for personal consumption, using small nets such as bow, dip or skim nets, but drifted or set gill nets have been popular, too.

In the late 1960s, Wildlife Commission biologist Don Baker, the future chief of the Division of Inland Fisheries, surveyed the anadromous fish runs into inland waters and found that fishermen in those waters had harvested about 2.9 million pounds of river herring between April 1, 1967, and March 31, 1968. Baker determined that 76 percent of the herring catch was made with dip nets. Although the commercial harvest was much higher at the time, the recreational harvest over many years would have been another substantial factor in river herring fishing mortality.

Effective July 1, 2006, the commission placed a moratorium on the possession of river herring greater than 6 inches in length in all inland fishing waters of coastal rivers and their tributaries up to the first impoundment on the main course of the river, and all other inland waters east of Interstate 95. The 6-inch restriction allows anglers to use herring from stunted populations of inland reservoirs as bait. Most migrating herring are longer than 6 inches. In 2007, sensing an economic opportunity, some North Carolina seafood dealers imported fresh river herring from other states for sale as bait. In order to use those herring as bait, recreational fishermen were required to have in their possession a dated receipt, including the name of the retail store where they bought the fish. The receipt allowed enforcement officers to verify that the herring came from a legal source.

Bluebacks and alewives have long been the preferred natural bait for striped bass in eastern North Carolina and especially in the thriving Roanoke River fishery. The reason, of course, is that stripers prey on river herring, as do any number of other fish, including weakfish, bluefish, largemouth bass, white bass, white perch and yellow perch. (Throughout the Atlantic coastal area, birds such as cormorants, blue herons, ospreys and bald eagles also consume river herring.)

"To me, there's tremendous recreational and economic value to society in having abundant river herring to feed striped bass, or having juvenile river herring to feed a largemouth bass or crappie or warmouth," Kornegay said. "The adults and juveniles can really drive the prey base of all these game fish we consider important."

Some people believe that striped bass are one reason why river herring stocks have diminished. Stripers, however, have been blamed for other declining populations on both coasts, everything from blue crabs to steelhead trout, Chinook salmon, weakfish and American shad. Striped bass do eat those species and many more, but the argument that striped bass are primarily to blame for river herring declines doesn't work for Kornegay.

"Stripers and river herring have coexisted for years," he said. "There is no doubt that 1-year-old striped bass love to eat juvenile river herring. Whether or not that's having an impact on the stock is unknown. The crash in the river herring stocks began well before resurgence in striper stocks. The two events do not coincide."

Ironically, striped bass is another species whose population reached such low levels that many Atlantic states closed their coastal fisheries for much of the 1980s. The rebuilding of striped bass stock — from 4.6 million fish in 1982 to 65 million fish in 2005 — has proven to be one of the great fish management success stories. According to ecologist and author Carl Safina, "The resurgence of striped bass along the eastern coast of the U.S. is probably the best example in the world of a species that was allowed to recoup through tough management and an intelligent rebuilding plan."

All of those striped bass have to eat, and during their spring and fall migrations, river herring make up a sizeable portion of Albemarle Sound striper diets — although menhaden appear to be the preferred prey. With river herring populations having declined, is it possible that striped bass and other predators could be a limiting factor?

"I think it will hinder recovery a lot," Winslow said. "I think the populations are low enough for river herring and large enough for striped bass that predation probably is having some type of impact now."

Moratoria worked for striped bass; it is uncertain whether a moratorium will ever restore river herring to their former abundance. More than two years ago, recently retired DMF director Preston Pate told the ASMFC Shad and River Herring Management Board: "Our concern at home is that we may have done too little too late, and the population may be at such a low level that it can't return, that there's just not enough mass there to turn the momentum of decline around."

Back in 1996, Carmichael warned that restoration could be problematic. "Even if exploitation is reduced significantly," he wrote, "population growth will be minimal until recruitment improves significantly."

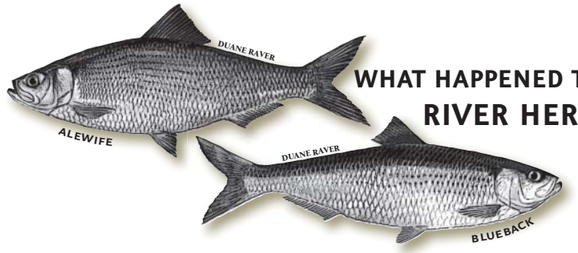
Brame is hopeful that the moratorium will provide relief. "We've found with other species that when we have put in measures to control harvest, populations have rebounded," he said. "We should have been controlling harvest for a long time. Herring are one of the greatest failures under the Fisheries Reform Act. The stock is beyond overfished; it's collapsed."

Under the 1997 N.C. Fisheries Reform Act, DMF is obligated to rebuild an overfished stock within 10 years. Even with a moratorium, DMF says the herring stock cannot be rebuilt in a decade. It could take 10 years plus one lifespan, which would amount to about 16 years. It could be more; it could be never.

Kornegay said he also thinks river herring can rebound. "They are so resilient that they can recover if we leave the existing spawning stock alone," he said. "I figure a minimum of five years before any recovery, and 10 to 15 years is more likely. We don't have any room for error, as decimated as the stock is now."

Impediments to Rebuilding

Aside from overfishing, which has been the primary factor in the decline of river herring,



WHAT HAPPENED TO RIVER HERRING?

POSSIBLE REASONS FOR THEIR POPULATION PLUMMET

HABITAT LOSS
Habitat has been lost not only through dam building, which blocks river herring's upstream access, but also from stream channelization, road culverts and even beaver dams.

PREDATION
While humans have been a major factor in river herring mortality, many fish, including striped bass and largemouth bass, also eat them, as do birds, reptiles and mammals.

BYCATCH
Bycatch remains one of the unknowns in the decline of river herring. Some biologists suspect that unintended catch of alewives and bluebacks in oceanic fisheries could be substantial.

WATER QUALITY
Although blue-green algae blooms once were common in the Chowan River because of excessive nutrients, water quality has markedly improved and should not limit restoration of the species.

OVERFISHING
The major factor in the decline of river herring has been overfishing, particularly of younger fish that have had little or no opportunity to spawn.

ILLUSTRATIONS BY BILL TIPTON

Surveying spawning areas is a crucial need. One of the possible ways to rebuild river herring stock is with a stocking program,

either through capture and relocation of adults or through a larval stocking program.

Before that could happen, however, biologists would have to know the viable and nonviable spawning runs.

Division of Marine Fisheries biologists annually sample to determine the abundance of juvenile river herring.

loss of habitat and diminished water quality also have affected the fish. The problems with habitat are various. Riparian habitat is being lost to development; river herring no longer can access upstream portions of some tributaries because of road culverts and other obstructions, including beaver dams; and stream banks have been altered by navigation or drainage projects.

In his 1996 study, Hightower, after stating that the 11.9-million-pound average harvest from 1880 to 1970 was sustainable, wrote: "Thus, the only remaining question is whether habitat has been lost or degraded to such a degree that historical levels of harvest are no longer possible." In other words, a lack of habitat could be a limiting factor in rebuilding the stock.

Despite a loss of some habitat, DMF biologists concluded in the Fishery Management Plan that there are not enough spawning river herring now to fully utilize the habitat that is available.

"To me there still is suitable habitat for the population to be brought back," Winslow said. "Through a combination of adult trap and transport, possible stocking, I think we can bring it back. Nobody is going to expect a 10-million-pound harvest anymore. The market's not there; the demand's not there. As far as it being a viable stock again, I think it can be done.

"It's not going to happen overnight, and unfortunately that's what most folks want, and that isn't going to happen. When you figure three to five years before anything spawned this year is going to be sexually mature, you're going to need two or three generations before you start seeing anything."

Christian Waters, Piedmont regional fishery supervisor for the Wildlife Commission, studied the effects of water quality on the hatching success of blueback herring eggs in the Chowan River. He agrees that river herring stock can be rebuilt. "It's pretty clear that overfishing is the cause of the decline," he said. "My graduate work with Joe Hightower indicated that water quality is not the limiting factor for restoration, and my observations would further suggest habitat loss isn't either. Those issues would limit the restoration to 19th-century levels, but I am confident a viable population could be supported under current conditions."

Water quality in the Albemarle Sound area, including the Chowan River, actually has improved over the past 20 years. But in 1979, the Chowan became the first body of water in the state to receive the designation of Nutrient Sensitive Waters because of excessive algae blooms. The Chowan drains about 4,800 square miles of North Carolina and Virginia. Periodically throughout the 1970s, '80s and '90s, blue-green algae blooms plagued the river, lowering the dissolved oxygen content in the water. Fish kills were not uncommon, and the algae blooms also had detrimental effects on plankton. The water quality problems were simply one more impediment for river herring.

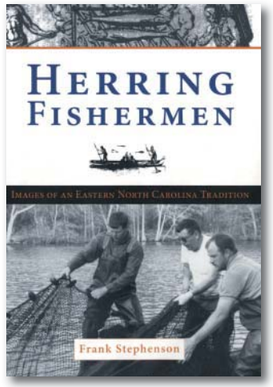
"East Carolina University did several projects and showed that at that time there was a decline in those zooplankton and phytoplankton," Winslow said. "Once they significantly reduced the nitrogen and phosphorous entering the river, mainly from point and nonpoint source discharges in the Chowan basin, the algae blooms started disappearing."

That CF Industries, a fertilizer manufacturer in Winton, shut down and Union Camp Bleached Paper Division in Virginia improved the quality of its effluent also benefited the river's water quality. CF Industries remains a Superfund site, however.

DMF has been unable to survey as much spawning habitat as it would like because of a lack of funding. In the early and mid-1970s, DMF's anadromous fish program operated largely with federal funds that were available based on the large harvests of foreign offshore fleets. As the landings declined, so did the amount of money the state received. Biologists have surveyed spawning habitat in two Albemarle Sound tributaries in the past 19 years — in 1993 and 2001. Other areas with historic river herring populations, such as the Tar-Pamlico, Neuse and Cape Fear, have not been surveyed in more than 25 years, due to loss of federal funds and personnel.

Surveying spawning areas is a crucial need. One of the possible ways to rebuild river herring stock is with a stocking program, either through capture and relocation of adults or through a larval stocking program. Before that could happen, however, biologists would have to know the viable and nonviable spawning runs.

Such a stocking program might never get under way because of the lack of hatchery facilities. "I do not see us as being able to convert any of our hatcheries to mass-produce river herring in enough numbers to make a significant difference," said Bob Curry, chief of the Wildlife Commission's Division of Inland Fisheries. "It would impact our other production. We can certainly experiment with methodologies on how to do it. We can experiment with ways that we may be able to move some fish and mark them to see if they are having an impact.



Frank Stephenson's "Herring Fishermen" is published by History Press.

"We would have to give up a lot to convert one of our facilities to forage fish, and that's basically what you would be doing. I don't see the ability to be able to buy hatcheries. If we can get a coastwide moratorium and get rid of the bycatch, I think the animals can recover on their own with time. And it does take time."

The Wildlife Commission has two warmwater hatcheries, McKinney Lake in Richmond County and Watha in Pender County.

Another stocking method some scientists are exploring is trap and transfer. Roger Rulifson, a fisheries biologist from East Carolina University, currently is working with commercial fishermen to test whether an adult river herring stocking program can be practical in North Carolina. He and Andrew Gross, an ECU Master of Science candidate, collected adults with commercial pound nets in the Scuppernong River, and then transported them to Lake Phelps where they were released. Work during the summer and fall will determine whether the adults spawned successfully in the lake, and also whether adults were able to migrate back to Albemarle Sound from the lake. "Adult alewife stocking is common practice in New England," Rulifson said, "but we'll have to wait until all data are collected on mortality related to capture, transport and release before we can determine success of the method."

As fisheries management moves into a new century, ecosystem management seems to be the path of the future. Instead of managing species by species, biologists would manage for the sustainability of the ecosystem.

There is a caveat, or perhaps more than one. "Ecosystem management sounds like a great idea until you try to implement it," Brame said. "Maybe we need to look first at the forage base, identify the species, look at them as a whole and figure out how many we need to support piscivorous species. We need to look at that forage base and what effects changes in it have on predators. We've ignored the bottom of the food web, just assumed it would be there. Now we're finding maybe it won't be."

In a 2005 meeting of the ASMFC Shad and River Herring Management Board, Eric Smith of the Connecticut Department of Environmental Protection noted that there are species, such as river herring and weakfish, that have declined for reasons that are not clear. Mortality in the ocean, he said, can be great.

"I think as we approach ecosystem management, we ought to start seriously looking at the fact that some of the valuable fisheries we have and the ones that are cherished, we may not have in the same way that we have had in the past, as some of the other fish we manage come back in greater abundance.

"It may just be a sad fact of life that you don't see river herring because you have a bigger fish out there that's eating a lot of them."

River herring, Kornegay said, could provide an opportunity to think anew about fisheries management. "I think it would be great if we had the stock for a commercial fishery. But you have to err on the side of conservation. If you have doubts, you err on the side of the fish; you don't gamble with the fish.

"River herring could be a poster child for how we should do things right, how to correct things that are wrong in fisheries management. Do we keep fishing them into extinction or do the right thing and give that stock the time it takes to recover? Then we can all begin to enjoy the benefits of having river herring around again."

Jim Wilson is the associate editor of Wildlife in North Carolina.

NATURE'S WAYS

How Can River Herring Live in Both Fresh and Salt Water?

See Nature's Ways, page 39.