Introduction

This document presents a summary of the 2023 benchmark stock assessment for black drum. The assessment was peer-reviewed by an independent panel of scientific experts through the ASMFC external peer review process. The assessment is the second coastwide assessment for black drum and contains the latest and best information available on the status of the stock for use in fisheries management.

Management Overview

The Interstate Fishery Management Plan (FMP) for Black Drum was approved in 2013 (ASMFC 2013), providing managers with a suite of options for managing the fishery. Prior to the FMP, management was state-specific and varied from no regulations in North Carolina to a combination of size limits, possession limits, commercial trip limits, and/or annual commercial quotas in other states from New Jersey to Florida. The Maryland portion of the Chesapeake Bay was closed to commercial harvest of black drum in 1998.

The FMP required all states to implement a maximum possession limit and minimum size limit (of at least 12 inches) by January 1, 2014, with an additional increase of the minimum size limit to at least 14 inches required by January 1, 2016. The FMP also included a management framework to adaptively respond to future concerns or changes in the fishery or population.

Addendum I to the FMP was approved in May 2018. The Addendum allowed Maryland to reopen its black drum commercial fishery in the Chesapeake Bay in 2019 with a daily vessel limit of up to 10 fish and a 28-inch minimum size.

What Data Were Used?

The black drum assessment used both fishery-dependent and fishery-independent data as well as information about black drum biology and life history. Fishery-dependent data come directly from recreational and commercial fisheries. Fishery-independent data are collected through scientific research and surveys.

Life History

Mature black drum undergo extensive south-north migrations every spring, spawning in estuaries and coastal bays along the Atlantic coast from Florida to New Jersey. Spawning begins as early as January in Florida and occurs progressively later as fish move north, peaking in May in the Delaware Bay. Black drum are batch spawners and may spawn every 3-4 days throughout the spawning season. Young-of-year (YOY) fish in the Mid-Atlantic are believed to migrate south during their first fall and join other YOY fish in the South Atlantic. Juvenile fish use estuarine habitat and then migrate offshore to the mature stock around age 4. Migration patterns and genetic studies suggest that black drum along the Atlantic coast are a single stock unit.

Black drum are a relatively fast growing, long-lived species, experiencing rapid growth until approximately age 10. The oldest recorded fish was 67 years old and was captured in 2000. Natural mortality is estimated to be 0.104 based on the observed maximum age.

Fishery-Dependent Data
Recreational Data

Recreational fisheries have accounted for the majority of coastwide black drum harvest, averaging just over 4.1 million pounds from 1981-2020. Harvest decreased in the late 1980s and remained below 3 million pounds through the mid-1990s. Harvest increased in the late 1990s and became relatively stable in the early to mid-2000s, averaging 4.9 million pounds from 2000-2007. Harvest peaked in 2008 at 10.7 million pounds and decreased after 2011 through the remainder of the 2010s, with an average of 5.3 million pounds landed from 2012-2020. South Atlantic states (North Carolina- Florida) harvested the majority of black drum.

**Recreational Harvest and Releases**
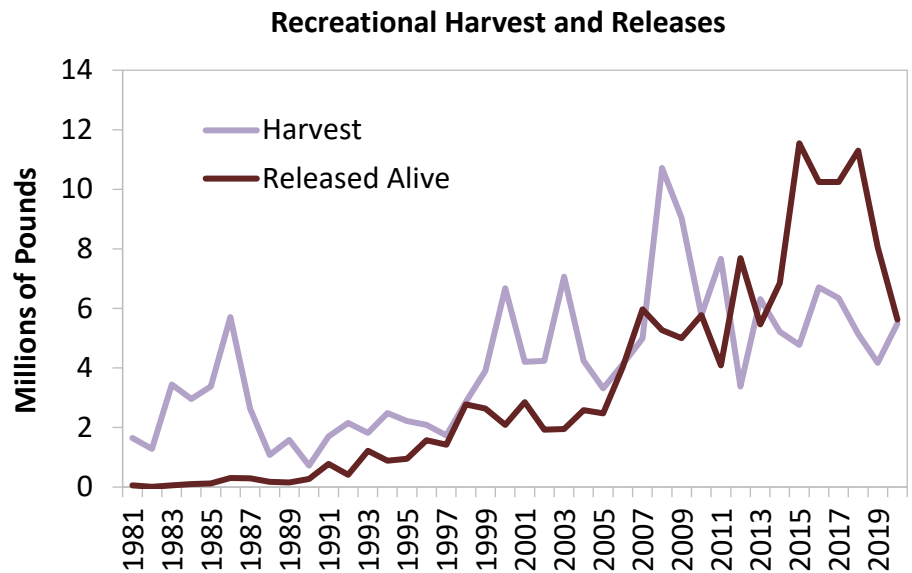
Recreational releases have increased steadily since the 1980s, peaking at 11.5 million pounds and 11.3 million pounds in 2015 and 2018, respectively, after which releases declined. Black drum release mortality rate, applied to all releases to calculate dead discards, was assumed to be the same as red drum release mortality rate (0.08) based on the similarities in life histories and fisheries for both species. Estimates of harvest and releases were provided by the Marine Recreational Information Program (MRIP).

Length sampling of the recreational harvest has been sparse for a majority of the time series, particularly in the Mid-Atlantic, and there is no length information available for fish released alive. The mean length of black drum harvested along the coast was relatively stable prior to the coastwide minimum length regulations implemented in the FMP (2014). Mean fork length (FL) averaged 14.7 inches from 1981-2013. Following the implementation of the FMP in 2014, mean length increased to 17.3 inches FL from 2014-2020. Length data suggest that South Atlantic catches are mostly juvenile fish. In the Mid-Atlantic, the fishery operates earlier in the year and primarily catches mature fish as the spawning adults migrate to this region. YOY are typically captured during the summer and fall. No ageing structures (i.e., otoliths) are collected by MRIP and limited but improving age sampling has been conducted by state sampling programs.

Recreational Index of Abundance
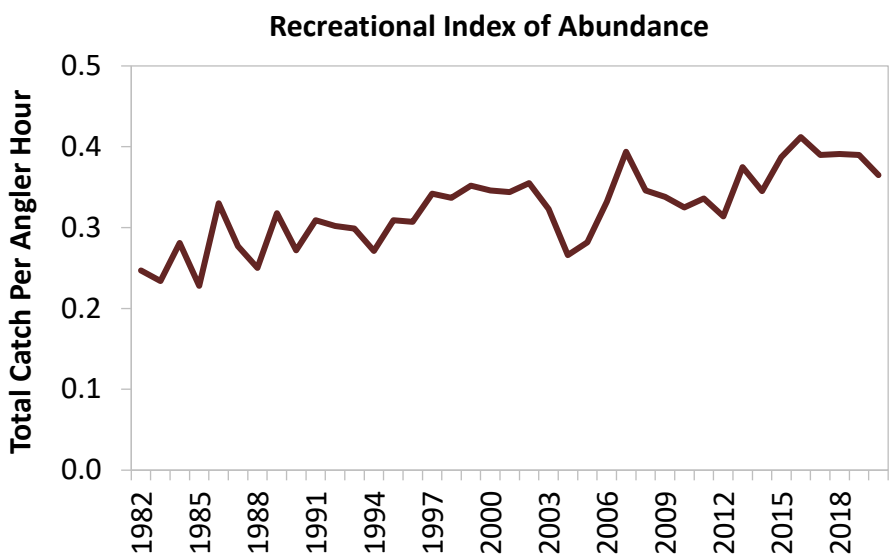
An index of abundance was developed from access-point intercepts of anglers' catch-per-unit-effort (CPUE) conducted by MRIP (see graph on previous page). Directed trips, used to calculate this index of abundance, were defined as any intercepts where the anglers identify black drum as either the primary or secondary species targeted during their trip and any additional intercepts where anglers reported catching black drum. This is the only index that spans the stock's range and includes all ages caught in the fisheries, whereas fishery-independent indices primarily track YOY and sub-adult (< 600mm total length) abundance. There is an increasing trend in the index of abundance over the time series from 1982-2020.
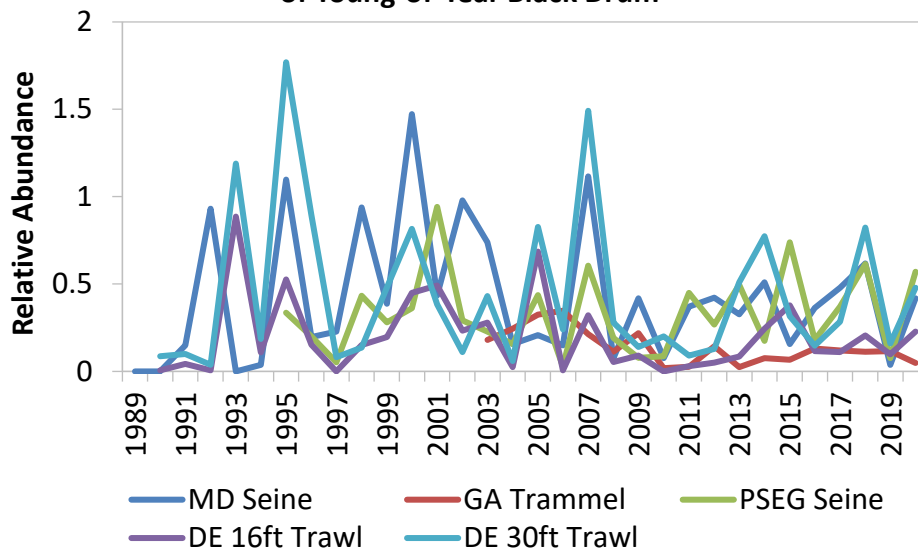
Commercial Data

Commercial Landings
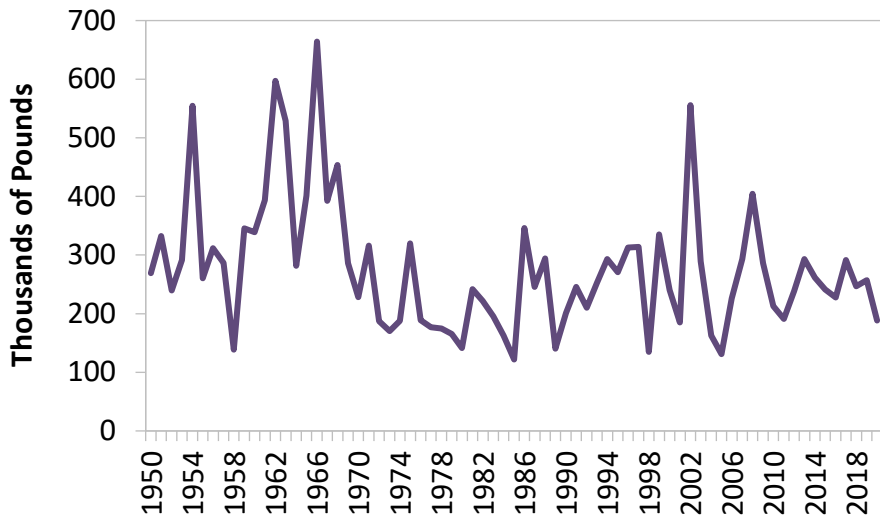
Black drum are primarily landed as bycatch in commercial fisheries. There are some small-scale, targeted fisheries in the Mid-Atlantic, supplying fish for consumption, primarily on Virginia's Eastern Shore.

Overall, total commercial landings have been small and characteristic of bycatch in fisheries directed at other species, never exceeding 700,000 pounds a year. Landings were highest in the 1960s, averaging 434,000 pounds, and declined through the 1970s. Landings increased slightly in the late 1980s and have been relatively stable since, averaging 258,000 pounds since 1986.

Landings were primarily in Florida and Virginia before Florida implemented regulations in the 1980s and a gillnet ban in the 1990s. Since the 1990s, the majority of landings have been in Virginia and North Carolina. Landings in other states have been variable and relatively minimal. Most black drum are landed with gillnets and pound nets, while smaller percentages are landed with seines, trawls, and hook and line.

Fishery-Independent Abundance Indices of Young-of-Year Black Drum

Legend: MD Seine, GA Trammel, PSEG Seine, DE 16ft Trawl, DE 30ft Trawl

Length sampling of commercial fisheries has been limited outside of North Carolina, but indicates black drum landed in commercial fisheries are similar in size to those harvested in recreational fisheries within the same region.

Fishery-Independent Surveys

Twenty-eight fishery-independent surveys were evaluated during the assessment. Most surveys were not designed to target black drum and encounters were infrequent during many of the surveys. Eight surveys were accepted for use in the stock

assessment. Five surveys tracked YOY abundance including the Public Service Enterprise Group Beach Seine survey (PSEG Seine), Delaware Division of Fish and Wildlife 16ft and 30ft Trawl Surveys (DE 16ft and 30ft Trawl), Maryland Department of Natural Resources Coastal Bays Seine Survey (MD Seine), and Georgia Department of Natural Resources Marine Sportfish Population Health Trammel Net Survey (GA Trammel) (see figure on previous page). Two surveys tracked abundance of sub-adult fish, including the North Carolina Division of Marine Fisheries Program 915 Gill Net Survey (NC P915) and the South Carolina Department of Natural Resources Trammel Net Survey (SC Trammel). One survey, the New Jersey Department of Environmental Protection Ocean Trawl Survey (NJ Ocean Trawl), occurs at the northern extreme of the population range and is believed to be a better measure of range expansion than stock abundance due to its sporadic but generally increasing trend in catches over time. The YOY and sub-adult indices were highly variable.

Fishery-Independent Abundance Indices of Sub-Adult Black Drum
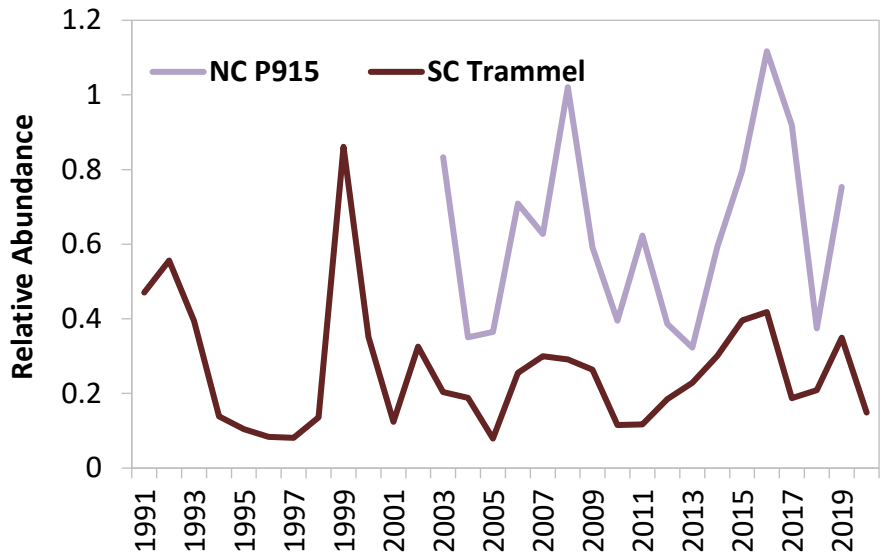
Fishery-Independent Indicator of Range Expansion from NJ Ocean Trawl
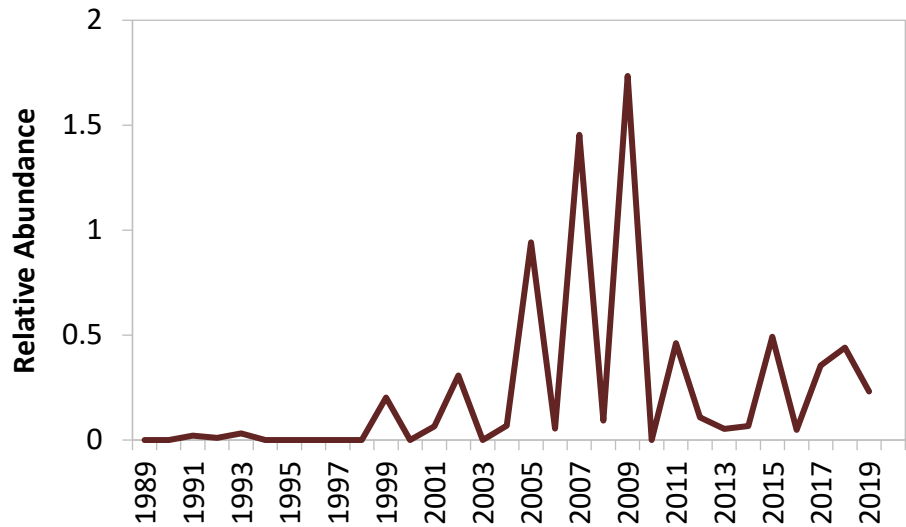
How Are Data Analyzed
Stock Indicators

The Peer Review Panel that reviewed the 2015 benchmark stock assessment recommended that a protocol be developed that could indicate any major changes in the black drum fishery and the potential need to expedite a stock assessment. During the 2023 assessment, a suite of indicators calculated from black drum data sets was established to address this recommendation. These simple indicators can be updated easily on an annual basis to monitor the stock between assessment years and can also be used as a check against model-derived estimates within stock assessments. Indicators included 8 indices of abundance, 1 index of range expansion, and 6 indices of fishery characteristics (regional catch time series).

Indicators show increased fishery removals over the past 20 years and fewer large recruitment events in the Mid-Atlantic over the past 10 years. There are no clear indications of a declining trend in abundance from abundance indicators, but there is a declining trend in the final two years of the recreational releases time series that may be reflective of abundance in addition to other factors. There is some indication of northern range expansion. Overall, stock indicators do not appear negative at this time.

What Assessment Methods Were Used?

This assessment evaluated several methods for estimating stock status, including methods using only the fishery removal time series (commercial landings, recreational harvest, and recreational dead discards) and methods using an index of abundance, as well as the fishery removal time series. Ultimately, JABBA-Select (Winker et al. 2020), a surplus production modeling framework, was identified as the preferred method to provide management advice in the 2023 assessment because it: (1) includes an index of abundance as recommended by the 2015 Peer Review Panel; (2) differentiates between exploitable biomass and spawning biomass, which are different for black drum due to life history and exploitation patterns; (3) requires one less assumption about biomass depletion than other models; (4) does not require use of historical, uncertain catch data; and (5) accounts for changes to fishery selectivity through time. Additionally, this method moves away from catch-based management advice to management advice based on biomass and exploitation levels.

JABBA-Select estimates annual spawning abundance (SB), annual exploitation (H), and biological reference points, using an index of abundance (MRIP CPUE), total fishery removals, life history information, and selectivity information to describe black drum's vulnerability to fisheries. The model estimates annual spawning biomass and exploitation according to the index of abundance and fishery removal data sets, as well as threshold levels of spawning biomass (SB_{MSY}) and exploitation (H_{MSY}).

What is the Status of the Stock?

The JABBA-Select model estimated an increasing trend in spawning biomass that has remained above the threshold throughout the time series. Exploitation was estimated to be relatively high in the mid-1980s, followed by lower levels throughout the 1990s. Exploitation increased around 2000 and remained at a higher, stable level throughout the remainder of the time series. Exploitation has remained below the threshold throughout the time series.

Black drum are considered overfished when spawning biomass falls below the SB_{MSY} threshold ($SB_y/SB_{MSY} < 1$).

Relative Spawning Biomass and Exploitation

Overfishing is occurring when exploitation exceeds the H_{MSY} threshold ($H_y/H_{MSYy} > 1$). In 2020, the median relative spawning biomass estimate was 2.99 and the median relative exploitation estimate was 0.28, indicating the stock was not overfished nor experiencing overfishing.

Data and Research Needs

The assessment report outlines several data and research needs that would improve the next benchmark assessment, such as the need for a fishery-independent adult survey and associated biological data, expansion of current tagging programs, and increased biological sampling in commercial and recreational fisheries.
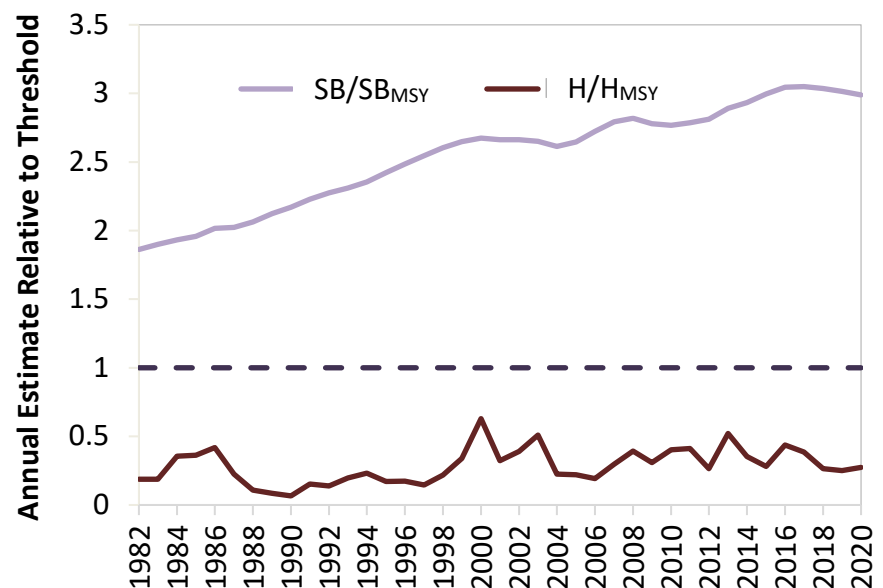
What are the Next Steps for Management?

The favorable stock status estimates indicate that no immediate management action is needed. However, black drum remains a data-poor stock and the assessment acknowledges a relatively high level of uncertainty in available data sets and quantitative population estimates despite greater certainty in qualitative estimates of stock status (i.e., overfished vs. not overfished and overfishing occurring vs. overfishing not occurring). Due to this uncertainty, the stock assessment recommends that stock indicators be reviewed annually by the Sciaenids Management Board to closely monitor the stock for any concerning trends between stock assessments. It is recommended that the next benchmark assessment should be conducted in five years.

Whom Do I Contact For More Information?

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Glossary

Biological reference point: A particular value of biomass, abundance, catch, or exploitation that may be used as a benchmark to compare to current or past values of these quantities estimated for the stock. Biological reference points can be categorized as limits, targets, or thresholds depending on their intended use.

Bycatch: The component of catch taken in addition to the catch of targeted species because of non-selectivity of gear.

Exploitation: The proportion of biomass or abundance removed by fisheries, including through harvest and discards of dead fish.

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

Otoliths: Inner 'ear bones' of fish that can be used to age fish.

Overfished: Occurs when stock biomass falls below the threshold primarily due to exploitation, impacting the stock's reproductive capacity to replace fish removed by fisheries.

Overfishing: Removing fish from a population at a rate that exceeds the threshold, impacting the stock's reproductive capacity to replace fish removed by fisheries.

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

Surplus production model: Also known as 'Biomass Dynamic Models', these models are among the simplest stock assessment techniques commonly employed by fisheries scientists to model population dynamics and track biomass. They are "simple" because they characterize the dynamics of a stock in terms of changes in total biomass without regard to age or size structure.

Threshold: Benchmarks that represent critical levels not to be crossed. If crossed, the sustainability of the stock is threatened. When on the safe side of a threshold, the stock is expected to be healthy.

Young-of -year (YOY): Fish in their first year of life.

References

ASMFC. 2013. [Interstate Fishery Management Plan for Black Drum](). Atlantic States Marine Fisheries Commission. Arlington, VA.

ASMFC. 2015. [Black Drum Stock Assessment and Peer Review Reports.]() Atlantic States Marine Fisheries Commission. Arlington, VA.

ASMFC. 2023. [Black Drum Benchmark Stock Assessment and Peer Review Report](). Atlantic States Marine Fisheries Commission. Arlington, VA.

Winker, H., F. Carvalho, J.T. Thorson, L.T. Kell, D. Parker, M. Kapur, R. Sharma, A.J. Booth, and S.E. Kerwath. 2020. JABBA-Select: Incorporating life history and fisheries' selectivity into surplus production models. Fisheries Research 222.