ASMFC Stock Assessment Overview: Weakfish

Introduction

This document presents a summary of the 2016 benchmark stock assessment for weakfish. The assessment was peer-reviewed by an independent panel of scientific experts through ASMFC's external peer review process. This assessment is the latest and best information available on the status of the weakfish stock for use in fisheries management.

Management Overview

Weakfish are managed under Amendment 4 to the Interstate Fishery Management Plan for Weakfish and its subsequent addenda (Addendum I-IV). Addendum IV requires states to implement a one fish recreational creel limit, 100 pound commercial trip limit, 100 pound commercial bycatch limit, and 100 undersized fish per trip allowance for the finfish trawl fishery. The Addendum's measures are intended to reduce the level of harvest without creating a large amount of discards and poise the stock for recovery should natural mortality decrease in the future.

What Data Were Used?

The weakfish stock assessment uses both fisheries-dependent and fisheries-independent data, including information on weakfish biology and life history, to determine the current stock condition. Fisheries-dependent data come from recreational and commercial fisheries, while fisheries-independent data are collected through scientific research and surveys.

Life History

Weakfish (*Cynoscion regalis*) occur along the Atlantic coast of North America from Nova Scotia to southeastern Florida, but are more common from New York to North Carolina. Warming of coastal waters in the spring prompts an inshore and northerly migration of adults from their offshore wintering grounds between Chesapeake Bay and Cape Lookout, North Carolina to nearshore sounds, bays, and estuaries. Spawning occurs shortly after, peaking from April to June, with some geographical variation in timing. Females continuously produce eggs during the spawning season and release them over a period of time. In the fall, an offshore and southerly migration of adults coincides with declining water temperatures.

Feeding on microscopic animals, larval weakfish journey from spawning areas to nursery areas, located in deeper portions of coastal rivers, bays, sounds, and estuaries. They remain in these areas until October to December of their first year, after which the juveniles migrate to the coast. Growth in weakfish is especially rapid in the first year and they mature at a young age. Size at age-1 is variable but most fish are 10 to 11 inches long. As adults, weakfish are often found near the periphery of eelgrass beds, perhaps because weakfish feed primarily on shrimp, other crustaceans, and small fish that are found near these grass beds.

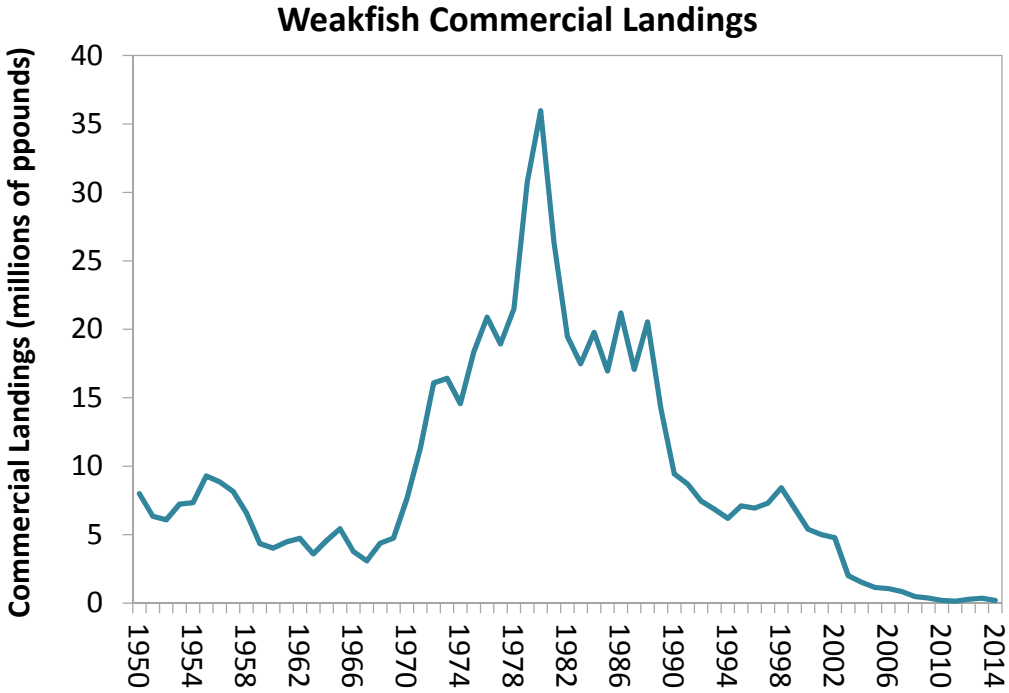
Natural Mortality

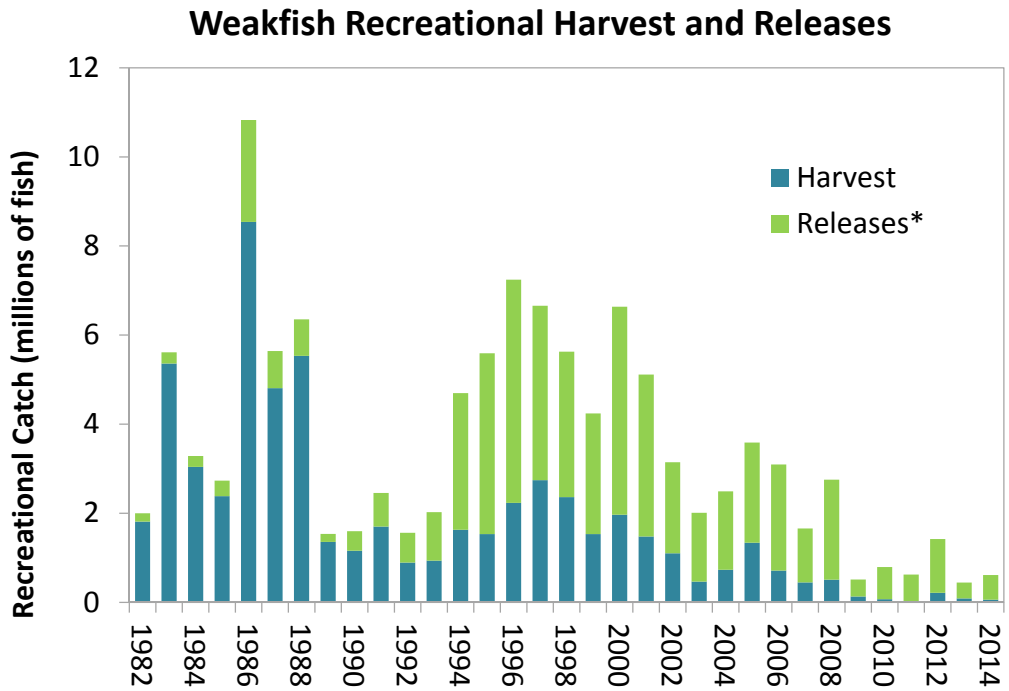
Since the early 2000s, the weakfish fishery has experience decreased catch rates and a shrinking age structure. Young-of-year indices remained relatively steady, but even with very low levels of harvest, the population showed no signs of recovery. This suggested that an

increase in natural mortality (M) had occurred for the stock. The 2009 assessment included several analyses to investigate time-varying M and concluded that, while there was evidence to support an increase in M, it was not possible to identify a driving factor (e.g. predation, sea surface temperature, etc). The 2016 assessment revisited this issue by looking at several methods to estimate time-varying M, including the relationship between catch and the Atlantic Multidecadal Oscillation and using data on harvest, relative abundance, and catchability to model changes in M. Overall, the different analyses support the hypothesis that M has increased since the mid-1990s, but the underlying cause or causes remain unclear.

Commercial and Recreational Data

Weakfish fishery data were evaluated between 1982 and 2014 from four fishery sectors: commercial harvest, commercial discards, recreational harvest, and recreational discards. Commercial harvest data were obtained from state and federal harvest reporting systems through the National Marine Fisheries Service (NMFS) while recreational harvest statistics are available from the NMFS Marine Recreational Fishery Information Program (MRIP).





* The stock assessment assumes 10% of the released fish died as a result of being caught and released.

Weakfish commercial landings have dramatically declined since the early 1980s, dropping from over 19 million pounds landed in 1982 to roughly 200,000 pounds landed in 2014. The majority of landings occur in North Carolina and Virginia and, since the early 1990s, the primary gear used has been gillnets. Discarding of weakfish by commercial fishermen is known to occur, especially in the northern trawl fishery, and the discard mortality is assumed to be 100%.

Discards peaked in the 1990s but have since declined as the result of management measures and a decline in stock abundance.

Like the commercial sector, catch in the recreational fishery has declined from over 11 million pounds in 1983 to roughly 77,000 pounds in 2014. Recreational harvest has been dominated by New Jersey, Delaware, Maryland, Virginia and North Carolina. Recreational discard mortality, which is assumed to be 10%, has decreased with recreational catch.

A recreational harvest-per-unit effort (HPUE) index was developed from MRIP data and used as a fishery-dependent index of abundance. This index showed a peak in the mid-1980s followed by a decline that was reversed in the early to mid-1990s, corresponding to an expansion of the age-structure in the catch. However, the index has declined steadily since 1998 and remains low.

Fishery-independent Data

Out of 45 fisheries-independent surveys considered by the Technical Committee, 14 were considered suitable for the assessment based on criteria including survey length, geographic range, and sampling methodology. Seven young-of-year (YOY) fisheries-independent surveys were incorporated into the stock assessment. These include the trawl surveys for juvenile finfish conducted by the states of Rhode Island through North Carolina. A composite index of these surveys showed that YOY has generally varied without trend but was below average in the 1980s and from 2006 to 2014.

Seven fisheries-independent surveys were used to characterize the abundance of weakfish older than one year, including the North Carolina Gill Net Survey, the Delaware Bay Trawl Survey, the New Jersey Ocean Trawl Survey, the Northeast Fisheries Science Center Bottom Trawl Survey, the Southeast and Northeast Area Monitoring and Assessment Programs (SEAMAP and NEAMAP, respectively), and the Chesapeake Bay Multispecies Monitoring and Assessment Program (ChesMMAP). All of the adult indices showed declines in abundance and a collapse of the age-structure since the early 2000s, with the exception of SEAMAP, which has been more variable and has not shown a strong declining trend in the index.

What Models Were Used?

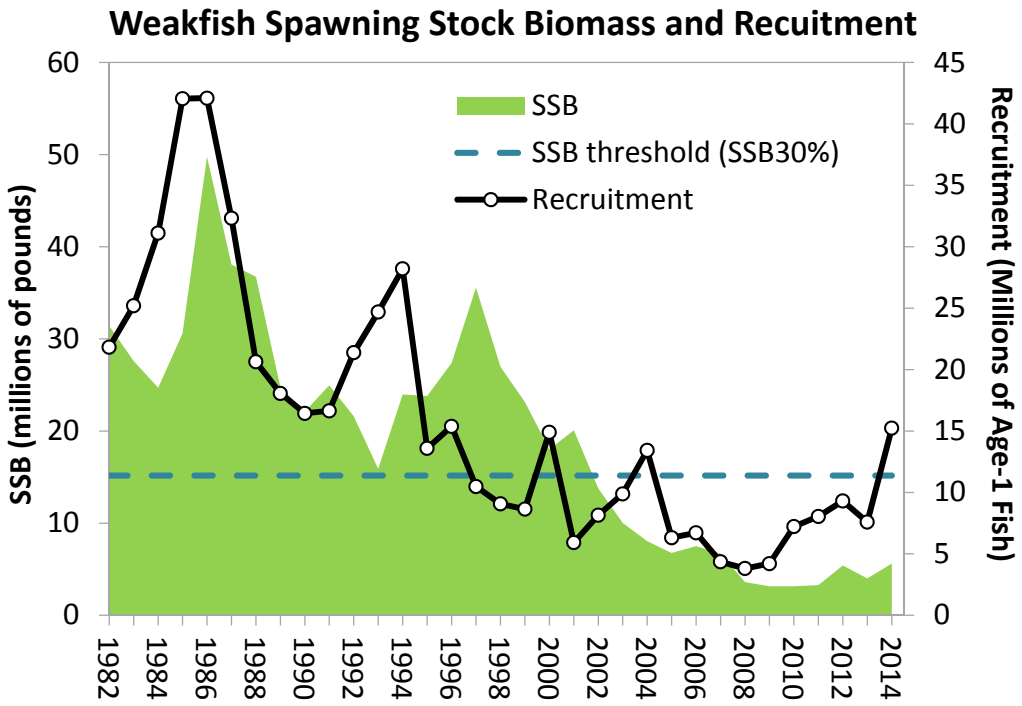
In collaboration with researchers at Virginia Tech, a sophisticated new model was developed to assess weakfish. This model is similar to the forward-projecting statistical catch-at-age models used to assess other ASMFC species, but uses Bayesian techniques that allowed the Technical Committee to estimate natural mortality, along with recruitment and fishing mortality. The model also incorporates variations in the spatial distribution of the weakfish population by assuming that the population trend being sampled by the various surveys differs based on survey location.

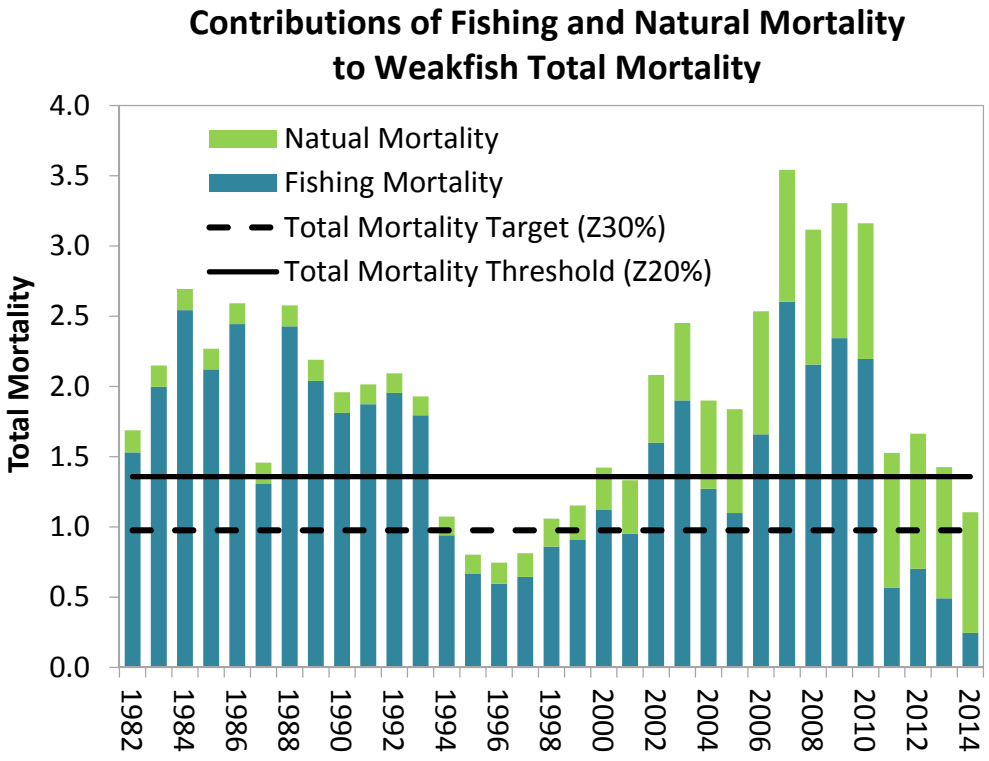
What is the Status of the Stock?

Results of the assessment show that the weakfish stock is depleted and has been for the past 13 years. Under the new reference points proposed in the assessment, the stock is considered depleted when the stock is below a spawning stock biomass (SSB) threshold of 30% (15.17 million pounds), equivalent to 30% of the projected total weight of fish in a stock that are old enough to spawn under average natural mortality and no fishing. In 2014, SSB was 5.62 million pounds. The preferred model does indicate some positive signs in the weakfish stock in the most recent years, with a slight increase in SSB and total abundance; however, the stock is still well below the SSB threshold.

The model indicated natural mortality has been increasing since the mid-1990s, from approximately 0.16 at the beginning of the time-series to an average of 0.93 from 2007-2014. Therefore, even though fishing mortality has been at low levels in recent years, the weakfish population has been experiencing very high levels of total mortality which has prevented the stock from recovering.

The Technical Committee recommends the use of total mortality (Z) benchmarks (which includes fishing mortality and natural mortality) to prevent an increase in fishing pressure when M is high. The assessment proposes a total mortality target of 0.93 and threshold of 1.36. Total mortality in 2014 was 1.11, which is above the target but below the threshold, indicating that total mortality is still high but within acceptable limits. This is the first time in 13 years that Z has been below the threshold, and additional years of data are needed to determine whether the terminal year Z will remain below the threshold.





Data and Research Needs

The Technical Committee compiled a list of prioritized research needs to improve understanding of weakfish life history and population dynamics as well as aid in the development of future stock assessments. High priority needs include increased observer coverage to identify the magnitude of discards in the commercial fishery, continued investigation into the causes of the increase in natural mortality, and research to identify potential sub-stocks, such as tagging or genetic work.

What are the Next Steps for Management?

The Board reviewed the results of the stock assessment and the peer review report in May 2016 and approved the benchmark assessment for management use. The Board is now considering the implications of and potential management response to the continued low abundance, high natural mortality, and depleted status of weakfish.

Whom Do I Contact For More Information?

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Glossary

Atlantic Multidecadal Oscillation: an ocean current which produces cyclical patterns in sea surface temperature in the North Atlantic over a 65-70 year period.

Bayesian: a branch of logical that uses knowledge of prior events to predict future events.

Bycatch: fish from one species that are caught while fishing for a different species.

Depleted: a stock which has reached critically low biomass or abundance.

Discards: fish returned to the sea dead or alive.

Fishery-Dependent Data: information collected from fishermen and dealers on catch, landings, and effort.

Fishery-Independent Data: information collected by scientists via a long-term research survey or other.

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.).

Overfishing: harvesting from a stock at a rate greater than the stocks reproductive capacity to replace fish removed through harvest.

Spawning stock biomass: the total weight of fishing in a stock that are old enough to spawn.

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 sum of fishing and natural mortality (Z=F+M)

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

References

ASMFC. 2016. Weakfish Stock Assessment and Peer Review Report. Atlantic States Marine Fisheries Commission, Stock Assessment Report, 435 p.

ASMFC. 2009. Guide to Fisheries Science and Stock Assessments. Arlington, VA