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Introduction

This document presents a summary of the 2024 benchmark stock assessment for alewife and blueback herring, collectively referred to as river herring. The assessment was peer-reviewed by an independent panel of scientific experts through the Atlantic States Marine Fisheries Commission's (ASMFC) external peer review process. This assessment is the latest and best information available on the status of the US river herring for fisheries management.

River herring are a data-poor species that is challenging to assess, but this new benchmark assessment made progress in several areas from the last benchmark assessment in 2012. New data sets were incorporated, resulting in abundance or mortality information for 84 rivers, representing 105 stocks of river herring. Methods to analyze trends and calculate total mortality were refined, and new models were developed to understand the impacts of habitat loss on river herring populations and provide ways to calculate limits on ocean bycatch.

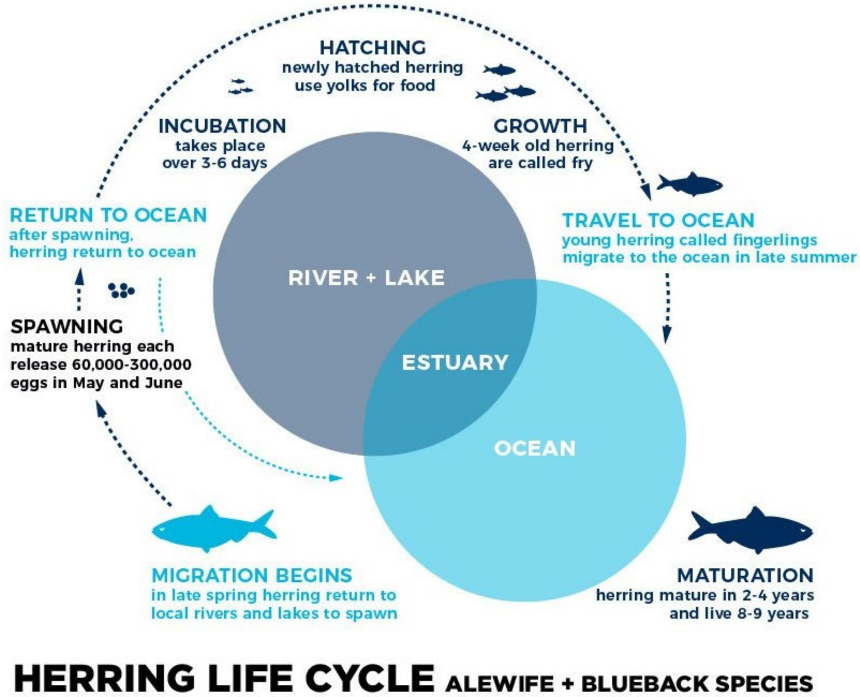
Management Overview

The Fishery Management Plan (FMP) for Shad and River Herring, implemented in 1985, was one of the very first FMPs developed by ASMFC. In 1994, the Shad and River Herring Management Board (Board) determined that the FMP was no longer adequate for protecting or restoring the remaining shad and river herring stocks. Amendment 1 was adopted in 1998 and required specific American shad monitoring programs, as well as recommended fishery-dependent and -independent monitoring programs for river herring and hickory shad, in order to improve the data available for future stock assessments.

In 2009, the Board approved Amendment 2, which strengthened river herring management. The Amendment prohibited state waters commercial and recreational fisheries as of January 1, 2012, unless a state or jurisdiction has a Sustainable Fishery Management Plan (SFMP) reviewed by the Technical Committee and approved by the Board. The Amendment defines a sustainable fishery as "a commercial and/or recreational fishery that will not diminish the potential future stock reproduction and recruitment." Submitted SFMPs must clearly demonstrate that the state's or jurisdiction's river herring fisheries meet this definition through the development of sustainability targets which must be achieved and maintained. Amendment 2 required states to implement fisheries-dependent and -independent monitoring programs, and contained recommendations to member states and jurisdictions to conserve, restore, and protect critical river herring habitat. As of 2024, the Shad and River Herring Management Board approved SFMPs for Maine, New Hampshire, Massachusetts, New York, and South Carolina, although neither New Hampshire nor Massachusetts had commercial fisheries in 2022 and 2023 due to low numbers of returning river herring.

What Data Were Used?

The river herring assessment used both fishery-dependent and -independent data as well as information about river herring biology and life history. Fishery-dependent data come from commercial fisheries that target river herring or catch them incidentally, while fishery-independent data are collected through scientific research and surveys. Data from a total of 84 river systems from Maine through Florida, as well as surveys in ocean waters, were included in this assessment.

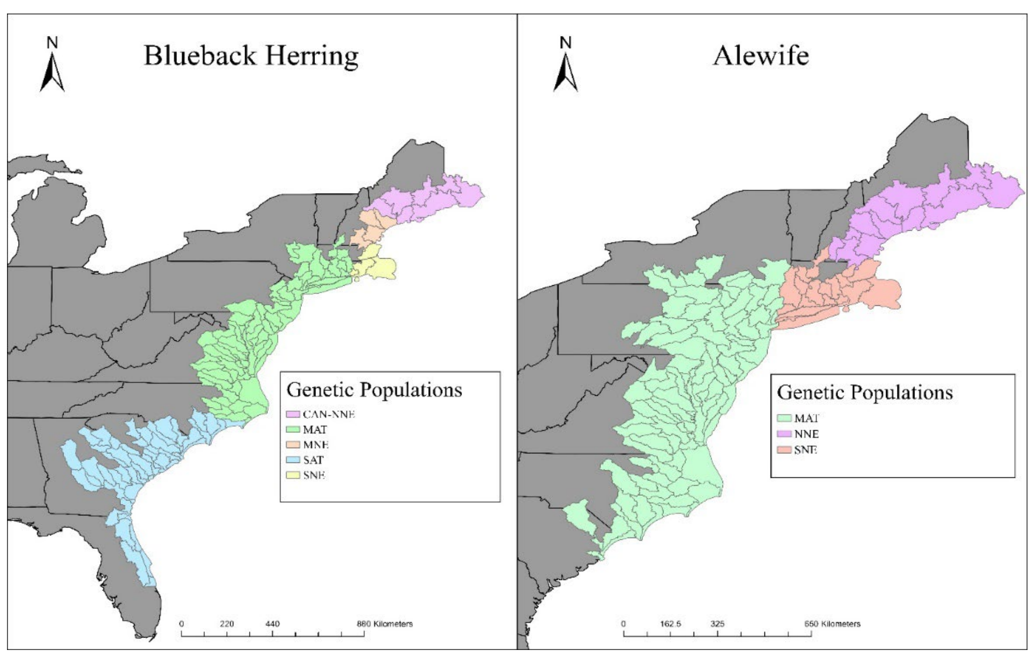


Life History

River herring are anadromous, like salmon, meaning they live in the ocean but spawn in freshwater. River herring spawn in the spring in rivers from Florida through Maine and up into Canada. The newly spawned fish migrate out of the rivers into the ocean in the fall, where they spend the next three to five years of their life. When they are sexually mature, they return to spawn in the river where they were born. Unlike salmon, river herring do not all die after spawning and may return to spawn several times over the course of their lives. Historically, the oldest observed ages for river herring were 14 years for alewife and 11 for blueback herring, but the oldest fish seen in rivers today are 6 to 9 years old.

Analysis of river herring DNA shows that alewife and blueback herring can be grouped into genetic stock-regions, where fish from rivers in those regions are more similar to each other than they are to fish in other stock-regions. It is harder to tell fish from individual rivers apart genetically, due to fish straying

Figure 1. Genetic stock-regions of river herring. Five genetic populations for blueback herring (Canada-Northern New England, Mid-New England, Southern New England, Mid-Atlantic, and South Atlantic) and three genetic populations for alewife (Northern New England, Southern New England [SNE], and Mid- Atlantic).



to nearby rivers to spawn and stocking across rivers, but there are still genetic differences even at the river-level within these stock-regions since most fish return to the river where they were born to spawn. Alewife and blueback herring were assessed at the river level where ever possible, but reference points were developed and trends were summarized at the stock-region level.

Fishery-Dependent Data

River herring are caught in a number of different fisheries, both as a target species and as bycatch. Because alewife and blueback herring are difficult to tell apart, commercial landings cannot be separated by species and instead are reported simply as "river herring." The assessment included historical landings back to 1887, although the fisheries that target river herring date back to colonial times. The earliest years of data are not complete; they include records from only some states and rivers. The quality of the data has improved as reporting requirements have become more rigorous. Reported commercial landings of river herring peaked in 1965 and declined steadily and rapidly after that. In some river systems, biological data including lengths, ages, and repeat spawner marks were examined as indicators of total mortality. The closure of commercial fisheries in multiple states resulted in discontinuation of several commercial catch-per-unit-effort (CPUE) time-series evaluated during the previous benchmark assessment.

River herring are also caught as bycatch in ocean fisheries targeting other species such as Atlantic herring and mackerel. This incidental catch may be discarded at sea or retained and landed. Total incidental catch of river herring was estimated from sampling done by at-sea observers.

Although river herring are caught by recreational anglers, both as a target species and as bait for other gamefish like striped bass, there is very little data on recreational landings. The Marine Recreational Information Program, which tracks recreational saltwater landings, rarely encounters anglers fishing for river herring and, as a result, its estimates of recreational landings are highly uncertain.

Over the past ten years, total removals of river herring from all sources (commercial landings, recreational catch, and bycatch) have averaged 2.67 million pounds or 6.83 million fish per year. This is approximately 4% of the reported landings at the height of the directed fishery in the 1950s and 1960s. From 2005-2019, ocean bycatch made up 27% of total removals in weight and 35% of total removals in numbers. However, estimates of bycatch were much lower in 2020-2022, and made up only 8% of total removals in weight and 10% of total removals in numbers. These lower estimates of bycatch were due to reduced effort in the Atlantic herring and mackerel fleets in recent years, but also lower observer coverage and port sampling in those years, especially in Mid-Atlantic midwater trawls.

Fishery-Independent Data

The assessment examined a total of 52 data sets on abundance trends for alewife and 42 datasets for blueback herring. These datasets included run counts, fishery-independent surveys of adult fish in rivers, young-of-year (YOY) indices, and surveys that occurred in the ocean and caught of mix of adult and juvenile river herring. There were also 14 run counts where river herring were not identified to the species level and only reported as "river herring." Biological data including lengths, ages, and spawner marks were also examined as indicators of total mortality. The fishery-independent data sets represent a relatively short time series, compared to the long history of the fishery, and all of them were initiated after the peak and sharp decline in landings.

Figure 2. River Herring Total Removals in Numbers and Weight of Fish

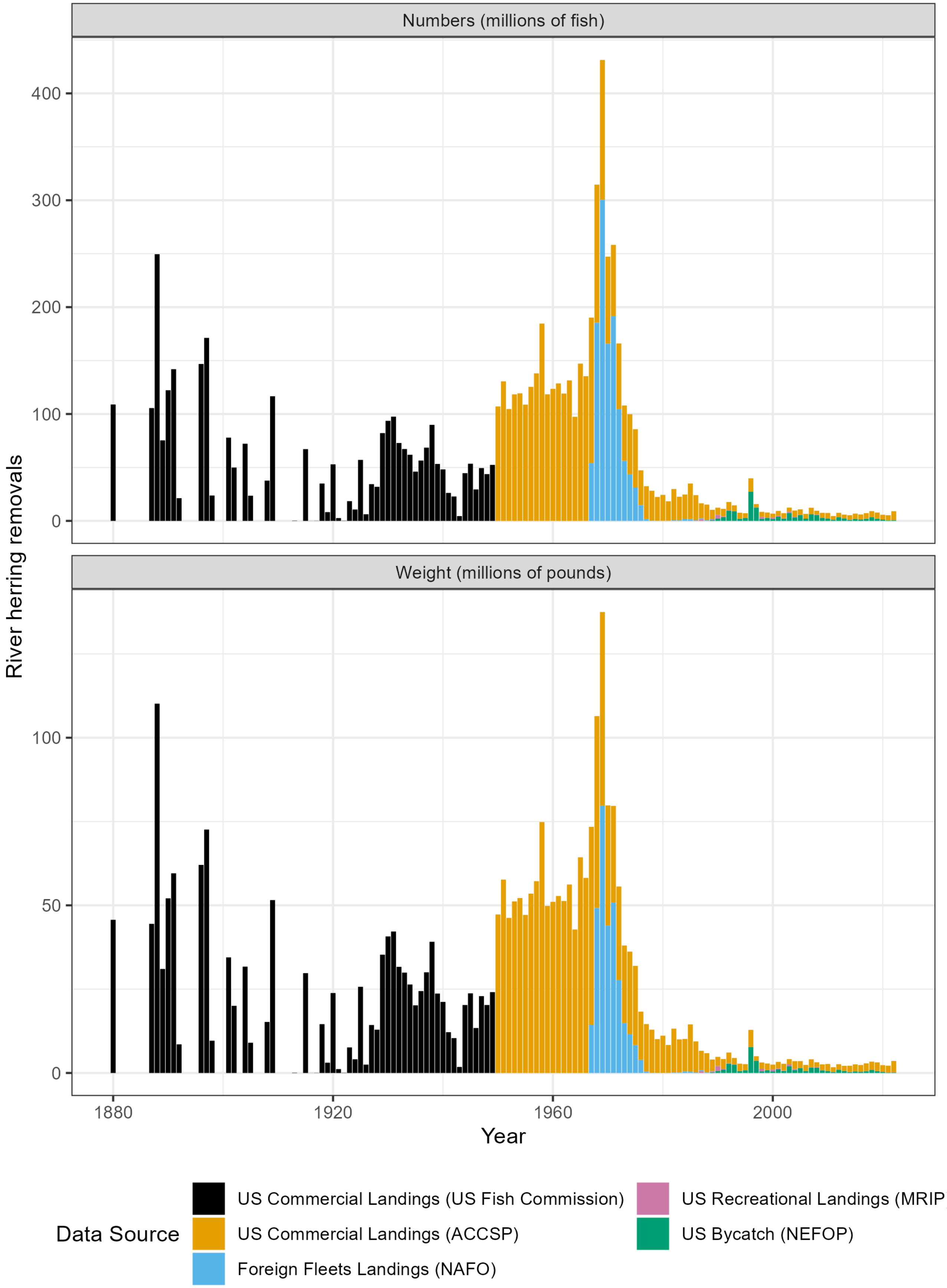
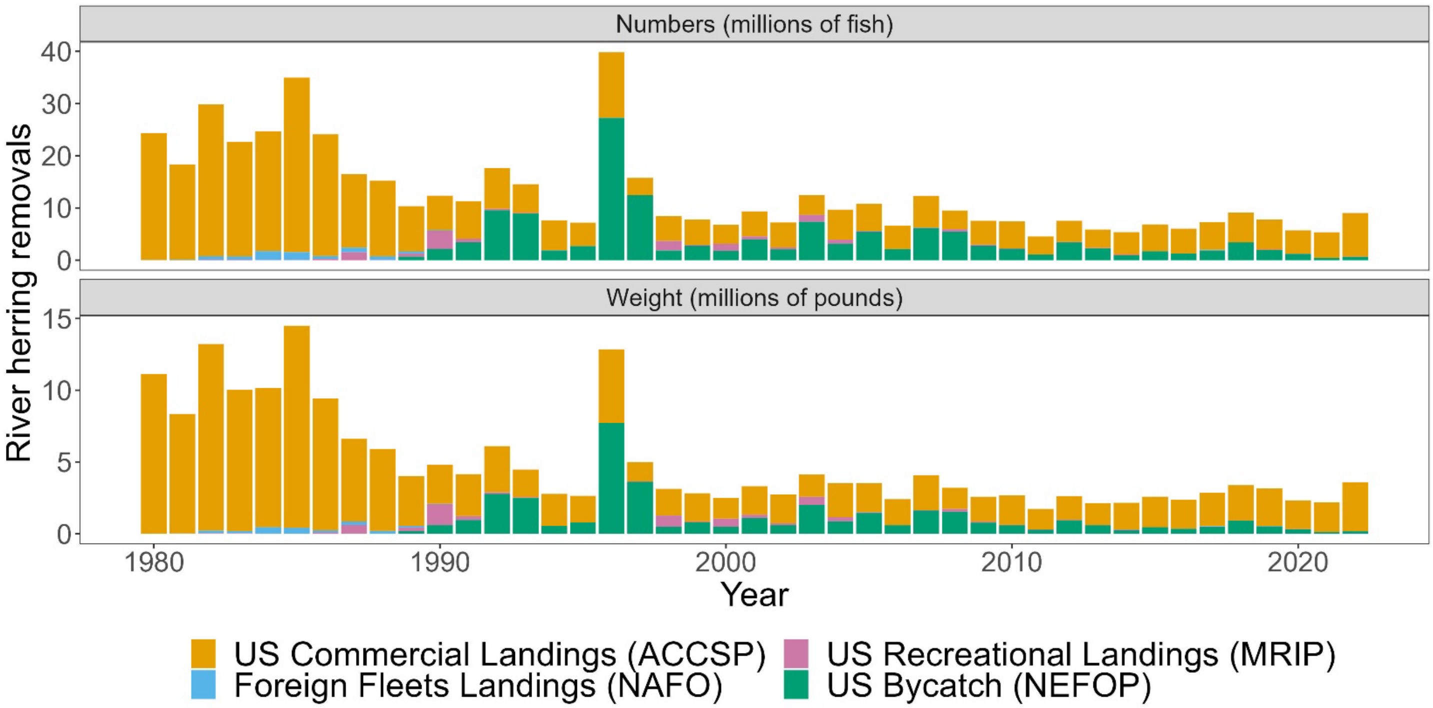


Figure 3. River Herring Total Removals in Numbers and Weight of Fish from 1980-2022



Run counts record the numbers of river herring using fish passage or being lifted at dams. For some rivers, the counts represent the entire run. For other rivers, the counts represent an unknown fraction of the total run size, as not all the fish that return to the river to spawn are able to use the available fish passage and may spawn in the river below where the count is taken. The assessment treated run counts as an index of the relative abundance of the spawning population over time, not as a true population estimate.

Young-of-year indices track the relative abundance of river herring spawned each year and are conducted in rivers and bays. YOY indices were available for Maine through Florida.

Fishery-independent trawl surveys were conducted in nearshore coastal waters and bays and track the abundance of juvenile and adult fish. NOAA Fisheries Service Northeast Fisheries Science Center bottom trawl survey had the widest geographic range of the available trawl surveys, sampling both inshore and offshore waters from Massachusetts to North Carolina.

Most of the run count data are from the more northern states, while most of the survey datasets are from the Mid-Atlantic region.

What Models Were Used?

River herring were assessed on a river-by-river basis where the data were available. For the vast majority of rivers, the data were not available to conduct a model-based stock assessment. Instead, trend analysis was used to identify recent trends in the available fishery-dependent and -independent data sets. A Mann-Kendall test was used to determine if there was a significant trend in each data set over the time-series and an ARIMA trend analysis method was used to determine the probability that the index in the most recent year of the time-series was higher than the index in 2009, to evaluate whether relative abundance was higher than it was when Amendment 2 was adopted. For three rivers – the Monument River in Massachusetts, the Nanticoke River in Maryland, and the Chowan River in North Carolina – data were available to update statistical catch-at-age models. However, with the closure of the directed fisheries in these states, the usefulness and reliability of these models is greatly reduced. Total mortality (*Z*) reference points were calculated for each stock-region using spawning stock biomass per recruit analysis. Estimates of *Z* from the observed age structure of adult alewife and blueback herring were compared to these reference points, to determine if the total mortality on adult fish was too high.

A new habitat model was developed, similar to the model developed for American shad in 2020, that used a simulation approach to look at the effects of dams and habitat loss on the potential productivity of alewife and blueback herring in each stock-region.

Data-limited approaches were explored to develop a proof-of-concept method to establish biologically-based caps or limits on bycatch of river herring in ocean fisheries. Current caps in the Atlantic herring and Atlantic mackerel fishery are based on historical levels of bycatch, but the approach proposed in this assessment would use trends in index data to modify the caps. This would mean that if abundance indices declined, the cap would be reduced, and if abundance indices increased over time, the cap could be increased.

What is the Status of the Stock?

The coastwide populations of both alewife and blueback herring are depleted relative to historic levels, with the habitat model indicating that overall productivity of both species is lower than an unfished population before the occurrence of any habitat modifications (e.g., dams or human alterations to the environment). The depleted determination was used instead of overfished and overfishing because of the many factors that have contributed to the declining abundance of river herring, which include not just directed and incidental fishing, but also habitat loss, predation, and climate change.

In terms of recent trends, there is no clear signal for either species across the coast. Even within the genetic stock-regions, trends in abundance and mortality differed from river to river, with some rivers showing increasing trends and low mortality rates, and others showing flat or declining trends and total mortality rates above the reference point. Although very few significant trends overall were detected since the adoption of Amendment 2 in 2009, the majority of abundance indices for both alewife and blueback herring are likely to be higher now than they were in 2009. However, half of the blueback populations and 65% of the alewife populations have a high probability of being above the total mortality reference point, indicating total mortality on adult fish was too high. Total mortality is the removal of fish from a population due to both fishing and natural causes.

The northern New England region seemed to have more positive trends and a higher probability of abundance in the most recent years being greater than in 2009. It is unclear why that is the case, especially as the more northern regions also had higher probabilities of being above the total mortality reference point. States in northern New England region have conducted extensive habitat restoration and dam removal, but so have states further south, and they have not seen the same degree of positive trends in run counts and indices. In addition, states in the northern stock-region have also accounted for the majority of directed catch in recent years, while states in the Mid-New England, Southern New England, and Mid-Atlantic stock-regions have closed their fisheries. Genetic analysis indicated that most of the ocean bycatch around Cape Cod and Long Island Sound was of alewife from the Southern New England stock-region and blueback herring from the Mid-Atlantic stock-region, two areas that have had more negative trends in recent years despite habitat restoration efforts and directed fishery closures.

Tables 1 and 2. Trends in Indices by Stock-Region for the Entire Time-Series and since 2009 for Alewife and Blueback Herring (see pages 9 and 10 for trends by river system).

Alewife					
	Time-Series Trends				
Stock-Region	Number of Decreasing (↓) Trends	Number of Data Sets with No Trend	Number of Increasing (↑) Trends	Number of Indices with > 50% Probability that Relative Abundance in 2022 > than in 2009	Number of Rivers with > 50% Probability Total Mortality > Reference Point
Northern New England	0	4	4	7/8 (88%)	21/29 (72%)
Southern New England	4	12	1	4/8 (50%)	7/9 (78%)
Mid-Atlantic	4	13	4	11/17 (65%)	0/6 (0%)
Mixed stock (ocean)	1	6	2	6/9 (67%)	

Blueback Herring					
	Time-Series Trends				
Stock-Region	Number of Decreasing (↓) Trends	Number of data sets with no trend	Number of Increasing (↑) Trends	Number of Indices with > 50% Probability that Relative Abundance in 2022 > than in 2009	Number of Rivers with > 50% Probability Total Mortality > Reference Point
Canadian-Northern New England	0	0	1	1/1 (100%)	
Mid-New England	2	3	0	4/5 (80%)	1/1 (100%)
Southern New England					2/2 (100%)
Mid-Atlantic	6	17	4	16/18 (89%)	3/10 (33%)
South Atlantic	1	1	1	2/3 (67%)	1/1 (100%)
Mixed stock (ocean)	0	5	2	4/7 (57%)	

The data-limited methods produced estimates of bycatch caps that were lower than the current coastwide bycatch estimates and lower than the current caps in the Atlantic herring and Atlantic mackerel fishery. However, more work needs to be done on the data-limited bycatch cap approach, including consulting with the Mid-Atlantic and New England Fishery Management Councils on risk levels and how to implement species-specific caps in fisheries where the bycatch monitoring includes American and hickory shad as well as river herring. The assessment also recommended exploring species distribution modeling to identify hot spots of river herring bycatch that could be avoided with time-area closures as an alternative or complement to in-season monitoring of river herring bycatch.

Data and Research Needs

Efforts to assess the status of river herring on the Atlantic coast are hampered by a lack of data and the complex stock structure. Several high priority research needs were identified during the benchmark stock assessment to improve future stock assessments.

High priority short-term recommendations for research and data collection include developing consistent ageing protocols across all states; establishing a database of existing data sources with comprehensive metadata and recommendations for use; expanding observer and port sampling coverage including genetic sampling to better quantify incidental catch of river herring; conducting studies to quantify, improve, and implement standard practices for fish passage efficiency; and evaluating and validating hydroacoustic methods to quantify river herring spawning run numbers in major river systems.

Continued development of the habitat model or similar models to predict the potential impacts of climate change on river herring distribution and stock persistence and develop targets for rivers undergoing restoration (dam removals, fishways, supplemental stocking, etc.) was a high-priority short term research recommendation for assessment methodology.

High priority long-term recommendations were to conduct regular exchanges or workshops to monitor the precision of ageing across states and maintain or implement river herring-specific surveys, particularly in rivers without run counts or rivers where restoration efforts (e.g., dam removal) will break or end the time series of run counts.

Whom Do I Contact For More Information?

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Glossary

ARIMA: Auto-Regressive Integrated Moving Average, a statistical technique that removes noise from the abundance index trends and calculates the probability that the value in the last year of the time-series is different from a reference value

Catch-at-age: the number of fish of each age that are removed in a year by fishing activity.

Spawner mark: Marks on scales of fish formed each time they spawn in freshwater throughout their lives.

Statistical catch-at-age (SCAA) model: an age-structured stock assessment model that works forward in time to estimate population size and fishing mortality in each year. It assumes some the catch-at-age data have a known level of error.

Total mortality (*Z*) – The rate of removal of fish from a population due to both fishing and natural causes.

Young-of-the-year (YOY) – An individual fish in its first year of life; for most species, YOY are immature fish.

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Table 3. Trends in Indices by River System for the Entire Time Series and since 2009 for Alewife. This table does not include rivers that had a recent estimate of total mortality but not an index of abundance; see the full report for all Z estimates.

Stock-Region	River	Ages	Years	Time Series Trend	Probability Current Index Value > 2009 Index Value	Probability Current Total Mortality > Total Mortality Reference Point
Canadian-Northern New England	**St. Croix**					
	Run counts (mixed species)	Adults	1981-2022	Not significant	100%	
Northern New England	**Union**					
	Run counts	Adults	1982-2022	↑	95%	
	Damariscotta					
	Run counts	Adults	1977-2021	↑	97%	
	Kennebec					
	Run counts (mixed species)	Adults	2006-2022	↑	95%	
	Penobscot					
	Run counts (mixed species)	Adults	2015-2022	Not significant		
	Saco					
	Run counts (mixed species)	Adults	1993-2021	↑	98%	
	Sebasticook					
	Run counts (mixed species)	Adults	2000-2021	↑		
	Androscoggin					
	Run counts (mixed species)	Adults	1983-2022	↑	94%	
	Merrymeeting Bay					
	ME DMR Juvenile Alosine Seine Survey	YOY	1982-2021	Not significant	83%	
	Cocheco					
	Run counts	Adults	2004-2021	Not significant	0%	0.1%
	Exeter					
	Run counts	Adults	2004-2016	↑	100%	85%
	Lamprey					
	Run counts	Adults	2004-2021	Not significant	91%	14%
	Oyster					
	Run counts	Adults	2004-2021	↑	89%	84%
	Hamton-Seabrook/Great Bay Estuaries					
	NH Juvenile Finfish Survey	YOY	1997-2021	Not significant	98%	
Southern New England	**Agawam**					
	Run counts (mixed species)	Adults	2006-2021	Not significant	94%	
	Back					
	Run counts (mixed species)	Adults	1986-2021	Not significant	83%	92%
	Herring					
	Run counts (mixed species)	Adults	2012-2021	Not significant		
	Mattapoissett					
	Run counts (mixed species)	Adults	1988-2021	↓	4%	
	Monument					
	Run counts (mixed species)	Adults	1980-2021	Not significant	70%	56%
	Mystic					
	Run counts (mixed species)	Adults	2012-2021	↑		61%
	Nemasket					
	Run counts (mixed species)	Adults	2012-2021	↑	94%	100%
	Stony Brook					
	Run counts (mixed species)	Adults	2007-2019	Not significant	95%	
	Town Brook					
	Run counts (mixed species)	Adults	2011-2021	Not significant		27%
	Wankinco					
	Run counts (mixed species)	Adults	2007-2021	↑	100%	
	Nonquit					
	Run counts	Adults	1999-2022	↓	16%	99%
	Gilbert-Stuart					
	Run counts	Adults	1999-2021	Not significant	63%	55%
	Buckeye Brook					
	Run counts	Adults	2003-2021	Not significant	99%	
	Hunt Forge					
	Run counts	Adults	2010 - 2021	Not significant		
	Ten Mile					
	Run counts	Adults	2015-2021	Not significant		
	Woonasquatucket					
	Run counts	Adults	2010-2021	Not significant		
	Narrow					
	RI Coastal Ponds Survey	YOY	1994-2022	Not significant	6%	
	Bride Lake					
	Run counts	Adults	2011-2022	Not significant		
	East					
	Run counts	Adults	2015-2021	Not significant		
	Eight Mile					
	Run counts	Adults	2014-2021	Not significant		
	Latimer Brook					
	Run counts	Adults	2006-2022	↑	84%	
	Mianus					
	Run counts	Adults	2008-2021	↓		
	Mill Brook					
	Run counts	Adults	2003-2022	Not significant	89%	
	Pequonnock					
	Run counts	Adults	2014-2021	Not significant		
	Queach Brook					
	Run counts	Adults	2006-2022	↓	25%	
	Quinnipiac					
	Run counts	Adults	2013-2022	↓		
	Shetucket					
	Run counts	Adults	2007-2022	Not significant	37%	
Mid-Atlantic	**Hudson**					
	NY DEC 300' Haul Seine Survey	Adults	2012-2022	Not significant	97%	0.0%
	NY DEC Juvenile Beach Seine	YOY	1980-2022	↑	26%	
	Delaware Bay/River					
	DE Bay 30' Trawl	Age-1	1990-2021	Not significant	84%	
	DE Bay 16' Trawl	Age-1	1991-2021	↓	61%	
	NJ Striped Bass Seine Survey	YOY	1987-2021	↓	58%	
	Nanticoke					
	MD Commercial CPUE	Adults	1991-2021	↓	20%	40%
	MD DNR Juvenile Estuarine Finfish Surve	YOY	1959-2021	↓	38%	
	DE Juvenile Seine Survey	YOY	1999-2021	Not significant	35%	
	North East					
	MD Gillnet Survey	Adults	2015-2021	Not significant		42%
	Choptank					
	MD DNR Juvenile Estuarine Finfish Surve	YOY	1959-2021	Not significant	71%	
	Potomac					
	MD DNR Juvenile Estuarine Finfish Surve	YOY	1959-2021	Not significant	85%	
	Appomattox					
	VA DWR Electrofishing Survey	Adults	2000-2018	Not significant	14%	
	James					
	VA DWR Electrofishing Survey	Adults	2002-2022	Not significant	92%	
	VIMS River Herring Gillnet Survey	Adults	2015-2021	Not significant		30%
	Chickahominy					
	VA DWR Electrofishing Survey	Adults	2011-2022	Not significant		
	VIMS Surface Trawl Survey	YOY	2014-2022	Not significant		
	Rappahannock					
	VA DWR Electrofishing Survey	Adults	2001-2022	Not significant	40%	36%
	Albemarle Sound					
	NC DMF P135 Gillnet Survey	Adults	1991-2019	↑	94%	
	NC DMF P100 Seine Survey	YOY	1972-2021	Not significant	83%	
	Chowan					
	NC WRC Electrofishing Survey	Adults	2006-2022	↑	100%	3%
	Neuse					
	NC WRC Electrofishing Survey	Adults	2006-2022	↑	100%	

Table 4. Trends in Indices by River System for the Entire Time Series and since 2009 for Blueback Herring. This table does not include rivers that had a recent estimate of total mortality but not an index of abundance; see the full report for all total mortality estimates.

Stock-Region	River	Ages	Years	Time Series Trend	Probability Current Index Value > 2009 Index Value	Probability Current Total Mortality > Total Mortality Reference Point
Canadian-Northern New England	**St. Croix**					
	Run counts (mixed spp)	Adults	1981-2022	Not significant	100%	
	Kennebec					
	Run counts (mixed spp)	Adults	2006-2022	↑	95%	
	Penobscot					
	Run counts (mixed spp)	Adults	2015-2022	Not significant		
	Saco					
	Run counts (mixed spp)	Adults	1993-2021	↑	98%	
	Sebasticook					
	Run counts (mixed spp)	Adults	2000-2021	↑	100%	
	Androscoggin					
	Run counts (mixed spp)	Adults	1983-2022	↑	94%	
	Merrymeeting Bay					
	ME DMR Juvenile Alosine Seine Survey	YOY	1982-2021	↑	98%	
Mid-New England	**Cocheco**					
	Run counts	Adults	2004-2021	Not significant	81%	
	Exeter					
	Run counts	Adults	2004-2016	Not significant	100%	
	Lamprey					
	Run counts	Adults	2004-2021	Not significant	100%	
	Oyster					
	Run counts	Adults	2004-2021	↓	16%	79%
	Winnicut					
	Hamton-Seabrook/Great Bay Estuaries					
	NH Juvenile Finfish Survey	YOY	1997-2021	↓	96%	
Southern New England	**Agawam**					
	Run counts (mixed spp)	Adults	2006-2021	Not significant	94%	
	Back					
	Run counts (mixed spp)	Adults	1986-2021	Not significant	83%	
	Herring					
	Run counts (mixed spp)	Adults	2012-2021	Not significant		
	Mattapoissett					
	Run counts (mixed spp)	Adults	1988-2021	↓	4%	
	Monument					
	Run counts (mixed spp)	Adults	1980-2021	Not significant	70%	93%
	Mystic					
	Run counts (mixed spp)	Adults	2012-2021	↑		98%
	Nemasket					
	Run counts (mixed spp)	Adults	2012-2021	↑	94%	
	Stony Brook					
	Run counts (mixed spp)	Adults	2007-2019	Not significant	95%	
	Town Brook					
	Run counts (mixed spp)	Adults	2011-2021	Not significant		
	Wankinko					
	Run counts (mixed spp)	Adults	2007-2021	↑	100%	
Mid-Atlantic	**Connecticut River**					
	Run counts	Adults	1976-2022	↓	100%	
	USFWS CT River Electrofishing Survey	Adults	2013-2022	Not significant		
	CT River Beach Seine Survey	YOY	1979-2021	↓	86%	
	Chicopee River	Adults	2013-2022			40%
	Farmington River	Adults	2013-2022			9%
	Wethersfield Cove	Adults	2013-2022			5%
	Eight Mile					
	Run counts	Adults	2014-2022	Not significant		
	Mianus					
	Run counts	Adults	2008-2021	Not significant		
	Quinnipiac					
	Run counts	Adults	2013-2022	Not significant		
	Hudson					
	NY DEC 300' Haul Seine Survey	Adults	2012-2022	Not significant		1%
	NY DEC Juvenile Beach Seine	YOY	1980-2022	Not significant	64%	
	Delaware Bay/River					
	DE Bay 30' Trawl	Age-1	1990-2021	Not significant	69%	
	NJ Striped Bass Seine Survey	YOY	1987-2021	↓	39%	
	Nanticoke					
	MD Commercial CPUE	Adults	1991-2021	↓	21%	79%
	MD DNR Juvenile Estuarine Finfish Survey	YOY	1959-2021	↓	54%	
	DE Juvenile Seine Survey	YOY	1999-2021	Not significant	76%	
	North East					
	MD Gillnet Survey	Adults	2015-2021	Not significant		25%
	Choptank					
	MD DNR Juvenile Estuarine Finfish Survey	YOY	1959-2021	↑	87%	
	Potomac					
	MD DNR Juvenile Estuarine Finfish Survey	YOY	1959-2021	Not significant	87%	
	Appomattox					
	VA DWR Electrofishing Survey	Adults	2000-2018	Not significant	53%	
	James					
	VA DWR Electrofishing Survey	Adults	2002-2022	↑	100%	
	VIMS River Herring Gillnet Survey	Adults	2015-2021	Not significant		47%
	VIMS Striped Bass Seine Survey	YOY	1967-2022	Not significant	86%	
	Chickahominy					
	VA DWR Electrofishing Survey	Adults	2011-2022	Not significant		
	VIMS Surface Trawl Survey	YOY	2014-2022	Not significant		
	Rappahannock					
	VA DWR Electrofishing Survey	Adults	2001-2022	↑	74%	16%
	Albemarle Sound					
	NC DMF P135 Gillnet Survey	Adults	1991-2019	Not significant	100%	
	NC DMF P100 Seine Survey	YOY	1972-2021	↓	87%	
	Chowan					
	NC WRC Electrofishing Survey	Adults	2006-2022	Not significant	100%	85%
	Neuse					
	NC WRC Electrofishing Survey	Adults	2006-2022	↑	100%	84%
South Atlantic	**Cape Fear**					
	NC WRC Electrofishing Survey	Adults	2006-2022	Not significant	88%	
	Santee-Cooper					
	Run counts	Adults	2013-2022	↓	3%	97%
	St. Johns					
	FL FWC Pushnet Survey	YOY	2006-2021	↑	93%	