



Introduction

This document provides an overview of the 2021 stock assessment update for tautog (*Tautoga onitis*), which includes four regional stock assessments. The update uses the assessment methodology that was approved for management use as part of the 2016 Regional Benchmark Stock Assessment and subsequently used in the 2017 update. The following overview will provide a mix of general information that applies to all four regional assessments and region-specific information that covers stock status and landings.

Management Overview

Currently, tautog is managed under Amendment 1 (2017) to the Fishery Management Plan. Amendment 1 delineated the stock into four regions due to differences in biology and fishery characteristics, and limited coastwide movement: Massachusetts–Rhode Island (MARI), Long Island Sound (LIS), New Jersey–New York Bight (NJ-NYB), and Delaware–Maryland–Virginia (DelMarVa). Amendment 1 established new regional biological reference points, fishing mortality targets, and stock rebuilding schedules. The Amendment requires each region to implement measures that have at least a 50% probability of achieving the regional fishing mortality target. If the current fishing mortality exceeds the regional threshold, the Board must initiate corrective action within one year.

The 2017 assessment update found that all regions except MARI were overfished, and overfishing was occurring in the LIS and NJ-NYB regions. As such, Amendment 1 required the LIS region to reduce harvest by at least 20.3%, and the NJ-NYB region to reduce harvest by at least 2%. The MARI and DelMarVa regions were not required to reduce harvest, but adjusted their regulations to establish consistent measures across all the states within each region where possible.

Additionally, Amendment 1 established a commercial harvest tagging program to address the pervasive issue of illegal harvest of undersized and unreported tautog. Under the tagging program, all states within the management unit must require commercially permitted harvesters to tag all tautog at the time of harvest or prior to offloading. Tautog must be landed in the state that is identified on the tag. The selected tags are non-lethal and are applied to fish intended for both live and fresh markets. State implementation of the tagging program began in 2020.

What Data Were Used?

The assessment update used both fishery-dependent and independent data as well as information about tautog biology and life history. Fishery-dependent data come from the commercial and recreational fisheries, while fishery-independent data are collected through scientific research and surveys.

Life History

Tautog are a species of wrasse found on the Atlantic coast. Unlike most wrasse species, which inhabit tropical waters, tautog are most abundant from the southern Gulf of

Maine (lower Massachusetts Bay and southern Cape Cod Bay) to Chesapeake Bay. Like their warm-water cousins, they are very structure-oriented and prefer to live on rocky reefs. Tagging data suggest tautog may make some offshore migrations during colder weather, but they do not make extensive north-south migrations along the coast. In fact, some tautog have been recaptured multiple times on the same reef. Because of this, tautog are assessed as four separate, regional stocks: MARI, LIS, NJ-NYB, and DelMarVa. The stock boundaries were determined by life history information and exploitation patterns.

Age and growth studies indicate tautog are slow-growing and long-lived. Fish as old as thirty years have been caught in Rhode Island, Connecticut, and Virginia, but most of the fish caught are four to eight years old. The largest record catch was twenty-eight pounds.

Commercial and Recreational Data

While tautog are targeted by both commercial and recreational fisheries, over 90% of the total harvest comes from the recreational fishery. Total catch included estimates of recreational landings and discards from the Marine Recreational Information Program (MRIP) conducted by the NOAA Fisheries, and commercial landings from the Atlantic Coast Cooperative Statistics Program (ACCSP) Data Warehouse. This update includes the new time-series of calibrated recreational data from MRIP. For all regions, the calibrated MRIP estimates of recreational removals was higher across the entire time series than the uncalibrated estimates. Tautog are not well-sampled by the MRIP program, resulting in higher percent standard errors (approximately 20-30% in recent years at the regional level) and large year-to-year swings in catch estimates. More detailed information on recreational catch and commercial landings can be found under each region's section.

Because collection of age data began at different times in each of the regions, the MARI assessment starts in 1982, the LIS in 1984, the NJ-NYB in 1989, and the DelMarVa in 1990. All regional assessments use data through 2020, the most recent year of available catch and index data.

Indices of Abundance

Tautog are not easily sampled by standard trawl-based fishery independent surveys, because it's hard to trawl over their preferred habitat of rocky reefs. The assessments investigated fishery-independent surveys from Massachusetts through Maryland, and each region used fishery-independent indices specific to that region.

In addition, regional fishery-dependent indices of abundance (catch per unit effort, CPUE) were developed from the MRIP intercept data.

What Models Were Used?

This assessment updates the accepted statistical catch-at-age (ASAP) model for each region using the NOAA Fisheries Toolbox. In general, the only change from the 2016 update was the additional years of data and the use of newly calibrated MRIP data to update the historical catch-at-age and removals. Biological reference points for the population were calculated using spawning potential ratio (SPR)-based methods. Additional analyses confirmed the results of the ASAP model.

Status of the Stock in a Snapshot

Spawning stock biomass (SSB) and fishing mortality (F) reference points for all four regions were updated during the assessment (see below table). The new MRIP estimates resulted in higher estimates of SSB and recruitment in all regions, but had less of an impact on fishing mortality. Stock status in 2020 varied by region but was generally improved from the 2016 update. Specifically, the LIS population moved from overfished and overfishing occurring to not overfished and overfishing not occurring. The NJ-NYB population was no longer experiencing overfishing in 2020, but was still overfished, although SSB had increased since 2015 and was just below the SSB threshold. Additionally, the DelMarVa stock moved from overfished to not overfished status. The changes in stock status are not due to the new MRIP numbers, but instead reflect strong year classes and lower landings in all regions that resulted in lower fishing mortality and increasing SSB. Details about each region follow.

Tautog Biological Reference Points and Stock Status by Region

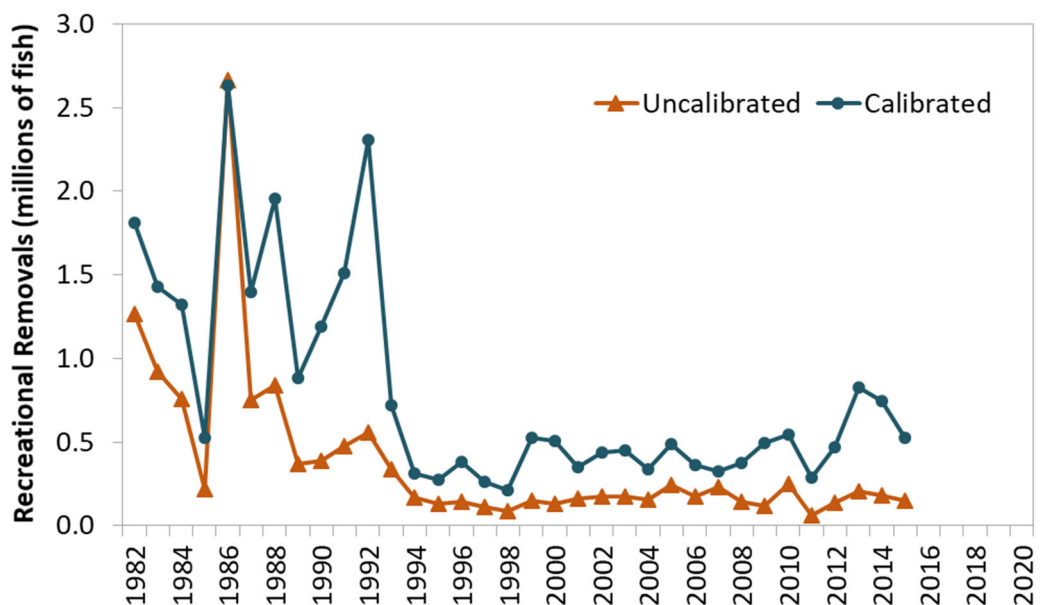
Stock Region	Spawning Stock Biomass (in millions of pounds)			Fishing Mortality			Stock Status
	Target	Threshold	2020 Estimate	Target	Threshold	3-year Average	
MARI	10.09	7.57	14.90	0.28	0.49	0.23	Not overfished; overfishing not occurring
LIS	14.83	11.12	14.70	0.26	0.38	0.30	Not overfished; overfishing not occurring
NJ-NYB	14.45	10.78	10.54	0.19	0.30	0.26	Overfished; overfishing not occurring
DelMarVa	9.90	7.40	9.66	0.17	0.27	0.06	Not overfished; overfishing not occurring

Region-specific Overviews of Landings and Population Trends

Massachusetts-Rhode Island

In 2020, the commercial fishery landed approximately 116,000 pounds. Total recreational removals were 1.9 million pounds in 2020, 349,492 pounds of which are assumed to have died due to release mortality. Throughout the time series (1982-2020), recreational harvest has ranged from a high of 10.2 million pounds in 1992 to a low of 916,663 pounds in 1998. Release mortality has averaged 80,553

Figure 1. Comparison of Calibrated and Uncalibrated Recreational Removals (harvest + dead releases) for the MARI Region



pounds throughout the time series, with a significant uptick in release mortality beginning in 2014 (229,540 pounds). The new calibrated estimates of recreational removals were consistently higher than the uncalibrated estimates across the entire time series, averaging about 163% higher than the uncalibrated estimates. Fishery-independent indices used for the MARI region include two adult surveys: the MA Trawl Survey and the RI Fall Trawl Survey, and one young-of-year (YOY) survey: RI Narragansett Bay Seine. The assessment also used a region-specific MRIP CPUE index of adult abundance.

Tautog in MARI are not overfished and not experiencing overfishing relative to the assessment recommended

reference points. In 2020, SSB was estimated at 14.90 million pounds, above the $SSB_{THRESHOLD}$, and the three-year average of fishing mortality was estimated at 0.23, below the $F_{THRESHOLD}$. A strong year class in 2014 (age-1 in 2015) has contributed to the increasing trend in SSB and decreasing trend in fishing mortality that has been seen since 2015.

Figure 2. Annual Spawning Stock Biomass (SSB) & Recruitment for MARI Region

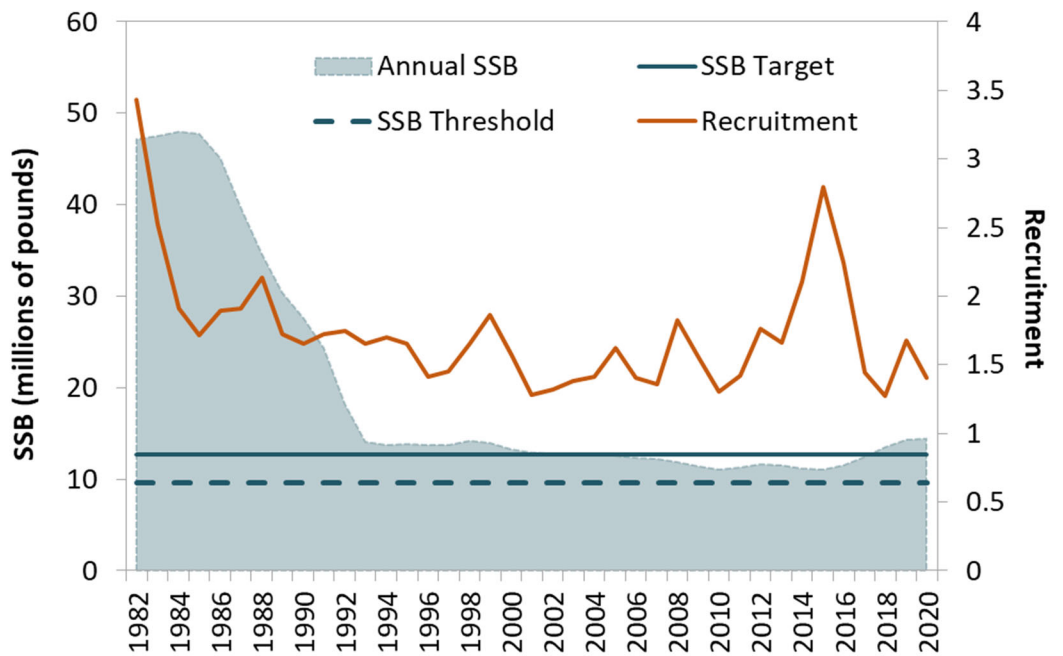
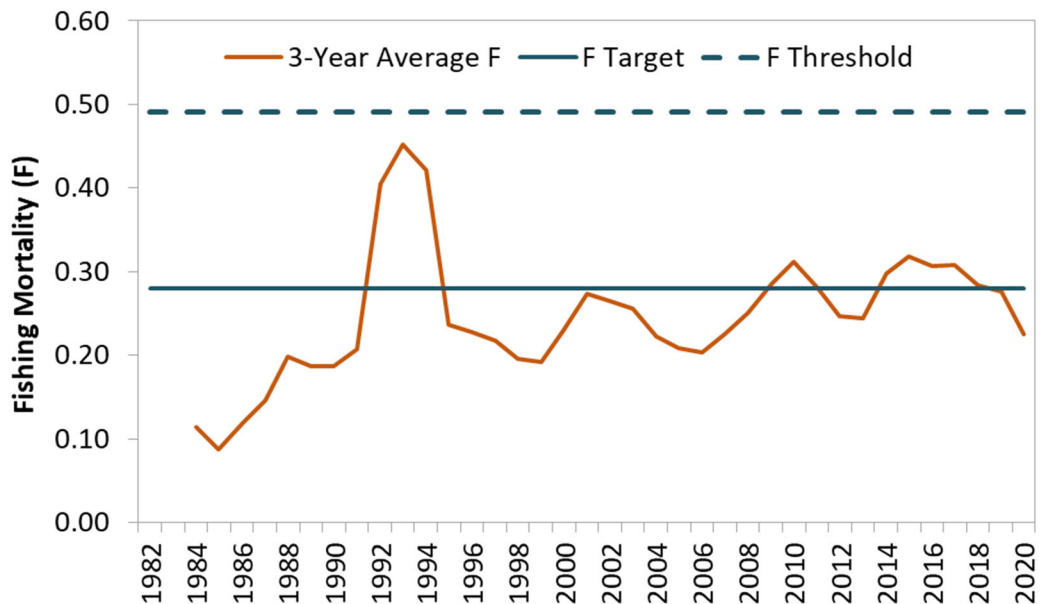


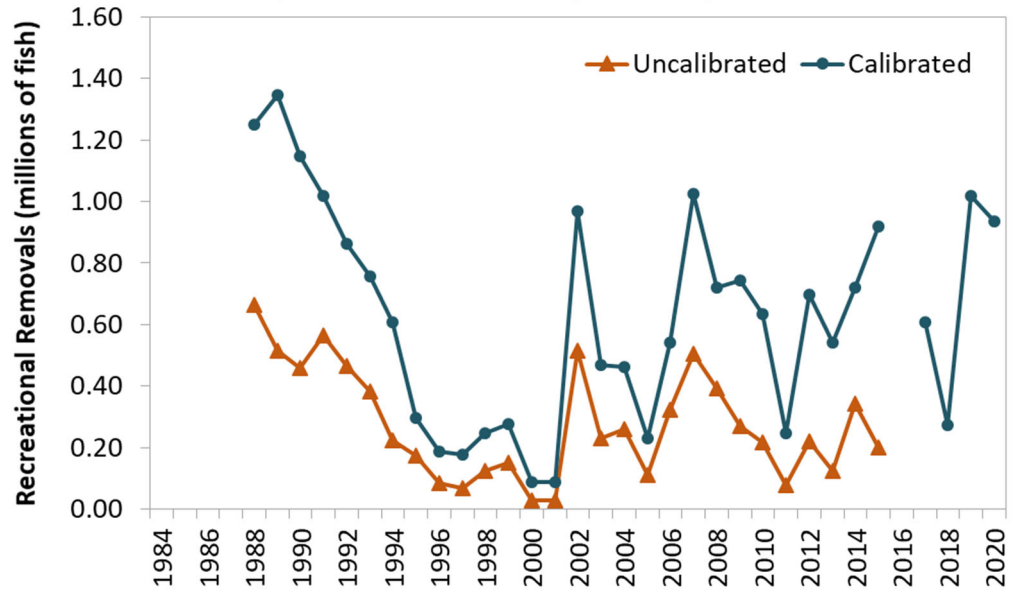
Figure 3. 3-Year Average of Fishing Mortality for MARI Region



Long Island Sound

In 2020, the commercial fishery landed approximately 127,824 pounds. Total recreational removals were 2.7 million in 2020, 212,209 pounds of which are assumed to have died due to release mortality. Throughout the time series (1984-2020), recreational harvest has ranged from a high of 5.5 million pounds in 1987 to a low of 333,969 pounds in 2001. Release mortality has averaged 57,773 pounds throughout the time series, with a significant uptick in release mortality beginning in 2012 (149,102 pounds). The calibrated estimates of recreational removals were consistently higher across the entire time series, averaging about 143% higher than the uncalibrated estimates. Fishery independent indices used for the LIS region includes one adult survey: the CT-LIS Trawl Survey, and two YOY surveys: NY Peconic Bay Trawl Survey and the NY YOY Seine Survey. The assessment also used a region-specific MRIP CPUE index of adult abundance.

Figure 4. Comparison of Calibrated and Uncalibrated Recreational Removals (harvest + dead releases) for LIS Region



Tautog in the LIS region are not overfished, and not experiencing overfishing relative to the assessment recommended reference points.

In 2020, SSB was estimated at 14.70 million pounds, above the $SSB_{THRESHOLD}$, and the three-year average of fishing mortality was estimated at 0.30, below the $F_{THRESHOLD}$, although still above the F_{TARGET} . Several strong year classes in recent years have contributed to the increasing trend in SSB and the decreasing trend in fishing mortality in this region.

Figure 5. Annual Spawning Stock Biomass (SSB) and Recruitment for LIS Region

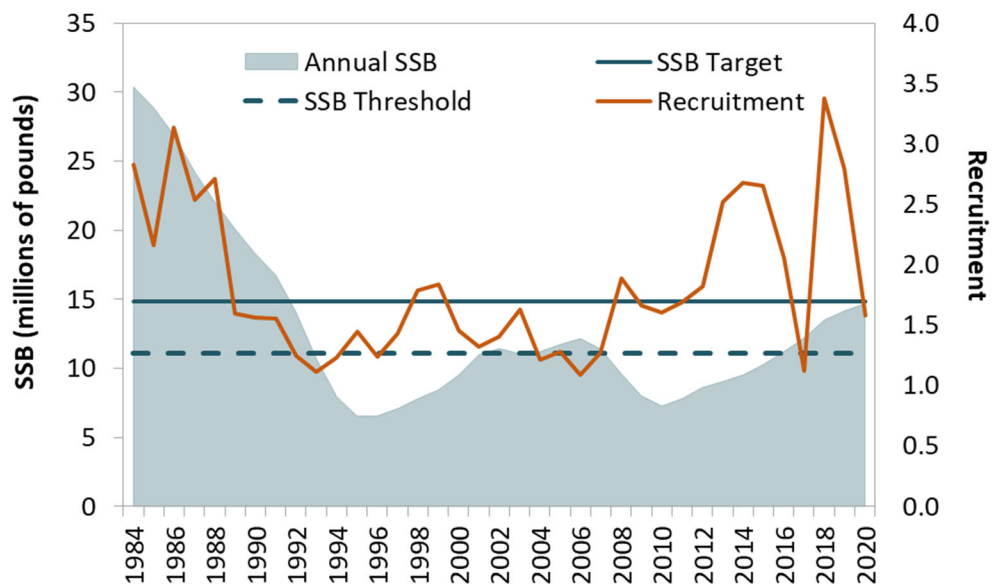
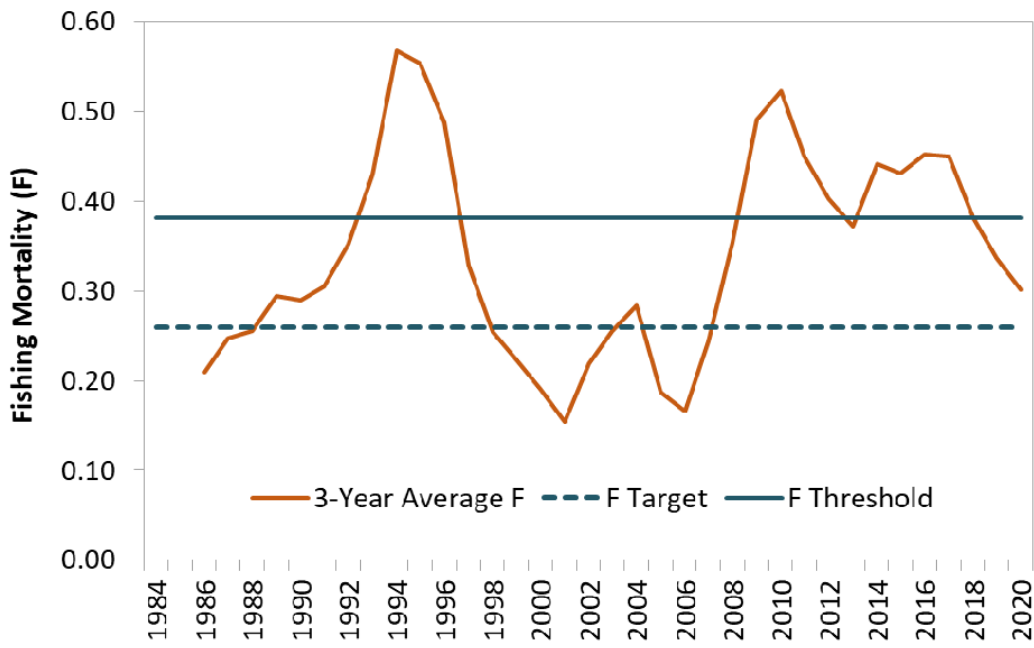


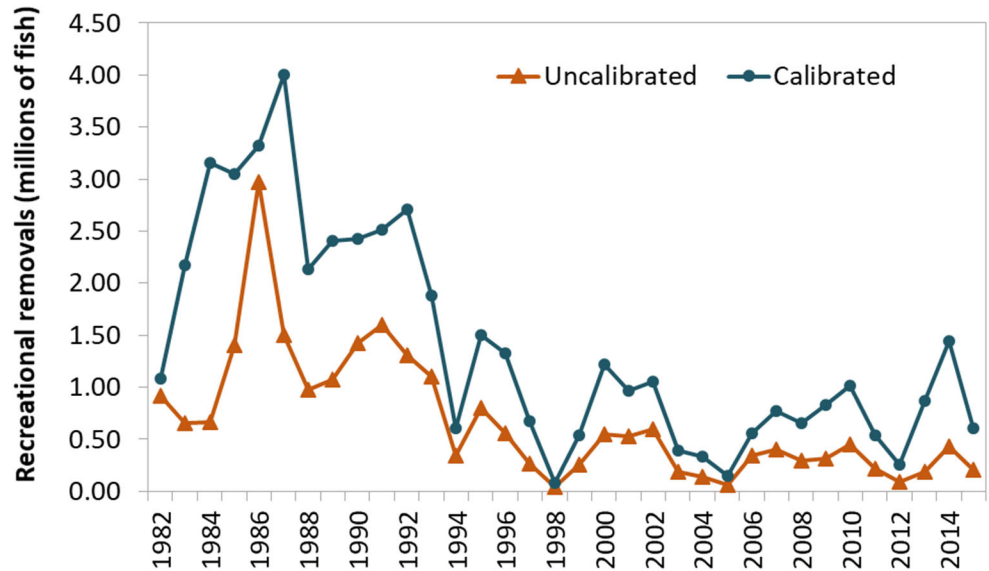
Figure 6. 3-year average of Fishing Mortality for LIS Region



New Jersey-New York Bight

In 2020, the commercial fishery landed approximately 70,714 pounds. Total recreational removals were 1.7 million in 2020, 324,179 pounds of which are assumed to have died due to release mortality. Throughout the time series (1982-2020), recreational harvest has ranged from a high of 7.5 million pounds in 1987 to a low of 142,245 pounds in 1998. Release mortality has averaged 104,570 pounds throughout the time series. The calibrated estimates of recreational removals were consistently higher across the entire time series, averaging about 133% higher than the uncalibrated estimates.

Figure 7. Comparison of Calibrated and Uncalibrated Recreational Removals (harvest + dead releases) for NJ-NY Bight Region



The calibrated estimates of recreational removals were consistently higher across the entire time series, averaging about 133% higher than the uncalibrated estimates. Fishery independent indices used for the NJ-NYB region include one adult survey: the NJ DEP Ocean Trawl Survey, and one YOY survey: the NYSDEC Western Long Island Seine Survey. The assessment also used a region-specific MRIP CPUE index of adult abundance.

Tautog in the NJ-NYB region are overfished, but not experiencing overfishing relative to the assessment recommended reference points.

In 2020, SSB was estimated at 10.54 million pounds, below the $SSB_{THRESHOLD}$, although SSB has been trending upward since the last assessment update. The three-year average of fishing mortality was estimated at 0.26, below the $F_{threshold}$, although still above the F_{target} .

Figure 8. Annual Spawning Stock Biomass (SSB) & Recruitment for NJ-NY Bight Region

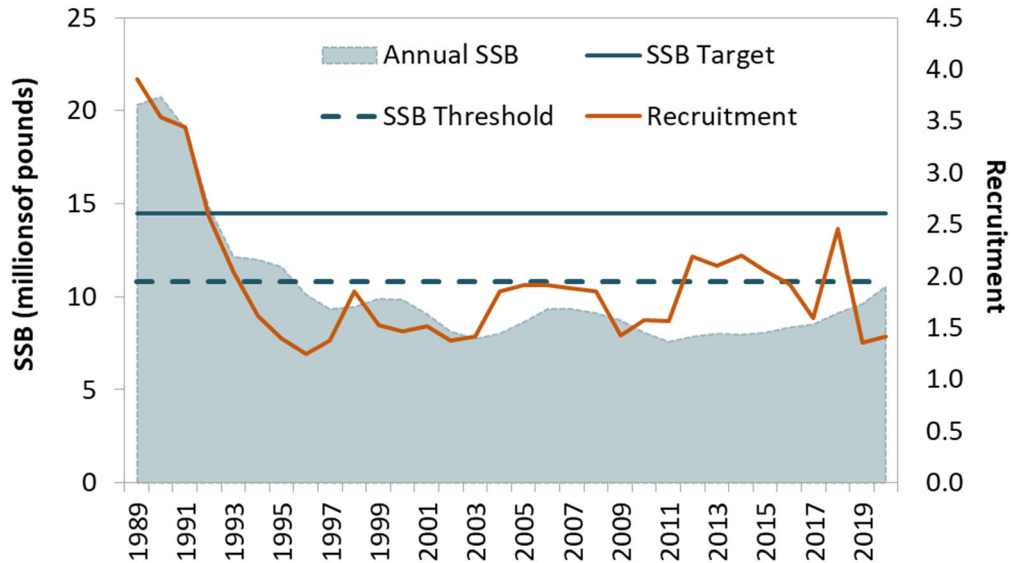
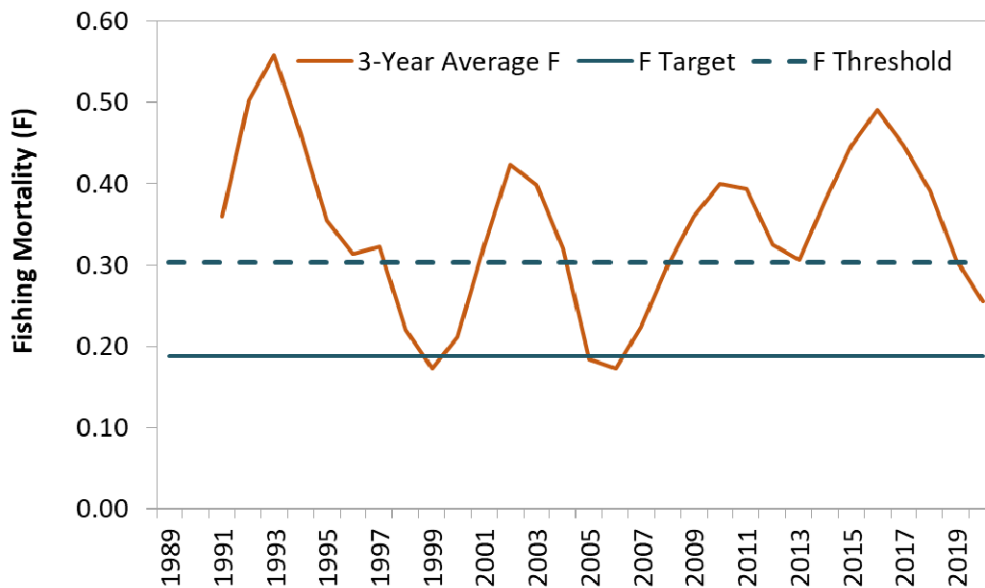


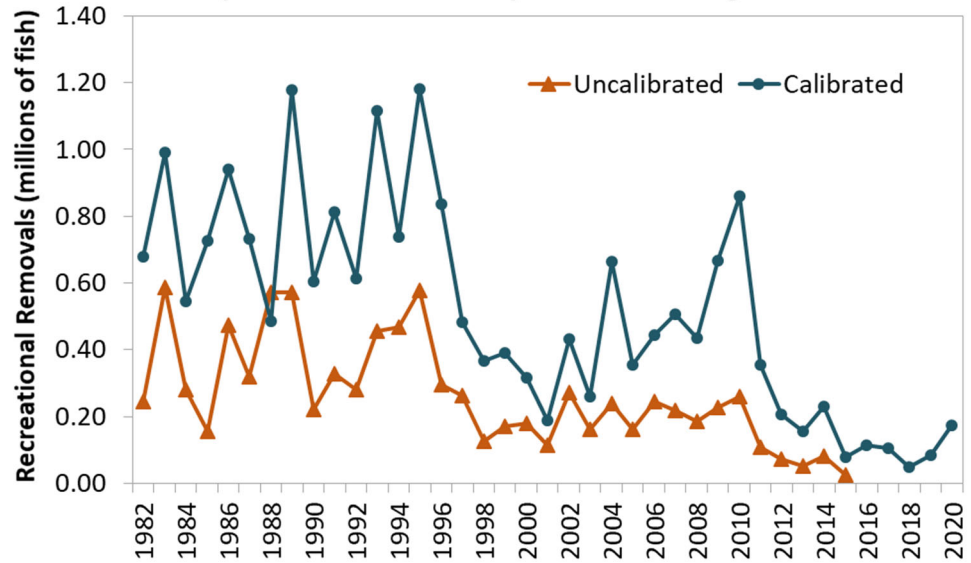
Figure 9. 3-Year Average of Fishing Mortality for NJ-NY Bight Region



DelMarVa

In 2020, the commercial fishery landed approximately 2,844 pounds. Total recreational removals were 562,077 in 2020, 23,616 pounds of which are assumed to have died due to release mortality. Throughout the time series (1982-2020), recreational harvest has ranged from a high of 3.9 million pounds in 1989 to a low of 110,360 pounds in 2018. Release mortality has averaged 40,909 pounds throughout the time series, reaching a high of 103,811 pounds in 2010. The calibrated estimates of recreational removals were consistently higher across the entire time series, averaging about 138% higher than the uncalibrated estimates. No fishery independent indices of abundance were available for the DelMarVa region, but the assessment was able to use a region-specific MRIP CPUE index of adult abundance.

Figure 10. Comparison of Calibrated and Uncalibrated Recreational Removals (harvest + dead releases) for DelMarVa Region



Tautog in the DelMarVa region are not overfished, and not experiencing overfishing relative to the assessment recommended reference points. In 2020, SSB was estimated at 9.66 million pounds, above the $SSB_{THRESHOLD}$, and the three-year average of fishing mortality was estimated at 0.06, below the $F_{THRESHOLD}$ and below the F_{TARGET} . Landings and fishing mortality in this region have declined significantly since 2012, resulting in an increase in SSB over that time period, so that the stock is no longer overfished.

Figure 11. Annual Spawning Stock Biomass (SSB) and Recruitment for DelMarVa Region

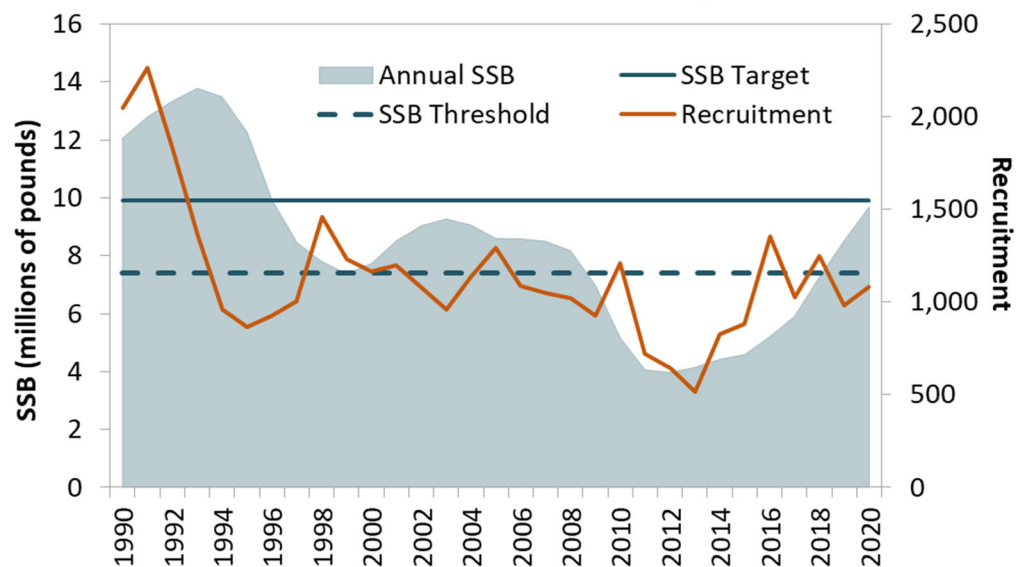
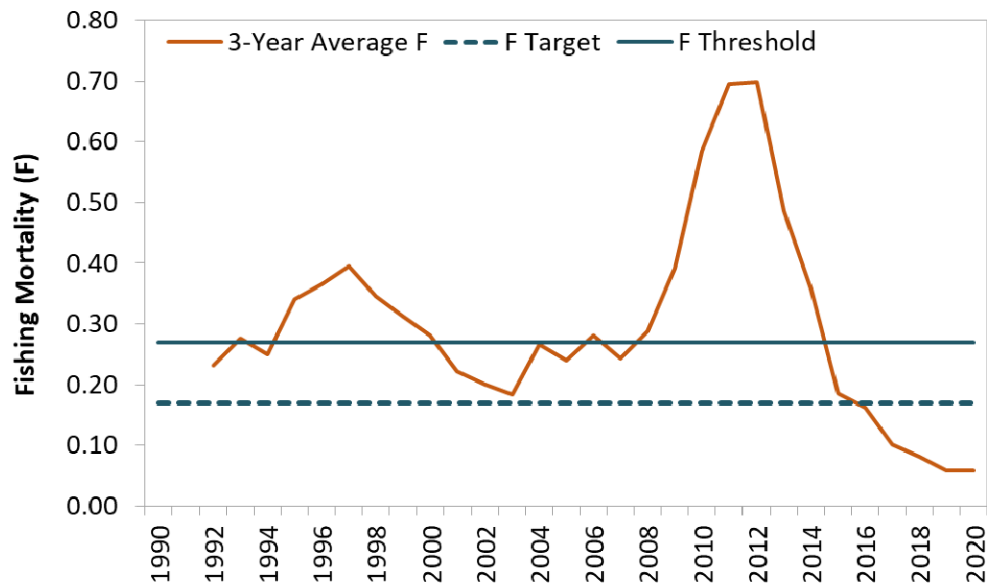


Figure 12. 3-year average of Fishing Mortality (F) for DelMarVa Region



Data and Research Needs

For the 2016 regional assessment, the Technical Committee (TC) compiled a list of prioritized research needs to improve understanding of tautog life history and stock dynamics as well as aid in development of future stock assessments. High priority needs included improved biological sampling of the catch for commercial and recreational fisheries, better sampling of the smallest and largest fish, improved characterization of the lengths of discarded or released fish, and development of a comprehensive fishery-independent survey that is more appropriate for a reef-oriented species, such as a pot or trap survey. In addition, the TC supports efforts to better define the stock structure of tautog through genetic studies and improved biological data collection.

For the next assessment, additional improvements to MRIP sampling for tautog should be made, and fishery-independent sampling should continue to be a priority to improve the age-length key model. The stock assessment subcommittee also highlighted sources of uncertainty in the retrospective analysis and recommended that this issue be addressed during the next benchmark.

Whom Do I Contact For More Information?

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Glossary

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

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.

Spawning Stock Biomass (SSB): 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

Statistical catch-at-age 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.

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

References

ASMFC. 2021. Tautog Regional Stock Assessment Update. Atlantic States Marine Fisheries Commission, Stock Assessment Report, 97 p.

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