ASMFC Stock Assessment Overview: River Herring

Introduction

This document presents a summary of the 2012 benchmark stock assessment for alewife and blueback herring, collectively referred to as river herring. The assessment was peer-reviewed 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 Atlantic river herring fisheries management.

Management Overview

The Fishery Management Plan (FMP) for Shad and River Herring was one of the very first FMPs developed at the ASMFC in 1985. 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 management plan 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 plans 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 January 1, 2012, the Shad and River Herring Management Board approved sustainable fishery management plans for Maine, New Hampshire, New York, North Carolina and South Carolina.

What Data Were Used?

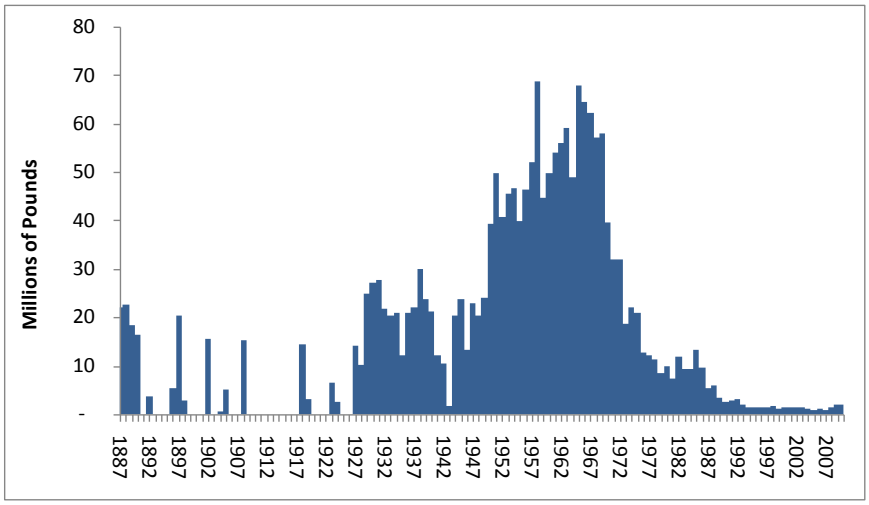
The river herring assessment used both fishery-dependent and -independent data as well as information about river herring biology and life history. Fishery-dependent data come from commercial fisheries that target river herring or catch them incidentally, while fishery-independent data are collected through scientific research and surveys. Data from a total of 57 river systems from Maine through Florida were included in this assessment.

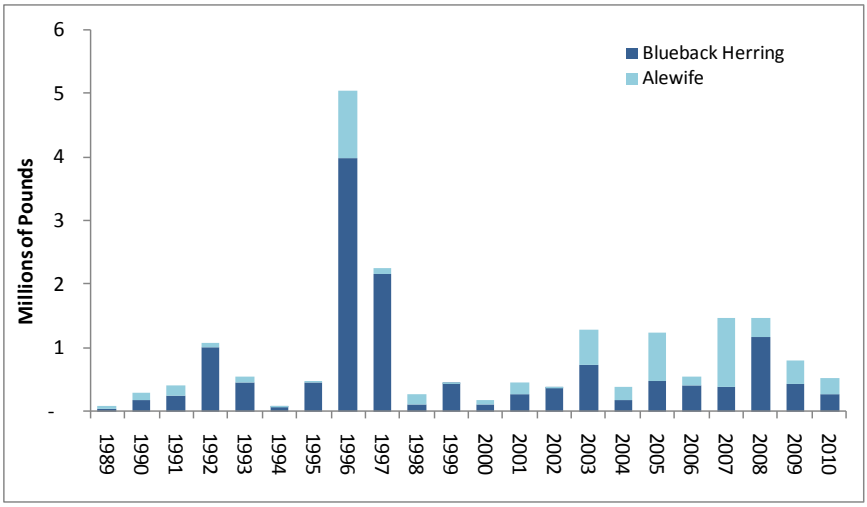
Life History

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 the river where they were born to spawn. 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 six to eight 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 here simply as "river herring." The assessment included historical landings back to 1887, although the fisheries that target river herring date back to colonial times. Reported commercial landings of river herring peaked in 1965 and declined steadily and rapidly after that. 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. The commercial landings come from a combination of NOAA Fisheries Service port sampling, dealer reports, and fishermen reports. In some river systems, biological samples were available from the commercial catch to describe the age and sex composition. 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.





Figures 1 & 2. Commercial landings of river herring (combined alewife and blueback herring), 1887 – 2010 (top) and total incidental catch of alewife and blueback herring, 1989 – 2010 (bottom). Note: Only 2005 - 2010 include incidental catch estimates from mid-water trawls.

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 Fishing Statistics Survey, 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. 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 patterns in the available fishery-dependent and -independent data sets. For three rivers – the Monument River in Massachusetts, the Nanticoke River in Maryland, and the Chowan River in North Carolina – data were available to construct statistical catch-at-age models. Spawning stock biomass per recruit analysis was used to calculate benchmarks for total mortality (Z), which were compared to estimates of Z from the observed age structure of adult alewife and blueback herring for rivers where those data were available.

State	River	Status Relative to Historic Levels/Recent Trends
ME	Damariscotta	Depleted[A], Stable[A]
	Union	Increasing[A] , Stable[A]
NH	Cocheco	Unknown[A,B], Stable[A,B]
	Exeter	Depleted[A], Increasing[A]
	Lamprey	Depleted[A], Unknown[A]
	Oyster	Depleted[B], Stable[B]
	Taylor	Depleted[B], Decreasing[B]
	Winnicut	Depleted[A,B], Unknown[A,B]
MA	Mattapoisett	Depleted[A], Unknown[A]
	Monument	Depleted[A], Unknown[A]
	Parker	Depleted[A], Unknown[A]
	Stony Brook	Depleted[A], Unknown[A]
RI	Buckeye	Depleted[A], Unknown[A]
	Gilbert	Depleted[A], Decreasing[A]
	Nonquit	Depleted[A], Decreasing[A]
CT	Connecticut	Depleted[B], Decreasing[B]
NY	Hudson	Depleted[A,B], Stable[A.B]
MD, DE	Nanticoke	Depleted[A,B], Decreasing[A,B]
VA, MD, DC	Potomac	Depleted[A,B], Unknown[A,B]
NC	Chowan	Depleted[A,B], Stable[A.B]
SC	Santee-Cooper	Depleted[B], Increasing[B]

Table 1. Status of select alewife and blueback herring stocks along the Atlantic coast. Status relative to historic levels is pre-1970. Recent trends reflects last ten years of data. A = Alewife only; B= Blueback herring only; A,B = Alewife and blueback herring by species

The assessment also attempted to model the coastwide population using a Depletion-Based Stock Reduction Analysis (DBSRA). This model was developed to estimate management parameters for data-poor stocks by determining what the unfished population size had to have been in order to sustain the observed catches without going extinct. However, the Peer Review Panel determined the reference points produced by the model were not credible and the model required further development before it was appropriate for management use.

What is the Status of the Stock?

Of the 52 stocks of alewife and blueback herring for which data were available, 23 were depleted relative to historic levels, one stock was increasing, and the status of 28 stocks could not be determined because the time-series of available data was too short.

Estimates of abundance and fishing mortality could not be developed because of the lack of adequate data. 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. The stock assessment identified a number of high priority research needs.

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).

To reduce uncertainty in age determination, current ageing techniques for river herring should be assessed and validated using known-age fish, scales, otoliths and spawning marks. Ideally, states should conduct biannual aging workshops to maintain consistency and accuracy in ageing fish sampled in state programs.

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.

Glossary

Age class: all of the individuals in a stock that were spawned or hatched in the same year. This is also known as the year class or cohort.

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

Fishing mortality (F): the instantaneous (not annual) rate at which fish are killed by fishing

Natural mortality (M): the instantaneous (not annual) rate at which fish die because of natural causes (predation, disease, starvation, etc)

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.

References

ASMFC. 2012. River Herring Stock Assessment Report for Peer Review. Atlantic States Marine Fisheries Commission, Stock Assessment Report No. 12-2 (supplement), 1049 p.

ASMFC. 2009. Guide to Fisheries Science and Stock Assessments. Washington, DC. http://www.asmfc.org/publications/GuideToFisheriesScienceAndStockAssessments.pdf