



Mid-Atlantic Fishery Management Council

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Michael P. Luisi, Chairman | P. Weston Townsend, Vice Chairman

Christopher M. Moore, Ph.D., Executive Director

MEMORANDUM

Date: September 24, 2021
To: Council
From: Julia Beaty, staff
Subject: Review of 2022 Atlantic chub mackerel specifications

On October 5, 2021, the Mid-Atlantic Fishery Management Council (Council) will review the previously implemented 2022 specifications for Atlantic chub mackerel and discuss if revisions are necessary. Council staff, the Scientific and Statistical Committee, the Monitoring Committee, and the Advisory Panel all recommend no changes.

The following materials are provided behind this tab (unless otherwise noted) for the Council's consideration.

- 1) Summary of the September 14, 2021 Monitoring Committee webinar
- 2) September 2021 Scientific and Statistical Committee report (*behind the Committee Reports Tab*)
- 3) September 2021 Advisory Panel Fishery Performance Report
- 4) Staff memo on 2022 specifications for Atlantic chub mackerel
- 5) 2021 Chub Mackerel Fishery Information Document



Mackerel, Squid, Butterfish Monitoring Committee
September 14, 2021
Webinar Meeting Summary

Monitoring Committee Attendees: Julia Beaty (MAFMC staff), Doug Christel (GARFO), Jason Didden (MAFMC staff), Daniel Hocking (GARFO)

Additional Attendees: Katie Almeida (AP member), Greg DiDomenico (Lund's Fisheries, AP member), James Fletcher (United National Fisherman's Association), Zachary Greenberg (Pew Charitable Trusts), Jeff Kaelin (Lund's Fisheries, AP member), Eric Reid (NEFMC liaison to MAFMC), David Stormer (Council members), Alissa Wilson.

Meeting Objectives

- Review recent fishery information, Advisory Panel (AP) Fishery Performance Report, SSC recommendations, and staff recommendations.
- Review and if necessary, recommend revisions to the previously 2022 specifications.

Monitoring Committee Discussion

The Monitoring Committee recommended no changes to the previously approved 2022 chub mackerel specifications.

The Monitoring Committee agreed that the higher discard percentages shown in the observer data in recent years do not suggest a need to change the expected discards used in the specifications calculations because there was little, if any, targeted fishing effort and very low overall catch in those years. The acceptable biological catch (ABC) is based on the year with the historic high for landings and the highest targeted fishing effort.

The Council will consider the potential impacts of a recreational minimum fish size limit for Atlantic mackerel through the Atlantic Mackerel Rebuilding Framework. Some Council members questioned whether the same recreational minimum size limit should be implemented for chub mackerel due to challenges differentiating the species. The Monitoring Committee did not recommend for or against this approach, but discussed some relevant considerations. For example, monitoring and enforcement of a recreational Atlantic mackerel minimum size limit would be more effective if the same size limit also applied to chub mackerel. This could also improve compliance, avoid incentives to misreport species catch, and lead to better confidence in the fishery data used to monitor catch of both species. However, the Monitoring Committee questioned the conservation benefits of a minimum size limit given the likely high discard mortality rate for both species. For example, the Atlantic mackerel stock assessment assumes a 100% recreational discard mortality rate.

Input from Other Participants

One AP member said he does not disagree with the recommendation of no changes for 2022, but thought the quota should increase in the future given the wide distribution of the stock and the ability of the species to sustain much larger fisheries in other parts of the world. He said this is an emerging fishery and there is market demand.

Another individual on the call agreed that the commercial fishery should be allowed to harvest more chub mackerel. He strongly recommended against a minimum size limit given concerns about discard mortality.

SSC Report is behind
the Committee Reports
tab.



Chub Mackerel Fishery Performance Report

September 2021

The Mid-Atlantic Fishery Management Council's (Council's) Mackerel, Squid, and Butterfish Advisory Panel met via webinar on September 1, 2021 to review the 2021 Chub Mackerel Fishery Information Document and develop the following Fishery Performance Report. Dr. Walt Golet also presented preliminary findings on research funded by the Council to assess the importance of chub mackerel in the diets of tunas and marlins in the Mid-Atlantic.

The primary purpose of this Fishery Performance Report is to contextualize catch histories for the Scientific and Statistical Committee by providing information about fishing effort, market trends, environmental changes, and other factors.

Please note: Advisor comments described below are not consensus or majority statements.

Advisory Panel members present: Katie Almeida, Stefan Axelsson, Eleanor Bochenek, Gregory DiDomenico, Zack Greenberg, Meghan Lapp, Pam Lyons Gromen, Gerry O'Neill.

Others present: Julia Beaty (Council staff), Alan Bianchi (NC DMF), Doug Christel (GARFO staff), Jason Didden (Council staff), Gavin Fay (SSC member), James Fletcher, Walt Golet (University of Maine and Gulf of Maine Research Institute), Peter Hughes (Council member), Eric Reid (NEFMC member and liaison to MAFMC), Alissa Wilson

Discussion questions:

1. What factors have influenced recent catch (markets/economy, environment, regulations, other factors)?
2. Are the current fishery regulations appropriate? How could they be improved?
3. What would you recommend as research priorities?
4. What else is important for the Council to know?

Summary of Advisor Comments

Management Issues

Advisors did not recommend any changes to the chub mackerel management measures for 2022.

One participant on the webinar who is a member of other Advisory Panels strongly advised against consideration of a recreational minimum size limit as this will only create discards and anglers should keep what they catch. Consideration of a minimum size limit felt like the Council is "cutting and pasting" old ideas without attempting to find real solutions.

Recreational Chub Mackerel Fishery

Marine Recreational Information Program (MRIP) data show increasing recreational chub mackerel harvest from Maine through North Carolina over the past five years. One advisor asked if similar trends are shown in the South Atlantic recreational harvest estimates. Staff said there was no estimated recreational chub mackerel harvest in South Carolina through the east Coast of Florida during 2018-2020.

Another advisor reminded the group that the 2020 MRIP estimates include imputed data to address data gaps resulting from suspension of the Access Point Angler Intercept Survey (APAIS) from the late spring through much of the summer in 2020 due to COVID-19. This creates uncertainty in the 2020 data. This advisor said, for this reason, it will be important to see how the 2021 estimates compare to the 2020 estimates.

Relationship Between Chub Mackerel and *Illex* Availability

Dr. Walt Golet summarized his findings on the diets of yellowfin and bigeye tuna and white and blue marlin. Among other findings, his results suggest that *Illex* squid can be important in the diets of yellowfin and bigeye tuna, and to a lesser extent in the diets of marlins. One advisor noted that the commercial landings data and input from fishermen show that chub mackerel landings are low when availability of *Illex* is high and asked if something similar is happening in the diets of tunas and marlins. For example, do both the fisheries and diet trends suggest that chub mackerel are not as prevalent when *Illex* are abundant?

Dr. Golet emphasized that his results are a snapshot of tuna and marlin diets in 2018 and 2019 and that diets can change over time. Commercial fishery landings in 2018 and 2019 suggest that those were years with high availability of *Illex*.

Another advisor asked if any active commercial fishermen on the call could clarify if the inverse relationship between *Illex* squid and chub mackerel landings is because chub mackerel are not available in years of high *Illex* availability, or if this pattern is due to fishermen targeting *Illex*. One advisor who is an active commercial fisherman clarified that he does see chub mackerel during years of high *Illex* availability, but that chub mackerel tend to be found closer to shore than *Illex*.

Chub Mackerel Distribution

Two advisors and one other participant on the webinar noted that chub mackerel can be abundant close to shore based on their own observations while fishing, observations of landings at a processing facility, or fishing reports and other anecdotal observations. One advisor said the Fishery Information Document should be revised in future years to make it more clear that chub mackerel can be found close to shore, as well as offshore.

Research Priorities

One advisor said that although Dr. Golet's research represents a snapshot of 2018 and 2019, it does not suggest that further research is needed into the role of chub mackerel in the diets of tunas and marlins. Given the sample sizes obtained by Dr. Golet and difficulties in obtaining additional marlin samples, additional research would not be worthwhile and would likely not provide different conclusions. This advisor stated that Dr. Golet's research used a rigorous methodology and came to a clear conclusion that chub mackerel account for an exceptionally small component of the diet of tunas and marlins. This should conclude the issue.

Another advisor said they did not disagree, but noted that some of Dr. Golet's findings on the importance of *Illex* squid and bullet and frigate mackerel could warrant further exploration as those are species of interest to the Council. This advisor said this study was an important step towards better understanding the diets of tunas and marlins more broadly and considering the forage base from an ecosystem level.

A third advisor said they also agreed that Dr. Golet's findings do not suggest additional research is needed on the importance of chub mackerel as prey for tunas and marlins. The research suggest that these predators eat what is most available.

One advisor did not support the Council funding further research into the importance of *Illex* squid in the diets of tunas and marlins. This could be addressed in other ways, such as through the next research track assessment for *Illex*. This advisor noted that fishing mortality on *Illex* is low, the season is short, and the fishery is constrained, regardless of the size of the quota.



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Michael P. Luisi, Chairman | P. Weston Townsend, Vice Chairman

Christopher M. Moore, Ph.D., Executive Director

MEMORANDUM

Date: August 30, 2021
To: Chris Moore, Executive Director
From: Julia Beaty, staff
Subject: 2022 specifications for Atlantic chub mackerel

Executive Summary

This memorandum includes information to assist the Mid-Atlantic Fishery Management Council's (Council's) Scientific and Statistical Committee (SSC) and Mackerel, Squid, and Butterfish (MSB) Monitoring Committee in reviewing the previously approved 2022 catch and landings limits for Atlantic chub mackerel (*Scomber colias*), as well as the other management measures which can be modified through the annual specifications process.

Additional information on fishery performance and past management measures can be found in the 2021 Chub Mackerel Fishery Information Document and the 2021 Chub Mackerel Fishery Performance Report developed by advisors.¹

The Council approved 2020-2022 catch and landings limits for Atlantic chub mackerel (Table 1) in March 2019 based on the SSC's acceptable biological catch (ABC) recommendations. These measures were implemented through Amendment 21 to the MSB Fishery Management Plan (FMP) and became effective in September 2020 (85 Federal Register 47103). The SSC, Monitoring Committee, and Council reviewed these measures in the fall of 2020 and recommended no changes for 2021.

During their September 2021 meeting, the SSC will review their previously recommended 2022 ABC and consider if revisions are necessary. The Monitoring Committee will then meet to review and, if appropriate, recommend changes to the previously approved 2022 annual catch limit (ACL), annual catch target (ACT), and total allowable landings limit (TAL), and other management measures which can be modified through the annual specifications process.

The Council will meet in October 2021 to review the recommendations of the SSC and Monitoring Committee, as well as input from advisors. They will then consider revising their previously approved catch and landings limits for 2022, and any other management measures which can be modified through the annual specifications process.

Pending additional input provided by advisors during their meeting on September 1, Council staff recommend no revisions to the previously approved 2022 specifications for chub mackerel.

¹ Both documents will be posted to <https://www.mafmc.org/fishery-performance-reports>.

Table 1. Previously approved 2020-2022 catch and landings limits for Atlantic chub mackerel.

Measure	mil lb	mt	Basis
ABC	5.07	2,300	SSC recommendation
Expected SC-FL catch	0.08	38	A conservative estimate based on the highest annual SC-FL landings shown in commercial dealer and MRIP data, increased by about 10% to account for discards, which are not well quantified.
ACL	4.99	2,262	ABC minus expected SC-FL catch.
ACT	4.79	2,171	ACL reduced by a 4% management uncertainty buffer.
Expected total dead discards, ME-NC	0.29	130	6% of ACT based on based on the commercial discard rate during 2003-2017 according to northeast observer data.
TAL	4.50	2,041	ACT minus expected total dead discards.

Recent Catch and Landings

After remaining below 0.5 million pounds per year for many years, commercial chub mackerel landings spiked to 5.25 million pounds in 2013, but decreased to pre-2013 levels by 2016. In 2020, 56,925 pounds of chub mackerel were landed by commercial fishermen from Maine through North Carolina. Recreational chub mackerel landings are variable and averaged 105,062 pounds per year during 2016-2020. In 2020, recreational fishermen harvested an estimated 149,578 pounds of chub mackerel (Table 2).

Table 2. Commercial and recreational chub mackerel landings, in pounds, 2001-2020, from Maine through North Carolina. Landings in some years are combined to protect confidential data associated with fewer than three vessels and/or dealers.

Year	Commercial landings	Recreational landings	Total landings
2001	4,384	0	4,384
2002	471	0	471
2003	488,316	0	488,316
2004	126	0	126
2005	0	0	0
2006	0	0	0
2007-2009	21,039	0	21,039
2010-2011	192,301	355	192,656
2012	164,867	0	164,867
2013	5,249,686	0	5,249,686
2014	1,230,411	48,087	1,278,498
2015	2,108,337	0	2,108,337
2016	610,783	2,093	612,876
2017	2,202	14,831	17,033
2018	22,357	128,949	151,306
2019	60,522	74,462	134,984
2020	56,925	149,578	206,503
2001-2020 avg	600,749	24,609	625,358

Stock Status and Biological Reference Points

The stock status of chub mackerel in the western Atlantic Ocean is unknown as there have been no quantitative assessments of this species in this region. In July 2018, the SSC assumed that biomass is currently at or above biomass at maximum sustainable yield, as described in more detail in the following section.

Review of Prior SSC Recommendations

The SSC recommended the current chub mackerel ABC during their July 2018 meeting. They concluded that insufficient information exists to assess the status and trends of chub mackerel in the northwest Atlantic. They concluded that an overfishing limit could not be specified and recommended an ABC of 2,300 mt (5.07 million pounds) based on expert judgement. Their ABC recommendation is based loosely on the historic high for commercial and recreational landings (around 5.25 million pounds in 2013) and assumptions about discards. This level of ABC will prevent the fishery from achieving its historic high, but will allow landings to exceed those in every other year over at least the past 20 years (Table 2). The SSC agreed that this level of catch is unlikely to result in overfishing given the general productivity of this species in fisheries throughout the world combined with the relatively low fishery capacity in U.S. Atlantic waters. Based on their recommendations, the ABC applies to total dead catch (i.e., commercial and recreational landings and dead discards) from Maine through the east coast of Florida.

The SSC determined the following to be the most significant sources of scientific uncertainty associated with the ABC:

- Stock size and productivity cannot be determined, there is no information to determine reference points for stock biomass levels, and little information exists to determine reference points for fishing mortality rates.
- There is no information on the source of recruits; it is unknown whether chub mackerel are episodic in the Mid-Atlantic, whether this is a range expansion with localized spawning, or neither.
- There is no information on predation mortality, or on the role of chub mackerel in predator diets.
- There is very high uncertainty in recreational landings and discards. Observer coverage on fisheries likely to catch chub mackerel may be low (*Illex* fleet, Mid-Atlantic small mesh bottom trawl).

The SSC reviewed their recommendations in September 2020 and recommended no changes.

Annual Catch Limit

The ACL for chub mackerel is derived by subtracting expected catch from South Carolina through the east coast of Florida from the ABC (Figure 1). When the Council adopted 2020-2022 specifications in March 2019, they approved a value of 84,500 pounds of expected catch from South Carolina through the east coast of Florida. This represents about 2% of the ABC and was intended to be a conservative estimate based on the highest annual South Atlantic landings shown in commercial dealer and Marine Recreational Information Program (MRIP) data through 2017 (i.e., 76,835 pounds in 2011), increased by about 10% to account for discards. Chub mackerel discards in the South Atlantic are highly uncertain.

As previously stated, when the Council approved a value of 84,500 pounds of expected South Atlantic catch, they considered data through 2017. MRIP data for 2018-2020 show no estimated recreational chub mackerel harvest from South Carolina through the east coast of Florida.

Atlantic Coastal Cooperative Statistics Program data show commercial landings amounts that are confidential, but less than 200 pounds in total during 2018-2020.

Staff recommend no changes to the 2021 chub mackerel ACL of 4.99 million pounds (2,262 mt).

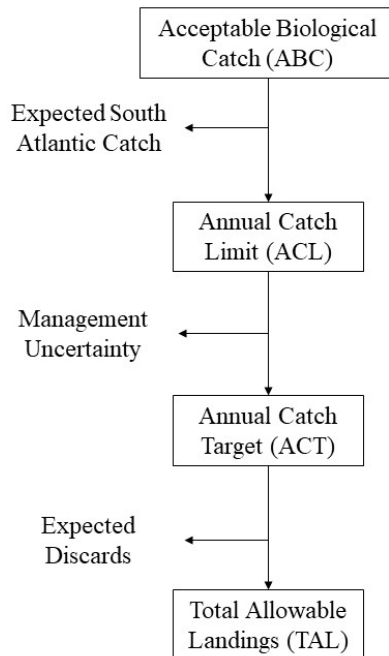


Figure 1. Flowchart summarizing chub mackerel catch and landings limits.

Annual Catch Target

As defined in the FMP, The ACT can be set less than or equal to the ACL to account for management uncertainty (Figure 1). The Council adopted a 4% management uncertainty buffer when they set the 2020-2022 specifications in March 2019. Considered in combination with the in-season commercial fishery closure regulations described on the next page, this was expected to be a reasonable buffer between the ACL and ACT to prevent ACL overages.

Council staff recommend no changes to the previously implemented ACT of 4.79 million pounds (2,171 mt).

Discards

Expected commercial and recreational discards in weight are subtracted from the ACT to derive the TAL (Figure 1). When setting 2020-2022 specifications in March 2019, the Council agreed to reduce the ACT by 6% to account for expected discards. This was based on the commercial discard rate during 2003-2017 according to northeast observer data. The Council selected this as a preferred alternative because it was based on 15 years of data. It does not explicitly account for recreational data; however, based on information available at the time, the volume of recreational chub mackerel discards was assumed to be low compared to commercial discards, especially in years with targeted commercial fishing effort. The previously implemented catch and landings limits are based loosely on years with targeted commercial fishing effort.

There are currently no expanded estimates of total chub mackerel commercial dead discards. Discard percentages based on observer and vessel trip report (VTR) data through 2020 are shown in Table 3. The most recent 5 years of observer data show that 43% of total observed chub

mackerel catch was discarded, considerably higher than the 6% assumed discard rate previously used to set specifications. As shown in Table 2, 2016-2020 were years with comparatively low commercial landings. As previously stated, the 2022 ABC is loosely based on the historic high for chub mackerel catch (2013). The average percentages over longer time periods are approximately 3% - 7%, depending on the time period and dataset (Table 3).

Staff recommend no changes to the previously implemented 2021 TAL of 4.50 million pounds (2,041 mt) at this time.

Table 3. Percent of total commercial chub mackerel catch that was discarded, based on northeast fisheries observer and VTR data, 2006-2020, with associated number of trips.

Years	Observer Discard %	VTR Discard %
2006-2020 (15 years)	7% (337 trips)	3% (869 trips)
2011-2020 (10 years)	6% (301 trips)	3% (854 trips)
2016-2020 (5 years)	43% (193 trips)	4% (582 trips)
2013-2015 (top 3)	4% (95 trips)	3% (282 trips)
2013 (historic high)	3% (27 trips)	1% (63 trips)

Possession Limits

Under the currently implemented specifications, there is no recreational chub mackerel possession limit. There is no commercial possession limit until 90% of the TAL is projected to be landed. At that point, a 40,000 pound (18 mt) possession limit is in effect. Once 100% of the TAL is projected to be landed, commercially permitted vessels are limited to a 10,000 pound (4.5 mt) possession limit. When setting 2020-2022 specifications, the Council agreed that commercial fishery possession limits prior to in-season closure were unnecessary as the preferred in-season AMs were likely sufficient to constrain the fishery to prevent ACL overages.

According to stakeholder input provided during development of the Unmanaged Forage Omnibus Amendment, 40,000 pounds is approximately the amount of chub mackerel needed to fill a bait truck. Given the low value of chub mackerel (e.g., \$0.51 per pound in 2020 dollars on average during 2001-2020), fishermen may not target chub mackerel when restricted to a 40,000 pound possession limit; however, they would have an incentive to land chub mackerel caught incidentally. A 40,000 pound possession limit could, therefore, discourage discards. The number of trips which landed more than 40,000 pounds of chub mackerel over the past 20 years is confidential as it is associated with fewer than three vessels and/or dealers.

Ten thousand pounds was selected as the possession limit to be implemented in-season after the TAL is projected to be fully landed because it is approximately the average trip-level landings of chub mackerel based on northeast commercial fishery data for 1998-2017. A small number of vessels are responsible for most chub mackerel landings. If those vessels are excluded from the calculation, about 99% of the trips which landed chub mackerel during 1998-2017 landed less than 10,000 pounds. Trip-level landings for 2011-2020 show very similar patterns (i.e., about 11,000 pounds per trip on average and 99% of trips landing less than 12,000 pounds).

As previously stated, unless modified, the 2021 TAL will be 4.50 million pounds (2,041 mt). Therefore, a commercial possession limit will be triggered once 4.05 million pounds (1,837 mt) of chub mackerel are projected to be landed by commercial and recreational fishermen. This level of landings has been reached only once over the past 20 years (i.e., in 2013, Table 2).

Council staff recommend no changes to the commercial or recreational chub mackerel possession limits for 2022.

Other Management Measures

There are no commercial or recreational minimum fish size limits for chub mackerel in federal waters. Minimum fish size limits are typically used to reduce fishing mortality on immature fish; however, a commercial minimum size limit for chub mackerel may provide little additional biological benefits considering current fishery selectivity. According to an analysis of observer data done for Amendment 21, about 88% of the chub mackerel caught in bottom otter trawls are at least 20 cm in length. As suggested in Daley and Leaf (2019)² and supported by comments from fishermen, it is possible that chub mackerel's fast swimming speed reduces the potential for capture of larger individuals in the commercial fishery. Several scientific studies have documented the length at maturity for chub mackerel in various regions. The length at maturity varies by study. Daley (2018)³ examined chub mackerel caught in commercial fisheries in the Mid-Atlantic and Southern New England and found that 50% of females reached maturity at about 27 cm. According to observer data, about 73% of the chub mackerel caught in bottom trawls are at least 27 cm.

Given that chub mackerel are predominantly caught with bottom otter trawls in commercial fisheries off the U.S. east coast, it can be assumed that most discarded chub mackerel would not survive. Therefore, a minimum fish size likely would increase mortality on this species without notable benefits of protecting immature fish.

Most chub mackerel landed on the U.S. east coast over the past 20 years were caught on bottom trawl vessels which also participate in the *Illex* squid fishery. Regulations for that fishery specify gear requirements (see 50 CFR 648.23), including gear restrictions for specific regulated mesh areas (50 CFR 648.80). The Council did not see a need to develop additional gear restrictions for chub mackerel beyond what vessels are currently subject to in other fisheries. There are also no recreational gear restrictions for chub mackerel in federal waters.

At this point in time, Council staff do not recommend that the Council implement new chub mackerel management measures such as minimum fish sizes, closed seasons, or gear restrictions.

² Daley, T. T. and R. T. Leaf. 2019. Age and growth of Atlantic chub mackerel (*Scomber colias*) in the Northwest Atlantic. *Journal of Northwest Atlantic Fisheries Science*. 50: 1-12.

³ Daley, T. 2018. Growth and reproduction of Atlantic chub mackerel (*Scomber colias*) in the Northwest Atlantic. Master's thesis. University of Southern Mississippi.



Chub Mackerel Fishery Information Document

August 2021

This document provides a brief overview of the biology, stock condition, management system, and fishery performance for Atlantic chub mackerel (*Scomber colias*) with an emphasis on the most recent few years. Data sources include commercial dealer reports, vessel trip reports (VTRs), and Marine Recreational Information Program (MRIP) data. All 2020 data should be considered preliminary. For more resources, including previous Fishery Information Documents, please visit <https://www.mafmc.org/msb>.

Key Facts

- The Mid-Atlantic Fishery Management Council developed the first management measures for Atlantic chub mackerel in U.S. waters. These measures became effective in 2017 and were modified in 2020.
- The stock status of chub mackerel in this region is unknown as there has been no quantitative stock assessment. The Scientific and Statistical Committee assumes that biomass is currently at a sustainable level.
- After spiking at 5.25 million pounds in 2013, commercial landings returned to low levels. In 2020, commercial fishermen landed 56,925 pounds of chub mackerel from Maine through North Carolina.
- It is estimated that recreational fishermen from Maine through North Carolina harvested 149,578 pounds of chub mackerel in 2020, the highest estimate in the MRIP time series (i.e., 1981 through present).

Basic Biology

Atlantic chub mackerel are a schooling pelagic species. They migrate seasonally and can be found throughout U.S. Atlantic waters to depths of about 250-300 meters.¹ Adults prefer temperatures of 15-20°C (about 60-70°F).^{1,2} Some studies suggest that juveniles tend to be found closer inshore than adults.^{3,4}

Atlantic chub mackerel grow rapidly during the first year of life.^{2,3,5,6} They can reach at least age 13.⁷ Daley and Leaf (2019) found that most fish sampled from commercial fishery catches off the northeast U.S. were age 3.⁶

Atlantic chub mackerel spawn in several batches. Spawning areas likely occur from North Carolina through the Gulf of Mexico.^{8,9} Daley (2018) suggested that chub mackerel reach maturity around age two in the Northwest Atlantic, though other studies from various locations have published a range of ages at maturity.^{3,9}

Chub mackerel are opportunistic predators with a seasonally variable diet of small crustaceans (especially copepods), small fish, and squid.^{1,10} Adults tend to consume larger prey and more fish prey than juveniles.⁴

Very few quantitative estimates of the contribution of chub mackerel to the diets of predator species in the western North Atlantic are available. This is likely due in part to the difficulty of visually distinguishing partially-digested chub mackerel from related species such as Atlantic mackerel (*Scomber scomber*), bullet mackerel (*Auxis rochei*), and frigate mackerel (*Auxis thazard*).¹¹ The family Scombridae has been documented in the diets of some fish, marine mammals, sea birds, and sharks in the western North Atlantic.^{12,13} However, few studies identify chub mackerel to the species level in the diets of any predators. A thorough literature review conducted by Council and NMFS staff in 2018 identified only one study with quantitative data on the role of chub mackerel in the diets of any predators off the U.S. east coast.¹⁴ Manooch et al. (1984) found that chub mackerel made up 0.2% (by frequency of occurrence) of the diets of dolphinfish sampled off North Carolina through Texas.¹⁵ Chub mackerel have been documented as prey for some predators in other parts of the world. For example, they are important prey for blue marlin at certain times of year off Portugal¹⁶ and Cabo San Lucas.¹⁷ They have also been documented as prey for Cory's shearwaters in the eastern North Atlantic, for long-beaked common dolphins off South Africa, and short-beaked common dolphins off the Iberian Peninsula.¹⁸ It should be emphasized that diet composition of a predator species may vary by geography and can be flexible. Therefore, the importance of chub mackerel in the diets of predators in other parts of the world does not necessarily indicate its importance off the U.S. east coast. More diet information would be required to better establish this relationship.

In 2018, the Council funded a study with the goal of better delineating the role of chub mackerel in the diets of tunas and marlins, which were identified by stakeholders as predators of key interest. Preliminary results will be presented to the Mackerel, Squid, and Butterfish Advisory Panel and the Scientific and Statistical Committee (SSC) in September 2021.

Status of the Stock

The stock status of chub mackerel in the western Atlantic Ocean is unknown as there have been no quantitative assessments of this species in this region. The SSC assumes that biomass is currently at or above biomass at maximum sustainable yield.¹⁹

Large fluctuations in abundance have been reported around the world, including in the mid-Atlantic and New England.^{3, 20} These fluctuations may be partly the result of environmental influences such as temperature and upwelling strength on recruitment.³ Given that chub mackerel are a fully pelagic species, ocean processes likely influence their availability in any given area, as well as their recruitment.

Management System and Fishery Performance

Management

The Mid-Atlantic Fishery Management Council manages Atlantic chub mackerel fisheries in federal waters from Maine through North Carolina.

An increase in commercial landings during 2013-2015, as well as concerns about the potential role of chub mackerel as prey for tunas and marlins, prompted the Council to adopt an annual commercial landings limit and a commercial possession limit for chub mackerel as part of the Unmanaged Forage Omnibus Amendment.¹³ These measures were implemented in September 2017 and were the first regulations for chub mackerel fisheries off the U.S. east coast. They were intended to be temporary measures and were replaced by longer-term measures developed

through Amendment 21 to the Mackerel, Squid, and Butterfish Fishery Management Plan and became effective in September 2020.²¹

The Council's SSC recommends annual acceptable biological catch (ABC) limits for chub mackerel. The Council must either approve the ABC recommended by the SSC or approve a lower ABC. Total catch (i.e., commercial and recreational landings and dead discards) from Maine through the east coast of Florida count against the ABC. Expected South Carolina through Florida catch is subtracted from the ABC to derive the annual catch limit (ACL). An annual catch target (ACT) is set less than or equal to the ACL to account for management uncertainty. Expected dead discards are subtracted from the ACT to derive a total allowable landings limit (TAL). The commercial and recreational fisheries do not have separate annual catch or landings limits (Figure 1).

Unless revised, the 2022 catch and landings limits include an ABC of 5.07 million pounds, an ACL of 4.99 million pounds, an ACT of 4.79 million pounds, and a TAL of 4.50 million pounds. These limits have been unchanged since they were implemented in 2020.

Although total catch from Maine through the east coast of Florida counts against the ABC, the ACL, ACT, and TAL apply to Maine through North Carolina. Based on past landings trends, the Council agreed that catch from South Carolina through Florida is immaterial to proper management. Therefore, commercial and recreational fisheries in South Carolina through Florida are not subject to the permit and possession limit requirements described below.

A commercial mackerel, squid, or butterfish fishing permit is required of vessels which retain chub mackerel for sale in federal waters from Maine through North Carolina. Ten permit types meet this requirement. The owner of any party or charter vessel that fishes for, possesses, or retains chub mackerel while carrying passengers for hire must have the federal mackerel/squid/butterfish for-hire permit. There is no federal permit type specific to Atlantic chub mackerel in either the commercial or recreational fisheries.

There is no commercial possession limit for chub mackerel until 90% of the TAL is projected to be landed. At that point, a 40,000 pound possession limit is in effect. Once 100% of the TAL is projected to be landed, commercially-permitted vessels are limited to a 10,000 pound possession limit. There are no federal waters recreational possession limits for chub mackerel.

There are no commercial or recreational gear restrictions, fish size requirements, or closed seasons for Atlantic chub mackerel in federal waters.

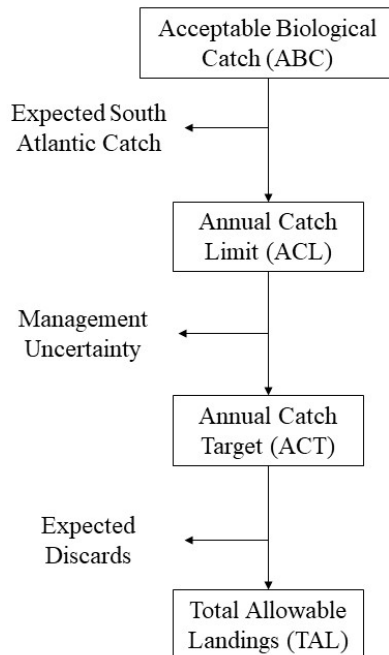


Figure 1. Flowchart summarizing chub mackerel catch and landings limits.

Commercial Fishery Trends

After remaining below 0.5 million pounds per year for several years, commercial chub mackerel landings spiked to 5.25 million pounds in 2013, but decreased to pre-2013 levels by 2016 (Table 1).²² This temporary increase was the result of a small number of trawl vessels targeting chub mackerel. These vessels also participate in the *Illex* squid fishery. Some fishermen have described chub mackerel as a “bailout” species which they sometimes target when they are not able to harvest *Illex* squid. Chub mackerel tend to be harvested in the same areas and times of year when *Illex* squid are harvested; however, fishermen have said they typically will not harvest both species at the same time because the quality of both species suffers when they are stored together.

According to public comments, a small number of vessels on the east coast are capable of harvesting chub mackerel in profitable quantities because vessels need to be large, fast, and have refrigerated sea water or freezing capabilities in order to harvest this fast-swimming, low-value, warm water species. Landings data seem to support these statements.

Fewer than 5 vessels accounted for more than 95% of chub mackerel landings over the last 20 years (2001-2020). The chub mackerel landings from these vessels were sold to fewer than three dealers; therefore, much of the data associated with these vessels and dealers are confidential.²²

At least 19 dealers across 6 states (MA, RI, CT, NY, NJ, VA) purchased at least 100 pounds of chub mackerel over the past 20 years combined (2001-2020), with only four dealers purchasing more than 10,000 pounds of chub mackerel. During this time period, an average of 6 vessels, with a maximum of 20 vessels, landed at least 100 pounds of chub mackerel per year from Maine through North Carolina.²²

The annual average ex-vessel price per pound varied during 2001-2020, averaging \$0.51 per pound (adjusted to 2020 dollars). There appears to be a relationship between price and volume landed; however, this relationship is neither linear nor consistent across time. In general, years with higher landings had lower average annual prices per pound, and vice versa (Table 1).²²

According to VTR data, about 91% of the chub mackerel landed by commercial fishermen from Maine through North Carolina from 2001 through 2020 were caught with bottom otter trawls.²³

Nearly all commercial chub mackerel landings (>97%) from Maine through North Carolina over the past 20 years occurred during June-October. The highest proportion of landings occurred in September (38%). June, July, August, and October contributed about equally to commercial landings (13-16%).²²

According to VTR data, nearly all commercial chub mackerel landings from 2001-2020 originated from statistical areas south of New York. Much of these landings came from statistical areas which overlap with the shelf break (Figure 2).²³

Public comments received during development of Amendment 21 suggest that most chub mackerel landed on the east coast are processed for use as human food, much of which is sent overseas, and lesser amounts are used as bait in other fisheries.

Table 1. Commercial chub mackerel landings (pounds), ex-vessel value, and average price per pound, Maine through North Carolina, 2001-2020. Value and price are adjusted to 2020 dollars using the Gross Domestic Product Price Deflator. Landings in some years are combined to protect confidential data representing fewer than 3 vessels and/or dealers.²²

Year	Landings (pounds)	Ex-vessel value (2020 dollars)	Avg. price/pound (2020 dollars)
2001	4,384	\$6,179	\$1.41
2002	471	\$287	\$0.61
2003	488,316	\$33,622	\$0.07
2004	126	\$87	\$0.69
2005	0	\$0	--
2006	0	\$0	--
2007-2009	21,039	\$7,498	\$0.36
2010-2011	192,301	\$38,869	\$0.20
2012	164,867	\$71,433	\$0.43
2013	5,249,686	\$1,113,725	\$0.21
2014	1,230,411	\$366,318	\$0.30
2015	2,108,337	\$527,238	\$0.25
2016	610,783	\$109,168	\$0.18
2017	2,202	\$2,799	\$1.27
2018	22,357	\$11,731	\$0.52
2019	60,522	\$40,260	\$0.67
2020	56,925	\$29,584	\$0.52
2001-2020 avg.	600,749	\$138,753	\$0.51

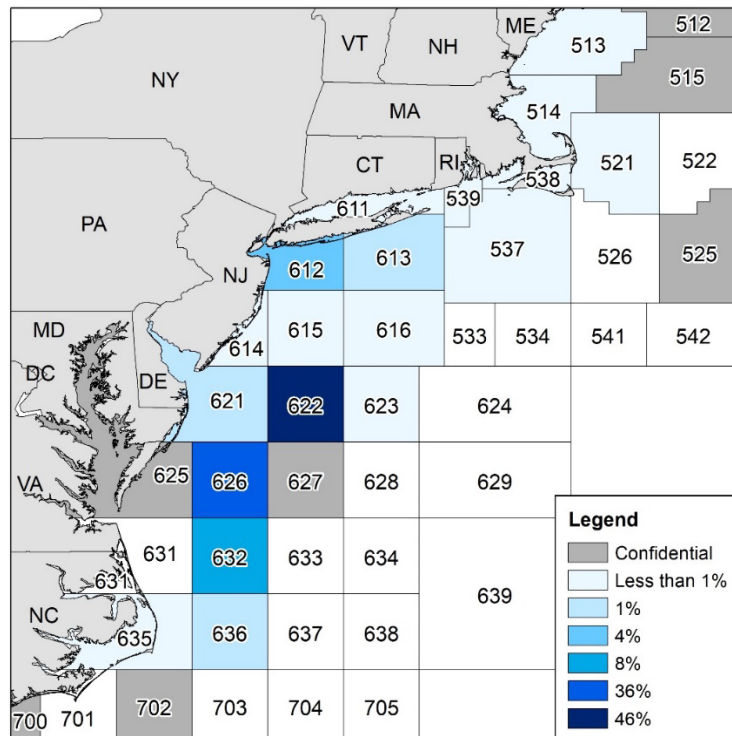


Figure 2. Percent of commercial chub mackerel landings by statistical area, 2001-2020 as shown in federal VTR data. Data associated with fewer than three vessels and/or dealers are confidential. Confidential landings collectively account for about 1% of the total.²³

Recreational Fishery Trends

MRIP data from Maine through North Carolina show increasing recreational catch and harvest of chub mackerel nearly year from 2015 through 2020 (Table 2). In 2020, an estimated nearly 200,000 chub mackerel were caught and 59,713 chub mackerel were harvested, corresponding to 73,983 pounds of harvested chub mackerel from Maine through North Carolina.²⁴

The increasing recreational catch and harvest estimates in recent years could be due, at least in part, to improved reporting and improved differentiation between chub mackerel and other species which are similar in appearance, such as Atlantic mackerel. For example, in 2017 chub mackerel were added to the core list of species for trainings of MRIP field samplers from Maine through Virginia. In addition, the Council and partners at NMFS developed a small scombrid species identification guide and distributed over 3,700 copies to commercial and recreational permit holders and other interested stakeholders in 2019.²⁵

MRIP data collection in 2020 was impacted by the COVID-19 pandemic. Specifically, the Access Point Angler Intercept Survey (APAIS), which serves as the basis for catch estimates in the shore based and private angler fishing modes, was suspended in all New England and Mid-Atlantic states in late March or April 2020 and resumed between May and August 2020, depending on the state. MRIP headboat sampling was also suspended in 2020 and has not yet resumed. NMFS used imputation methods to fill gaps in 2020 catch data with data collected in 2018 and 2019. These proxy data match the time, place, and fishing mode combinations that

would have been sampled had the APAIS continued uninterrupted. Proxy data were combined with observed data to produce catch estimates using the standard estimation methodology.

It is not likely that the increase in recreational chub mackerel catch and harvest in 2020 is due to the use of imputed data as the imputed data match the 2018 and 2019 data. Any change from 2018 and 2019 would be due to changes in effort data (which are collected through mail and telephone surveys that were largely unimpacted by the pandemic) or due to changes during the locations and times of year that did not require use of imputed data.

During 2016-2020, about 54% of the recreational chub mackerel harvest from Maine through North Carolina (in numbers of fish) was caught in state waters, with the remaining 46% caught in federal waters. The proportion of harvest by mode averaged 59% from private and rental boats, 34% from party and charter boats, and 7% from shore (Table 3). Most recreational catch and harvest occurred in New York, Rhode Island, New Jersey, and Connecticut (Table 4). Most catch and harvest occurred during July and August (Table 5).²⁴

Through development of Amendment 21, the Council heard anecdotal descriptions of recreational chub mackerel harvest, including reports of catch on for-hire vessels out of New York and New Jersey. There have also been reports of chub mackerel harvest for use as live bait on recreational trips out of Maryland and Virginia targeting white marlin, blue marlin, sailfish, spearfish, yellowfin tuna, bigeye tuna, and/or wahoo. According to public comments, this live bait fishery occurs on the edges of certain offshore canyons, especially Norfolk Canyon, where chub mackerel and their predators are concentrated in the late summer and early fall.²⁶

Table 2. MRIP-estimated recreational catch and harvest of chub mackerel from Maine through North Carolina, 2001-2020.²⁴

Year	Recreational catch (# of fish)	Recreational harvest (# of fish)	Recreational harvest (pounds)	% retained
2001	821	0	0	0%
2002-2010	0	0	0	--
2011	1,613	1,613	355	100%
2012	15,569	0	0	0%
2013	0	0	0	--
2014	60,191	49,813	48,087	83%
2015	0	0	0	--
2016	2,575	2,087	2,093	81%
2017	26,061	13,310	14,831	51%
2018	157,471	104,830	128,949	67%
2019	139,282	49,892	74,462	36%
2020	199,919	125,757	149,578	63%
2016-2020 Avg.	105,062	59,175	73,983	59%

Table 3. Chub mackerel harvest by recreational fishing mode in numbers of fish, 2001-2020, Maine through North Carolina.²⁴

Year	Party/charter	Private/rental boat	Shore
2001-2010	0	0	0
2011	0	0	1,613
2012-2013	0	0	0
2014	49,813	0	0
2015	0	0	0
2016	1,889	198	0
2017	2,422	10,888	0
2018	43,424	58,817	2,589
2019	17,149	32,743	0
2020	35,901	70,676	19,180
2016-2020 Avg.	20,157 (34%)	34,664 (59%)	4,354 (7%)

Table 4. Proportion of total chub mackerel catch and harvest in numbers of fish by state, 2016-2020.²⁴

State	Recreational catch	Recreational harvest
ME	0%	0%
NH	4%	6%
MA	1%	0%
RI	21%	22%
CT	12%	10%
NY	46%	48%
NJ	16%	14%
DE	0%	0%
MD	0%	0%
VA	0%	0%
NC	0%	0%
Total	100%	100%

Table 5. Proportion of total chub mackerel catch and harvest in numbers of fish by wave, Maine through North Carolina, 2016-2020. Note that only North Carolina conducts MRIP sampling during wave 1.²⁴

Wave	Catch	Harvest
1 (Jan-Feb)	0%	0%
2 (Mar-Apr)	0%	0%
3 (May-Jun)	4%	5%
4 (Jul-Aug)	60%	65%
5 (Sep-Oct)	36%	30%
6 (Nov-Dec)	0%	0%
Total	100%	100%

References

- ¹ Collette, B. B. and C. E. Nauen. 1983. FAO species catalogue. Vol. 2 Scombrids of the word: An annotated and illustrated catalogue of tunas, mackerels, bonitos, and related species known to date. Available at: <http://www.fao.org/docrep/009/ac478e/ac478e00.htm>
- ² Perrotta, R. G., M. D. Viñas, D. R. Hernandez, and L. Tringali. 2001. Temperature conditions in the Argentine chub mackerel (*Scomber japonicus*) fishing ground: implications for fishery management. *Fisheries Oceanography*. 10(3):275-283.
- ³ Hernández, J. J. C. and A. T. S. Ortega. 2000. Synopsis of biological data on the chub mackerel (*Scomber japonicus* Houttuyn, 1782). FAO Fisheries Synopsis No. 157.
- ⁴ Castro, J. J. 1993. Feeding ecology of chub mackerel *Scomber japonicus* in the Canary Islands area. *South African Journal of Marine Science*. 13(1): 323-328.
- ⁵ Velasco, E. M., J. D. Arbol, J. Baro, and I. Sobrino. 2011. Age and growth of the Spanish chub mackerel *Scomber colias* off southern Spain: a comparison between samples from the NE Atlantic and the SW Mediterranean. *Revista de Biología Marina y Oceanografía*. 46(1):27-34.
- ⁶ Daley, T. T. and R. T. Leaf. 2019. Age and growth of Atlantic chub mackerel (*Scomber colias*) in the Northwest Atlantic. *Journal of Northwest Atlantic Fisheries Science*. 50: 1-12.
- ⁷ Carvalho, N., R. G. Perrotta, and E. Isidro. 2002. Age, growth and maturity in the chub mackerel (*Scomber japonicus* Houttuyn, 1782) from the Azores. *Arquipélago Life and Marine Sciences*. 19A: 93-99.
- ⁸ Houde, E. D., S. A. Berkeley, J. J. Klinovsky, and C.E. Dowd. 1976. Ichthyoplankton survey data report: summary of egg and larvae data used to determine abundance of clupeid fishes in the eastern Gulf of Mexico. University of Miami Sea Grant Technical Bulletin Number 32. Available at: <https://repository.library.noaa.gov/view/noaa/10888>
Houde, E. D., J. C. Leak, C. E. Dowd, S. A. Berkeley, and W. J. Richards. 1979. Ichthyoplankton abundance and diversity in the eastern Gulf of Mexico - a report to the Bureau of Land Management prepared under contract number AA550-CT7-28. Available at: <https://www.boem.gov/ESPIS/3/4042.pdf>
Berrien, P. L. 1978. Eggs and larvae of *Scomber scombrus* and *Scomber japonicus* in continental shelf waters between Massachusetts and Florida. *Fishery Bulletin*. 76(1):95-115.
Richardson, D. E., J. K. Llopiz, C. M. Guignard, and R. K. Cowen. 2010. Larval assemblages of large and medium-sized pelagic species in the Straits of Florida. *Progress in Oceanography*. 86(2010):8-20.
Southeast Area Monitoring and Assessment Program (SEAMAP) larval survey catches from 1983-2014.
- ⁹ Daley, T. 2018. Growth and reproduction of Atlantic chub mackerel (*Scomber colias*) in the Northwest Atlantic. Master's thesis. University of Southern Mississippi.
- ¹⁰ Castro, J. J. and A. S. Del Pino. 1995. Feeding preferences of *Scomber japonicus* in the Canary Islands area. *Scientia Marina*. 59(3-4):352-333.
Sever, T. M., B. Bayhan, M. Bilecenoglu, and S. Mavili. 2006. Diet composition of the juvenile chub mackerel (*Scomber japonicus*) in the Aegean Sea (Izmir Bay, Turkey). *Journal of Applied Ichthyology*. 22(2006):145-148.
- ¹¹ Paine, M. A., J. R. McDowell, and J. E. Graves. 2007. Specific identification of western Atlantic Ocean scombrids using mitochondrial DNA cytochrome C oxidase subunit I (COI) gene region sequences. *Bulletin of Marine Science*. 80(2):353-367.
Personal communication with John Graves, Virginia Institute of Marine Science; Steve Poland, N.C. Division of Marine Fisheries, and Michelle Staudinger, University of Massachusetts Amherst.
- ¹² Montevecchi, W. A. and Myers, R. A. 1997. Centurial and decadal oceanographic influences on changes in northern gannet populations and diets in the north-west Atlantic: implications for climate change. *ICES Journal of Marine Science*. 54: 608-614.

- Smith, L. A., J. S. Link, S. X. Cadrin, and D. L. Palka. 2015. Consumption by marine mammals on the Northeast U.S. continental shelf. *Ecological Applications*. 25(5):373-389.
- Staudinger, M.D., K. E. Mills, K. Stamieszkin, N. R. Record, C. A. Hudak, A. Allyn, A. Diamond, K. D. Friedland, W. Golet, Me. E. Henderson, C. M. Hernandez, T. G. Huntington, R. Ji, C. L. Johnson, D. S. Johnson, A. Jordaan, J. Kocik, Y. Li, M. Liebman, O. W. Nichols, D. Pendelton, R. A. Richards, T. Robben, A. C. Thomas, H. J. Walson, and K. Yakola. 2019. It's about time: a synthesis of changing phenology in the Gulf of Maine ecosystem. *Fisheries Oceanography*: 1-34. Available at: <https://doi.org/10.1111/fog.12429>
- Personal communication, Nancy Kohler, NEFSC.
- ¹³ Unmanaged Forage Omnibus Amendment. Available at: <http://www.mafmc.org/actions/unmanaged-forage>
- ¹⁴ Chub mackerel literature review available at: http://www.mafmc.org/s/12_Chub_lit_review_July2018.pdf
- ¹⁵ Manooch, C. S., D. L. Mason, and R. S. Nelson. 1984. Food and gastrointestinal parasites of dolphin *Coryphaena hippurus* collected along the southeastern and Gulf Coasts of the United States. *Bulletin of the Japanese Society of Scientific Fisheries*. 509(9):1151-1525.
- ¹⁶ Veiga, P., J. C. Xavier, C. A. Assis, and K. Erzini. 2011. Diet of the blue marlin, *Makaira nigricans*, off the south coast of Portugal. *Marine Biology Research*. 7:820-825.
- ¹⁷ Abitia-Cardenas, L. A., F. Galvan-Magaña, F. J. Gutierrez-Sanches, J. Rodriguez-Romero, B. Aguilar-Palomino, and A. Moehl-Hitz. 1999. Diet of blue marlin *Makaira mazara* off the coast of Cabo San Lucas, Baja California Sur, Mexico. *Fisheries Research*. 44(1999):95-100.
- ¹⁸ Alonso, H, J. P. Granadeiro, V. H. Paiva, A. S. Dias, J. A. Ramos, and P. Catry. 2012. Parent-offspring dietary segregation of Cory's shearwaters breeding in contrasting environments. *Marine Biology*. 159 (2012): 1197-1207.
- Alonso, H, J. P. Granadeiro, M. P. Dias, T. Catry, and P. Catry. 2018. Fine-scale tracking and diet information of a marine predator reveals the origin and contrasting spatial distribution of prey. *Progress in Oceanography*. 162 (2018): 1-12.
- Ambrose, S. T, P. W. Froneman, M. J. Smale, G. Cliff, and S. Plön. 2013. Winter diet shift of long-beaked common dolphins (*Delphinus capensis*) feeding in the sardine run off KwaZulu-Natal, South Africa. *Marine Biology*. 160 (2013): 1543-1561.
- Granaderio, J. P., L. R. Monterio, and R. W. Furness. 1998. Diet and feeding ecology of Cory's shearwater *Calonectris diomedea* in the Azores, north-east Atlantic. *Marine Ecology Progress Series*. 166 (1998): 267-276.
- Marçalo, A., L. Nicolau, J. Giménez, M. Ferreira, J. Santos, H. Araújo, A. Silva, J. Vingada, and G. J. Pierce. 2018. Feeding ecology of the common dolphin (*Delphinus delphis*) in western Iberian waters: has the decline in sardine (*Sardina pilchardus*) affected dolphin diet? *Marine Biology*. 165 (2018): 44.
- ¹⁹ Report of the July 2018 SSC meeting. Available at: <http://www.mafmc.org/ssc>
- ²⁰ Goode, G. B. 1884. The food fishes of the U.S. part 3: natural history of useful aquatic animals. In: *The Fisheries and Fishery Industries of the United States*. U.S. Government Printing Office. Washington, D.C. Available at: <http://celebrating200years.noaa.gov/rarebooks/fisheries/welcome.html>
- ²¹ More information on the Chub Mackerel Amendment (Amendment 21 to the Mackerel, Squid, and Butterfish Fishery Management Plan) is available at: <https://www.mafmc.org/actions/chub-mackerel-amendment>.
- ²² Unpublished NMFS commercial fish dealer data (i.e., "DERS"), which include both state and federal dealer data).
- ²³ Data from commercial vessel trip reports submitted to the NMFS Greater Atlantic Regional Fisheries Office.
- ²⁴ Personal communication from the National Marine Fisheries Service, Fisheries Statistics Division. Accessed August 12, 2021. Available at: <https://www.st.nmfs.noaa.gov/recreational-fisheries/data-and-documentation/queries/index>

²⁵ Digital copies of the small scombrid ID guide are available at: <https://www.mafmc.org/actions/chub-mackerel-amendment> (scroll down to “Related Resources”). Waterproof hard copies may be obtained by contacting Council staff at 302-674-2331 or contact@mafmc.org.

²⁶ Summary of November 9, 2017 webinar on chub mackerel in HMS diets. Available at: <http://www.mafmc.org/actions/chub-mackerel-amendment>