Introduction

This document presents a summary of the 2018 benchmark stock assessment for summer flounder. The assessment was peer-reviewed by an independent panel of scientific experts at the 66th Northeast Regional Stock Assessment Workshop/Stock Assessment Review Committee (SAW/SARC 66) meeting in November 2018. The assessment is the latest information available on the status of the summer flounder stock (from Cape Hatteras to the US-Canadian Border) for use in fisheries management.

Management Overview

Summer flounder (*Paralichthys dentatus*) are found in inshore and offshore waters from Nova Scotia, Canada to the east coast of Florida. In the U.S., they are most abundant in the Mid-Atlantic region from Cape Cod, Massachusetts to Cape Fear, North Carolina.

Because of their presence in, and movement between, state waters (0-3 miles) and federal waters (3-200 miles), summer flounder are jointly managed by the Atlantic States Marine Fisheries Commission (ASMFC) and the Mid-Atlantic Fishery Management Council (MAFMC) under the Summer Flounder, Scup and Black Sea Bass Fishery Management Plan (FMP) and its associated Amendments, Addenda, and Frameworks. The FMP defines the management unit as all summer flounder from the southern border of North Carolina northward to the US-Canada border.

ASMFC and MAFMC approve specifications (commercial quota, minimum size limit, minimum diamond and square mesh size; and recreational harvest limit) for the upcoming fishing seasons that apply to both state and federal waters. The Summer Flounder Commercial Issues Amendment was approved in March 2019 and revises the FMP's goals and objectives specific to summer flounder and implements new state-specific commercial allocations. The new allocations in the Amendment are expected to go into effect for the 2021 fishing season.

What Data Were Used?

The summer flounder assessment used both fishery-dependent and -independent data collected through state, federal, and academic research programs. The assessment included final data through 2017.

Life History

Summer flounder can live up to 20 years of age and have been recorded at sizes up to 24 pounds and 33 inches long. Adult summer flounder spend most of their life on or near the sea bottom. Summer flounder undergo seasonal migrations each year. They usually begin to spawn at age one at lengths greater than 12 inches. Spawning occurs beginning in the fall and into to next spring while the fish are moving offshore toward the edge of the continental shelf. The oldest and largest fish migrate first within the spawning migration. During their seasonal migrations, spawning summer flounder in the northern portion of the geographic range spawn and move offshore (depths of 120 to 600 feet) earlier than those in the southern part of the range. After hatching the larvae migrate to inshore coastal and estuarine areas. The larvae, or fry, move to benthic habitat upon reaching the coast and spend their first year in bays and other inshore

areas. At the end of their first year, some juveniles join the adult offshore migration. Recent research has indicated a shift in the center of biomass northward over the last twenty years.

Commercial and Recreational Data

The stock assessment used commercial and recreational fishery landings and discards-at age data from the states of Maine through North Carolina.

Strict commercial quota monitoring is conducted by states through various state and federal dealer and fishermen reporting systems; landings are compiled annually from those sources by state biologists. Throughout the 1980s, commercial landings ranged from 21 to 38 million pounds. Due to declining spawning stock biomass (SSB) throughout the early and mid-1980s, landings reached a low of nine million pounds in 1990. In 1993, the commercial quota was implemented for the first time, setting a landings limit of 12 million pounds. Since then, commercial landings have ranged from 6 to 17 million pounds. Over the past five years, commercial landings have been on the decline, dropping from 11 million pounds in 2015 to 6 million pounds in 2017 in part due to decreases in annual quota limits. Commercial discards averaged about 19% of total commercial removals from 2013-2017 (see Figure 1).

Recreational catch, effort, and length frequency data were obtained from the Marine Recreational Information Program (MRIP) for 1982-2017. MRIP estimates of recreational effort and catch were improved through a 2015 transition from a phone-based survey to a mail-based survey to estimate fishing effort. Old catch estimates prior to 2015 were subsequently calibrated to new estimates from the improved mail-based survey.

Figure 1. Summer Flounder Commercial and Recreational Landings and Discards

Source: NEFSC Data Update for 2019

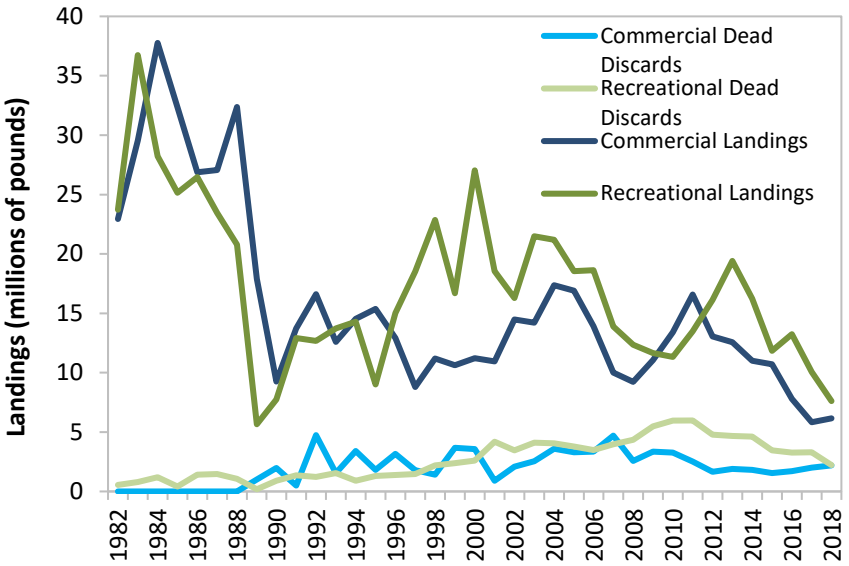
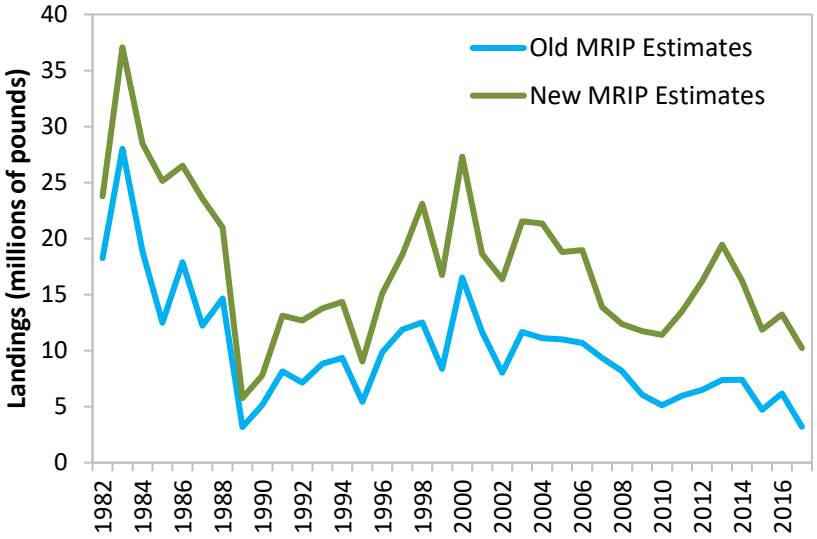


Figure 2. Comparison of Old & New MRIP Estimates of Recreational Landings of Summer Flounder

Source: ACCSP Data Warehouse, 2019



As a result of the survey improvements, new recreational landings estimates increased, on average, about 1.5 times in the early 1980s and about 3 times in the most recent 5 years (see Figure 2). These new MRIP estimates result in a larger stock abundance than previously estimated using old MRIP estimates. From 1981 through 2004, recreational landings varied widely from a high of 37 million pounds in 1981 to a low of 6 million pounds in 1989. Starting in 1993, harvest limits were implemented for the recreational fishery.

Beginning in the mid-2000s, recreational harvest began to decline, in part due to decreases in the coastwide recreational harvest limit (RHL). In 2017, recreational anglers harvested 10 million pounds of summer flounder. Figure 1 shows commercial and recreational landings and discards.

Fishery-Independent Surveys

The assessment used several fishery-independent indices of abundance with associated age compositions from the Northeast Fisheries Science Center (NEFSC) winter, spring, and fall surveys; Massachusetts and Connecticut spring and fall surveys; Rhode Island fall and monthly fixed surveys; Delaware, New York, and New Jersey surveys; and the Virginia Institute of Marine Science ChesMMAP and NEAMAP spring and fall trawl surveys. The model also used aggregate indices of stock abundance from the University of Rhode Island Graduate School of Oceanography trawl survey and NEFSC MARMAP and ECOMON larval surveys, and recruitment indices (age-0; young-of-the-year or YOY) from surveys conducted by the states of Massachusetts, Delaware, Maryland, Virginia and North Carolina.

How Were the Data Analyzed?

Age-Structured model, ASAP

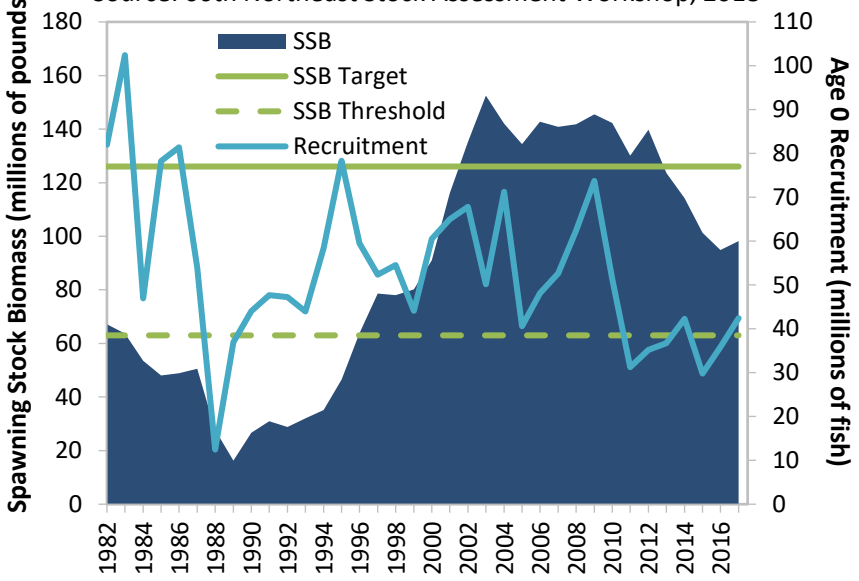
The accepted model for the summer flounder stock assessment is an age-structured model, ASAP, which uses commercial and recreational fishery landings and discards-at-age, as well as indices of abundance, to estimate annual stock size and fishing mortality rates. Indices of abundance track relative changes in abundance over time, while catch data provide information on the magnitude of abundance and the proportion of abundance removed by fishing. Age composition data link the information provided by indices of abundance and catch to specific year classes. Stock abundance is tracked by the model as new year classes recruit to the stock and then decline over time due to mortality (both natural and fishing).

What is the Status of the Stock?

The 2018 assessment indicates summer flounder is not overfished nor experiencing overfishing relative to the reference points defined in the assessment (see below). Female SSB is estimated at 98 million pounds, below the SSB target of 126 million pounds, but above the SSB threshold of 63 million pounds (Figure 3). While total fishing mortality is estimated at 0.334, below the fishing mortality threshold of 0.448 (Figure 4), current mortality from all sources is greater than recent recruitment levels can sustain long-term, which has resulted in a declining abundance. Overall, the magnitude of abundance has increased relative to earlier stock assessments primarily due to increases in MRIP catch estimates (Figure 5) from the new survey method.

Figure 3. Summer Flounder Spawning Stock Biomass and Recruitment

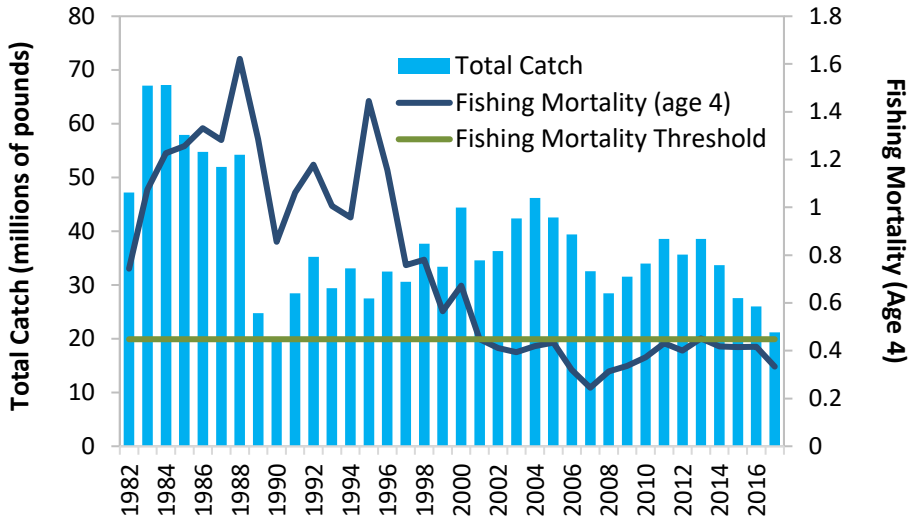
Source: 66th Northeast Stock Assessment Workshop, 2018



The assessment indicates increasing relative abundance of older fish and an expanding age structure since about 2000. However, the assessment also indicates decreasing trends in average lengths- and weights-at-age for both sexes, suggesting slower growth and delayed maturity, which impacts the biological reference points. Additionally, the assessment found the spatial distribution of the resource is continuing to shift northward and eastward.

Figure 4. Summer Flounder Total Catch & Fishing Mortality

Source: 66th Northeast Stock Assessment Workshop, 2018

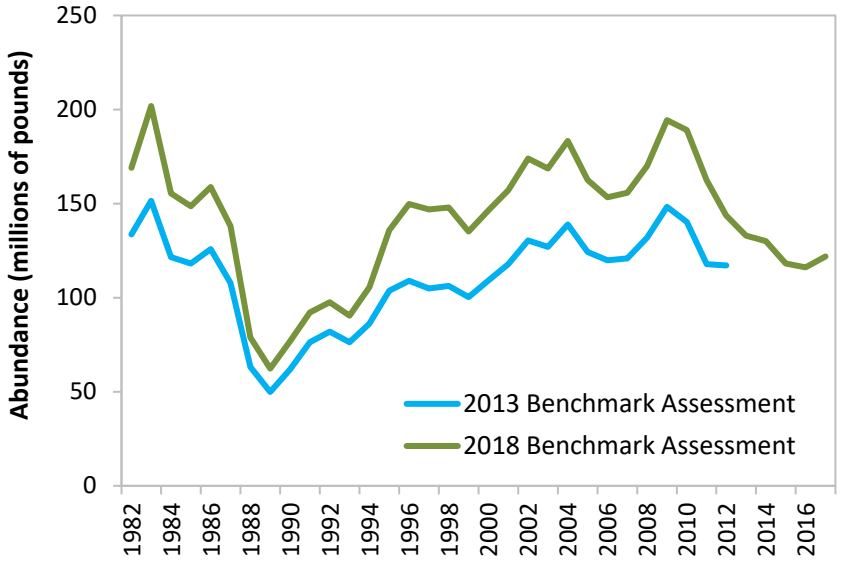


Recruitment

Summer flounder recruitment, or the number of age-0 fish, has been variable since 1982, though recruitment was higher in the 1980s and early 1990s than in the years since 1996. Average recruitment over the whole time series is 53 million fish. Recruitment has been below average since 2011, ranging from 30 to 42 million fish. The 1983 year class is the largest in the assessment time series at 102 million fish, while the 1988 year class is the smallest at only 12 million fish. Recruitment in 2017 was estimated at 42 million fish (Figure 3).

Figure 5. Comparison of Abundance Estimates from the 2013 Benchmark Using Old MRIP Numbers & the 2018 Benchmark Using New MRIP Numbers

Source: ACCSP Data Warehouse, 2019



The 1983 year class is the largest in the assessment time series at 102 million age-0 fish, while the 1988 year class is the smallest at 12 million fish. The average recruitment from 1982 to 2017 was 53 million fish. Recruitment was below average during 2011-2017, ranging from 30 to 42 million and averaging 36 million fish. The environmental drivers of the pattern in recruitment has not been definitively identified.

Biological Reference Points

The reference points used for management include a fishing mortality threshold of 0.448, SSB target of 126 million pounds, and SSB threshold of 63 million pounds. While the reference point definitions are unchanged from the previous assessment, the values have been updated with new information including updated weight-at-age, selectivity, and stock abundance estimates. The new fishing mortality and SSB reference point values are greater and less than the 2013 assessment reference point values, respectively. These changes are driven by the updated weight-at-age and selectivity data, which are both reduced for older ages relative to the last assessment.

Data and Research Priorities

The SAW Summer Flounder Working Group (SFWG) was able to address or make progress on several of the recommendations from the 2013 benchmark assessment report, including developing sex-specific supportive models and evaluating patterns of movement by sex and life stage. Additionally, the retrospective pattern observed in recent assessments, which underestimated fishing mortality and overestimated SSB, was negligible in the 2018 assessment, largely due to the inclusion of substantially higher recreational catch from the new MRIP estimates.

The SFWG identified several high priority recommendations to improve the assessment. These included continuing exploration of changes in the distribution of recruitment to better understand why the changes are occurring and their implications for stock productivity; carrying the uncertainty estimates through all the components of the assessment, biological reference points, and projections; and exploring potential mechanisms for recent slower growth that is observed in both sexes.

Next Steps

ASMFC and MAFMC have set specifications for 2019-2021. A stock assessment update, tentatively scheduled for 2021, will be used to set 2022-2023 specifications.

Glossary

Age structure: the separation of a fish population into distinct age groups

Benthic: at or near the bottom of a body of water including the lowest level of water and bottom substrate

ASAP: an age-structured stock assessment model that works forward in time to estimate population size and fishing mortality in each year

Fishing mortality: the instantaneous rate at which fish are killed by fishing

Natural mortality (M): the instantaneous rate at which fish die because of natural causes (predation, disease, starvation, etc.)

Spawning stock biomass: the total weight of the mature females within a stock of fish; frequently used instead of total biomass as a better measure of the ability of a stock to replenish itself

Recruitment: a measure of the weight or number of fish that enter a defined portion of the stock, such as the spawning stock or fishable stock. For this stock assessment, recruitment refers to the number of age-0 fish entering the population

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

References

ASMFC. 2009. Guide to Fisheries Science and Stock Assessments. Arlington, VA. http://www.asmfc.org/uploads/file/GuideToFisheriesScienceAndStockAssessments.pdf

NEFSC. 2019. 66th Northeast Regional Stock Assessment Workshop (66th SAW) Assessment Report, Northeast Fisheries Science Center, Woods Hole, Massachusetts. 1175p.

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