Mid-Atlantic Fishery Management Council
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Chub Mackerel Fishery Management Action Team (FMAT)
Meeting Summary

June 19, 2017

FMAT members in attendance: Julia Beaty (MAFMC), Douglas Christel (NMFS), John Manderson (NMFS), Katie Richardson (NMFS), Diane Stephan (NMFS), Alison Verkade (NMFS)

Others in attendance: Purcie Bennet-Nickerson (Pew Charitable Trusts), Taylor Daley (University of Southern Mississippi), Zack Greenberg (Pew Charitable Trusts), Joseph Gordon (Pew Charitable Trusts), Kevin Jackson (NMFS), Jeff Kaelin (Lund's Fisheries), Meghan Lapp (Seafreeze, ltd.), Robert Leaf (University of Southern Mississippi), Chris Sarro (NMFS)

Background

The chub mackerel FMAT met on June 19, 2017 at the GARFO office in Gloucester, MA. The purpose of this meeting was to review scoping comments, discuss data needs, and begin to develop management alternatives for an amendment to integrate chub mackerel (*Scomber colias*) into the (Atlantic) Mackerel, Squid, and Butterfish (MSB) Fishery Management Plan (FMP). This action follows on the Unmanaged Forage Omnibus Amendment, which implemented initial management measures for chub mackerel. These measures will expire in 2020 (see 82 Federal Register 18882, April 24, 2017).

The appendix on page 13 includes a summary of data considered by the FMAT for this meeting.

Amendment Goals and Objectives

The FMAT proposed the following draft goal statement for the chub mackerel amendment:

> *"The goal of this amendment is to manage Atlantic chub mackerel as a stock in the Mackerel, Squid, Butterfish Fishery Management Plan."*

When the Council took final action on the Unmanaged Forage Omnibus Amendment, they expressed their intent to develop a subsequent management action to integrate chub mackerel

into the MSB FMP.[1] This intent is demonstrated in the language of the Council's motions for final action on the Forage Amendment, and in the Council's 2017 Implementation Plan.

The FMAT agreed that there is sufficient rationale for managing chub mackerel within the MSB FMP. There is substantial overlap between the commercial chub mackerel and *Illex* squid fisheries in terms of participating vessels, gears used, and areas and times of year fished. In many cases, chub mackerel are landed on the same trips which also land *Illex* squid. Chub mackerel also share many life history characteristics with Atlantic mackerel. In addition, like the other species in the MSB FMP, chub mackerel can be considered a forage species due to their low trophic level, small size, and schooling behavior.

If the Council wishes to consider alternatives to the stock in the fishery designation, the proposed goal statement should be modified. Alternatives approaches could include:

- Developing a separate chub mackerel FMP;
- Managing chub mackerel as an ecosystem component within an existing FMP; or
- Continuing to use the Council's discretionary authority to manage chub mackerel, as was done through the Unmanaged Forage Omnibus Amendment.

Some FMAT members requested clarification from the Council on whether the chub mackerel amendment should consider these other options. The FMAT recommended postponing development of FMP goals and objectives specific to chub mackerel (as opposed to goals and objectives for this amendment) until the Council provides clarification on whether the amendment should consider these other options.

A review of the existing MSB FMP goals and objectives is listed as a proposed deliverable in the Council's 2017 implementation plan. The Council may want to consider chub mackerel when revising the FMP objectives for the other species.

The FMAT proposed the following draft objectives for the chub mackerel amendment:

- Meet the Magnuson-Stevens Fishery Conservation and Management Act requirements for a stock in the fishery.
- Consider, to the extent practical, the role of chub mackerel in the ecosystem, including its role as prey, as a predator, and as food for humans.
- 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.

[1] Integrating chub mackerel as a stock in the MSB FMP implies that chub mackerel are in need of conservation and management under the Magnuson-Stevens Conservation and Management Act. The FMAT did not discuss in detail how chub mackerel meets the criteria to determine if a stock is in need of conservation and management, as outlined in the National Standard Guidelines at 50 CFR 600.305. Such an evaluation should be carried out if the Council adopts a goal statement similar to that recommended by the FMAT.

- Facilitate development of a commercial chub mackerel fishery and preserve opportunities for recreational chub mackerel fishing.
- To the extent practical while meeting the other objectives, allow the *Illex* squid fishery to proceed without additional limiting restrictions when *Illex* are available.
- Seek to minimize conflicts within sectors of chub mackerel fisheries and between chub mackerel fisheries and other fisheries.

These objectives are not ranked in order of importance.

The FMAT considered drafting the second objective listed above based on the Council's forage policy as outlined in the EAFM Guidance Document[2] (i.e. "it shall be the policy of the Council to support the maintenance of an adequate forage base in the Mid-Atlantic to ensure ecosystem productivity, structure and function and to support sustainable fishing communities"). Some FMAT members expressed concern that this policy statement is difficult to apply given currently available data and the lack of measurable criteria for determining the appropriate level of forage biomass needed to "ensure ecosystem productivity, structure and function and to support sustainable fishing communities".

Short-Term Data and Analysis Needs

FMAT members and partners at the Northeast Fisheries Science Center (NEFSC) have summarized several relevant data sets, including:[3]

- Commercial dealer data from the northeast (i.e. Mid-Atlantic and New England) and southeast (i.e. South Atlantic and Gulf of Mexico), including information on the volume, location, and ex-vessel price of landings, participating dealers, and (for northeast data only), participating vessels. All southeast landings were reported from Florida dealers, with most landings in any given year occurring at Gulf coast dealers.
- Commercial vessel trip report (VTR) data, including information on fishing location, catch, landings, target species, and gear.
- NEFSC study fleet data, with tow-by-tow information on fishing location, gear, catch, landings, and, in some instances, temperature, depth, and tow speed.
- Southeast logbook program data, with information on landings, gear, and area fished. This data set includes only 11 records of chub mackerel.
- Marine Recreational Information Program (MRIP) data, with information on recreational chub mackerel catch and landings by state, wave (i.e. two-month period), and mode (e.g. for-hire, private, shore-based). These data are highly imprecise (e.g. most estimates have high percent standard errors) and likely do not accurately describe recreational fishing effort and catch of chub mackerel. Due to the similarity in appearance between chub mackerel and Atlantic mackerel, species identification may be an issue for MRIP surveys.

[2] Available at: http://www.mafmc.org/eafm/

[3] See page 13 for summaries of most of these data sets.

- Southeast region headboat survey data, including estimated numbers and weights of landed chub mackerel per year from 1986 through 2015. These data show sporadic and variable landings of chub mackerel and are likely an imprecise representation of true recreational fishing effort and landings.
- The Southeast Trip Interview Program, with information on gear, landings, and lengths of individual fish. This program also documents weight of individual fish (either measured or calculated based on length/weight formulas), sex, and maturity stage; however, there are few records of weight, sex, and maturity stage for chub mackerel.
- NEFSC bottom trawl survey data, which includes sparse records of chub mackerel catch between 1963 and 2016, with no overall pattern in the time series. These data have been summarized as catch per tow (including stratified average per year), weight per tow (including stratified average per year), proportion of positive tows by stratum, and catch by year and stratum.
- Data from the ECOMON survey, which samples from the Gulf of Maine to Cape Hatteras and includes records of 67 chub mackerel larvae.
- Southeast Area Monitoring and Assessment Program (SEAMAP) survey data, including records of 1,748 chub mackerel larvae caught throughout the Gulf of Mexico during 1983-2014.

In addition, researchers from the University of Southern Mississippi provided the FMAT with preliminary results of their research on the age, length, weight, growth, and maturity based on samples from commercial landings in the northeast in 2016.

The FMAT had the following recommendations for additional data to examine and analysis that could be performed using currently available data:

- Further examination of state waters fishery-independent trawl surveys and the SEAMAP trawl survey for additional information on abundance and distribution.
- A breakdown of ex-vessel price by month to analyze the impacts of potential time/area management measures alternatives.
- Evaluation of the economic benefits of the chub mackerel fishery beyond ex-vessel price, including benefits to support businesses; the value of chub mackerel as food (especially in developing countries), bait, and other uses; and the benefits of providing an alternative source of income for certain vessels when *Illex* squid are not available.
- A summary of the universe of vessels which may be impacted by this amendment. This could be defined based on vessel size, speed, and ability to freeze or store catch in refrigerated sea water. All *Illex* squid and Atlantic mackerel permit holders could be considered potential participants in commercial chub mackerel fisheries; however, permits associated with smaller vessels may need to be excluded as smaller vessels may not be able to efficiently harvest chub mackerel due to their fast swimming speed.

- Characterization of recreational fisheries for key chub mackerel predators, including a description of areas fished. Longer-term data needs related to chub mackerel predators are summarized in the next section.

These items are not ranked in priority order.

Long-Term Data Needs and Strategies for Future Data Collection

Given that the chub mackerel management measures implemented through the Unmanaged Forage Omnibus Amendment will expire after December 2020, the FMAT agreed that new management measures will need to be developed based on available data, though important longer-term data needs should be addressed. The FMAT agreed that much more information is needed to support management of chub mackerel as a stock in the fishery and to better understand the role of chub mackerel in the ecosystem. Most importantly, there is currently no stock assessment for Atlantic chub mackerel in U.S. waters. The FMAT agreed that collection of the following types of information should be prioritized to support future stock assessments:

- Information on catch per unit effort (CPUE). Both a historic and recent time series of CPUE will be needed for future stock assessments. It may be possible to reconstruct historic CPUE based on available data, information from other regions, and input from fishermen; however, the FMAT cautioned that, based on public comments, data examined to date, and the scientific literature, CPUE may not be a reliable indicator of chub mackerel abundance. For example, catch in the Mid-Atlantic appears to be influenced by factors such as the availability of substitute species (especially *Illex* squid), temperature, price, and market demand. In addition, 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.
- A fishery-independent index of abundance. Adult chub mackerel are rarely encountered in the NEFSC bottom trawl surveys, likely due to their fast swimming speed and preference for warm water. Multiple studies suggest that chub mackerel abundance is largely driven by recruitment. For these reasons, a larval survey may be the most appropriate index of abundance. The SEAMAP survey has collected chub mackerel larvae in the Gulf of Mexico. One FMAT member questioned whether samples from past survey cruises have been stored, but not thoroughly processed, which could provide additional data. It could also be beneficial to have additional larval sampling on the Florida shelf. The FMAT also briefly discussed the possibility of using acoustic surveys to monitor chub mackerel abundance. One FMAT member said acoustic surveys may not be able to generate useful indices of abundance for chub mackerel,[4] but they could be integrated with commercial fishery data to better understand fishery selectivity, which would also be useful for stock assessments.

[4] Potential challenges include effectively covering the stock area and estimating availability to the survey.

- Age and length compositions and maturity information. Existing programs, including the ongoing research at the University of Southern Mississippi, the southeast Trip Interview Program, and the observer program, could be expanded upon to obtain more data on age, length, and maturity. Funding will likely need to be provided to expand upon these existing capacities. It is important to consider how fishery selectivity may influence these data sources.
- Information on stock structure. Atlantic chub mackerel are found from southern New England, through the Gulf of Mexico, in the Caribbean, off South America, in the eastern Atlantic, and in the Mediterranean. Some studies from other regions suggest that sub-stocks may exist within this broad range. Genetic markers and/or otolith microchemistry could provide a better understanding of chub mackerel stock structure in the U.S. EEZ.

Given potential limitations on the ability to infer abundance from CPUE, the FMAT agreed that chub mackerel may need to be assessed using a data-limited approach. Literature from other regions could be used to inform some parameters in a data-limited model; however, this would not replace the need for data from this region.

The FMAT discussed the need for additional data on the role of chub mackerel in the ecosystem. For example, if one of the Council's goals is to ensure an adequate amount of chub mackerel prey for key predators, it is essential to better understand how dependent these predators are on chub mackerel.

The FMAT discussed currently available data to define the importance of chub mackerel in the diet of HMS predators. This topic has generated much debate at Council, Committee, and AP meetings and at scoping and public hearings, both for this amendment and for the Unmanaged Forage Omnibus Amendment. Many recreational fishermen have expressed concerns that a commercial chub mackerel fishery could negatively impact recreationally-important predators, especially white marlin.

Two FMAT members summarized their knowledge of available HMS diet data, including two relevant reports (Runderhausen et al. 2010, Poland 2014) and conversations with four researchers (Jeff Buckel, North Carolina State University; John Graves, Virginia Institute of Marine Science; Steve Poland, North Carolina Division of Marine Fisheries; and Paul Ruderhausen, North Carolina State University). Runderhausen et al. (2010) and Poland (2014) quantified the amount of scombrids in the diets of blue marlin, yellowfin tuna, blackfin tuna, and wahoos. These studies largely or entirely relied on samples from recreational fishing tournaments, which limits data collection to certain areas and times of year and biases the results towards larger individuals.

To date, the FMAT has found no diet studies which quantify the importance of chub mackerel in the diet of any HMS predators off the U.S. east coast. All the researchers spoken with to date identified notable amounts of unidentified scombrids in the diets of the predators they examined; however, none have quantified the amount of chub mackerel. This appears to be largely due to the difficulty in identifying partially digested small scombrids to the species level. Of the

scombrids identified in stomach contents, *Auxis* spp. (i.e. frigate and bullet mackerel) tended to be most commonly identified (Runderhausen et al. 2010; Poland 2014; personal communication, John Graves). The FMAT suggested that the challenges of identifying partially digested scombrids to the species level could be overcome in future research using genetic information, fatty acids, and/or otolith morphology.

The FMAT was not aware of any HMS diet studies that used a systematic random sampling methodology, as opposed to opportunistic sampling of recreational or commercial fishery catches.[5] The FMAT will continue looking for additional data sources.

Several Council members, Advisory Panel members, and members of the public have expressed concerns about the potential for negative impacts of commercial chub mackerel fisheries on white marlin, though none of these comments described evidence of negative impacts seen to date. The FMAT viewed annual trends in recreational white marlin catch (Figure 1), as estimated through the Large Pelagics Survey. The FMAT noted that there does not appear to be a relationship between white marlin catches and commercial chub mackerel landings (see Figure 1 in the appendix); however, the FMAT did not examine these data in detail and no FMAT members were familiar with the details of the Large Pelagics Survey sampling and estimation methodology.

Studies of marine mammals and sharks examined to date quantify the dietary importance of scombrids or mackerels. To date, no marine mammal or shark diet studies have been found which quantify the importance of chub mackerel (e.g. Smith et al. 2015; Nancy Kohler, personal communication).

The FMAT agreed that a better understanding of how chub mackerel abundance and availability are influenced by climate could help inform discussions of management measures.

The FMAT agreed that recreational catch of chub mackerel is poorly documented. This could be addressed through improved outreach with recreational fishermen to ensure that they are accurately reporting their catches through existing reporting requirements (e.g. VTRs, MRIP) and to ensure that they can distinguish chub mackerel from similar species such as Atlantic mackerel, frigate mackerel, and bullet mackerel. One FMAT member suggested that improved recreational catch data could be used to examine the inshore distribution of chub mackerel. In addition, it may be beneficial to work with recreational anglers to obtain biological samples from currently under-sampled portions of the stock (e.g. inshore areas, sizes and ages not captured in the commercial fishery or fisheries-independent surveys, and times of year when the commercial fishery and surveys do not operate).

[5] Poland (2014) relied mostly on recreationally-caught fish but included some samples from commercial catches. Runderhausen et al. (2010) obtained their samples from the Big Rock Blue Marlin Tournament, based out of Moorehead City, NC.

The FMAT recommended that the Council convene two workshops with invited experts to better understand chub mackerel fisheries, the role of chub mackerel in the ecosystem, and recreational fisheries for key chub mackerel predators, as well as to lay the groundwork for future data collection efforts. One workshop would focus on expertise from the commercial fishing industry and could examine topics such as fishermen's observations of chub mackerel biology, life history, and population ecology; historic and recent CPUE; factors influencing CPUE; factors influencing availability; methods for defining a directed trip or tow; and other topics. Relevant information from other regions could be discussed at the workshop.

The second workshop would focus on recreationally-important predators of chub mackerel and would examine topics such as the location of recreational fishing effort for key predators, methods for quantifying the importance of chub mackerel in the diet of these predators, and fishermen's observations of chub mackerel biology, ecology, and population trends. This information could help inform analysis of ecological and socioeconomic impacts of chub mackerel management alternatives.

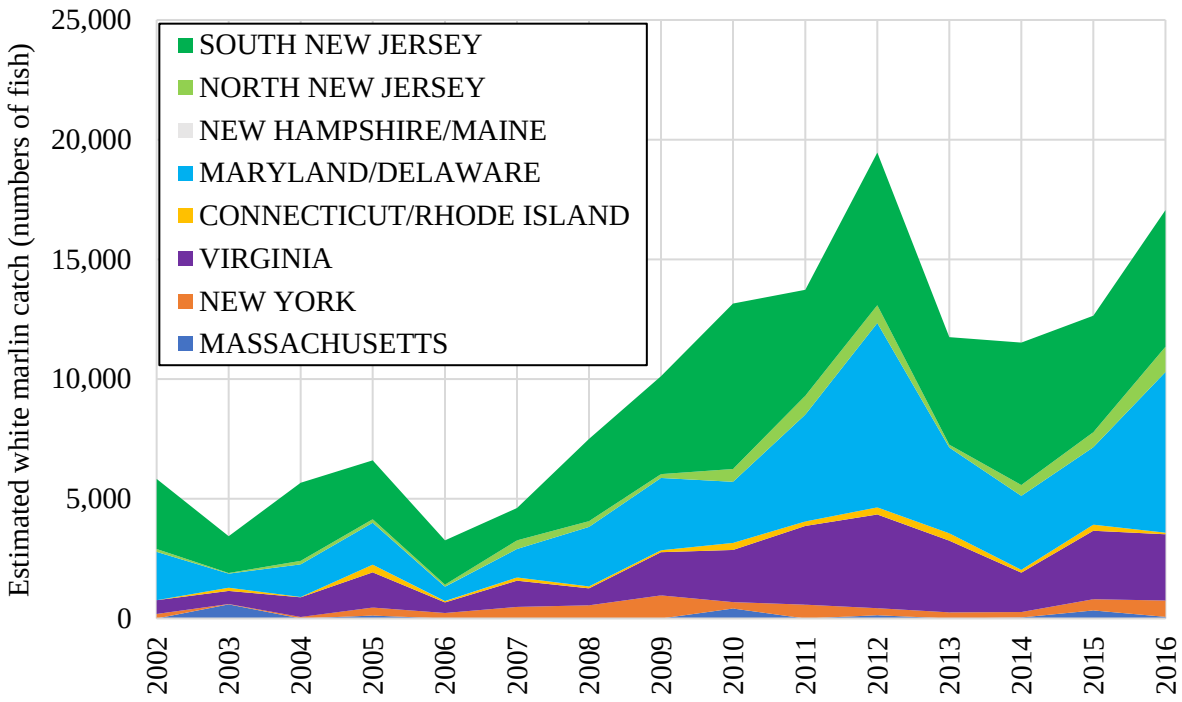

Figure 1: Estimated white marlin catch in numbers, including kept catch, fish released alive, and dead discards, 2002-2016. Source: large pelagics survey estimates, downloaded June 2017.

Essential Fish Habitat (EFH)

The FMAT agreed that, given the available data, chub mackerel EFH will need to be described based on level 1 information, including distribution data on some or all portions of the geographic range, opportunistically obtained data, and inferred habitat data. Higher-level habitat

data such as habitat-related densities (level 2), growth reproduction, or survival rates within habitats (level 3), and production rates by habitat (level 4) will likely not be available to describe chub mackerel EFH.

The FMAT agreed that EFH maps should cover the entire known distribution of chub mackerel in the U.S. EEZ based on all potentially relevant data sources, including, but not limited to, state and federal trawl surveys, fisheries-dependent data, and literature sources. The EFH text descriptions could be more restrictive, for example, describing preferred temperature ranges and seasonal differences in habitat use.

The requirement for static EFH maps poses challenges for describing rapidly changing species distributions. The distribution of chub mackerel is likely already shifting and will continue to change due to warming ocean temperatures. For example, it appears that their distribution may be shifting north with warming ocean temperatures. Use of northern habitat areas may continue to expand with warming ocean temperatures. The FMAT recommended using state and federal survey data and literature sources to identify ranges of environmental variables associated with the presence of chub mackerel. These data could be used to describe how spatial and temporal distributions of potential habitats have changed in the recent past and may change in the future.

Councils are required to describe EFH for all life stages. If information on habitat preferences for certain life stages is not available, EFH can be inferred based on life stages for which information is available (e.g. it can be assumed that adult EFH will encompass egg EFH) or different life stages could be combined. Such approaches may be required for chub mackerel.

An EFH geodatabase of data from state and federal surveys compiled by NMFS and state partners (not yet publicly available) shows that chub mackerel have been caught in state waters in some surveys. One FMAT member noted that, based on larval data and discussions with researchers, chub mackerel appear to spawn in the Gulf of Mexico. Larvae may be associated with plumes, at least in some areas.

One FMAT member noted that when analyzing the impacts of management alternatives, impacts to EFH for chub mackerel predators should be considered. Although chub mackerel are not explicitly listed as a component of EFH for any predator, they could play a role in contributing to the value of certain habitats as feeding areas.

The Council formed a separate FMAT to review and potentially revise EFH for Council-managed species. The chub mackerel FMAT agreed to coordinate with the EFH FMAT to ensure that chub mackerel EFH is described in a way that is consistent with the approaches that will be considered for other species.

Management Measures

The FMAT agreed to postpone development of alternatives for ACLs, AMs, ACTs, landings limits, and possession limits until after the SSC has discussed ABCs. The FMAT noted that the

Unmanaged Forage Omnibus Amendment established an annual landings limit and a reactionary possession limit once the annual landings limit is reached. These measures could form the basis for one set of alternatives for ACLs and AMs.

The FMAT agreed that sufficient arguments could be made for identifying minimum fish sizes, gear restrictions, limited access provisions, and control dates as measures which were "considered but rejected" (meaning that alternatives would not be developed). Available information, including preliminary data from the University of Southern Mississippi and studies from other regions, suggests that chub mackerel reach maturity at 1-2 years of age and most chub mackerel caught in commercial fisheries in this region are mature. In addition, due to the fast swimming speed of chub mackerel, the commercial fishery likely has a limited ability to harvest the largest, fastest, and most reproductively-valuable individuals. Thus, a minimum fish size may not provide any additional biological benefits beyond current fishery selectivity.

Very few vessels have actively participated in the commercial chub mackerel fishery in recent years. It appears that vessels need to be large (by Mid-Atlantic standards), fast, and able to freeze or store catch in refrigerated sea water to harvest sufficient volumes of these warm-water fish to be profitable. These factors seem to be limiting participation to a handful of vessels which also participate in the *Illex* squid fishery. Commercial chub mackerel fisheries are pursued in other parts of the world with purse seines; however, there are few existing offshore purse seine fisheries in this region. The FMAT agreed that given the relatively low ex-vessel price for chub mackerel (see appendix), it is unlikely that vessels would invest in modifications necessary for targeting chub mackerel with purse seines. For these reasons, the FMAT agreed that it is not necessary to develop management measures to restrict participation in commercial chub mackerel fisheries (e.g. limited access and control dates) at this point in time.

The FMAT did not see the need to develop alternatives for gear restrictions due to the substantial overlap between the commercial chub mackerel and *Illex* squid fisheries, and the existing limitations on expansion of the fishery previously described.

The FMAT did not discuss alternatives for permit requirements in detail, but agreed that most, if not all, active participants in the commercial chub mackerel fishery likely already have *Illex* squid permits or other commercial GARFO permits.

The FMAT discussed ideas for developing alternatives for time and area management measures for the commercial fishery, potentially including spatial and/or seasonal closures. Such closures have been requested by several recreational fishermen who wish to ensure a sufficient supply of chub mackerel prey during the times and areas when recreational HMS tournaments take place. Spatial/seasonal closures are strongly opposed by participants in the commercial chub mackerel fishery as the fishery is limited in time and space, thus such closures could effectively shut down the fishery. The FMAT identified the need for a better understanding of the importance of chub mackerel as prey for recreationally-important predators and a better understanding of the location

of recreational fishing effort to inform development of any alternatives for spatial/seasonal closures.

One approach to developing alternatives for time and area management could include mapping all areas within a certain radial distance of the main ports for key HMS tournaments. All HMS tournaments are required to be registered with NMFS. For most tournaments, fishing areas are limited only by timing restrictions and the speed of participating vessels. Closures alternatives could span several weeks or months to encompass all potentially affected HMS tournaments, or could take place for shorter periods to minimize impacts to commercial fisheries. One FMAT member suggested that closure alternatives could still allow for incidental harvest of chub mackerel. This could be especially useful for minimizing negative impacts to the *Illex* squid fishery. One FMAT member stressed the importance of thoroughly examining the socioeconomic impacts of such closures from all angles, including economic analysis of the impacts to support businesses for both commercial chub mackerel and recreational HMS fisheries, as well as the value of chub mackerel in global food markets.

The FMAT agreed that the chub mackerel management unit should include the entire range of the species within New England, Mid-Atlantic, South Atlantic, and Gulf of Mexico waters, consistent with Magnuson-Stevens Act requirements under National Standard 3. The same species is also found in the Caribbean; however, their migratory patterns are not well understood. Management unit alternatives could include U.S. waters from Maine through Texas (likely the most appropriate based on the biology of the species), U.S. waters from Maine through Florida, and U.S. waters from Maine through North Carolina.

The FMAT noted that the Council could develop separate management measures for different regions within the management unit based on considerations besides the biology of the species. For example, New England and Mid-Atlantic states have contributed to the recent expansion of the fishery, while South Atlantic and Gulf of Mexico states have not; therefore, the Council may consider developing one set of management measures for the Mid-Atlantic and New England, and separate or no measures for the South Atlantic and Gulf of Mexico. If the Council took this approach, all these regions could still be included in the overall management unit.

Joint management with the South Atlantic or Gulf of Mexico Councils may not be necessary at this point since landings in those regions have been much lower than in the Mid-Atlantic and New England, suggesting that there may be little interest in a commercial chub mackerel fishery in those regions at this point in time. Some of the major participants in the fishery are in Rhode Island; therefore, coordination with New England, either through joint management or use of the committee of the whole process, should be considered.

The FMAT did not discuss alternatives for recreational chub mackerel management measures in detail. The available data appears to be highly imprecise. For example, most estimates of annual landings by region during 1982-2016 have percent standard errors of at least 50%, which is considered by MRIP to be very imprecise. As previously stated, the FMAT briefly discussed

methods for improving recreational data collection, including outreach to recreational fishermen on reporting requirements and species identification, and the possibility of using electronic VTRs to improve reporting.

The following table categorizes several management measures based on the FMAT's discussions.

Alternatives which can be developed independently of ABC/OY	**Alternatives which should be developed based on ABC/OY**	**Alternatives which could be excluded from further consideration**
• Management unit • EFH • Time and area management measures (e.g. spatial/temporal closures) • Permit requirements • Reporting requirements	• ACLs* • AMs • ACTs* • Landings limits (commercial quotas and recreational harvest limits) • Possession limits	• Minimum fish size restrictions • Gear restrictions • Limited access provisions • Control dates

*Alternatives to define the process for deriving ACLs and ACTs from ABCs could be developed prior to adoption of an ABC; however, the ACLs and ACTs implemented in any given year will depend on the ABC.

References

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Appendix

Chub Mackerel Fishery-Dependent and Fishery-Independent Data Summary

For June 19, 2017 Chub Mackerel Fishery Management Action Team (FMAT) meeting

Fisheries-Dependent Data

Fisheries-dependent data on chub mackerel catch, landings, discards, effort, and areas fished are available from commercial fish dealer data, the northeast fisheries observer program (NEFOP), the Northeast Fisheries Science Center (NEFSC) study fleet[6], vessel trip reports (VTRs), the southeast logbook program, the Marine Recreational Information Program (MRIP), the southeast region headboat survey, the Southeast Trip Interview Program, and an ongoing University of Southern Mississippi study.

Commercial Catch and Landings

Commercial catch and landings data are summarized separately for the northeast (Mid-Atlantic and New England) and southeast (South Atlantic and Gulf of Mexico) because they were extracted from separate datasets.

According to dealer data, over 1994-2015 commercial chub mackerel landings in the Mid-Atlantic and New England averaged 444,245 pounds per year with an average ex-vessel price of $0.19 per pound (adjusted to 2016 dollars). Landings reached a peak of 5.25 million pounds in 2013 (Table 1).

All southeast dealer-reported chub mackerel landings from 1994-2016 occurred in Florida. At least 90% of the landings in each year were reported by Gulf coast dealers. Landings averaged 87,505 pounds per year with an average ex-vessel price of $0.34 per pound (adjusted to 2016 dollars; Table 2, Figure 2). Unlike northeast landings, southeast landings do not show an increasing trend in recent years (Figure 3).

In both the northeast and southeast, bottom trawls accounted for most chub mackerel landings. During 2006-2015, chub mackerel were mostly landed on bottom trawl trips which also landed *Illex* squid, longfin squid, and/or butterfish. On trips which landed at least 10,000 pounds of chub

[6] The NEFSC study fleet is a group of commercial fishing vessels which collect self-reported data on fishing effort, area fished, gear characteristics, catch, and biological observations while operating under normal fishing conditions. The study fleet is intended to be representative of the larger commercial fishing fleet. More information is available at http://www.nefsc.noaa.gov/read/popdy/studyfleet/

mackerel, *Illex* squid accounted for the majority of landings.[7] Lesser amounts were caught (though not always landed) in other bottom trawl fisheries and in gill net fisheries.[8]

Commercial landings from the Mid-Atlantic and New England show an inverse correlation between chub mackerel and *Illex* squid landings in recent years (Figure 4). This corresponds with input provided by commercial fishermen who stated that they sometimes target chub mackerel as a "bail out" or substitute species when *Illex* squid are not available.

About 87% of southeast commercial chub mackerel landings during 1994-2016 came from bottom trawls or unspecified trawls and 10% came from purse seines. All other gear types combined accounted for less than 3% of southeast landings.

According to northeast dealer data, northeast VTRs, NEFOP, and study fleet data, during 1996-2016 nearly all chub mackerel landings (>95%) were reported during the months of June-October. The highest proportion of landings occurred in September (35-65%, depending on the dataset), followed by August (16-17%, depending on the dataset). Southeast landings were not as seasonally concentrated as northeast landings. About 80% of southeast landings during 1994-2016 occurred during May-October. The highest proportion of southeast landings occurred during August (20%), followed by June (19%).

During 1994-2016, as many as 29 federally-permitted vessels per year landed chub mackerel in the Mid-Atlantic and New England.[9] As many as 8 federally-permitted dealers per year in 5 northeast states purchased these landings.

Southeast dealer data are not compiled in such a way that the number of vessels can be determined. As previously stated, all landings in the southeast dealer database for 1994-2016 occurred in Florida. As many as 11 Florida dealers per year (with an average of 5) reported chub mackerel landings per year.

According to northeast VTR and NEFOP data, during 1996-2016, about 90% of the reported chub mackerel catch was kept and about 10% was discarded.

Most northeast landings came from statistical area 622 (20-47%, depending on the dataset) or 626 (36-69%, depending on the dataset; e.g. Figure 5). About 80% of the landings reported through VTRs, the study fleet, and NEFOP resulted from catch at about 50-100 fathoms depth. Over 90% of the landings were from catch south of Hudson Canyon in statistical areas which included areas in or near the shelf break (e.g. Figure 5).

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[7] Based on northeast commercial fish dealer data and supported by public comments received during development of the Unmanaged Forage Omnibus Amendment (more information is available at: http://www.mafmc.org/actions/unmanaged-forage).

[8] According to Northeast Fisheries Observer Program data from 1996 through March 2016.

[9] The number of vessels without federal permits which landed chub mackerel is unknown.

Southeast logbook data include information on effort and areas fished; however, they contain very few records of chub mackerel representing only 11 trips since 2000. It is unlikely that informative conclusions could be drawn from these data due to the small number of records.

Recreational Catch and Landings

Data on recreational chub mackerel catch, landings, and effort are available from MRIP and the southeast region headboat survey. Both data sets show sporadic catches. For example, the southeast region headboat survey recorded chub mackerel landings in the South Atlantic during 14 of the past 30 years (through 2015), ranging from 1 to 65 pounds per year for the entire region. Chub mackerel landings were reported in the Gulf of Mexico during 7 of the past 30 years (through 2015) with landings ranging from 1 to 238 pounds per year for the entire region.

MRIP data for the entire Atlantic coast and the Gulf of Mexico show an average of 8,893 pounds of estimated recreational chub mackerel landings per year during 1994-2016; however, in about half of those years, no recreational landings were estimated (Table 3, Figure 6).

Chub mackerel may be rarely encountered on recreational trips throughout the east coast and Gulf of Mexico. There may also be instances of misreporting chub mackerel as Atlantic mackerel. Recreational chub mackerel data are generally considered highly uncertain and imprecise.

Biological Data from Commercial Fisheries

The Southeast Trip Interview Program (TIP) is a dockside sampling program that collects biological data from commercial vessels and dealers. This data set contains some records of individual lengths (n=164) and weights (n=7) of chub mackerel from the South Atlantic and the Gulf of Mexico, most of which were landed in Florida. This program also collects sex and maturity information; however, for virtually all the chub mackerel in the dataset, this information is listed as "unknown".

In 2016, researchers at the University of Southern Mississippi collected biological data from 1,387 chub mackerel sampled from two commercial fish processing plants (i.e. Lund's Fisheries in Cape May, New Jersey and Seafreeze ltd. in North Kingstown, Rhode Island). These samples were supplemented by 16 samples from the 2016 fall NEFSC bottom trawl survey. Length, weight, age, and maturity were documented. Preliminary results have been provided to the FMAT in a separate report. This work is ongoing.

Fisheries-Independent Data

Fisheries-independent data on chub mackerel are available from the NEFSC spring and fall bottom trawl surveys, the NEFSC's ECOMON plankton survey, and other sources (summarized below).

Atlantic chub mackerel are not a priority for data collection because they have not been managed by a state or Council and data have not been needed for stock assessments. For this reason, survey data may not have been as consistently recorded to the species level (as opposed to family level), compared to higher priority species.

Larvae

During February 2003 and January, February, March, and May 2004, Richardson et al. (2010) collected 99 chub mackerel larvae, mostly at depths of 0-50 m, along a transect which crossed the Straits of Florida at about 25°30'N.

The ECOMON survey collected 67 chub mackerel larvae from North Carolina through southern New England, ranging from about 5 to about 90 nautical miles from shore. Most larvae were collected from southern New Jersey through North Carolina.

Between 1983 and 2014, the Southeast Fisheries Science Center collected 1,748 chub mackerel larvae throughout the Gulf of Mexico (Figure 7).

Adults

Chub mackerel are rarely encountered in the NEFSC spring bottom trawl survey, generally appearing in less than 1% of survey samples. They usually occur in less than 3% of the samples from the NEFSC fall bottom trawl survey with most catches occurring south of the Hudson Shelf Valley. They tend to be captured in warm water (about 26-27°C; Figure 8). Most chub mackerel lengths recorded in the spring and fall surveys ranged from 15 to 21 cm. On average, about 132 pounds of chub mackerel were caught in these surveys per year.

Tables and Figures

Table 1: Northeast dealer-reported landings and average price per pound of chub mackerel and *Illex* squid, 1994-2016. Data from some years are combined to protect confidential information representing fewer than three vessels and/or dealers. Prices are adjusted to 2016 dollars using the gross domestic product deflator index.

Northeast region (Mid-Atlantic and New England)				
Year	**Chub mackerel landings (lb)**	**Average chub mackerel price per pound**	***Illex* squid landings (lb)**	**Average *Illex* squid price per pound**
1994-1996	44,706	$0.13	108,676,400	$0.18
1997	5,013	$0.12	29,444,276	$0.14
1998	40,219	$0.13	51,958,751	$0.13
1999	6,443	$0.26	16,289,021	$0.17
2000	16,246	$0.24	19,866,592	$0.14
2001	4,384	$0.74	8,837,567	$0.16
2002	471	$0.33	6,061,729	$0.18
2003	488,316	$0.04	14,090,521	$0.22
2004	126	$0.41	57,534,687	$0.23
2005	0	--	26,526,087	$0.26
2006	0	--	30,740,382	$0.22
2007-2009	55,562	$0.23	95,549,924	$0.20
2010-2011	192,301	$0.16	76,326,551	$0.37
2012	164,846	$0.36	25,813,134	$0.39
2013	5,249,567	$0.19	8,359,998	$0.27
2014	1,230,311	$0.26	19,327,085	$0.30
2015	2,108,337	$0.23	5,339,292	$0.29
2016	610,783	$0.17	14,736,843	$0.49
1994-2016 Average	444,245	$0.19	26,759,950	$0.19

Table 2: Southeast dealer-reported landings and average price per pound of chub mackerel, 1994-2016. Data for some years are combined to protect confidential information representing fewer than three dealers. Prices are adjusted to 2016 dollars using the gross domestic product deflator index.

Southeast region (South Atlantic and Gulf of Mexico)		
Year	**Chub mackerel landings (lb)**	**Average chub mackerel price per pound**
1994	0	N/A
1995	59,541	$1.21
1996	15,123	$0.70
1997	113,621	$0.69
1998	93,669	$0.20
1999	67,665	$0.37
2000	46,907	$0.20
2001	268,110	$0.66
2002	172,914	$0.35
2003	204,382	$0.36
2004	170,807	$0.36
2005	30,069	$0.37
2006	13,393	$0.17
2007	18,244	$0.24
2008	7,318	$0.36
2009	2,767	$0.26
2010	82,424	$0.14
2011	178,006	$0.19
2012-2013	193,976	$0.21
2014	117,686	$0.23
2015	98,503	$0.24
2016	57,499	$0.20
1994-2016 average	87,505	$0.34

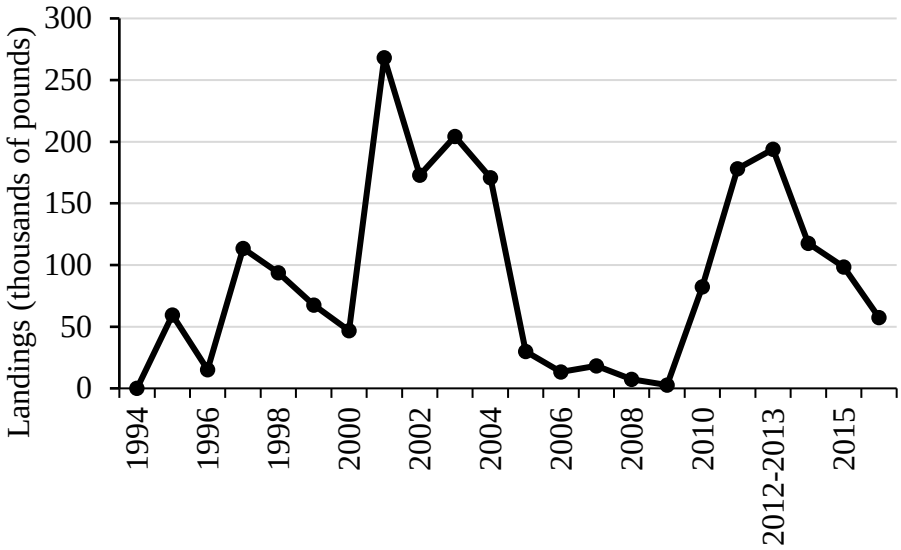

Figure 2: Southeast dealer-reported chub mackerel landings, 1994-2016. Data for some years are combined to protect confidential information representing fewer than three dealers.

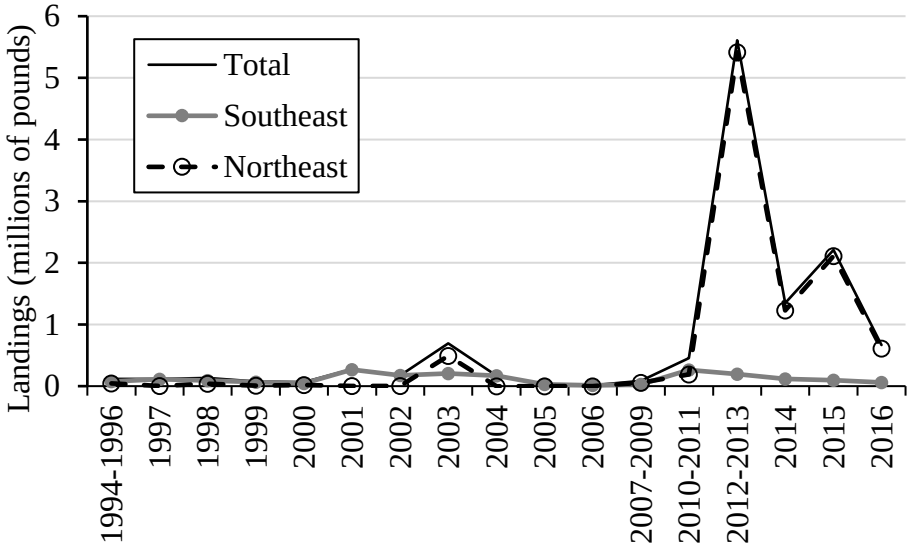

Figure 3: Dealer-reported chub mackerel landings, 1994-2016. Data for some years are combined to protect confidential information representing fewer than three vessels and/or dealers.

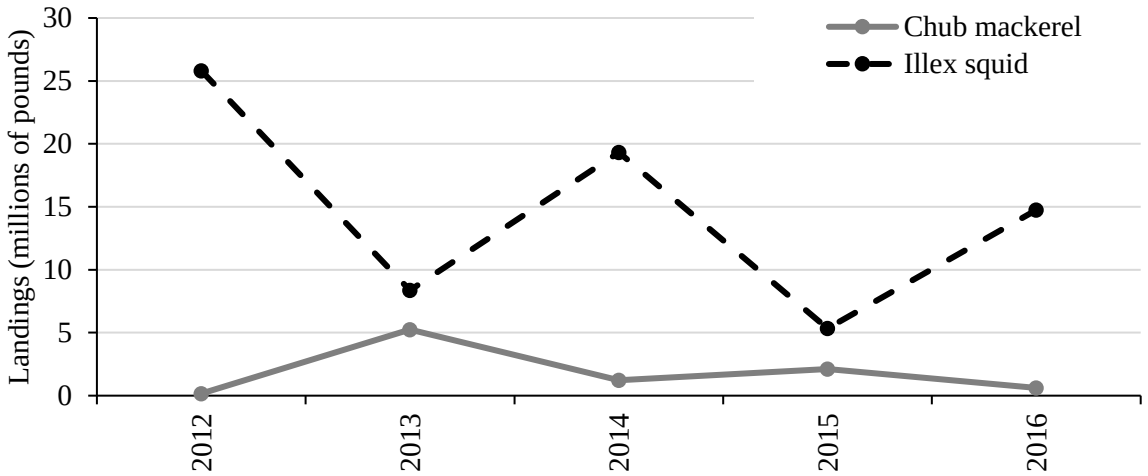

Figure 4: Landings of chub mackerel and *Illex* squid, 2012 - 2016, as shown in northeast commercial dealer data.

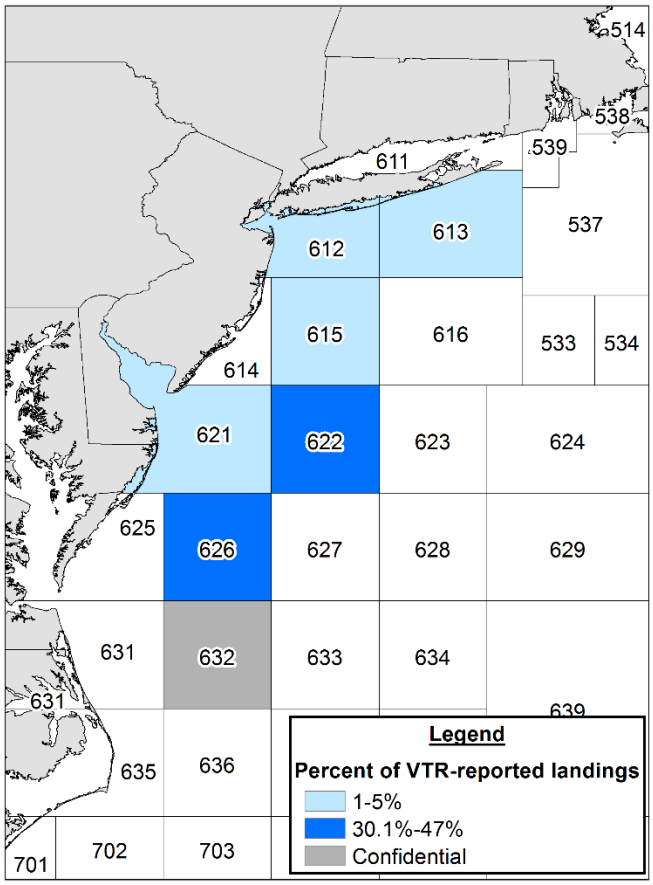

Figure 5: Percent of commercial chub mackerel landings (by weight) by statistical area, 1996-2016 as shown on Vessel Trip Reports. Data for statistical areas accounting for less than 1% of landings are not shown. Landings from statistical area 632 are confidential because they are associated with fewer than three vessels and/or dealers; however, they accounted for less than 30% of the overall landings.

Table 3: Marine Recreational Information Program estimated recreational landings of chub mackerel from New England, the Mid-Atlantic, South Atlantic, and Gulf of Mexico, 1994-2016.

Year	Estimated landings (pounds)
1994	1,823
1995	313
1996	0
1997	118
1998	363
1999	0
2000	2,773
2001	0
2002	43,676
2003	0
2004	96,344
2005	2,499
2006	6,745
2007	0
2008	0
2009	0
2010	0
2011	17
2012	0
2013	0
2014	0
2014	48,215
2016	1,660
1994-2016 average	8,893

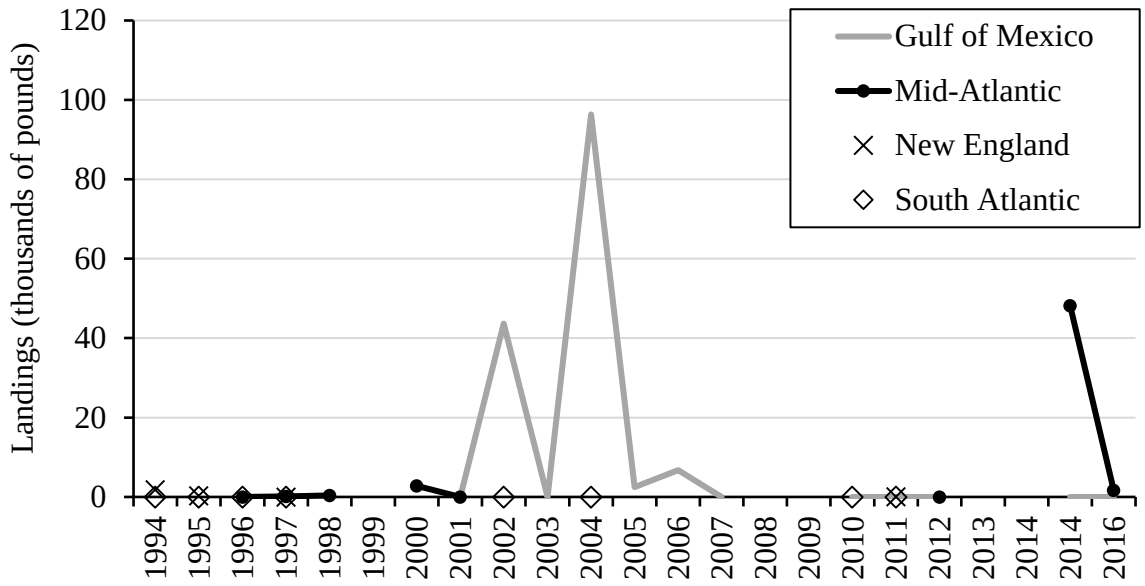

Figure 6: Marine Recreational Information Program estimated recreational landings of chub mackerel by region, 1994-2016.

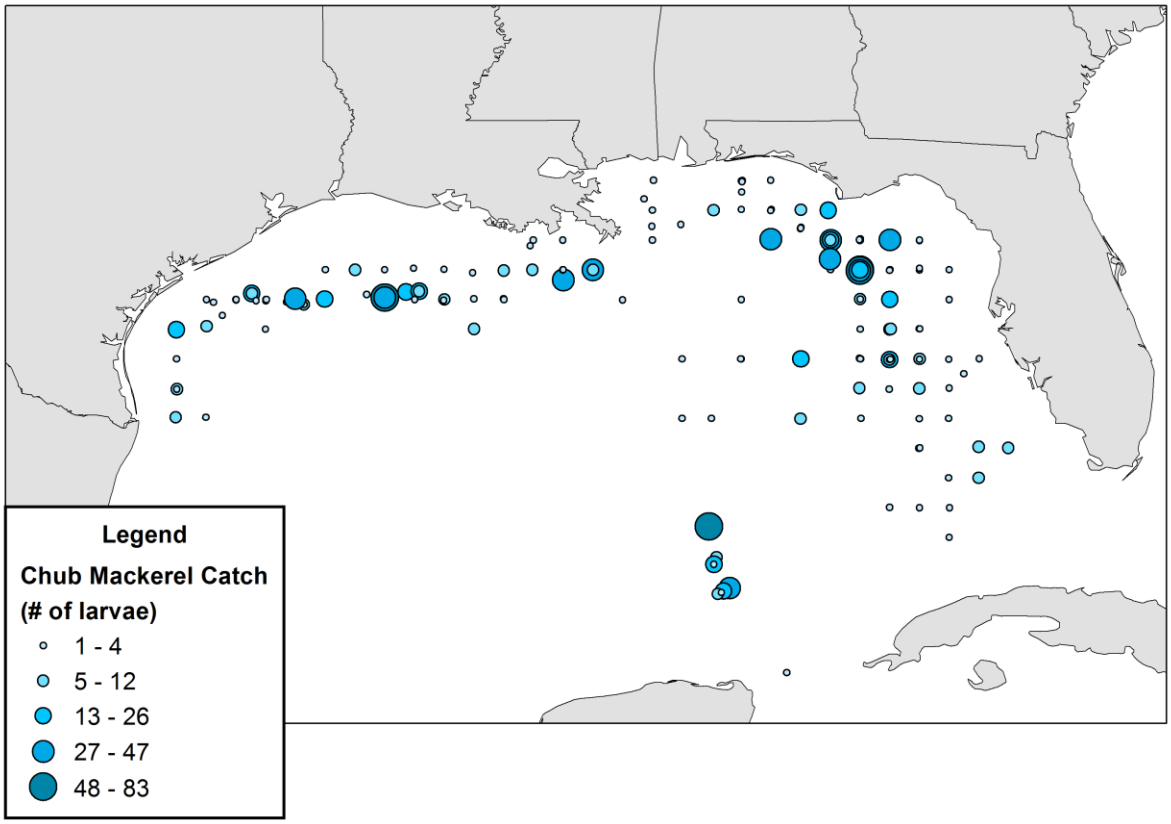

Figure 7: Southeast Fisheries Science Center larval survey catches of chub mackerel larvae, 1983-2014.

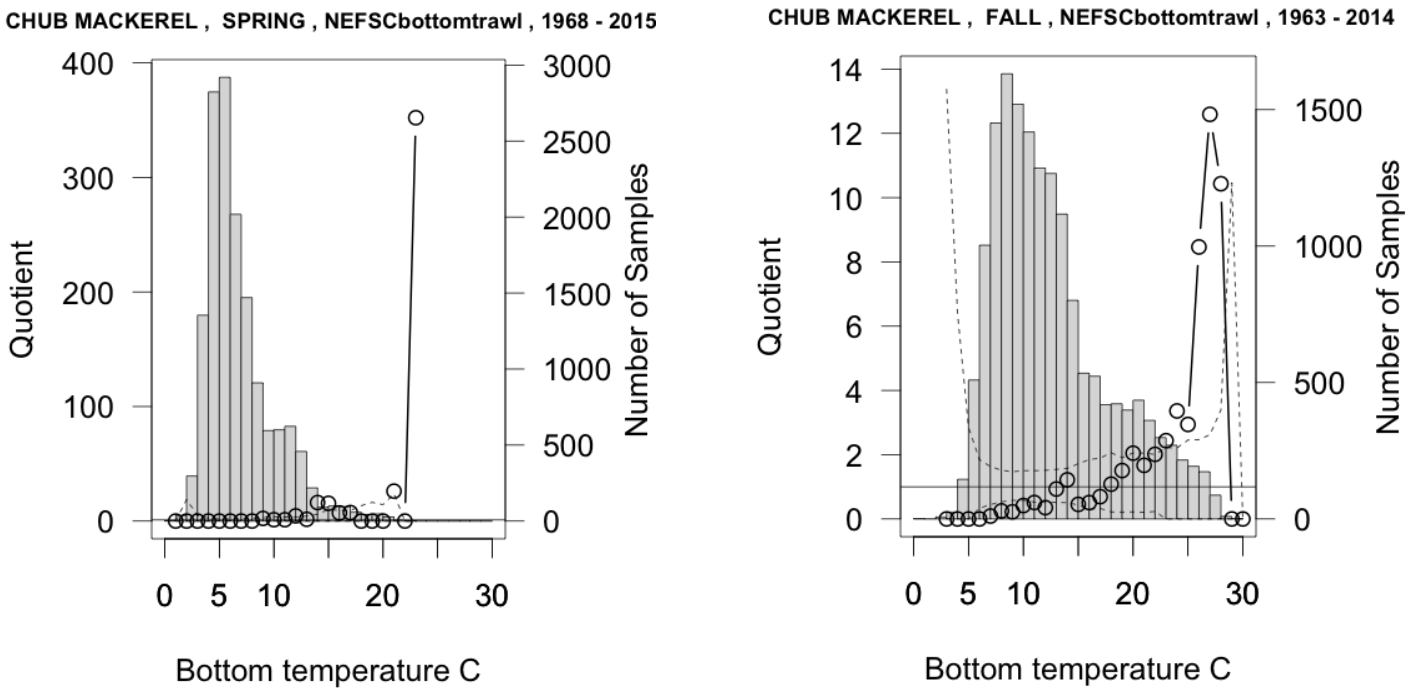

Figure 8: Quotient analysis performed on temperatures and chub mackerel catches in the NEFSC spring (left) and fall (right) bottom trawl surveys (van der Lingen et al. 2001, Bernal et al. 2007). Chub mackerel are rarely encountered in the spring survey. Histograms (vertical bars) show the distribution of bottom temperatures measured during the surveys. Points and lines show the quotients for chub mackerel calculated by dividing the percent of total catch concentration in each 1^{o}C temperature bin by the percent of stations in each temperature bin. Median and 97.5% confidence intervals for "null" quotients were generated by bootstrapping (N=999) random associations of temperature and catch. Quotient values falling above or below confidence intervals of the bootstrapped "null" model (dotted lines) indicate selection or avoidance of temperatures.

Appendix References

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