

**FISHERY MANAGEMENT PLAN UPDATE
RIVER HERRING
AUGUST 2020**

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

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| Original FMP Adoption: | February 2000 |
| Amendments: | Amendment 1 – September 2007 Amendment 2 – May 2015 |
| Revisions: | None |
| Supplements: | None |
| Information Updates: | None |
| Schedule Changes: | Delay review one year to 2021. |
| Next Benchmark Review: | May 2025 |

In North Carolina blueback herring (*Alosa aestivalis*) and alewife (*Alosa pseudoharengus*), collectively known as river herring, are managed under Amendment 2 to the North Carolina River Herring Fishery Management Plan (FMP) for River Herring. The original North Carolina River Herring FMP adopted February of 2000, focused on issues pertaining to stock conditions (overfished and recruitment overfishing), habitat degradations, and research/monitoring expansion to provide assessment data and socioeconomic data (NCDMF 2000). Amendment 1 to the North Carolina River Herring FMP implemented a no-harvest provision for commercial and recreational fisheries of river herring in coastal waters of the state, effective in 2007 (NCDMF 2007). This was a result of the North Carolina Division of Marine Fisheries (NCDMF) 2005 stock assessment of river herring (data through 2003) that determined blueback herring and alewife were overfished and overfishing was occurring, there was minimal recruitment with continued declines in abundance for both species, and high fishing mortality rates (Grist 2005). Additional management strategies included gear restrictions and stock recovery indicators (based on blueback herring). It also included a 7,500 pounds limited research set-aside harvest to be used for data collection and to provide product to local herring festivals. The NCDMF Director allocated a maximum of 4,000 pounds to be used for this discretionary harvest season by permitted fishermen, which occurred in the Chowan River Herring Management Area around Easter week each year. Additional outcomes of Amendment 1 included implementing monitoring programs, endorsing additional research on predation, restoration, impediments, bycatch and supporting spawning area habitat protection.

Amendment 2 to the North Carolina River Herring FMP was finalized in 2015 with three issues: 1) eliminating the discretionary river herring harvest season and permit since it was not serving the intended purposes of providing biological data for stock analysis and local product; 2) moving the Albemarle Sound/Chowan River Herring Management Areas to 15A NCAC 03R .0202, which corrected a reference and corrected the boundary of the Cashie River Anadromous Fish Spawning Area, and 3) removing alewife and blueback herring from exceptions in the Mutilated Finfish Rule 15A NCAC 03M .0101 (NCDMF 2015a).

Due to the Rules Review Committee receiving at least 10 letters requesting legislative review (pursuant to G.S. 150B), a portion of the third issue to prohibit possession of river herring (alewife and blueback herring) greater than six inches aboard a vessel or while engaged in fishing from the shore or a pier underwent legislative review during the 2016 spring short session. Since a bill was not introduced specifically disapproving the rule, the rule was effective June 13, 2016 in the River Herring Rule 15A NCAC 03M .0513.

In addition to the state FMP, North Carolina river herring also are managed through Amendment 2 of the Atlantic States Marine Fisheries Commission (ASMFC) Interstate FMP for Shad and River Herring. Adopted in 2009, Amendment 2 requires management measures from the ASMFC be adopted by North Carolina as the minimum standard for the fishery, while the North Carolina plan can adopt additional measures (ASMFC 2009). Additionally, Amendment 2 requires that states and jurisdictions develop sustainable FMPs in order to maintain a commercial and/or recreational river herring fishery past January 2012.

To ensure compliance with interstate requirements, North Carolina also manages river herring under the North Carolina Fishery Management Plan for Interjurisdictional Fisheries (IJ FMP). The goal of the IJ FMP is to adopt fishery management plans, consistent with N.C. law, approved by the Mid-Atlantic Fishery Management Council, South Atlantic Fishery Management Council, or the ASMFC by reference and implement corresponding fishery regulations in North Carolina to provide compliance or compatibility with approved fishery management plans and amendments, now and in the future. The goal of these plans, established under the Magnuson-Stevens Fishery Conservation and Management Act (federal council plans) and the Atlantic Coastal Fisheries Cooperative Management Act (ASMFC plans) are like the goals of the Fisheries Reform Act of 1997 to “ensure long-term viability” of these fisheries (NCDMF 2015b).

Management Unit

Blueback herring (*Alosa aestivalis*) and alewife (*Alosa pseudoharengus*) management authority lies with the ASMFC. Responsibility for management action in the Economic Exclusive Zone (EEZ), located from 3 to 200 miles from shore, lies with the Secretary of Commerce through the Atlantic Coastal Fisheries Cooperative Management Act in the absence of a federal FMP. The NCDMF also has a state FMP in place for statewide management of river herring.

Goal and Objectives

The goal of Amendment 2 to the North Carolina River Herring FMP is to restore the long-term viability of the river herring population. To achieve this goal, the plan adopts the following objectives:

- Identify and describe population attributes necessary to sustain long-term stock viability.
- Protect, restore, and enhance spawning and nursery area habitats.
- Initiate, enhance, and/or continue programs to collect and analyze biological, social, economic, fishery, and environmental data needed to effectively monitor and manage the river herring fishery.
- Promote education and public information to help the public understand the causes and nature of problems in the river herring stocks, its habitats and fisheries, and the rationale for management efforts to solve these problems.

The goal of Amendment 2 to the ASMFC Interstate FMP for Shad and River Herring (River Herring Management) is to protect, enhance, and restore east coast migratory spawning stocks of alewife and blueback herring in order to achieve stock restoration and maintain sustainable levels of spawning stock biomass. To achieve this goal, the plan adopts the following objectives:

- Prevent further declines in river herring (alewife and blueback herring) abundance.
- Improve our understanding of bycatch mortality by collecting and analyzing bycatch data.
- Increase our understanding of river herring fisheries, stock dynamics and population health through fishery-dependent and independent monitoring, in order to allow for evaluation of management performance.
- Retain existing or more conservative regulations for American shad and hickory shad.
- Promote improvements in degraded or historic alosine critical habitat throughout the species' range.

STATUS OF THE STOCK

Life History

River herring is a collective term for alewife and blueback herring. River herring are anadromous fish, meaning they migrate from the ocean, through inlets into coastal bays and sounds and ascend into freshwater rivers and streams to spawn. Alewife spawn in rivers, lakes, and tributaries from northeastern Newfoundland to South Carolina, but are most abundant in the Mid-Atlantic and the Northeast. Blueback herring prefer to spawn in swift flowing rivers and tributaries from Nova Scotia to northern Florida but are most numerous in waters from the

Chesapeake Bay south. Mature alewife (ages 3 to 8) and blueback herring (ages 3 to 8) migrate rapidly downstream after spawning. Juveniles remain in tidal freshwater nursery areas in spring and early summer but may also move upstream with the encroachment of saline water. As water temperatures decline in the fall, juveniles move downstream to more saline waters. Little information is available on the life history of juvenile and adult river herring after they emigrate to the sea and before they mature and return to freshwater to spawn.

Adult river herring feed primarily on zooplankton (small, often microscopic animals floating in the water column) although they may also feed on fish eggs, crustacean eggs, insects and insect eggs, and small fish in some areas and in larger individuals. In general, alewife are larger than blueback herring of the same age and with each species females are larger than males. Total length for either species in North Carolina rarely exceeds 12 inches.

Stock Status

An Atlantic coastwide stock assessment update for river herring was completed in August 2017, with data through 2015, by the Atlantic States Marine Fisheries Commission. Results indicate that river herring remain depleted and at near historic lows on a coastwide basis (ASMFC 2017). The North Carolina portion of the coastwide stock assessment is for the Chowan River blueback herring stock only, due to the long-term data available for this area. River herring in other parts of the state are currently listed as unknown by the ASMFC due to the lack of data for these systems. The stock assessment update found that, although the North Carolina stock in the Chowan River was not experiencing overfishing (harvesting from a stock at a rate greater than the stock's reproductive capacity to replace fish removed through harvest) due to the harvest moratorium, the stock still remains overfished. The factors leading to this recommendation of stock status remain largely unchanged since the 2012 stock assessment, despite a fishing pressure that is negligible. The spawning stock biomass (SSB) for blueback herring, a stock status indicator, remains 12 percent of the amount necessary to replace itself in the complete absence of fishing (Figure 1).

Stock Assessment

The ASMFC stock assessment update used a forward-projecting, age-structured statistical catch-at-age model for the Chowan River blueback herring stock. The stock assessment incorporated blueback herring data from total in-river catches, age compositions, length compositions and a fisheries-independent juvenile index to estimate age-3 abundance and mortality rates, from 1972 to 2015. Based on the 2015 fishing mortality rate and female spawning stock biomass estimates, the Chowan River blueback herring population is overfished but over-fishing is not occurring. Estimates of fishing mortality have been close to zero since the moratorium. Juvenile abundance is well below the target of 60 fish per haul with no increasing pattern evident. The percentage of repeat spawners varied from 2007 through 2010, remaining below the target of 10 percent, but has exceeded the target since 2011 to the highest level in 22 years of 16.8 percent in 2015. The SSB for blueback herring has been increasing since 2010, but still remains at approximately 12 percent of the target of 3.9 million pounds.

It is worthy to note the importance physical habitat and water quality play in the recovery of the river herring stocks in North Carolina and coastwide (NCDMF 2009). In North Carolina, considerable habitat area has been lost through wetland drainage, stream channelization and conversion to other uses. Some streams are blocked by dams, storm debris, and other physical barriers. Migration and spawning may be affected by the replacement of small road bridges and culverts. Oxygen consuming wastes are discharged into several streams and practices to control non-point discharges are inadequate causing nuisance algal blooms, fish kills, and fish diseases over the years. The NCDMF initiated a survey of culverts and obstructions following Amendment 1 to the 2000 River Herring FMP. The list created from the survey has resulted in the replacement of failing culverts and prioritized others for replacement or repair.

STATUS OF THE FISHERY

Current Regulations

In 2007, Amendment 1 to the North Carolina River Herring FMP implemented a no-harvest provision for commercial and recreational fisheries of river herring in coastal waters. The North Carolina River Herring FMP Amendment 2, adopted by the North Carolina Marine Fisheries Commission (NCMFC) in May 2015, eliminated the discretionary river herring harvest season and permit, removed alewife and blueback herring from exceptions in the Mutilated Finfish Rule, and prohibited the possession of river herring (blueback herring and alewife) greater than six inches aboard a vessel or while engaged in fishing from the shore or a pier.

Commercial Landings

North Carolina landings of river herring from 1972 through the mid-1980s peaked at 11.5 million pounds (Table 1 and Figure 2). Most landings occurred in the Chowan River and Albemarle Sound system. River herring landings declined sharply starting in 1986, prior to the implementation of regulations specific to river herring, first implemented in 1995. Amendment 1 implemented a no-harvest provision in 2007, allowing only for a limited discretionary harvest to provide local herring to festivals and continue NCDMF data collection from commercial fisheries. Table 2 includes information on landings data from 2007 through 2014 when the limited research set-aside season was prosecuted before being eliminated under Amendment 2 in 2015.

Recreational Landings

There is currently no recreational fishery for river herring per the no harvest provision outlined in Amendment 1. Formerly, most river herring caught recreationally were likely used for personal consumption or for bait. For the years leading up to the 2007 harvest closure, the extent of river herring harvest for personal consumption and bait in coastal North Carolina is unknown.

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

Commercial fishing activity is monitored through fishery-dependent sampling conducted by the NCDMF since 1972 in the Chowan River. The dominant gears for river herring were gill nets and pound nets. In 2007, the no-harvest provision essentially eliminated commercial landings. However, the Chowan River Pound Net survey was implemented in 2008, for the 2009 sampling year, to provide estimates of commercial catch-per-unit effort (CPUE), percent of repeat spawners, and age and sex data for alewife and blueback herring.

Table 3 and Table 4 describe the mean, minimum and maximum length data for blueback herring and alewife from 1972 to 2019. In 2019, a total of 1,125 blueback herring and 1,433 alewife were measured from the Chowan River pound net survey. The overall average size of blueback herring was 9.25 inches fork length and 9.50 inches fork length for alewife. Variation in modal, minimum, and maximum ages throughout the fishery-dependent monitoring is described in Table 5 for blueback herring and Table 6 for alewife, with little variation across the time-series. Figure 3 and Figure 4 illustrate the overall length at age (mean, minimum, and maximum) for blueback herring and alewife from all age samples collected at any given age from 1972 to 2019.

The NCDMF has monitored river herring repeat spawning since 1972 (Table 7 and Figure 5). Percent repeat spawners for blueback herring from the Chowan River spawning stock is one of the stock recovery indicators identified in Amendment 1. The Chowan River blueback herring spawning stock should contain at least 10 percent repeat spawners (percent of the spawning stock that have spawned more than once). Since 2011, percentages of blueback herring have increased to levels above the restoration target, with the exception of 2017. For alewife percentages have been above the restoration target since 2007, with the exception of 2014.

Total pound net effort (operable nets per week), estimated total river herring catch (pounds), and CPUE for the Chowan River Pound Net Survey (Table 8) shows a downward trend through 2012 followed by an increasing trend through 2017. In 2019, approximately 46 percent of the estimated total river herring catch were blueback herring, based on the weekly subsample of river herring from the survey.

Fishery-Independent Monitoring

The NCDMF has conducted an annual juvenile (age-0) seine survey for river herring since 1972. The seine survey has been conducted twice a month, at eleven fixed sites, in the Albemarle Sound-Chowan River area from June to October. Only the first pull from each month is used to calculate the index of abundance for juvenile river herring. Juvenile index of abundance of blueback herring is one of the stock recovery indicators identified in Amendment 1. The blueback herring juvenile index should exceed the three-year moving average 60-fish per haul. The relative annual abundance of juvenile blueback herring has remained well below the target of 60-fish per haul since the mid-1980's (Figure 6). Due to the low numbers of juvenile alewife caught across the time series, these data have not been used for management and are only shown here as an illustration of the trend in abundance (Figure 7). In 2019 overall mean juvenile index

of abundance was 33.02 for blueback herring and 0.07 for alewife. The annual index value for blueback herring, while still below the restoration target, is the highest on record since 1993.

Adult river herring are monitored using the NCDMF Albemarle Sound Independent Gill Net Survey (IGNS). The Albemarle Sound IGNS began collecting biological data on adult river herring in 1991 but did not start collecting aging structures until 2004. The survey uses a stratified random sampling scheme designed to characterize the size and age distribution for key estuarine species in the Albemarle Sound. River herring index of abundance has been calculated from the Albemarle Sound IGNS since 1991. Blueback herring and alewife index of abundance from the 2.5 and 3.0 inch stretched mesh (combined), January through May, 1991 to 2019 are shown in Table 9 and Figure 8. Catch of both species has increased since 2012.

Table 10 and Table 11 describe the mean, minimum and maximum length data for blueback and alewife from 1991 to 2019. In 2019, a total of 1,687 blueback herring and 2,063 alewife were measured from the Albemarle Sound IGNS. The overall average size of both blueback herring and alewife was 9.50 inches fork length. Variation in modal, minimum, and maximum ages throughout the fishery-dependent monitoring is described in Table 12 for blueback herring and Table 13 for alewife, with little variation since aging began in 2004. Figure 9 and Figure 10 illustrate the overall length at age (mean, minimum, and maximum) for blueback herring and alewife from all age samples collected at any given age from 1999 to 2019.

MANAGEMENT STRATEGY

Amendment 1 to the North Carolina River Herring FMP implemented four stock recovery indicators to evaluate stock status. Under Amendment 2 to the North Carolina River Herring FMP, the plan development team determined that only three of the stock recovery indicators were necessary and decided that the term stock status indicator was more appropriate, using blueback herring as the indicator species. The three stock status indicators were adopted by the North Carolina River Herring FMP plan development team, each based on a three-year moving average. The plan development team recommended using the first two stock status indicators (juvenile abundance and repeat spawners) as a trigger for doing a stock assessment earlier than 10 years. If a three-year moving average of each of the indicators was above the threshold, it would trigger the need for a new stock assessment, which would determine the third stock status indicator. The third stock status indicator sets the threshold that determines when the river herring fishery will re-open.

1. Catch per unit effort (CPUE) of 60 young-of-the-year per haul in the Albemarle Sound juvenile abundance survey.
2. Ten percent repeat spawners observed in fishery-dependent pound net samples.
3. Spawning stock biomass (SSB) of 30 percent unfished SSB, estimated in stock assessment model.

Collectively, these indices represent *minimal* stock rebuilding goals for the recovery of river herring stocks in the Albemarle Sound and Chowan River. In the 2012 stock assessment ASMFC recommended a ten-year interval between stock assessments (ASMFC 2012). The plan development team recommended using the first two stock status indicators (juvenile abundance

and repeat spawners) as a trigger for doing a stock assessment earlier than 10 years. If a three-year moving average of the first two indicators was above the threshold, it would trigger the need for a new stock assessment, which would determine the third stock status indicator.

The stock status indicator for percent repeat spawners of blueback herring has exceeded the target of 10 percent since 2011, except for 2017. The increase in the percent repeat spawners is a positive sign, which means that the current management strategy is working. Juvenile abundance has remained well below the target since the early 1990s. Spawning stock biomass will need to continue to increase enough to see results in the juvenile index before the fishery could reopen.

RESEARCH NEEDS

The NCMFC implemented a series of management strategies under North Carolina River Herring FMP Amendment 2. These management strategies and their implementation status are listed in Table 13. On an annual basis the ASMFC publishes a prioritized list of research needs for American shad and river herring in the Review of the Atlantic States Marine Fisheries Commission Fishery Management Plan for Shad and River Herring (ASMFC 2019). For more information on research needs for American Shad please see:

http://www.asmfc.org/uploads/file/5dc5d3bbShad_RiverHerringFMPReview_2019.pdf

FISHERY MANAGEMENT PLAN SCHEDULE RECOMMENDATION

The North Carolina River Herring FMP Amendment 2 was adopted by the Marine Fisheries Commission in 2015. An Atlantic coastwide stock assessment update for river herring was completed in August 2017, with data through 2015, by the ASMFC. Results indicate that river herring remain depleted and at near historic lows on a coastwide basis (ASMFC 2017). The Division of Marine Fisheries recommends the next review of the River Herring FMP begin in 2021, one year later than originally planned. This will provide additional time to submit to the ASMFC an updated North Carolina Sustainable Fishery Management Plan for River Herring and evaluate the need to preserve both a state and ASMFC river herring plan, the potential for achieving efficiencies by addressing any redundancy in management, and the possibility of retiring the state FMP while continuing to manage river herring via the North Carolina FMP for Interjurisdictional Fisheries and the ASMFC's Interstate Fishery Management Plan for Shad and River Herring.

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TABLES

Table 1. Commercial harvest in pounds of river herring in North Carolina, 1972-2006, all waterbodies combined. Commercial harvest prohibited in 2007.

| Year | Commercial Weight (lb) |
|------|------------------------|
| 1972 | 11,237,143 |
| 1973 | 7,925,898 |
| 1974 | 6,209,542 |
| 1975 | 5,952,067 |
| 1976 | 6,401,360 |
| 1977 | 8,523,813 |
| 1978 | 6,607,153 |
| 1979 | 5,119,150 |
| 1980 | 6,218,523 |
| 1981 | 4,753,723 |
| 1982 | 9,437,703 |
| 1983 | 5,868,332 |
| 1984 | 6,516,109 |
| 1985 | 11,548,278 |
| 1986 | 6,814,323 |
| 1987 | 3,194,975 |
| 1988 | 4,191,211 |
| 1989 | 1,491,077 |
| 1990 | 1,157,625 |
| 1991 | 1,575,378 |
| 1992 | 1,723,178 |
| 1993 | 916,235 |
| 1994 | 644,334 |
| 1995 | 453,984 |
| 1996 | 529,503 |
| 1997 | 334,809 |
| 1998 | 521,930 |
| 1999 | 443,494 |
| 2000 | 332,336 |
| 2001 | 306,761 |
| 2002 | 174,860 |
| 2003 | 199,716 |
| 2004 | 188,541 |
| 2005 | 250,021 |
| 2006 | 109,847 |

Table 2. Harvest landings and value of discretionary river herring harvest season in North Carolina, 2008-2014.

| Year | # of Permits Issued | Quota (lb/permit/period) | Harvest (lb) | Value (\$) |
|------|---------------------|--------------------------|--------------|------------|
| 2008 | 13 | 250 | 1,292 | 775 |
| 2009 | 27 | 125 | 643 | 836 |
| 2010 | 30 | 125 | 1,765 | 1,765 |
| 2011 | 23 | 150 | 1,611 | 1,611 |
| 2012 | 18 | 150 | 678 | 678 |
| 2013 | 12 | 150 | 743 | 743 |
| 2014 | 27 | 150 | 989 | 1,319 |

Table 3. Length (fork length, inches) data of blueback herring sampled from the Chowan River commercial fisheries, 1972-2019. *In 2007 a no-harvest provision went into effect and the Chowan River Pound Net survey began in 2009.

| Year | Mean Fork Length | Minimum Fork Length | Maximum Fork Length | Total Number Measured |
|-------|------------------|---------------------|---------------------|-----------------------|
| 1972 | 9.75 | 7.00 | 11.50 | 2,564 |
| 1973 | 9.75 | 5.50 | 11.50 | 2,208 |
| 1974 | 9.75 | 7.25 | 11.50 | 1,622 |
| 1975 | 9.50 | 6.00 | 11.00 | 2,428 |
| 1976 | 9.75 | 8.25 | 11.25 | 1,564 |
| 1977 | 9.75 | 5.50 | 11.75 | 1,425 |
| 1978 | 10.00 | 8.25 | 11.75 | 1,342 |
| 1979 | 10.00 | 8.25 | 12.25 | 1,218 |
| 1980 | 10.00 | 8.25 | 11.50 | 1,229 |
| 1981 | 10.00 | 8.50 | 12.00 | 1,469 |
| 1982 | 9.75 | 8.75 | 11.50 | 851 |
| 1983 | 9.50 | 8.25 | 11.25 | 482 |
| 1984 | 9.25 | 7.75 | 11.25 | 450 |
| 1985 | 9.50 | 8.50 | 11.25 | 388 |
| 1986 | 9.50 | 7.25 | 10.75 | 347 |
| 1987 | 9.50 | 8.00 | 11.00 | 318 |
| 1988 | 9.25 | 8.00 | 11.25 | 314 |
| 1989 | 9.25 | 8.25 | 10.75 | 273 |
| 1990 | 9.25 | 8.00 | 10.75 | 275 |
| 1991 | 9.25 | 8.00 | 11.00 | 357 |
| 1992 | 9.25 | 8.00 | 10.75 | 368 |
| 1993 | 9.25 | 7.50 | 10.50 | 160 |
| 1994 | 8.75 | 8.00 | 10.75 | 84 |
| 1995 | 9.25 | 8.25 | 10.50 | 322 |
| 1996 | 9.50 | 8.00 | 11.25 | 626 |
| 1997 | 9.50 | 8.00 | 11.25 | 625 |
| 1998 | 9.25 | 6.00 | 11.00 | 1,361 |
| 1999 | 9.50 | 7.75 | 11.00 | 720 |
| 2000 | 9.00 | 7.75 | 11.00 | 1,213 |
| 2001 | 9.25 | 7.75 | 10.75 | 667 |
| 2002 | 9.25 | 8.00 | 10.75 | 338 |
| 2003 | 9.00 | 7.50 | 10.50 | 304 |
| 2004 | 9.00 | 7.75 | 10.25 | 245 |
| 2005 | 9.00 | 7.75 | 10.75 | 305 |
| 2006 | 8.75 | 7.75 | 10.00 | 156 |
| 2007* | 9.00 | 7.75 | 10.75 | 231 |
| 2008* | 8.75 | 7.50 | 11.00 | 928 |
| 2009* | 9.00 | 7.75 | 10.50 | 546 |
| 2010* | 8.75 | 7.50 | 10.25 | 833 |
| 2011* | 9.00 | 7.50 | 10.50 | 500 |
| 2012* | 9.00 | 7.00 | 10.50 | 412 |
| 2013* | 9.00 | 7.75 | 10.75 | 492 |
| 2014* | 8.50 | 7.50 | 10.25 | 691 |
| 2015* | 8.75 | 7.75 | 10.75 | 589 |
| 2016* | 8.75 | 7.75 | 11.00 | 456 |
| 2017* | 9.00 | 7.50 | 10.25 | 528 |
| 2018* | 9.00 | 7.75 | 10.50 | 1,232 |
| 2019* | 9.25 | 8.00 | 10.50 | 868 |

Table 4. Length (fork length, inches) data of Alewife sampled from the Chowan River commercial fisheries, 1972-2019. In 2007 a no-harvest provision went into effect and the Chowan River Pound Net survey began in 2009.

| Year | Mean Fork Length | Minimum Fork Length | Maximum Fork Length | Total Number Measured |
|-------|------------------|---------------------|---------------------|-----------------------|
| 1972 | 10.25 | 6.25 | 12.25 | 1,337 |
| 1973 | 10.00 | 7.75 | 12.25 | 1,471 |
| 1974 | 9.00 | 5.75 | 11.25 | 616 |
| 1975 | 9.75 | 7.75 | 12.00 | 2,440 |
| 1976 | 9.75 | 8.25 | 12.00 | 2,029 |
| 1977 | 10.00 | 5.00 | 12.25 | 2,024 |
| 1978 | 10.25 | 7.75 | 11.50 | 997 |
| 1979 | 10.00 | 7.75 | 11.50 | 1,143 |
| 1980 | 10.00 | 8.50 | 12.25 | 551 |
| 1981 | 9.75 | 8.50 | 11.25 | 1,052 |
| 1982 | 9.75 | 8.50 | 12.00 | 752 |
| 1983 | 9.75 | 8.00 | 11.00 | 457 |
| 1984 | 9.75 | 8.75 | 11.75 | 351 |
| 1985 | 9.75 | 8.25 | 11.00 | 272 |
| 1986 | 9.25 | 8.25 | 11.00 | 203 |
| 1987 | 9.25 | 8.00 | 11.50 | 389 |
| 1988 | 9.50 | 8.00 | 10.75 | 312 |
| 1989 | 9.50 | 8.25 | 10.75 | 262 |
| 1990 | 9.50 | 8.00 | 11.00 | 194 |
| 1991 | 9.50 | 7.75 | 11.25 | 502 |
| 1992 | 9.25 | 7.75 | 11.00 | 300 |
| 1993 | 8.50 | 7.50 | 10.00 | 183 |
| 1994 | 8.50 | 8.00 | 9.00 | 2 |
| 1995 | 9.75 | 8.75 | 10.25 | 41 |
| 1996 | 9.50 | 8.50 | 10.50 | 42 |
| 1997 | 9.50 | 8.75 | 10.75 | 47 |
| 1998 | 9.50 | 7.75 | 11.00 | 55 |
| 1999 | 9.25 | 8.25 | 10.00 | 6 |
| 2000 | 9.25 | 7.75 | 10.50 | 798 |
| 2001 | 9.50 | 8.25 | 10.75 | 835 |
| 2002 | 9.75 | 7.75 | 10.75 | 963 |
| 2003 | 9.50 | 7.75 | 11.50 | 1,004 |
| 2004 | 9.50 | 8.00 | 11.25 | 720 |
| 2005 | 9.50 | 7.75 | 11.25 | 539 |
| 2006 | 9.50 | 7.75 | 12.25 | 553 |
| 2007 | 9.00 | 7.75 | 11.00 | 45 |
| 2008 | 9.00 | 7.50 | 11.25 | 1,872 |
| 2009* | 9.25 | 7.75 | 10.75 | 1,000 |
| 2010* | 9.50 | 8.00 | 11.00 | 822 |
| 2011* | 9.75 | 8.00 | 11.25 | 806 |
| 2012* | 9.75 | 7.50 | 11.25 | 641 |
| 2013* | 9.25 | 7.75 | 13.00 | 854 |
| 2014* | 9.25 | 8.00 | 11.50 | 1,037 |
| 2015* | 9.25 | 8.00 | 11.00 | 998 |
| 2016* | 9.25 | 7.75 | 11.25 | 773 |
| 2017* | 9.25 | 7.75 | 14.00 | 1,336 |
| 2018* | 9.25 | 7.75 | 11.25 | 1,360 |
| 2019* | 9.50 | 8.00 | 11.25 | 1,004 |

Table 5. Blueback Herring aging data collected from North Carolina fishery-dependent monitoring, 1972-2019.

| Year | Modal Age | Minimum Age | Maximum Age | Total Number Aged |
|------|-----------|-------------|-------------|-------------------|
| 1972 | 5 | 2 | 8 | 1,215 |
| 1973 | 5 | 3 | 8 | 1,092 |
| 1974 | 4 | 3 | 8 | 920 |
| 1975 | 4 | 3 | 8 | 951 |
| 1976 | 4 | 3 | 9 | 862 |
| 1977 | 5 | 3 | 8 | 767 |
| 1978 | 4 | 3 | 7 | 694 |
| 1979 | 5 | 3 | 8 | 942 |
| 1980 | 5 | 3 | 8 | 1,079 |
| 1981 | 5 | 3 | 9 | 794 |
| 1982 | 4 | 3 | 9 | 478 |
| 1983 | 4 | 3 | 8 | 314 |
| 1984 | 4 | 3 | 8 | 283 |
| 1985 | 5 | 3 | 7 | 249 |
| 1986 | 5 | 3 | 7 | 230 |
| 1987 | 4 | 3 | 7 | 208 |
| 1988 | 4 | 3 | 7 | 201 |
| 1989 | 4 | 3 | 6 | 184 |
| 1990 | 4 | 2 | 7 | 189 |
| 1991 | 4 | 2 | 7 | 242 |
| 1992 | 4 | 3 | 7 | 220 |
| 1993 | 5 | 2 | 8 | 112 |
| 1994 | 4 | 3 | 7 | 71 |
| 1995 | 5 | 3 | 7 | 192 |
| 1996 | 5 | 3 | 7 | 279 |
| 1997 | 4 | 3 | 7 | 180 |
| 1998 | 5 | 2 | 7 | 462 |
| 1999 | 5 | 3 | 7 | 389 |
| 2000 | 4 | 3 | 9 | 512 |
| 2001 | 5 | 3 | 7 | 311 |
| 2002 | 5 | 3 | 7 | 164 |
| 2003 | 5 | 3 | 7 | 147 |
| 2004 | 4 | 3 | 6 | 130 |
| 2005 | 4 | 3 | 6 | 162 |
| 2006 | 4 | 3 | 5 | 86 |
| 2007 | 5 | 3 | 6 | 143 |
| 2008 | 4 | 3 | 7 | 474 |
| 2009 | 4 | 3 | 7 | 251 |
| 2010 | 4 | 3 | 7 | 247 |
| 2011 | 4 | 3 | 6 | 175 |
| 2012 | 4 | 3 | 7 | 189 |
| 2013 | 5 | 3 | 7 | 217 |
| 2014 | 4 | 3 | 7 | 198 |
| 2015 | 4 | 3 | 7 | 184 |
| 2016 | 4 | 3 | 8 | 226 |
| 2017 | 5 | 3 | 7 | 250 |
| 2018 | 4 | 3 | 6 | 272 |
| 2019 | 4 | 3 | 7 | 276 |

Table 6. Alewife aging data collected from North Carolina fishery-dependent monitoring, 1972-2019.

| Year | Modal Age | Minimum Age | Maximum Age | Total Number Aged |
|------|-----------|-------------|-------------|-------------------|
| 1972 | 4 | 3 | 9 | 783 |
| 1973 | 4 | 3 | 9 | 721 |
| 1974 | 4 | 2 | 7 | 417 |
| 1975 | 4 | 2 | 9 | 842 |
| 1976 | 4 | 3 | 7 | 853 |
| 1977 | 5 | 3 | 8 | 759 |
| 1978 | 4 | 3 | 8 | 736 |
| 1979 | 4 | 3 | 8 | 701 |
| 1980 | 5 | 3 | 8 | 492 |
| 1981 | 5 | 4 | 8 | 532 |
| 1982 | 4 | 3 | 7 | 444 |
| 1983 | 4 | 3 | 7 | 295 |
| 1984 | 4 | 3 | 7 | 248 |
| 1985 | 5 | 3 | 7 | 195 |
| 1986 | 4 | 3 | 6 | 146 |
| 1987 | 4 | 3 | 7 | 266 |
| 1988 | 4 | 2 | 6 | 228 |
| 1989 | 4 | 3 | 7 | 179 |
| 1990 | 4 | 2 | 7 | 153 |
| 1991 | 5 | 3 | 7 | 319 |
| 1992 | 5 | 2 | 8 | 242 |
| 1993 | 4 | 2 | 7 | 130 |
| 1994 | 4 | 4 | 4 | 2 |
| 1995 | 5 | 4 | 6 | 40 |
| 1996 | 4 | 3 | 7 | 41 |
| 1997 | 4 | 3 | 7 | 18 |
| 1998 | | | | |
| 1999 | 3,6 | 3 | 6 | 6 |
| 2000 | 5 | 3 | 7 | 300 |
| 2001 | 5 | 3 | 7 | 369 |
| 2002 | 5 | 3 | 7 | 341 |
| 2003 | 4 | 2 | 7 | 350 |
| 2004 | 5 | 2 | 7 | 318 |
| 2005 | 5 | 3 | 7 | 253 |
| 2006 | 4 | 3 | 7 | 260 |
| 2007 | 4 | 3 | 6 | 30 |
| 2008 | 5 | 4 | 8 | 588 |
| 2009 | 5 | 3 | 7 | 342 |
| 2010 | 6 | 3 | 7 | 277 |
| 2011 | 6 | 3 | 8 | 211 |
| 2012 | 6 | 3 | 8 | 259 |
| 2013 | 5 | 2 | 7 | 308 |
| 2014 | 4 | 2 | 6 | 328 |
| 2015 | 4 | 3 | 7 | 206 |
| 2016 | 4 | 3 | 8 | 311 |
| 2017 | 5 | 3 | 7 | 346 |
| 2018 | 4 | 3 | 7 | 375 |
| 2019 | 4 | 3 | 7 | 286 |

Table 7. Blueback herring and alewife percent (%) repeat spawners from the Chowan River pound net survey 1972-2019. Blueback herring percent repeat spawner is a stock status indicator.

| Year | Percent (%) | |
|------|------------------|---------|
| | Blueback Herring | Alewife |
| 1972 | 22 | 15 |
| 1973 | 17 | 14 |
| 1974 | 18 | 4 |
| 1975 | 6 | 10 |
| 1976 | 11 | 8 |
| 1977 | 9 | 5 |
| 1978 | 6 | 8 |
| 1979 | 16 | 9 |
| 1980 | 19 | 18 |
| 1981 | 48 | 29 |
| 1982 | 11 | 1 |
| 1983 | 14 | 2 |
| 1984 | 7 | 34 |
| 1985 | 10 | 12 |
| 1986 | 16 | 4 |
| 1987 | 22 | |
| 1988 | 11 | 6 |
| 1989 | 4 | 9 |
| 1990 | 12 | 17 |
| 1991 | 31 | 21 |
| 1992 | 26 | 48 |
| 1993 | 12 | 5 |
| 1994 | 5 | |
| 1995 | 6 | 8 |
| 1996 | 13 | 29 |
| 1997 | 15 | 29 |
| 1998 | 7 | |
| 1999 | 13 | 67 |
| 2000 | 14 | 8 |
| 2001 | 9 | 13 |
| 2002 | 13 | 38 |
| 2003 | 16 | 30 |
| 2004 | 9 | 20 |
| 2005 | 13 | 15 |
| 2006 | 0 | 9 |
| 2007 | 9 | 10 |
| 2008 | 5 | 14 |
| 2009 | 3 | 14 |
| 2010 | 6 | 41 |
| 2011 | 12 | 27 |
| 2012 | 13 | 29 |
| 2013 | 14 | 11 |
| 2014 | 13 | 5 |
| 2015 | 17 | 18 |
| 2016 | 16 | 20 |
| 2017 | 7 | 33 |
| 2018 | 11 | 31 |
| 2019 | 13 | 24 |

Table 8. River herring total pound net effort, estimated catch and catch per unit effort for the Chowan River pound net survey 2009-2019.

| Year | Total Effort | | Total CPUE |
|-------|--------------------|----------------|------------|
| | (# of Active Sets) | Total RH (lbs) | |
| 2009 | 217 | 89,245 | 411.3 |
| 2010 | 260 | 71,532 | 275.1 |
| 2011 | 286 | 74,485 | 260.4 |
| 2012 | 315 | 18,415 | 58.5 |
| 2013 | 238 | 27,396 | 115.1 |
| 2014 | 271 | 45,619 | 168.3 |
| 2015 | 253 | 49,560 | 195.9 |
| 2016 | 228 | 77,372 | 339.4 |
| 2017 | 231 | 137,374 | 594.7 |
| 2018 | 276 | 86,605 | 313.8 |
| 2019 | 238 | 54,932 | 230.8 |
| Total | 255.7 | 66,594 | 269.4 |

Table 9. January-May adult river herring catch per unit effort (2.5 and 3.0 inch stretch mesh) from the North Carolina Albemarle Sound independent gill net survey 1991-2019.

| Alewife | | | | | Blueback Herring | | | | |
|---------|--------|-------|------|-----|------------------|--------|-------|-------|-----|
| Year | Effort | Sum | CPUE | PSE | Year | Effort | Sum | CPUE | PSE |
| 1991 | 472 | 222 | 0.47 | 16 | 1991 | 472 | 4,817 | 10.21 | 15 |
| 1992 | 548 | 1,056 | 1.93 | 18 | 1992 | 548 | 3,197 | 5.83 | 13 |
| 1993 | 558 | 139 | 0.25 | 27 | 1993 | 558 | 1,838 | 3.29 | 16 |
| 1994 | 527 | 93 | 0.18 | 22 | 1994 | 527 | 638 | 1.21 | 20 |
| 1995 | 517 | 207 | 0.40 | 17 | 1995 | 517 | 2,672 | 5.17 | 19 |
| 1996 | 512 | 150 | 0.29 | 59 | 1996 | 512 | 1,514 | 2.96 | 17 |
| 1997 | 521 | 64 | 0.12 | 19 | 1997 | 521 | 3,338 | 6.41 | 17 |
| 1998 | 506 | 64 | 0.13 | 16 | 1998 | 506 | 2,364 | 4.67 | 17 |
| 1999 | 536 | 281 | 0.52 | 42 | 1999 | 536 | 2,600 | 4.85 | 16 |
| 2000 | 525 | 938 | 1.79 | 15 | 2000 | 525 | 4,039 | 7.69 | 15 |
| 2001 | 498 | 1,380 | 2.77 | 11 | 2001 | 498 | 2,534 | 5.09 | 15 |
| 2002 | 505 | 321 | 0.64 | 11 | 2002 | 505 | 1,457 | 2.89 | 17 |
| 2003 | 552 | 310 | 0.56 | 13 | 2003 | 552 | 2,312 | 4.19 | 15 |
| 2004 | 504 | 379 | 0.75 | 12 | 2004 | 504 | 1,674 | 3.32 | 17 |
| 2005 | 503 | 267 | 0.53 | 12 | 2005 | 503 | 1,617 | 3.21 | 20 |
| 2006 | 526 | 1,060 | 2.02 | 11 | 2006 | 526 | 2,361 | 4.49 | 12 |
| 2007 | 511 | 3,310 | 6.48 | 11 | 2007 | 511 | 1,566 | 3.06 | 14 |
| 2008 | 499 | 1,282 | 2.57 | 10 | 2008 | 499 | 833 | 1.67 | 17 |
| 2009 | 452 | 1,050 | 2.32 | 10 | 2009 | 452 | 1,011 | 2.24 | 15 |
| 2010 | 419 | 1,144 | 2.73 | 14 | 2010 | 419 | 669 | 1.60 | 16 |
| 2011 | 418 | 466 | 1.11 | 14 | 2011 | 418 | 465 | 1.11 | 17 |
| 2012 | 355 | 348 | 0.98 | 13 | 2012 | 355 | 307 | 0.86 | 18 |
| 2013 | 363 | 1,246 | 3.43 | 18 | 2013 | 363 | 1,642 | 4.52 | 16 |
| 2014 | 402 | 2,810 | 6.99 | 15 | 2014 | 402 | 1,077 | 2.68 | 18 |
| 2015 | 443 | 2,013 | 4.54 | 11 | 2015 | 443 | 2,470 | 5.58 | 20 |
| 2016 | 460 | 2,369 | 5.15 | 11 | 2016 | 460 | 2,802 | 6.09 | 15 |
| 2017 | 451 | 1,677 | 3.72 | 10 | 2017 | 451 | 2,373 | 5.26 | 15 |
| 2018 | 377 | 2,805 | 7.44 | 19 | 2018 | 377 | 3,054 | 8.10 | 14 |
| 2019 | 462 | 3,202 | 6.93 | 13 | 2019 | 462 | 3,590 | 7.77 | 16 |

Table 10. Length (fork length, inches) data of blueback herring sampled from North Carolina Albemarle Sound independent gill net survey from 1991-2019.

| Year | Mean Fork Length | Minimum Fork Length | Maximum Fork Length | Total Number Measured |
|------|------------------|---------------------|---------------------|-----------------------|
| 1991 | 9.75 | 6.50 | 13.25 | 2,315 |
| 1992 | 9.75 | 8.00 | 11.75 | 2,140 |
| 1993 | 9.75 | 7.50 | 13.25 | 1,334 |
| 1994 | 9.75 | 8.25 | 13.25 | 555 |
| 1995 | 9.50 | 6.50 | 11.25 | 1,324 |
| 1996 | 9.50 | 5.75 | 13.25 | 1,090 |
| 1997 | 9.25 | 5.00 | 12.75 | 1,530 |
| 1998 | 9.50 | 8.00 | 11.25 | 1,231 |
| 1999 | 9.50 | 6.50 | 13.75 | 1,917 |
| 2000 | 9.50 | 8.25 | 11.25 | 2,740 |
| 2001 | 9.50 | 6.50 | 11.50 | 1,862 |
| 2002 | 9.75 | 5.50 | 11.00 | 1,339 |
| 2003 | 9.50 | 7.75 | 11.75 | 1,924 |
| 2004 | 9.50 | 8.25 | 17.25 | 1,157 |
| 2005 | 9.25 | 5.75 | 11.50 | 1,039 |
| 2006 | 9.25 | 7.25 | 13.25 | 1,790 |
| 2007 | 9.25 | 8.00 | 10.75 | 1,204 |
| 2008 | 9.25 | 4.75 | 10.75 | 697 |
| 2009 | 9.25 | 5.25 | 11.00 | 815 |
| 2010 | 9.25 | 7.75 | 12.25 | 609 |
| 2011 | 9.25 | 7.25 | 13.75 | 445 |
| 2012 | 9.50 | 8.00 | 10.75 | 295 |
| 2013 | 9.00 | 7.75 | 11.50 | 1,163 |
| 2014 | 9.25 | 7.75 | 13.00 | 799 |
| 2015 | 9.25 | 8.00 | 13.50 | 1,206 |
| 2016 | 9.50 | 4.25 | 11.25 | 1,555 |
| 2017 | 9.50 | 8.00 | 13.25 | 1,433 |
| 2018 | 9.50 | 8.00 | 12.75 | 1,764 |
| 2019 | 9.50 | 7.75 | 11.50 | 1,687 |

Table 11. Length (fork length, inches) data of alewife sampled from North Carolina Albemarle Sound independent gill net survey from 1991-2019.

| Year | Mean Fork Length | Minimum Fork Length | Maximum Fork Length | Total Number Measured |
|------|------------------|---------------------|---------------------|-----------------------|
| 1991 | 10.00 | 5.75 | 12.00 | 235 |
| 1992 | 10.00 | 8.50 | 13.75 | 860 |
| 1993 | 9.50 | 8.00 | 13.25 | 143 |
| 1994 | 9.25 | 8.50 | 11.00 | 99 |
| 1995 | 9.50 | 6.75 | 11.50 | 211 |
| 1996 | 9.75 | 4.50 | 13.50 | 102 |
| 1997 | 10.00 | 8.25 | 13.75 | 64 |
| 1998 | 9.75 | 7.75 | 11.50 | 64 |
| 1999 | 9.00 | 8.00 | 13.75 | 226 |
| 2000 | 9.25 | 8.25 | 11.25 | 1,436 |
| 2001 | 9.75 | 5.25 | 17.75 | 1,933 |
| 2002 | 10.00 | 8.00 | 11.00 | 477 |
| 2003 | 9.75 | 7.75 | 11.25 | 551 |
| 2004 | 9.75 | 8.00 | 14.00 | 388 |
| 2005 | 9.50 | 8.00 | 11.25 | 274 |
| 2006 | 9.25 | 8.00 | 13.50 | 1,006 |
| 2007 | 9.25 | 4.50 | 12.75 | 2,343 |
| 2008 | 9.50 | 6.25 | 12.00 | 1,221 |
| 2009 | 9.50 | 5.75 | 11.75 | 1,000 |
| 2010 | 9.75 | 8.00 | 13.75 | 1,036 |
| 2011 | 10.00 | 8.00 | 11.75 | 493 |
| 2012 | 10.25 | 7.75 | 12.00 | 363 |
| 2013 | 9.25 | 7.75 | 13.50 | 1,004 |
| 2014 | 9.50 | 8.00 | 13.75 | 1,930 |
| 2015 | 9.75 | 4.50 | 12.50 | 1,786 |
| 2016 | 9.75 | 7.75 | 13.00 | 2,042 |
| 2017 | 9.75 | 7.75 | 12.75 | 1,531 |
| 2018 | 9.25 | 7.75 | 12.00 | 1,950 |
| 2019 | 9.50 | 8.25 | 11.75 | 2,063 |

Table 12. Blueback herring aging data collected from North Carolina Albemarle Sound independent gill net survey, 1999-2019.

| Year | Modal Age | Minimum Age | Maximum Age | Total Number Aged |
|------|-----------|-------------|-------------|-------------------|
| 1999 | 5 | 3 | 7 | 241 |
| 2000 | | | | 0 |
| 2001 | | | | 0 |
| 2002 | | | | 0 |
| 2003 | | | | 0 |
| 2004 | 4 | 3 | 6 | 98 |
| 2005 | 4 | 2 | 7 | 174 |
| 2006 | 4,5 | 3 | 7 | 213 |
| 2007 | 5 | 3 | 7 | 173 |
| 2008 | 4,5 | 4 | 7 | 45 |
| 2009 | 4,5 | 4 | 7 | 72 |
| 2010 | 4 | 3 | 5 | 45 |
| 2011 | 4 | 3 | 6 | 100 |
| 2012 | 4 | 3 | 8 | 80 |
| 2013 | 3 | 2 | 7 | 107 |
| 2014 | 3 | 2 | 5 | 40 |
| 2015 | 4 | 3 | 6 | 139 |
| 2016 | 5,6 | 3 | 7 | 157 |
| 2017 | 5 | 3 | 7 | 176 |
| 2018 | 4 | 3 | 7 | 228 |
| 2019 | 4 | 3 | 7 | 211 |

Table 13. Alewife aging data collected from North Carolina Albemarle Sound independent gill net survey, 1999-2019.

| Year | Modal Age | Minimum Age | Maximum Age | Total Number Aged |
|------|-----------|-------------|-------------|-------------------|
| 1999 | 5 | 4 | 7 | 18 |
| 2000 | 4 | 3 | 7 | 190 |
| 2001 | 5 | 3 | 6 | 289 |
| 2002 | 6 | 4 | 7 | 81 |
| 2003 | 4 | 4 | 7 | 127 |
| 2004 | 4 | 3 | 6 | 106 |
| 2005 | 5 | 3 | 7 | 148 |
| 2006 | 4,5 | 3 | 7 | 283 |
| 2007 | 4 | 3 | 8 | 266 |
| 2008 | 5 | 4 | 7 | 96 |
| 2009 | 5 | 2 | 7 | 125 |
| 2010 | 6 | 4 | 7 | 122 |
| 2011 | 5 | 3 | 8 | 137 |
| 2012 | 6 | 3 | 8 | 129 |
| 2013 | 4 | 2 | 6 | 168 |
| 2014 | 4 | 3 | 6 | 110 |
| 2015 | 5 | 3 | 7 | 263 |
| 2016 | 5 | 3 | 7 | 173 |
| 2017 | 5 | 3 | 8 | 249 |
| 2018 | 4 | 3 | 8 | 331 |
| 2019 | 4 | 3 | 8 | 239 |

Table 14. Summary of the N.C. Marine Fisheries Commission management strategies and their implementation status for Amendment 2 of the River Herring Fishery Management Plan

| Management Strategy | Implementation Status |
|---|---------------------------------|
| Eliminate the discretionary river herring harvest season and permit | Existing proclamation authority |
| Moving the Albemarle Sound/Chowan River Herring Management Areas to correct boundary reference for the Cashie River Anadromous Fish Spawning Area | 15A NCAC 03R .0202 |
| Remove alewife and blueback herring from the Mutilated Finfish Rule | 15A NCAC 03M .0101 |
| Prohibit possession of alewife and blueback herring greater than six inches aboard a vessel or while engaged in fishing from the shore or a pier. | 15A NCAC 03M .0513 |

FIGURES

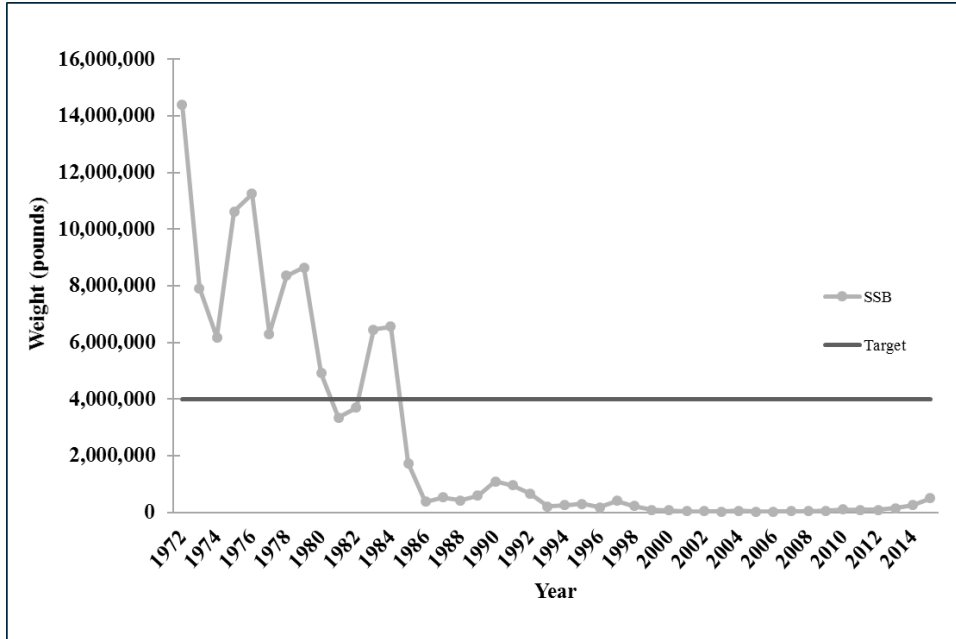


Figure 1. Annual estimate of blueback herring spawning stock biomass (SSB) in pounds for the Chowan River blueback herring stock, 1972-2015 (ASMFC 2017). Stock status indicator.

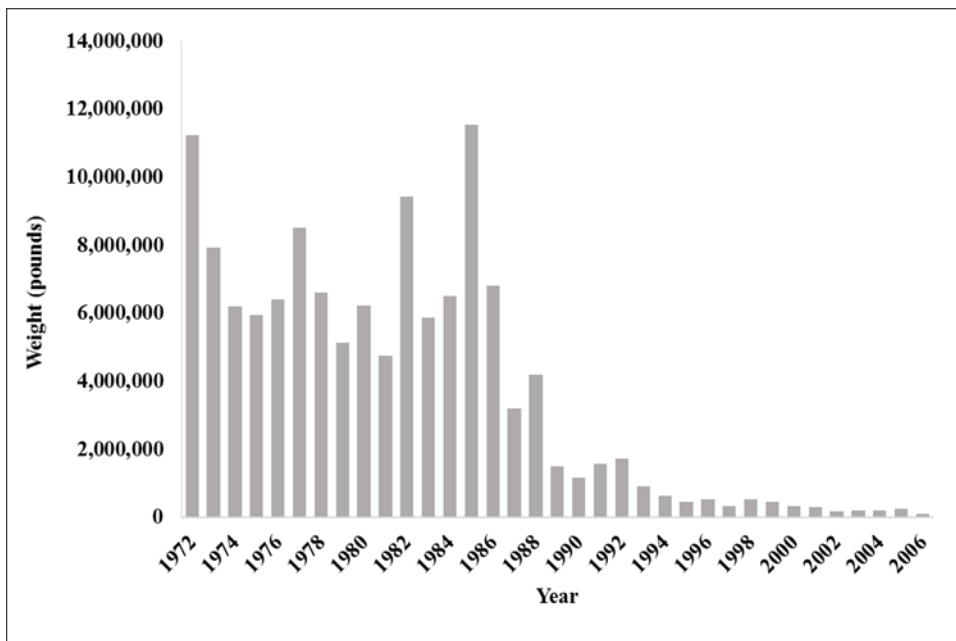


Figure 2. Commercial harvest in pounds of river herring (blueback herring and alewife combined) in North Carolina from 1972-2006, all waterbodies combined.

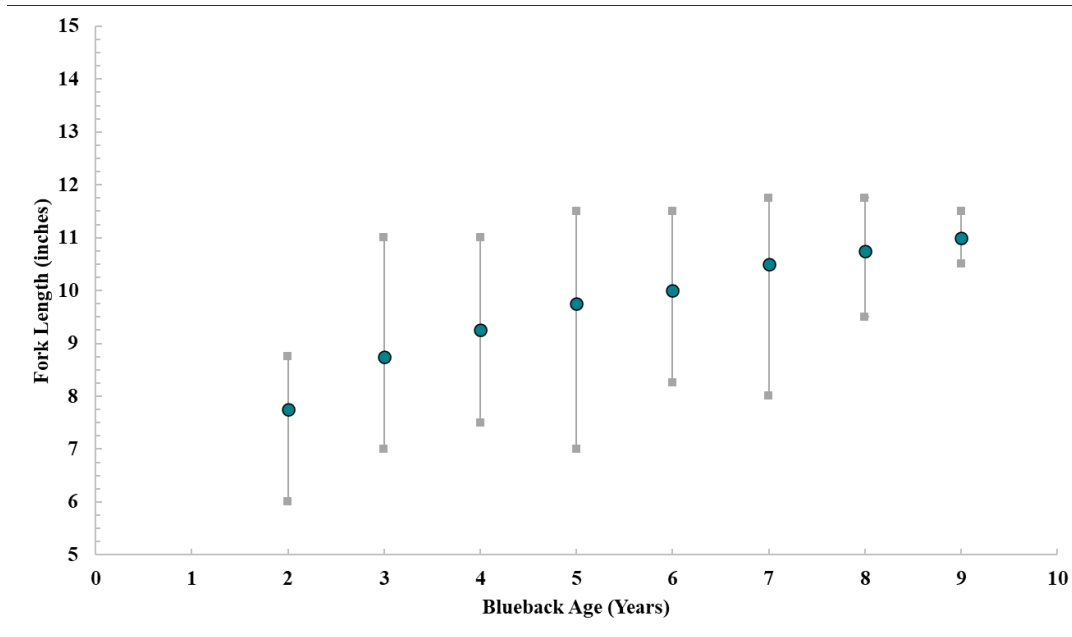


Figure 3 Blueback herring length at age from all age samples collected from fishery-dependent monitoring, 1972-2019. Blue circles represent the mean size at a given age while the gray squares represent the minimum and maximum observed size for each age.

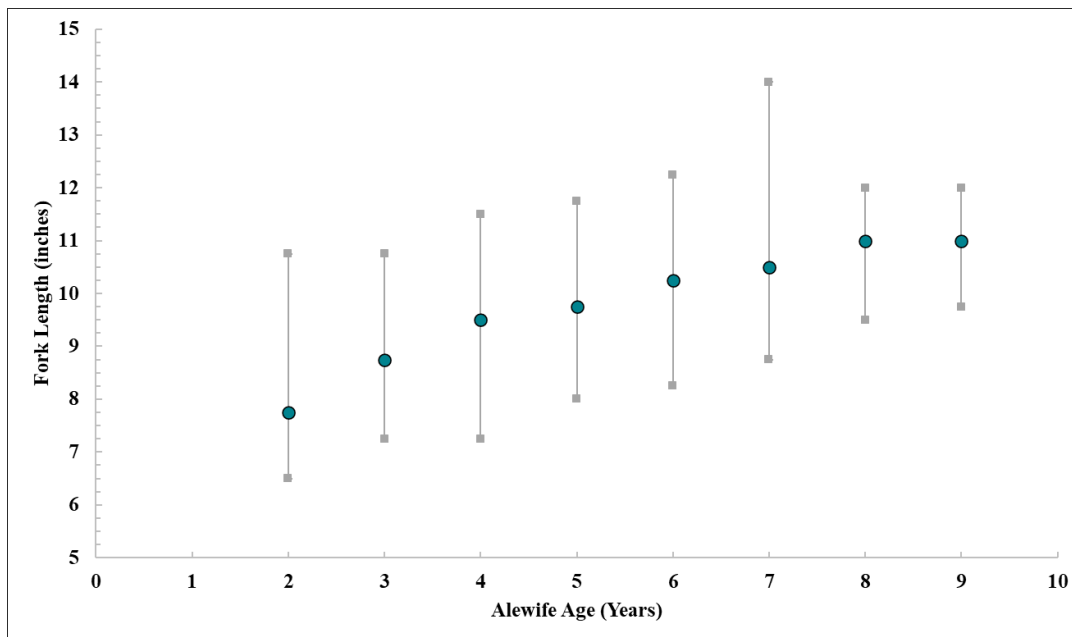


Figure 4 Alewife length at age from all age samples collected from fishery-dependent monitoring, 1972-2019. Blue circles represent the mean size at a given age while the gray squares represent the minimum and maximum observed size for each age.

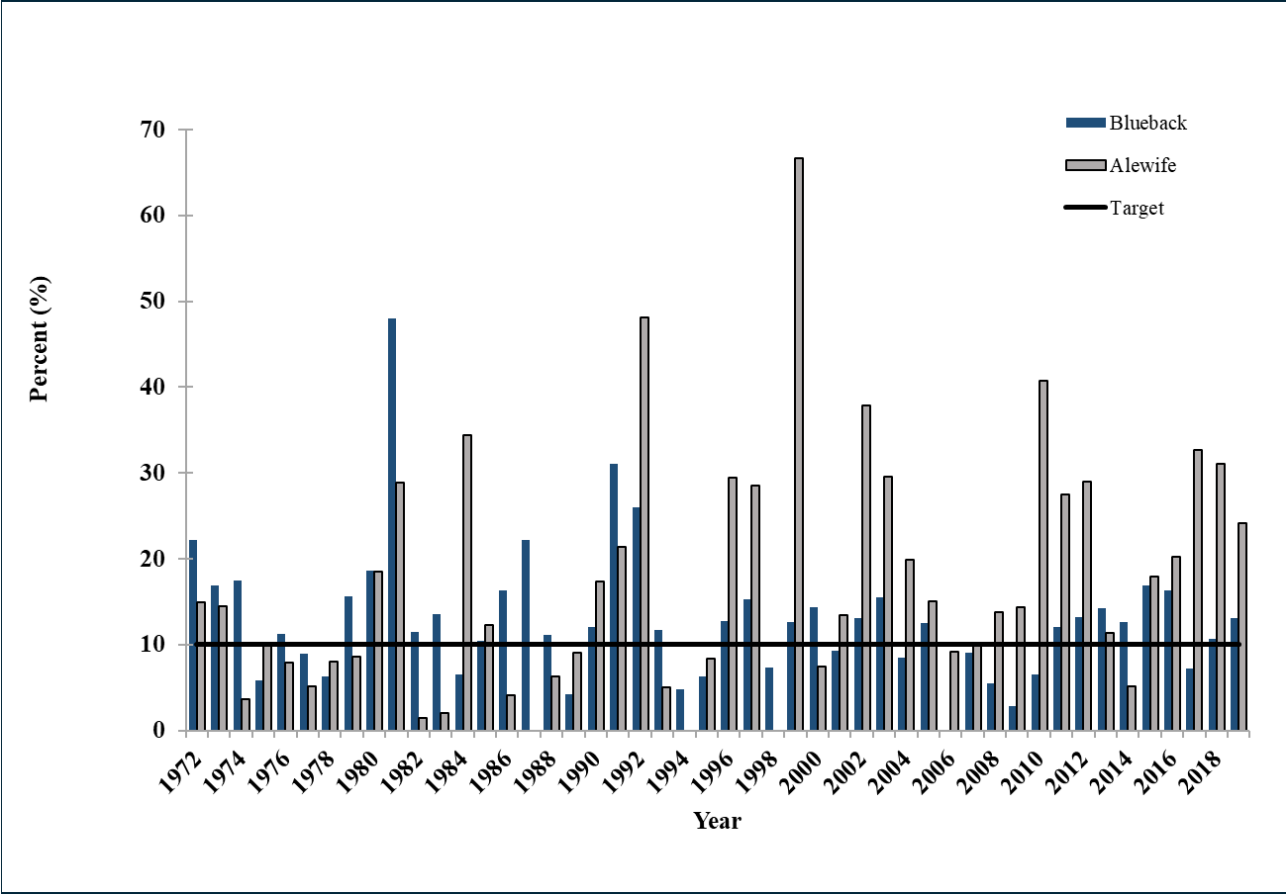


Figure 5. Percent of repeat spawners (blueback herring and alewife) in the Chowan River Pound Net Survey, 1972-2019. Blueback herring percent repeat spawner is a stock status indicator.

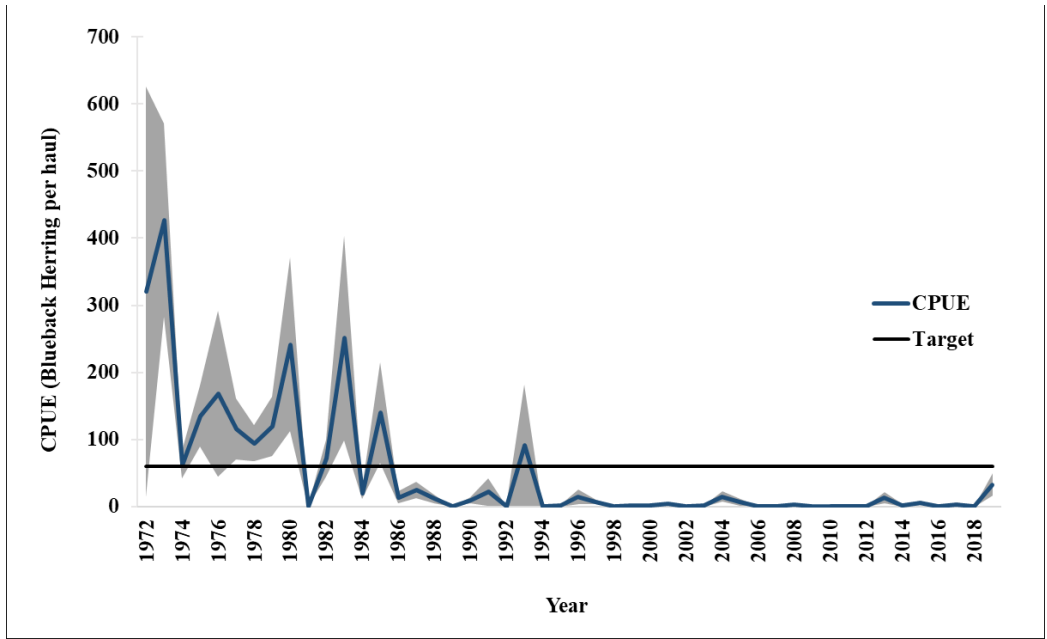


Figure 6. Blueback herring annual juvenile (age-0) abundance index from the NCDMF Albemarle Sound juvenile survey, 1972-2019. Stock status indicator.

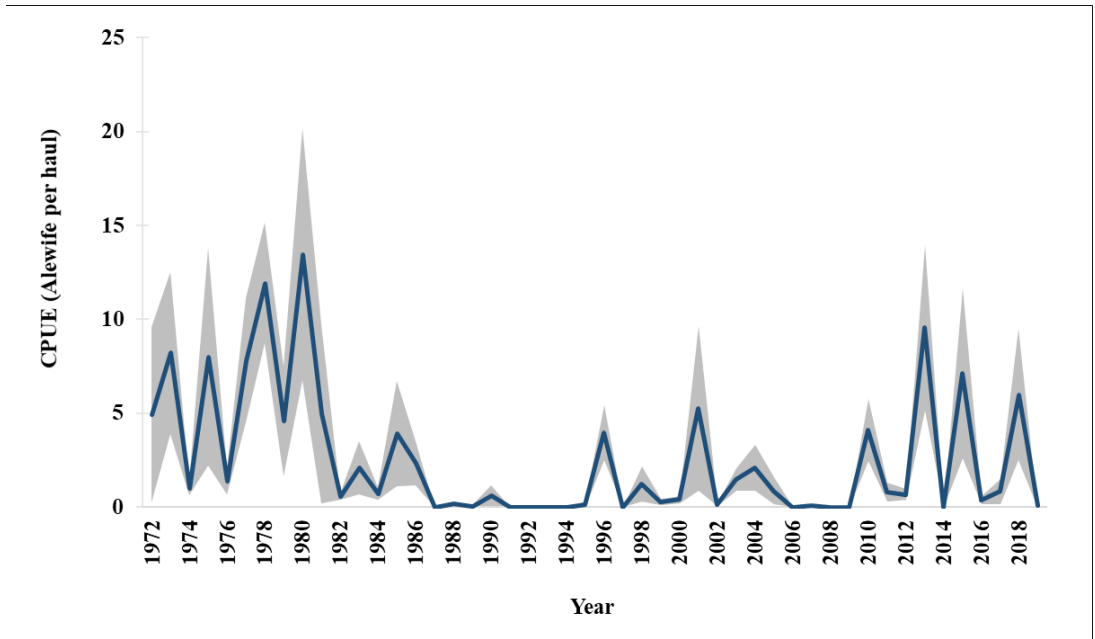


Figure 7. Alewife annual juvenile (age-0) abundance index from the NCDMF Albemarle Sound juvenile survey, 1972-2019.

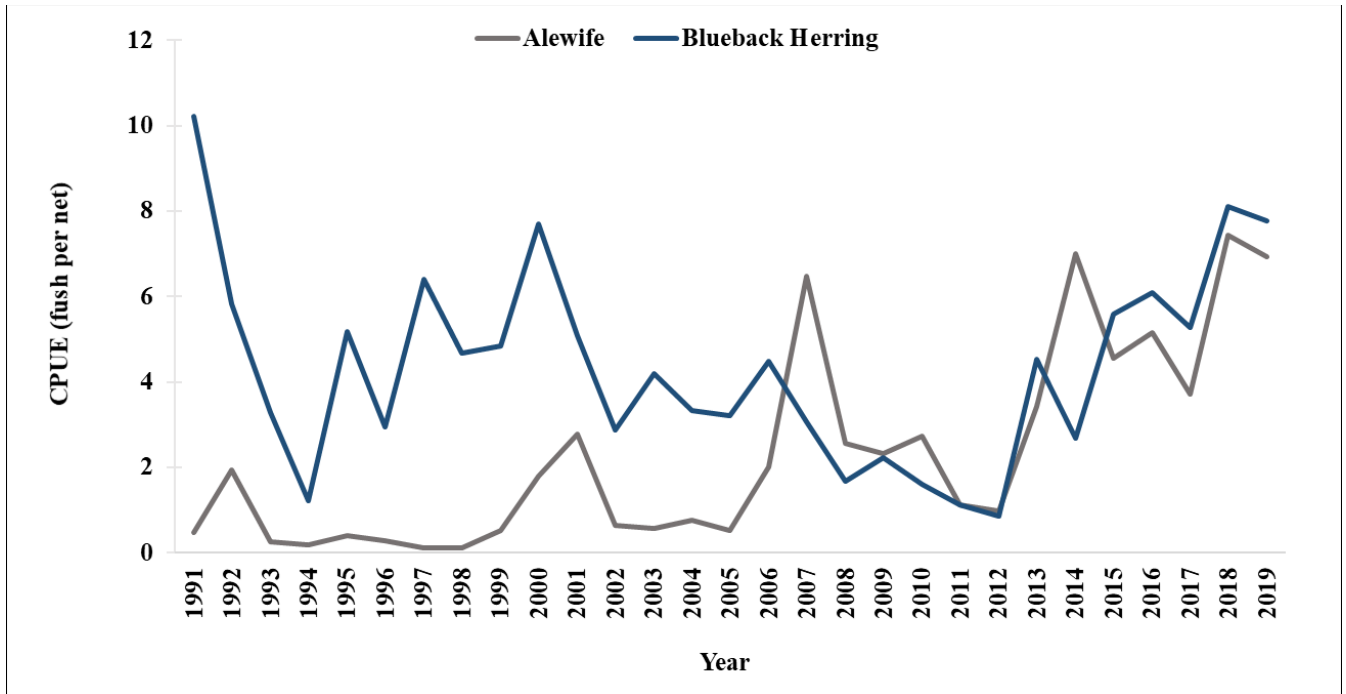


Figure 8. January-May adult river herring index of abundance (2.5 and 3.0 inch stretch mesh) from the North Carolina Albemarle Sound independent gill net survey 1991-2019.

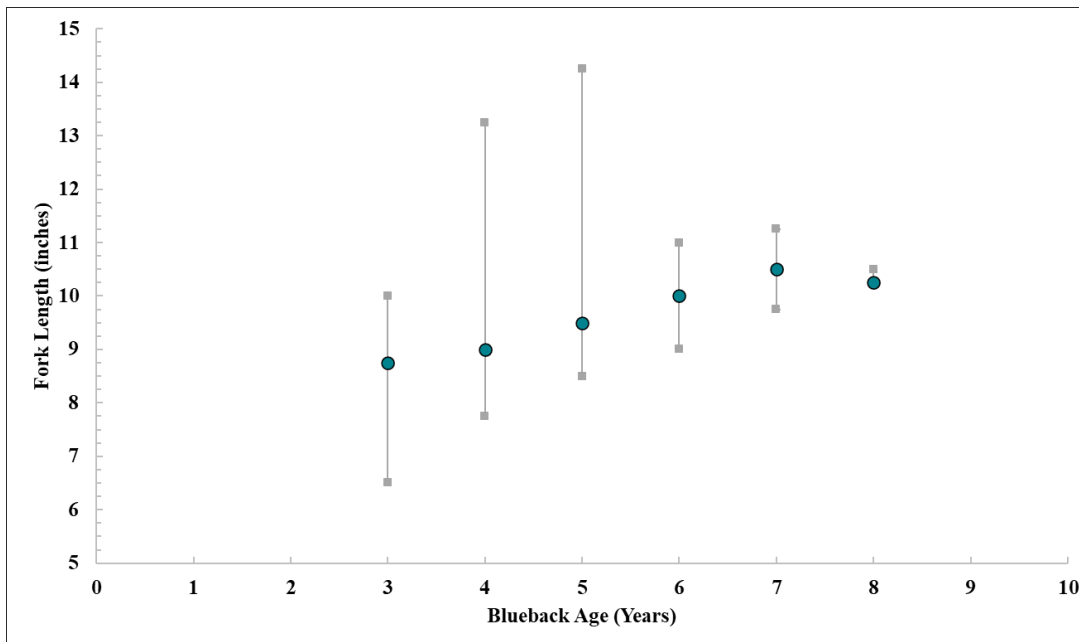


Figure 9. Blueback herring length at age from all age samples collected from North Carolina Albemarle Sound independent gill net survey, 1999-2019. Blue circles represent the mean size at a given age while the gray squares represent the minimum and maximum observed size for each age.

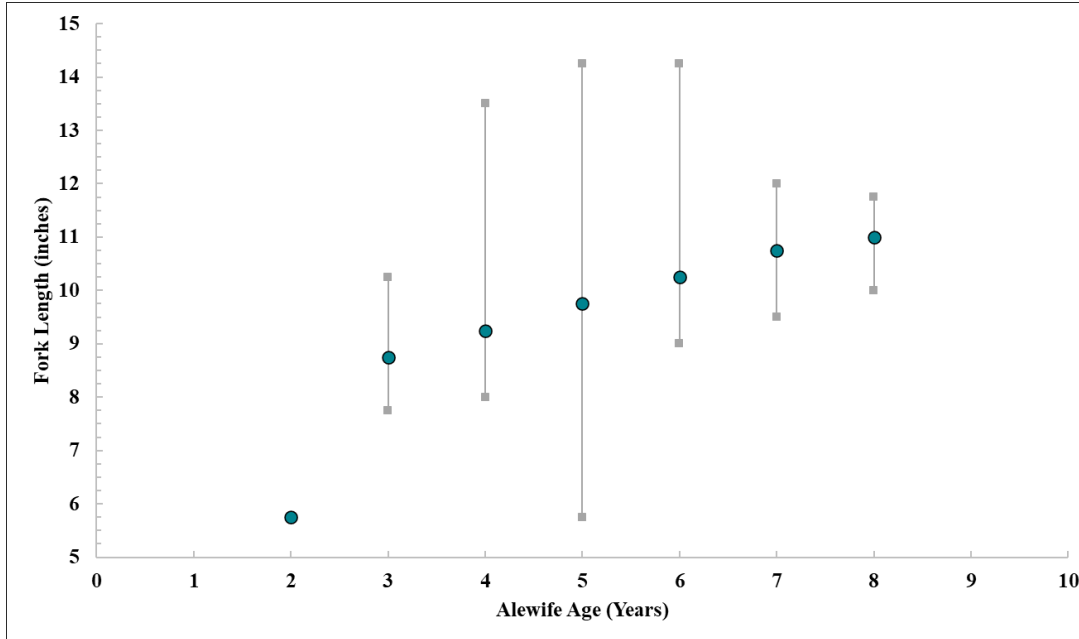


Figure 10. Alewife length at age from all age samples collected from North Carolina Albemarle Sound independent gill net survey, 1999-2019. Blue circles represent the mean size at a given age while the gray squares represent the minimum and maximum observed size for each age.