Mid-Atlantic Fishery Management Council
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MEMORANDUM

Date: June 22, 2018

To: SSC

From: Julia Beaty

Subject: Chub mackerel ABC considerations

Goals and Objectives of Amendment

The Council is developing an amendment which will consider adding Atlantic chub mackerel (*Scomber colias*) to the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan with catch limits, accountability measures, and other conservation and management measures required for stocks in the fishery.

In June 2018 the Council approved the following draft goals and objectives for the amendment.

- *Goal 1*: Maintain a sustainable chub mackerel stock.
    - *Objective 1.1:* Prevent overfishing and achieve and maintain sustainable biomass levels that achieve optimum yield in the fisheries and meet the needs of chub mackerel predators.
    - *Objective 1.2:* Consider and account for, to the extent practicable, the role of chub mackerel in the ecosystem, including its role as prey, as a predator, and as food for humans.
- *Goal 2:* Optimize economic and social benefits from utilization of chub mackerel, balancing the needs and priorities of different user groups.
    - *Objective 2.1:* Allow opportunities for commercial and recreational chub mackerel fishing, considering the opportunistic nature of the fisheries, changes in availability that may result from changes in climate and other factors, and the need for operational flexibility.
    - *Objective 2.2:* To the extent practicable, minimize additional limiting restrictions on the *Illex* squid fishery.
    - *Objective. 2.3:* Balance social and economic needs of various sectors of the chub mackerel fisheries (e.g. commercial, recreational, regional) and other fisheries, including recreational fisheries for highly migratory species.
- *Goal 3:* Support science, monitoring, and data collection to enhance effective management of chub mackerel fisheries.
    - *Objective 3.1:* Improve data collection to better understand the status of the chub mackerel stock, the role of chub mackerel in the ecosystem, and the biological, ecological, and socioeconomic impacts of management measures, including impacts to other fisheries.
    - *Objective 3.2:* Promote opportunities for industry collaboration on research.

Stock Assessment Considerations

In 2017, the Council issued a request for proposals for a chub mackerel stock assessment. However, based on the recommendations of a review panel of Council and Northeast Fisheries Science Center (NEFSC) staff and an SSC member, the Council ultimately decided not to fund an assessment. The review panel agreed that given the extreme data limitations for chub mackerel, even a data limited modeling approach would likely produce highly uncertain results, which could prove risky for setting management measures.

Significant concerns identified by the review panel, the chub mackerel Fishery Management Action Team, and fishing industry stakeholders regarding the ability to quantitatively assess the status of the chub mackerel stock include:

- **Low and sporadic catches in fisheries independent surveys**
  - NEFSC bottom trawl survey
    - There are no records of chub mackerel caught in the spring NEFSC bottom trawl survey during 1963-2016 (personal communication, Michele Traver and Chris Tholke, NEFSC).
    - Chub mackerel are periodically encountered in the fall NEFSC bottom trawl survey. Most of these catches occurred south of the Hudson Shelf Valley in warm water temperatures (i.e. generally higher than about 20°C/68°F; personal communication, John Manderson, Michele Traver, and Chris Tholke, NEFSC; Figure 1 and Figure 2).
  - State trawl surveys
    - Catches in state fisheries-independent surveys are rare (John Manderson, personal communication, NEFSC).
  - Larval surveys
    - The Chub Mackerel Amendment Fishery Management Action Team agreed that a larval survey may be the most appropriate fishery-independent index of abundance, given that recruitment is likely a main driver of abundance.
    - From 1977 through 2016, 67 chub mackerel larvae were identified in ECOMON survey catches from North Carolina through southern New England.
    - During 1983 - 2014, the Southeast Fisheries Science Center collected 1,748 chub mackerel larvae throughout the Gulf of Mexico (Figure 3).
    - Richardson et al. (2010) documented chub mackerel larvae in the straits of Florida in nearshore waters during January – May.[1]
- **The influence of factors other than abundance on fishery catch per unit effort**
  - Catch in the mid-Atlantic and southern New England appears to be influenced by factors such as the price and availability of substitute species (especially *Illex* squid) and temperature.[2]
  - Due to the significant overlap with the *Illex* squid fishery, it can be difficult to determine which trips targeted chub mackerel, as opposed to *Illex* squid.

[1] 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.

[2] For more information, see the 2018 chub mackerel fishery information document and advisory panel fishery performance report (both are available at: http://www.mafmc.org/actions/chub-mackerel-amendment).

    - Directed fishing effort on chub mackerel was generally very low until about 2013 and has been variable since that time (Figure 4).
    - Chub mackerel landings in the southeast may be largely incidental (Figure 4).[3]
- **Limited data on growth and maturity in U.S. Atlantic waters**
    - The only known information on age, length, and maturity for chub mackerel in U.S. Atlantic waters is included in Daley (2018).[4]
    - With additional funding, additional data on age, length, and maturity could be collected from existing sampling programs, such as the NEFSC and state trawl surveys, the southeast Trip Interview Program, and the observer program.
- **Uncertainty regarding stock structure in U.S. waters**
    - In the eastern Atlantic Ocean, chub mackerel are found from southern New England, through the Gulf of Mexico, in the Caribbean, and off South America.
    - No studies on stock structure in U.S. waters have been conducted.
    - Studies from other regions (e.g. Europe and Africa) suggest based on differences in morphology, spawning seasons, and/or sizes at maturity that sub-stocks may exist; however, the species is genetically uniform across wide areas (e.g. the eastern Mediterranean Sea, the Ivory Coast, and South Africa).[5]

The Council is developing an amendment to add chub mackerel as a stock in the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan. This necessitates adoption of an acceptable biological catch (ABC) level. Given the lack of a stock assessment and the data limitations described above, the ABC could be specified based on catch history.

Tables 1-9 include information on commercial and recreational landings and discards for three different regions. This information could be used to inform development of an ABC for chub mackerel.

It is important to note that at least 90% of the South Atlantic and Gulf of Mexico landings each year were landed at Florida Gulf coast dealers. Landings in the mid-Atlantic and New England occurred in Massachusetts, New Jersey, New York, Rhode Island, and Virginia. During 15 of the last 20 years, New Jersey and Rhode Island accounted for at least 99% of mid-Atlantic and New England landings.

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[3] Ibid.

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

[5] Cerna, F. and G. Plaza. 2014. Life history parameters of chub mackerel (*Scomber japonicus*) from two areas off Chile. *Bulletin of Marine Science*. 90(3):833-848.

Chen, X., G. Li, B. Feng, and S. Tian. 2009. Habitat suitability index of chub mackerel (*Scomber japonicus*) fromJuly to September in the East China Sea. *Journal of Oceanography*. 65: 93-102.

Scoles, D. R., B. B. Collette, and J. E. Graves. 1998. Global phylogeography of mackerels of the genus *Scomber*. *Fishery Bulletin.* 96: 823-842.

Weber, E. D. and S. McClatchie. 2012. Effect of environmental conditions on the distribution of Pacific mackerel (*Scomber japonicus*) larvae in the California Current System. *Fishery Bulletin*. 110:85-97.

Yasuda, T., R. Yukai, and S. Ohshimo. 2014. Fishing ground hotspots reveal long-term variation in chub mackerel *Scomber japonicus* habitat in the East China Sea. *Marine Ecology Progress Series*. 501: 239-250.

Zardoya, R., R. Castilho, C. Grande, L. Favre-Krey, S. Caetano, S. Marcato. 2004. Differential population structuring of two closely related fish species, the mackerel (*Scomber scombrus*) and the chub mackerel *Scomber japonicus*), in the Mediterranean Sea. *Molecular Ecology.* 13:1785-1798.

For more information on chub mackerel fisheries, see the 2018 Chub Mackerel Fishery Information Document, available at: http://www.mafmc.org/actions/chub-mackerel-amendment.

Current Management Measures

The Council developed the first management measures for Atlantic chub mackerel in U.S. waters through the Unmanaged Forage Omnibus Amendment, which was approved by the Council in August 2016. These measures have been in place since September 2017 and include a 2.86 million pound commercial landings limit, which applies to all commercial chub mackerel landings in the northeast region (ME-NC). Once this landings limit is met, commercial vessels fishing in mid-Atlantic federal waters are subject to a 40,000 pound chub mackerel possession limit. There is no chub mackerel possession limit until the 2.86 million pound landings limit is met. The possession limit does not apply to vessels fishing in New England waters, although landings in New England count towards the 2.86 million pound limit. Commercial vessels which possess chub mackerel in mid-Atlantic federal waters are required to obtain a commercial fishing permit for any species from the NMFS Greater Atlantic Regional Fisheries Office. There is no permit specific to chub mackerel.

The 2.86 million pound landings limit was based on northeast (ME-NC) commercial landings during 2013-2015, years with targeted commercial fishing effort. It is a landings limit only and does not account for discards. The 40,000 pound possession limit was based on the recommendation of a Council member who is familiar with the recent chub mackerel fishery. It is approximately the amount of chub mackerel needed to fill a bait truck. It was assumed that vessels would not target chub mackerel under a 40,000 pound possession limit; however, this limit would enable vessels to land chub mackerel caught incidentally. It was assumed that a lower limit would lead to higher discards because vessels could not easily sell smaller amounts.

The chub mackerel measures implemented through the Forage Amendment will expire on January 1, 2021. After that date, there will be no management measures for chub mackerel unless additional action is taken by the Council. The current measures were intended to be temporary and replaced by measures developed through an amendment to add chub mackerel as a stock in the Mackerel, Squid, Butterfish FMP. Management as a stock in an FMP[6] requires adoption of an ABC. The current landings limit could form the basis for an ABC recommendation; however, derivation of this limit did not include commercial discards or recreational catch.

Committee and Advisory Panel Recommendations

The Council's Mackerel, Squid, and Butterfish Advisory Panel (AP) and Committee met jointly on May 15, 2018 to discuss several aspects of the chub mackerel amendment.[7] AP and Committee members supported consideration of ABCs ranging from 1,300 MT to 5,000 MT (about 2.87 - 11.02 million pounds). 1,300 MT is roughly equivalent to the annual chub mackerel landings limit for New England and the mid-Atlantic that was implemented through the Unmanaged Forage Omnibus Amendment (i.e. 2.86 million pounds). However, one AP member did not support an ABC above the current limit as the ecosystem impacts of any catch limit are uncertain.

[6] Also referred to in the National Standards Guidelines as a stock "in need of conservation and management".

[7] A summary of the meeting is available at: http://www.mafmc.org/actions/chub-mackerel-amendment.

SSC Recommendations

The chub mackerel terms of reference for the July 2018 SSC meeting direct the SSC to identify an ABC, as well as the geographic range associated with the ABC. Possible geographic range options could include Maine through North Carolina, Maine through the east coast of Florida, and Maine through Texas. Table 1 shows average commercial and recreational landings for each of these three regions and for five different time periods. Table 2 includes commercial discard rates for these same time periods based on northeast fisheries observer program (NEFOP) and vessel trip report data. Observer data is generally considered the most accurate source of discard information. Discard data from the South Atlantic and Gulf of Mexico are available but are limited and have not yet been examined. Table 3 shows recreational discard information, which is sparse and likely not an accurate representation of true recreational discards.

According to NEFOP data and southeast commercial landings data, over 90% of commercial chub mackerel landings over the past 20 years were caught with bottom otter trawls or unspecified trawls. It is commonly assumed that bottom trawl gear has a 100% discard mortality rate.

The SSC could consider setting an ABC by selecting a commercial and recreational landings value from one of the time period and area combinations in Table 1 and increasing that amount based on the appropriate commercial discard value from Table 2. The ABC options which result from this approach, when using NEFOP discard data, are shown in Table 9. If the Unmanaged Forage Amendment measures were to form the basis for an ABC recommendation, then the ABC could be based on catch during 2013-2015 from Maine through North Carolina.

If the SSC identifies an ABC based on catch data from a larger area, such as Maine through Florida, the Council may select a management unit that includes that entire area or only a portion of that area (e.g. Maine through North Carolina). The Council has not yet identified a preferred management unit. If the ABC were based on catch data from Maine through Florida, then catch throughout that area could count towards the ABC, even if only a portion of that area is included in the management unit. In this case, the Council could recommend that vessels throughout the entire area obtain a fishing permit from the NMFS Greater Atlantic Regional Fisheries Office in order to harvest chub mackerel.

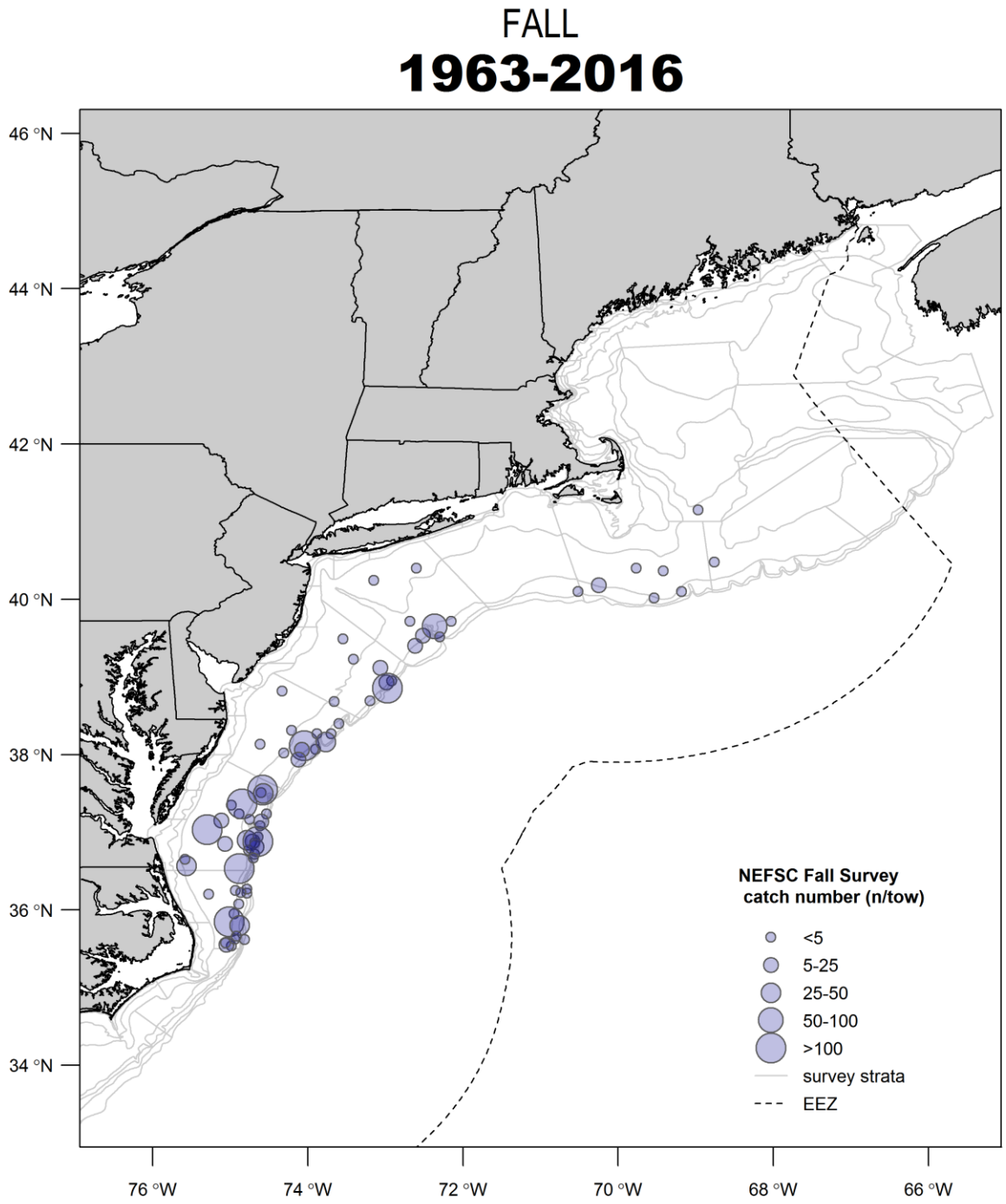

Figure 1: NEFSC fall survey chub mackerel catch in numbers per tow, 1963-2016 (source: Michele Traver and Chris Tholke, NEFSC, personal communication).

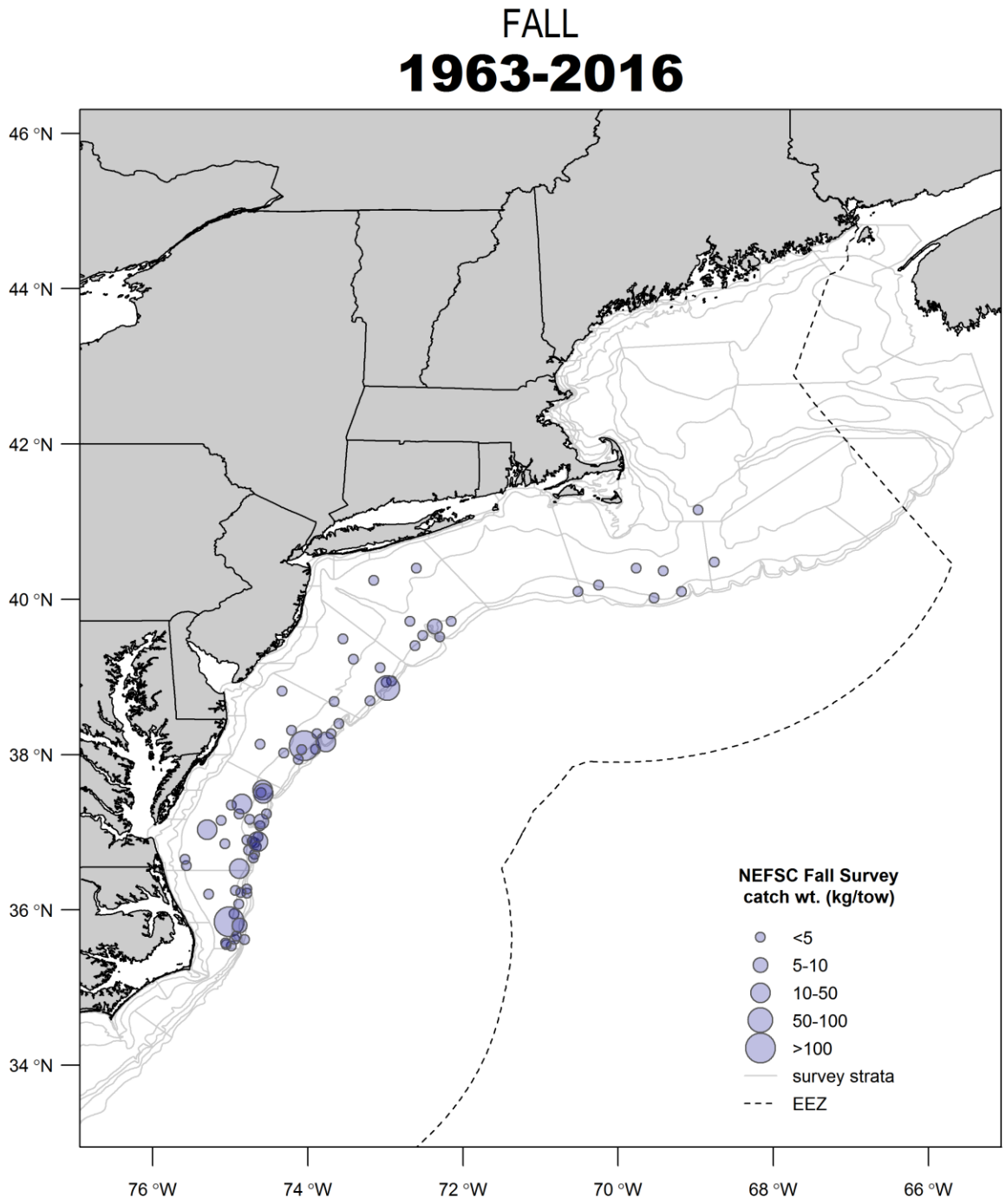

Figure 2: NEFSC fall survey chub mackerel catch in weight per tow (kg), 1963-2016 (source: Michele Traver and Chris Tholke, NEFSC, personal communication).

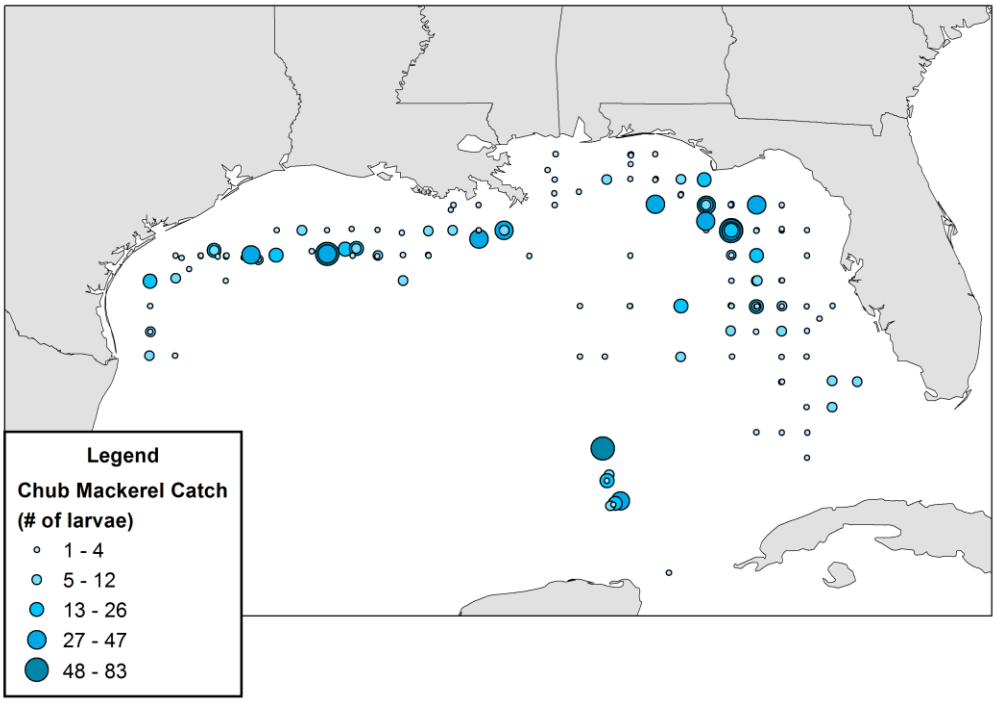

Figure 3: Southeast Fisheries Science Center larval survey catches of chub mackerel larvae, 1983-2014.

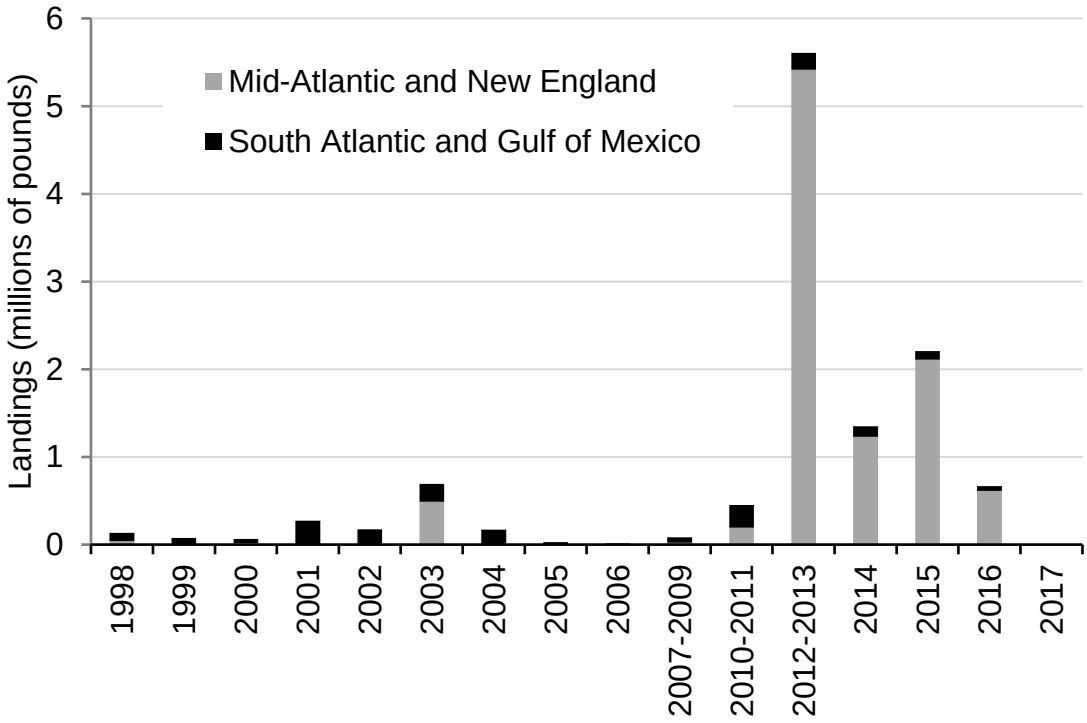

Figure 4: Dealer-reported chub mackerel landings, 1998-2017. Data are combined into two regions and some years are combined to protect confidential information representing fewer than three vessels and/or dealers.

Table 1: Average commercial and recreational chub mackerel landings, in pounds, by region.

Time Period	ME-NC	ME-FL	ME-TX
2003-2017 (15 years)	675,188	677,709	762,867
2008-2017 (10 years)	963,871	967,620	1,041,141
2013-2017 (5 years)	1,852,235	1,852,621	1,916,182
2013-2015 (top 3 and basis for Unmanaged Forage Amendment Measures)	2,878,810	2,879,439	2,966,221
2013 (historic high)	5,249,567	5,250,807	5,295,612

Table 2: Percent of commercial chub mackerel catch that was discarded, based on northeast fisheries observer program (NEFOP) and northeast vessel trip report (VTR) data. The associated number of trips is in parentheses.

Years	NEFOP Discard %	VTR Discard %
2003-2017 (15 years)	6% (217 trips)	3% (1,894 trips)
2008-2017 (10 years)	5% (199 trips)	3% (1,869 trips)
2013-2017 (5 years)	4% (156 trips)	3% (1,540 trips)
2013-2015 (top 3)	4% (95 trips)	3% (740 trips)
2013 (historic high)	3% (27 trips)	1% (120 trips)

Table 3: Recreational discard rates by year and region, according to the Marine Recreational Information Program. Years with no reported discarded chub mackerel are not shown.

Year	Region	Estimated discard rate
2002	Gulf of Mexico	7%
2003	Gulf of Mexico	100%
2004	Gulf of Mexico	1%
2010	Gulf of Mexico	13%
2012	Mid-Atlantic	100%
2014	Mid-Atlantic	17%
2016	Mid-Atlantic	16%
2017	North Atlantic	8%
2017	Mid-Atlantic	63%
2017	Gulf of Mexico	1%

Table 4: Total commercial chub mackerel landings from Maine through Texas, 1998-2017.

Year	**Total Commercial Landings** (pounds)
1998	133,888
1999	74,108
2000	63,153
2001	272,494
2002	173,385
2003	692,698
2004	170,933
2005	30,069
2006	13,393
2007	18,913
2008	62,121
2009	2,857
2010	268,966
2011	183,765
2012	312,777
2013	5,295,612
2014	1,347,997
2015	2,206,840
2016	668,282
2017	2,202
20 year average (1998-2017)	**599,723**
5 year average (2013-2017)	**1,904,187**

Table 5: Total commercial chub mackerel landings, Maine - Virginia, 1998-2017. Some years are combined to protect confidential data representing fewer than three vessels and/or dealers.

Year	Northeast Commercial Landings (pounds)
1998	40,219
1999	6,443
2000	16,246
2001	4,384
2002	471
2003	488,316
2004	126
2005	0
2006	0
2007-2009	21,039
2010-2011	192,301
2012	164,846
2013	5,249,567
2014	1,230,311
2015	2,108,337
2016	610,783
2017	2,202
20 year average (1998-2017)	**506,780**
5 year average (2013-2017)	**1,840,240**

Table 6: Total commercial chub mackerel landings from North Carolina through the Atlantic coast of Florida, 1998-2017. Some years are combined to protect confidential data representing fewer than three dealers.

Year	South Atlantic Commercial Landings (pounds)
1998-2000	4,948
2001	73
2002	234
2003-2004	64
2005-2006	202
2007	60
2008	34,575
2009-2012	982
2013-2016	1,930
2017	0
20 year average (1998-2017)	**2,153**
5 year average (2013-2017)	**386**

Table 7: Total commercial chub mackerel landings from the Gulf coast of Florida through Texas, 1998-2017. Some years are combined to protect confidential data representing fewer than three dealers.

Year	Gulf of Mexico Commercial Landings (pounds)
1998	90,319
1999	66,075
2000-2001	314,936
2002-2003	377,040
2004-2008	295,429
2009	2,740
2010	82,300
2011	177,731
2012	147,375
2013	44,805
2014	117,044
2015	98,497
2016	57,457
2017	0
20 year average (1998-2017)	**93,587**
5 year average (2013-2017)	**63,561**

Table 8: Estimated chub mackerel harvest in pounds by recreational fishermen, 1998-2017, based on data from the Marine Recreational Information Program.

Year	North Atlantic (i.e. ME-CT)	Mid-Atlantic (i.e. NY-VA)	South Atlantic (i.e. NC-FL)	Gulf of Mexico (i.e. FL-TX)	Total
1998	0	363	0	0	363
1999	0	0	0	0	0
2000	0	2,773	0	0	2,773
2001	0	0	0	0	0
2002	0	0	0	43,676	43,676
2003	0	0	0	0	0
2004	0	0	0	96,344	96,344
2005	0	0	0	2,499	2,499
2006	0	0	0	6,745	6,745
2007	0	0	0	0	0
2008	0	0	0	0	0
2009	0	0	0	0	0
2010	0	0	0	0	0
2011	17	0	0	0	17
2012	0	0	0	0	0
2013	0	0	0	0	0
2014	0	48,215	0	0	48,215
2015	0	0	0	0	0
2016	0	1,659	0	0	1,659
2017	8,845	1,258	0	0	10,103

Table 9: Average commercial and recreational chub mackerel landings, in pounds, by region, as shown in Table 1, increased by the NEFOP discard rates as shown in Table 2.

Time Period	ME-NC	ME-FL	ME-TX
2003-2017 (15 years)	715,699	718,372	808,639
2008-2017 (10 years)	1,012,065	1,016,001	1,093,198
2013-2017 (5 years)	1,926,324	1,926,726	1,992,829
2013-2015 (top 3 and basis for Unmanaged Forage Amendment Measures)	2,993,962	2,994,617	3,084,870
2013 (historic high)	5,407,054	5,408,331	5,454,480