Introduction

This document presents a summary of an update to the 2012 benchmark stock assessment for alewife and blueback herring, collectively referred to as river herring. An update of a stock assessment includes applying the peer-reviewed, and Management Board-accepted benchmark assessment approaches to recent data. This update includes additional data from 2011-2015 and is the latest and best information available on the status of the Atlantic river herring fisheries management. The updated stock assessment report consists of two volumes: volume I covers a coastwide synthesis of data and analyses and volume II includes details of state-specific river herring fisheries, restoration efforts, monitoring, data, and analyses.

Management Overview

The Fishery Management Plan (FMP) for Shad and River Herring was one of the very first FMPs developed at the ASMFC. In 1994, the Shad and River Herring Management 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 stock assessment capabilities.

In 2009, the Shad and River Herring Management Board approved Amendment 2, which strengthened river herring management. The Amendment prohibits state waters commercial and recreational fisheries beginning January 1, 2012, unless a state or jurisdiction has a Sustainable Fishery Management Plan (SFMP) reviewed by the Technical Committee and approved by the Management 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 new definition of sustainability 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 contains recommendations to member states and jurisdictions to conserve, restore, and protect critical river herring habitat. As of June 1, 2017, the Shad and River Herring Management Board approved sustainable fishery management plans for Maine, New Hampshire, Massachusetts, New York, and South Carolina.

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 57 river systems from Maine through Florida 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. The oldest observed ages for river herring are 14 years for alewife and 11 for blueback herring, but the oldest fish seen in rivers today are 6 to 9 years old.

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 rigorous. Reported commercial landings of river herring peaked in 1965 and declined steadily and rapidly after that. Landings since the benchmark assessment have been relatively stable, averaging just over 1.4 million pounds, which was almost identical to the average landings over the last five years of the benchmark stock assessment. Utility of these data for inferring about coastwide population size have decreased due to the number of moratoria that have been implemented in recent years. However, the level of landings do not suggest any major changes since the benchmark stock assessment. In some river systems, biological data including lengths, ages, and spawner marks were examined as indicators of total mortality. The assessment also examined time-series of commercial catch-per-unit-effort (CPUE), a fishery-dependent index of abundance, from some rivers where consistent measures of effort were available. Moratoria have resulted in discontinuation of several CPUE time-series evaluated during the 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 NOAA Fisheries Service 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 and were not used in the assessment.

Fishery-Independent Data

The assessment examined run size indices from five states, young-of-year indices from 10 states, adult net and electrofishing indices from three states, and 19 fishery-independent trawl surveys conducted in coastal waters. 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.

The run size indices are counts 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 utilize the available fish passage. Run size indices were only available for states in New England.

Young-of-year (YOY) 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 North Carolina.

State fishery-independent trawl surveys were conducted in nearshore coastal waters and bays and track the abundance of juvenile and adult fish. The 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.

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. For two rivers – the Monument River in Massachusetts and the Chowan River in North Carolina – data were available to update statistical catch-at-age models. Statistical catch-at-age models for a third river, the Nanticoke River in Maryland, could not be updated due to moratoria and discontinuation of required data sets. Total mortality (Z) benchmarks were calculated in the benchmark assessment using spawning stock biomass per recruit analysis and used in the update to compare to estimates of Z from the observed age structure of adult alewife and blueback herring for rivers where those data were available.

What is the Status of the Stock?

Stock status is not determined from trend analyses, but recent trends in abundance were updated. Of the 54 stocks of river herring for which data were available, 16 experienced increasing trends over the ten most recent years of the update assessment data time series, 2 experienced decreasing trends, 8 were stable, 10

State	River	Benchmark Trends (2001-2010)	Updated Recent Trends (2006-2015)
NE U.S. Continental Shelf (NMFS Bottom Trawl)^		NA	Increasing[A,B]
ME	Androscoggin	Unknown[A]	Increasing[A]
	Kennebeck	Unknown[RH]	Increasing[RH]
	Sebasticook	Unknown[A]	Increasing[RH]
	Damariscotta	Stable[A]	Increasing[A]
	Union	Stable[A]	No Trend[A]
NH	Cocheco	Stable[A,B]	Increasing[A,B]
	Exeter	Unknown[A,B]	Stable[RH]
	Lamprey	Increasing[A]	Increasing[RH]
	Oyster	Stable[B]	Decreasing[RH]
	Taylor	Decreasing[B]	No Returns[RH]
	Winnicut	Unknown[A,B]	Unknown[A,B]
MA	Mattapoisett	Unknown[A]	Increasing[A]
	Monument	Unknown[A]	Increasing[A,B]
	Nemasket	Unknown[A]	Increasing[A]
	Parker	Unknown[A]	Stable[A]
	Stony Brook	Unknown[A]	Unknown[A]
RI	Buckeye	Unknown[A]	Increasing[A]
	Gilbert	Decreasing[A]	Stable[A]
	Nonquit	Decreasing[A]	Decrease[A]
CT	Bride Brook	Unknown[A]	Increasing[A]
	Connecticut	Decreasing[B]	Stable[B]
	Farmington	Unknown[A,B]	Unknown[A,B]
	Mianus	Unknown[A,B]	No Trend[A], Increasing[B]
	Mill Brook	Unknown[A]	No Trend[A]
	Naugatuck	Unknown[A,B]	Unknown[A,B]
	Shetucket	Unknown[A,B]	No Trend[A], Stable[B]
NY	Hudson	Stable[A.B]	Increasing[RH]
NJ, DE,PA	Delaware	Unknown[A,B]	No Trend[A,B]
MD, DE	Nanticoke	Decreasing[A,B]	Stable[A], No Trend[B]
VA, MD, DC	Potomac	Unknown[A,B]	Stable[A], Unknown[B]
VA	James	Unknown[A,B]	Unknown[A,B]
	Rappahannock	Unknown[A,B]	No Trend[A], Increasing[B]
	York	Unknown[A,B]	Unknown[A,B]
NC	Alligator	Unknown[A,B]	Unknown[A,B]
	Chowan	Stable[A.B]	No Trend[A], Stable[B]
	Scuppernog	Unknown[A,B]	Unknown[A,B]
SC	Santee-Cooper	Increasing[B]	No Trend[B]
FL	St. Johns River	NA	Unknown[B]

Table 1. Abundance trends of select alewife and blueback herring stocks along the Atlantic coast from the 2012 benchmark assessment and the 2017 assessment update. ^NE shelf trends are from the spring, coastwide survey data which encounters river herring more frequently than the fall survey. A = Alewife only; B= Blueback herring only; A,B = Alewife and blueback herring by species; RH = alewife and blueback herring combined.

experienced no discernible trend due to high variability, and 18 did not have enough data to assess recent trends, including 1 that had no returning fish. Three year averages of observed Z values were above Z benchmarks recommended by the benchmark assessment for 12 of the 14 stocks with available data, indicating that recent total mortality may be unsustainable in some rivers. During the benchmark, three year average Z values were above these benchmarks for all 18 of the stocks with available data.

Though some positive signs were apparent through the update (e.g., few declining abundance trends by data set in recent years), river herring continue to be depleted on a coastwide basis and near historic lows. 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 changes.

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.

Estimates of total catch of river herring need to be improved through expanded observer and port sampling coverage to quantify additional sources of mortality, including bait fisheries and incidental catch in other fisheries. Genetic analysis and other techniques are needed to determine population stock structure along the coast and to quantify which stocks are impacted by mixed stock fisheries (including bycatch fisheries). Stock identity data (e.g., genetic data from fin clips) collection should be ongoing.

To reduce uncertainty in age determination, current ageing techniques for river herring should be validated using known-age fish. An ageing workshop was conducted following the benchmark assessment to evaluate and provide a baseline of error among ageing labs, but ongoing efforts to standardize ageing techniques are necessary.

Monitoring protocols and analyses should be developed and implemented to determine river herring population responses and targets for rivers undergoing restoration (dam removals, fishways, supplemental stocking, etc.), as well as to quantify and improve fish passage efficiency and support the implementation of standard practices. Efforts should build off the 2015 data collection standardization workshop conducted by ASMFC in response to the benchmark assessment.

Whom Do I Contact For More Information?

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Glossary

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.

Spawning stock biomass per recruit analysis: an expanded form of yield per recruit analysis that incorporates maturity and fecundity information. These models provide a group of reference points that define the amount of spawning biomass to preserve to ensure a population can replace itself.

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 juveniles.

References

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